RECREATION RESEARCH PROGRAM

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RECREATION CARRYING CAPACITY DESIGN AND MANAGEMENT STUDY

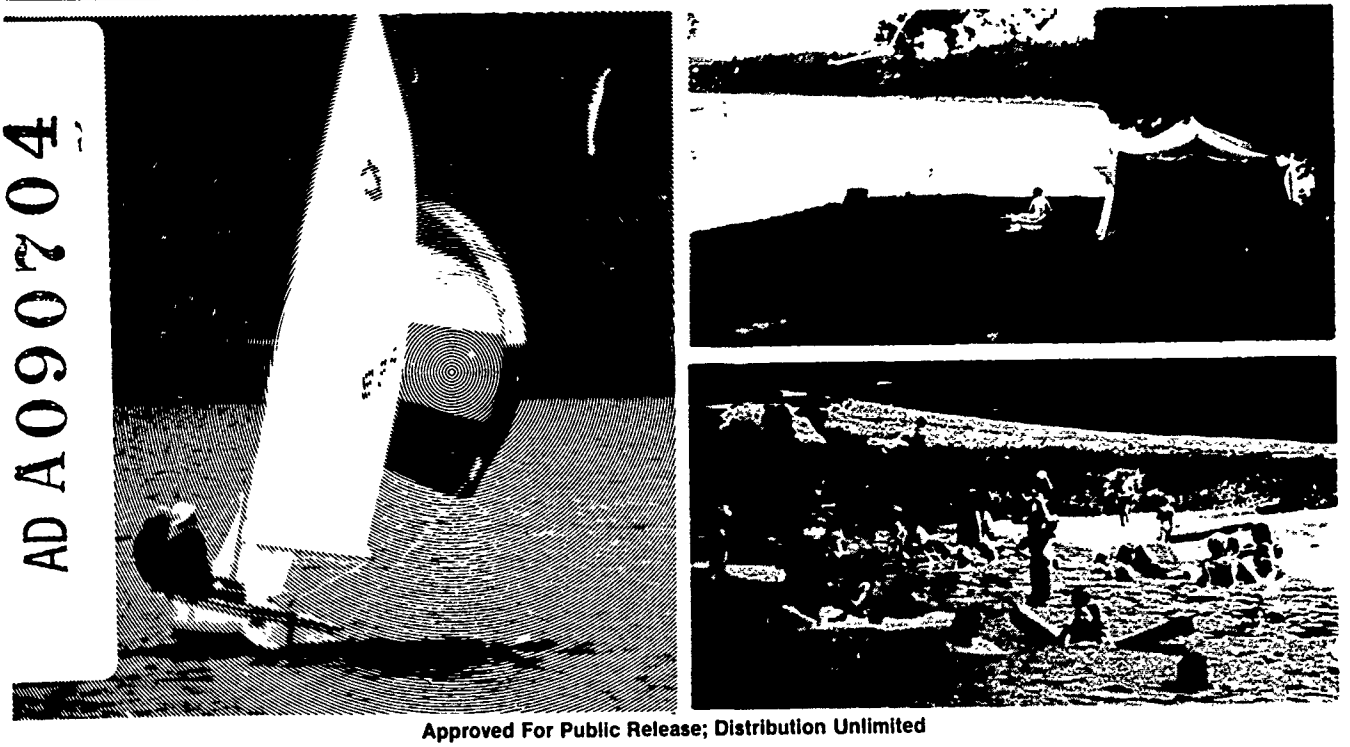
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The increase in use of Corps recreation facilities and prospects of even greater demand have brought about two major consequences and concerns: resource overuse and user overcrowding. More definitive recreation carrying capacity design and management guidelines are needed to preserve recreation qualities while offering a range of recreation opportunities.

This Technical Report presents findings and recommendations of the
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20. ABSTRACT (Continued).

Recreation Carrying Capacity Design and Management Study. Results of the site analyses, management interviews, and user surveys are included for the 11 Corps projects that were the subjects of this study. On the basis of study findings, methodologies for determining recreational carrying capacity levels are provided. Carrying capacity design and management techniques are also included for use in preventing and correcting problems of overcrowding, overuse, and underuse of recreation resources. Demonstrations are used to show how carrying capacity guidelines can be developed and applied.

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PREFACE

This report presents the findings and recommendations of the Urban Research and Development Corporation (URDC) relative to recreational carrying capacity at Corps of Engineers project areas. Results of site analyses, management interviews, and user surveys are presented for 11 Corps project areas which were the subjects of this study. Arising from these results are methodologies for determining recreational carrying capacity levels. Carrying capacity design and management techniques are explored for use in preventing and correcting problems of overcrowding, overuse, and underuse of recreational resources. A Handbook has been prepared to show specific methodologies for carrying capacity determination and to illustrate the use of effective carrying capacity planning, design, and management techniques. The study was conducted under contract with the U. S. Army Engineer Waterways Experiment Station (WES), Vicksburg, Mississippi (Contract No. DACW39-78-C-0096).

Mr. Donald R. Detwiler, President of URDC, was the Principal-In-Charge of this study, assisted by Mr. Martin C. Gilchrist, Executive Vice President and Mr. David H. Humphrey, Vice President. Mr. B. Thomas Palmer, Project Director, had major responsibility for technical project direction; Messrs. Phillip D. Hunsberger and Paul L. Sabrosky were involved in site analysis, conducting surveys, and survey analysis; and Mr. Timothy A. Fluck was involved in conducting surveys, survey analysis, and development of methodologies.

Mr. R. Scott Jackson (WES) was the project monitor. Mr. William J. Hausen was Leader of the Recreation Research Team. Dr. Adolph Anderson, WES, was program manager of the Environmental Laboratory (EL) Recreation Research Program. The study was supervised by Dr. Conrad J. Kirby, Chief, Environmental Resources Division, EL, and under the general supervision of Dr. John Harrison, Chief, EL.

COL J. L. Cannon, CE, and COL N. P. Conover, CE, were Commanders and Directors of WES during this study. Technical Director was Mr. F. R. Brown.

CONTENTS

	PAGE
PREFACE	i
PART I: INTRODUCTION	3
Situation	7
Problem and Need	8
Purpose	9
Study Parameters	10
Study Uses	12
PART II: THE STUDY PROCESS	15
Major Phases	17
Study Areas	21
Recreation Activities Considered	32
Selection of Activity Areas for the User Survey	34
User Survey Purpose and Procedures	44
PART III: SUMMARY OF FINDINGS	47
Carrying Capacity Factors	49
Overcrowding	51
Overuse and Underuse	53
Indicators of Overuse and Overcrowding	54
Carrying Capacity Management Techniques	56
Other Findings	58
PART IV: DETAILED FINDINGS BY STUDY AREA	61
Introduction	63
Barkley Lock and Dam	63
Benbrook Lake	72
Hartwell Lake	81
McNary Lock and Dam	90
Milford Lake	99
New Hogan Lake	109
Lake Ouachita	117
Lake Shelbyville	126
Shenango River Lake	134
Somerville Lake	141
Surry Mountain	149
PART V: MANAGEMENT AND USER SURVEY FINDINGS BY ACTIVITY	157
Introduction	159
Management Survey Findings	168
User Survey Findings	198

PAGE

PART VI: CARRYING CAPACITY GUIDELINES 235

Introduction. 237
Social Capacity Guidelines. 238
Resource Capacity Guidelines. 257

PART VII: TECHNIQUES FOR CAPACITY MANAGEMENT. 261

Description of Techniques 263
General Planning and Activity Relationship Techniques 265
Site Planning and Design Techniques 273
Management Techniques 287
User Acceptance of Techniques 294
Summary 304

PART VIII: DEMONSTRATIONS 311

Introduction. 313
Single Use Areas. 313
Multiple Use Boating Situations 330
Multiple Use Land Areas 336

PART IX: SUGGESTIONS FOR FURTHER CARRYING CAPACITY PROGRESS 345

Monitoring. 347
Educating 351
Performing Additional Research. 352

REFERENCES 355

APPENDICES 357

Appendix A: Key Terms. A1

Appendix B: Notes. B1

Appendix C: Example Survey Forms C1

Appendix D: Recreation Settings and Their Descriptions D1

Appendix E: Overall Findings from the Mississippi River Pool #10 and the Meldahl Management/Site Survey E1

Appendix F: Distance/Area/Density Conversion Tables. F1

PART I: INTRODUCTION

CONVERSION FACTORS, U. S. CUSTOMARY TO METRIC (SI)
UNITS OF MEASUREMENT

U. S. customary units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
acres	4046.856	square metres
Fahrenheit degrees	5/9	Celsius degrees or Kelvins*
feet	0.3048	metres
horsepower (550 foot-pounds per second)	745.6999	watts
inches		
miles per hour (U. S. statute)	1.609344	kilometres per hour
miles (U. S. statute)	1.609344	kilometres
square feet	0.09290304	square metres
yards	0.9144	metres

* To obtain Celsius (C) temperature readings from Fahrenheit (F) readings, use the following formula: $C = (5/9)(F - 32)$. To obtain Kelvin (K) readings, use $K = (5/9)(F - 32) + 273.15$.

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RECREATION CARRYING CAPACITY DESIGN AND MANAGEMENT STUDY

PART I: INTRODUCTION

Situation

1. Recreation at Corps-built lakes and waterways has become a major program over the past 30 years. Corps facilities provide for the outdoor recreation needs of millions of people. In 1978, over 438 million recreation days of use were reported at 439 Corps lakes and lock and dam projects, an increase of almost 60 percent since 1970. Presently, 11.4 million acres* of land and water and 3094 developed recreation areas exist at Corps of Engineers project areas.

2. Results of the recent National Outdoor Recreation Survey[1] (Heritage Conservation and Recreation Service (HCRS) 1978) show that Corps recreators are likely to be repeat visitors, recreate in large groups, and travel within two hours from home. The Survey also discovered that Corps facilities have the lowest percentage of long distance travelers of all the Federally managed recreation lands. Unlike many Federal recreation areas, most Corps recreation facilities are in close proximity to many potential recreators. The nationwide survey also found that 35 percent of the respondents surveyed at Corps areas cited crowding as a deterrent to the use of park and recreation areas.

3. The outlook for continued increases in recreational use at Corps of Engineer facilities is excellent. A number of factors will contribute to these increases. Americans are working fewer hours and devoting more time to leisure. The leisure year is now 123 days long--one third of the calendar year--with seven three-day weekends, and an average of 16 vacation days per worker, which represents more available leisure time than in the past. More importantly, fuel shortages and rising fuel costs will result in increasing demands for more and more

* A table of factors for converting U. S. customary units of measurement to metric (SI) is presented on page 5.

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close-to-home recreation opportunities, such as those provided by many Corps of Engineers recreation facilities.

Problem and Need

4. The increase in use of Corps recreation facilities and prospects of even greater demand have brought about several major consequences and concerns:

a. Recreation resources* have sometimes been damaged or destroyed due to recreational overuse--the very resources which initially attracted the recreationist. The future opportunities offered by such resources are uncertain if heavy or indiscriminate use continues.

b. Conflicts between recreators have sometimes arisen because of overcrowding, functional interference, noise, safety, and other reasons. Overcrowding and user conflicts can reach a point where the recreation experience expected by the participant is not realized.

Increased resource destruction and user dissatisfaction are inevitable unless actions are taken to manage Corps recreation areas using recreational carrying capacity as a foundation.

5. Presently, the Corps does not maintain rigid standards which are sensitive to differing recreational settings. Design criteria cited in Corps regulations now serve as rough "across-the-board" guidelines with considerable flexibility left to design and planning personnel. This flexible approach has been necessary because of the wide variety of physical/environmental and social conditions represented at Corps recreation areas and because realistic standards must be based on targeted research and a wealth of experience. Managers interviewed as part of the Management/Site Survey in this study confirmed that carrying capacities vary from place to place because of variable physical site conditions and user situations. Because of these variables and the absence of past carrying capacity research, many project managers and rangers surveyed were unsure of what the carrying capacities of their recreation areas should be.

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* Key terms used in this report are defined in Appendix A.

6. The Corps project area managers agreed that easy-to-use methods are needed to help them determine realistic carrying capacities. They also indicated more definitive recreational carrying capacity guidelines are required to deal with the various resource features, user characteristics, and possible management objectives relating to Corps project areas.

7. A better understanding of the recreational capabilities and limitations of Corps recreation resources and the level of use which can be sustained by those resources is necessary to preserve the recreational qualities while offering a range of opportunities to the public. More definitive recreational carrying capacity design and management guidelines are needed to relate to the various Corps recreation resources, user characteristics, and management objectives.

Purpose

8. The overall purposes of this study were to conduct recreational carrying capacity research on selected Corps projects, to develop methods and techniques for determining carrying capacity, and to identify and develop techniques for capacity management. More specifically, the study involved the following tasks:

a. Identification and description of those factors which affect carrying capacity levels of recreation "activity areas" at Corps projects;

b. Development of carrying capacity ranges and norms for specific activities at Corps recreation areas;

c. Development of a methodology for determining capacity levels at specific recreation areas;

d. Identification and evaluation of techniques for controlling recreational overuse of project resources; and

e. Preparation of a handbook with carrying capacity guidelines for Corps planners, designers, and managers.

Study Parameters

Definition of recreational carrying capacity

9. Recreational carrying capacity can mean different things to different people. Because of its vagueness when applied to outdoor recreation, carrying capacity is a term frequently used but often misunderstood. Environmentalists, ecologists, and biologists have viewed and investigated carrying capacity primarily in terms of resource destruction and restoration. Sociologists and psychologists, on the other hand, have been mainly concerned with the quality of user experiences and the effects of crowding upon human behavior. Site and space planners tend to view capacity in terms of the physical space required to effectively and safely conduct an activity. Administrators and managers may look at capacity in terms of cost-effectiveness, administrative ease, and the feasibility of exercising controls. These many different perspectives from which recreation carrying capacity can be viewed are all important. Ideally, the level and mix of recreational use of Corps resources should not exceed the carrying capacities as viewed from all these perspectives.

10. Recreational carrying capacity, as viewed in this study, is the capability of a recreational resource to provide opportunity for certain types of satisfactory recreational experiences over time without significant degradation of the resource. Inherent in this view of carrying capacity are the resource (biophysical) and social (psychosocial) capacities. For the purpose of this study, carrying capacity is viewed in two ways:

a. Resource capacity. This is the level of recreational use of a resource beyond which irreversible biological deterioration takes place or degradation of the physical environment makes the resource no longer suitable or attractive for that recreational use.

b. Social capacity. Social capacity means the level of recreational use of a resource or area beyond which the user's expectation of the experience is not realized and he/she does not achieve a reasonable level of satisfaction.

Specific study parameters

11. The entire subject of carrying capacity is multifaceted and contains variables far too numerous for this report to fully encompass. This study does take a comprehensive view of carrying capacity as it relates to major Corps recreation activities and their corresponding resource and user characteristics.

12. The study presents carrying capacity guidelines for recreation planners and administrators to use in planning, designing, and managing recreation areas. The study does not deal with the intricacies of demand and management objectives; however, recognition is given to the large role played by demand and management objectives in determining and implementing carrying capacity. Not all specific socioeconomic differences between users, the economic feasibility of park development, cost/benefit considerations, nor other variables not directly related to the determination of carrying capacity were examined in this study.

13. The specific parameters of this study are identified below:

a. Outdoor recreation activities only. This study deals only with outdoor recreation activities. These activities include camping, picnicking, boating, boat launching, fishing, waterskiing, swimming, sunbathing, off-road vehicle riding, hiking, hunting, snowmobiling, cross-country skiing, and horseback riding (see paragraphs 53-62 for activity definitions and descriptions).

b. Corps of Engineer managed facilities only. The survey data, recreation environment characteristics, and other study information and findings pertain only to recreation areas managed by the Corps.

c. Resource capacity and social capacity only. Although the study recognizes the role of such elements as management objectives and economic feasibility in setting and using capacities, this study deals only with what the capacity should be, based on the resource and social capacities. Final determinations as to what should be the design and operating capacity of the recreation area from the standpoint of demand, economics, politics, personnel management, and the like are assumed to be the prerogatives of the individual agency or person making the final planning and administrative decisions.

d. Instant capacity as a main social capacity concern. The suggested carrying capacity ranges consider social capacity as being "instant" capacity--the number of recreation units (e.g., picnic tables or people) which would be accommodated by a recreation area at any single point in time. Although instant capacity is paramount to this study, daily and seasonal capacities could be estimated through the use of turnover information. The study also develops and suggests a monitoring system which will allow for examining cumulative resource use during the recreation season.

e. Instant capacity units of measurement. This study expresses instant carrying capacity in terms of distances between people, picnic tables, campsites, etc., and/or in terms of the number of recreational units (campsites, boats, blankets, picnic tables, etc.) per acre.

f. Carrying capacity spacing/density guidelines for recreation activity areas only. The suggested carrying capacity guidelines do not deal with the additional space required for parking (lots), buffers between activity areas, maintenance and utility structures, or other support areas. While the guidelines will help determine support facility requirements, they pertain only to the spacing of people or recreation units within the recreation activity area.

g. Recreation activity situations covered. This study provides guidelines for determining the carrying capacity of both single-activity and multiple-activity areas. While the suggested capacity ranges pertain to individual activity areas, guidelines are included to allow for determining the carrying capacity of recreation area with several different individual activity areas. Also, the proposed system for selecting a capacity level includes factors which indicate the influences which one activity area may have on the carrying capacity of another.

Study Uses

Corps Uses

14. This final report presents research findings which contribute to a better understanding of recreational carrying capacity at Corps project areas. As a result, all Corps recreation personnel can benefit from this study. Even though the research was conducted at lake projects, certain results, such as the land-based activity guidelines and many of the capacity management techniques, can be transferred to nonlake projects.

15. The carrying capacity handbook which evolved from this study is a guidebook and a practical tool for use by practitioners in planning, designing, and managing Corps project recreation areas. Guidelines are provided for use by recreation planners and administrators in determining appropriate carrying capacities for their particular recreation activity areas and under their specific physical and social circumstances.

16. In cases where recreation sites are presently overused or overcrowded, the guidelines can be used to determine the level of remedial action (e.g., redesign, site hardening, user control) necessary to protect the resource and provide for a pleasant recreation experience. The handbook can also be used in initial policymaking and planning to estimate whether the size of the resource is large enough to meet the projected demand, while not exceeding desired capacity levels. Capacity guidelines can also help the designer or planner determine the "best use" areas for various activities, foresee the management implications of the site plans, and achieve the proper balance between the recreation activities and their supporting facilities, such as parking and waste disposal. The guidelines will also be valuable to recreation administrators in determining the levels at which user controls should be put into effect. A useful carrying capacity monitoring system is also suggested for determining the effectiveness of recreational programs and facilities utilized over time and for identifying overuse and overcrowding.

Benefits to others

17. Many recreational resource planners, designers, managers, and program administrators outside the Corps can use this report to verify or refute their own experiences, to guide them in their day-to-day and longer range decisions about recreational resource use, and to give them a basis for establishing and conducting their own recreation capacity surveys and for their planning/management efforts.

18. Elected officials and policymakers will find this study useful because it explains the basis and importance of carrying capacity and provides a systematic approach and justification for recreational resource protection and for the preservation of recreational quality.

PART II: THE STUDY PROCESS

PART II: THE STUDY PROCESS

Major Phases

19. This study was conducted by Urban Research and Development Corporation's (URDC) professional carrying capacity team during the 21-month period between September of 1978 and May of 1980. Periodic workshop meetings were held between the U. S. Army Engineer Waterways Experiment Station (WES) and URDC to discuss detailed approaches, preliminary findings, and study progress.

20. The overall study process involved six major phases:

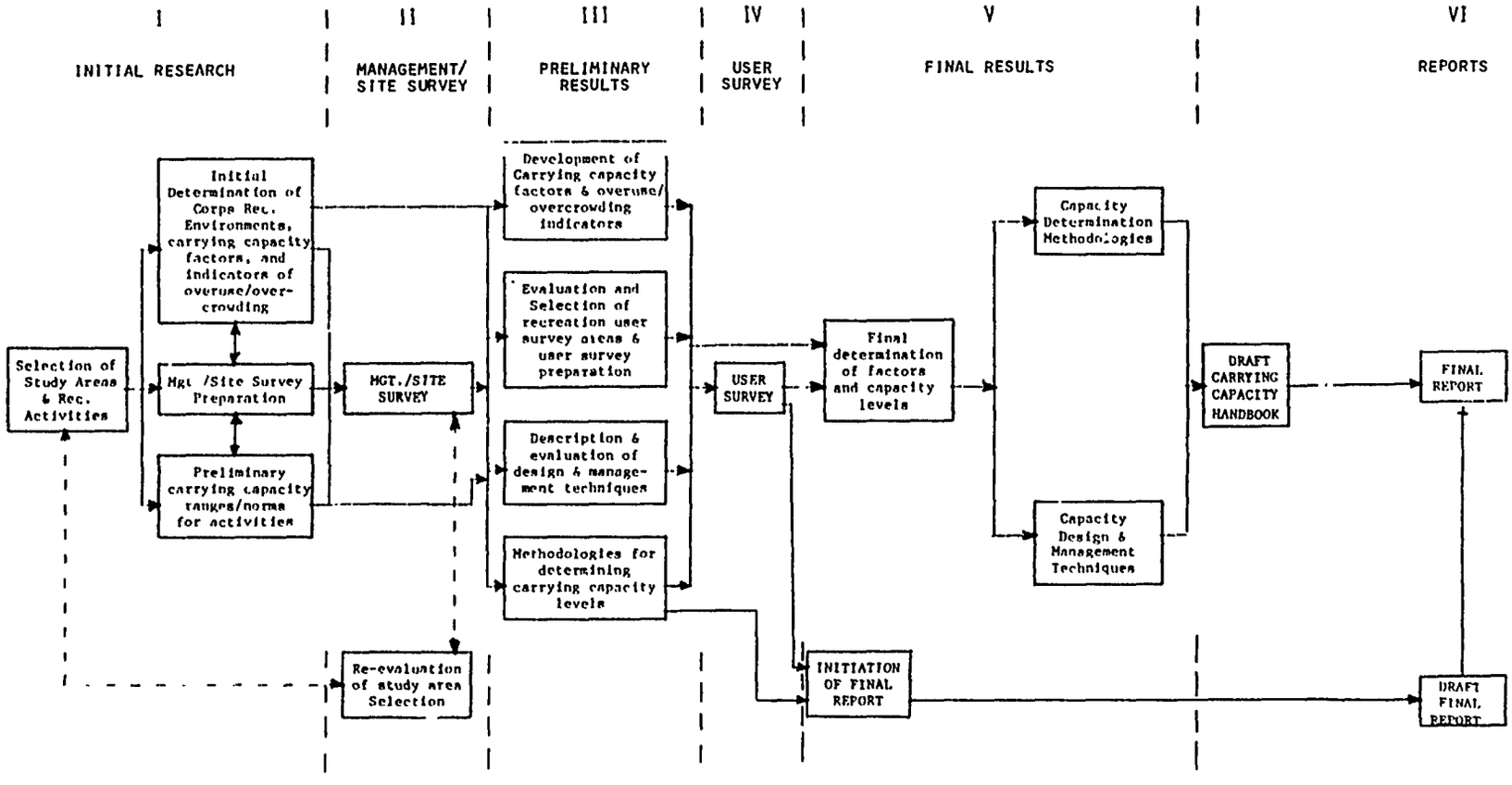
I. Initial Research
II. Management/Site Survey
III. Preliminary Results
IV. User Survey
V. Final Results
VI. Reports

A flow chart outlining the major phases of the study process is provided on page 18.

Phase I - Initial research

21. The WES Recreation Research and Demonstration System (RRDS) includes 24 project areas. These project areas are representative of other Corps facilities, recreation activities, and resources and serve as study units for recreation research. They also serve as outdoor laboratories where new methods, structures, layouts, and policies can be tested. Twelve candidate study areas were initially selected from these 24 recreation research and demonstration units. A preliminary list of recreation activities to be studied was then developed. Phase I included the identification of Corps recreation environments, the initial factors affecting carrying capacity, and the discovery of indicators of overuse and overcrowding. Preliminary carrying capacity ranges and norms were selected from the study entitled, "Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity," (URDC 1977) for later

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I
INITIAL RESEARCH
II
MANAGEMENT/ SITE SURVEY
III
PRELIMINARY RESULTS
IV
USER SURVEY
V
FINAL RESULTS
VI
REPORTS
Selection of Study Areas & Rec. Activities
Initial Determination of Corps Rec. Environments, carrying capacity factors, and indicators of overuse/over-crowding
Mgt /Site Survey Preparation
Preliminary carrying capacity ranges/norms for activities
MGT./SITE SURVEY
Re-evaluation of study area Selection
Development of Carrying capacity factors & overuse/ overcrowding indicators
Evaluation and Selection of recreation user survey areas & user survey preparation
Description & evaluation of design & management techniques
Methodologies for determining carrying capacity levels
USER SURVEY
INITIATION OF FINAL REPORT
Final determination of factors and capacity levels
Capacity Determination Methodologies
Capacity Design & Management Techniques
DRAFT CARRYING CAPACITY HANDBOOK
FINAL REPORT
DRAFT FINAL REPORT

testing and subsequent refinement.

22. During this first phase, the study team became familiar with Title 36 regulations, the Recreation Resource Management System (RRMS), and information and maps relating to the project areas being considered for detailed study. Management/site survey materials (management questionnaires and use area analysis sheets) were then prepared for use in Phase II.

Phase II - Management/site survey

23. The management/site survey was conducted during this phase, the first of two surveys conducted as part of this study. Resource managers, rangers, and maintenance personnel were interviewed at each of the 12 areas and a reconnaissance was made of overused, overcrowded, underused, and well-balanced recreation areas. Management questionnaires and discussion guides were used during the interviews and discussions with management and staff. These materials assisted the URDC study team and the Corps staff to:

a. Learn more about visitor characteristics at the project areas;

b. Categorize recreation areas which are overcrowded, overused, underused, and well balanced;

c. Evaluate previously prepared information on carrying capacity factors, indicators, and ranges; and

d. Explore techniques for dealing with recreational carrying capacity.

Use area analysis sheets were used to record detailed site characteristics during onsite visits to each selected overcrowded, overused, well-balanced. underused recreation area.

Phase II Preliminary results

24. The analysis of Management/Site Survey information was a significant part of Phase III. Preliminary findings regarding carrying capacity factors and their relative importance, indicators of overuse and overcrowding, and Corps design and management techniques were analyzed. The user survey instruments were then developed and recreation activity areas were chosen for interviewing recreationists. Demonstration areas were also chosen among the interview areas for detailed study

and for later testing of carrying capacity methodologies and control techniques. Various methodologies for determining carrying capacity levels were also examined during this phase.

Phase IV - User survey

25. User surveys were administered at selected activity areas within the study project areas. The user interviews were conducted at each project area over a four-day period covering Friday, Saturday, Sunday, and Monday during a month of high visitation. The purpose of the user survey was to discover what the users of Corps projects deem to be overcrowding and overuse, what factors they feel are most important, how they feel about various techniques for controlling capacity, and why visitors sometimes do not use existing facilities to their capacity. The results of this study were used to develop a method for determining appropriate levels of recreational carrying capacity which will satisfy user needs and desires while protecting the natural resources upon which the recreation activities are based.

Phase V - Final results

26. A data processing system was developed for the recording, organization, and comparison of data from the user survey and the management/site survey. The data were then analyzed and findings reported with particular regard to overcrowding, resource overuse, carrying capacity factors, feasibility of applying capacity control techniques, and the relationship of site and management characteristics to overcrowding and overuse. This phase also included the preparation of final guidelines for determining carrying capacity and for applying capacity design/management techniques. The previously selected demonstration areas were used to suggest how methodologies and techniques can be applied to real capacity situations experienced by the Corps. All other study results were finalized in this phase and final report preparation was initiated.

Phase VI - Reports

27. A draft final report was completed and submitted to WES for review and comment. Adjustments were made, and this final report was prepared. This report contains a detailed description of the study methodology, analyses of data, and findings. In addition, a separate user

manual has also been prepared that highlights the results of this study and how they can be utilized in recreation planning design and management.

Study Areas

Initial selection of project study areas

28. The 12 original Corps project areas considered for this recreational carrying capacity study were selected from the 24 recreation research and demonstration units chosen by the Office of the Chief of Engineers. The criteria for selection of study areas included consideration of the widest possible ranges of recreation activities, natural resource features, and Corps facilities and support systems at each project. Corps project areas experiencing overcrowding, overuse, user conflicts, and underuse, among others, were considered as areas of substantial emphasis. Other criteria considered in selecting the study areas were size of the project area and the geographic location of projects throughout the west coast, Midwest, Southeast, and Northeast areas of the nation.

29. Initial project area selection resulted in the following list of 12 projects:

a. Barkley Lock and Dam, Lake Barkley - Kentucky and Tennessee, Nashville District.

b. Benbrook Lake - Texas, Fort Worth District.

c. Captain Anthony Meldahl Lock and Dam, Meldahl Navigation Pool - Ohio and Kentucky, Huntington District.

d. Hartwell Lake - Georgia and South Carolina, Savannah District.

e. Lake Ouachita - Arkansas, Vicksburg District.

f. Lake Shelbyville - Illinois, St. Louis District.

g. McNary Lock and Dam, Lake Wallula - Oregon and Washington, Walla Walla District.

h. Milford Lake - Kansas, Kansas City District.

i. Mississippi River Pool 10 - Iowa and Wisconsin, St. Paul District.

j. New Hogan Lake - California, Sacramento District.

k. Somerville Lake - Texas, Fort Worth District.

l. Surry Mountain Lake - New Hampshire, New England Division.

30. Each project area was further evaluated in the following three steps: conducting the management/site survey, examining the project's recreation environments, and selecting the final study project areas.

Management/site survey

31. The management/site survey was the first of two surveys conducted at Corps project areas; the user survey was the second. Interviews were conducted with resource managers, rangers, district representatives, and maintenance staff at each of the 12 initial project areas. Also, a reconnaissance was made of recreation areas deemed by managers to be overused, overcrowded, underused, and well balanced. The six specific objectives of the management/site survey were to:

a. Obtain resource managers' data and observations regarding recreation area overcrowding, overuse, and underuse;

b. Become as familiar as possible, through onsite analysis, with areas considered by the managers to be overcrowded, overused, underused, and exceptionally well balanced;

c. Explore planning, design, and management techniques of potential value in dealing with carrying capacity and to determine their past successes and failures;

d. Present previously prepared information on carrying capacity factors, the relative importance of these factors, and the possible carrying capacity levels for activities represented in the project areas;

e. Confirm project area data already acquired and collect any new data available; and

f. Receive input from managers regarding the methodology, site locations, questions, and mechanics for the subsequent user survey of all study areas.

32. Management questionnaires and activity area analysis sheets were prepared for each activity. The management questionnaires were used during the discussions with the project area staff and provided a means for becoming more familiar with the user and resource characteristics of the project areas. The activity area analysis sheets were filled out by the survey team during examination of individual recreation areas and provided a means for recording detailed site characteristics of areas previously identified during the management interviews. (Examples of the management questionnaires and the activity area analysis sheets are included in Appendix C).

Recreation environments

33. The survey uncovered many different settings for each recreational activity studied; these settings, or components of recreational environments, were documented so that further carrying capacity research could be applied to areas representative of Corps project carrying capacity situations. The survey found recreational settings with different physical settings, including project area distance from urban areas, slope, and vegetation characteristics. The different levels of development/control features discovered included the level of facilities and services provided and the degree of management control exercised. Activity/use relationship features varied according to the predominant role of the recreation activity area, the sharing of an area by more than one activity, and the closeness or remoteness of activity areas. Each area was classified according to the combined physical, development/control, and activity/use relationship settings it exhibited.

34. Many different recreational settings were discovered during this study. The following section lists the most significant recreational settings found at the Corps recreation areas visited* The number of settings has been kept to a managable size and limited to those most essential for developing a workable approach to determining recreational carrying capacity. These settings provided a basis for selecting the recreational environments which were subjects of the subsequent user survey and detailed carrying capacity research. The settings include:

* See Appendix D for more detailed descriptions of the recreation settings.

Physical Settings

- Project Accessibility
  - Regional setting
    - . within metropolitan area
    - . within 50 miles of metropolitan area
    - . within 100 miles of metropolitan area
    - . within 200 miles of metropolitan area
    - . beyond 200 miles of metropolitan area
  - Distance to Expressway
    - . 0 - 5 miles
    - . 6 - 25 miles
    - . 26 - 50 miles
    - . 51 - 75 miles
    - . 75+ miles
  - Distance to State/Local Highway
    - . 0 - 1 mile
    - . 2 - 5 miles
    - . 6 - 10 miles
    - . 10+ miles

- Area Characteristics
  - Slope
    - . Level (0 - 5%)
    - . Moderate (5 - 10%)
    - . Steep (10+%)
  - Vegetation
    - . Open
    - . Moderate
    - . Dense
  - Accessibility to water body
    - . Easily accessible
    - . Moderately accessible
    - . Relatively inaccessible
  - Visibility to water body
    - . Unobstructed view
    - . Partially obstructed view
    - . Obstructed view

Development/Control Settings

- Level of Development
  - High level
  - Moderate level
  - Limited level

- Degree of Control
  - High degree
  - Moderate degree
  - Little or none
  - Undesignated

Activity/Use Relationship Settings

- Predominate Use of Area
  - Camping
  - Day Use

- Relationship to Other Activity Areas
  - Activity sharing same location with other activities
  - Activity separate from but adjacent to other activity areas
  - Activity isolated from other activity areas

- Level of Use Situation
  - Overcrowded
  - Overused
  - Overcrowded and overused
  - Well balanced
  - Underused

Final selection of project study areas

35. The recreational settings and environments of each project and the analysis of other management/site survey results provided a basis for reevaluation of each project area visited to determine whether all projects should continue to be included in this study.

36. A reexamination of the project areas showed that two of the 12 projects did not represent the breadth and depth of settings and carrying capacity situations which would result in greatest benefit to this particular research. This finding is no reflection on the management of these project areas and does not imply that the areas are without issues and problems of a design and management nature which should be addressed by further Corps research. A decision was made not to continue researching the Captain Anthony Meldahl Lock and Dam Navigation Pool and the Mississippi River Pool #10 because other approaches to the navigation pool carrying capacity problems would be more effective. At the Meldahl Navigational Pool only one of the 12 Corps recreation areas is heavily used; most of the other recreation areas have relatively few Corps facilities. The Mississippi River Pool #10 has only one small Corps-operated recreation area which is remotely located and is not heavily used. Overall findings from the Mississippi River Pool #10 and Meldahl Management/Site Survey are included in Appendix E.

37. The Shenango River Lake, located in Ohio and Pennsylvania in the Pittsburgh District, was chosen as a replacement for Meldahl and Mississippi Pool #10. It exhibits extensive water use activities and a much greater number of facilities developed and operated by the Corps than the Meldahl and Mississippi #10 project areas.

Summary of selected
project study areas

38. The 11 final project study areas contain recreational characteristics and situations which make each project capable of yielding valuable data for this carrying capacity study. Figure 1 shows the location of the 11 project areas. Table 1 and Figure 2 provide a comparison of the 11 project areas. These project areas are summarized in the following paragraphs.

39. Barkley Lock and Dam, Lake Barkley - Kentucky and Tennessee, Nashville District. The Corps provides many land and water recreational opportunities at Lake Barkley. Freeway proximity allows easy access to the project and individual areas are served by secondary roads. The diverse landscape offers a variety of recreation environments, with areas

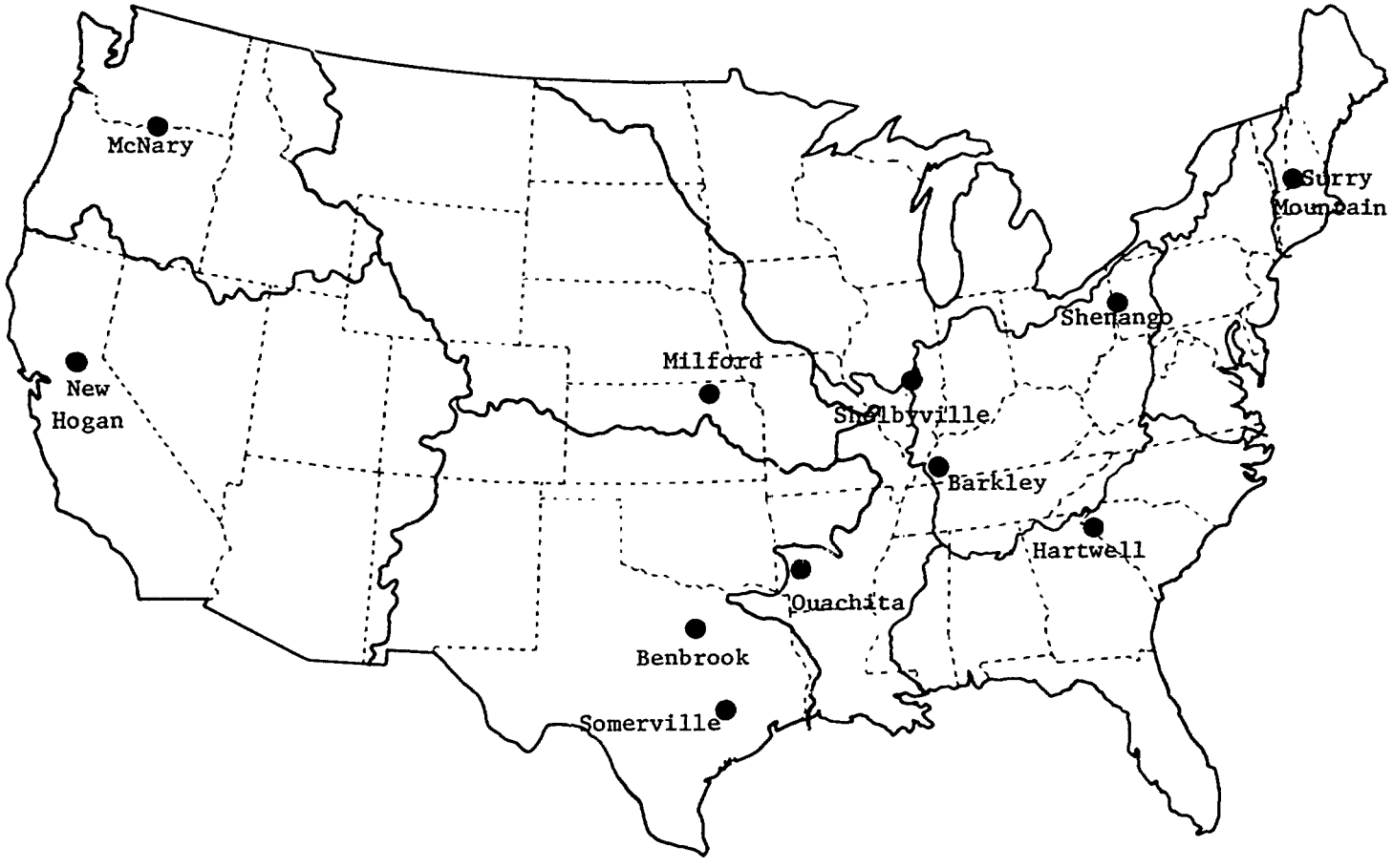


Figure 1. - Location of study project areas and division boundaries

Table 1

Summary of Study Project Area Features[1*]

Project Area	Authorized Purposes**	Project Area Size: Total Area acres	Project Area Size: Normal Pool Size acres	Project Area Size: Shoreline miles	Climate: Average Annual Rainfall, inches	Climate: Average Annual Temperature, °F	No. of Corps Recreation Areas	Visitation: 1978	Visitation: Highest Months
Barkley	F, N, P	108,600	57,920	1000	44	58	23	5,395,900	June
Benbrook	F, N, W	8,401	3,498	37	32	64	4	2,515,000	June
Hartwell	F, P	80,000	56,000	962	48	57	70	11,420,500	June
McNary	I, N, P	48,212	35,922	242	6	54	13	4,534,000	July
Milford	F, S	48,939	16,190	163	32	55	6	1,459,660	July
New Hogan	F, I	6,064	3,120	44	33	62	11	248,312	July
Ouachita	F, P	82,373	40,060	690	51	62	18	2,960,400	May-July
Shelbyville	F, N, S	44,408	11,100	172	38.6	55	14	2,937,200	July
Shenango	F, W	14,534	3,550	44	38.5	50	3	1,758,200	July
Somerville	F, W	30,096	9,700	72	36	68	7	2,485,200	May
Surry Mtn.	F	1,688	260	4	40	45	2	229,711	July

1* See Notes in Appendix B.

** Purposes: F = flood control, I = irrigation, N = navigation, P = power generation, S = water supply, W = water conservation.

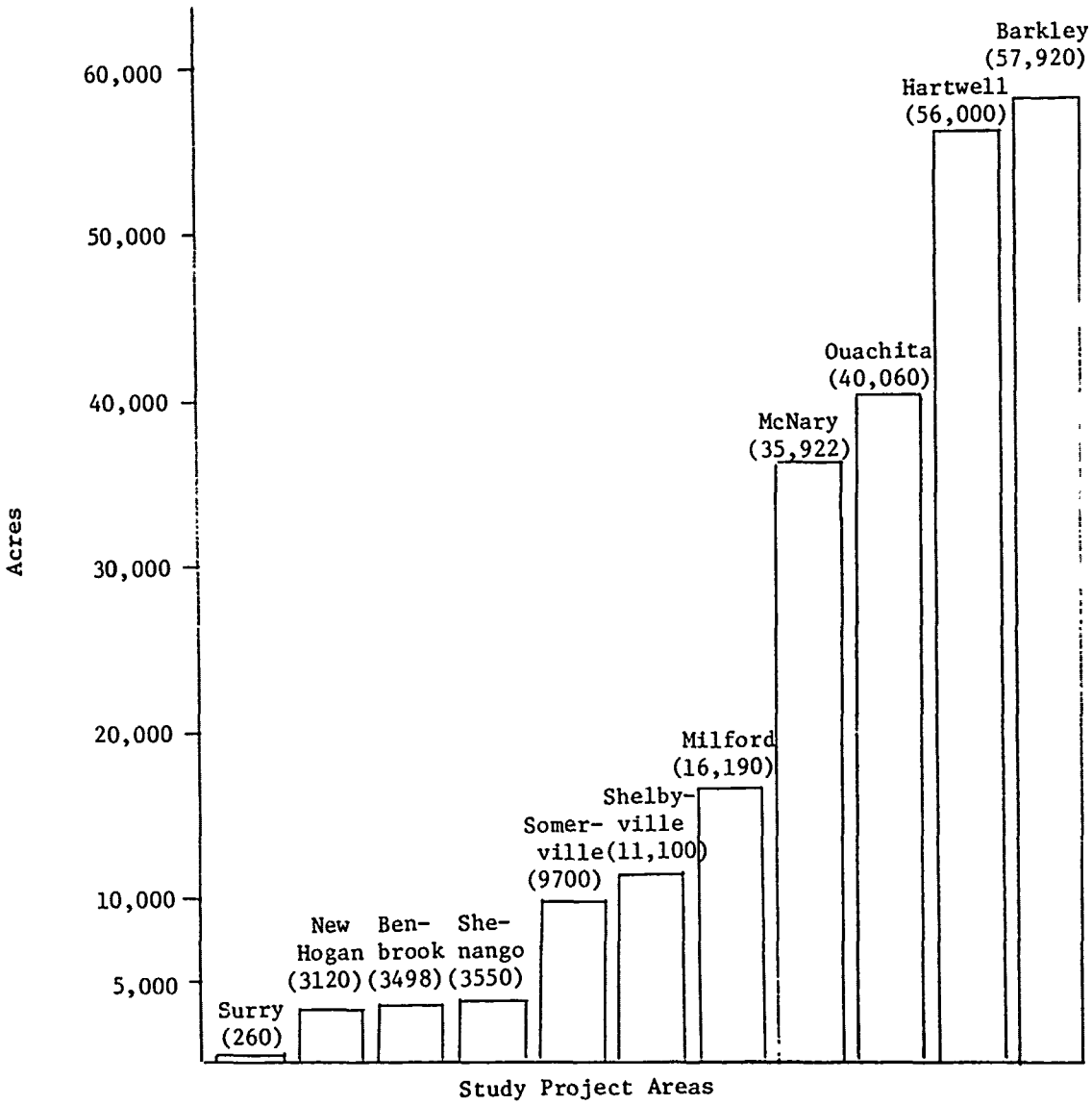


Figure 2. - Normal recreation pool sizes of the study project areas--a comparison

ranging from underused to heavily used; some areas have been redeveloped to preclude overuse. Wooded and nonwooded areas, well-developed to less developed areas, and areas close to the lake and far away exhibit the various recreational environments present at Barkley. Lake Barkley's submerged lands and obstructions make water depths uncertain, causing many boaters to use adjacent Kentucky Lake instead.

40. Benbrook Lake - Texas, Fort Worth District. Benbrook Lake, in the Dallas/Fort Worth metropolitan area, is an excellent example of a Corps metropolitan lake situation. It offers a variety of concentrated and dispersed activity areas. The lake surface receives heavy boating use; Mustang Park is overused and overcrowded; and Holiday Park is well balanced. The project area also includes 7 miles of horseback riding trails with rest stops and a camping area.

41. Hartwell Lake - Georgia and South Carolina, Savannah District. This very large lake of 56,000 acres has over 200 access points to the shoreline and is one of the most heavily used Corps lakes in the Nation. The location of campsites and picnic tables directly adjacent to the water or to interior natural areas of the parks make this project noteworthy. Overcrowding and overuse exist in several individual parks. Well balanced areas and underused areas are also present, thus providing a wide variety of use situations.

42. Lake Ouachita - Arkansas, Vicksburg District. Lake Ouachita contains several overcrowded and overused recreation areas used primarily for camping. The Brady Mountain Recreation Area, in particular, is now well balanced, the result of extensive changes made to the park through campsite reduction. Lake Ouachita's recreation areas vary greatly in their travel distances from the primary highway to the park; Brady Mountain Recreation Area is 7 miles (mostly on dirt roads) from a highway, while Joplin Recreation Area is located only 2 miles from a highway. The steep sloped and heavily wooded landscape is unlike many other projects visited.

43. Lake Shelbyville - Illinois, St. Louis District. Lake Shelbyville is the largest and most popular lake in its region. A wide variety of land- and water-based activities are available at several areas, some

of which are remotely located. State highways and secondary roads serve the area. Use of the individual recreation areas ranges from underused to heavily used. Wooded and clear areas exist at varying distances from the shoreline. Some areas have many facilities and services, others do not; a few areas have been redeveloped to better serve the users' needs and desires. Boating and waterskiing are attractive at Shelbyville because of good water depths.

44. McNary Lock and Dam, Lake Wallula - Oregon and Washington, Walla Walla District. Lake Wallula, at the McNary Lock and Dam, offers a range of overcrowded and overused to underused recreation areas. Also, several well-balanced activity areas exist because of irrigation, redesign, and user controls. The project is somewhat unique compared to the other Corps project areas visited; it is a lock and dam project and provides for hydroelectric power and irrigation. The extensive 64-mile-long Lake Wallula is situated in an arid climate and adjacent to an urbanized area of over 100,000 people.

45. Milford Lake - Kansas, Kansas City District. Milford Lake offers a wide variety of situations. While many of the recreation areas are heavily used, many are also well balanced. Several areas are also reportedly underused. Many of these areas with contrasting use levels are situated adjacent to one another and offer excellent potential for further study. In addition, the climate, natural features, vegetation, and activity area situations are different from the other project areas. Many of the project's earlier overuse and overcrowding problems have been eliminated through redesign.

46. New Hogan Lake - California, Sacramento District. New Hogan Lake is one of the smaller lakes visited; its recreational pool contains only 3120 acres. New Hogan receives considerable use from San Francisco Bay Area residents. Overcrowded and overused camping areas are represented here, with adjacent underused picnic areas. Boating on the lake is reportedly well balanced, but approaching overcrowded conditions. The hot climate, rocky soils, steep slopes, sparse vegetation, and heavy lake use make this project area excellent for further study.

47. Shenango River Lake - Pennsylvania and Ohio, Pittsburgh District. Shenango River Lake offers a wide variety of activity situations. It is a 3550-acre lake with heavy pool use. Lake zoning is used to prevent overcrowding and overuse and to achieve a well-balanced boating situation. A very large 300-site campground is located in the Shenango Recreation Area; many of these campsites are closely spaced, resulting in overcrowding and some overuse. A new 114-site campground has recently been completed and received its first use during the 1979 recreation season. These use situations make Shenango an excellent project for carrying capacity study.

48. Somerville Lake - Texas, Fort Worth District. Overlook and Welch Parks are nonfee areas which are overcrowded and overused. The parks include designated picnic and camping areas, as well as areas for random camping and other activities. The existence of informal roads leading to the shoreline, random shoreline parking, and overcrowding and overuse have all been reported. Yegua Creek Park offers a contrast to Welch and Overlook Parks because it is a well-balanced camping area with designated sites. Yegua is controlled through the use of a gate and attendant. Yegua Park also has one of the few off-road vehicle riding areas of the projects visited. The location of Somerville Lake is representative of the hot climate of the southwest.

49. Surry Mountain Lake - New Hampshire, New England District. The 260-acre Surry Mountain Lake is the smallest lake visited and provides a different setting for carrying capacity examination. It is reportedly representative of most New England Corps project areas. Surry Mountain exhibits a heavily used day use area in which overcrowding and overuse occur in several picnic locations. This day use area is inundated annually. The designated beach receives heavy use but is considered well balanced, and the lake is reportedly at the threshold of being overcrowded. Access to the water is limited to only the day use area because of mountainous terrain. This topographic condition offers unusual opportunities for control over water use.

Recreation Activities Considered

Initial activities

50. An initial list of possible outdoor recreation activities to be studied was prepared. This initial list was reviewed, refined, and reduced to include those activities considered most appropriate by WES and URDC.

51. Fifteen outdoor recreation activities were originally selected for study and grouped according to their priority for study:

a. First level priority. Camping, picnicking, boat launching, boating, boat fishing, shoreline fishing, waterskiing, swimming, and sunbathing.

b. Second level priority. Off-road vehicle (ORV) riding, hiking, hunting, snowmobiling, cross-country skiing, and horseback riding.

Final study activities and priorities

52. The initial field surveys of the project areas and additional study team discussions showed that all of the initially listed first level priority activities were relevant for carrying capacity consideration at the project areas. The most popular second level priority summer activities found at Corps recreation areas, hiking and off-road vehicle riding, were also selected for inclusion in the 1979 user survey. It was also decided that the greatest emphasis should be placed on camping, boating, waterskiing, swimming, sunbathing, and picnicking, and that fishing, ORV riding, and hiking receive less attention. Hunting, snowmobiling, cross-country skiing, and horseback riding would be either eliminated or selectively treated for the following reasons:

a. Hunting. Hunting is not a summer activity and there is a safety hazard involved with interviewing hunters. Further, hunting was not found to be a major problem at the projects visited during the management/site survey, and it is an activity which is regulated and enforced by the states rather than by the Corps.

b. Cross-country skiing and snowmobiling. Of all projects included in the user survey, cross-country skiing and snowmobiling occur only at Surry Mountain and Shenango. Also, these activities would require a winter user survey.

c. Horseback riding. Designated horseback riding trails on Corps-managed land were found only at Benbrook Lake, and horseback riding was not found to be a major carrying capacity problem.

Activity descriptions

53. This section defines the recreation activities addressed in this study and describes how each one is treated with respect to carrying capacity.

54. Boating. In this study, boating is defined as riding watercraft on a body of water for pleasure. Included in this activity are nonpower boating and limited and unlimited power boating. Carrying capacity guidelines pertain to lake boating as opposed to boating on a flowing river or stream. Carrying capacity guidelines are expressed in terms of distances between boats and amounts of water surface per boat.

55. Camping. Camping is temporary, overnight housekeeping away from one's permanent residence, set up either solely for the enjoyment derived from this activity or for the opportunity to participate in other activities. Capacity guidelines are more applicable to tent and trailer camping than to wilderness or group camping situations. Guidelines are expressed in terms of distances between the centers of campsite pads and in campsites per acre.

56. Fishing. Fishing is an activity which involves the taking of aquatic animals from bodies of water. Activities and capacity guidelines include boat and shoreline fishing. Boat fishing carrying capacity guidelines are expressed in terms of distances between anchored boats and in anchored boats per fished acre of surface water (this excludes water surface areas designated solely for waterskiing, swimming, etc.). Shoreline fishing capacity guidelines apply to distance between fishermen.

57. Hiking. In this study, hiking is considered to be walking along improved trails. This activity is often done in conjunction with nature study activities such as wildlife, flora, and bird observation along with camping. Guidelines are expressed in terms of distances between groups of hikers and do not apply to backpacking along primitive trails.

58. Off-road vehicle (ORV) riding. This activity involves riding

powered vehicles (motorcycles, jeeps, dune buggies, all terrain and four-wheel drive vehicles) on designated trails and off-road areas. Vehicle per mile guidelines pertain to ORV trail riding and vehicle per acre guidelines pertain to open area ORV play.

59. Picnicking. Picnicking involves outdoor eating and drinking activities set up either solely for the enjoyment of eating outdoors or also to participate in other outdoor recreation activities. Guidelines pertain to family picnicking rather than group picnicking and are expressed in terms of distances between picnic tables or numbers of picnic tables or units per acre.

60. Sunbathing. Sunbathing is defined as lying in the sun for the main purpose of enjoying the warmth and tanning effects of the sun's rays and for relaxation. Sunbathing can occur on most any type of site, but for purposes of this study, sunbathing applys to beach areas only. Guidelines are expressed in terms of the distance between groups of sunbathers and the number of groups of sunbathers per acre.

61. Swimming. Swimming involves propelling oneself through water at a fresh water beach. Recreation carrying capacity guidelines are expressed in terms of the distance between swimmers and the square feet of water surface per swimmer.

62. Waterskiing. Waterskiing is defined as riding over water on skis pulled by a boat to which the participant is tethered. Capacity guidelines are expressed in terms of distances between boats and numbers of boats per acre of surface water.

Selection of Activity Areas for the User Survey

63. An activity area is best described as an individual area, such as a hiking trail, campground, boat launching ramp, beach, picnic area, etc., upon which an activity takes place. Generally, there are several activity areas which together make up a larger recreation area or project area. For boating activities, the lake is the activity area.

64. Identification of candidate activity areas for the user survey was based upon the previous management/site survey which included

interviews with project area managers and rangers and onsite field surveys of the project areas. Thus, the sample areas for the user survey were not randomly selected and may not represent Corps areas as a whole. However, candidate activity areas were systematically evaluated and selected by activity according to four major criteria:

a. Predominant use level (overcrowded and overused, overcrowded, overused, well balanced, heavily used, or underused);

b. Representativeness of the activity area in terms of other Corps areas visited;

c. Individual activity area situations, or recreational environments; and

d. Potential for providing useful information in developing carrying capacity guidelines or demonstrating carrying capacity related techniques.

This process was used to identify the best candidate activity areas for each activity for the user survey.

65. All candidate activity areas were plotted on a matrix according to three environmental settings: (a) physical setting, (b) development /control setting, and (c) activity/use relationship setting. Each setting consisted of a variety of characteristics. Taken as a whole, the settings comprised a particular recreation environment for each activity area.

66. After all activity areas had been plotted on the matrix, the predominant settings of each activity became apparent as illustrated by the example in Figure 3 (e.g., "within 50 miles of metro area" is the predominant regional setting in the picnicking example in Figure 3). These predominant characteristics were highlighted on an overlay sheet and were called representative settings. The column for each candidate activity area intersected with the rows of possible representative settings at several points to produce an individual recreation environment for each activity area. For example, each picnic environment in Figure 3 is made up of 11 different recreation settings.

67. The next step consisted of recording the number of intersections each candidate activity area had with a representative setting (see numbers at bottom of Figure 3). The environments deemed most representative were those environments whose settings coincided most frequently with the

Representative Recreation Settings: [ ]

Candidate Activity Areas

(Recreation Environments)

I. Physical Settings	Rocky Creek	Holiday Park	Welch Park	Big Creek	Joplin	Little Fir	Spillway	Brady Mt.	Twelve Mile	Singing Pines	Big Oaks	Long Point	Hillside	Point	Upper	Lock Site	Old Lock	Bo Wood	Dam West	Lithia
A. Project Accessibility:																				
1. Regional Setting																				
. within SMSA*	X	X														X	X			
. within 50 mi of SMSA			X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
. within 100 mi of SMSA																				
. within 200 mi of SMSA																				
. beyond 200 mi of SMSA																				
2. Distance to Expressway																				
. 0 - 5 miles		X																		
. 6 - 25 miles	X		X	X			X	X	X	X	X	X	X	X	X					
. 26 - 50 miles					X											X	X	X	X	X
. 51 - 75 miles						X														
3. Distance to Highway																				
. 0 - 1 mile			X						X	X	X		X	X	X	X			X	
. 2 - 5 miles		X			X							X					X	X		X
. 6 - 10 miles	X			X		X	X	X												
. 10+ miles																				
B. Area Characteristics:																				
1. Slope																				
. Level (0-5%)	X	X	X	X		X		X		X	X	X		X	X		X	X	X	
. Moderate (6-10%)							X		X				X			X				X
. Steep (10%+)					X															
2. Vegetation																				
. Mostly open	X	X	X	X							X		X		X	X	X	X		
. Moderate							X					X								
. Dense					X	X		X	X	X			X		X					X
3. Access to Water Body																				
. Unobstructed	X	X	X	X		X		X	X			X		X					X	
. Partially obstructed					X		X			X	X		X					X		X
. Obstructed															X	X	X			

(continued)

* SMSA - Standard Metropolitan Statistical Area.

Figure 3. - Representative recreation settings for picnicking--AN EXAMPLE

Representative Recreation Settings: [ ]

Candidate Activity Areas (Recreation Environments)

	Rocky Creek	Holiday Park	Welch Park	Big Creek	Joplin	Little Fir	Spillway	Brady Mt.	Twelve Mile	Singing Pines	Big Oaks	Long Point	Hillside	Point	Upper	Lock Site	Old Lock	Bo Wood	Dam West	Lithia
I. Physical Settings (cont.)																				
4. Visibility to Water Body																				
. Mostly unobstructed	X	X	X	X					X		X			X					X	
. Partially obstructed					X	X	X	X		X		X	X		X	X	X	X		X
. Obstructed																				
5. Configuration of Area																				
. Regular			X	X	X	X	X	X	X	X	X	X	X	X	X	X				
. Irregular																	X	X	X	X
. Linear	X	X														X				
II. Development/Control Settings																				
A. Level of Development																				
. High								X		X		X				X		X	X	X
. Moderate	X			X	X	X	X		X		X		X	X	X					
. Limited		X	X														X			
B. Degree of Control																				
. High					X			X					X	X						
. Moderate	X	X		X			X		X	X	X	X			X	X		X	X	X
. Limited			X			X											X			
III. Activity/Use Relationship Settings																				
. Sharing			X	X																
. Adjacent					X	X	X	X	X	X		X	X	X				X	X	
. Separate	X	X									X				X	X	X			
. Remote																				
Total number of intersections each activity area had with a representative setting	6	4	7	8	5	7	7	7	8	8	8	8	7	9	8	5	3	6	7	3

Figure 3. (continued)

representative settings. Most of the recreation environments were different in some way, i.e., they possessed at least one characteristic which was not the same as in other environments for that activity. However, some activity areas shared a common type of recreation environment even though they may not have been located in the same project area.

68. Whether a recreation environment was deemed to be representative or nonrepresentative depended upon the number of times it coincided with the various representative settings. A representative number was found by examining the recreation environments. Starting with those environments which had the highest number of intersections with representative settings (see bottom of Figure 3) and proceeding incrementally to those with fewer, each environment was considered representative until a variety of use levels was reached. For example, it was sometimes necessary to include recreation environments with lower representative numbers, to ensure a mix of overcrowded (OC), overused (OU), and well-balanced (W) areas. A number was not determined for hiking or horseback riding because of insufficient variety of use levels and the small number of activity areas.

Priority matrix

69. Priorities were assigned to the candidate activity areas for the user survey according to the following schedule based upon level of use and representativeness (highest to lowest priority):

a. Overcrowded and overused (OC/OU)--representative
b. Overcrowded and overused (OC/OU)--nonrepresentative
c. Overcrowded or overused (OC/OU)--representative
d. Well balanced (W)--representative
e. Overcrowded or overused (OC/OU)--nonrepresentative
f. Well balanced (W)--nonrepresentative
g. Heavily used, not necessarily overused (H)--representative
h. Heavily used, not necessarily overused (H)--nonrepresentative
i. Moderately heavily used (M-H)--representative
j. Moderately heavily used (M-H)--nonrepresentative
k. Underused (U)--representative
l. Underused (U)--nonrepresentative

The higher the priority, the more important it was for the activity area to be included in the user survey. The priority matrix served as the primary source for selecting activity areas for the user survey. However, it was necessary to include some lower priority areas to cover a variety of different situations--fee/nonfee, primitive/highly developed areas, urban/rural locations, multiple use/single use areas, etc. Several areas with lower priority ratings were selected because of their high potential for demonstrating carrying capacity related techniques. Nearly all activity areas which experience overcrowding and/or overuse were selected. Also, many well-balanced areas were chosen. Heavily used areas were used to fill voids where higher priorities were deficient and some underused areas were chosen. The resulting recreation areas selected for the user survey are listed by Corps Project in Table 2.

Determining the number of interviews by activity

70. The URDC Study Team allocated a percentage of the total 3,300 interviews to each recreation activity. The allocation was made largely on the basis of two considerations:

a. The relative importance of the activity based upon the number of offerings at the Corps project, the capacity problem areas identified by project area staff, and field observations by URDC Study Team members; and

b. The number of visitors likely to be found participating in a given activity.

The results of this allocation process are summarized in Table 3.

Determining the number of interviews by activity area

71. The activity areas had been selected and the number of interviews desired per activity were determined. The next step was to distribute the number of interviews among the various activity areas. The number allocated to each activity was then equally spread over all the activity areas in which that activity occurred. This procedure was used for all of the activities except picnicking and camping. The number of picnicking and camping interviews per activity area was determined

Table 2

User Interview Plan by Activity Area

Project	Recreation Area	Number of Interviews Planned by Activity Area for each Recreation Activity												
		Picnicking	Camping	Sunbathing	Swimming	Boat Launch	Boating	Water-skiing	Boat Fishing	Shore Fishing	Hiking	Horseback Riding	ORV Riding	Totals for Project Area
Hartwell	Singing Pines	22												
	Long Point	26												
	Twelve Mile	9				18		16	16					
	Watsaddler		14											
	Oconee Point		21	19	12			16	16					
	Milltown		19											
	Asbury		19											
	Crescent		18											
	Big Oaks					18								
	Hartwell Lake						39							
	Savanah River									14				
	Beaver Trail										19			
	Locust Point											13		
	(Subtotals)	57	91	19	12	36	39	32	32	14	19	13		364
Surry	Point 2-B	15												
	Upper 2-C	8												
	Surry Mountain Res.			22	12	18	39	17						
	(Subtotals)	23		22	12	18	39	17						131
McNary	Hood Park	67	26	19	11	17		19						
	Madame Dorion		9											
	McNary Beach				11									
	McNary Dam					17								
	McNary Wildlife										19			
	Lake Walula						39							
	(Subtotals)	67	35	19	22	34	39	19			19			254
Benbrook	Holiday H1+2	12												
	Mustang Park M-3		6	19	12									
	Holiday H-4		9											
	Rocky Creek					18								
	Benbrook Lake						39	16	18					
	Holiday Park									14		14		
	Dam Breast									14				
	(Subtotals)	12	15	19	12	18	39	16	18	28		14		191
Somerville	Welch	12	10	19	12	17		16	16					
	Yegua Creek		35			17		16	16				8	
	Big Creek		24			17				16				
	Somerville Lake						39							
	Overlook Point								16					
	(Subtotals)	12	69	19	12	51	39	32	48	16			8	306

(continued)

Table 2 (continued)

Project	Recreation Area	Number of Interviews Planned by Activity Area for each Recreation Activity												
		Picnicking	Camping	Sunbathing	Swimming	Boat Launch	Boating	Water-skiing	Boat Fishing	Shore Fishing	Hiking	Horseback Riding	ORV Riding	Totals for Project Area
Ouachita	Little Fir	11							16	14				
	Joplin	2	22	19	11	17		16						
	Crystal Spring		22	19	11	17		16						
	Brady Mountain		24	19		17					18			
	Lake Ouachita						39							
	Hiway 27								17	14				
	Denby Point										18			
	(Subtotals)	13	68	57	22	51	39	32	33	28	36			379
Shelbyville	Dam West	31		19	11									
	Bo Wood	45									18			
	Opossum - Tent C, D, E		9											
	Lone Point - A,B,C,D,E		36					16						
	Lithia - C		10											
	Coon Creek-A,B,C,D,E,F		70								18			
	Coon Creek - G, H		17											
	Sullivan				11									
	Lithia					17								
	Wilborn					17								
	S. Lake @ Lithia						39	16						
	Kaskaskia Wildlife								16					
	Okaw Wildlife								16					
	Findlay Brook									14				
	Tail Water									14				
	Wolf Creek State Park											13		
	(Subtotals)	76	142	19	22	34	39	32	32	28	36	13		473
Barkley	Eureka	17	13			17								
	Kuttawa	21		19	12									
	Canal		23		12								8	
	Canal Walk-in Tent		8											
	Hurricane					17								
	Tail Water								18					
	Lake Barkley State Pk.											13		
	Hickman											13		
	Lake Barkley						39							
	(Subtotals)	38	44	19	24	34	39		18			26	8	250

(continued)

Table 2 (Concluded)

Project	Recreation Area	Number of Interviews Planned by Activity Area for each Recreation Activity												
		Picnicking	Camping	Sunbathing	Swimming	Boat Launch	Boating	Water-skiing	Boat Fishing	Shore Fishing	Hiking	Horseback Riding	ORV Riding	Totals for Project Area
Milford	School Creek		40										8	
	Timber Creek - North		16											
	Rolling Hills				12					14				
	Outlet				12					14				
	Farnum Creek					18								
	Milford Lake						39	16						
	Timber Creek - South										19			
	(Subtotals)		56		24	18	39	16		28	19		8	208
New Hogan	Fiddleneck	17				18								
	North Shore	33												
	Acorn		45			17								
	Oak Knoll		28											
	Wrinkle Cove				12									
	New Hogan Lake						39	19						
	Whiskey Creek								18					
	Calaveras River									14	18			
	(Subtotals)	50	73		12	35	39	19	18	14	18			278
Shenango	Shenango	15	122	19	12	17								
	Mahaney	66		19	12	17								
	Mercer		11											
	Shenango River						39	16						
	East End								16					
	West End								16					
	846 Crossing									14				
	Golden Run									14				
	Dam Outlet									14				
	Seth Meyers										18			
	Paden Farm												9	
	(Subtotals)	81	133	38	24	34	39	16	32	42	18		9	466
	GRAND TOTALS	429	726	231	198	363	429	231	231	198	165	66	33	3300

Table 3

User Interview Allocation Plan by Activity

Activity	Project Areas	Activity Areas	Average Interviews per Activity Area	Activity Interviews	Percent of Total Interviews
Picnicking*	10	18	24	429	13
Camping*	10	29	25	726	22
Sunbathing	9	12	19	231	7
Swimming	11	17	12	198	6
Boat launching	11	21	17	363	11
Boating	11	11	39	429	13
Waterskiing	10	14	16	231	7
Boat fishing	8	14	16	231	7
Shore fishing	8	14	14	198	6
Hiking	7	9	18	165	5
Horseback riding	4	5	13	66	2
ORV riding	4	4	8	33	1
				3,300	100

*Of the recreation areas surveyed, the average size picnic area has 56 picnic tables and the average size camping area has 68 campsites.

proportionately on the basis of the number of sites within the activity area; areas with more sites received more interviews. Table 2 shows the resulting distribution of interviews by activity area for the 11 projects visited in the user survey.

Schedule for the
1979 summer user survey

72. The following user survey schedule was prepared based on number of interviews planned, peak month visitation data, prior discussions with resource managers, and the mechanics of scheduling project visits in May, June, and July:

	Schedule			
Project	Friday	Saturday	Sunday	Monday
New Hogan	May 11	12	13	14
Benbrook	May 18	19	20	21
Somerville	May 18	19	20	21
Quachita	June 15	16	17	18
Hartwell	June 22	23	24	25
Barkley	July 6	7	8	9
Milford	July 6	7	8	9
McNary	July 13	14	15	16
Shelbyville	July 13	14	15	16
Surry Mountain	July 20	21	22	23
Shenango	July 27	28	29	30

User Survey Purpose and Procedures

User survey purpose

73. The purpose of the user survey was to determine what the actual users of Corps projects deem to be overcrowding and overuse and why users sometimes do not use existing facilities to their capacity. This survey was designed to determine whether or not the problem of overcrowding and/or resource overuse is really a problem in the minds and experiences of the recreating public at Corps recreation areas to ascertain the reasons

for pleasant and unpleasant experiences and to test the acceptability of various capacity design and management techniques.

74. The results of this survey were used in developing a method for determining appropriate levels of recreational carrying capacity which will satisfy user needs and desires while protecting the natural resources upon which the recreation activities are based. The survey results were also used to develop day-to-day practical carrying capacity design and management guidelines for use by Corps managers, planners, and designers.

User survey procedures

75. Interviews were conducted at each study project area over a four-day period covering Friday, Saturday, Sunday, and Monday. The interviews were scheduled during a month of high visitation. Professionals from the URDC study team conducted the onsite interviews with recreators participating in one of the following 11 recreation activities: camping, boating, boat launching, waterskiing, swimming, sunbathing, picnicking, shoreline fishing, boat fishing, hiking, and off-road vehicle riding.

76. The following guidelines were used by the study team to select interviewees:

a. Respondents should be selected from a variety of age groups. Age groups should include young adults (18-25), middle age (26-40), mature age (41-65), and elderly (over 65). Attempts should be made to interview members of each age group. Also, people 15-17 and over 65 should be interviewed.

b. People participating in an activity under crowded, heavy use, and conflict situations should be interviewed whenever possible.

c. Heads of households or their spouses should be interviewed whenever possible.

d. People participating with groups of various sizes should be interviewed.

e. No more than one member of a family or user group should be interviewed.

f. A participant should be interviewed only one time and for only one activity, even though he or she may be participating in more than one activity during his or her visit.

g. In case of a nonresponse, the interviewer should continue selecting and interviewing respondents in accordance with the above guidelines until the predetermined number of interviews is reached.

PART III: SUMMARY OF FINDINGS

PART III: SUMMARY OF FINDINGS

77. Major findings are included in this part of the report. Additional and supportive information regarding the findings can be found in other sections of the report (see reference pages in the right-hand column). The findings are grouped according to the following six categories:

a. Carrying Capacity Factors;

b. Overcrowding;

c. Overuse and Underuse;

d. Indicators of Overuse and Overcrowding;

e. Carrying Capacity Management Techniques; and

f. Other Summary Findings.

78. Overall, this study found that Corps recreation environments cover a multitude of recreation settings. Each environment is made up of different physical settings, development and control settings, and activity relationship settings. Although some Corps recreation environments are overcrowded and overused, many are well balanced according to the results of the management/site survey and user survey.

Carrying Capacity Factors

79. The appropriate carrying capacity of a Corps recreation environment contains elements of both social capacity and resource capacity. Social capacity is the capacity level which is most appropriate for user satisfaction. Resource capacity is the capacity level which is most appropriate for recreation resource protection. Understanding and dealing with recreational carrying capacity requires knowledge about the many factors which affect and determine social and resource capacity. The number and variability of these factors have in the past frustrated the development of carrying capacity analysis.

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Summary findings regarding carrying capacity factors are listed below:

		References
a.	The management/site survey and user survey confirm that many factors affect both the resource and social capacity of a given activity area.	Part V
b.	Corps personnel interviewed recognize the need to identify and examine carrying capacity factors prior to determining an area's carrying capacity.	Part V
c.	Most of the management/site survey respondents readily identified with resource capacity factors, but found it more difficult to relate to and determine the social capacity factors.	Part V
d.	Overall, more factors affect social capacity than resource capacity.	Part V
e.	Most respondents interviewed during the management/site survey felt that the social capacity factors are more important than resource factors when determining carrying capacity of water-oriented activities (e.g., boating, swimming, waterskiing).	Part V
f.	For many activities, the most important social capacity factors include: degree of control, level of development/support facilities, compatibility of nearby primary activities, density of vegetation, proximity to the water, and proximity to support facilities.	Part V
g.	Several important resource capacity factors common to many activities include: resiliency of soils, vegetation, etc.; level of development; degree of control; topography/slope of the land; and stability of beach, trail, etc.	Part V
h.	Planning and management objectives can increase or decrease an area's carrying capacity. For example, the decision to utilize impact campsites could greatly increase the resource capacity of an activity area; or the decision to plan for semi-wilderness, walk-in tenting areas could reduce an area's carrying capacity.	Part VII

i.	Users will generally accept closer spacing (higher densities) if the level of development is higher, if facilities are more conveniently located, or if facilities are better maintained.	Part V
j.	Users will generally accept closer spacing (higher densities) if the degree of control provided is higher.	Part V
k.	Users will generally accept closer spacing when the condition of trees and grass is pleasant, when the water quality is pleasant, or when catching fish is pleasant.	Part V
l.	Campers and picnickers generally prefer greater spacing (lower densities) when sites are more accessible to the lake or when the lake is more visible from the sites.	Part V
m.	The impact that different user characteristics (age, travel time, group size, etc.) have on social capacity varies among different activities.	Part V

Overcrowding

80. Overcrowding is a condition where the recreator does not achieve a satisfactory recreation experience because he believes that there are too many people or that there is inadequate spacing between users. Overcrowding occurs when the social capacity of an area is exceeded. Crowding is an important consideration in understanding social capacity. Frustrations occur when people are too close together or when people have to wait too long to use a recreation area. Overcrowding often causes negative influences on both the users' experiences and the resource when people start to compete for space, when activities conflict with one another, when litter and vandalism increase, when noise levels rise, and when accidents occur. Summary findings regarding overcrowding are listed below:

		References
a.	Of all the Corps activity areas, camping areas had overcrowding problems most frequently.	Part IV

	References
b. Overcrowding occurs at some Corps campgrounds (especially those with limited controls), beaches and swimming areas, picnic areas, launching ramps, and portions of the lake surface (especially the water areas near ramps, marinas, and developed recreation areas). No overcrowding was reported or observed at Corps hiking trails.	Parts IV, V
c. Overcrowding typically occurs at activity areas which are attractive to users and which have limited use controls (e.g., campgrounds that afford easy access to the lake but have no individually designated sites or gate attendant).	Parts IV, V
d. Overcrowding on Corps lakes is more of a problem than overuse, and overcrowding on the lake will generally occur before overuse. Some signs of overcrowding are: increases in the number of user compliants, increases in the number of accidents, and changes in the types of users (e.g., fewer sailboats, nonpower boats than before).	Parts IV, V
e. Smaller lakes are more prone to overcrowding than larger lakes. Larger lakes generally tend to have nodal crowding problems on water areas near boat launching ramps, marinas, and developed recreation areas.	Part V
f. According to most of the users surveyed, the Corps of Engineers is providing for just-the-right number of recreators in a given area. Over 75 percent of the respondents indicated the number of people participating in the activity was just right. Ten percent of the respondents indicated there were too many people.	Parts IV, V
g. Eighty-one percent of the respondents indicated that the distance between them and other recreators was just right. Fourteen percent felt other people were too close, while five percent felt other people were too far.	Part IV

Overuse and Underuse

81. Overuse is a condition where degradation of the physical environment during the course of a recreation season/y. makes the resource no longer suitable or attractive for the present use. Overuse occurs when the resource capacity of an area is exceeded. Underuse is a condition where use levels of an area are significantly less than their potential. Summary findings regarding overuse and underuse are listed below:

	References
a. Resource overuse conditions are best perceived by project managers and rangers rather than by users.	Parts IV, V
b. Generally, activity areas that have one or several of the following characteristics are prone to overuse: a location adjacent to the lakeshore; a steep sloping topography; shallow sensitive soils; a dense tree canopy (which blocks out sunlight and prevents the establishment of grass); and a limited degree of control.	Parts IV, V
c. Overuse occurs primarily in camping areas in particular, those sites which are shaded and near the water.	Parts IV, V
d. Overuse can be eliminated and prevented through the application of certain techniques, such as, site hardening, strict enforcement of parking regulations, and vehicle circulation control. Prior overuse problems have been solved in some camping areas as a result of designated sites, hardened camp pads, and vehicle circulation controls.	Parts IV, VII
e. If not corrected, the impacts due to overuse are cumulative from season to season.	Part IV
f. Some Corps project areas have significant shoreline erosion problems. Shoreline erosion, while it is aggravated by boating activities, occurs largely because of wave action from wind and from water level fluctuations.	Parts IV, V

g.	Some Corps recreation areas are underused. Typically, underused activity areas have one or more of the following characteristics: a relatively remote location in regard to the lake, project users, or other activity areas; poor road access to the area; difficult access within the activity area; a limited number of support facilities; or few shade trees.	Part IV
h.	Underuse situations were most typically found: on remotely located hiking trails; in picnic areas located away from the lake; and in some camping areas that were comparatively far from the lake and lacked electric/water hookups.	Part IV

Indicators of Overuse and Overcrowding

82. Many indicators can be used in conjunction with a monitoring system to determine when activity areas are overused or overcrowded. To be effective, indicators (signs) of overcrowding and overuse must be predictive. They should occur before serious problems develop so that actions can be taken to prevent such problems. Summary findings regarding indicators of overuse and overcrowding are listed below:

		References
a.	Project managers agreed that periodic observations together with good indicators can be used to determine when a recreation environment is approaching overcrowding and overuse. A monitoring of use level situations will permit the evaluation of the carrying capacity of an area under real-life conditions.	Parts IV, V, IX
b.	Basically three general categories signal overcrowding and/or overuse: (1) increases in negative social incidents, (2) degradation of the recreation resource, and (3) increases in the provision of services, maintenance, and restoration.	Part V
c.	For many activities, the most important indicators of overcrowding include: increases in the number of complaints, conflicts between users, crowded support facilities, and increases in the provision of services.	Part V

	References
d. The most important indicators of overuse reported during the management survey include: ground cover wearing away, compacted soils, absence/change in aquatic life, and increases in the provision of maintenance and restoration.	Part V
e. Some indicators are unique to a particular activity or recreation resource. For example, an absence or change in a particular wildlife species might indicate there are too many off-road vehicle riders or snowmobilers, or other recreators in an activity area.	Part V
f. Some indicators can be seen immediately (ground cover wearing away, eroded soils, congested support facilities, etc.), others require more time to observe (changes in the type of users at an activity area, user relocations, etc.).	Part V
g. Some indicators are easier to measure, particularly the resource overuse indicators; others, especially the indicators of overcrowding, appear to be more subjective and more difficult to determine.	Part V
h. Most resource managers were able to relate well to the indicators listed on the management/site survey sheets and could decide on the relative importance of indicators; managers had more difficulty relating to carrying capacity factors and their relative importance.	Part V
i. Most project managers and rangers interviewed during the management/site survey agreed that for water surface activities such as boating, waterskiing, and swimming, indicators of overcrowding will occur well before indicators of resource overuse.	Part V

Carrying Capacity Management Techniques

83. Various techniques are available for dealing with overuse and overcrowding. Problems created by overcrowding and overuse in recreation areas can often be prevented or remedied. Summary findings regarding management techniques are listed below.

		References
a.	Among the Corps projects visited, a wide variety of different techniques and methods are used to affect carrying capacity, control use, and ensure visitor safety.	Part VII
b.	Generally, carrying capacity control techniques can be grouped into five categories: (1) general planning techniques, (2) site planning and design techniques, (3) management techniques - procedures, (4) management techniques - rules and regulations, and (5) management techniques - services/facilities.	Part VII
c.	Some of the techniques are more direct (e.g., closing a gate), others are more subtle (e.g., providing separate camping and day use areas).	Part VII
d.	Some techniques can be used in the initial master planning stages (e.g., providing dispersed recreation areas), others are remedial-action oriented (e.g., reducing the size of a parking lot).	Part VII
e.	Of all the recreation activities, camping has received the most attention in terms of the number of techniques applied.	Part IV
f.	Many techniques apply generally to recreation areas and not to specific recreation activities.	Part VII
g.	Activity zoning of lake surface is not used at any of the study projects; however, boat speed zoning is used at several to reduce user conflicts and shoreline erosion.	Part IV
h.	A number of techniques which affect carrying capacity control are influenced by Title 36;[2] in some situations, Title 36 in some ways limits or precludes the use of certain techniques.	Part VII

		References
i.	Most of the techniques identified during the management/site survey were reported to be effective.	Part IV
j.	One of the most effective methods of reducing resource overuse reported in many of the project areas was channelizing vehicular traffic and providing designated campsites and impact areas--these have solved many of the earlier overuse problems.	Part IV
k.	Except for use of control gates, few techniques that directly control overcrowding were encountered; techniques regarding public awareness, rules and regulations, maintenance, and restoration were used more frequently.	Part IV
l.	At a number of the recreation areas visited, techniques to control overcrowding and overuse were not needed because the areas were well balanced or underused.	Part IV
m.	The more recent practice of separating camping from day use activities reportedly had reduced user conflicts and enhanced the recreational experience in many areas.	Part IV
n.	Reservation and permit systems have been used largely for group activities.	Part IV
o.	Project managers should expect some expression of opposition to any carrying capacity control technique they employ. The more users understand the rationale of a technique, the more likely they will accept its use.	Part VII
p.	The more apparent the problem of overcrowding and overuse is to the user, the more likely the user will accept a remedial technique to solve the problem.	Part VII
q.	Generally, techniques which can be applied on a short-term or selective basis to problem areas are favored.	Part VII
r.	Remedial techniques which call for reductions in existing recreation opportunities are strongly disfavored. Overdeveloping an area with the idea that selective cutbacks in services and facilities can be accomplished later should be avoided.	Part VII

	References
s. Users probably will be more inclined to accept a preventative technique applied in newly developed areas than a corrective technique applied to established areas.	Part VII

Other Findings

The users surveyed

84. The following describe the user characters and situations identified as a result of the user survey:

a. A variety of different age groups utilize Corps recreation facilities. Forty-one percent of the users surveyed were in the 26-40 age group. Five percent were under 17, 23 percent were 18-25, 20 percent were 41-55, 8 percent were 56-65, and 3 percent were over 65.	Part V
b. Almost 32 percent of the people interviewed were with groups of five or more people. Eight percent of the interviewees were with groups of nine or more people, 35 percent were with groups of three or four people, 28 percent had a group size of two, and five percent of the users surveyed were by themselves.	Part V
c. The Corps project area was the final destination of 95 percent of the users surveyed; five percent of all the people interviewed were at Corps recreation areas as a result of a stopover on a longer trip.	Part V
d. Sixty percent of the people interviewed travelled less than one hour to get to Corps Recreation Areas; 36 percent of the users surveyed travelled less than 30 minutes; only eight percent travelled more than three hours.	Part V
e. Ninety-two percent of the people interviewed participated at least once last year in the activity for which they were interviewed.	Part V
f. Most Corps recreators surveyed engaged in multiple activities. Approximately 80 percent of the people interviewed were at the	Part V

	References
project area to participate in more than one activity. Over 30 percent were there to participate in their main activity plus four or more other activities.	Part V
g. Many of the users surveyed were repeat visitors. Seventy-six percent of the people interviewed came to the same project at least once last year.	Part V
h. Fifty-seven percent of the respondents engaged in day use activities recreated for a period of more than five hours. Fifty-nine percent of the campers reported that they camped for a period greater than two days; 28 percent were two-day campers; and 13 percent were one-day (overnight) campers.	Part V

User survey responses about changes in the recreation area

85. The following describe the changes in recreation areas reported by the respondents in the user survey:

a. Seventy-six percent of the user survey respondents who visited the area sometime before noticed either physical and/or social changes from previous visits to the recreation areas where they were interviewed.	Part V
b. Over 60 percent of these respondents indicated positive changes in the physical environment of recreation areas; 51 percent indicated negative changes in people's use of the recreation areas.	Part V

Management/site survey findings regarding user complaints

86. The following describe the user complaints reported by the respondents in the management/site survey:

a. Corps rangers receive the brunt of the complaints from users because their contact with the users is high. Most user complaints are made by campers, picnickers, boaters, swimmers, and sunbathers; very few complaints come from waterskiers, hikers, or boat launchers.	Parts IV, V
b. User complaints concern all facets of the recreation experience; many of the user	Parts IV, V

	References
complaints are related to support facilities (inadequate parking, cleaner restrooms, etc.).	Parts IV, V
c. Many user complaints are indirectly related to carrying capacity while others are more directly related to overcrowding and overuse. Too much noise, conflicts between users, not enough campsites, not enough support facilities, and too many boaters, skiers, and people are prevalent complaints relating to overcrowding. Late arriving picnickers locating too closely to early arrived picnickers is a specific complaint received at several project areas which directly suggests overcrowding.	Parts IV, V
d. User complaints about resource overuse are few in comparison to user satisfaction and overcrowding-related complaints. Generally, the user complaints relating to overuse reflect dislike of being restricted from doing things which cause overuse, i.e., restricting vehicle access to an area, channelizing traffic, etc.	Parts IV, V

PART IV: DETAILED FINDINGS BY STUDY AREA

PART IV: DETAILED FINDINGS BY STUDY AREA

Introduction

87. This part of the report uses a case study approach to present the major findings of the site analysis, management survey, and user survey by project area. An initial descriptive orientation is provided for each of the 11 study project areas.[3*] This format encourages the examination of major project features together with the significant survey findings, thus enabling project managers to compare their projects with the projects studied.

88. The user survey findings section presents summary findings that show an overview of the users' perception of the use level situation at each project area. The findings include statements of fact from the survey results. No attempt has been made in this section to analyze and provide reasons for each finding; reasons will be explored in subsequent chapters. Also, additional user survey results are included, from time to time, in the analysis of total survey results.

Barkley Lock and Dam

Descriptive orientation

89. Barkley Lock and Dam provides flood control, navigation, and hydroelectric power. It is located in a rural area, with Paducah, Kentucky, 25 miles to the west; Nashville, Tennessee, about 100 miles to the southeast; and St. Louis, Missouri, about 150 miles to the northwest. Lake Barkley has the largest total project acreage of the survey projects (108,600 acres), the largest normal pool area (57,920 acres), and the longest shoreline (1004 miles). Lake Barkley extends 118 river miles upstream, varying in width from 1/2 to 2-1/2 miles. The topography of the surrounding land varies from gently rolling hills causing a moderately steep shoreline to steep hills causing low bluffs along the shore. The

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* See Appendix B.

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vegetation in the project area also varies: grazing pastures, hayfields, herbaceous and woody plants, and a variety of forested areas exist. In summer the temperature is in the upper 80°F, while the average annual precipitation is 44 in. of rain and 12 in. of snow.

90. The project is accessible to both local and regional traffic by a well-dispersed system of Federal, State, and county highways. A variety of recreation environments exist, with areas ranging from under-used to heavily used, well developed with many facilities and services to less developed; to close proximity to the lake and far away. The 1978 visitation was 5,395,900 recreation days.

Site analysis findings

91. The Corps manages 23 recreation areas (Figure 4) and numerous access areas. A State resort park, municipally operated recreation areas, and six privately operated marinas are also on the lake. Activities available at Corps and/or other public or private areas are: camping, boating, hiking, picnicking, horseback riding, fishing, hunting, and waterskiing. Most of the Corps areas are located on the edge of the lake with easy access to the water.

92. The recreation areas are dispersed around the lake. Although some are up to 5 miles from a main highway, the local roads are in good condition.

93. Originally, some camping areas were poorly laid out. Many sites are now being rehabilitated to better fit the terrain, levels of use, and type of camping.

94. The overall level of development and control is moderate. The two fee areas provide electric hookups, a control gate with an attendant, and other support facilities.

95. More information about the recreation settings and features of the Barkley study activity areas is shown in Table 4.

Management survey findings

96. Project management personnel report that the use level situation is generally well balanced to heavily used. There is some evidence of overuse in campgrounds, in picnic areas, and on the shoreline where boats are beached at campgrounds, but overuse is not a serious problem.

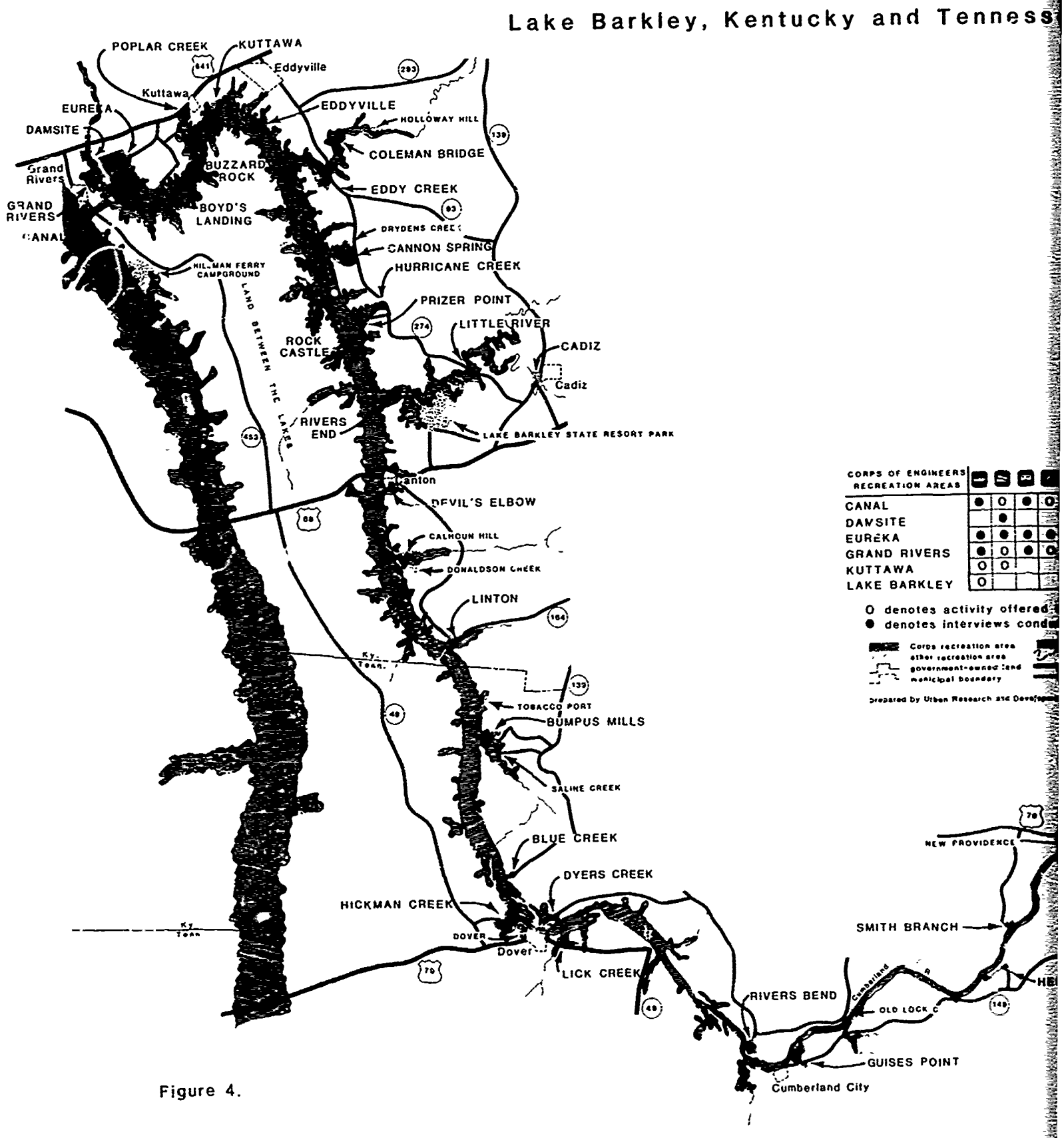
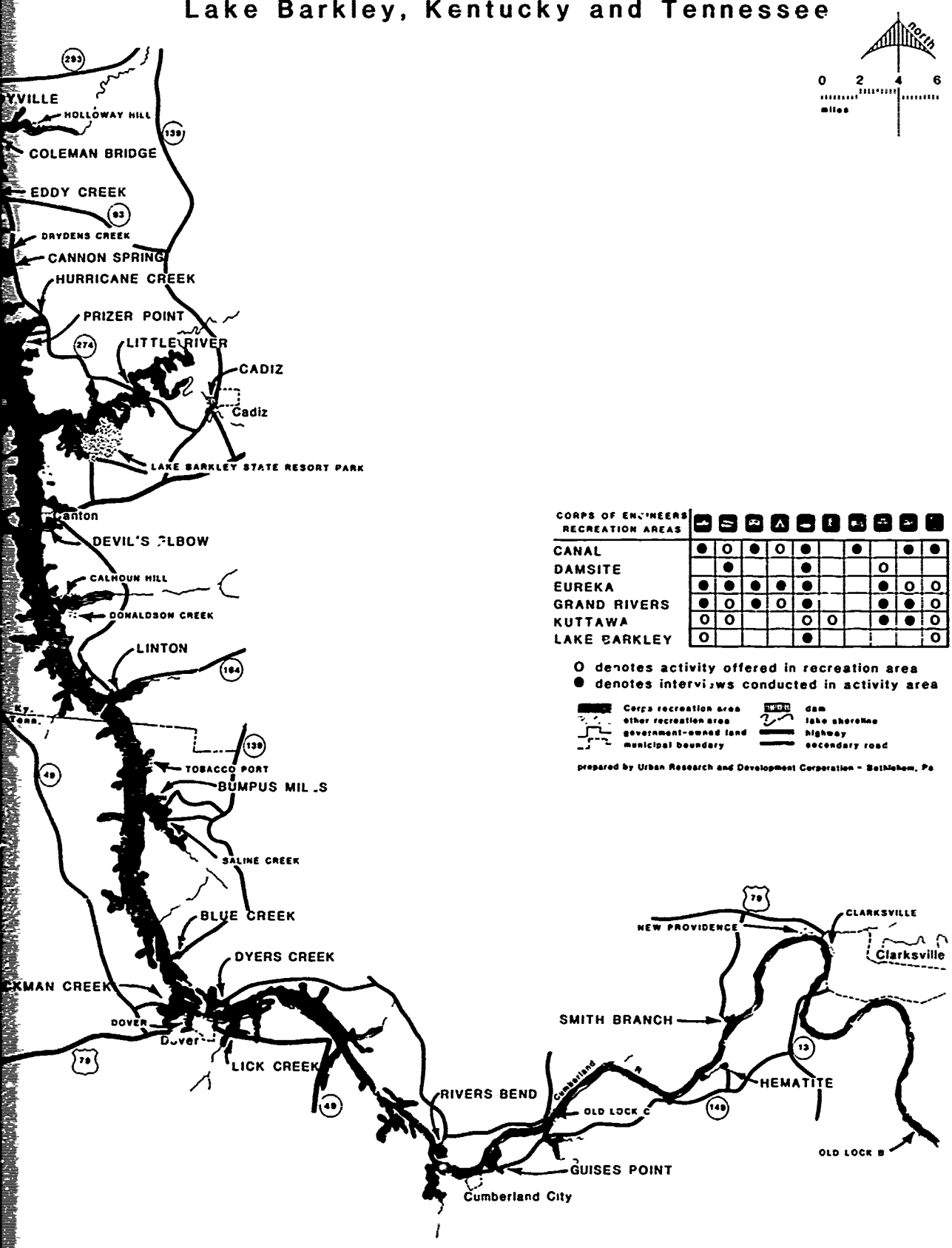

Lake Barkley, Kentucky and Tenness
POPLAR CREEK
KUTTAWA
Eddyville
Kuttawa
EUREKA
DAMSITE
EDDYVILLE
HOLLOWAY HILL
COLEMAN BRIDGE
BUZZARD ROCK
Grand Rivers
GRAND RIVERS
CANAL
BOYD'S LANDING
EDDY CREEK
DRYDENS CREEK
CANNON SPRING
HURRICANE CREEK
HILLMAN FERRY CAMPGROUND
LAND BETWEEN THE LAKES
PRIZER POINT
LITTLE RIVER
ROCK CASTLE
CADIZ
Cadiz
RIVERS END
LAKE BARKLEY STATE RESORT PARK
Canton
DEVIL'S ELBOW
CALHOUN HILL
DONALDSON CREEK
LINTON
Ky. Tenn.
TOBACCO PORT
BUMPUS MILLS
SALINE CREEK
BLUE CREEK
DYERS CREEK
HICKMAN CREEK
Ky. Tenn.
DOVER
Dover
LICK CREEK
NEW PROVIDENCE
SMITH BRANCH
RIVERS BEND
Cumberland
OLD LOCK
GUISES POINT
Cumberland City
CORPS OF ENGINEERS RECREATION AREAS
CANAL
DAMSITE
EUREKA
GRAND RIVERS
KUTTAWA
LAKE BARKLEY
O denotes activity offered
● denotes interviews cond
Corps recreation area
other recreation area
government-owned land
municipal boundary
Prepared by Urban Research and Deve

Figure 4.

Lake Barkley, Kentucky and Tennessee



CORPS OF ENGINEERS RECREATION AREAS										
CANAL	●	O	●	O	●		●		●	●
DAMSITE		●			●			O		
EUREKA	●	●	●	●	●			●	O	O
GRAND RIVERS	●	O	●	O	●			●	●	O
KUTTAWA	O	O			O	O		●	●	O
LAKE BARKLEY	O				●					O

O denotes activity offered in recreation area
● denotes interviews conducted in activity area

Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation - Bethlehem, Pa

Table 4

Barkley Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land			Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control				Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acres)	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+% Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																								
Canal		x				x					x					x			x	x			x			x			x				x				-	57,920	-	N
Eureka		x				x					x					x			x	x			x			x			x				x				-	-	-	N
Grand Rivers		x				x					x					x			x	x			x			x			x				x				-	-	-	N
Boat Fishing																																								
Lake Barkley		x				x				x						x			x	x			x			x			x				x				-	57,920	-	N
Boat Launching																																								
Eureka		x				x					x			x			x			x			x			x			x					x			2		-	N
Outlet		x				x				x				x			x			x			x			x			x					x			8		-	N
Camping																																								
Canal		x				x					x				x			x		x			x			x			x					x			63	70	0.9	$
Eureka		x				x					x			x			x			x			x			x			x					x			35	51	0.7	N
Grand Rivers		x				x					x				x			x			x			x			x			x					x			44	40	0.9	N
Shore Fishing																																								
Grand Rivers		x				x					x			x			x			x			x			x			x					x			-	-	-	N
Outlet		x				x				x					x		x			x			x			x			x					x			-	-	-	N
Sunbathing																																								
Canal		x				x					x				x			x		x			x			x			x					x			-	-	-	N
Kuttawa		x				x				x				x			x			x			x			x			x					x			-	-	-	N
Swimming																																								
Kuttawa		x				x				x				x			x			x			x			x			x					x			-	-	-	N
Waterskiing																																								
Canal		x				x					x				x			x		x			x			x			x					x			-	57,920	-	N
Eureka		x				x					x				x			x		x			x			x			x					x			-	-	-	N
Grand Rivers		x				x					x				x			x		x			x			x			x					x			-	-	-	N

*See Appendix D for descriptions of the various recreation settings.

**Developed area acres include parking lots and other support facilities.

97. The Corps has anticipated carrying capacity related problems and has acted to prevent them by utilizing various planning and design techniques:

a. Impact campsites have been and are being installed in the Canal recreation area--a moderately wooded, sloping area. This is primarily a redevelopment action to make sites more usable and to reduce overuse. Some of the original sites are too steep, too close, not deep enough, or have tables on the wrong (left) side. Some of these sites are being retained to serve as bad examples for comparative purposes in a campsite design training course taught by the project staff;

b. An underused picnic area in the Canal area was converted to a walk-in tenting area;

c. Stone and timber ties have been used to reduce shoreline erosion. Some campsites and concrete picnic tables have rock and mortar around their bases to keep them from being undermined;

d. Barriers have been set around a parking lot to prevent cars from being driven across the grass to nearby picnic tables;

e. A new OHV area, of about 1000 acres, has been proposed. It is hoped that, by providing this area, the use of OHV's in campgrounds and other unauthorized areas will be eliminated.

User survey findings

98. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 5. Management's perception of the use level situation also is included in the table for comparisons.

The significant findings from Table 5 are:

a. Managers and recreators agree that overcrowding is not a significant problem at Barkley;

b. Over 75 percent of the campers indicated the campsites were spaced "just right;"

c. Nine percent of the Eureka campers indicated that other campers are "too far" away, while 14 percent of the Canal campers were "too close" to other campers;

d. Over 75 percent of the boaters thought the spacing between boats was "just right;"

e. The average preferred distance between fishing boats was over 1500 ft; the minimum acceptable distance was 32 ft;

f. Most sunbathers prefer an average distance range of 20 to 30 ft; most swimmers prefer to be 10 to 15 ft apart;

g. While most shoreline fishermen would tolerate an average spacing of 14 ft, they prefer to be between 50 and 75 ft apart.

Table 5

Barkley User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation (Heavily Used (H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded (OC))	Actual Distance Response: % of Responders who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Power Lake	5	H	0	20	80	75-500	-	200	245	75-300	300	200	205	20-200	-	50 150	105
Boat Fishing Lake	17	WB	7	0	93	75-A**	150 5300 A	2000 2640	169	60-5300	5300	390-2000	1890	0-150	100	45	32
Boat Launching Eureka	3	H	100	0	0	4-5	4	4	4.3	0	0	0	0	-	-	-	-
Tail Water		OU	50	0	50	3-8	5	5	5	4-10		4 6	6	-	-	-	-
Camping Canal	22	WB	14	0	86	10-100	50 75	50-60	54	25-120	75	60	64	10-75	20	35	33
Eureka	22		0	9	91	50-105	100	80	80	40-300	50	60 70	80	30-100	40 50	40-50	51
Grand Rivers	9	WB	0	0	100	30-100	60	60	58	30-100	60	60	58	10-80	25	25	28
Picnicking Grand Rivers	1	-	-	-	-	-	-	-	-	100	100	100	100	-	-	-	-
Kuttawa	11	WB	-	-	-	-	-	-	-	40-100	40-70	50	61	-	-	-	-

Table 5 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used(H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Shore Fishing																	
Grand Rivers	2	WB	0	0	100	60-75	60 75	60-75	68	60-75	60 75	60 75	68	2-25	2 25	2-25	14
Outlet	5		0	0	100	10-50	50	50	47	50-75	50	50	58	6-30	10	10	14
Sunbathing																	
Canal	2	WB	0	0	100	30	30	30	30	30	30	30	30	5-10	5 10	5-10	8
Kuttawa	10		0	0	100	10-50	20 30	20	25	5-50	30	20	22	0-20	5	5	7
Swimming																	
Kuttawa	5		0	0	100	5-15	15	10 15	12	5-15	15	15	12	0-100	-	3	25
Waterskiing																	
Lake	2		-	-	-	-	-	-	-	300	300	300	300	75-300	75 300	75 300	180
ORV																	
Canal	1		0	0	100	7	7	7	7	7	7	7	7	6	6	6	6

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

Benbrook Lake

Descriptive orientation

99. Benbrook Lake is located within the Dallas/Fort Worth metropolitan area and exemplifies an urban lake situation. The lake was authorized for the purposes of flood control, water conservation, and navigation. Benbrook is one of the smaller lakes visited, having a normal recreation pool of 3498 acres. The lake is approximately 7 miles long and its width averages 1.5 miles. Approximately 40 miles of shoreline exists at the recreation pool level and the total project area covers 11,295 acres. The land bordering the lake is typical of the Texas Prairie. In most places, the shore area slopes gradually to the water; much of the shoreline is usable and accessible. Benbrook Lake lies in a region characterized by a relatively mild climate. Summer seasons are long. Precipitation consists of 32 in. of rain and 3 in. of snow annually. The Texas Prairie has few trees, except for areas near water courses. North Central Texas, specifically the city of Fort Worth, is the major area from which visitors are attracted to the Lake. Visitation in 1978 was approximately 2.5 million recreation days.

Site analysis findings

100. The Corps currently manages four developed recreation areas (Figure 5). These areas include Dutch Branch Park and Holiday Park located along the western shoreline and Mustang and Rocky Creek Parks at the southern end of the lake. All four areas provide for picnicking and boat launching. Camping is provided at Holiday, Mustang, and Rocky Creek Parks. Holiday Park also offers areas for hiking, horseback riding, and model airplane flying; Mustang Park also provides an improved swimming area.

101. The recreation areas selected for the user survey include: Benbrook Lake water surface; Dutch Branch Park (the Corps-managed portion); Holiday Park; Mustang Park; and Rocky Creek Park. Summary information about the recreation settings and features of the individual study activity areas are found in Table 6.

102. The individual picnic sites at Holiday and Mustang Parks are spaced far apart, in many cases, more than 100 ft. Vegetation is sparse

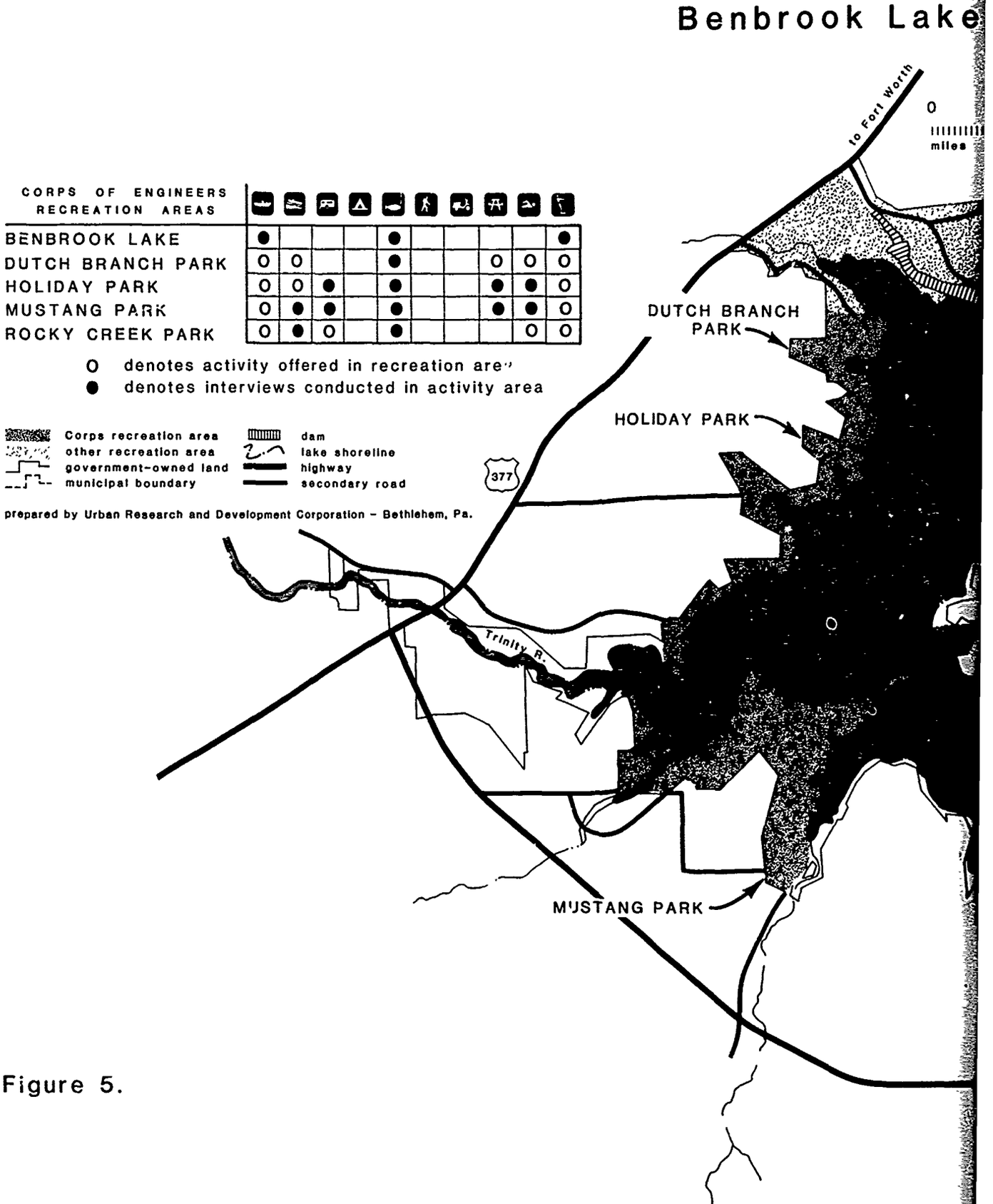

Benbrook Lake
to Fort Worth
0
miles
CORPS OF ENGINEERS RECREATION AREAS
BENBROOK LAKE
DUTCH BRANCH PARK
HOLIDAY PARK
MUSTANG PARK
ROCKY CREEK PARK
O denotes activity offered in recreation area
● denotes interviews conducted in activity area
Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road
prepared by Urban Research and Development Corporation – Bethlehem, Pa.
DUTCH BRANCH PARK
HOLIDAY PARK
377
Trinity R.
MUSTANG PARK

Figure 5.

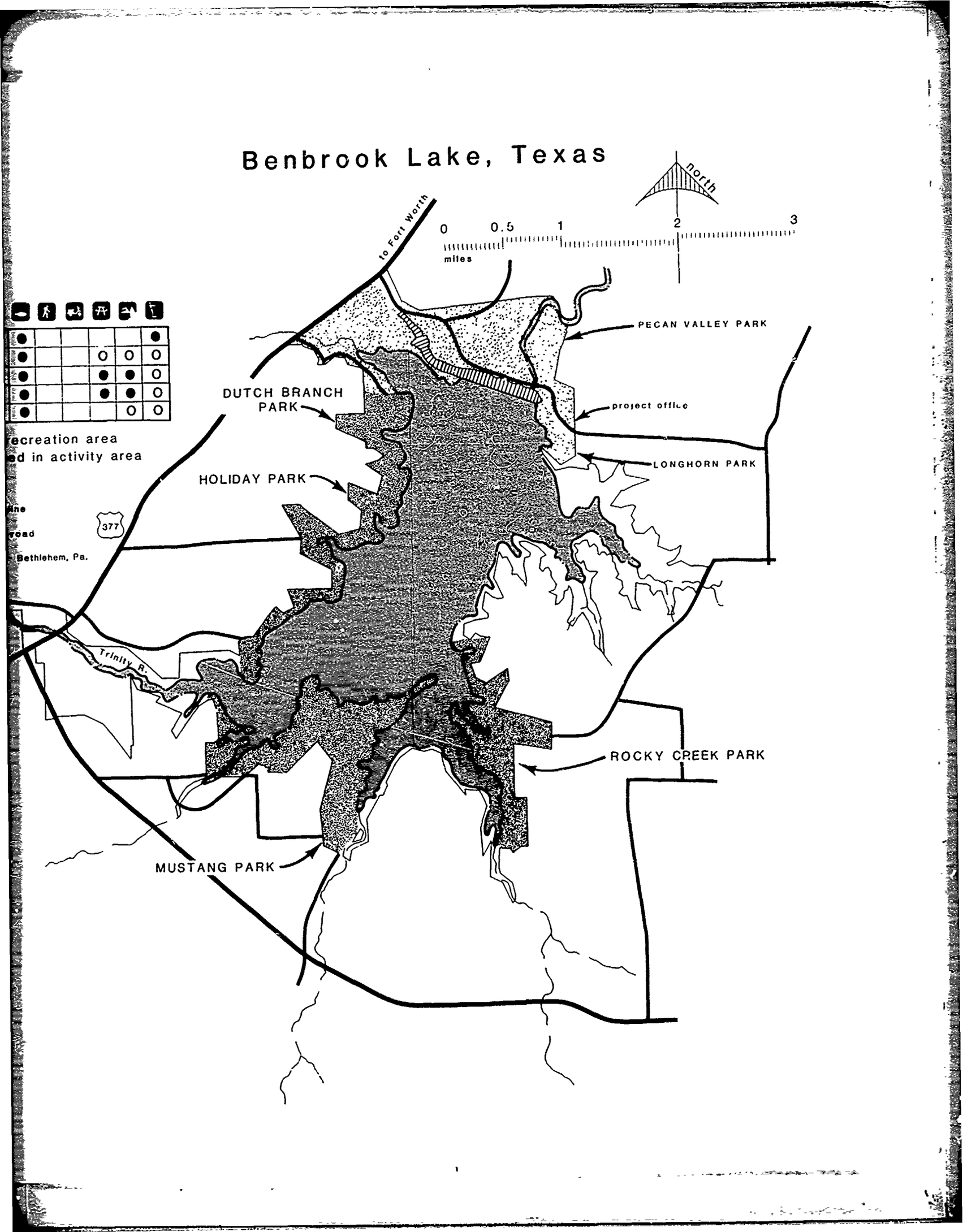

Benbrook Lake, Texas
north
0
0.5
1
2
3
miles
to Fort Worth
PECAN VALLEY PARK
project office
LONGHORN PARK
DUTCH BRANCH PARK
HOLIDAY PARK
377
Trinity R.
ROCKY CREEK PARK
MUSTANG PARK
ecreation area
d in activity area
Bethlehem, Pa.

Table 6

Benbrook Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land			Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: Units per developed acre**	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																										
Lake	X					X					X					X				X			X			X			X			X					-	3,498	-	N
Boat Fishing																																										
Lake	X					X					X					X				X			X			X			X			X					-	3,498	-	N
Boat Launching																																										
Mustang Park	X					X					X				X				X				X			X			X			X					1	-	-	N
Rocky Creek Park	X					X						X			X				X				X			X			X			X					2	-	-	N
Camping																																										
Holiday Park (H4)	X					X					X				X				X				X			X			X			X					24			$
Mustang Park (M)	X						X					X			X				X				X			X				X			X					12			$
Picnicking																																										
Holiday Park (H1 & H2)	X					X					X				X				X				X			X			X			X					29			N
Mustang Park	X						X					X			X				X				X			X				X			X								N
Shore Fishing																																										
Dam	X					X					X				X				X				X			X			X			X					-	-	-	N
Holiday Park	X					X					X				X				X				X			X			X			X					-	-	-	N
Mustang Park	X						X					X			X				X				X			X				X			X					-	-	-	N
Rocky Creek	X						X					X			X				X				X			X				X			X					-	-	-	N
Sunbathing																																										
Holiday Park	X					X					X				X				X				X			X			X			X					-	-	-	N
Mustang Park	X						X					X			X				X				X			X				X			X					-	-	-	N
Swimming																																										
Mustang Park	X						X					X				X			X				X			X				X			X					-	-	-	N
Waterskiing																																										
Lake	X					X					X					X			X				X			X			X			X					-	3,498	-	N

*See Appendix D for descriptions of the various recreation settings.

**Developed area acres include parking lots and other support facilities.

and only a few trees grow in the area. Shelters are provided over all picnic tables. Other support facilities at the picnic area include: drinking fountains, vault toilets, and cooking grills. Some informal roads have evolved and some erosion exists. It is noteworthy that only a small percentage of the park users actually picnic per se. Most of the use at the picnic areas involves sightseeing, walking around, meeting and visiting other people, and partying. At a portion of Holiday Park (H-1), this type of use results in overcrowding and overuse because many young people and their vehicles crowd into a small area. Mustang (M-3) experiences a similar problem but on a smaller scale.

103. Mustang Park (M-3) includes a beach and a designated area for swimming that is marked with a float line. Support facilities include: a parking area, bathhouse, drinking water, and security lighting.

104. Many of the campsites at Holiday and Mustang Parks are spaced relatively far apart, 100 ft and greater. The Holiday Park (H-4) campground has a higher level of development (electric/water hookups) and higher degree of control (gate attendants) than does the Mustang Park (M-3) campground. Holiday Park and Mustang Park campgrounds are fee areas. Fees at Holiday Park area are collected by ma-and-pa gate attendants; roving fee collectors are used at Mustang Park.

105. Benbrook Lake is unzoned, but tree stumps act as natural barriers keeping boaters out of certain areas. The lake is an official seaplane landing area, but landings are not frequent. Access to the water is provided by 16 ramps located around the lake. The two-lane boat ramp at Rocky Creek, selected for the user survey, is formally planned and highly developed. With designated parking spaces and a planned circulation system, this ramp is better equipped than the ramp at Mustang (M-3) which only has a large paved turnaround area and a parking area with no planned circulation system.

106. Horseback riding is permitted only on the designated trail. The trail is 7.3 miles long and takes between three and four hours to ride round trip. The terrain along the trail includes flat open spaces, rolling hills, wooded areas, and challenging slopes. A split rail fence is used to channel riders through developed recreation areas. There are

three enclosed rest areas along the trail. Overnight camping for horseback riders only is permitted at the Trails End and Rest Area #2.

Management survey findings

107. Project management personnel report that there are a variety of use level situations at Benbrook. Boating and fishing on the lake are heavy but reportedly well balanced. The Mustang Park launching ramp is well balanced; the Rocky Creek ramp is cited as overcrowded. Both Holiday Park and Mustang Park picnic areas are overused. The Holiday Park campground (H-4) is considered well balanced and the Mustang Park campground (M-3) is reportedly both overcrowded and overused. The sunbathing and swimming area at Mustang Park are overcrowded and overused.

108. Recognizing that overcrowding and overuse are problems at some activity areas, the Corps is considering the following solutions:

a. Using posts and cable to control vehicle circulation and to delineate designated parking areas to reduce overuse and user conflicts;

b. Closing some access roads to limit ingress and egress points and to eliminate unnecessary traffic;

c. Changing circulation patterns and creating dead end turnarounds to eliminate through traffic between activity areas;

d. Providing electricity to some campsites to satisfy users and to encourage campers to use less popular areas;

e. Reducing erosion and soil compaction by putting posts around camp pads to control vehicles;

f. Using gate attendants to control use levels, provide security, and enhance the camping experience;

g. Reducing camper/day user conflicts by providing separate areas for camping and day use and separate access roads;

h. Enlarging beach area at Mustang to meet heavy day use demand;

i. Allowing only campers to launch boats at the Holiday Park (H-4) ramp;

j. Sending out questionnaires for public input regarding solutions to overcrowding and overuse.

User survey findings

109. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown

in Table 7. Management's perception of the use level situation also is included in the table for comparisons.

110. The significant findings from Table 7 are:

a. With the exception of the Rocky Creek boat launching area, the Mustang Park beach and swimming area, and the Holiday Park Campground, most users agree with management's perception of the use level situation;

b. Most Benbrook boat launchers would tolerate waiting 15 min to launch their boat;

c. At Mustang Park over 15 percent of the swimmers and sunbathers indicated the distance between people was "too far;"

d. Over 60 percent of the campers at Holiday Park (H-4) indicated the sites were spaced "too far" apart;

e. Campers at Holiday Park (H-4) prefer an average distance of 72 ft between campsites, while most Mustang Park campers prefer 96 ft.

f. Over 65 percent of the Mustang Park campers indicated the spacing between them and other campers was "just right;"

g. Over 65 percent of the picnickers at Holiday and Mustang Parks indicated that the spacing between them and other picnickers was "just right;"

h. Over 80 percent of the boaters indicated other boats were spaced "just right;" nonpower boaters prefer an average distance of 180 ft between boats, but power boaters prefer an average distance of 260 ft;

i. At least 44 percent of the waterskiers indicated that 75 ft between boats is "too close;" Benbrook waterskiers prefer an average distance of 160 ft between boats;

j. Boat fishermen prefer an average distance of about 100 ft between boats.

Table 7

Benbrook User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used(HU), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Power Lake	11	WB	18	0	82	40-1320	100	100-120	291	40-1320	150	150	260	-	-	-	-
Sailing, Nonpower Lake	8	WB	17	0	83	25-300	-	50	165	15-600	30 300	125 150	183	10-40	10 40	10 40	25
Boat Fishing Lake	12	WB	18	9	63	40-175	40 75 150	75	96	40-195	40 75	85	104	10-30	10 30	10-30	20
Boat Launching Mustang Park	3	WB	0	0	100	3-5	3 5	3-5	4	-	-	-	-	30-60	30 60	30-60	45
Rocky Creek Park	7	OC	0	0	100	2-10	3	3	4	-	-	-	-	15-30	15	15	20
Camping Holiday Park	9	WB	0	62	38	60-150	150	100-150	113	30-100	100	75 65	72	-	-	-	-
Mustang Park	9	OU, OC	22	11	67	20-200	100	80	85	20-300	-	75	96	-	-	-	-
Picnicking Holiday Park	6	OU	0	33	67	50-200	200 20	75 80	112	10-200	-	70-80	82	-	-	-	-
Mustang Park	4	OU	0	25	75	20-75	75 150	75	82	10-150	20	20	50	-	-	-	-
Shore Fishing Dutch Branch	10	WB	30	0	70	6-[illegible]	15	15	23	6-[illegible]	20 [illegible]	24-[illegible]	35	15	15	15	15

Table 7 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Holiday Park	6	WB	100	0	0	15-50	50	30 50	36	20-150	60 100	60-100	82	-	-	-	-
Mustang Park	8	WB	38	12	50	30-75	30	30	48	5-225	90	50-90	77	30	30	30	30
Rocky Creek Park	2	WB	100	0	0	15	15	15	15	30	30	30	30	-	-	-	-
Sunbathing																	
Holiday Park	4	OU	0	0	100	30-100	-	20 30	41	-	-	-	-	-	-	-	-
Mustang Park	16	OU, OC	0	19	81	3-100	10 15	15	41	3-100	10 15	15	22	-	-	-	-
Swimming																	
Mustang Park	6	OU, OC	0	17	83	2-A**	A	10-30	12	-	-	-	-	2-3	3	3	3
Waterskiing																	
Lake	9	WB	44	12	44	75-210	75	75-100	126	100-225	150	150	160	50-150	50 150	50-150	100

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

Hartwell Lake

Descriptive orientation

111. Hartwell Lake was authorized for the purposes of flood control and hydroelectric power generation. Located about midway between Charlotte, South Carolina, and Atlanta, Georgia, the lake is in a region of rapidly growing population. This very large lake of 55,950 acres has over 200 access points along the 962-mile shoreline and a total project area of over 80,000 acres. The Tugaloo arm of the lake is 49 miles long; the Seneca arm of the lake is 45 miles long. The Corps administers a narrow strip of land (averaging 200 ft in width) around the shoreline.

112. It is one of the most heavily used Corps lakes in the Nation with a 1978 visitation of 11,420,500 recreation days, more than double that of the next highest lake studied. The topography around the reservoir is rugged, with slopes varying from 5 percent to over 25 percent in the upper reaches of the reservoir. Cut-over mixed pine and upland hardwood forests predominate. The climate is mild, with normal summer temperatures in the middle 80°F; annual precipitation consists of 48 in. of rain and 2 in. of snow. Primary access to the project is via I-85. Encircling the reservoir and connecting with I-85 are numerous primary and secondary roads.

Site analysis findings

113. The Corps operates 68 recreational areas which occupy over 3000 acres, varying in size from 1 to 369 acres (Figure 6). Twenty of these areas provide space for tent and trailer camping. All other areas are designated for day use only. Non-Corps recreation areas include three State parks and several county and municipal recreation and access areas.

114. The Corps recreation areas are scattered around the lakeshore. Some areas are several miles from a main road. Access roads are all-weather, but some need repair and improvement of signage. Most recreation areas are on or near the lake and provide good access to the lake. Virtually all the 20 campgrounds have sites on the water side of the access roads, thus providing easy lake access.

115. The level of development and control is high at camping areas,

although there are no electric hookups at any of the Corps-managed campgrounds. Contracted gate attendants are used at some campgrounds; some impact sites have recently been put in the Watsadlers campground to reduce overuse; and some campgrounds have overflow areas. Posts for camp lanterns are provided at campsites to reduce tree damage.

116. Most of the day use areas have a moderate level of development. Some day use areas have little control and show signs of overuse. While the Corps provides areas for swimming, these areas have a limited level of development without showers, changing rooms, and other major improvements. Long Point is very popular for swimming.

117. The lake's many islands, coves, and inlets are quite popular with boaters and picnickers.

118. There is no lake zoning and shoreline erosion is severe in some places.

119. A recently developed hiking trail traverses a wetland area with a beaver colony. This 1/2-mile trail is rather remotely located from major activity areas, but is near a highway. Wood chips are used to harden the trail, enhance attractiveness, and allow for comfortable circulation. Interpretive stops are planned.

120. Many private docks and boat ramps exist at Hartwell Lake. All of the Corps ramps are dispersed around the lake, have a high level of development, and contain only one launching lane each.

121. More information about the recreational settings and features of the study activity areas can be found in Table 8.

Management survey findings

122. Project management personnel report that a wide variety of use levels exist at Hartwell. Overcrowding and overuse exist in several areas. Well-balanced and underused areas also occur, thus providing a variety of recreational environments for study. The overall lake surface is well balanced, with the water areas near ramps, marinas, and recreation areas receiving heavy use. Carrying capacity problems on the lake are nodal rather than widespread.

123. There are numerous private ramps and docks on the lake which make lake control and management unusually difficult.

Hartwell Lake, Georgia and South Carolina

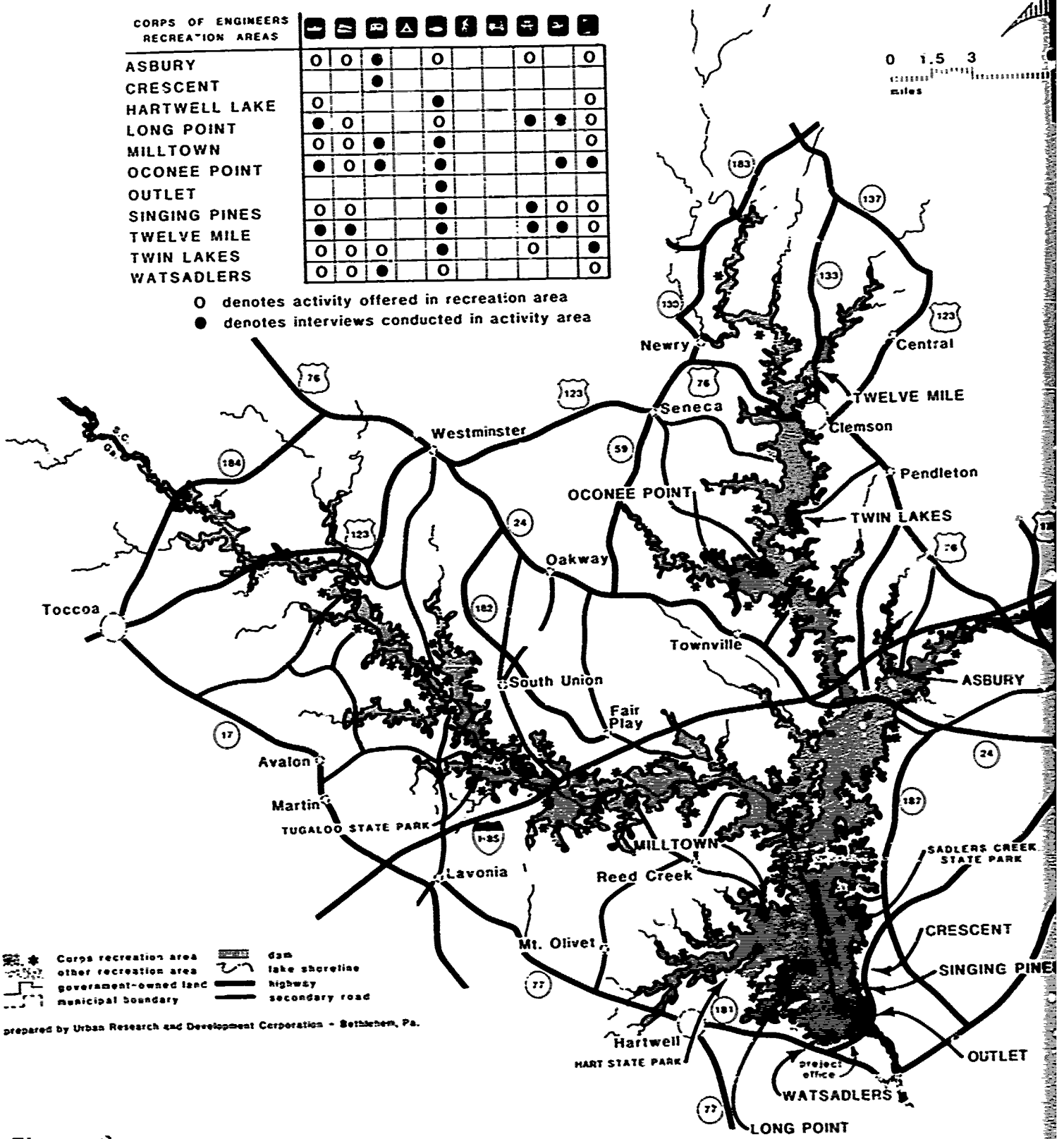


Figure 6.

artwell Lake, Georgia and South Carolina

ENGINEERS N AREAS										
NT	O	O	●		O			O		O
LL LAKE			●							
INT	O				●					O
N	●	O			O			●	●	O
POINT	O	O	●		●					O
	●	O	●		●				●	●
PIN					●					
	O				●			●	O	O
	O				●			●	●	O
	O	O			●			O		●
	O	O	●		O					O

● denotes activity offered in recreation area
O denotes interviews conducted in activity area

north

0 1.5 3 6 9
miles

Newry
Central
Seneca
TWELVE MILE
Clemson
Westminster
Pendleton
OCONEE POINT
TWIN LAKES
Oakway
Townville
South Union
ASBURY
Fair Play
Anderson
Avalon
Martin
TUGALOO STATE PARK
MILLTOWN
Lavonia
Reed Creek
SADLERS CREEK STATE PARK
CRESCENT
Mt. Olivet
SINGING PINES
Hartwell
HART STATE PARK
project office
OUTLET
WATSADLERS
LONG POINT

dam
lake shoreline
highway
secondary road

ant Corporation - Bethlehem, Pa.

Table 8

Hartwell Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land				Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acres, or miles of trail)	Overall Density: (Units per developed acre**)	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	Undesignated	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																										
Long Point		X					X					X				X				X			X			X			X			X				X				56,000		N
Oconee Point		X					X					X				X				X			X			X			X			X				X				-	-	N
Twelve Mile		X					X				X					X				X			X			X			X			X				X				-	-	N
Boat Fishing																																												
Lake		X				X						X				X				X			X			X			X			X				X				56,000	-	N
Boat Launching																																												
Twelve Mile		X					X				X				X				X				X			X			X			X				X				1	-	-	N
Camping																																												
Asbury		X				X					X				X				X				X			X			X			X				X				51	15	3.4	$
Crescent		X					X				X				X				X				X			X			X			X				X				41	36	1.0	$
Milltown		X					X					X			X				X				X			X			X			X				X				51	28	1.8	$
Oconee Point		X					X				X				X				X				X			X			X			X				X				58	20	2.9	$
Watsedlers		X					X				X				X				X				X			X			X			X				X				37	30	1.2	$
Picnicking																																												
Long Point		X					X				X				X				X				X			X			X			X				X				60	25	2.4	N
Singing Pines		X					X				X				X				X				X			X			X			X				X				51	30	1.7	N
Twelve Mile		X					X				X					X			X				X			X			X			X				X				20	15	1.3	N
Shore Fishing																																												
Outlet		X					X				X				X				X				X			X			X			X				X				-	-	-	N
Singing Pines		X					X				X				X				X				X			X			X			X				X				-	-	-	N
Sunbathing																																												
Long Point		X					X				X				X				X				X			X			X			X				X				-	-	-	N
Oconee Point		X					X				X				X				X				X			X			X			X				X				-	-	-	N
Twelve Mile		X					X				X				X				X				X			X			X			X				X				-	-	-	N
Swimming																																												
Long Point		X					X					X					X				X			X			X			X			X				X				-	-	-	N
Waterskiing																																												
Oconee Point		X					X					X					X				X			X			X			X			X				X				-	56,000	-	N
Twin Lakes		X					X				X						X				X			X			X			X			X				X				-	-	-	N

*See Appendix D for descriptions of the various recreation settings.
**Developed area acres include parking lots and other support facilities.

124. Some overcrowding and overuse exist in both the campgrounds and day use areas. The camping areas at Oconee Point and Watsadlers are overcrowded while the Asbury, Cresent, and Milltown campgrounds are reportedly well balanced. The picnic areas at Long Point, Singing Pines, and Twelve Mile are all deemed overcrowded by management. The swimming and sunbathing areas at Long Point and Twelve Mile are overcrowded and overused, and the Twelve Mile launch ramp is overcrowded.

125. Some of the existing and potential carrying capacity problems being addressed with specific techniques are:

a. Severe shoreline erosion is being combated with bulkheading and riprap;

b. Overused campsites are being replaced in some areas with impact sites of gravel bordered with timbers;

c. Some overused areas will be selectively closed after the peak visitation period to allow for reestablishment of vegetation;

d. Overuse and overcrowding is being reduced by having an eight-person limit per campsite;

e. Day user and camper conflicts are reduced as a result of separate activity areas with separate access roads;

f. Shoreline erosion is reduced by establishing no wake zones;

g. Overuse of picnic areas is being reduced through the use of bollards and rope barriers to control traffic;

h. Overuse along the hiking trail is minimized through use of wood chips;

i. Overcrowding of launching ramps is reduced as a result of good circulation systems to and from the ramps;

j. Conflicts between off-road vehicle riders and other recreators is reduced through a designated area for off-road vehicle riding (a power line transmission easement).

User survey findings

126. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 9. Management's perception of the use level situation also is included in the table for comparisons.

127. The significant findings from Table 9 are:

Table 9

Hartwell User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used(H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Nonpower																	
Lake	1	H	100	0	0	150	150	150	150	300	300	300	300	150	150	150	150
Boating, Power																	
Lake	6	H	0	17	83	25-A**	-	200 300	225+	50-300	-	225	192	10-200	150	150	78
Boat Fishing																	
Lake	15	H	20	0	80	50-A	A	900	507	100-1500	1500	750	765	20-300	150	150	193
Boat Launching																	
Twelve Mile	17	OC	6	0	94	5-15	5	5	6	5-20	5	5	7	15-30	30	20	21
Camping																	
Asbury	16	WB	25	6	69	25-150	30	75	78	70-300	75 300	80	113	10-100	40	50	53
Cresent	17	WB	6	0	94	30-1200	70	70	184	50-A	75	80	86+	40-100	50	50	57
Milltown	19	WB	0	0	100	35-A	50	70	66	5-A	-	75 80	85+	20-100	100	50	60
Oconee Point	30	OC	0	0	100	40-120	75	75	75	45-150	75	75	80	10-120	50 60	50	55
Watsadlers	14	OC	21	0	79	25-200	80	60	73	60-A	100	90	84+	30-100	60	60	65
Picnicking																	
Long Point	16	OC	20	0	80	25-70	25	40	46	40-70	40 60 70	60	56	20-50	40 50	40	40
Singing Pines	13	OC	0	0	100	25-A	25 80	50	54	25-100	60 80	60	65	10-75	35-50	35 50	40

Table 9 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used(H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Actual Distance Response: Range of Actual Distances (ft)	Actual Distance Response: Mode (ft)	Actual Distance Response: Median (ft)	Actual Distance Response: Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Preferred Distance Response: Mode (ft)	Preferred Distance Response: Median (ft)	Preferred Distance Response: Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Minimum Acceptable Distance Response: Mode (ft)	Minimum Acceptable Distance Response: Median (ft)	Minimum Acceptable Distance Response: Mean (ft)
Twelve Mile	11	OU, OC	0	0	100	40-70	40	40	47	30-70	40	50	50	20-40	25	30	30
Shore Fishing																	
Outlet	13	WB	8	8	84	15-A	-	150	180	15-A	200	100 150	122+	5-150	10	10	32
Singing Pines	1	WB	0	100	0	A	A	A	A	100	100	100	100	10	10	10	10
Sunbathing																	
Long Point	12	OU, OC	17	9	75	25-120	30 60	50 60	57	5-120	30	50	55	5-60	5	5 10	20
Oconee Point	2	WB	0	0	100	10-120	10 120	10-120	65	10-120	10-120	10-120	65	5-55	5 55	5-55	27
Twelve Mile	1	OU, OC	100	0	0	5	5	5	5	20	20	20	20	8	8	8	8
Swimming																	
Long Point	8	OU, OC	0	0	100	10-200	-	10-50	59	-	-	-	-	7-60	-	17	23
Waterskiing																	
Oconee Point	2	WB	0	0	100	250-A	250 A	250-A	250+	250-300	250 300	250 300	275	100-150	100 150	100 150	175
Twin Lakes	14	H	29	0	71	100-1500	100	150	321	100-1500	300	300	638	50-1500	150	100-120	206

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators

a. The user survey confirms that some overcrowding exists at Long Point (picnicking, sunbathing), at Twelve Mile (sunbathing), on the lake (boat fishing), at Asbury campground, at Twin Lakes (waterskiing);

b. Average and preferred distances between campsites range from 80 ft at Oconee Point to 113 ft at Asbury;

c. Boat fishermen prefer an average distance of about 750 ft between boats;

d. Most boat launchers at Twelve Mile would tolerate waiting 20 min to launch, but prefer launching within 5 to 7 min;

e. Most shore fishermen at the outlet prefer an average distance of over 100 ft between them and other fishermen;

f. Most waterskiers prefer a spacing of 300 ft or more between other boats;

g. Like most other Corps recreators, most Hartwell recreators indicated they could tolerate a closer spacing than presently exists.

McNary Lock and Dam

Descriptive orientation

128. McNary Lock and Dam is located on the Columbia River 292 miles from the Pacific Ocean. The project was authorized for the purposes of navigation, hydroelectric power generation, and irrigation. The Washington cities of Richland, Pasco, and Kennewick border Lake Wallula. Lake Wallula extends 64 miles upstream from the dam and represents 35,922 acres of water surface and 242 miles of shoreline at its normal pool elevation. The project area covers a total of 53,912 acres, which makes McNary the third largest project area studied. More than two thirds of the land bounding Lake Wallula is characterized by steep, rugged basalt formations. In some places, bluffs rise abruptly from the shoreline; in other places, the topography at the shoreline is gently sloping. The climate of the area is arid; precipitation averages only 6 in. annually. Summer temperatures average near 90°F (with extremes to over 110°F). Trees are scarce and the vegetative cover is sparse, consisting of mainly grasses, sagebrush, forbs, and low shrubs.

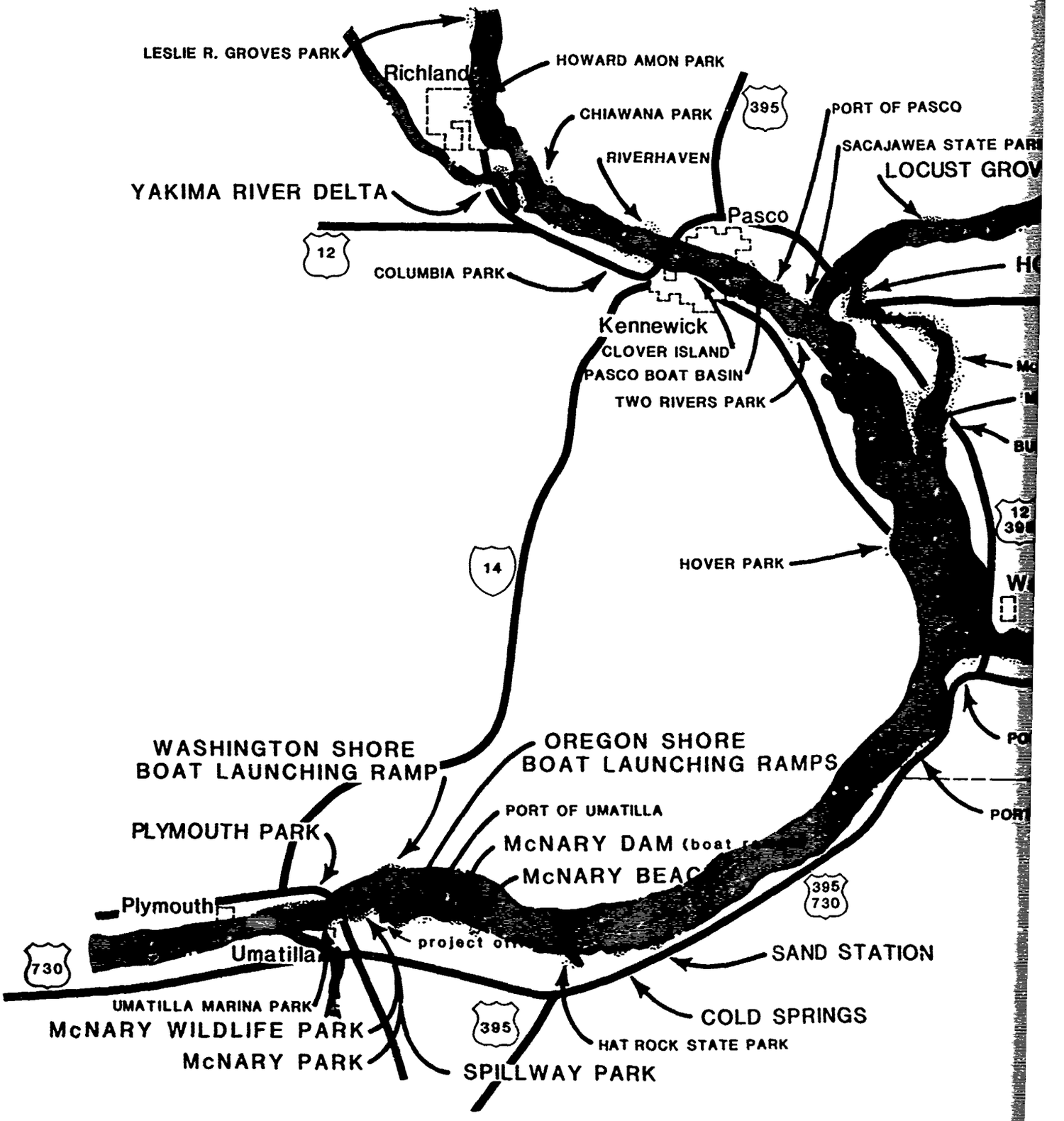
129. The upper and lower ends and the eastern portions of the project are accessible via adjacent highways. However, much of the lake's eastern and western shoreline is not accessible due to high canyonlike cliffs at the water's edge. The project's recreation facilities serve visitors from a very large area encompassing northern Oregon and southeastern Washington. Visitation in 1978 was 4.5 million recreation days.

Site analysis findings

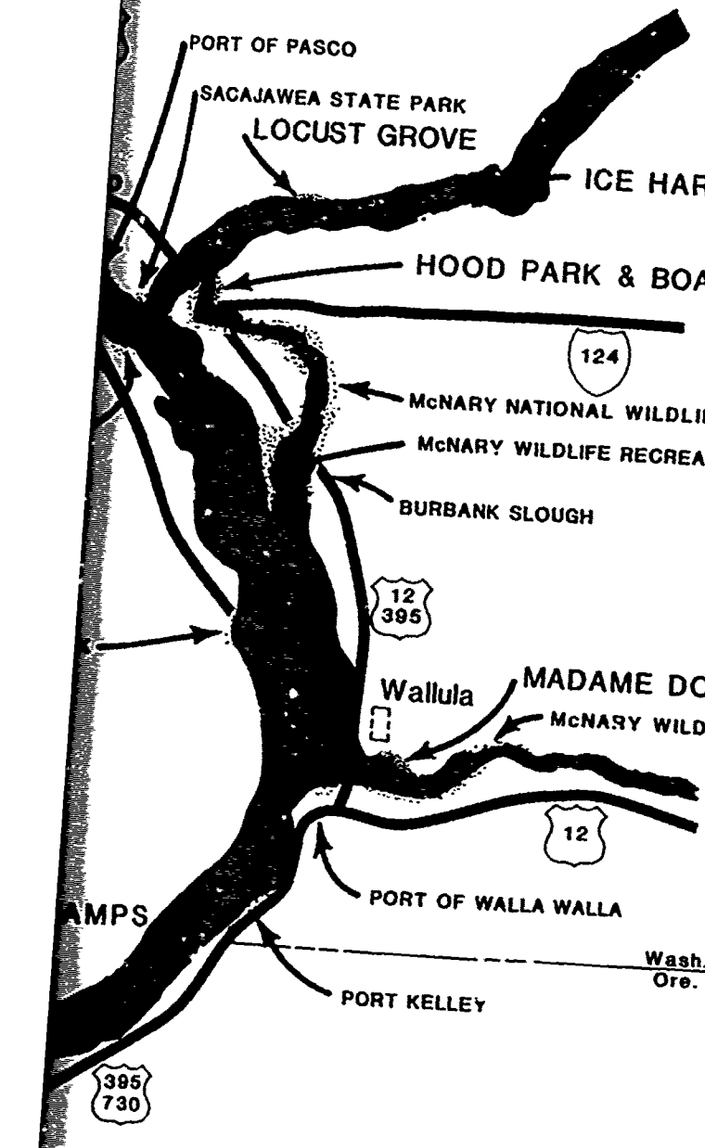
130. Project lands surrounding the lake are used largely for public recreation, wildlife conservation, and port development (Figure 7). The Corps manages 13 of the 30 recreation areas on the lake; other recreation areas are State, county, and municipally operated. In addition to boating, fishing, swimming, camping, hiking, and picnicking, other points of special interest at McNary Dam include: the powerhouse gallery and control room window, the spillway observation point, navigation lock, and the fish viewing rooms.

131. The most popular Corps-operated recreation areas are located

McNary Lock and Dam - Lake W



Lake Wallula, Oregon and Washington



0 2 4
miles

CORPS OF ENGINEERS RECREATION AREAS				
HOOD PARK	O	●	●	
LAKE WALLULA	●			
McNARY BEACH				
McNARY DAM (boat ramps)	O	●		
McNARY WILDLIFE PARK				
MADAME DORION PARK			●	

O denotes activity offered i
● denotes interviews condu

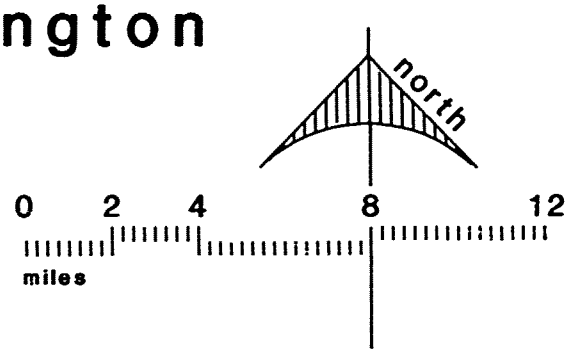
Corps recreation area
other recreation area
government-owned land
municipal boundary

dam
lake shore
highway
secondary

prepared by Urban Research and Development Corporation

12

Oregon and Washington



BOR LOCK AND DAM

T BASIN

CORPS OF ENGINEERS RECREATION AREAS										
HOOD PARK	O	●	●		O			●	●	O
LAKE WALLULA	●				O					●
McNARY BEACH								O	●	
McNARY DAM (boat ramps)	O	●			O					O
McNARY WILDLIFE PARK						●				
MADAME DORION PARK			●					O		

FE REFUGE

ATION AREA

ORION PARK

LDLIFE RECREATION AREA

O denotes activity offered in recreation area

● denotes interviews conducted in activity area

Corps recreation area
other recreation area
government-owned land
municipal boundary

dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation - Bethlehem, Pa.

gh.
re.

Figure 7.

at three general areas: (a) at or nearby McNary Dam (McNary Wildlife Park, McNary Park, Spillway Park, McNary Beach, Cold Springs, Sand Station); (b) at the confluence of the Walla Walla River (Madame Dorian Park); and (c) along or in the vicinity of the Snake River (Hood Park). With a few exceptions, these recreation areas all are within 1 mile of a highway, have a relatively level to gently sloping topography, have sparse vegetation, are adjacent to other recreation activity areas, and have a high level of development and control. The exceptions are: McNary Wildlife Park which has moderate vegetation, especially along the nature trail and Madam Dorian Park which has a limited degree of control and level of development. The McNary Wildlife Park Nature Trail, Lake Wallula, McNary Beach, Madame Dorian Park, and Hood Park are the activity areas that were selected for the user survey.

132. The nature trail at McNary Wildlife Park received year-round use. It is 3/4 of a mile long and 3 to 4 ft wide. It has a gravel surface and meanders around fishing ponds and through a variety of wildlife habitats. Camera blinds are located at several places along the trail.

133. McNary Beach provides for swimming, sunbathing, and picnicking. Here the Corps has improved shore access, put in a float line and swimming dock with a diving board, added new parking areas, and established an attractive lawn area for sunbathing and picnicking.

134. Hood Park is a multiple-use area which includes camping, picnicking, swimming, sunbathing, and boat launching areas. Access to the camping and day use areas is provided by the same road. Access into the park is controlled by a gate; there is no gate attendant. The boat launching area, located in the day use area, consists of a two-lane ramp with a gravel and grass parking area. This launching area is in the process of being redesigned and expanded. The Corps redesigned and regraded the camping area and put in 70 designated sites with picnic tables and asphalt pads. The spacing between campsites varies between 40 to 100 ft, but most are approximately 75 ft apart. About an equal number of back-in and pull-through sites are provided. Within the campground, the Corps has added new flush toilets, hot showers, electric hookups, and installed an underground irrigation system. Around-the-clock irrigation

is required during hot summer periods to maintain the attractive, green lawn in the camping area.

135. Madame Dorian Park is a nonfee area, primarily used for camping. It has excellent exposure from an adjacent major highway. It is 2.5 acres in size and has 20 less-developed campsites with no designated or hardened camp pads. Water connections, a vault toilet, and a dump station are provided.

136. More information about the recreational settings and features of the study areas can be found in Table 10.

Management survey findings

137. In general, management's perception of the use level situations at most of the activity areas is that they are relatively well balanced. At Hood Park, the camping area is very well balanced, while the day use areas are very heavily used and sometimes overcrowded. Madame Dorian Park is reportedly well balanced, but is beginning to show signs of some overuse. The Wildlife Park Nature Trail is reportedly underused to well balanced. Overcrowding does not occur across Lake Wallula; boating is considered to be well balanced. There are no designated areas for off-road vehicle riding.

138. Perhaps the major problem confronting project management is the problem of providing recreation in an arid climate where recreation resources are sensitive. The following list contains some of the items contributing to well-balanced use situations at McNary:

a. Extensive irrigation of recreation areas to provide attractive recreation areas and to reduce resource overuse;

b. Asphalt camp pads at Hood Park to reduce resource overuse;

c. Movable picnic tables which allows users to establish their preferred table spacing and helps protect the picnic area from overuse;

d. Full-time grounds keepers (Hood Park) to keep the area attractive and functioning well;

e. Waterski docks, which enhance the waterskiing experience;

f. Meandering nature trail with gravel base, designed to reduce user conflicts and overuse on the trail;

Table 10

McNary Activity Area Recreation Settings and Features*

Activity Area:	Proximity to Metropolitan Area (SMSA)				Distance to Expressway				Distance to Highway				Slope of Land				Vegetative Screen				Access to Water Body				Visibility to Water Body				Level of Development				Level of Control				Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density, (Units per developed acre**)	Fee (F) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	Undesignated	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																											
Lake	X					X				X						X		X			X			X				X				X				X				-	15,922	-	N
Boat Launching																																											
Dam	X					X				X				X				X				X			X				X				X				X				2	1	-	N
Hood Park	X				X					X				X				X				?	X		?	X			X				X				X				2	-	-	N
Camping																																											
Hood Park	X					X				X				X				X				X			X				X				X				X				70			$
Maupay Portion	X					X				X				X				X			X		X			X			X				X				X				20	2.5 Ac.	8	N
Hiking																																											
Wildlife Trail	X					X				X				X				X			X			X			X				X				X				-	3/4 Mi.	-	N
Picnicking																																											
Hood Park	X					X				X				X				X				X			X				X				X				X				156	5	31	N
Sunbathing																																											
Hood Park	X					X				X				X				X				X			X				X				X				X				-	-	-	N
McNary Beach	X					X				X				X				X				X			X				X				X				X				-			N
Swimming																																											
Hood Park	X					X				X					X				X			X			X				X				X				X				-	3 2	-	N
McNary Beach	X					X				X					X				X			X			X				X				X				X				-			N
Waterskiing																																											
Lake	X					X				X					X				X			X			X				X				X				X				-	15,922	-	N

*See Appendix D for descriptions of the various recreation settings.
**Developed area acres include parking lots and other support facilities.

g. Buoys and diving platforms at swim areas to enhance the experience and to separate different types of swimmers;

h. Entrance gates to control hours and levels of use;

i. Landscaped buffers screening nonrecreation areas from recreation areas;

j. Using the tops of levees as pathways for hiking, jogging, etc.;

k. Stabilizing shoreline (to prevent erosion caused by waves from wind, large traffic, and boaters).

User survey findings

139. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 11. Management's perception of the use level situation also is included in the table for comparisons.

140. The significant findings from Table 11 are:

a. Project managers and users agree that McNary activity areas have overall well-balanced use situations;

b. Most McNary recreators, like most of the other Corps recreators surveyed, would tolerate a much closer spacing than they would otherwise prefer;

c. Most boat launchers at Hood Park would tolerate spending 20 min to launch their boat, but would prefer 6 min;

d. Twenty-four percent of the power boaters interviewed indicated that other boats were "too close." Most of the boaters interviewed were boating in the vicinity of Hood Park;

e. Hood Park campers generally preferred more space than the Madame Dorian campers;

f. Twenty-seven percent of the Hood Park sunbathers indicated they were "too close," while 22 percent of the McNary Beach sunbathers indicated they were "too far;"

g. Over 75 percent of the campers and swimmers thought the spacing between campsites and picnic tables was "just right."

Table 11

McNary User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation: Heavily Used (H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded (OC)	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Nonpower Lake	1	WB	0	0	100	300	300	300	300	400	400	400	400	400	400	400	400
Boating, Power Lake	17	WB	24	0	76	25-A**	300	300	625	50-1800	300	300	529	600 20-	150	150	180
Boat Launching Dam	2	H	0	0	100	5	5	5	5	5	5	5	5	15	15	15	15
Hood Park	24	WB	0	0	100	0-5	5	5	5	1-15	5	5	6	6-60	20	20	22
Camping Hood Park	26	WB	8	0	92	40-225	75	75	74	10-A	75	75	52+	10-75	50	35	38
Madame Dorion	9	WB,OU	0	0	100	25-50	50	40-50	42	30-A	50	50	45	15-50	20	20	26
Hiking Wildlife Park Trail	3	U	33	33	33	5-A	-	A	5+	150-A	-	300	225	50-100	50	50	67
Picnicking Hood Park	39	WB,OC	11	3	86	20-200	100	70	65	30-A	50 100	50	66	8-100	30 50	30	40
Sunbathing Hood Park	15	WB	27	6	67	10-150	40	40	54	15-A	40 50	40 50	53	5-40	10 20 40	20	21
McNary Beach	11	H	0	22	78	25-300	30	50	103	15-60	15 20	20	26	5-20	15	15	17
Swimming Hood Park	20	WB	15	20	65	10-A	40 50	40 50	77	5-A	40 50	20 25	34	3-30	10	10	12

Table 11 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
McNary Beach	9	H	0	11	89	30-300	30	50	80	20-200	20 40	40	75	5-25	10	10	12
Waterskiing Lake	11	WB	18	0	82	65-A	A	500	592	100-A	300	500	512	20-600	100 300 600	180	235

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

Milford Lake

Descriptive orientation

141. Milford Lake, authorized for the purposes of flood control and water supply, is located on Republican River 4 miles northwest of Junction City, Kansas. Much of the area surrounding the lake is rural and is devoted to agriculture. Milford Lake has a normal recreation pool of 16,190 acres and 163 shoreline miles. The lake proper extends 20 miles upstream and averages about 1 mile in width. Average water depth is 15 ft. The total size of the project area is 48,939 acres. The area's topography lends itself well to recreation use and management. Lands in developed recreation areas are gently rolling to level, sloping mildly to the shore. Most of the shoreline is usable. The project area is subject to a broad range of temperatures, high winds, and intense rainfall. Summer temperatures average in the upper 80°F. Precipitation amounts to 32 in. of rain and 22 in. of snow annually. Much of the project area is sparsely wooded, with extensive plantings accomplished in the public use areas. The climax cover is comprised of a mixture of the tall and medium grasses characteristic of the true prairie. Federal highways border the lake on three sides and within a 100-mile radius of the lake are the major metropolitan areas of Topeka and Wichita, Kansas. In addition to serving nearby Kansas residents, Milford Lake provides water-oriented recreation opportunities to the personnel stationed at Fort Riley, a nearby large military reservation. Visitation in 1978 was approximately 1.5 million recreation days.

Site analysis findings

142. The Corps presently operates six recreation areas at Milford Lake (Figure 8). Other recreation areas at the lake include a State park, municipal and county parks and access areas, and two marinas. Activities at Corps-managed areas include: camping, boating, fishing, swimming, sunbathing, picnicking, hiking, and off-road vehicle riding (at the School Creek recreation area). Three of the six Corps recreation areas are located at the southern end of the lake. The other three areas are more remotely located.

143. In 1967, there were no designated campsites. A spacing of 75 ft between campsites was used as a guideline during the planning of individually designated campsites. Opportunities for individual, multifamily, and group camping can be found at Milford. The updated master plan includes a guideline calling for 30 percent multifamily sites (two to four camp pads located close together). Generally speaking, the Corps campgrounds have a moderate level of development and a moderate level of control. None of the Corps-managed campsites have electric or water hookups, although future plans call for providing some electric hookup camp pads at Timber Creek, Curtis Creek, and Rolling Hills. An overflow area for camping is provided at Timber Creek. Currently, no campgrounds have gate attendants; campground fees are collected via the roving ranger method. An entrance station and gate attendant are proposed at Timber Creek.

144. There is no lake zoning; boats are required to stay 300 ft from shore. Generally, under 2000 boats are on the lake on summer weekends at any one time. Approximately 90 percent of the boats using the lake are power boats, 9 percent are sailboats, and 1 percent or less are nonpower boaters. In recent years, sailboaters have increased dramatically. Some shoreline erosion occurs because of wave action. The lake fluctuates only from 2 to 3 ft.

145. Some of the picnic sites are located on isolated, high hills since original Corps standards did not permit picnic areas below the flood pool elevations. Movable picnic tables are used and group picnic areas with pavilions are very popular. Some picnic areas have been converted to camping areas.

146. Fourteen boat launching ramps are located around the lake. The ramps have multiple, divided lanes. The parking areas are asphalt and the spaces are marked. The ramps are mostly used between 1:00 p.m. and 4:00 p.m. The Farnum Creek ramp is considered to be particularly well designed.

147. A designated area is provided for off-road vehicle (ORV) riding. The area, once an old rock quarry, is sometimes used by up to 105 ORV riders. It is used mostly by motorcycles, but also by three-

Milford Lake, Kansas

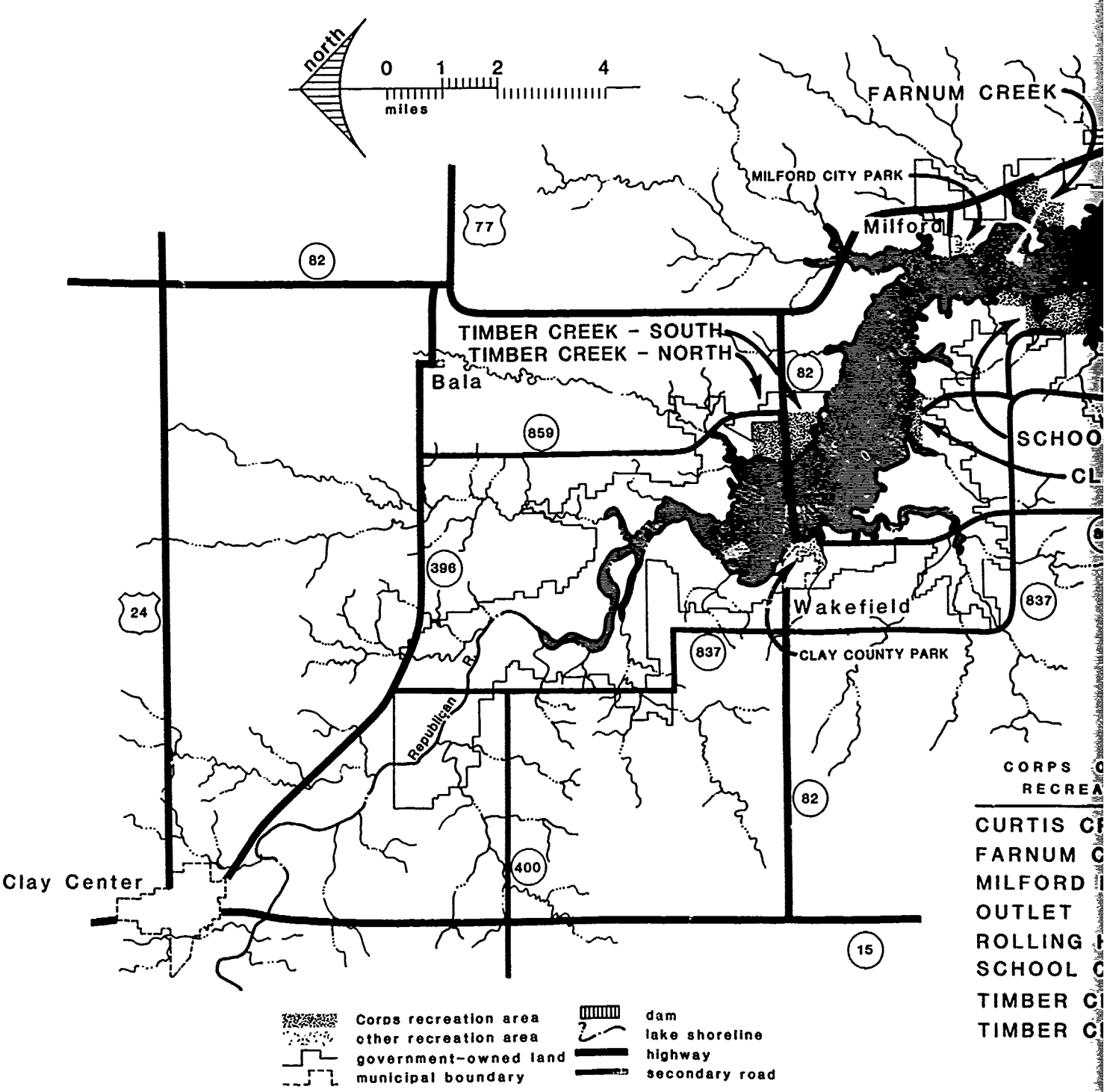
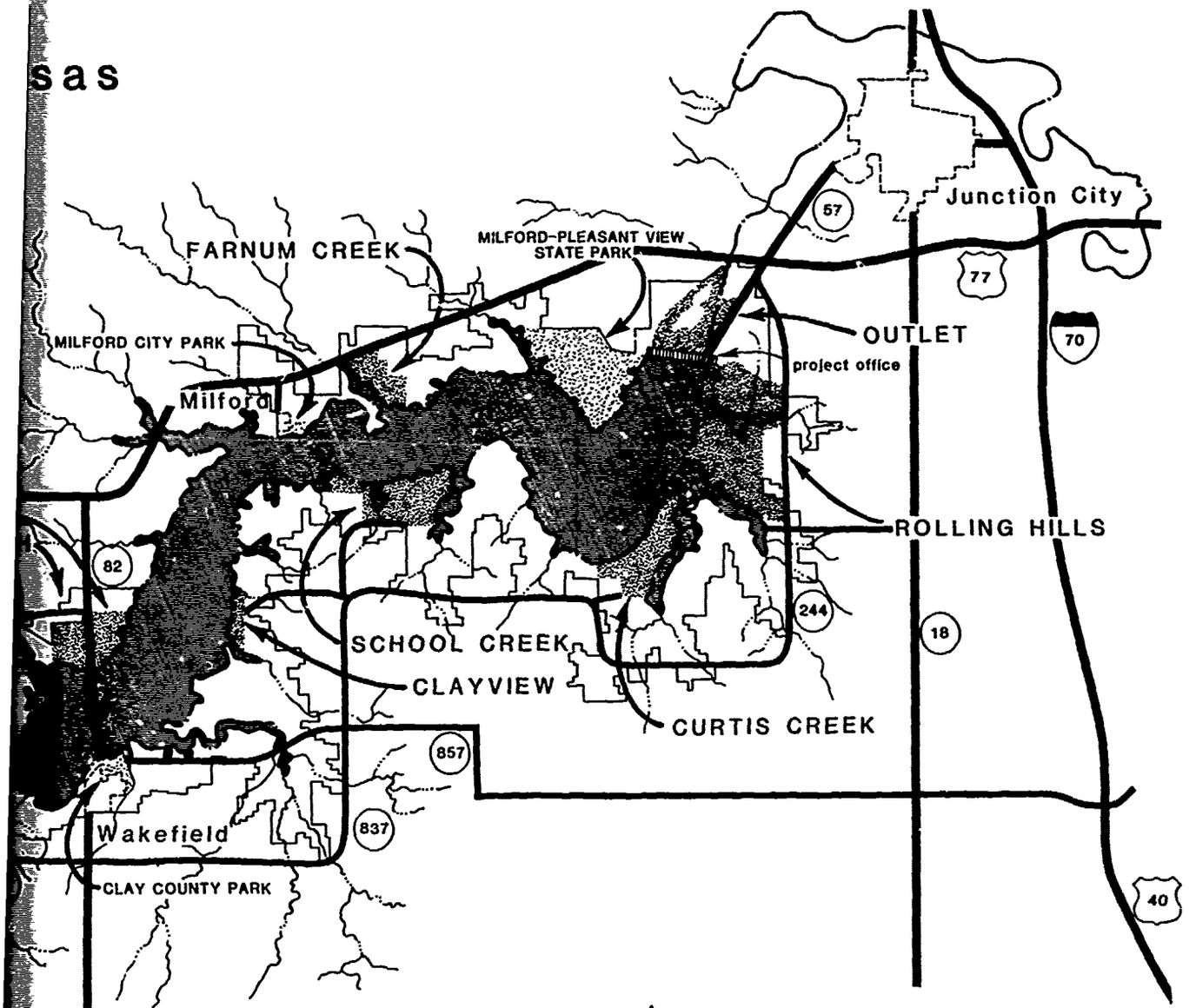


Figure 8.

prepared by Urban Research and Development Corporation - Bethlehem, Pa.

sas



CORPS OF ENGINEERS RECREATION AREAS										
CURTIS CREEK	O	O	●		O			O		O
FARNUM CREEK	O	●	●		O			O		O
MILFORD LAKE	●				O					●
OUTLET					●				●	
ROLLING HILLS	O	O	O		O			O	●	O
SCHOOL CREEK	O	O	●		O		●	O		O
TIMBER CREEK-NORTH			●			O	O			
TIMBER CREEK-SOUTH	O	O	●		O	●		O		O

O denotes activity offered in recreation area

● denotes interviews conducted in activity area

...oline

...y road

...– Bethlehem, P...

wheelers, jeeps, and all-terrain vehicles. Vault toilets and trash containers are provided.

148. The Corps has developed several improved swimming areas. The swim areas are marked with float lines. Drinking fountains, bathhouses, parking areas, and other support facilities are provided. Swimmers are encouraged to use these improved areas.

149. The South Timber Creek interpretive trail is used mostly by campers and organized groups. The pathway is heavily worn.

150. The study areas selected for the user survey and a summary of their recreation settings and features can be found in Table 12.

Management survey findings

151. Project management personnel report that Milford Lake has experienced some overuse and overcrowding. Currently, however, most of the activity areas are characterized as having well-balanced use. Use levels of camping areas range from very heavy use to underuse, with more areas considered well balanced. Most of the earlier overcrowding and overuse problems have been solved as a result of designating campsites, hardening camp pads, and controlling vehicle circulation. The lake is reported to be underused to well balanced for boating. Management indicates no overcrowding on the lake; most summer weekends produce well-balanced lake use. The number of sailboats on the lake has increased dramatically in recent years. Like most project areas, there are some conflicts between fishermen and power boaters. Some of the picnic areas are underused; some of these will be converted into camping areas. The Corps provides group facilities for picnics, parties, and reunions. The group areas are very popular and the Corps requires a permit (no charge) with the names of people responsible for the activity. No vehicles are allowed on the grass. Although several areas are heavily used, none of the swimming/sunbathing areas are reported to be overcrowded or overused. Shoreline fishing is popular at Milford, especially at the outlet channel and dam face. The Corps is planning to provide better and safer access areas for fishermen. Most of the boat launching ramps are reported to be well balanced. The Farnum Creek ramp is well designed and heavily used but not overcrowded. Overall, less than 40 percent of the car/trailer

Table 12

Milford Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land				Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acres)	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Unassigned	Sharing	Adjacent	Separate	Remote				
Boating																																									
Curtis Creek	X					X				X						X				X			X			X			X			X				-	16,190	-	N
Big K Marina/Milford St.Pk.	X					X				X						X				X			X			X				X			X				-	-	-	N
Timber Creek	X					X				X						X				X			X			X			X				X				-	-	-	N
Boat Launching																																									
Farnum Creek	X					X				X				X				X			X			X			X			X				X				3	-	-	N
Milford State Park	X				X					X					X			X			X			X			X			X				X				-	-	-	N
North Timber Creek	X					X				X				X				X			X			X			X			X					X			4	-	-	N
Camping																																									
Curtis Creek	X					X				X				X				X			X			X			X			X					X				440		$
Farnum Creek	X					X				X				X				X			X			X			X			X				X					250		$
School Creek	X					X				X				X				X			X			X			X			X				X				108	675	0.2	N
North Timber Creek	X					X				X				X				X			X			X			X			X					X			45	-		$
South Timber Creek	X					X				X				X				X			X			X			X			X				X				46	-		$
Hiking																																									
Timber Creek	X					X				X				X				X			X			X			X			X				X				-		-	N
ORV																																									
School Creek	X					X				X					X			X			X			X				X			X				X			-	-	-	N
Shore Fishing																																									
Outlet	X					X				X					X			X			X			X			X			X				X				-	-	-	N
Sunbathing																																									
Outlet	X					X				X				X				X			X			X			X			X				X				-	-	-	N
Rolling Hills	X					X				X				X				X			X			X			X			X				X				-	-	-	N
Swimming																																									
Outlet	X					X				X					X				X		X			X			X			X				X				-	-	-	N
Rolling Hills	X					X				X					X				X		X			X			X			X				X				-	-	-	N
Waterskiing																																									
Lake	X					X				X					X				X		X			X				X			X				X				-	16,190	-	N

*See Appendix D for descriptions of the various recreation settings.

spaces are used. The designated off-road vehicle (ORV) area at School Creek is reported to be well balanced. The Corps feels this ORV area makes good use of an otherwise wasted area--an old quarry.

152. The following show some of the actions the Corps has taken or is planning to take at Milford to provide for well-balanced resource use:

a. Planning to improve the ORV riding with input from local cycle clubs to provide a safe and enjoyable riding experience;

b. Providing a variety of different campsite situations (tent camping, trailer camping, group camping, multi-family camping) to satisfy the needs of a variety of campers;

c. Planning to add finger docks at boat launching ramps to expedite launching;

d. Planting numerous trees to enhance the recreation experience;

e. Restricting parking on the grass, with strict enforcement to prevent overuse and congestion;

f. Converting or relocating underused facilities to increase use;

g. Providing areas for overflow camping when campgrounds are full;

h. Requiring power boats to stay 300 ft from the shore to reduce user conflicts and shoreline erosion;

i. Seeding shoreline with millet during low water periods for wildlife and to prevent shoreline erosion;

j. Providing an interpretive trail and planning to use wood chips to reduce overuse;

k. Providing crappie beds, trees, and other fish attractors to improve fishing conditions; and

l. Planning to provide better and safer shoreline fishing access.

User survey findings

153. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 13. Management's perception of the use level situation also is included in the table for comparisons.

154. The significant findings from Table 13 are:

Table 13

Milford User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Non-Power																	
Lake	1	WB, OU	0	0	100	-	300	300	300	-	300	300	300	-	150	150	150
Boating, Power																	
Lake	4	WB, OU	50	0	50	120-375	-	225-300	255	100 1500	150	150	475	50 375	60	60	136
Boat Launching																	
Farnum Creek	3	H	0	20	80	0 25	0 5	5	7	0 25	5	5	8	15 30	-	-	23
Milford State Park	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
North Timber Creek	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Camping																	
Curtis Creek	4	H	75	0	25	30-60	-	40-50	45	60 100	75	75	78	30 50	30	30-40	38
Farnum Creek	10	H	60	0	40	30-Λ**	-	50-70	57	30 180	-	80	88	20 90	20 50	45-50	42
School Creek	10	WB	10	0	90	30-600	40	40-50	118	150 600	-	450	400	25 150	40	40	66
North Timber Creek	11	H	27	0	73	30-375	30	100	162	30 Λ	-	130	141	18 375	30 300	40	176
South Timber Creek	8	OU	25	0	75	20-100	60	50-60	53	40 100	-	75	72	20 75	30	30	34
Hiking																	
South Timber Creek	1	OU	0	0	100	-	-	-	Out of Sight	-	-	-	1320	-	-	-	300
ORV																	
School Creek	7	WB	17	0	83	150-Λ	-	660	405	50 Λ	50 150	150	212	15 600	15 45	45	157

Table 13 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the use Level Situation: Heavily Used(H) / Overused (OU) / Well Balanced (WB) / Underused (U) / Overcrowded(OC)	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Shore Fishing																	
Outlet	26	H	28	12	60	2-150	25	30	50	6 300	15 30	30	68	2 120	-	15	26
Sunbathing																	
Outlet	7	H	0	14	86	25 100	25	25	35	5 100	25	25	29	3 20	3 10	10	9
East Rolling Hills	7		11	0	89	10 40	20	20	23	5 A	-	20	6	4 15	-	6	8
Swimming																	
Outlet	19	H	11	21	68	0 A	25 50	40	44	2 100	5 30	25	17	1 15	10	10	9
Rolling Hills	11	H	10	10	80	20 80	20 30	30	39	20 80	20	28	25	4 15	15	6 10	10
East Rolling Hills	6		25	0	75	10 25	20	20	19	10 50	20	20	25	5 10	10	10	8
Waterskiing																	
Lake	3	WB	0	0	100	1050 A	-	-	-	300 2700	-	1800	1600	600 1800	-	-	1200

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

a. Over 60 percent of the campers at Curtis Creek and Farnum Creek indicated that other campers were "too close;"

b. Over 70 percent of the campers at School Creek, North Timber Creek, and South Timber Creek indicated that the distance between other campers was "just right;"

c. Milford campers prefer an average distance of over 70 ft between campsites;

d. Fishermen at the outlet below the dam would tolerate an average of 26 ft between other fishermen, but prefer an average of almost 70 ft;

e. Almost 30 percent of the shore fishing respondents indicated they were crowded;

f. Milford swimmers prefer an average spacing of between 17 and 25 ft between them and other swimmers, but will accept a minimum of 10 ft;

g. Sunbathers at Rolling Hills prefer a closer spacing than the Outlet sunbathers;

h. Like most project areas, Milford recreators indicated a wide range of distance responses for the same activity areas;

i. Over 80 percent of the off-road vehicle (ORV) riders at the School Creek area indicated there were just enough riders in the area; and

j. Milford ORV riders prefer an average distance of about 200 ft between other riders.

New Hogan Lake

Descriptive orientation

155. New Hogan Lake was developed to provide flood control and irrigation. At the normal recreational pool, the surface area of the lake is 3120 acres, the shoreline is 44 miles long, and the land area is 3944 acres. Its average width is about 1 mile, ranging from 1/4 of a mile to 1-3/4 miles wide. Located in the western foothills of the Sierra Nevadas, the lake is 37 miles east of Stockton, California, 68 miles southeast of Sacramento, and 125 miles east of San Francisco. Access from these major population centers to the lake is good. In 1978, visitation was about 1/4 million recreation days.

156. The climate of the area is characterized by hot, dry summers and by mild, wet winters. Because of the rocky soils, vegetative cover is sparse, consisting of grasses, chapparal, oaks, and scattered conifers. Steep terrain and rock outcroppings occupy about half of the project land, limiting development to the 11 existing sites. Overcrowded and overused camping areas exist with adjacent underused picnic areas. Boating is reportedly well balanced, but approaching overcrowded conditions.

157. New Hogan has 11 Corps-managed recreation areas (Figure 9). The project areas have varying levels of development, but the highest level of development is found along the northern shore at Fiddleneck day use area, Wrinkle Cove, and Oak Knoll and Acorn campgrounds. The other recreation areas are used mostly for fishing access. Recreation activities at the lake include: camping, picnicking, waterskiing, boating, fishing, hunting, swimming, and hiking. Corps facilities also include a highly developed boat launching area and a marina concession operation.

158. The two campgrounds, Acorn and Oak Knoll, are full every weekend from March through Labor Day. Many campers (80 percent) have boats and, during the weekends, many visitors join them. Visitors are issued permits and extra vehicle parking areas are provided.

159. A single entrance gate and attendant control access in and out of the two campgrounds. Oak Knoll is a nonfee, 75-site campground. The campground has designated sites, but a limited level of development

unpaved camp pads, no electric or water hookups). Campsites are spaced an average of 50 ft apart and picnic tables are provided at the campsites. In the past, Oak Knoll was the overflow area for Acorn Campground.

160. Acorn Campground is a 121-site fee campground which is more highly developed than Oak Knoll. The newer pads are paved; picnic tables, camp fire rings, shower buildings, and fish cleaning facilities are provided. A boat ramp and extra vehicle parking areas are provided within the campground. Campsites are spaced an average distance of 45 ft.

161. The picnic area at North Shore is located on steep slopes relatively far from parking lots and the lakeshore. Most sites appear underused. The picnic area includes 120 tables with concrete bases, and stoves are provided for cooking. Shade trees are scarce.

162. Swimming is very popular at New Hogan; some dangerous areas exist because of steep, rocky shorelines. Swimming is encouraged at Wrinkle Cove. Sand was brought in for the beach and a swimming area was delineated with buoys. Early in the recreation season, high water inundates the entire beach area.

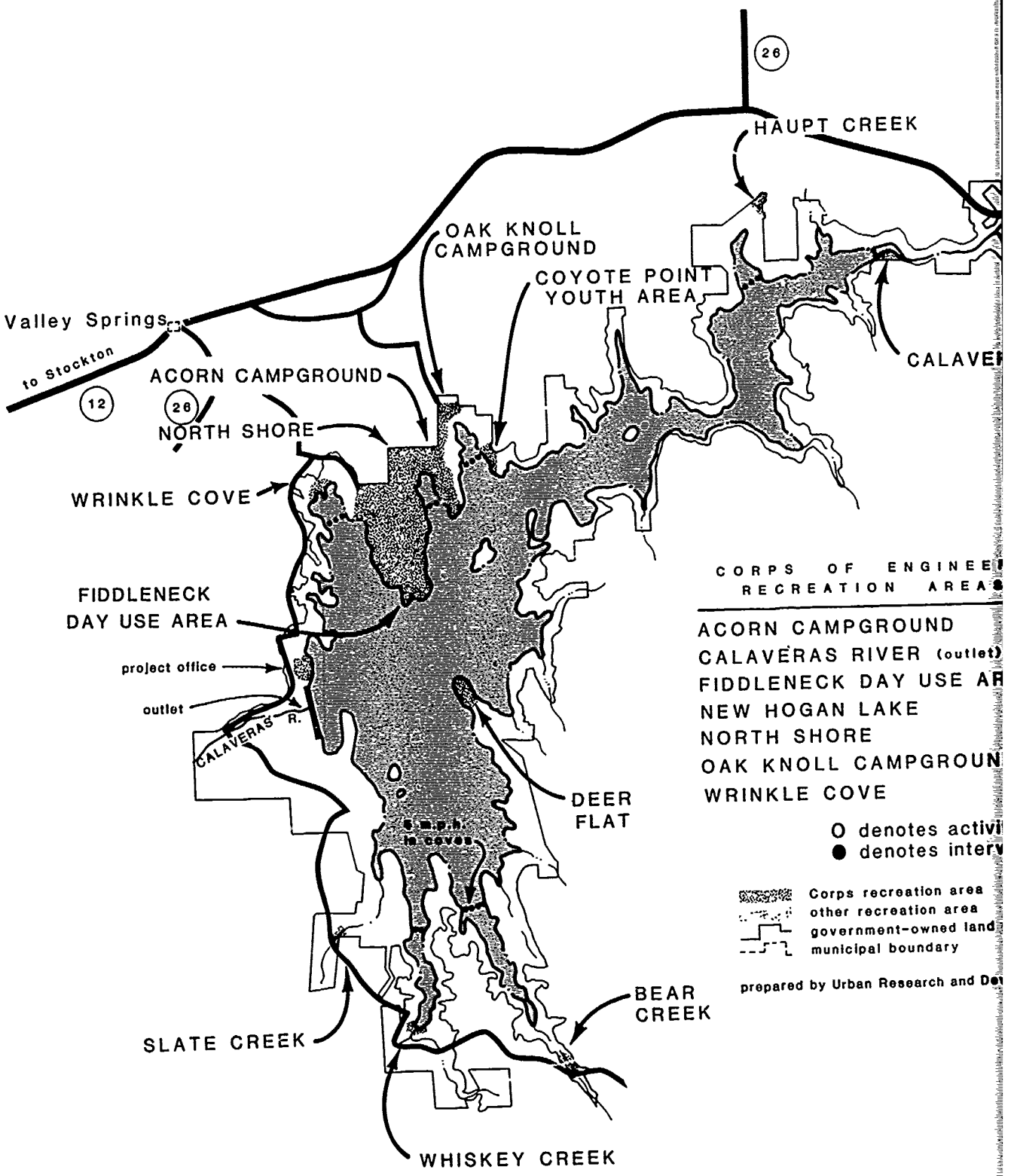
163. Three very long, highly developed multiple lane (three to six lanes) ramps exist at the same area within the North Shore recreation area. Three large parking areas are provided for 250 cars and trailers. Courtesy docks extend from the ramps and different ramps are used during low and high water periods.

164. A county ordinance prohibits night boating on the lake; boats may be operated from one hour before sunrise until one hour after sunset. Boating activities on the lake are not zoned; however, some cove areas require speeds of 5 mph or less. This has helped reduce conflicts between power boaters and boat fishermen. Hazardous rocks and shallow areas are marked with buoys.

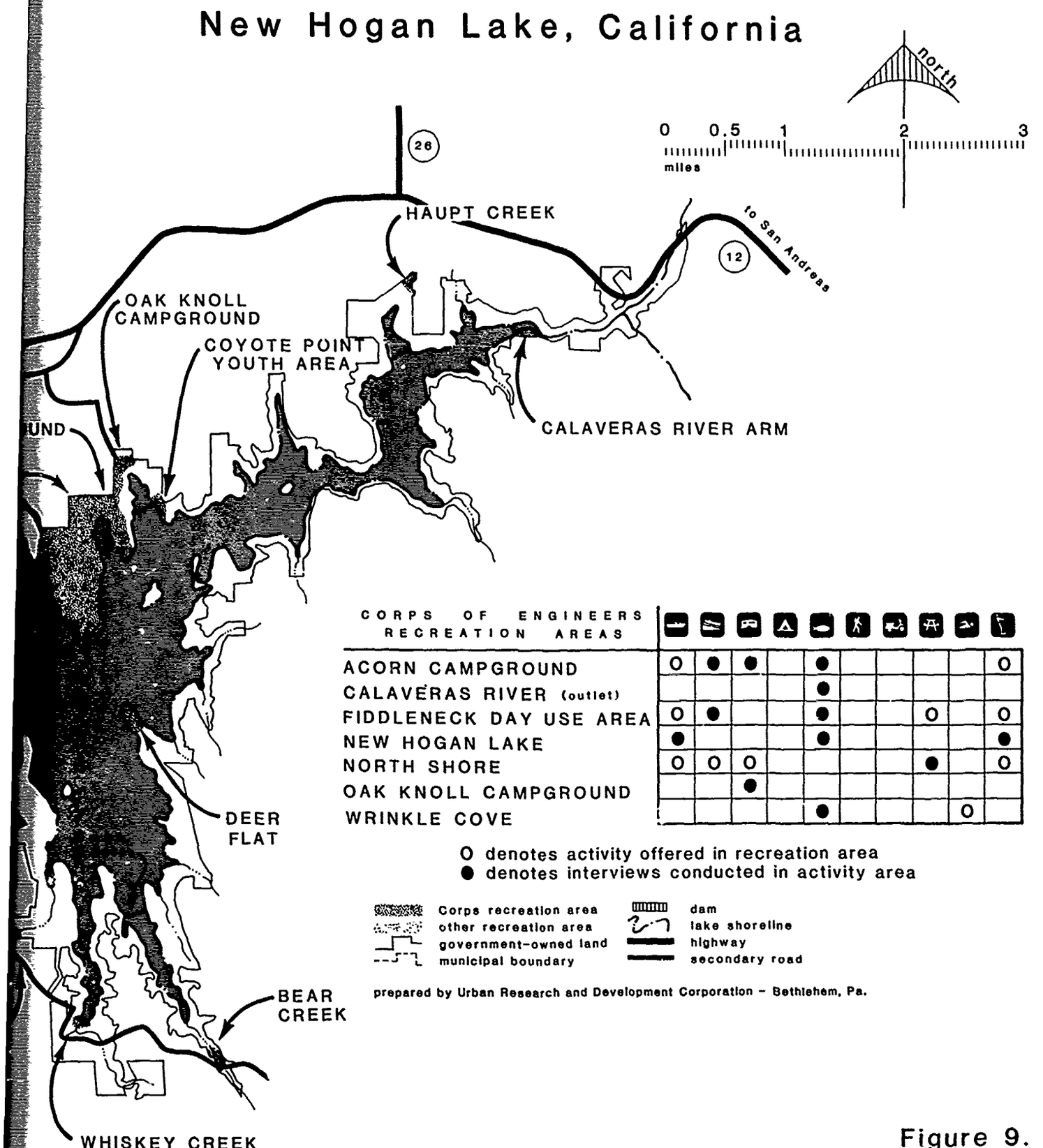
165. No areas are designated for off-road vehicle (ORV) riding. Project managers indicated there is a need for ORV areas, but no suitable areas exist at the project.

166. More information about the recreation settings and features of the study activity areas can be found in Table 14.

New Hogan Lake, C



New Hogan Lake, California



CORPS OF ENGINEERS RECREATION AREAS										
ACORN CAMPGROUND	O	●	●		●					O
CALAVERAS RIVER (outlet)					●					
FIDDLENECK DAY USE AREA	O	●			●			O		O
NEW HOGAN LAKE	●				●					●
NORTH SHORE	O	O	O					●		O
OAK KNOLL CAMPGROUND			●							
WRINKLE COVE					●				O	

O denotes activity offered in recreation area
● denotes interviews conducted in activity area

Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation – Bethlehem, Pa.

Figure 9.

Table 14

New Hogan Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land				Vegetative Screen				Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee (S) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 - 25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																										
Lake			X				X				X						X				X			X			X			X			X				-	3,120	-	N
Boat Fishing																																										
Lake			X				X				X						X				X			X				X			X			X				-	3,120	-	N
Boat Launching																																										
Acorn Campground			X				X				X					X				X				X			X			X			X				1	-	-	N
Fiddleneck			X				X				X				X					X				X			X			X			X				3 4	-	-	N
Camping																																										
Acorn Campground			X				X				X					X				X				X			X			X			X				121			$
Oak Knoll Campground			X				X				X					X				X				X				X			X			X				75	22	3.4	N
Hiking																																										
Outlet			X				X					X				X				X				X				X			X			X				-		-	N
Picnicking																																										
North Shore			X				X				X					X				X				X				X			X			X				62-87	175		N
Shore Fishing																																										
Acorn Campground/N. Shore			X				X				X					X				X				X			X			X			X				-	-	-	N
Calaveras River			X				X					X			X					X				X			X			X			X				-	-	-	N
Fiddleneck			X				X				X				X					X				X			X			X			X				-	-	-	N
Wrinkle Cove			X				X				X				X					X				X			X			X			X				-	-	-	N
Waterskiing																																										
Acorn Campground			X				X				X						X				X			X			X			X			X				-	-	-	N
Lake			X				X				X						X				X			X			X			X			X				-	3,120	-	N

*See Appendix D for descriptions of the various recreation settings.

**Developed area acres include parking lots and other support facilities.

Management survey findings

167. Project management personnel report that some overuse and overcrowding occurs at both campgrounds, although to a greater degree at Oak Knoll. Overcrowding has been greatly reduced by adding an entrance gate with Corps attendant and by controlling the number of people visiting campers. Providing individually designated campsites and controlling circulation through the use of timber poles and large rocks have helped reduce overuse. Adding extra vehicle parking lots and limiting the number of people (eight) and vehicles (two) per campsite have also helped solve overuse and overcrowding problems.

168. The lake is reportedly well balanced, but at the threshold of being overcrowded. The 5-mph speed zones in several of the cove areas have worked well and have helped reduce power boating and boat fishing conflicts. Buoys are used to mark hazards. If overcrowding on the lake would become a problem, project managers would consider marking off additional cove areas for limited speeds and/or controlling boat circulation in the same direction.

169. Project managers have reported that much of the North Shore picnic area is underused because of a variety of reasons: located far from the lake; steep slopes which make walking to the picnic sites very difficult; parking spaces located far from the sites; lack of grass and shade trees; lack of shelters or pavilions; inadequate cooking stoves; hot summer temperatures; and snakes. They plan to take some of the picnic tables out and relocate them to more desirable locations. They also hope to encourage more use by developing group facilities, by adding shelters and better cooking grills, and by irrigating the area.

170. The launching ramps are well balanced. Additional parking has been added and there now appears to be a good balance between the number of spaces and the level of use. High and low water ramps are necessary because of lake fluctuation; the system works well. The launching ramp in Acorn Campground works well and the trailer parking area helps eliminate campsite congestion.

User survey findings

171. A summary of the user survey responses regarding the actual,

preferred, and minimum acceptable distances between recreators is shown in Table 15. Management's perception of the use level situation also is included in the table for comparisons.

172. The significant findings from Table 15 are:

a. Twenty-five percent of the Acorn and Oak Knoll campers indicated that other campers were "too close;"

b. Campers at Acorn prefer an average distance of 106 ft between campsites; while Oak Knoll campers prefer an average distance of 69 ft;

c. Most New Hogan power boaters and waterskiers would accept a distance of 300 ft between boats;

d. Most Fiddleneck boat launchers prefer launching within 6 min, but will tolerate a 20-min launch;

e. Although the North Shore picnic area is underused, over 50 percent of the respondents indicated the sites were "too close" together;

f. Responses from people shoreline fishing varied considerably. People fishing along the Calavares River generally prefer a greater spacing than people fishing on the lake shore; and

g. People boat fishing prefer an average distance of 850 ft between boats.

Table 15

New Hogan User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of User Surveyed	Management's perception of the Use Level Situation (Heavily Used(H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Nonpower																	
Lake	2	H	0	0	100	300 3000	-	-	1650	300 3000	-	-	1650	-	-	-	-
Boating, Power																	
Lake	10	H	0	10	90	150 3960	1320	1320	1777	150 3960	1320	1320	1629	150 700	300	300	407
Boat Fishing																	
Lake	19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boat Launching																	
Acorn	4	H	25	0	75	0 38	-	5 10	13	0 30	-	5 10	11	-	-	-	-
Fiddleneck	16	H	0	0	100	3 10	5	5	5	3 10	5	5	6	15 30	15	15	20
Camping																	
Acorn	57	OU, OC	25	0	75	20 150	40	40	44	25 300	60	72 80	106	-	-	-	-
Oak Knoll	26	OU, OC	25	0	75	5 150	50	40	48	5 300	50	50	69	-	-	-	-
Picnicking																	
North Shore	7	OU	57	0	43	15 75	40 70	40	47	45 120	70	70	74	-	-	-	25
Shore Fishing																	
Acorn	2	WB	0	0	100	13 50	-	-	32	13 50	-	-	32	-	-	-	-
Calaveras River	10	OU	14	0	86	4 1500	600	600	436	4 1500	600	600	438	-	-	-	50
Fiddleneck	6	OU	0	0	100	15 300	150	150	138	15 300	150	150	138	-	-	-	10
Wrinkle Cove	13	OU	0	38	62	15 600	-	60 70	182	15 115	-	35 60	53	-	-	-	-
Waterskiing																	
Lake	7	H	43	0	57	50 1320	1320	1320	813	100 1320	1320	630	784	50 600	300	300	313

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

Lake Ouachita

Descriptive orientation

173. Blakely Mountain Dam and Reservoir was authorized for the purposes of flood control and hydroelectric power generation. Lake Ouachita is located in west central Arkansas, 13 miles northwest of Hot Springs and 60 miles southwest of Little Rock. Approximately 2.8 million persons live within 150 miles of the lake. The total project area is 82,373 acres with a lake surface area of 40,060 acres, a lake shoreline of 690 miles, and a land area of 48,300 acres when the lake is at the average recreational pool elevation of 578 ft msl (mean seal level). The steeply sloped and heavily wooded landscape distinguishes Lake Ouachita from many other projects visited. Normal summer temperatures are in the middle 80°F (with extremes to 100°F) and the average annual precipitation consists of 48 in. of rain and 2 in. of snow.

174. Access to the more developed southern portions of the lake is provided by State and county roads leading from U.S. 270. State roads provide access to the northern and western shores. The eastern shore is accessible at two locations (the damsite and at Ouachita State Park) via State roads. The travel distances of the Corps recreation areas from the primary highway vary from 2 to 7 miles. In 1978, attendance reached almost three million recreation days.

Site analysis findings

175. The Corps currently operates 15 developed recreation areas, two primitive areas, and one wilderness area (Figure 10). Corps-developed sites generally provide areas for camping, boat launching, and picnicking, as well as comfort facilities. Swimming areas and group picnic shelters are provided at several sites.

176. Ouachita State Park, on the eastern shore, provides a marina and restaurant, picnic facilities, campsites, cabins, and a variety of nature programs. Commercial concessionaires lease 236 acres from the Corps at nine of the developed recreation sites. Concessions include cabins, motel rooms, trailer spaces, boat rentals, docks and slips, launching ramps, eating establishments, and grocery or general supply

stores.

177. Corps recreation sites are distributed over the entire project area; however, the southern shore has better access and contains more recreation sites. Many of the recreation areas are located on fingers or peninsulas; some are very narrow. The steep terrain and shallow soil are extremely susceptible to erosion. The steep slopes and narrow fingers make circulation difficult in some areas such as Joplin. Overuse is evident at Joplin and Crystal Springs recreation areas.

178. The campgrounds provide opportunities for walk-in tent camping and trailer camping. Most of the campgrounds visited provide 60 to 80 sites and contain overflow areas, registration stations, dump stations, and nearby boat launching facilities. No individual electric or water hookups are provided at the Corps campsites. Most campsites enjoy easy access to the lake.

179. Some small picnic areas and other day use areas are located within the camping area. Picnicking and day use activities are very popular at the spillway recreation area, which is located relatively close to Hot Springs.

180. There is no zoning on the lake. Like most Corps project areas, conflicts exist between boat fishermen and waterskiers. Waterskiing is very popular at Lake Ouachita. Heavy use areas include those areas adjacent to ramps, camping areas, and marinas. The narrow channels are especially hazardous.

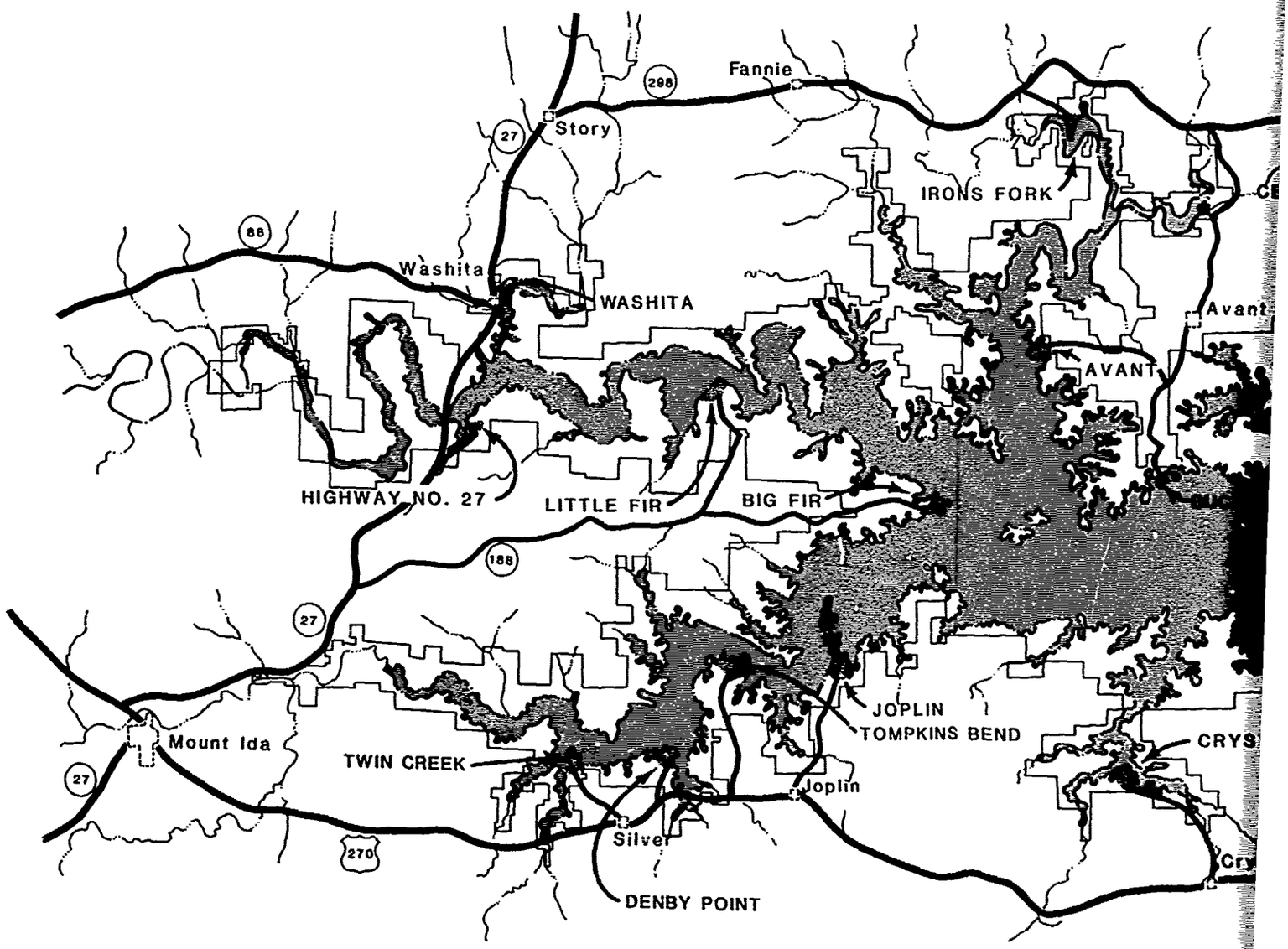
181. The Woodpecker Hollow and Buckskin nature trails are each 1/2 mile long, have interpretive stops, and have recently been added to the Arkansas Trails System. They are located within camping areas.

182. More information about the study activity area recreation settings and features can be found in Table 16.

Management survey findings

183. Project management personnel point out a variety of different use level situations for study at Ouachita. Overcrowding and overuse are both problems at some activity areas. Overuse has occurred largely in the camping areas. Crystal Springs and Joplin camping areas are both overcrowded and overuse. Campsites at these recreation areas are very

Lake Ouachita, A



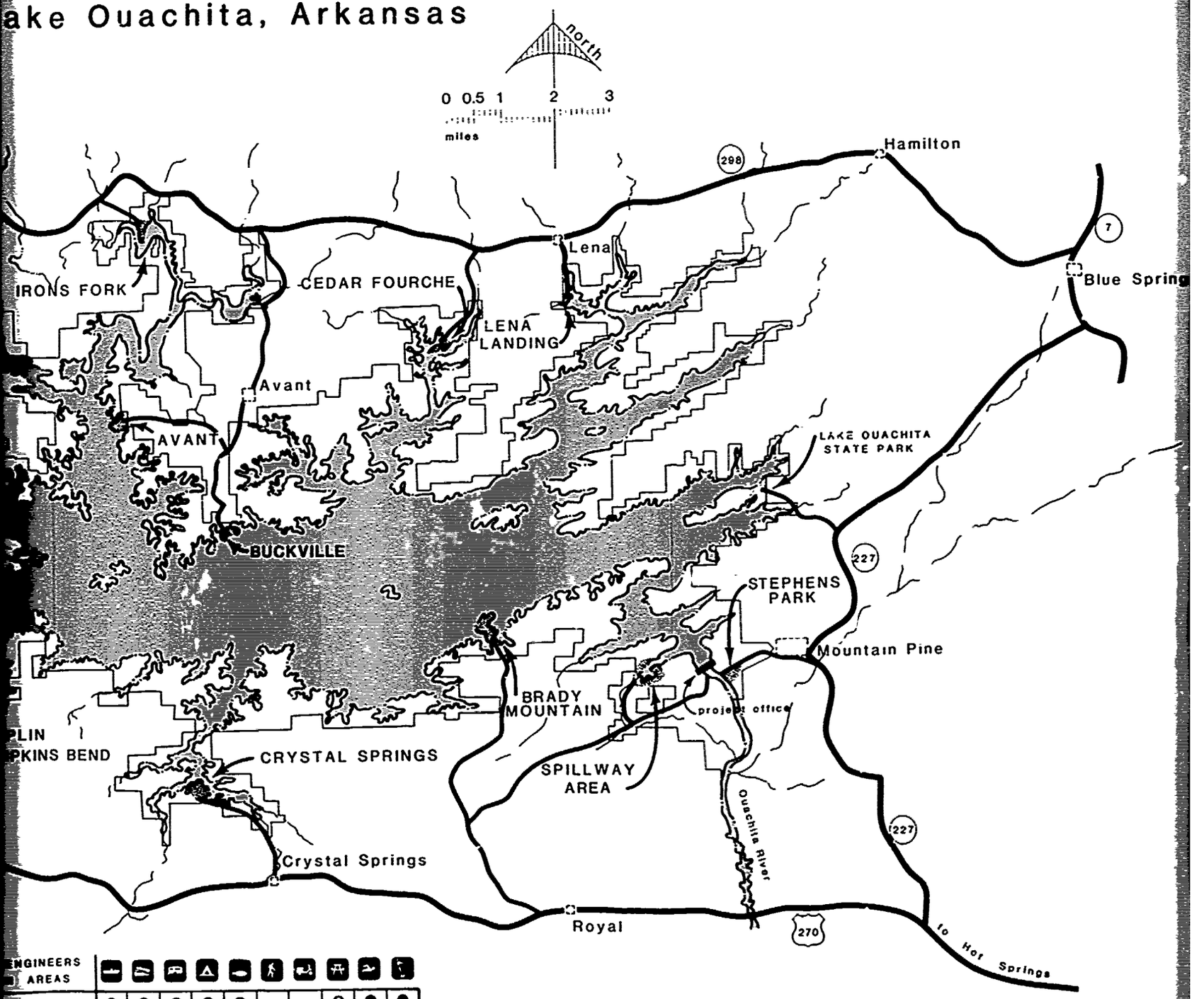
CORPS OF ENGINEERS RECREATION AREAS							
BRADY MOUNTAIN	O	●	●	●	O		
CRYSTAL SPRINGS	●	●	●	●	O		
JOPLIN	●	O	●		O		
LAKE OUACHITA	O				●		
SPILLWAY	O	O			O		

Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation - Bethlehem, Pa.

O denotes activity offered in recreati
● denotes interviews conducted in ac

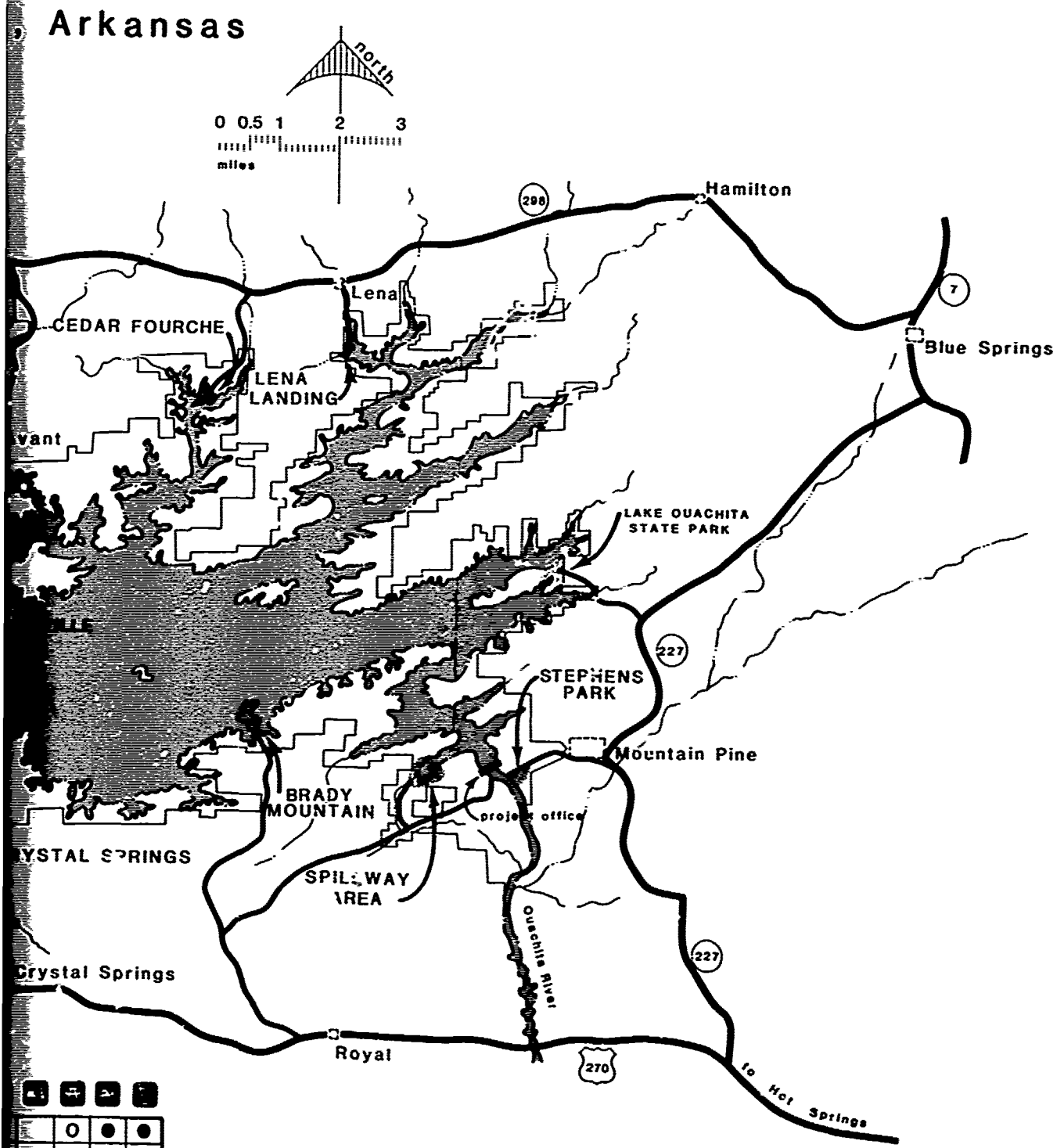
ake Ouachita, Arkansas



ENGINEERS AREAS										
UNTAIN	o	●	●	●	o			o	●	●
PRINGS	●	●	●	●	o			o	●	●
	●	o	●		o			o	●	●
HITA	o				●					o
	o	o			o			●	o	o

●notes activity offered in recreation area
●notes interviews conducted in activity area

Figure 10.



	O	●	●
	O	●	●
	O	●	●
			O
	●	O	O

tion area
ctivity area

Figure 10.

Table 16

Ouachita Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway				Distance to Highway				Slope of Land				Vegetative Screen				Access to Water Body				Visibility to Water Body				Level of Development				Level of Control				Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee (F) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	Undesignated	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																											
Crystal Springs		X				X					X					X			X			X			X			X			X			X				-	40,060	-	N
Joplin		X					X				X					X			X			X			X			X			X			X				-	-	-	N
Boat Fishing																																											
Brady Mountain		X				X					X					X			X			X			X			X			X			X				-	40,060	-	N
Highway 27		X					X			X						X			X			X			X			X			X			X				-	-	-	N
Little Fir		X					X				X					X			X			X			X			X			X			X				-	-	-	N
Boat Launching																																										
Brady Mountain		X				X					X			X				X				X			X			X			X			X				-	-	-	N
Crystal Springs		X				X				X				X				X				X			X			X			X			X				-	-	-	N
Camping																																											
Brady Mountain		X				X					X			X				X				X			X			X			X			X				64	75	0.8	$
Crystal Springs		X				X				X				X				X				X			X			X			X			X				65	49	1.2	$
Joplin		X				X				X				X				X				X			X			X			X			X				60	165	0.4	$
Picnicking																																											
Spillway Area		X						X			X			X					X			X			X			X			X			X				10	11	0.8	N
Sunbathing																																											
Brady Mountain		X				X					X			X				X				X			X			X			X			X				-	-	-	N
Crystal Springs		X				X				X				X				X				X			X			X			X			X				-	-	-	N
Joplin		X					X				X			X					X			X			X			X			X			X				-	-	-	N
Swimming																																											
Brady Mountain		X				X					X				X				X			X			X			X			X			X				-	-	-	N
Crystal Springs		X				X				X					X				X			X			X			X			X			X				-	-	-	N
Joplin		X					X				X				X				X			X			X			X			X			X				-	-	-	N
Waterskiing																																											
Brady Mountain		X				X					X				X				X			X			X			X			X			X				-	40,060	-	N
Crystal Springs		X				X				X					X				X			X			X			X			X			X				-	-	-	N
Joplin		X					X				X				X				X			X			X			X			X			X				-	-	-	N

*See Appendix B for descriptions of the various recreation settings.

**Developed area acres include parking lots and other support facilities.

popular and overuse has resulted largely from heavy use of a sensitive resource with shallow soils and steeper slopes prone to sheet erosion. Limited circulation controls also contribute to Joplin's overuse.

184. The Brady Mountain camping area, once overcrowded and overused, is now reportedly well balanced since extensive changes have been made through campsite relocation and restoration.

185. The following are some solutions that are being used to reduce overcrowding and overuse and provide well-balanced campgrounds:

a. Providing less intense, walk-in tenting areas in steeper sloping areas and narrow peninsulas to reduce overuse;

b. Using an entrance gate and attendant to control use levels and offer security and assistance to campers;

c. Limiting the number (two) of camp units per pad to reduce overcrowding and overuse;

d. Providing separate areas for day users and campers to reduce user conflicts;

e. Providing separate overflow areas in campgrounds to accommodate extra campers when the regular campground is full;

f. Designating individual campsites, paving camp pads, and controlling vehicle access to solve overuse and reduce overcrowding;

g. Studying erosion and vegetative problems and reseeding, fertilizing, and "hydro-seeding" to restore overused resources; and

h. Reducing the number of campsites in one of the areas to solve both overcrowding and overuse.

186. Overall, the boating situation at Lake Ouachita is well balanced. The more heavily used areas include the cove areas and areas near launching ramps and developed recreation areas. Waterskiing is also very popular at these areas. There is no lake zoning per se, but no wake and no ski areas exist. No ski areas are designated in some of the narrow channels (Crystal Springs) to prevent accidents and shore erosion. Also, to enhance boat fishing and to reduce fishing/power boating conflicts, standing timber was allowed to remain in most narrow inlets of the lake. Management does not believe that strict zoning of boating activity areas would be advisable because of user dissatisfaction.

187. Project managers have indicated there are some camping and day use conflicts at the Crystal Springs and Joplin areas due to use of the same swimming/sunbathing sites. Separate beach areas are planned for campers and for day users in order to eliminate conflicts. In the past, beaches have been maintained and sand has been replenished.

188. Congestion occurs at the launching areas in Crystal Springs, Brady Mountain, and Joplin recreation areas. Marking individual car/trailer spaces at the parking areas has helped reduce congestion, but additional parking space is needed.

User survey findings

189. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 17. Management's perception of the use level situation also is included in the table for comparisons.

190. The significant findings from Table 17 are:

a. Most users indicated they were spaced "just right" from other visitors;

b. Boat fishermen prefer an average distance of about 300 ft between boats;

c. Most boat launchers prefer to launch their boats within 10 min;

d. About 40 percent of the Joplin campers indicated they were "too close" to other campers;

e. Over 75 percent of the Crystal Springs and Brady Mountain campers indicated their sites were spaced "just right;"

f. Picnickers at the Spillway prefer an average spacing of about 40 ft between other picnic sites; and

g. Sunbathers prefer an average distance range of 11 to 23 ft; while swimmers prefer to be spaced an average distance of between 11 to 35 ft.

Table 17

Ouachita User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation: Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC)	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Power																	
Joplin	11	WB	0	0	100	30 1320	1320	1320	890	100 2640							
Crystal Springs	3	WB	0	0	100	A**	-	-	A	-	-	-	-	-	-	-	-
Boat Fishing																	
Lake	23	OC	0	9	91	45 A	A	A	715	45 1320	150	200	319	5 300	100 300	100	119
Boat Launching																	
Crystal Springs	15	WB	8	0	92	5 15	5	8	8	3 10	5	5 7	6	60	-	-	60
Brady Mountain	5	WB	0	0	100	10 15	10	10	11	5 18	5 15	10 15	11	20 30	30	30	27
Camping																	
Crystal Springs	19	OU, OC	16	0	84	30 80	50	40	49	40 A	60	60	65	10 50	60	40	42
Joplin	24	OU, OC	36	0	64	25 80	40	40	44	35 300	-	80 90	123	20 150	30 50	50	52
Brady Mountain	27	WB	19	4	77	30 100	50	68	62	35 100	70	70	66	25 100	50	50	53
Picnicking																	
Spillway	10	WB	0	10	90	30 50	40	40	40	25 50	40	40	39	15 40	30	25 30	25
Sunbathing																	
Crystal Springs	14	OC	50	0	50	3 20	8	6	7	5 A	10	10	11	2 10	10	10	8
Brady Mountain	11	WB	9	9	82	15 [illegible]	15	15	30	15 [illegible]	15	20	23	5 15	5	5	6
Joplin	1	WB	0	0	100	10	-	-	10	-	-	-	-	5	-	-	5
Swimming																	
Crystal Springs	11	OC	50	0	50	3 20	10	6 10	9	5 A	10	18	24	3 20	10	10	10
Brady Mountain	2	WB	0	0	100	50	50	50	50	20 50	-	-	35	10	10	10	10
Joplin	2	WB	0	0	100	12	-	-	12	10 20	-	-	11	6	6	6	6

Table 17 - Continued

Activity, Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used(H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Waterskiing																	
Crystal Springs	2	WB	100	0	0	100 200	-	-	150	200 600	-	-	400	150 200	-	-	175
Brady Mountain	5	WB	0	0	100	450 2640	450	600	1188	600 2640	600 1500	1500	1368	150 1320	600	600	594
Joplin	9	UB	14	0	86	40 225	-	-	133	50 600	300	300	269	50 600	150	150	206

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other

Lake Shelbyville

Descriptive orientation

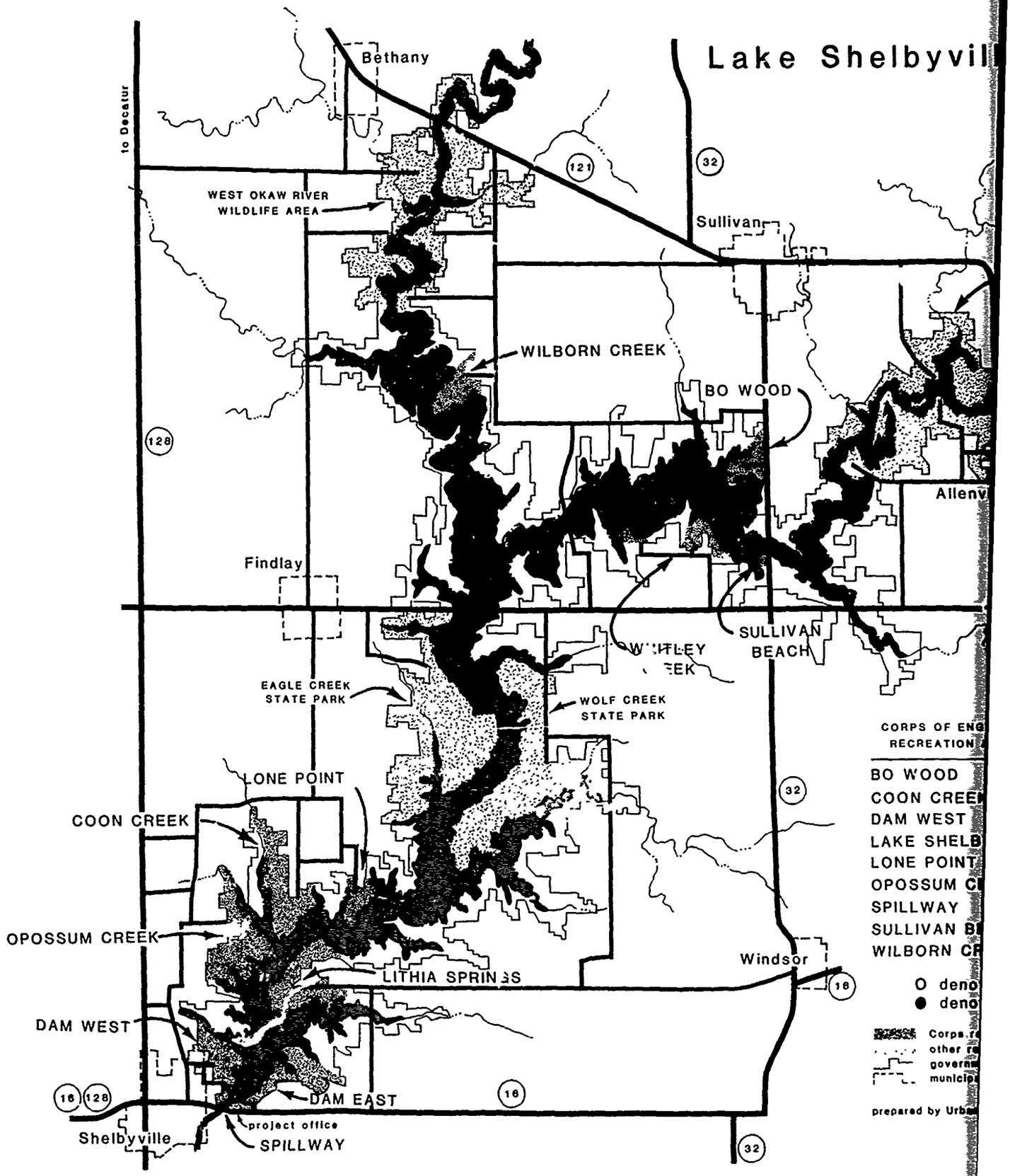
191. Lake Shelbyville provides flood control, navigation releases for the Kaskaskia River, and domestic and industrial water supply. The project is located in an agricultural area and is approximately 30 miles south of Decatur, Illinois. Chicago is approximately 200 miles to the north and St. Louis is about 110 miles to the southwest. At the normal recreational pool elevation of 600 ft msl, the lake surface area is 11,100 acres, the shoreline is 172 miles long, and the land area is 23,308 acres. The normal recreation pool extends 20 river miles upstream, and averages about 1 mile in width. A large number of coves and inlets are present along the shore. In 1978, 2.9 million recreation days were reported at Lake Shelbyville. The surrounding topography is relatively flat. The climate is fairly moderate, with normal summer temperatures in the upper 70°F (with extremes to over 100°F), and with 38.6 in. of annual precipitation (20 in. of snowfall). Access from the major population centers to the project is good via numerous State highways.

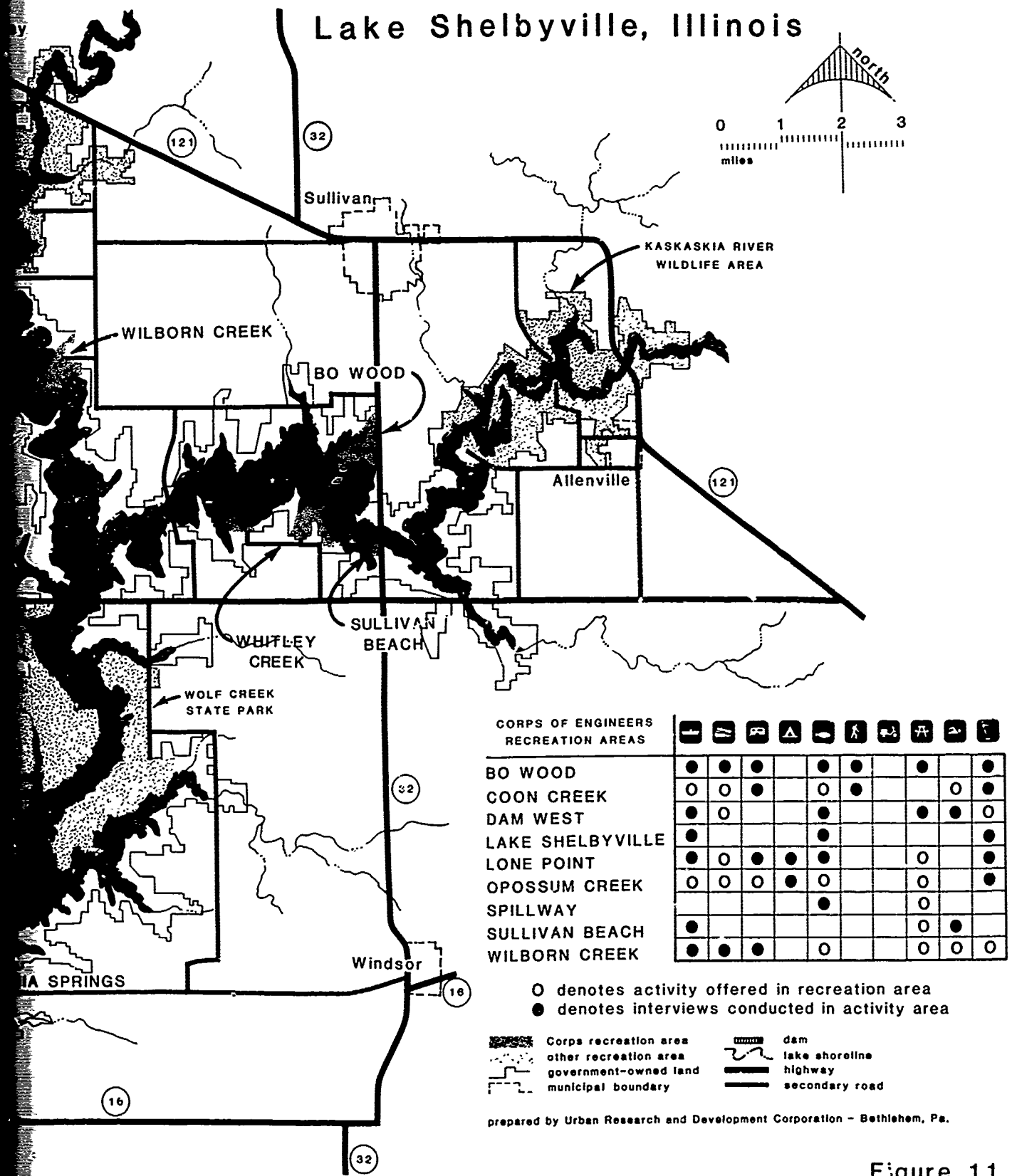
Site analysis findings

192. Ten recreation areas are operated by the Corps and two parks are operated by the State (Figure 11). Parts of these areas are situated on the water, and some areas are on peninsulas. While most camping sites are not on the lake and do not have a view of the lake, most sites have easy access to the water, except where a few steep slopes limit access.

193. The only evidence of significant overuse is found on campsites at the "D" leg of Coon Creek, at some of the wooded sites, at Bo Wood, and at some other sites which are shaded and near the water. Although some resource overuse and overcrowding occurs at the beaches, boat ramps, and several of the camping areas, this does not present serious problems.

194. Most campsites have electric hookups, and water is located nearby. The recreation areas have a high level of development and control, even in the free camping area. Gate attendants and patrolling rangers provide security. Although most camp pads are paved, excessive


Lake Shelbyvil
Bethany
to Decatur
121
32
WEST OKAW RIVER
WILDLIFE AREA
Sullivan
WILBORN CREEK
BO WOOD
128
Allenv
Findlay
SULLIVAN
BEACH
EAGLE CREEK
STATE PARK
WOLF CREEK
STATE PARK
CORPS OF ENG
RECREATION
LONE POINT
COON CREEK
BO WOOD
COON CREE
DAM WEST
LAKE SHELB
LONE POINT
OPOSSUM C
SPILLWAY
SULLIVAN B
WILBORN CR
OPOSSUM CREEK
Windsor
18
LITHIA SPRINGS
O deno
deno
DAM WEST
Corps
other re
governm
municip
16
128
DAM EAST
prepared by Urb
project office
Shelbyville
SPILLWAY
16
32



CORPS OF ENGINEERS RECREATION AREAS										
BO WOOD	●	●	●		●	●		●		●
COON CREEK	O	O	●		O	●			O	●
DAM WEST	●	O			●			●	●	O
LAKE SHELBYVILLE	●				●					●
LONE POINT	●	O	●	●	●			O		●
OPOSSUM CREEK	O	O	O	●	O			O		●
SPILLWAY					●			O		
SULLIVAN BEACH	●							O	●	
WILBORN CREEK	●	●	●		O			O	O	O

O denotes activity offered in recreation area
● denotes interviews conducted in activity area

Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation - Bethlehem, Pa.

Figure 11.

wear occurs at the edges. Many campers bring a boat and desire to park the trailer at their campsite. Not all sites are large enough to accommodate boat trailers. (Shelbyville enforces a rule requiring all wheels of all vehicles to be on the pad.)

195. Wooden steps and pontoon bridges have been installed to reduce overuse on the Coon Creek trail. Small sewage treatment plants have been installed at several of the campgrounds, and fish cleaning stations have been installed at all boat ramps to improve sanitary conditions. Buoys and floats have been placed around swimming areas and no wake markers are located around beaches, boat ramps, and marinas.

196. More information about the study activity area recreation settings and features can be found in Table 18.

Management survey findings

197. Lake Shelbyville is heavily used. Some overuse occurs in portions of certain activity areas. However, underuse occurs in some camping and day use areas. The project staff is aware of some changes that are needed in management policies or use areas. They have reduced carrying capacity problems by redeveloping areas and have prevented problems by anticipating them. When the carrying capacity of an area is reached, the area is altered to accommodate the use. When an area is underutilized, it is redeveloped to increase its level of use. Examples of several solutions used are described below:

a. Originally, each campground had overflow sites. To accommodate heavier demand, these sites have been incorporated into the main camping areas. A separate overflow campground has been designated for use only when all other campgrounds are full.

b. Two swimming areas have been redeveloped because of continued increased usage. The beaches have been regraded, the parking lots have been enlarged and paved, and bathhouses have been built.

c. Some picnic areas were underused. These areas have been converted to camping sites, mostly for walk-in tenting.

d. Two legs of Coon Creek campground experienced carrying capacity problems. Leg "D" had sites situated on easily eroded soil and experienced critical overuse. These sites have been rehabilitated and hardened with timber and gravel to withstand more use. Leg "C" had too many

Table 18

Shelbyville Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land			Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas			Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee (F) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+% Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																					16,100			N
Bo Wood	x				x					x						x			x	x			x			x			x				x							N
Dam West	x	x				x				x						x			x	x			x			x				x			x							N
Lone Point	x	x				x				x						x			x	x			x			x			x				x							N
Sullivan Beach	x									x						x			x	x			x			x				x			x							N
Wilborn	x	x				x					x					x			x	x			x			x				x			x							N
Boat Fishing																																									
Bo Wood	x				x						x					x			x	x			x			x			x				x							N
Coon Creek	x	x				x					x					x			x	x			x			x				x			x							N
Lake	x				x						x					x			x	x			x			x				x			x				16,100			N
Boat Launching																																									
Bo Wood	x				x						x				x		x			x			x			x				x				x			4				N
Wilborn	x				x						x			x			x			x			x			x				x				x			4				N
Camping																																									
Bo Wood	x				x					x						x				x			x			x			x					x				72			$
Coon Creek - A,B,D,E,F	x					x				x					x			x			x			x			x			x					x			231	173	1.3	$
Coon Creek - C	x					x				x				x			x				x			x			x			x					x						$
Coon Creek - G, H	x					x				x						x		x			x			x			x			x						x		47			$
Lone Point	x					x				x					x			x			x			x			x			x						x		97	86	1.1	$
Opposum	x					x				x					x			x			x			x				x			x						x	93	79	1.2	N
Wilborn Group	x				x					x					x			x				x			x			x				x				x			110			$
Biking																																									
Bo Wood	x				x					x					x			x			x			x			x			x				x			-				N
Coon Creek	x					x				x					x			x				x			x			x			x				x			-	1	-		N
Picnicking																																									
Bo Wood	x				x						x			x			x				x			x			x			x				x			73				N
Dam West	x					x				x				x			x				x			x			x			x				x			88	101	0.7		N
Shore Fishing																																									
Spillway	x					x				x					x			x			x			x			x			x				x			-	-	-		N
Sunbathing																																									
Sullivan Beach	x									x				x			x				x			x			x			x				x			-	20	-		N
Swimming																																									
Dam West	x					x				x						x			x	x			x			x			x				x			-	-	-		N
Sullivan Beach	x									x						x			x	x			x			x				x			x			-	-	-		N
Waterskiing																																					16,000			N
Bo Wood	x				x						x				x			x			x			x			x			x				x			-	-	-		N
Coon/Opposum	x					x					x				x			x			x			x				x		x				x			-	-	-		N
Long Point	x					x					x				x			x			x			x				x		x				x			-	-	-		N

*See Appendix B for descriptions of the various recreation settings.

**Developed area acres include parking lots and other support facilities.

sites for the resource. Almost one half the sites were removed. The area is now considered to be well balanced.

e. New, more easily read signs have been installed to guide people to the recreation areas.

198. A high incidence of ranger/user contact exists because of patrol and interpretive programs. This helps the user better understand the problems associated with recreation resource management.

199. Providing electrical hookups at certain popular camping areas has acted as a magnet and caused more use to already overused sites. A demand continues for more sites serviced with electricity and water at Shelbyville.

User survey findings

200. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 19. Management's perception of the use level situation also is included in the table for comparisons.

201. The significant findings from Table 19 are:

a. Most users agreed with management that Shelbyville is well balanced overall;

b. Over 70 percent of the campers indicated the distance between other campers was "just right;"

c. Power boaters prefer average distances of 100 and 300 ft between boats;

d. Boat launchers would not tolerate waiting over 7 min to launch;

e. Hikers at Coon Creek prefer an average spacing of 2426 ft, while Bo Wood hikers prefer 1463 ft;

f. Picnickers prefer a distance between 50 to 100 ft;

g. Sunbathers prefer more space than swimmers;

h. People shore fishing prefer a distance of 36 ft between others.

Table 19

Shelbyville User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation: Heavily Used (H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded (OC)	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Sunbathing																	
Dam West	24	H	0	0	100	10 30	10 20	20	17	10 100	20	20	26	2 20	5	5	8
Sullivan	10	H	40	0	60	5 25	12	12	12	10 30	12	12	14	4 20	10	10	10
Swimming																	
Dam West	22	H	0	0	100	10 40	15	15	20	2 50	15	15	19	1 10	5	5	6
Sullivan	10	H	10	0	90	8 30	8	15 20	18	8 30	8	15 20	18	3 20	5	5 6	7
Camping																	
Coon Creek	54	H	28	0	72	5 300	25	25	42	10 200	30	45	77	5 100	20	25	37
Bo Wood	33	WB	9	0	91	15 75	30	35	39	25 1320	75	60	152	10 50	30	30	30
Lone Point	20	WB	18	0	82	30 300	50	60	117	50 1320	150	150	212	15 300	50	50	68
Wilborn	4	WB												30	30	30	30
Opossum	9	WB	12	0	88	50 400	50	75	111	75 400	-	150	183	40 200	50	50	79
Boat Fishing																	
Dam West	1	WB	0	0	100				200				200				75
Coon Creek	2	WB	0	0	100	100 300			200	100 300			200	50 75			63
Bo Wood	8	WB	0	0	100	50 A**	-	300	242	50 A	300	300	225	20 150	-	40	63
Lake	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Waterskiing																	
Opossum	1		0	0	100				200								50
Lone Point	7	WB	0	0	100	200 1000	200	300	400	200 A	600 A	600	540	75 200	150	150	129
Coon Creek	8	WB	25	0	75	75 600	300 600	300	304	50 3000	900	450 600	800	25 900	300	150 300	278
Bo Wood	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 19 - Continued

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation: Heavily Used(H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded(OC)	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Nonpower																	
Bo Wood	2	H	0	0	100	A	A	A	A	A	A	A	A	100	100	100	100
Lone Point	3	WB	34	0	66	30 1000	-	60	363	100 100	-	600	567	30 100	-	300	443
Boating, Power																	
Bo Wood	12	H	0	8	92	40 1320	200	150 200	270	50 600	50	100 200	211	10 300	100	50	75
Lone Point	6	WB	0	0	100	20 1000	300	300	403	300 1000	300	300	517	20 300	100 300	100	145
Wilborn	2	H	0	0	100	100	100	100	100	100	100	100	100	40	40	40	40
Sullivan	2	H	0	0	100	1320	1320	1320	1320	175	175	175	175	-	-	-	-
Dam West	5	WB	0	0	100	20 1000	-	50	240	30 100	150	150	286	20 100	50	50	50
Boat Launching																	
Wilborn	6	H	0	0	100	5 7	5	5	6	5 7	5	5	6	5 7	5	5	6
Bo Wood	16	H	0	0	100	5 15	5	5	7	5 15	5	5	7	5 15	5	5	7
Hiking																	
Coon Creek	5	OU	0	0	100	1320	1320	1320	1320	150 5280	150 5280	1320	2426	30 1320	-	90	328
Bo Wood	8	OU	0	0	100	100 5300	5300	5300	4557	100 5300	200	200	1463	20 200	50	50	86
Picnicking																	
Dam West	20	WB	0	0	100	20 60	50	50	47	20 60	50	50	51	5 30	30	30	51
Bo Wood	28	H	11	0	89	10 A	A	80 450	95	20 A	500 100	60 80	111	9 100	50	40	40
Shore Fishing																	
Tail Water	23	H	8	4	88	10 200	25	30	38	10 A	25	25	36	5 30	5	10	12

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C19). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

Shenango River Lake

Descriptive orientation

202. The Shenango Reservoir Project was authorized for the purposes of flood control and seasonal augmentation of low flows of the Shenango and Beaver Rivers. The lake is located in northwestern Pennsylvania and northeastern Ohio, approximately 10 miles northeast of Youngstown, Ohio, and 65 miles northwest of Pittsburgh, Pennsylvania. When the recreational pool is established at an elevation of 896 msl, the lake surface area is 3550 acres, the lake shoreline is 44 miles long, and the project land area is 10,984 acres. The lake extends 11 miles up the arm of the Shenango River and 5 miles up the Pymatuning Creek. The reservoir lies in broad, flat, meandering valleys. Along the main body of the reservoir, 30 percent of the land is intermittent wood lots and border timber, with the remainder in meadows and fields. The two arms of the reservoir are bounded by wooded areas, meadows, fields, and marshes. The average summer temperature is 75°F, and the average annual precipitation is 38.5 in. Access to the project area is excellent; Federal Interstates 79, 80, and 90 provide access for visitors from the Cleveland and Pittsburgh areas, while many well-maintained local roads provide access for nearby residents. In 1978, attendance reached almost 4.8 million recreation days.

Site analysis findings

203. The Corps operates four recreation areas which include two campgrounds; one day use area with picnicking, swimming, and boat launching; and an off-road vehicle riding area (Figure 12). A county-operated beach was opened during 1979 and several private recreation and access areas exist at the lake. All recreation areas are situated on the lake. However, while some campsites are on the shore, others require a long walk or drive to get to the water.

204. The 332-site campground at the Shenango recreation area has a moderate level of development. There are no electric hookups, but some are planned for the 1980 season. A contact station provides access control. The campsites are spaced an average distance of 30 ft.

Shenango River Lake, Pennsylvani

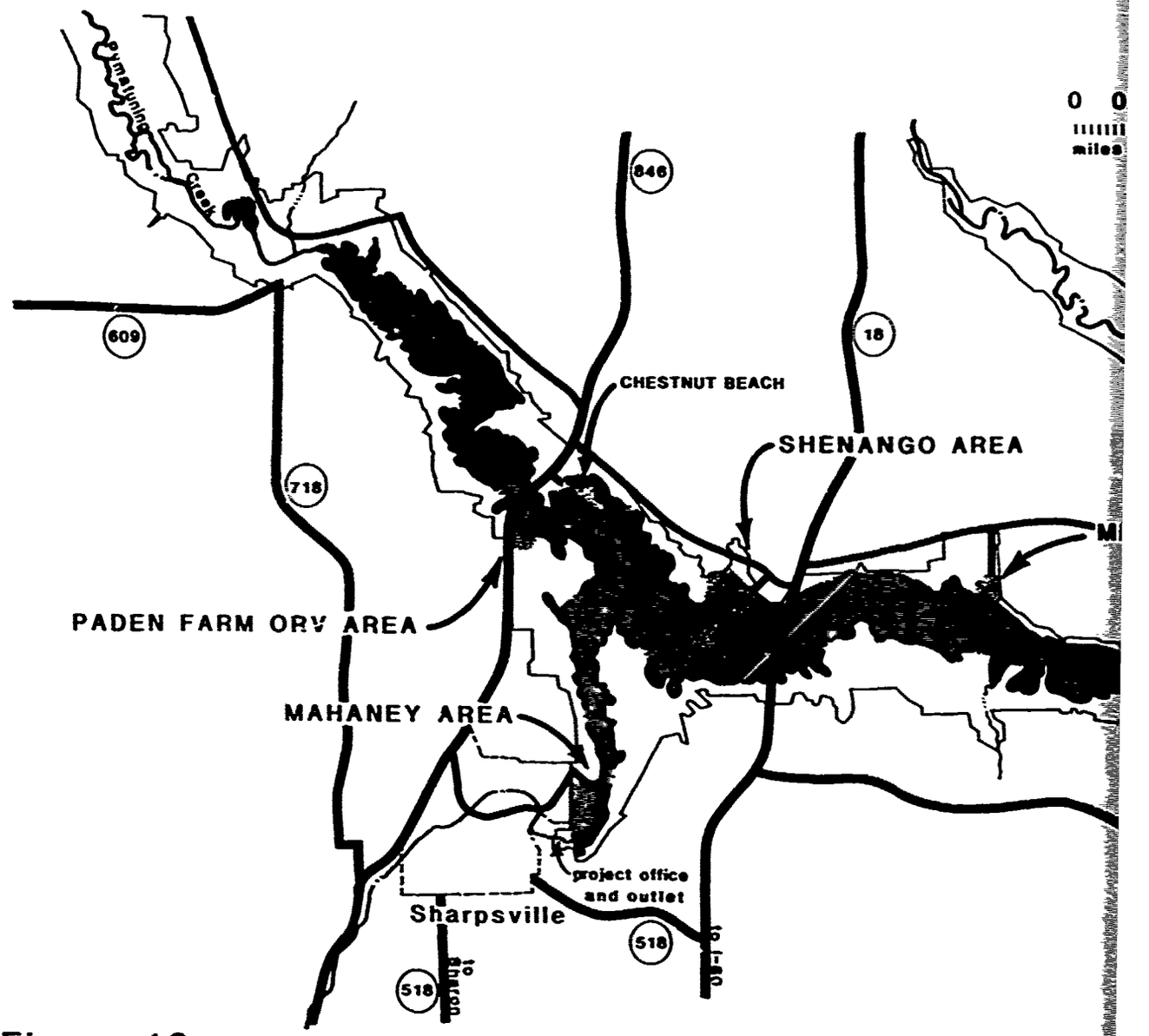


Figure 12.

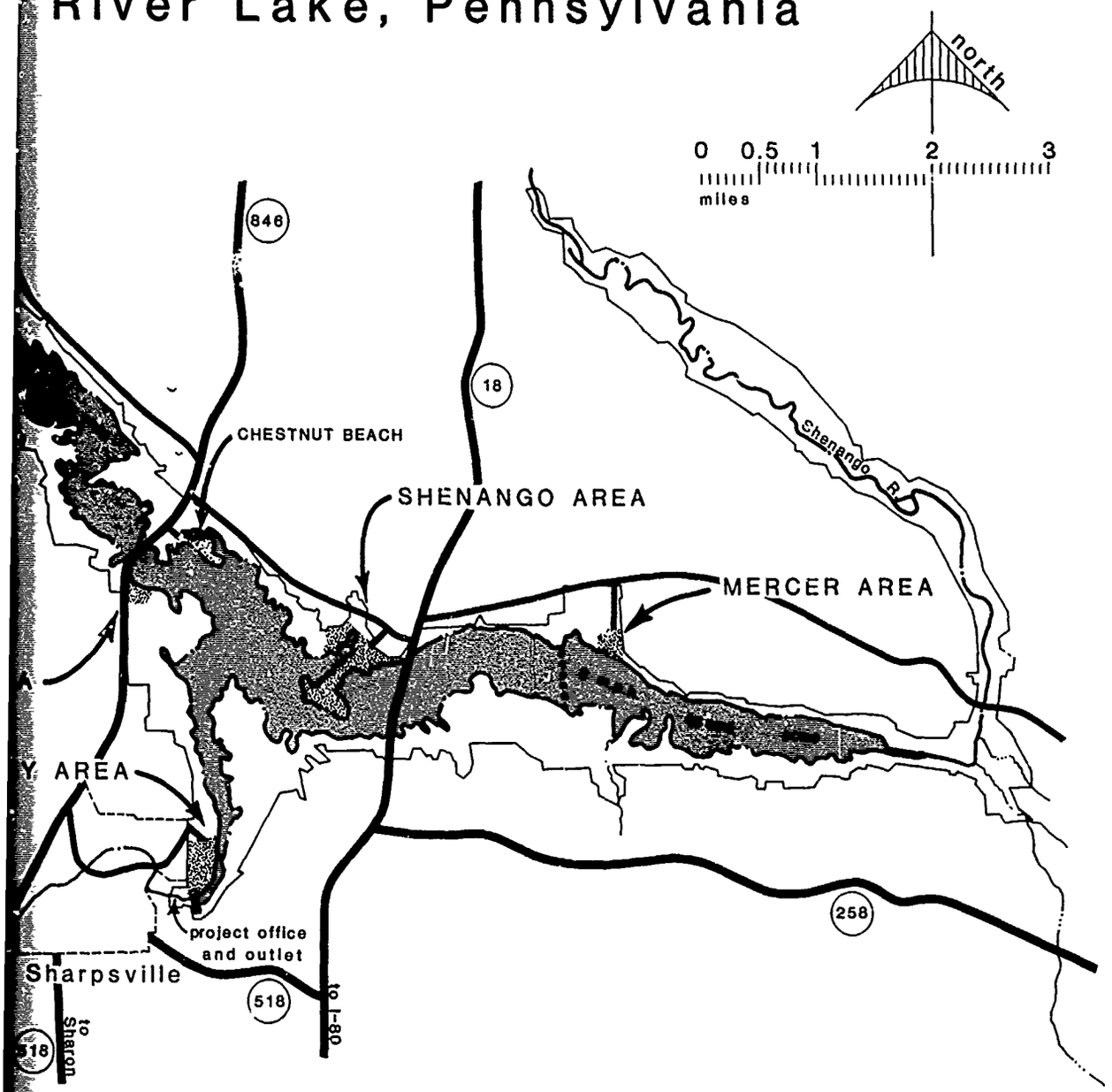
CORPS OF ENGINEERS RECREATION AREAS		
MAHANEY AREA	●	O
OUTLET		
PADEN FARM ORV AREA		
SHENANGO AREA	●	O
SHENANGO RIVER LAKE	O	

Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation – Bethlehem, Pa.

O denotes activity off
● denotes interviews

River Lake, Pennsylvania



dam
lake shoreline
highway
secondary road

Corporation - Bethlehem, Pa.

CORPS OF ENGINEERS RECREATION AREAS										
MAHANEY AREA	●	O			●	●		●	●	●
OUTLET					●					
PADEN FARM ORV AREA							●			
SHENANGO AREA	●	O	●		●	O		●	●	●
SHENANGO RIVER LAKE	O				●					O

O denotes activity offered in recreation area

● denotes interviews conducted in activity area

205. The Mahaney day use area has a high level of development and little need for increased control. The Mercer Campground is a non-fee area with little development and only occasional ranger patrol.

206. Shenango is the only large lake in the area where there are no general restrictions on the power of boats. However, the eastern and western arms of the lake are restricted to limited and nonpower boating only because of shallow water.

207. The Seth Myers Nature Trail is a 1/2-mile-long trail which is narrow and meandering. Seventeen interpretive stops are provided and wood chips are used to minimize trail degradation.

208. Fishing is very popular at Shenango. A parking lot exists at the outlet where steps and benches are also provided. Additional fishing access points and parking areas are planned. The Corps plans to upgrade some existing roads into small dead-end parking lots approximately 100 yards from the shore. The lots will be gravel and will accommodate about 20 cars. Posts and cable will be used to delineate the lots.

209. A 200-acre area (Paden Farm) is set aside for off-road vehicle riding. The area is a large sand and gravel borrow area well suited for ORV use. Posts and cables have not been successful in keeping riders out of an adjacent meadow. Ditches will now be used to prevent access into this area.

210. More information about the recreational settings and features of the study activity areas can be found in Table 20.

Management survey findings

211. Project management personnel report that Shenango is generally well balanced to heavily used. Overcrowding and overuse were reported to exist at the Shenango recreation area, particularly in the campground. Some underuse is reported at the Mahaney day use area.

212. Some of the techniques being used or being developed to solve carrying capacity related problems are:

a. The lake is zoned, with the east arm being restricted to 8 mph and the west arm to electric motors only.

b. The swimming area at Mahaney has been relocated from one side to the other side of a boat launching area and away from the main body of the lake to minimize user conflicts;

Table 20

Shenango Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway				Distance to Highway			Slope of Land			Vegetative Screen		Access to Water Body		Visibility to Water Body		Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	Undesignated	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																											
Mahaney		X				X					X				X				X				X				X				X				X				-	-	-	N
Shenango Recreation Area		X				X					X				X				X				X				X				X				X				-	-	-	N
Boat Fishing																																											
Lake		X				X					X				X				X				X				X				X				X				-	3,550	-	N
Camping																																											
Shenango Recreation Area		X				X					X				X				X				X				X				X				X				22	250	0.9	$
Hiking																																											
Mahaney		X				X					X				X				X				X				X				X				X				-	1	-	N
ORV																																											
Paden Farm		X				X					X				X				X				X				X				X				X				-	200	-	N
Picnicking																																											
Mahaney		X				X					X				X				X				X				X				X				X				.45	40	3.6	N
Shenango Recreation Area		X				X					X				X				X				X				X				X				X				35	-	-	N
Shore Fishing																																											
Outlet		X				X					X				X				X				X				X				X				X				-	-	-	N
Sunbathing																																											
Mahaney		X				X					X				X				X				X				X				X				X				-	-	-	N
Shenango Recreation Area		X				X					X				X				X				X				X				X				X				-	-	-	N
Swimming																																											
Mahaney		X				X					X					X			X				X				X				X				X				-	-	-	N
Shenango Recreation Area		X				X					X					X			X				X				X				X				X				-	-	-	N
Waterskiing																																											
Lake		X				X					X					X			X				X				X				X				X				-	3,550	-	N

*See appendix D for descriptions of the various recreation settings.
**Developed area acres include parking lots and other support facilities.

c. Sections of the Shenango recreation area campground will be closed on a rotating basis to allow campsites to be naturally restored;

d. The nature trail was purposely designed to be narrow and winding to reduce potential overcrowding and overuse;

e. In order to relieve the overcrowding at the two Corps boat ramps, additional light-duty ramps will be provided by using upgraded old roads terminated by the lake;

f. Twenty-seven campsites in Shenango recreation area will be provided with electric service for the 1980 season to meet growing demands for this service;

g. Some of the sites which are located along the water and experiencing the greatest overuse will be converted to impact sites;

h. Some of the sites that are very close to other sites will be removed;

i. Shoreline areas will be stabilized where severe erosion exists; and

j. Trees are being planted in many of the informal roads that have evolved and entrance points are being blocked to eliminate unwanted vehicle penetration.

User survey findings

213. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 21. Management's perception of the use level situation also is included in the table for comparisons.

214. The significant findings from Table 21 are:

a. Shenango power boaters prefer an average distance of 864 ft between boats;

b. Campers at the Shenango Campground prefer an average distance of 45 ft between sites; 86 percent indicated the existing spacing (about 30 ft) was "just right;"

c. Mahaney picnickers prefer an average distance of 43 ft between sites and Mahaney sunbathers prefer 28 ft between blankets; and

d. Twenty-eight percent of the swimmers at Mahaney were "too close;" they prefer an average spacing of 25 ft.

Table 21

Shenango User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation (Heavily Used (H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Actual Distance Response: Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating, Nonpower																	
Lake	-																
Boating, Power																	
Lake	31	H	29	0	71	10 A**	A	300	460	30 15,840	600	225 200	864	20 900	100	100	140
Boat Fishing																	
Lake	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Camping																	
Shenango Recreation Area	62	OU	11	3	86	10 60	30	30	31	15 A	30 50	40	45	5 150	20	25	26
Hiking																	
Seth Meyers	2	UU	0	100	0	A	-	-	A	-	-	-	-	200	-	-	200
ORV																	
Paden Farm	1	WB	0	0	100	A	-	-	A	5280	-	-	5280	50	-	-	50
Picnicking																	
Mahaney	13	WB	0	0	100	20 200	60	60	73	20 70	30	35	43	10 200	20	30	57
Shenango Recreation Area	4	WB	25	0	75	15 20	20	20	18	15 25	15	15 20	19	10 20	15	15	15
Shore Fishing																	
Outlet	7	H	14	0	86	5 20	-	15	14	15 20	15	15	16	5 20	10	10	9
Sunbathing																	
Mahaney	12	H	0	8	92	10 50	20 25	15	25	15 A	-	25	28	5 20	10	10	10
Swimming																	
Mahaney	7	H	28	0	72	1 30	-	10	14	15 30	30	30	25	5 10	10	10	9
Shenango Recreation Area	1	H	0	0	100	150	-	-	150	150	-	-	150	150	-	-	150
Waterskiing																	
Lake	2	H	50	0	50	15 100	-	-	58	70 300	-	-	185	25 50	-	-	38

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

** An "A" in the table means at least one person or more indicated that they wanted to be alone or isolated from other recreators.

Somerville Lake

Descriptive orientation

215. Somerville Lake was authorized for the purposes of flood control and water conservation. The dam is located approximately 26 miles southwest of Bryan, Texas; Houston is 88 miles to the southeast. The area surrounding the lake is predominantly rural. Somerville Lake has an average recreation pool of 9700 acres and 72 shoreline miles. The recreational lake averages approximately 8.5 miles long and is about 1.5 miles wide. The total project area covers 32,725 acres. The topography of the project area is characterized by undulating lands with wide valleys and moderate slopes. The lake's shoreline is gradually sloping and has few steep or high banks. Somerville Lake lies in a moderately humid region where the climate is generally mild with hot summers and relatively cool winters. Vegetative densities vary throughout the project area, consisting of heavily wooded areas, sparsely wooded areas, and areas of old pasture growth. The dam area and the recreation areas located near the eastern end of the lake are easily accessible via adjacent State highways. Approximately 3.5 million people lived within a 100-mile radius of Somerville Lake in 1970. Visitation at Somerville Lake in 1978 was approximately 2.5 million recreation days.

Site analysis findings

216. Currently, the Corps manages seven recreation areas, two of which are undeveloped (Figure 13). The five developed areas encompass approximately 2000 acres. Recreation activities at Corps facilities include camping, picnicking, swimming, sunbathing, boating, fishing, waterskiing, waterfowl hunting, and off-road vehicle riding. The state of Texas operates two parks at the western portion of the lake. The seven Corps recreation areas are distributed along the eastern and southern portion of the lake. The most heavily used Corps areas are Welch and Overlook Parks, which are both very accessible and are located adjacent to the dam. Welch and Overlook Parks are primarily day use areas, but they also provide for nonfee camping. Both areas provide picnic facilities and launching areas and are heavily used by teens and

young adults. Swimming, sunbathing, and partying are popular activities at both areas. Many informal or volunteer roads have resulted from vehicles being driven in random fashion through these areas. The Corps is currently upgrading Welch Park by channelizing traffic, constructing parking lots, and developing a beach area for swimming and sunbathing. Yegua Creek, Big Creek, and Rocky Creek camping areas are more developed (some sites have electric and water hookups) and controlled (they have entrance gates and attendants), and provide for more family-oriented recreation experiences. Boating, waterskiing, and boat fishing are popular activities at Somerville. Like most of the other Corps lakes visited, lake zoning is not used.

217. More information about the study activity area recreation settings and features can be found in Table 22.

Management survey findings

218. Currently, most of the recreation activity areas at Somerville are well balanced. Boating use on the lake is well balanced but at the threshold of being overcrowded. Past problems of overuse and overcrowding at the developed campgrounds, for the most part, have been solved by: channeling vehicle circulation, hardening camper pads, and providing entrance gates and attendants. Efforts are underway to prevent future overuse at Welch Park. The boat launching ramps at Welch and Yegua Parks are reportedly overcrowded; congestion results largely because of limited circulation and parking controls.

219. The following list shows some of the approaches used or planned to achieve well-balanced recreation resource use at Somerville:

a. Providing areas, such as Welch Park and Yegua Creek Park, which allow for contrasting types of recreation experiences to satisfy the needs of different types of recreators;

b. Providing a variety of campsite settings--some close to the water, others in shaded and secluded areas;

c. Leaving a thick buffer of undergrowth between campsites (Big Creek and parts of Yegua Creek) to increase privacy;

d. Utilizing the steeper sloping areas in campgrounds fo- walk-in tent camping to avoid overuse;

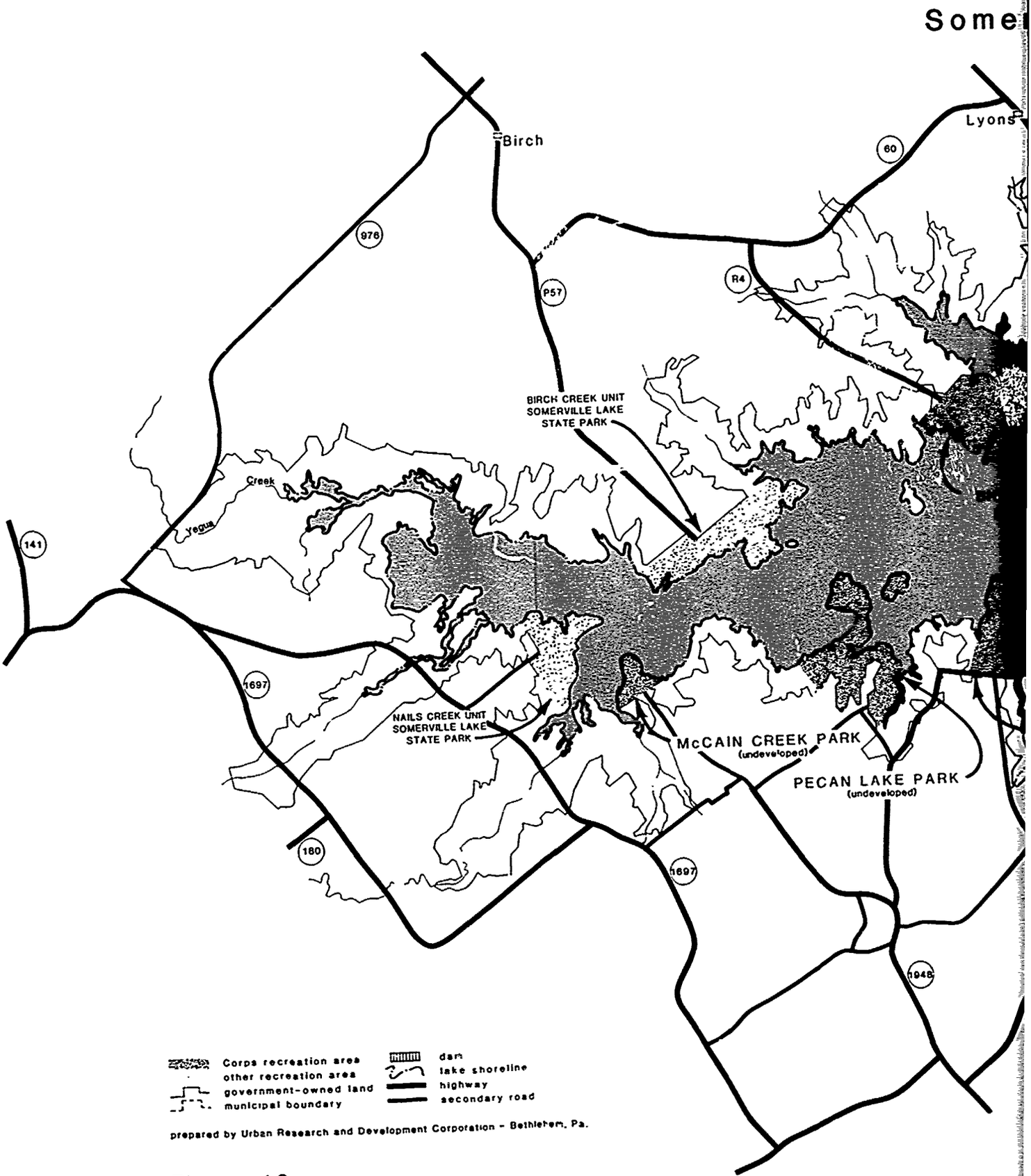
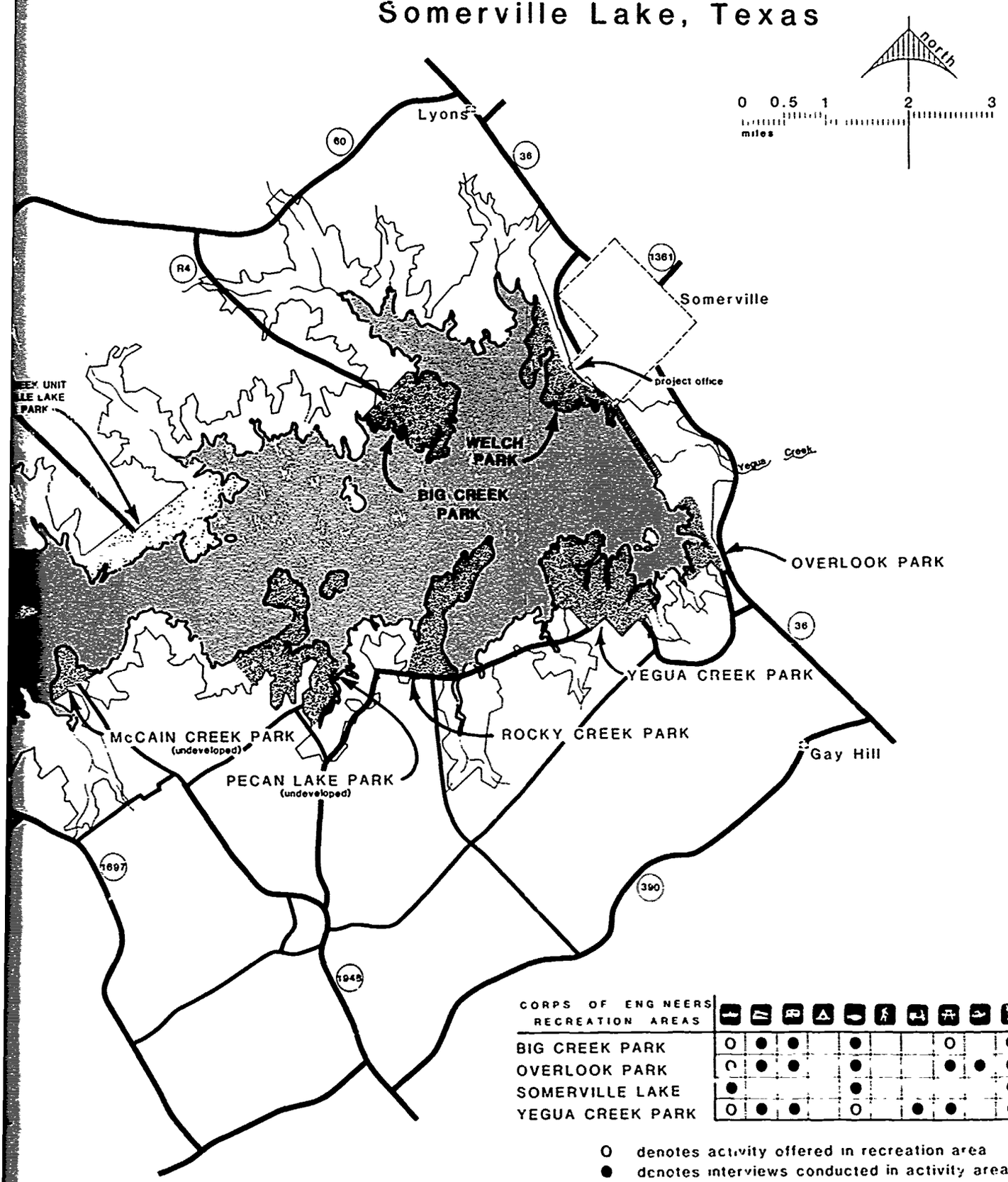

Somer
Birch
Lyons
60
976
P57
R4
BIRCH CREEK UNIT
SOMERVILLE LAKE
STATE PARK
Creek
Yegua
141
1697
NAILS CREEK UNIT
SOMERVILLE LAKE
STATE PARK
McCAIN CREEK PARK
(undeveloped)
PECAN LAKE PARK
(undeveloped)
180
1697
1948
Corps recreation area
other recreation area
government-owned land
municipal boundary
dam
lake shoreline
highway
secondary road
prepared by Urban Research and Development Corporation - Bethlehem, Pa.

Figure 13.

Somerville Lake, Texas



CORPS OF ENGINEERS RECREATION AREAS										
BIG CREEK PARK	O	●	●		●			O		O
OVERLOOK PARK	O	●	●		●			●	●	O
SOMERVILLE LAKE	●				●					●
YEGUA CREEK PARK	O	●	●		O		●	●		O

O denotes activity offered in recreation area

● denotes interviews conducted in activity area

Table 22

Somerville Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land				Vegetative Screen			Access to Water Body			Visibility to Water Body			Level of Development			Level of Control			Relation to Other Activity Areas			Number of Units: (Campsites, picnic tables, launching lanes, etc.)	Size of Area (Developed area, acres,** recreation pool acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee (S) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Obstructed	Unobstructed	Partially Obstructed	Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																									
Lake		X					X					X						X				X			X			X			X						-	9,700	-	N
Boat Fishing																																									
Lake		X					X					X						X				X			X			X			X						-	9,700	-	N
Boat Launching																																										
Big Creek Park		X					X					X			X				X				X			X			X			X			X			4	-	-	N
Overlook		X					X				X				X				X				X			X			X			X			X			2	-	-	N
Yegua		X					X					X			X				X				X			X			X			X			X			1	-	-	N
Camping																																										
Big Creek		X					X					X			X				X				X			X			X			X			X			66	93	0.7	$
Overlook		X					X				X				X				X				X			X			X			X			X			-	-	-	N
Yegua Creek Park		X					X					X			X				X				X			X			X			X			X			94	93	1.0	$
ORV																																									
Yegua Creek Park		X					X				X				X				X					X			X			X			X			X			-	-	-	N
Picnicking																																										
Overlook Park		X					X				X				X				X				X			X			X			X			X						N
Yegua Creek Park		X					X					X			X				X				X			X			X			X			X				-	-	N
Shore Fishing																																										
Big Creek Park		X					X					X			X				X				X			X			X			X			X			-	-	-	N
Overlook Park		X					X				X				X				X				X			X			X			X			X			-	-	-	N
Sunbathing																																										
Overlook Park		X					X				X				X				X				X			X			X			X			X			-	-	-	N
Swimming																																										
Overlook Park		X					X				X					X			X				X			X			X			X			X			-	-	-	N
Waterskiing																																										
Lake		X					X					X				X			X				X			X			X			X			X			-	9,700	-	N

*See Appendix D for descriptions of the various recreation settings.
**Developed area acres include parking lots and other support facilities.

e. Providing parking areas for extra vehicles and visitors in the campgrounds to reduce congestion at the campsites;

f. Sacrificing Welch Park as the overflow area for the other camping areas;

g. Restricting vehicles to roadways and parking lots to prevent overuse;

h. Utilizing 5-mph buoys on the lake to reduce user conflicts;

i. Developing an area for group picnicking, available by reservation only;

j. Reducing conflicts between sunbathers and vehicles at Welch Park by channeling traffic, regulating traffic, and providing designated parking areas;

k. Providing more and better shoreline fishing access points than now exist; and

l. Utilizing an old borrow area for off-road vehicle riding and using posts and cables to contain riders within the area.

User survey findings

220. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 23. Management's perception of the use level situation also is included in the table for comparisons.

221. The significant findings from Table 23 are:

a. Most users agree that, overall, Somerville is well balanced;

b. Nonpower boaters prefer a greater spacing than power boaters;

c. Fifty-five percent of the Overlook boat launchers indicated they were overcrowded;

d. Boat fishing people prefer an average distance of about 600 ft between boats, but would tolerate 300 ft;

e. Over 80 percent of the campers indicated they were spaced "just right;" and

f. Picnickers prefer an average spacing between 50 to 85 ft between sites.

Table 23

Somerville User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation (Heavily Used (H), Overused (OU), Well Balanced (WB), Underused (U), Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	Actual Distance Response: % of Respondents who indicated "Too Far"	Actual Distance Response: % of Respondents who indicated "Just Right"	Actual Distance Response: Range of Actual Distances (ft)	Actual Distance Response: Mode (ft)	Actual Distance Response: Median (ft)	Actual Distance Response: Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Preferred Distance Response: Mode (ft)	Preferred Distance Response: Median (ft)	Preferred Distance Response: Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Minimum Acceptable Distance Response: Mode (ft)	Minimum Acceptable Distance Response: Median (ft)	Minimum Acceptable Distance Response: Mean (ft)
Boating, Nonpower																	
Lake	8	WB	0	11	89	100 1320	1320	1320	998	100 3960	1320	1320	1265	600	-	-	600
Boating, Power																	
Lake	14	WB	8	25	66	100 2640	300	500 600	1714	100 1500	300 600	500	602	300	-	-	300
Boat Launching																	
Big Creek	15	WB	9	0	91	10	5	5	6	4 8	5	5	5	-	-	-	-
Yegua	6	OC	0	0	100	5 10	8 10	8	8	5 10	8 10	8	8	25	-	-	25
Overlook	10	WB	55	0	45	4 30	5	7 8	11	4 25	4 5	6	11	30	-	-	30
Boat Fishing																	
Lake	13	WB	0	10	90	150 1350	1320	600 900	846	150 1350	450 600	450 600	612	150 375	-	300	275
Camping																	
Yegua	29	WB	17	0	83	5 75	30	30	35	15 75	30	30	38	30	-	-	30
Big Creek	24	WB	14	5	81	30 120	40	40	49	30 120	40	40	53	-	-	-	-
Overlook	15	WB	9	9	82	50 100	60	60	69	50 120	50 60	60	70	-	-	-	-
ORV																	
Yegua	2	WB	0	0	100	660	-	-	660	150	-	-	150	-	-	-	-
Picnicking																	
Overlook	5	WB	0	20	80	50 150	50	50	72	50 60	50	50	52	-	-	-	-

Table 23 - Continued

Activity Area	Number of Users Surveyed	Management's perception of the Use Level Situation (Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Yegua	3	WB	100	0	0	45 60	45	45	50	72 90	90	90	84	45 60	45	45	50
Short Fishing																	
Pij Creek	1	WB	0	0	100	40	-	-	40	40	-	-	40	-	-	-	-
Overlook	4	WB	0	25	75	150 200	150 200	150 200	175	150 200	150	150	167	-	-	-	-
Sunbathing																	
Overlook	7	WB	0	0	100	30 100	30 100	50	60	30 100	30 100	50	60	-	-	-	-
Swimming																	
Overlook	3	WB	0	100	0	100 200	200	200	167	-	-	-	-	-	-	-	-
Waterskiing																	
Lake	8	WB	0	0	100	300 1320	-	400 900	730	300 1320	-	400 600	1080	300 600	600	600	500

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

Surry Mountain

Descriptive orientation

222. Surry Mountain Reservoir is located 5 miles north of the city of Keene, New Hampshire. The smallest project visited, Surry Mountain provides a different basis for examination of carrying capacity. Authorized for the purpose of flood control, it serves as a recreation area for residents of southern New Hampshire. Surry is reportedly representative of most New England Corps projects.

223. The pool is 260 acres at the lake's normal recreational elevation of 500 ft msl. The reservoir extends 1 mile up the Ashuelot River, averages 1/2 mile wide and 6 feet deep, and covers 4 shoreline miles. The topography of the area is characterized by hilly land with moderate relief. About one third of the project's lands are wooded. The climate of the area is variable with a mean annual temperature of 45°F and the mean annual precipitation is about 40 in., uniformly distributed throughout the seasons. The average annual snowfall is about 60 in.

224. The project area is readily accessible over a network of paved roads and interstate highways. In 1978, 229,711 recreation days of visitation were recorded at Surry Mountain Lake.

Site analysis findings

225. The Corps maintains two recreation areas at the project: a picnic site located at the eastern end of the dam which receives little use and a second area about 2000 ft upstream from the dam on the western shore (Figure 14). The second and more prominent area is a day use area with a gently sloping, sandy beach. Facilities include a nature trail, picnic tables, fireplaces, a boat launching ramp, a change house for swimmers, and a toilet building. A second toilet building is planned. The wooded mountain on the eastern shore of the lake provides a scenic backdrop for users. Because of the mountainous terrain, access to the water is limited to the day use area, allowing unusual opportunities for control over water use. This day use area is rather unique in that it is annually inundated.

226. A camping area is situated on private land about 800 ft south

of the day use area. The city of Keene operates a pistol range and an archery course is operated privately, both on lands leased from the Corps.

227. More information about the study activity area recreation settings and features can be found in Table 24.

Management survey findings

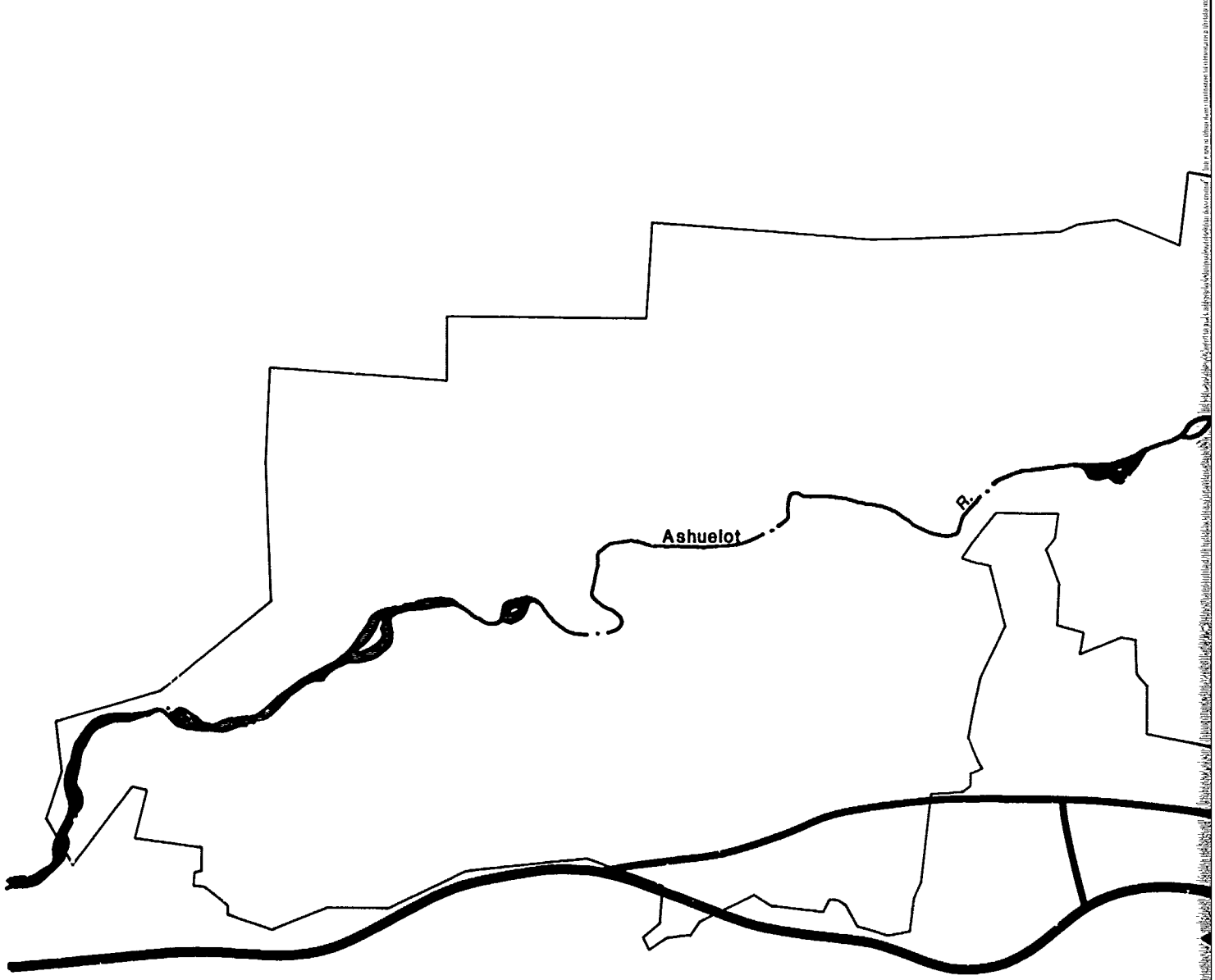
228. Project management personnel have reported that four different picnicking activity areas can be identified at Surry with use levels ranging from underuse to overcrowding and overuse. The upper picnic area is overused as a result of vehicles driving throughout the area--the degree of overuse gets worse each year. This activity area, affording an excellent view of the lake, is suited for picnicking but is narrow and exhibits steeper slopes. Project managers plan to restrict vehicles to a single parking area and allow only walk-in picnicking. They also have used wood chips to help reduce overuse.

229. The other picnicking areas are overcrowded or unused largely because of their location with respect to the beach and parking lot. Those areas near the beach and parking lot receive heavy use and sometimes are overcrowded. Those areas more remotely located are generally underused. All tables are movable and management feels that this helps reduce overcrowding.

230. Boating on the lake is considered to be well balanced but at the threshold of being overcrowded. Recognizing that overcrowding is a potential problem on the lake, limits have been placed on the number of boats (20) that the boat rental concession can let out on the lake at one time. They also provide only limited access to the lake via a single two-lane ramp within the single day use area. Due to the mountainous terrain, access to the water is limited only to this day use area, thus allowing unusual opportunities for control over water use. Management has been successful in providing a well-balanced boating situation largely because only one launching ramp with a small boater parking area is provided. If the lake becomes very crowded, project managers might consider limited power boating only.

231. Power boating/swimming conflicts in the vicinity of the swimming area have been a problem at the water areas adjacent to the

Surry Mountain Da



Corps recreation area
other recreation area
government-owned land
municipal boundary

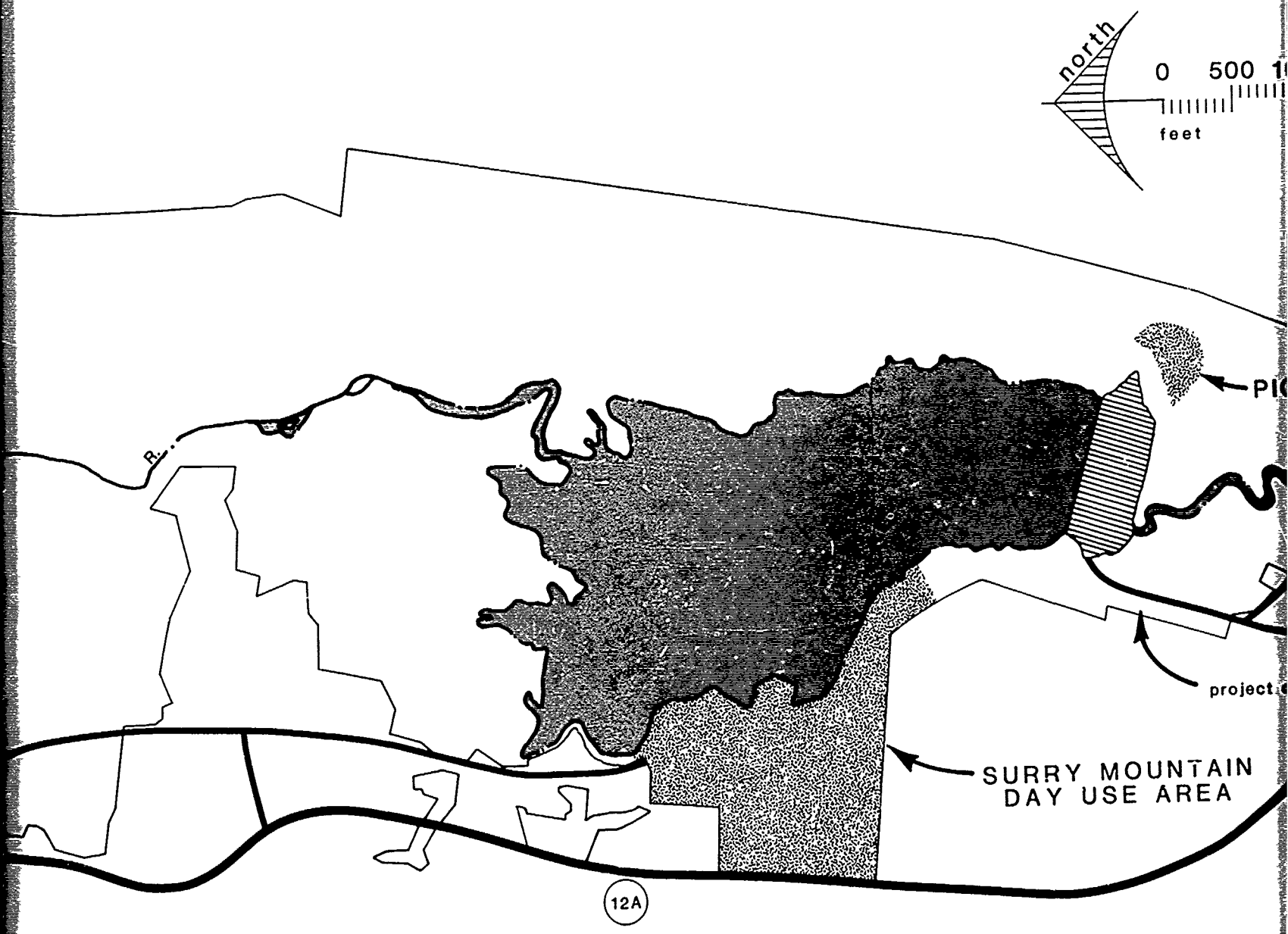
dam
lake shoreline
highway
secondary road

prepared by Urban Research and Development Corporation – Bethlehem, Pa.

CORP
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SURRY MO
SURRY MO

Mountain Dam and Reservoir, New Hamp

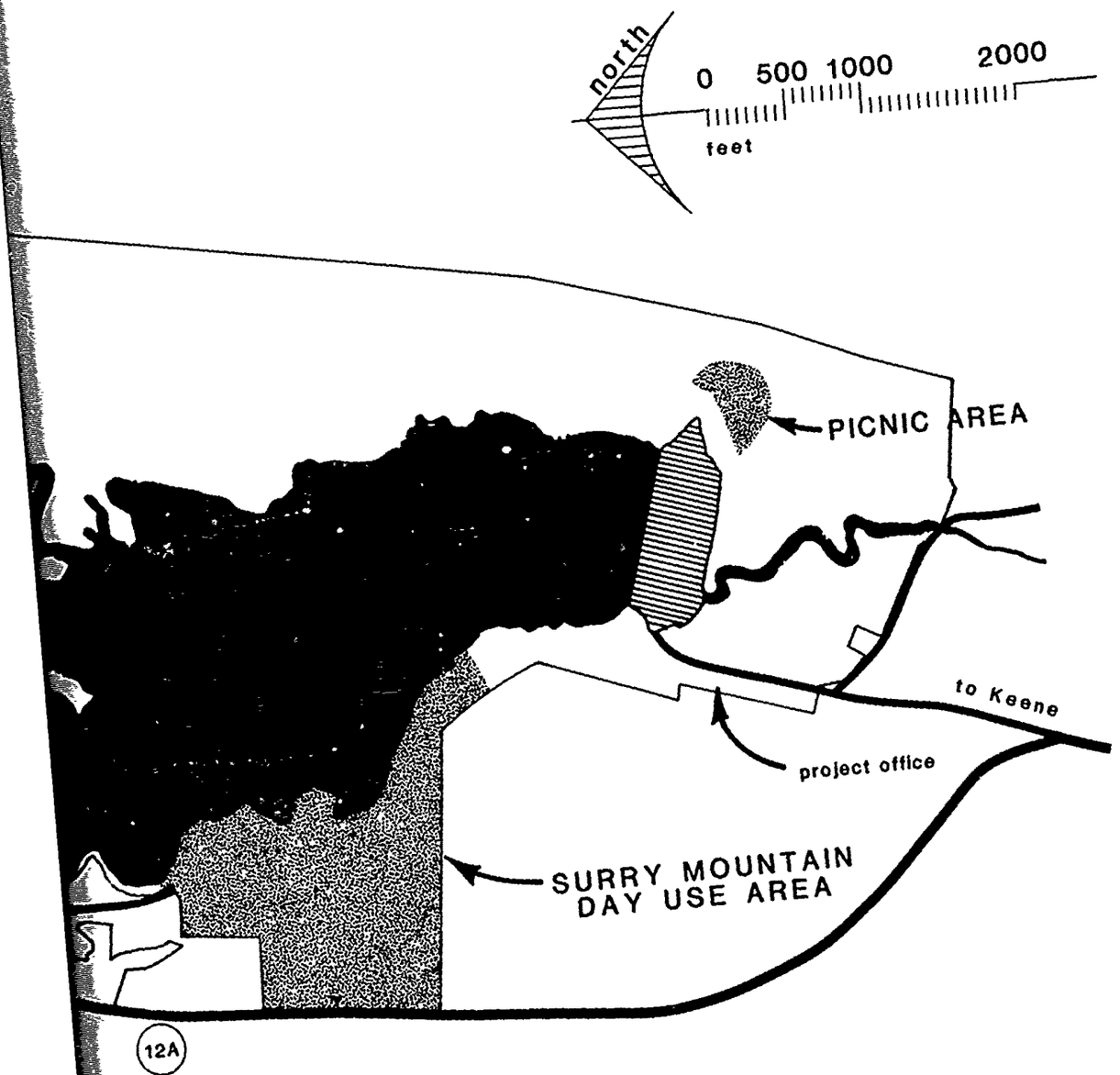


CORPS OF ENGINEERS RECREATION AREAS										
SURRY MOUNTAIN DAY USE AREA	O	O			O			●	●	
SURRY MOUNTAIN RESERVOIR	●				O					●

lehem, Pa.

O denotes activity offered in recreation area
● denotes interviews conducted in activity area

d Reservoir, New Hampshire



INEERS AREAS										
USE AREA	O	O			O			●	●	
ERVOIR	●				O					●

enotes activity offered in recreation area
enotes interviews conducted in activity area

Figure 14.

Table 24

Surry Mountain Activity Area Recreation Settings and Features*

	Proximity to Metropolitan Area (SMSA)				Distance to Expressway					Distance to Highway				Slope of Land				Vegetative Screen				Access to Water Body		Visibility to Water Body		Level of Development			Level of Control			Relation to Other Activity Areas				Number of Units: (campsites, picnic tables, launching lanes, etc.)	Size of Area (developed area, acres,** recreation poo: acreage, or miles of trail)	Overall Density: (units per developed acre**)	Fee ($) or Nonfee (N) Area
	Within Metro Area	Within 50 miles	Within 100 miles	Within 200 miles	Beyond 200 miles	0 - 5 miles	6 -25 miles	26-50 miles	51-75 miles	75+ miles	0 - 1 mile	2 - 5 miles	6 - 10 miles	10+ miles	0 - 5%	5 - 10%	10+%	Not Applicable	Mostly Open	Moderate	Dense	Not Applicable	Unobstructed	Partially Obstructed	Unobstructed	Partially Obstructed	High	Moderate	Limited	High	Moderate	Limited	Undesignated	Sharing	Adjacent	Separate	Remote				
Boating																																							
Lake		X				X					X					X				X			X		X			X					X				-	260	-	N
Picnickers																																							
Beach/Point		X				X					X				X				X				X		X			X					X				35	16	2.2	N
Upper Beach		X				X					X				X				X					X		X			X					X				18	3	6.0	N
Sunbathing																																							
Beach		X				X					X				X				X				X		X			X					X				-	2	-	N
Swimming																																							
Area		X				X					X					X			X				X		X			X					X				-		-	N
Waterskiing																																							
Lake		X				X					X					X			X				X		X				X				X				-	260	-	N

*See Appendix D for descriptions of the various recreation settings.
**Developed area acres include parking lots and other support facilities.

beach. A float line has been used in the past to contain swimmers, but vandalism to the line has occurred. Project managers plan to use anchor buoys to keep boats out rather than swimmers in.

232. With the exception of snowmobiling, there is no off-road vehicle riding permitted at Surry Mountain. They have designated a 400-acre area for snowmobiling, but the area is used more by people just passing through. The area includes two trails totaling 3900 ft. The trails are 8 ft wide and allow for two-way travel. Neighbors sometimes complain about noise from snowmobiles. The game warden is responsible for policing snowmobilers. A cross-country ski trail is being started in the upper area and more trails are planned.

User survey findings

233. A summary of the user survey responses regarding the actual, preferred, and minimum acceptable distances between recreators is shown in Table 25. Management's perception of the use level situation also is included in the table for comparisons.

234. The significant findings from Table 25 are:

a. Most users indicated they were spaced "just right" from other recreators;

b. Picnickers at Surry prefer an average distance of between 39 to 48 ft between other picnickers;

c. Sunbathers prefer an average distance of 23 ft, but will tolerate 6 ft between other blankets; and

d. Swimmers prefer 17 ft between other swimmers, but will tolerate 7 ft.

Table 25

Surry Mountain User Survey Findings--Actual, Preferred, and Minimum Distance Responses*

Activity Area	Number of Users Surveyed	Management's Perception of the Use Level Situation (Heavily Used (H); Overused (OU); Well Balanced (WB); Underused (U); Overcrowded (OC))	Actual Distance Response: % of Respondents who indicated "Too Close"	% of Respondents who indicated "Too Far"	% of Respondents who indicated "Just Right"	Range of Actual Distances (ft)	Mode (ft)	Median (ft)	Mean (ft)	Preferred Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)	Minimum Acceptable Distance Response: Range of Responses (ft)	Mode (ft)	Median (ft)	Mean (ft)
Boating Lake	JNP	WB	0	0	100	300	300	300	300	100-300	300	300	233	20-300	20 300	20 300	160
Picnic Beach	6	OC	0	0	100	20	20	20	20	20-75	20	20 40	42	5-30	10	10	14
Point	16	OU	0	0	100	15-50	50	50	33	15-100	50	50	39	5-50	10	20 25	18
Upper	10	U	0	0	100	20-60	20	20 30	30	20-100	20 50 60	50	48	2-20	10	10	15
Sunbathing Beach	28	WB	4	4	92	4-75	20	20	24	5-75	20	20	23	1-15	10	5	6
Swimming Beach	17	WB	0	0	100	10-20	15	15	14	10-30	10	15	17	2-15	5	5	7
Waterskiing Lake	3	WB	0	0	100	300	300	300	300	110-300	110 200 300	200	203	100-110	100 110	100 110	105

* The distance responses are based on Question #10 of the user survey (see Appendix C, page C15). With the exception of boat launching, all the responses are distance expressed in feet; boat launching responses are expressed in minutes of time.

PART V: MANAGEMENT AND USER SURVEY FINDINGS BY ACTIVITY

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PART V: MANAGEMENT AND USER SURVEY FINDINGS - BY ACTIVITY

Introduction

Purpose

235. Part V describes the detailed management survey and user survey findings for the 11 study recreation activities. The findings include information regarding: (a) factors affecting recreation carrying capacity, (b) indicators of overuse and overcrowding, (c) activity situations, and (d) preferred distances between recreation units (i.e., preferred spacing between people, boats, campsites, picnic tables, etc.) as expressed by users. Part V also describes how this information provided the basis for the carrying capacity system and guidelines developed in Part VI.

Factors affecting social capacity and resource capacity

236. Understanding and addressing recreational carrying capacity requires knowledge about the factors that affect and determine social and resource capacity.

237. The management survey was used as one source of information on the factors that affect social and resource capacity. Corps personnel interviewed recognized the need to identify and examine carrying capacity factors prior to determining an area's carrying capacity. Most management survey respondents readily identified with the resource capacity factors; the social capacity factors were more difficult to relate to and their relative importance was more difficult to determine.

238. For each activity, each manager surveyed was asked to evaluate the importance of different factors on a scale of 1 (unimportant) to 10 (most important) as they impact social capacity or resource capacity. Managers could also include additional factors which they considered were relevant. At the completion of the management survey, the factors were ranked according to their average scores. Factors with average scores of 7.5 and above are considered "very important," those with scores of 3.5

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to 7.4 are considered "moderately important," and those with scores of 3.4 and below are considered "minor to no importance."

239. The management survey findings are the primary source of information used to: (a) identify and rank the importance of resource capacity factors, and (b) develop the resource capacity guidelines outlined in Part VI. In regard to the social capacity guidelines, the management survey identified and provided information regarding the relative importance of factors that were not addressed as part of the user survey (e.g., season/weather/time of day, remoteness/degree of solitude, safety measures, and additional social capacity factors). Also, the onsite inspections of the study activity areas, conducted as part of the management survey, provided the basis for developing the various characteristics of a particular recreation setting (e.g., vegetation: open, moderate, dense, see Appendix D).

240. The user survey findings are the primary source of information used to: (a) identify and rank the importance of social capacity factors, and (b) develop the social capacity guidelines outlined in Part VI.

241. For each activity, the preferred distance responses of the users surveyed were grouped according to different values or levels of each factor tested. If the mean preferred distances of the groups under any factor varied significantly and systematically from the mean preferred distance of all users of that activity, the factor was considered "very important." If the means of the groups varied somewhat less significantly but systematically from the mean of all users, the factor was considered "moderately important." If the means did not vary significantly or did so unsystematically from all users, the factor was considered "minor to no importance."

242. The findings of both the management/site survey and user survey confirm that many factors affect both the resource and social capacity of a given activity area. Overall, more factors affect social capacity than resource capacity. For many activities, the more important social capacity factors include: similarity of visitor groups, level of development/support facilities, compatibility of nearby primary

activities, proximity to the water, and proximity to support facilities. Several important resource capacity factors common to many activities include: topography/slope of the land, resiliency of soils, degree of control, level of development, resiliency of vegetation, and stability of beach, trail, etc.

243. This Part lists factors affecting social capacity and resource capacity, indicates the impacts that the factors have on social and resource capacity, and ranks their relative importance based upon the user and management surveys.

Indicators of
overcrowding and overuse

244. Indicators show that an area is becoming overused or overcrowded. They are the signs one looks for when monitoring user satisfaction and resource change. Basically, indicators can be used for three specific purposes:

a. To predict or confirm problems of user overcrowding and resource change.

b. To help establish the actual carrying capacity of a particular area.

c. To serve as key components of a monitoring system.

245. To be effective, indicators have to have the ability to predict change. Ideally, indicators should be observable before serious problems develop so actions can be taken to prevent such problems. Project managers surveyed agreed that periodic observations together with good indicators can be used to determine when a recreation environment is approaching overcrowding and overuse.

246. As with the social and resource capacity factors, the management survey was used to obtain information on the indicators of overcrowding and overuse. For each activity, each manager surveyed was asked to rank the importance of different indicators on a scale of 1 (unimportant) to 10 (most important) for detecting overcrowding or overuse. Managers could also include additional factors which they considered were relevant. At the completion of the management survey, the indicators were ranked according to their average scores. Indicators with average scores of 7.5 and above were considered "very important," those with scores of 3.5 to

7.4 are considered "moderately important," and those with scores of 3.4 and below are considered "minor to no importance."

247. Most project managers were able to relate well to the indicators listed on the management/site survey sheets and could decide on the relative importance of indicators; managers had more difficulty relating to carrying capacity factors and their relative importance. Most managers and rangers interviewed agreed that for water surface activities such as boating, waterskiing, and swimming, indicators of overcrowding will generally occur well before indicators of resource overuse. This Part lists overcrowding and overuse indicators for each recreation activity and shows their relative importance based upon the management survey.

248. There are three general categories of indicators of overcrowding and/or overuse: (a) increases in negative social incidents, (b) increases in the need for services, maintenance, and restoration, and (c) degradation of the recreation resource. For many activities, the most important indicators of overcrowding include increases in the number of complaints and conflicts between users. The most important indicators of overuse include ground cover wearing away, compacted soils, soil erosion, and absence or change in wildlife or aquatic life. Some indicators can be seen immediately (ground cover wearing away, eroded soils, congested support facilities, etc.); others require more time to observe (changes in the type of users at an activity area, user relocations, etc.).

Activity situations

249. Boating. A variety of boating experiences are enjoyed by boaters at the study project areas because of the variety of boat types (e.g., power boats and sailboats, houseboats and canoes), the boat sizes, and the variety of lake sizes and configurations. Boating is very popular at the study project lakes, and power boating is the predominant boating activity. Conflicts occur among power boaters, nonpower boaters, boat fishermen, and swimmers.

250. In the past, it has not been necessary or practical at most study project areas to maintain a very high degree of control over

boating activities. No boating permits are required and lake zoning of boats is used only by a few of the project areas visited (e.g., Shenango, New Hogan). Where lake zoning is used, it is designed to control the speed of boats rather than the type of boating activity. Overcrowding is rare on the entire lake surface, but nodal crowding is common, especially in water areas adjacent to launch ramps and marinas and in developed recreation areas.

251. Water fluctuations are common. These fluctuations can increase the threat posed by submerged hazards and cause shoreline erosion. Shoreline erosion from wakes and the beaching of boats at picnic areas and camping areas is also a problem in some locations. Some project areas have numerous private docks which can limit the ability of the Corps to control access to the lake.

252. Boat fishing. Boat fishing is a popular activity at all of the study project areas. Overcrowding generally tends to be more of a problem than overuse, but neither are significant problems at the study project areas. Although boat fishing occurs on all areas of the lake, it is most often done in cove areas. Marinas often serve as focal points for the provision of rental equipment, bait, and other supplies. Conflicts between boat fishermen and waterskiers/high speed boaters are widespread; some conflicts between boat fishermen and swimmers also occur.

253. Techniques such as marking coves as "no wake" areas, inundating standing timber, and providing fish attracters (such as crappie beds) are techniques being used at some of the study project areas to provide better boat fishing opportunities. Some project areas are also upgrading old roads which lead to the lakeshore to serve as informal boat launching areas. Fish cleaning stations are provided at some ramps and campgrounds.

254. Boat launching. Many boat launching ramps at the study project areas get crowded--especially late in the morning and afternoon during hot summer weekend days. Most of the ramps are multiple lane ramps. These ramps are used by a variety of boat types, although power boats generally outnumber nonpower and low powered boats. At some projects ramps are dispersed around the lake, while at others the ramps are

concentrated at one side or end of the lake. Many ramps are located adjacent to or within campgrounds and day use areas.

255. Most ramps are concrete and can be used during high water and low water periods. Some ramps provide courtesy docks. Ramps differ widely in the delineation of a clear traffic pattern. Some project areas are upgrading old roads which lead down to the lakeshore to serve as informal boat ramps, particularly for use by smaller, nonpowered and low powered boats.

256. Camping. Tent and/or trailer camping areas predominate at the study project areas. Walk-in tent areas, group camping areas, primitive (nonfee) camping areas, and overflow camping areas also exist. Most campgrounds afford easy access to the water as well as good views of the lake. Few of the campgrounds surveyed contain vegetation thick enough to function as a visual buffer to screen adjacent campsites. Facilities at a typical campsite include a table, fireplace or fire ring, and a hardened pad. Some areas provide water and/or electric hookups, showers, flush toilets, dump stations, gate attendants, impact sites, and parking areas for visitors and extra vehicles.

257. Some campgrounds limit the number of camping units per campsite to avoid overcrowding and overuse. Many campers bring a boat and those who do prefer to park their boat trailer at or near their campsite, which contributes to overcrowding and overuse. Many Corps recreators use campgrounds as a "hotel" or a place to stay while they are at the project recreating in other activities rather than for a pure camping experience. Sometimes conflicts arise between campers and day users and conflicts sometimes occur between campers who prefer different types of camping experiences (e.g., tent campers and trailer campers). Of all the Corps activity areas, the camping areas have had the most overcrowding problems. Overcrowding occurs mostly in campgrounds that afford easy access to the lake but have no individually designated sites or gate attendant.

258. Generally, campsites that have one or several of the following characteristics are prone to overuse: a location adjacent to the lakeshore; a steep sloping topography; shallow sensitive soils; a dense tree canopy (which blocks out sunlight and prevents the establishment of grass);

and a limited degree of vehicle control.

259. Hiking. Most of the hiking trails at the study project areas are interpretive trails; many are self-guided. Most trails do not exceed 3/4 of a mile in length. Trails are generally located near camping areas, but few trails lead from one activity area to another. Some project areas provide two trail loops of different lengths to provide for users seeking different types of hiking experiences.

260. Some trails have hardening materials (gravel, wood chips, or wood planks) on trail surfaces to reduce overuse. Overuse of trails is more likely to be a problem than overcrowding and many trails are underused. Typically, underused trails have one or more of the following characteristics: a relatively remote location in regard to the lake, project users, or other activity areas; a limited number of support facilities; or a limited number of directional signs.

261. Off-road vehicle riding. Several of the study project areas provide separate areas for off-road vehicle riding (ORV). The ORV areas are typically located in primitive areas (borrow areas, abandoned quarries and gravel pits, etc.) at the study project areas, although a powerline easement is used at Hartwell. These areas provide trails and/or open areas for random ORV use. Different types of ORV's (4-wheel drive vehicles, all-terrain vehicles, dune buggies, dirt bikes, and mini-bikes) use these areas. Providing one area to serve all ORV riders was generally viewed by management as being preferable to providing no ORV area at all or allowing ORV riding in camping and other activity areas. A few project managers questioned whether the Corps should be providing for ORV use.

262. Management at some areas encourages users to maintain the area and control their use and seeks to have organized groups of ORV riders assist in developing designated trails. Most of the ORV areas studied reportedly have well-balanced use conditions.

263. Picnicking. Most picnic areas receive heavy use at study project areas. Some are overcrowded and/or overused and some are underused. Underuse at some of the picnic areas results because of either:

(a) limited support facilities (parking, shelters, grills, etc.), (b) lack of attractive site amenities (scenic views of the lake or natural features), or (c) a remote location far from other activity areas. Some picnic sites have been removed and relocated because of underuse. Overuse around tables has led to the use of hardened surfaces and movable tables. Movable tables also allow picnickers to establish their own spacing preferences.

264. The most popular picnic areas are those near the water body and those which are most accessible to other activity areas. Picnic areas with individual tables, small groupings of tables (two to four tables together), and large group areas were found at the study project areas. Picnic areas differ in the allocation of open space: some areas cluster tables and provide for a multipurpose activity area to be jointly used by many user groups; others increase the spacing between tables, allocating a separate area for each group to use. Areas also differ in the percentage of tables which are provided with shelters. There appears to be an increasing demand for group picnic sites (some areas provide for the reservation of group facilities), and walk-in picnic areas are also popular. Use of some picnic areas is permitted only during designated hours.

265. Shoreline fishing. Basically, there are two different types of shoreline fishing situations: fishing along the lakeshore and fishing at the outlet. Fishing is most popular at outlet areas, especially where easy access is afforded. Marina docks, piers, rip-rap areas, concrete bleachers, and bridges also serve as sites for shoreline fishing.

266. Three types of development aid the shoreline fishermen: (a) increased access to fishing areas; (b) fish cleaning stations at outlet areas, campgrounds, and boat ramps; and (c) fencing of hazardous shoreline areas. Conflicts between shoreline fishermen and boating activities occur (when boats foul or cut fishing lines). User conflicts also occur between shoreline fishermen and campers/picnickers (when fish cleaning occurs at water faucets and sinks intended for general use).

267. Overcrowding and overuse are not major problems at the shoreline fishing areas surveyed.

268. Sunbathing. Sunbathing occurs at designated beaches and informally at various locations at a project area. Sunbathing areas differ in the level of support facilities provided and in the type and quality of the ground surface (grass, sand, or dirt). Fluctuations in the water levels require continual maintenance and restoration of beaches. Parking on the beach has created problems of overuse and overcrowding in some areas. Beaches located within campground sometimes are used by both day users and campers resulting in conflicts between these two user groups. Some areas have also adopted rules which establish a minimum age for unattended children at beaches. Overcrowding and overuse are not major problems at the sunbathing areas surveyed.

269. Swimming. Designated swimming areas are provided at some study project lakes. Swimming often occurs in a variety of situations, including at boat ramps and other areas where conflicts can arise. Conflicts sometimes occur between swimmers and boaters, but areas marked by float lines help to prevent these conflicts. At the study project areas, problems of overcrowded and overused swimming areas were not found to be a significant problem.

270. The level of development at swimming areas differed at the study project areas: change houses, docks, diving platforms, roped-off areas (float lines), and designated parking areas are provided at some project areas while others provide only limited or no improvements. Lifeguards are not supplied at any of the study project areas; swimming pools were observed only at a few of the private resorts and concessions.

271. Waterskiing. Waterskiers prefer coves and other areas of the lake protected from wind and choppy water conditions. Waterskiing typically occurs near day use areas and camping areas. None of the study projects have zoned separate areas on the lake surface for waterskiing. In some cove areas at some of the lakes, waterskiing is prohibited. Few improvements are provided on the lake for waterskiing, although McNary does provide waterski docks which serve as takeoff points. Conflicts between skiers and boat fishermen are widespread and frequently occur at the study project areas.

Management Survey Findings

272. This section presents the findings of the management survey regarding: (a) indicators of overcrowding and overuse, and (b) carrying capacity factors. A description of how these management survey findings were used to develop the guidelines presented in Part VI is also included.

Indicators of overcrowding and overuse

273. Overcrowding. The following tables summarize the indicators (signs) of overcrowding and their relative importance for use based upon the results of the management survey. Summary tables (Tables 26-35) list indicators of overcrowding addressed in the management survey. The relative importance of each indicator is shown by its position in the list from top to bottom in descending order of importance. Indicators which are ranked on the basis of only a limited number of responses (i.e., less than four) are identified (see footnotes at the bottom of the tables). Suggestions regarding key indicators of overcrowding and a possible monitoring system to identify potential overcrowding are provided in Part IX.

Table 26

Indicators of Overcrowding for Boating

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Congestion on ramp in evening as leaving*,**	++
Observation of overall boating situation*,**	++
Increase of moving boat violation*,**	++
Increase in number of accidents	++
Long lines waiting to use launching area	++
Arguments/conflicts between boaters	++
Increase in the number of complaints	+
Crowding on sandbars*,**	+
Crowded support facilities	+
More use of marina*,**	+
Increase in noise	+
Increase in litter	+
Occurrence of displacement/succession (changes in visitor characteristics)	+
Shorter stays	+
Decrease in water quality	+
Fewer returnees	+
Increase in resource and facility destruction	0
Increase in crime	0
Boating in unauthorized areas*,§	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.
§ Level of importance based upon only two responses.

Table 27

Indicators of Overcrowding for Boat Fishing

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in the number of complaints	++
Arguments/conflicts between visitors	++
Increase in litter/trash	+
Increase in number of accidents	+
Long waits tc use launch areas	+
Fewer returnees	+
Growded support facilities	+
Occurrence of displacement/succession (changes in visitor characteristics)	+
Shorter stays	+
Increase in crime	0
Increase in noise	0
Fishing in unauthorized areas	0
Increase in resource and facility destruction	0

Table 28

Indicators of Overcrowding for Boat Launching

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Backup of those waiting to launch*,§	++
Increase in the number of complaints	++
Long line at evening take out*,§	++
Overall congestion*,§	++
Arguments/conflicts between boaters	+
Increase in number of accidents	+
Crowded support facilities	+
Launching in unauthorized areas	+
Fewer returnees	+
Increase in litter/trash	+
Increase in noise	0
Occurrence of displacement/succession (changes in visitor characteristics)	0
Shorter stays	0
Increase in resource and facility destruction	0
Increase in crime	0

* Additional indicator identified during the management survey.
§ Level of importance based upon only two responses.

Table 29

Indicators of Overcrowding for Camping

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in number of regulations broken or citations issued*,§	++
People sharing same tent stakes*,**	++
Extra vehicles on sites*,**	++
Increase in use of overflow area*,§	++
Increase in the number of complaints	+
Crowded support facilities	+
Increase in needed garbage collection*,**	+
Camping in unauthorized areas	+
Arguments/conflicts between campers	+
Increase in use levels	+
Moving of vehicle barriers*,**	+
Less desirable areas being used*,**	+
Increase in noise	+
Increase in resource and facility destruction	+
Increase in number of accidents	+
Increase in litter/trash	+
Requests for new campsite designations	+
Increase in use of hookups*,§	+
Deficiencies of supplies at support facilities*,§	+
Fewer returnees	+
Increase in crime	+
Occurrence of displacement/succession (changes in visitor characteristics)	+
Shorter stays	+

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.
§ Level of importance based upon only two responses.

Table 30

Indicators of Overcrowding for Hiking

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in noise *	++
Arguments/conflicts between hikers *	++
Increase in the number of complaints**	++
Occurrence of displacement/succession (changes in visitor characteristics)	++
Crowded support facilities *	++
Increase in litter **	+
Increase in resource and facility destruction **	+
Increase in number of accidents *	+
Hiking in undesignated trails *	+
Increase in crime*	+
Fewer returnees**	+
Shorter stays**	+

* Level of importance based upon only one response.
** Level of importance based upon only two responses.

Table 31

Indicators of Overcrowding for ORV Riding

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in noise*	++
Increase in litter/trash*	+
Increase in the number of complaints*	+
Lack of wildlife**,§	+
Crowded support facilities*	+
Increase in number of accidents	+
Increase in resource and facility destruction*	+
Riding in unauthorized areas	+
Arguments/conflicts between users*	+
Occurrence of displacement/succession (changes in visitor characteristics)*	+
Fewer returnees *	+
Shorter stays *	+
Increase in crime *	+

* Level of importance based upon only three responses.
** Additional indicator during the management survey.
§ Level of importance based upon only one response.

Table 32

Indicators of Overcrowding for Picnicking

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in the number of complaints	+
Increase in use levels	+
Arguments/conflicts between picnickers	+
Increase in litter/trash	+
Picnicking in nonpicnic areas	+
Increase in resource and facility destruction	+
Increase in number of accidents involving vehicles	+
Fewer returnees	+
Increase in noise	+
Shorter stays	+
Increase in crime	+
Occurrence of displacement/succession (changes in visitor characteristics)	+

Table 33

Indicators of Overcrowding for Shoreline Fishing

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in litter	+
Increase in the number of complaints	+
Arguments/conflicts between visitors	+
Fishing in unauthorized areas	+
Crowded support facilities	+
Fewer returnees	0
Increase in resource and facility destruction	0
Increase in crime	0
Shorter stays	0
Increase in noise	0
Increase in number of accidents	0
Occurrence of displacement/succession (changes in visitor characteristics)	0

Table 34

Indicators of Overcrowding for Sunbathing and/or Swimming

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Need for adding restrictions*	++
Arguments between swimmers & boaters*	++
Parking lot full*	++
Traffic to look at sunbathers*	++
Increase in the number of complaints	++
Crowded support facilities	+
Increase in litter/trash	+
Arguments/conflicts between sunbathers	+
Arguments/conflicts between swimmers	+
Sunbathing in areas adjacent to the beach	+
Fewer returnees	+
Occurrence of displacement/succession (changes in visitor characteristics)	+
Increase in number of accidents	+
Increase in noise	+
Shorter stays	+
Increase in crime	+
Increase in resource and facility destruction	+
Swimming in unauthorized areas	0

* Additional indicator identified during the management survey.

Table 35

Indicators of Overcrowding for Waterskiing

Overcrowding Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increase in the number of complaints	++
Increase in number of accidents	++
Turbulence of the water*	++
Arguments/conflicts between users	++
Occurrence of displacement/succession (changes in visitor characteristics)	+
Request for designated ski areas	+
Increase in noise	+
Crowded support facilities	+
Shorter stays	+
Fewer returnees	+
Skiing in unauthorized areas	+
Increase in litter	0
Increase in resource and facility destruction	0
Increase in crime	0

* Additional indicator identified during the management survey.

274. Overuse. The following tables summarize the indicators (signs) of overuse and their relative importance for use based upon the results of the management survey. The summary tables (Tables 36-45) list indicators of overuse addressed in the management survey. The relative importance of each indicator is shown by its position in the list from top to bottom in descending order of importance. Indicators which are ranked on the basis of only a limited number of responses (i.e., less than four) are identified (see footnotes at the bottom of the tables). Suggestions regarding key indicators of overuse and a possible monitoring system to identify potential overuse are provided in Part IX.

Table 36

Indicators of Overuse for Boating

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increased litter/trash	+
Absence/change in aquatic life	+
Change in water quality	0
Increased erosion/sedimentation	0
Need for replacement of support facilities before normal life period	0

Table 37

Indicators of Overuse for Boat Fishing

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Absence/change in aquatic life (few catches)	+
Increased litter/trash	+
Change in water quality	+
Need for replacement of support facilities before normal life period	0

Table 38

Indicators of Overuse for Boat Launching

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increased litter/trash	+
Ground cover wearing away	+
Frequent buoy replacement*,**	+
Need for replacement of support facilities before normal life period	+
Letters received from public*,§	0
Increased erosion/sedimentation	0
Compacted soils	0
Damaged trees and/or undergrowth	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.
§ Level of importance based upon only two responses.

Table 39

Indicators of Overuse for Camping

Overuse Indicators	Relative Importance: ++ very important + moderately important 0 minor to no importance
Increased ranger confrontation with public*,**	++
Amount of water used (metered)*,**	++
Ground cover wearing away	++
Damaged trees and/or undergrowth	++
Compacted soils	++
Increased erosion/sedimentation	+
Footpaths being created*, **	+
Need for replacement of support facilities before normal life period	+
Increased runoff	+
Increased litter/trash	+
Absence/change in wildlife	+
Trees cut down	+
Little deadfall	0
Rodent infestation	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.

Table 40

Indicators of Overuse for Hiking

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Ground cover wearing away **	++
Increased erosion/sedimentation **	++
Compacted soils **	++
Increased runoff **	++
Increased litter/trash §	++
Damaged trees and/or undergrowth §	++
Trees cut down §	++
Absence/change in wildlife **	+
Need for increased maintenance*,**	+
Need for replacement of support facilities before normal life period	+

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.
§ Level of importance based upon only two responses.

Table 41

Indicators of Overuse for ORV Riding

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increased erosion/sedimentation *	++
Ground cover wearing away *	++
Increased litter/trash *	+
Compacted soils*	+
Absence/change in wildlife*	+
Damaged trees and/or undergrowth	+
Increased runoff *	+
Need for replacement of support facilities before normal life period *	0

* Level of importance based upon only three responses.

Table 42

Indicators of Overuse for Picnicking

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Ground cover wearing away	++
Compacted soils	+
More stray dogs*,**	+
Amount of toilet paper and towels used*,**	+
Amount of water use*,**	+
Damaged trees and/or undergrowth	+
Increased erosion/sedimentation	+
Need for replacement of support facilities before normal life period	+
Increased litter/trash	+
Increased runoff	+
Rodent infestation	+
Trees cut down	0
Absence/change in wildlife	0
Little deadfall	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.

Table 43

Indicators of Overuse for Shoreline Fishing

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Lack of fish*,**	++
Increased litter/trash	+
Ground cover wearing away	+
Compacted soils	+
Damaged trees and/or undergrowth	0
Absence/changes in aquatic life (fewer catches)	0
Increased erosion/sedimentation	0
Increased runoff	0
Trees cut down	0
Rodent infestation	0
Change in water quality	0
Need for replacement of support facilities before normal life period	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.

Table 44

Indicators of Overuse for Sunbathing and/or Swimming

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Poorer water quality*,**	++
Increased litter/trash	++
Ground cover wearing away	++
Parking on grass*,**	++
Compacted soils	++
Need for replacement of support facilities before normal life period	++
Increased erosion/sedimentation	0
Absence/change in aquatic life	0
Damaged trees and/or undergrowth	0
Beach submergence	0
Increased runoff	0

* Additional indicator identified during the management survey.
** Level of importance based upon only one response.

Table 45

Indicators of Overuse for Waterskiing

Overuse Indicators	Level of Importance: ++ very important + moderately important 0 minor to no importance
Increased litter/trash	+
Change in water quality	+
Increased erosion/sedimentation	+
Need for replacement of support facilities before normal life period	+
Absence/change in aquatic life	+

275. Using the indicators to monitor use levels. When used in conjunction with a carrying capacity monitoring program, indicators can aid in the collection of three types of information: (a) use levels, (b) impacts on use levels, and (c) user attitudes toward use levels. The fact that in many cases indicators are themselves capacity problems points out the importance of determining, as early as possible, when the indicators are increasing in frequency or intensity. The key indicators, identified as a result of the management survey, are used as the basis for the capacity monitoring programs outlined in Part IX.

Carrying capacity factors

276. The following section presents the findings of the management survey regarding (a) social capacity factors and (b) resource capacity factors. Both types of factors are presented by activity.

277. Social capacity factors. Tables 46-55 present the social capacity factors, their relative importance, and their impact on social capacity for each activity based upon the management survey. The rationale for most of the factors can be explained by the following general statement: users are willing to trade off the utility derived from greater spacing for the utility derived from the factor. However, certain factors for some activities can be explained using the different rationales summarized later in the paragraphs following Tables 77-84.

Table 46

Factors Affecting Social Capacity
Based Upon the Management Survey

Boating

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Type of boating area/boater (nonpower → power)	++	N
Shoreline configuration	++	P
Number of launching areas	++	P
Compatibility of nearby activities	+	N
Size of boating area	+	P
Proximity to other activity areas	+	N
Scenic views	+	N
Water quality	+	P
Location of project area (urban → rural)	+	P
Charging of fees	+	P
Degree of control	+	N
Distance from highway access	+	P
Level of development	+	N
Amount/location of facilities	+	N
Number, type, and degree of man-made intrusions or disturbances	0	P
User Characteristic		
Similarity of visitor groups	++	N
Experience of user	+	N
Travel time to project area	+	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.
N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

Table 47

Factors Affecting Social Capacity Based Upon the Management Survey

Boat Fishing

Social Capacity Factors	Relative Importance	Impacts
Site Characteristic		
Catching fish	++	N
Amount/location of facilities	+	N
Compatibility of nearby activities	+	N
Proximity to other activity areas	+	N
Size of fishing area	+	P
Single purpose or multipurpose recreation area	+	P
Configuration of area	0	N
Location of lake	0	P
Number, type, and degree of man-made intrusions or disturbances	0	P
Scenic views	0	N
Charging of fees	0	P
Degree of control	0	N
Distance from highway access	0	P
User Characteristic		
Type and amount of fishing equipment (e.g., boat, nonpower → power boating)	++	P
Travel time	+	P
Similarity of visitor groups	+	N
Experience	0	P, N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 48

Factors Affecting Social Capacity Based Upon the Management Survey

Boat Launching

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Proximity to other activity areas	++	P
Ease of launching	+	P
Level of development	+	P
Time of day	+	P, N
Distance from highway access	+	N
Charging of fees	+	N
Distance between launching areas	+	N
Amount/location of facilities	+	P
User Characteristic		
Similarity of visitor groups	+	N
Travel time	+	P
Origin of user	0	P
Experience	0	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 49

Factors Affecting Social Capacity Based Upon the Management Survey

Camping

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Accessibility to water body	++	N
Level of development	++	N
Degree of control	++	N
Proximity to other activity areas	++	N
Visibility of water body	+	N
Distance from highway access	+	P
Maintenance of facilities	+	N
Vegetation	+	N
Amount/location of facilities	+	P
Degree of campsite delineation	+	N
Configuration of area	+	N
Remoteness/degree of solitude	+	N
Number, type and degree of man-made intrusions or disturbances	+	P
Size of camping area	+	P
Charging of fees	+	P
Slope of land	0	P
User Characteristic		
Travel time	+	P
Equipment	+	P
Similarity of visitor groups	+	N
Origin of user/location of area	+	P
Campsite selection opportunity	+	N
Safety measures	+	N
Animals/dogs	+	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

Table 50

Factors Affecting Social Capacity Based Upon the Management Survey

Hiking

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Scenic views	++	N
Type of hiking experience (general → primitive)	++	P, N
Configuration of the trail	++	N
Vegetation	++	N
Number, type and degree of man-made intrusions or disturbances	++	P
Length of trail	++	P
Proximity to the water	+	N
Proximity to other activity areas	+	N
Compatibility of nearby activities	+	N
Location of area/origin of user (urban → rural)	0	P
Single purpose or multipurpose recreation area	0	P
Amount/location of facilities	0	P
Level of development	0	N
Charging of fees	0	P
User Characteristic		
Similarity of visitor groups	++	N
Travel time	0	P
Experience	0	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 51

Factors Affecting Social Capacity Based Upon the Management Survey

Off-Road Vehicle Riding

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Configuration of area	+	N
Charging of fees	+	P
Degree of control	+	N
Size of area/length of trail	+	P
Distance from highway access	+	P
Level of development	+	N
Amount/location of facilities	+	P
Single purpose or multipurpose recreation area	+	P
Vegetation	+	N
Number, type, and degree of man-made intrusions or disturbances	0	P
Proximity to other activity areas	0	N
Scenic views	0	N
Proximity to water	0	N
Compatibility of nearby activities	0	N
User Characteristic		
Similarity of visitor groups	+	N
Travel time	+	P
Experience	+	N
Origin of user	+	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

Table 52

Factors Affecting Social Capacity Based Upon the Management Survey

Picnicking

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Type of vegetation	++	N
Amount/location of facilities	++	P
Accessibility to water body	++	N
Visibility of water body	++	N
Maintenance of facilities	++	N
Level of development	++	N
Proximity to other activity areas	+	N
Size of picnic area	+	P
Charging of fees	+	P
Configuration of area	+	N
Degree of area designation	+	N
Number, type, and degree of man-made intrusions or disturbances	+	P
Visual screening between groups	+	N
Distance from highway access	+	P
Slope of the land	+	P
User Characteristic		
Travel time to project area	+	P
Similarity of visitor groups	+	N
Origin of user/location of area	+	P
Experience	0	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

Table 53

Factors Affecting Social Capacity Based Upon the Management Survey

Shoreline Fishing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Catching fish	++	N
Amount/location of facilities	+	P
Size of fishing area	+	P
Single purpose or multipurpose area	+	P
Proximity to other activity areas	+	N
Type of shoreline	+	N
Compatibility of nearby activities	+	N
Slope of shoreline	+	P
Distance from highway access	0	P
Charging of fees	0	P
Location of area	0	P
Quality/variety of natural amenities	0	N
Configuration of area	0	N
Number, type, and degree of man-made intrusions or disturbances	0	P
Degree of designation	0	N
User Characteristic		
Type of fishing	++	P, N
Experience	+	N
Similarity of visitor groups	+	N
Travel time	0	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

F,N indicates the factor could have both a positive or negative relationship.

Table 54

Factors Affecting Social Capacity Based Upon the Management Survey

Sunbathing and/or Swimming

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Degree of control	++	N
Size of swimming area	++	P
Amount/location of facilities	++	P
Level of development	+	N
Proximity to other activity areas	+	N
Compatibility of nearby activities	+	N
Water quality	+	N
Design of area	+	N
Scenic views	+	N
Number, type, and degree of man-made intrusions or disturbances	+	P
Distance from highway access	+	P
Charging of fees	+	P
Location of area	+	P
User Characteristic		
Similarity of visitor groups	+	N
Waders/swimmers	+	P
Experience	+	N
Travel time	+	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

Table 55

Factors Affecting Social Capacity Based Upon the Management Survey

Waterskiing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Water temperature	++	N
Weather	++	P
Controlled circulation	++	N
Amount/location of facilities	+	P
Size of skiing area	+	P
Shoreline configuration	+	P
Single or multipurpose area	+	P
Proximity to other activity areas	+	N
Charging of fees	+	P
Designated waterskiing area	+	N
Compatibility of nearby activities	+	N
Number, type, and degree of man-made intrusions or disturbances	+	P
Location of lake (urban → rural)	+	P
Degree of control	+	N
Water quality	+	N
Distance from highway access	+	P
Scenic views	0	N
User Characteristic		
Type of boat used	++	P
Travel time	+	P
Experience	+	N
Similarity of visitor groups	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

278. Resource capacity factors. Tables 56-66 present the resource capacity factors, their relative importance, and their impact on resource capacity based upon the management survey.

Table 56

Factors Affecting Resource Capacity Based Upon the Management Survey

Boating

Resource Capacity Factors	Relative Importance*	Impacts**
Tolerance of shore species	++	P
Depth of water	++	P
Lake shape	++	P
Shoreline configuration	++	P
Pool fluctuation	++	N
Lake size	+	P
Amount of wave action/choppy water	+	N
Type of boating area	+	N
Number of launching areas	+	P
Navigation charts and other information	+	P
Tolerance of aquatic life	+	P
Degree of normal maintenance applied	+	P
Degree of off-season restoration applied	+	P

Table 57

Factors Affecting Resource Capacity Based Upon the Management Survey

Boat Fishing

Resource Capacity Factors	Relative Importance*	Impacts**
Fish availability	++	P
Underwater cover	++	P
Water depth	++	P
Shoreline configuration	++	P
Size limit of catch	++	P
Frequency and extent of water level change	++	N
Type of fish species	+	P
Water quality	+	P
Seeding exposed shore area	+	P
Degree of policing/control	+	P
Degree of normal maintenance applied	+	P
Degree of off-season restoration applied	0	+
Group size	0	-

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

Table 58

Factors Affecting Resource Capacity Based Upon the Management Survey

Boat Launching

Resource Capacity Factors	Relative Importance*	Impacts**
Design layout (also ramp slope)	++	P
Type of launching area	++	P
Level of development (e.g., paved areas)	++	P
Wind and exposure	++	N
Depth of water	+	P
Type of support facilities	+	P
Number of launching areas	+	P
Type of boat being launched	+	N
Size of parking area	+	P
Degree of normal maintenance applied	+	P
Climate/microclimate	+	P, N
Degree of off-season restoration applied	0	P
Resiliency of natural environment	0	P

Table 59

Factors Affecting Resource Capacity Based Upon the Management Survey

Camping

Resource Capacity Factors	Relative Importance*	Impacts**
Degree of control	++	P
Level of development (e.g. paved roads/paths vs. unpaved roads/paths)	++	P
Resiliency of vegetation type	++	P
Tree cover	++	N
Resiliency of soils	++	P
Slope/topography	++	N
Site drainage	+	P
Climate/microclimate	+	P, N
Degree of normal maintenance applied	+	P
Group size	+	N
Resiliency of wildlife	+	P
Degree of off-season restoration applied to activity area	+	P
Slope orientation	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 60

Factors Affecting Resource Capacity Based Upon the Management Survey

Hiking

Resource Capacity Factors	Relative Importance*	Impacts**
Stability of trail surface	++	P
Design/width of trail	++	+
Climate/microclimate	++	P, N
Degree of normal maintenance applied	++	P
Tree cover	++	N
Degree of off-season restoration applied	+	P
Length of trail	+	P
Soil drainage	+	P
Slope	+	N
Group size	0	N

Table 61

Factors Affecting Resource Capacity Based Upon the Management Survey

ORV Riding

Resource Capacity Factors	Relative Importance*	Impacts**
Resiliency of soils	++	P
Trail obstacles	++	N
Type of vehicle	++	N
Soil drainage	++	P
Degree of normal maintenance applied	+	P
Resiliency of vegetation type	+	P
Slope	+	N
Degree of control	+	P
Degree of off-season restoration applied	+	P
Level of development (e.g. paved roads/paths vs. unpaved roads/paths)	+	P
Tree cover	+	N
Climate/microclimate	+	P, N
Group size	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 62

Factors Affecting Resource Capacity Based Upon the Management Survey

Picnicking

Resource Capacity Factors	Relative Importance*	Impacts**
Tree cover/shade	++	N
Resiliency of vegetation type	++	P
Level of development (e.g., paved roads/paths vs. unpaved roads/paths)	++	P
Resiliency of soils	+	P
Degree of normal maintenance applied	+	P
Slope/topography	+	N
Climate/microclimate	+	P, N
Site drainage	+	P
Group size	+	N
Slope orientation	+	N
Degree of off-season restoration applied	+	P
Resiliency of wildlife	0	P

Table 63

Factors Affecting Resource Capacity Based Upon the Management Survey

Shoreline Fishing

Resource Capacity Factors	Relative Importance*	Impacts**
Underwater cover	++	P
Fish availability/spawning season	++	P
Frequency and extent of water level change	++	N
Depth of water	+	P
Slope of shoreline	+	N
Shoreline stability	+	N
Water quality	+	P
Level of development (e.g., paved roads/paths vs. unpaved roads/paths)	+	P
Tolerance of fish species	+	P
Degree of normal maintenance applied	+	P
Type of shoreline (irregular, regular, stream, or lake shore)	+	P
Slope orientation	0	N
Group size	0	N
Soil drainage	0	P
Degree of off-season restoration applied	0	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 64

Factors Affecting Resource Capacity Based Upon the Management Survey

Sunbathing

Resource Capacity Factors	Relative Importance*	Impacts**
Resiliency of vegetation	++	P
Exposure to wind/wave action	++	N
Slope of land	++	N
Stability of beach	++	P
Climate	++	P, N
Degree of normal maintenance applied	+	P
Frequency and extent of water level change	+	N
Degree of off-season restoration applied	+	P
Level of development (e.g., paved roads/paths vs. unpaved roads/paths)	+	P
Group size	+	N
Soil drainage	0	P

Table 65

Factors Affecting Resource Capacity Based Upon the Management Survey

Swimming

Resource Capacity Factors	Relative Importance*	Impacts**
In-water facility (float)	++	P, N
Size of swimming area	++	P
Lake bottom material	++	P
Exposure to wind/wave action	++	N
Water circulation	++	P
Slope of shoreline	++	N
Stability of beach	++	P
Climate	++	P, N
Degree of normal maintenance applied	+	P
Fluctuating water level	+	N
Depth of water	+	P
Slope orientation	+	N
Degree of off-season restoration applied	+	P
Group size	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

P,N indicates the factor could have both a positive or negative relationship.

Table 66

Factors Affecting Resource Capacity Based Upon the Management Survey

Waterskiing

Resource Capacity Factors	Relative Importance*	Impacts**
Shoreline configuration	++	N
Channel width/width of waterway	++	P
Depth of water	+	P
Hazards in water/above water (limbs)	+	P
Frequency and extent of level fluctuation	+	N
Tolerance of aquatic life	+	P
Degree of normal maintenance applied	0	P
Degree of off-season restoration applied	0	P
Tolerance of wildlife species along the shore	0	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the resource capacity increases.

N indicates negative relationship. As the level/amount of the factor increases, the resource capacity decreases.

Using the management
survey findings to develop
carrying capacity guidelines

279. The management survey findings were the primary source of information used to: (a) identify and rank the importance of resource capacity factors, (b) develop the resource capacity guidelines outlined in Part VI, and (c) develop the capacity monitoring programs outlined in Part IX. Major factors affecting resource capacity, as well as areas of resource concern, are included in Part VI, Table 87. The key indicators of overcrowding and overuse, identified as a result of the management survey, were used as the basis for the social and resource capacity monitoring programs included in Part IX, Tables 104 and 105.

280. The management survey also contributed to the development of the social capacity guidelines. It provided information regarding the relative importance of factors that were not addressed as part of the user survey. Also, the onsite inspections of the study activity areas, conducted as part of the management survey, provided the basis for establishing the various levels of a particular recreation setting (see Appendix D).

User Survey Findings

281. This section presents the findings of the user survey which relate to: (a) the characteristics of the users surveyed, (b) the distance/density preferences of users, and (c) the social capacity factors. These findings are presented by activity. A fourth section shows how the social capacity factors were used to develop the social capacity guidelines in Part VI.

Characteristics in the users surveyed

282. Table 67 summarizes the characteristics of the users surveyed at the study projects. (Because of the limited number of questionnaire responses, no user characteristics are included in the table for hiking and off-road vehicle riding.)

283. Sunbathers, swimmers, and waterskiers are more likely to be young (under 26 years of age). Boat fishing and shoreline fishing are more often conducted in small user groups (1-2 users) while picnicking is more often conducted in large groups (>8 users).

284. Picnickers, shoreline fishermen, sunbathers, and swimmers are more likely to be from near by locations (>30 min travel time), while campers are likely to be from more distant locations (>1 hr travel time) than the other activities. Boaters, boat fishermen, shoreline fishermen, sunbathers, swimmers, and waterskiers are likely to have more experience (>10 times last year). Shoreline fishermen are much more typically engaged in no other activities, while boaters, campers, and waterskiers are more typically engaged in many other activities (>3).

285. Campers, picnickers, and shoreline fishermen were more likely to regard the amount/location of facilities as being unpleasant, while boat fishermen were less likely to regard the maintenance of facilities as being unpleasant. Waterskiers were less likely to regard the water quality as being unpleasant than any other users, while campers were less likely to regard the condition of trees and grass as being unpleasant. Boat fishermen were pleased somewhat less often by the type, number, and size of the fish they were catching than shoreline fishermen.

Table 67

Characteristics of the Users Surveyed - By Activity

User Characteristic	Activity							
	Boating	Boat Fishing	Camping	Picnicking	Shoreline Fishing	Sunbathing	Swimming	Waterskiing
Age								
<26	22%	15%	16%	24%	25%	50%	54%	53%
26-55	72	68	65	68	59	48	46	45
>55	6	18	19	8	16	2		2
Group Size								
1-2	23	59	30	8	68	42	40	10
3-8	64	41	63	70	32	53	60	80
>8	13	0	7	22		5		10
Travel Time to Project Area								
<30 min	35	24	16	50	48	65	70	33
30 min - 1 hr	25	31	23	28	22	23	16	23
>1 hr	40	45	61	22	30	13	14	43
No. of Times Last Year								
0	9	5	12	3		7		5
1-5	15	13	36	35	33	13	33	18
6-10	23	11	23	26		16		18
>10	53	71	29	36	67	64	67	59
No. of Other Activities Engaged In								
0	10	31	6	14	78	4	8	10
1	17	19	12	13	9	53	50	12
2-3	27	33	30	55	8	35	34	32
>3	46	18	52	18	5	8	8	49
Equipment								
Sailboat	13							
Canoe/Rowboat	5							
Power Boat	82							
Power Boat <25 hp		30						
Power Boat >25 hp		70						
Tent			29					
Trailer, Motor Home, Van Camper			61					
User Attitudes Regarding Amount/Location of Facilities								
Pleasant	82%	91%	71%	74%	72 %	82 %	82 %	85 %
Unpleasant	18	9	29	26	28	18	18	15
User Attitudes Regarding Maintenance of Facilities								
Pleasant	94	99	95	95		95		97
Unpleasant	6	1	5	5		5		3
User Attitudes Regarding Water Quality								
Pleasant						77	81	93
Unpleasant						23	19	7
User Attitudes Regarding Condition of Trees/Grass								
Pleasant			94	86		88		
Unpleasant			6	14		12		
User Attitudes Regarding Catching Fish								
Pleasant		68			75			
Unpleasant		32			25			

Distance/density findings

286. Each user surveyed for each activity was asked to state the distance which he preferred between himself and other users. It was emphasized that this distance was to be the distance which the respondent believed to be ideal, and not the minimum distance which he could tolerate.

287. Typically, there was a wide range of preferred distance responses for each activity (see Figures 15-25). Because it is unlikely that the Corps will be able to provide recreation environments with distance/density levels which will satisfy the preferences of all users and because a large percentage of users had spacing preferences within a relatively limited range, a planning range was developed for each activity. The planning range for each activity is the range of spacing preferences which best accommodates the preferences expressed by users with the constraints faced by Corps management in developing recreation areas. The planning range was developed in steps. First, the central clustering was identified. Second, the number of responses equal to about 90 percent of the total numeric preferred responses was calculated to serve as a guide for the number of responses to be included in the planning range. Third, the extreme low and high distance values were excluded so that the planning range incorporated the most typical responses which are at the same time the most feasible. Table 68 summarizes the total number of users surveyed, the number of numeric preferred distance responses (some users did not or could not provide a numerical distance response), and the percentage of numeric responses within the planning range for each activity.

288. In order to better illustrate the pattern of distance preferences, a smoothed distribution is included in Figures 21-25. This smoothed distribution emphasizes the modal points where preferences have been expressed and de-emphasizes the significance of the low number of responses for the intervening distances.

289. Because the spacing preferences of users within the planning range for any one activity are clustered, each cluster has been grouped to summarize the multiple spacing preferences of users for that activity.

This produced preference groupings for each activity. A central distance value from each grouping can act as the typical spacing preference for that group, from which a typical density guideline can be developed. Part VI presents a system for using these density guidelines in conjunction with factors affecting social capacity for determining the social capacity of individual areas.

290. Tables 69-76 illustrate the percentages of respondents surveyed at each project area whose preferred distance responses were in the planning range and in each of the preference groupings for each activity.

Table 68

Number of Users Surveyed, Numeric Responses, and Percent of Numeric Responses in the Planning Range for the Study Activities

	Total Number of Users Surveyed	Total Number of Numeric Responses	% of Numeric Responses in Planning Range
Boating	173	135	79
Boat Fishing	151	111	91
Boat Launching	165	109	97
Camping	648	511	90
Hiking	20	12	*
ORV	11	8	*
Picnicking	217	190	93
Shoreline Fishing	139	106	83
Sunbathing	198	161	88
Swimming	160	120	90
Waterskiing	111	95	91

*No planning range developed because of the limited number of responses.

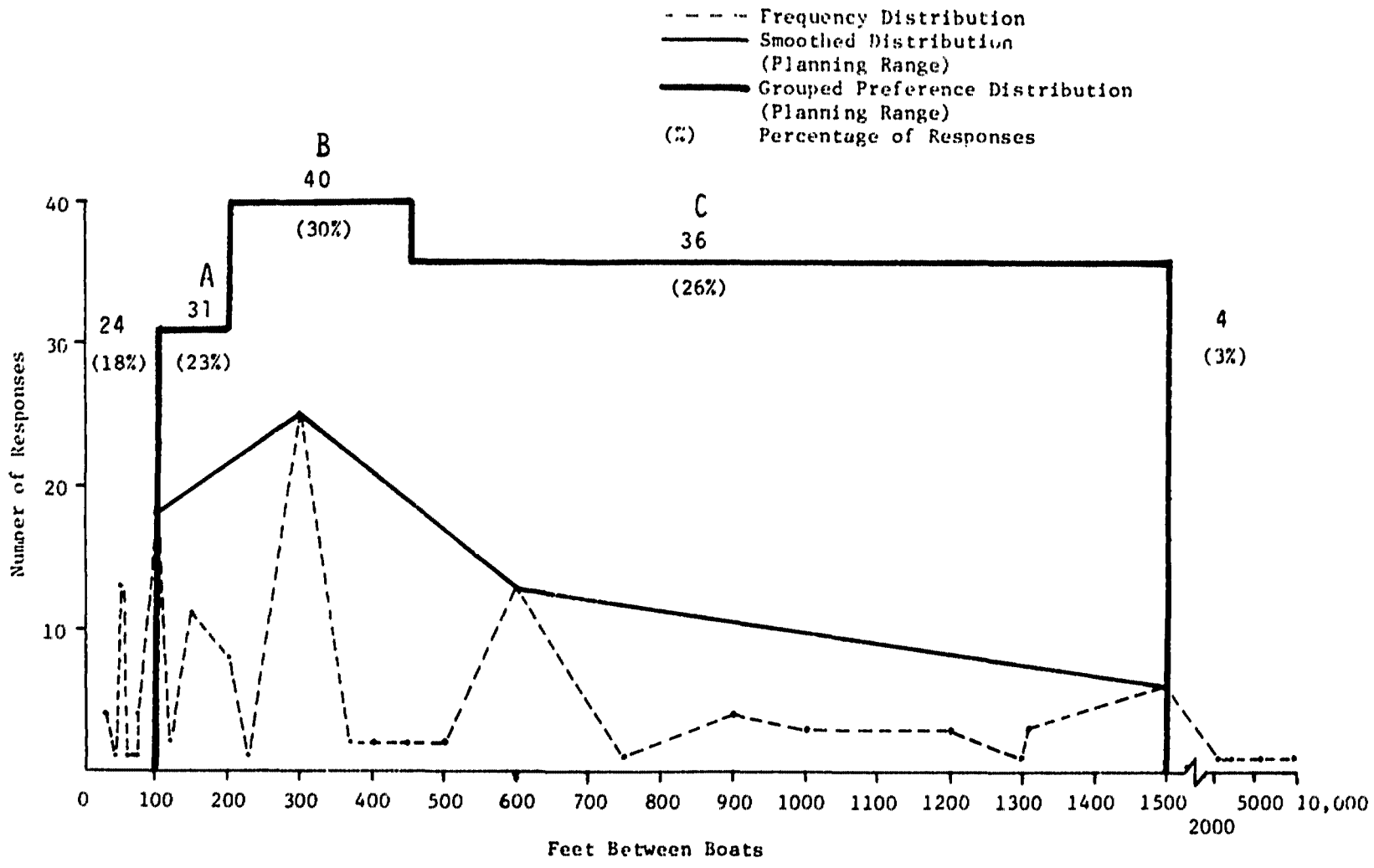


Figure 15: Preferred distances for boating (frequency distribution, smoothed distribution, and grouped distribution)

Table 69

Preferred Distance Responses of Boaters
in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (100'-1500')	Percent in Preference Group		
		A (100'-199')	B (200'-450')	C (451'-1500')
All Boaters	79	29	37	34
Barkley*	80	25	75	0
Benbrook	78	58	21	21
Hartwell**	75	0	100	0
McNary	89	19	50	31
Milford	100	60	20	20
New Hogan	64	14	14	72
Ouachita	80	50	0	50
Shelbyville	82	35	39	26
Shenango	67	20	30	50
Somerville	94	13	25	63
Surry Mt.§	100	33	67	0

* Based on six responses.
** Based on four responses.
§ Based on three responses.

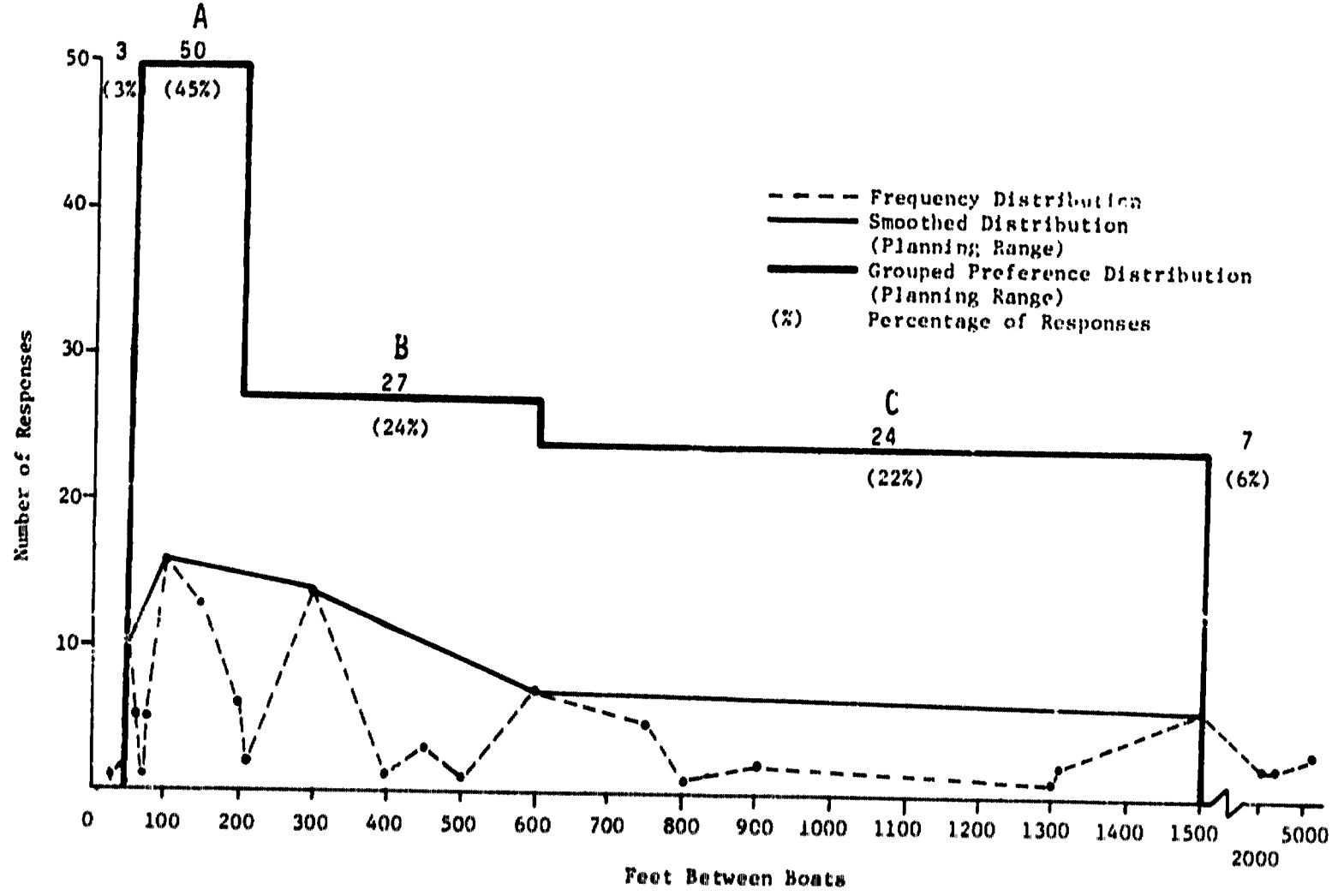


Figure 16: Preferred distances for boat fishing (frequency distribution, smoothed distribution, and grouped distribution)

Table 70

Preferred Distance Responses of Boat Fishermen in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (50'-1500')	Percent in Preference Group		
		A (50'-199')	B (200'-599')	C (600'-1500')
All Boat Fishermen	91	49	27	24
Barkley	50	57	43	0
Benbrook*	78	100	0	0
Hartwell	100	21	14	64
McNary	-	-	-	-
Milford	-	-	-	-
New Hogan**	100	0	50	50
Ouachita	91	43	33	24
Shelbyville	50	100	0	0
Shenango	93	73	27	0
Somerville	100	20	30	50
Surry Mt.	-	-	-	-

* Based on eleven responses.
** Based on two responses.

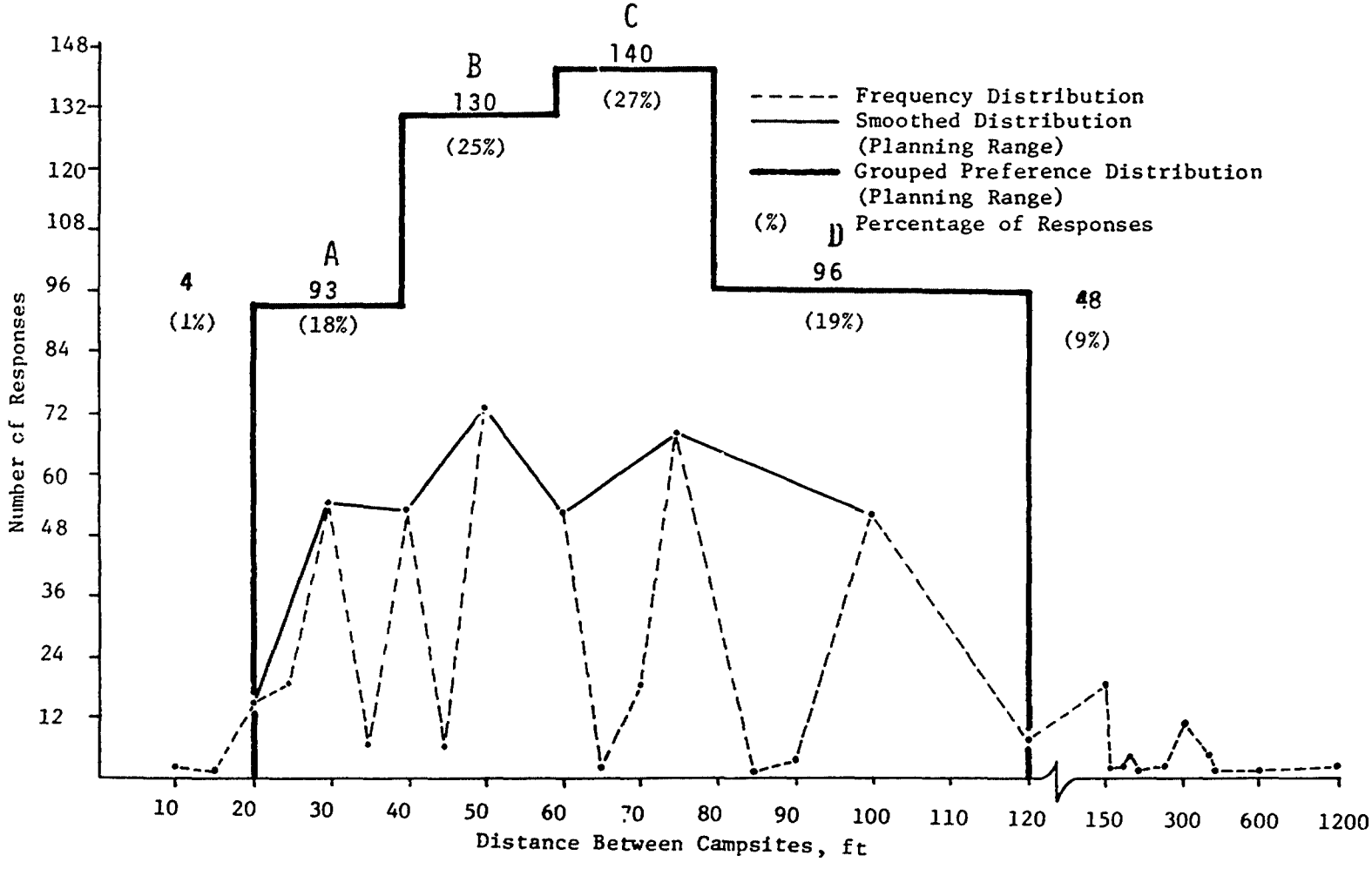


Figure 17: Preferred distances for camping (frequency distribution, smoothed distribution, and grouped distribution)

Table 71

Preferred Distance Responses of Campers
in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (20'-120')	Percent in Preference Group			
		A (20'-39')	B (40'-59')	C (60'-79')	D (80'-120')
All Campers	90	20	28	31	21
Barkley	98	2	34	37	27
Benbrook*	71	17	0	33	50
Hartwell	87	0	10	56	33
McNary	85	13	30	57	0
Milford	72	17	17	28	39
New Hogan	82	21	29	29	21
Ouachita	96	4	30	40	28
Shelbyville	73	26	26	30	18
Shenango	95	47	31	11	11
Somerville	97	28	41	21	10
Surry Mt.	-	-	-	-	-

*Based on fifteen responses.

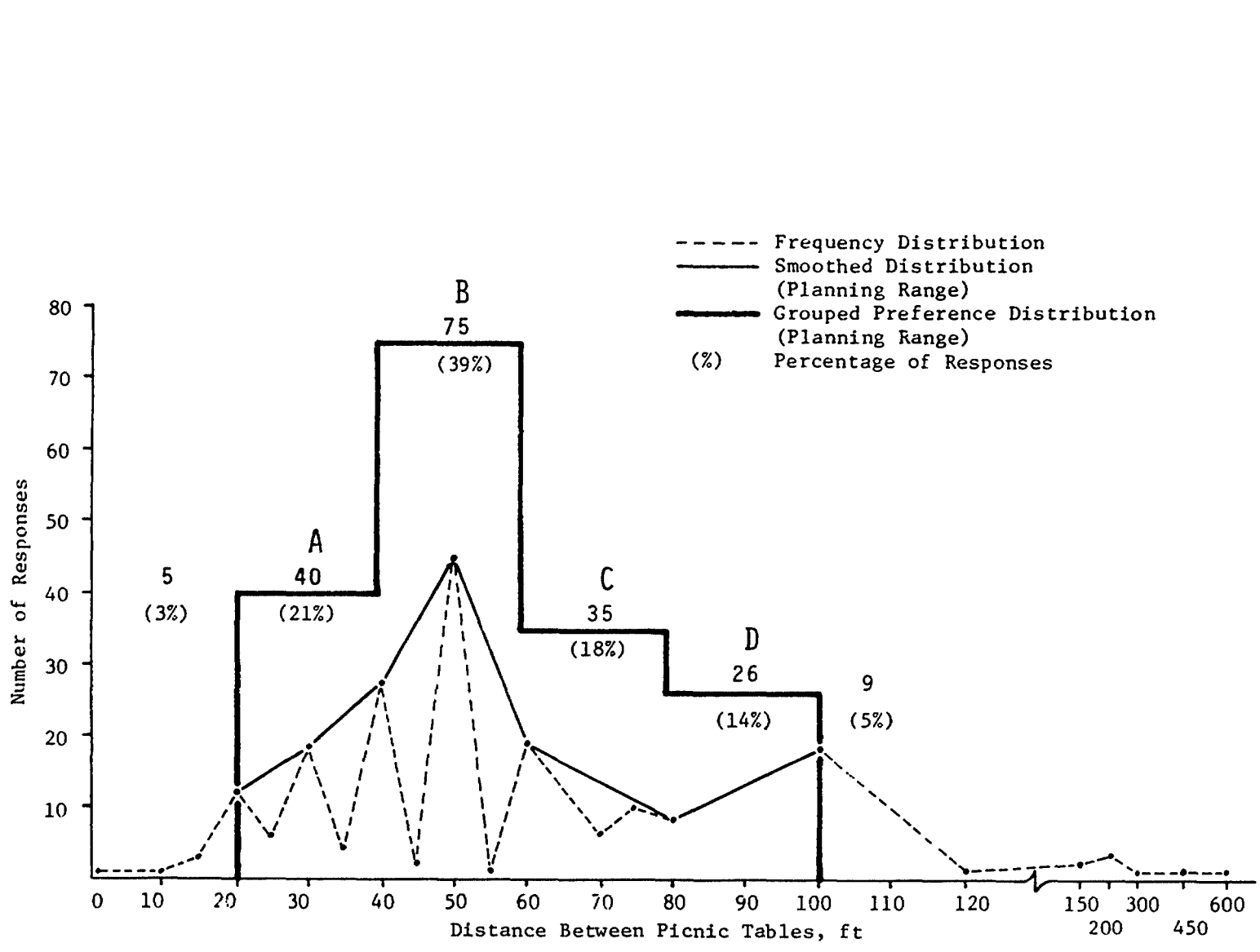


Figure 18: Preferred distances for picnicking (frequency distribution, smoothed distribution, and grouped distribution)

Table 72

Preferred Distance Responses of Picnickers in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (20'-100')	Percent in Preference Group			
		A (20'-39')	B (40'-59')	C (60'-79')	D (80'-100')
All Pichickers	93	23	42	20	15
Barkley	100	0	45	36	18
Benbrook	60	50	0	17	33
Hartwell	100	4	44	40	12
McNary	96	19	38	12	31
Milford	-	-	-	-	-
New Hogan*	86	0	17	67	17
Ouachita	100	20	80	0	0
Shelbyville	91	18	49	15	18
Shenango	87	62	8	31	0
Somerville**	100	0	43	29	29
Surry Mt.	97	27	40	27	7

* Based on seven responses.
** Based on eight responses.

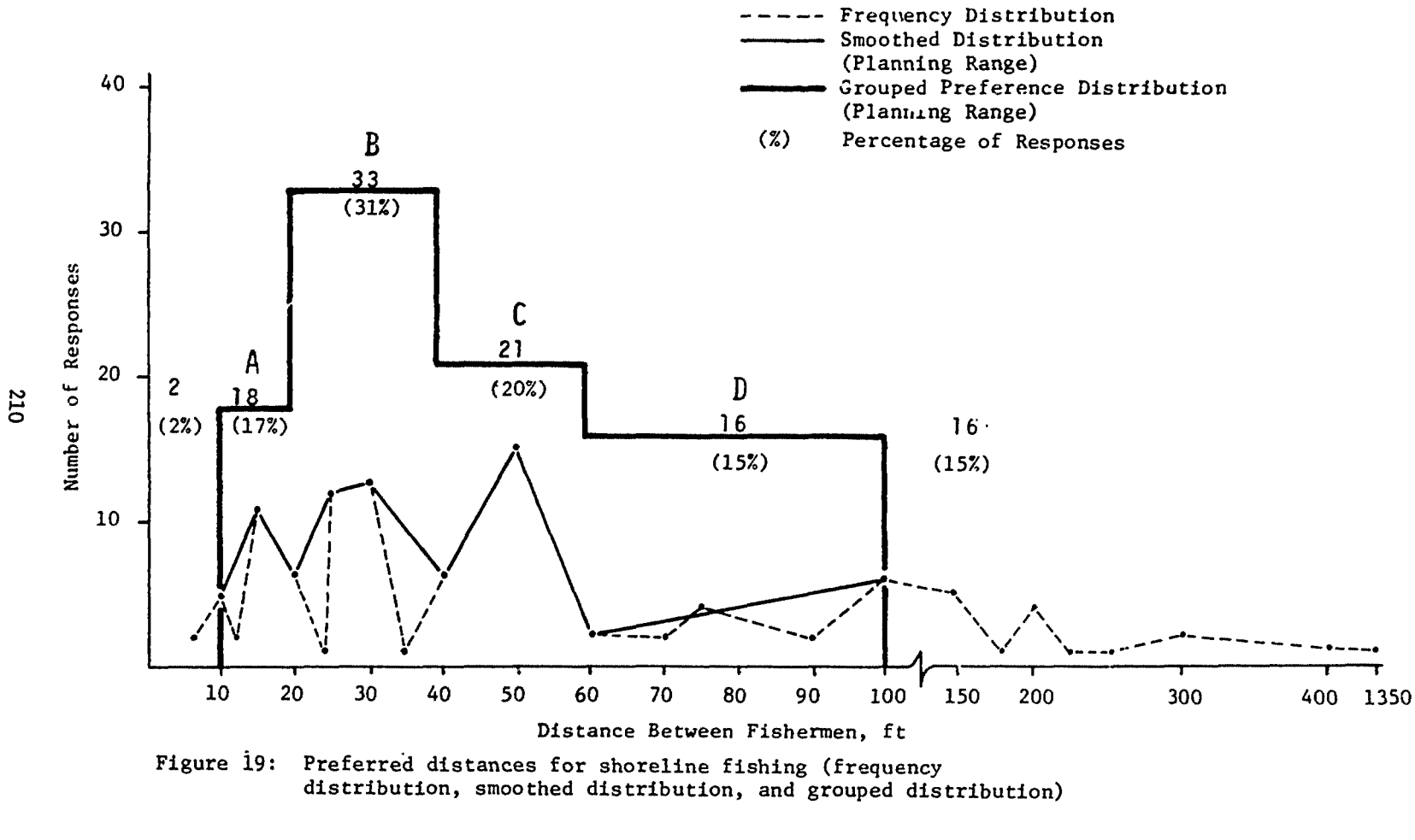


Figure 19: Preferred distances for shoreline fishing (frequency distribution, smoothed distribution, and grouped distribution)

Table 73

Preferred Distance Responses of Shoreline Fishermen in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (10'-100')	Percent in Preference Group			
		A (10'-19')	B (20'-39')	C (40'-59')	D (60'-100')
All Shore Fishermen	83	20	38	24	18
Barkley*	100	17	0	33	50
Benbrook	83	5	55	5	35
Hartwell	45	0	40	0	60
McNary	-	-	-	-	-
Milford	77	29	29	29	12
New Hogan	55	27	36	9	27
Ouachita	-	-	-	-	-
Shelbyville	95	25	50	25	0
Shenango**	100	80	20	0	0
Somerville§	25	0	0	100	0
Surry Mt.	-	-	-	-	-

* Based on seven responses.
** Based on five responses.
§ Based on four responses.

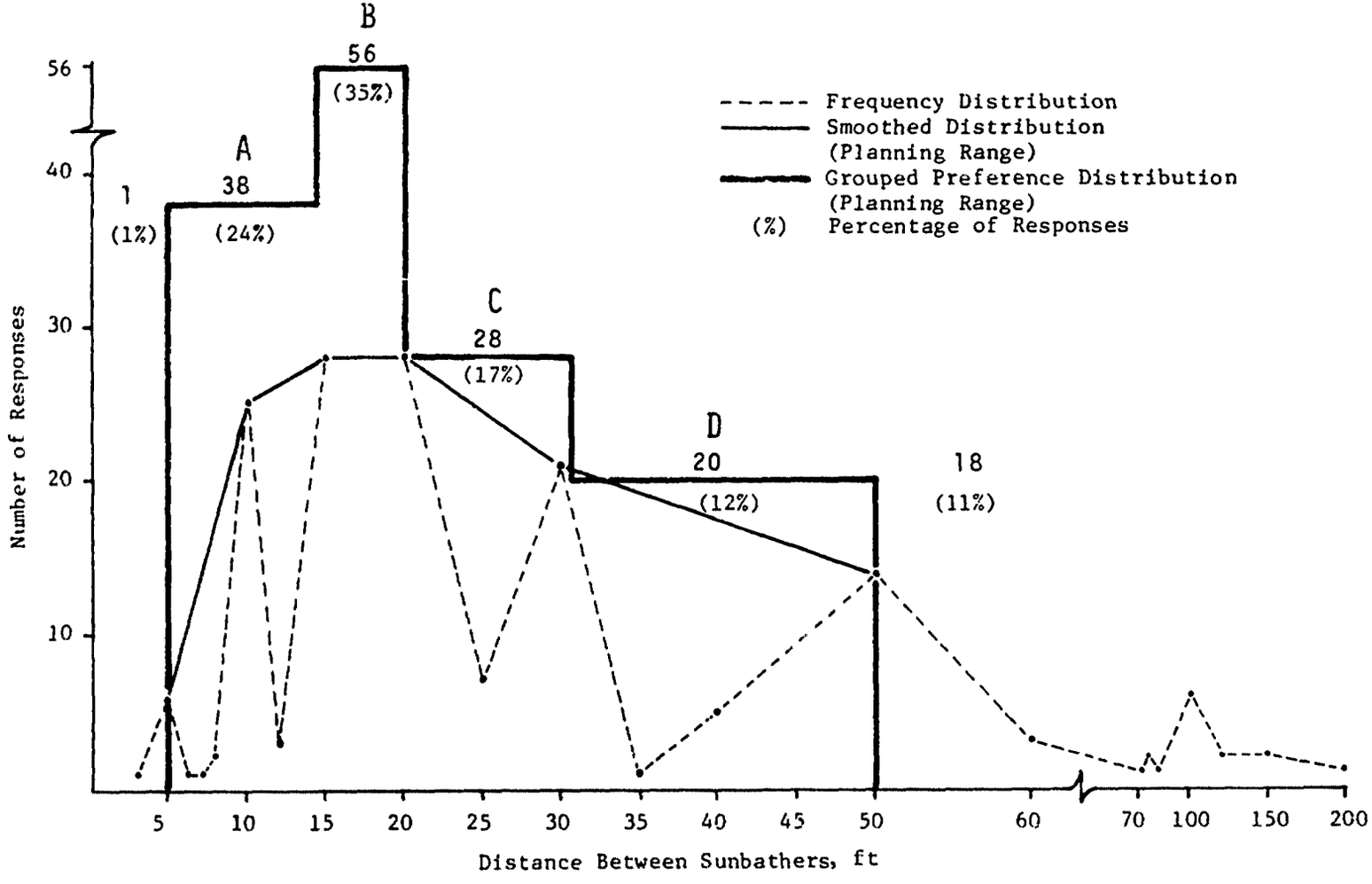


Figure 20: Preferred distances for sunbathing (frequency distribution, smoothed distribution, and grouped distribution)

Table 74

Preferred Distance Responses of Sunbathers in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (5'-50')	Percent in Preference Group			
		A (5'-14')	B (15'-20')	C (21'-30')	D (31'-50')
All Sunbathers	88	27	39	20	14
Barkley	100	27	18	5	1
Benbrook	87	39	40	8	8
Hartwell	58	14	14	43	29
McNary	82	0	43	14	43
Milford	88	50	10	40	0
New Hogan	-	-	-	-	-
Ouachita	100	39	44	9	9
Shelbyville	97	40	37	10	13
Shenango*	100	0	44	33	22
Somerville**	57	0	0	50	50
Surry Mt.	96	27	42	15	15

*Based on nine responses.
**Based on seven responses.

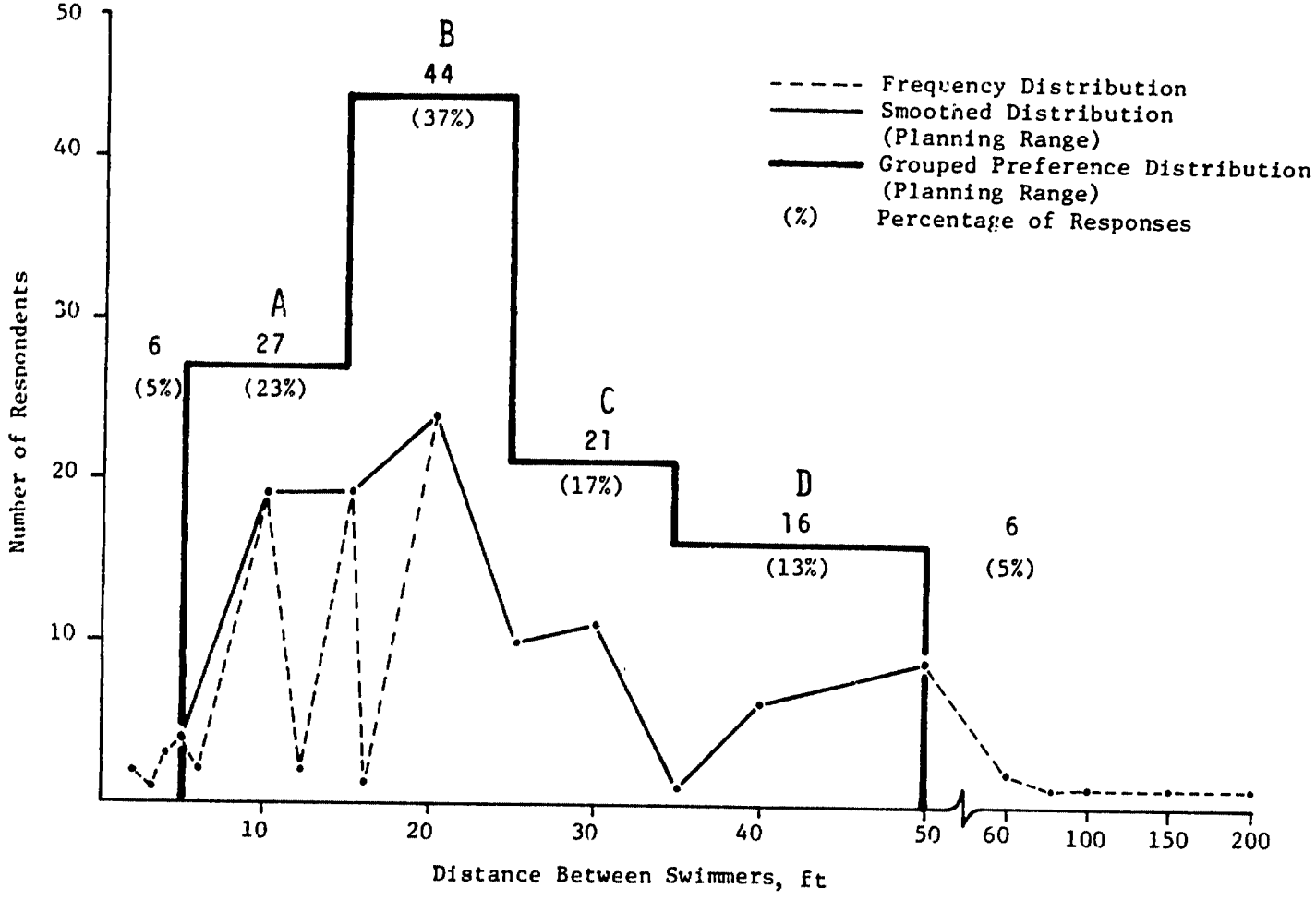


Figure 21: Preferred distances for swimming (frequency distribution, smoothed distribution, and grouped distribution)

Table 75

Preferred Distance Responses of Swimmers
in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (5'-50')	Percent in Preference Group			
		A (5'-14')	B (15'-24')	C (25'-34')	D (35'-50')
All Swimmers	90	25	41	19	15
Barkley *	100	33	67	0	0
Benbrook**	67	50	0	50	0
Hartwell	-	-	-	-	-
McNary	92	4	17	26	52
Milford	90	37	19	26	19
New Hogan	-	-	-	-	-
Ouachita	100	46	31	0	23
Shelbyville	97	24	52	17	7
Shenango	75	0	33	67	0
Somerville§	0	0	0	0	0
Surry Mt.	100	44	31	25	0

* Based on five responses.
** Based on four responses..
§ Based on three responses.

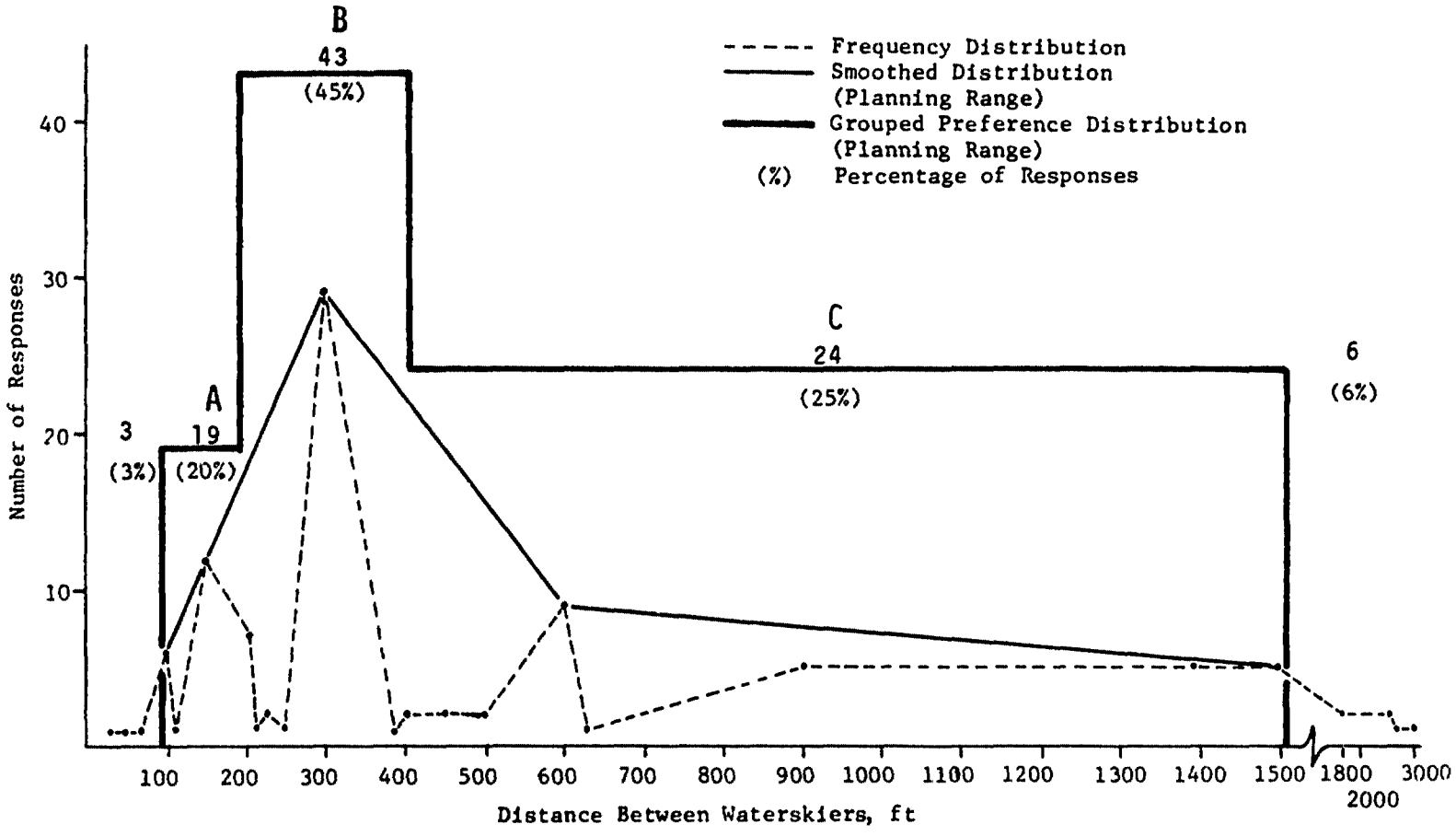


Figure 22: Preferred distances for waterskiing (frequency distribution, smoothed distribution, and grouped distribution)

Table 76

Preferred Distance Responses of Waterskiers
in the Planning Range and Preference Groupings

Sample	Percent in Planning Range (100'-1500')	Percent in Preference Group		
		A (100'-199')	B (200'-400')	C (401'-1500')
All Waterskiers	91	22	50	28
Barkley *	100	0	100	0
Benbrook	100	75	25	0
Hartwell	100	19	56	25
McNary	86	14	57	29
Milford	33	0	100	0
New Hogan	100	14	14	72
Ouachita	87	8	46	46
Shelbyville	86	42	46	13
Shenango*	50	0	100	0
Somerville	100	0	50	50
Surry Mt.**	100	33	67	0

* Based on two responses.
** Based on three responses.

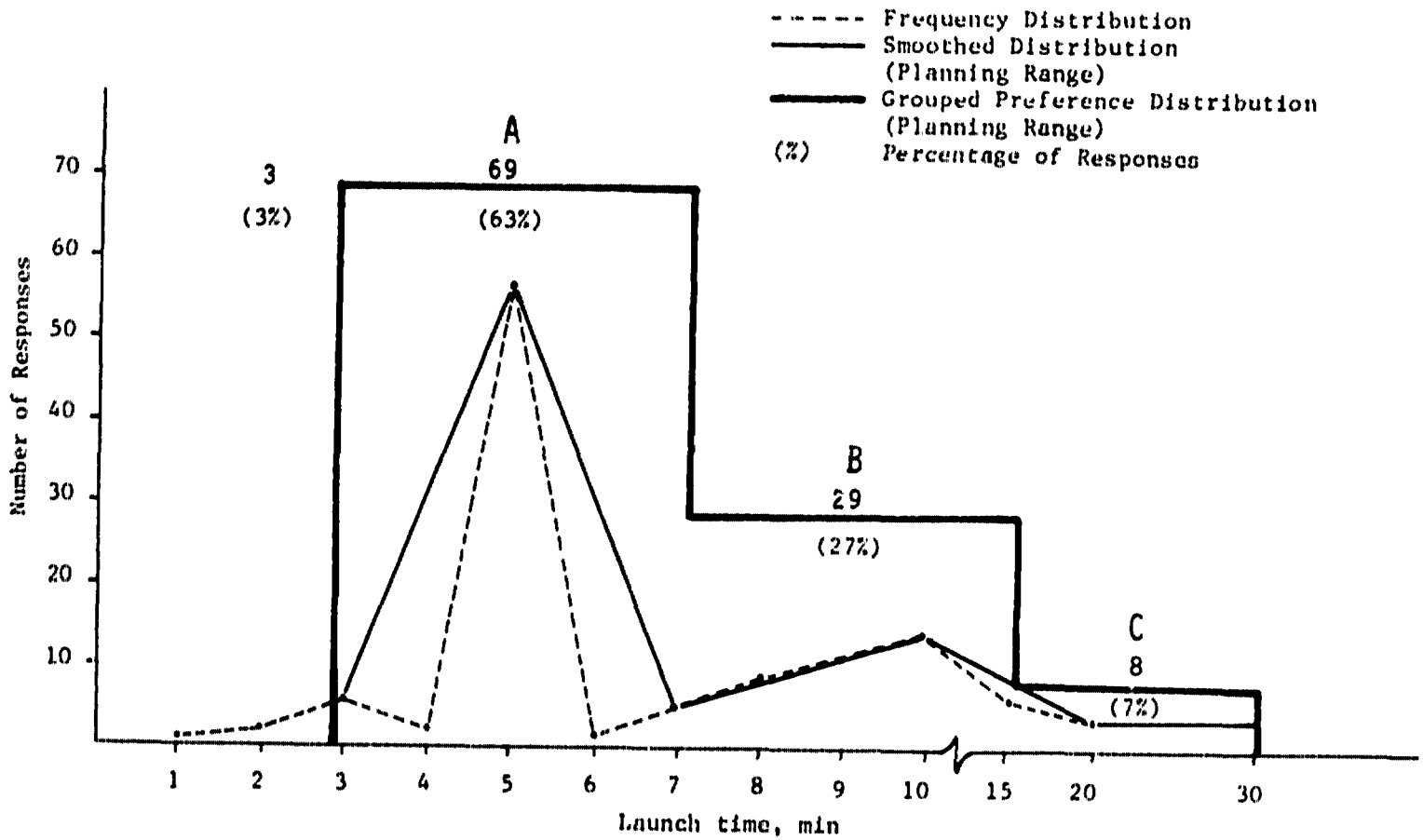


Figure 23: Preferred time for boat launching (frequency distribution, smoothed distribution, and grouped distribution)

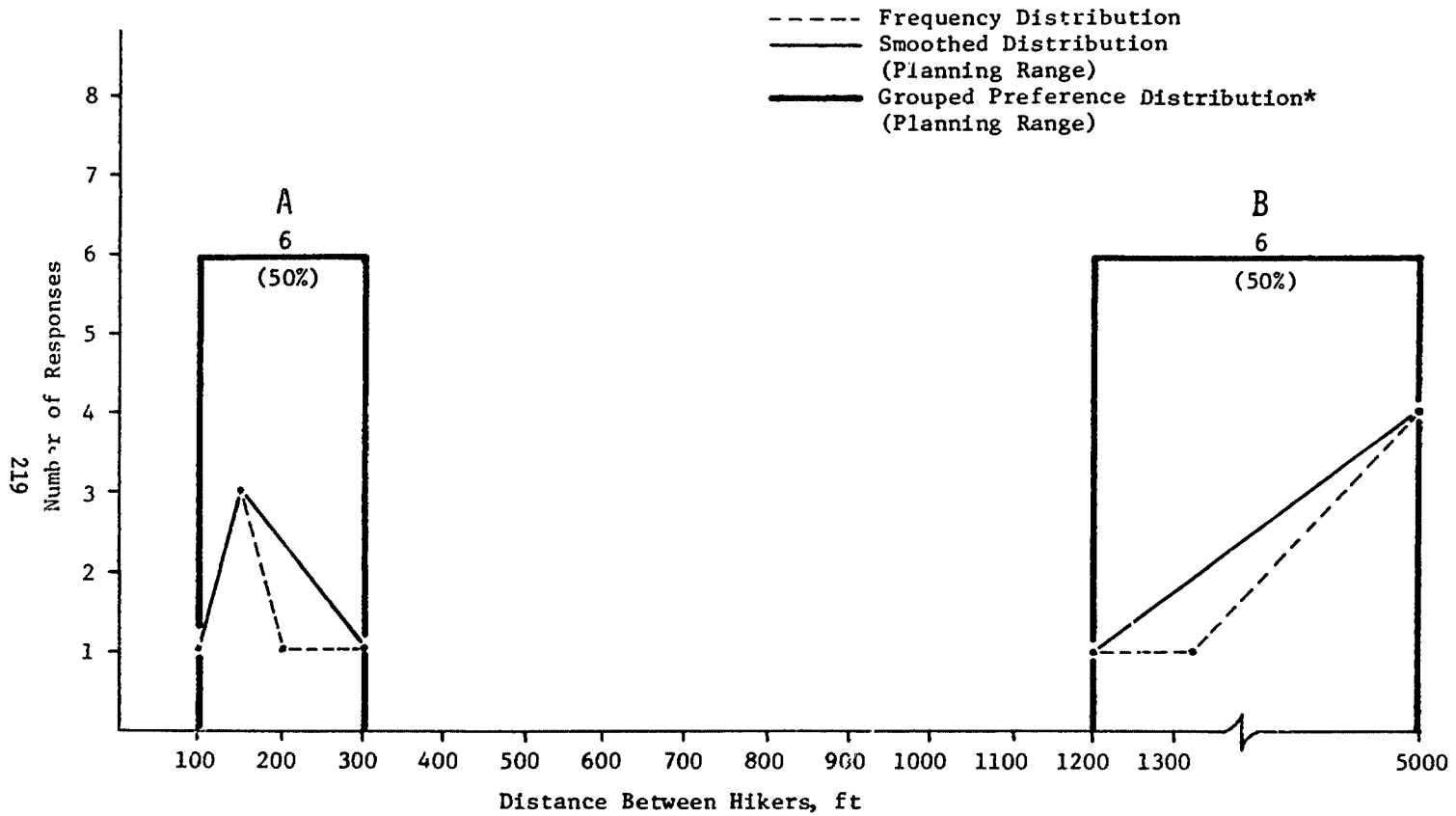


Figure 24: Preferred distances for hiking (frequency distribution, smoothed distribution, and grouped distribution)

*Although the preference distribution reveals two distinct preference groups, no common user or site characteristics were identified which support the two clusters. All the trails were basically the same, i.e. interpretive.

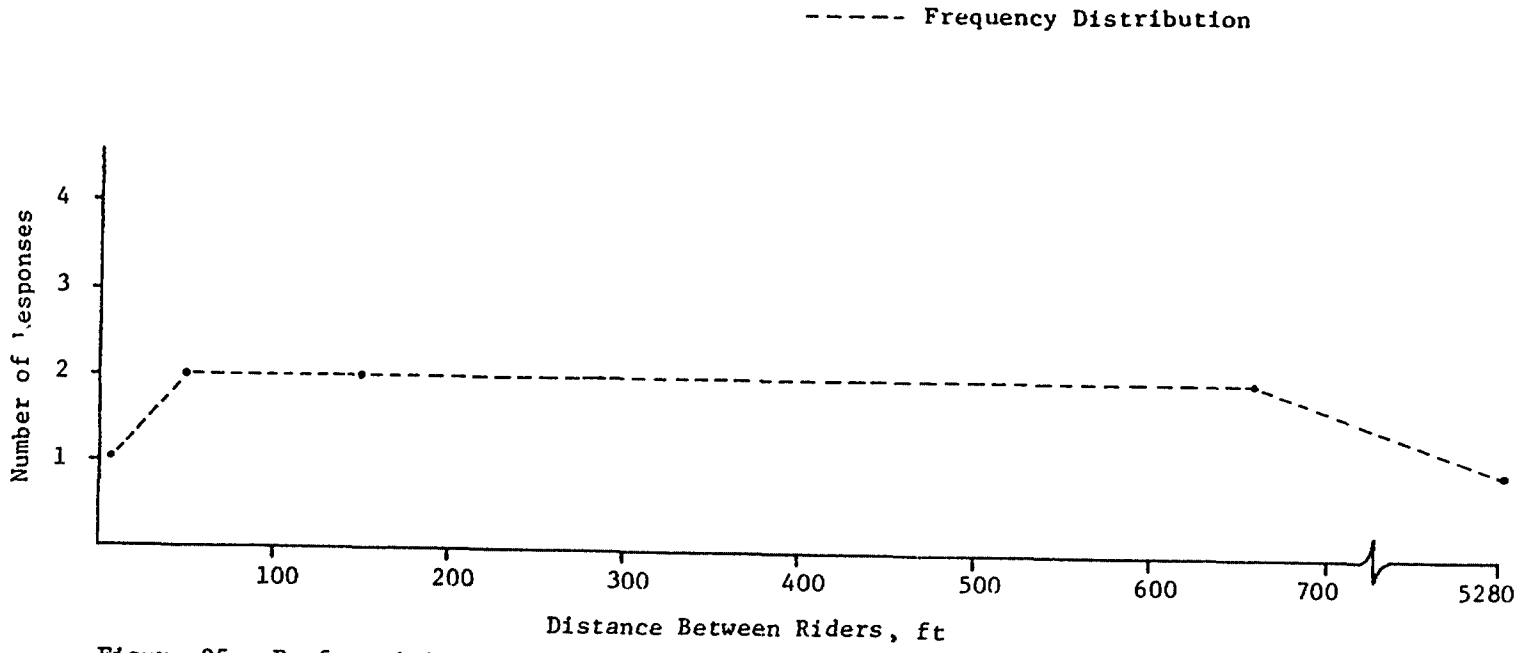


Figure 25: Preferred distances for off-road vehicle riding

* Although the preference distribution seems to suggest two distinct preference groups, no common user or site characteristics (e.g., riders in a group versus individual riders) were identified to explain this distribution.

Social capacity factors

291. Tables 77-84 indicate the social capacity factors, their relative importance, and their impact on social capacity for each activity based upon the user survey. The rationale for most of the factors can be explained by the following general statement: users are willing to trade off the utility derived from greater spacing for the utility derived from the factor. However, certain factors for some activities can undoubtedly be explained by other rationales noted in the paragraphs following the individual tables (Tables 77-84).

Using the user survey findings to develop social capacity guidelines

292. The user survey findings were used to develop the social capacity guidelines in Part VI as follows.

293. The preference distribution for each activity was used to define a planning range (the range of distances within which approximately 90 percent of the users in each activity indicated they preferred to be from other users) and several preference groupings.

294. For each activity, the mean of the preferred distance responses within the planning range was calculated. Next, the mean of the preferred distance responses was calculated for those users contained within each level of each factor tested. Then the variance of the factor level means from the mean for the activity was calculated (see page 239 for more information regarding this process). These variances were used to determine which factors influenced the preferences of users. Those which did were included in the social capacity factors tables in Part VI.

Table 77

Factors Affecting Social Capacity Based Upon the User Survey

Boating

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Type of boating area/boater§	++	N
Degree of control	0	N
Distance from highway access	0	
Level of development	0	
Amount/location of facilities	0	
Maintenance of facilities	0	
User Characteristic		
Number of other activities engaged in§	++	N
Experience of user§	++	N
Travel time§ to project area§	++	P
Age of user§	+	P
Group size§	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates a negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 295 to 300 for possible rationales.

295. Type of boating area/boater. Greater spacing is preferred by nonpower boaters. This may be because: (a) nonpower boats are more likely to be smaller, hence, more affected by the wakes of other boats, (b) sailboats require more area to maneuver, or (c) operators of nonpower boats may tend to seek solitude.

296. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

297. Experience of user. Greater spacing is preferred by boaters with less experience. This may be because: (a) boaters with little

experience prefer the added safety afforded by greater spacing, or (b) boaters with little experience have idealized expectations of spacing.

298. Travel time to project area. Greater spacing is preferred by boaters travelling from far away locations. This may be because: (a) users from nearby locations are willing to trade off the utility derived from greater spacing for the utility derived from shorter trip duration, (b) users from nearby locations go boating more often, hence, have lower expectations for spacing, or (c) users from far away locations have less opportunity to go boating during off-peak usage periods, hence, expect greater spacing to protect against overcrowding.

299. Age of user. Greater spacing is preferred by older users. This may be because: (a) users in different age groups prefer different levels of privacy or safety, or (b) users in different age groups may prefer the same levels of privacy or safety, but value spacing differently.

300. Group size. Greater spacing is preferred by users in

Table 78

Factors Affecting Social Capacity Based Upon the User Survey

Boat Fishing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Amount/location of facilities	++	N
Catching fish	++	N
Degree of control	+	N
Maintenance of facilities	0	
Distance from highway access	0	
User Characteristic		
Number of other activities§	++	N
Equipment§	++	P
Group Size§	++	N
Experience§	++	N
Age§	++	N
Travel time§	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 301 to 306 for possible rationales.

smaller groups. This may be because: (a) groups of different sizes may prefer different levels of privacy, or (b) smaller groups may tend to be in smaller boats, hence, prefer the safety afforded by greater spacing.

301. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

302. Equipment. Greater spacing is preferred by boat fishermen using boats with more powerful engines (>25 hp). This may be because boat fishermen using boats with more powerful engines: (a) require more lake surface to maneuver, or (b) are more likely to be seeking solitude.

303. Group size. Greater spacing is preferred by users in smaller groups. This may be because: (a) groups of different sizes may prefer different levels of privacy, or (b) smaller groups may tend to be in smaller boats, hence, prefer the safety afforded by greater spacing.

304. Experience of user. Greater spacing is preferred by boat fishermen with less experience. This may be because boat fishermen with greater experience: (a) have less idealized expectations for spacing, or (b) are less likely to be seeking solitude.

305. Age of user. Greater spacing is preferred by younger boat fishermen. This may be because younger boat fishermen: (a) have relatively less experience, or (b) are more likely to be seeking solitude.

306. Travel time to project area. Greater spacing is preferred by boat fishermen who are from relatively nearby locations. This may be because: (a) boat fishermen from nearby locations may have a greater opportunity to boat fish during off-peak times, hence, have their expectations influenced by off-peak spacing, or (b) boat fishermen from far away locations have less opportunity to select a fishing location, or have less knowledge of better locations and select locations where other boat fishermen have anchored.

Table 79

Factors Affecting Social Capacity Based Upon the User Survey

Camping

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Accessibility to water body§	++	P
Visibility of water body§	++	P
Slope of land§	++	P
Level of development	++	
Distance from highway access	+	P
Maintenance of facilities	+	N
Degree of control	+	N
Vegetation§	+	P
Condition of trees/grass	+	N
Amount/location of facilities	+	N
Proximity to other activity areas	0	
User Characteristic		
Age§	++	N
Travel time§	++	N
Group size§	++	P
Number of other activities§	++	P
Equipment§	++	N
Experience§	+	P, N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

P,N indicates the factor could have either a positive or negative relationship.

§ See paragraphs 307 to 316 for possible rationales.

307. Accessibility to water body. Greater spacing is preferred where accessibility is greater. This may be because: (a) sites adjacent to sites with accessibility also are likely to have accessibility, hence, are more likely to be occupied, or (b) the slope of the lakeshore may decrease the amount of usable space.

308. Visibility of water body. Greater spacing is preferred where visibility is greater. This may be because: (a) sites adjacent to sites with visibility also are likely to have visibility, hence, are

more likely to be occupied, or (b) the slope of the lakeshore may decrease the amount of usable space.

309. Slope of the land. Greater spacing is preferred where slopes are steeper. This may be because steeper slopes decrease the amount of usable space.

310. Vegetation. Greater spacing is preferred where vegetation is more dense. This may be because: (a) campers prefer the space occupied by vegetation to be usable space, (b) vegetation may be perceived as curtailing ventilation and harboring insects and other pests, or (c) vegetation may limit visibility of scenic views.

311. Age of user. Greater spacing is preferred by younger campers. This may be because: (a) campers in different age groups prefer different levels of privacy, or (b) campers in different age groups prefer the same level of privacy, but value spacing differently.

312. Travel time to project area. Greater spacing is preferred by campers travelling from nearby locations. This may be because nearby users have greater site selection opportunities, hence, higher expectations of spacing.

313. Group size. Greater spacing is preferred by larger groups. This may be because: (a) larger groups may require more usable space, or (b) groups of different sizes prefer different levels of privacy.

314. Number of other activities. Greater spacing is preferred by users participating in a greater number of activities. This may be because users participating in a greater number of other activities require more space to store the equipment used in other activities.

315. Equipment. Greater spacing is preferred by tent campers than by campers using trailers, vans, and campers. This may be because: (a) tent campers may prefer a different level of privacy, (b) tent campers may typically be younger, or (c) tent campers may require more usable space outside of the area occupied by the tent because of the fewer facilities and activities which can be conducted in a tent.

316. Experience of user. Greater spacing is preferred by campers who did not go camping at all the previous year and by campers who went camping 11 or more times the previous year. This may be because

expectations for spacing are based on prior experiences: (a) campers with little or no experience have idealized expectations, (b) campers with some experience have expectations based on typical spacing, and (c) campers with a great deal of experience have expectations based on their best experiences (when spacing was greatest).

Table 80

Factors Affecting Social Capacity Based Upon the User Survey

Picnicking

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Type of vegetation	++	N
Amount/location of facilities	++	N
Proximity to other activity areas	+	
Accessibility to water body§	+	P
Degree of control§	+	N
Visibility of water body§	+	P
Maintenance of facilities	0	
Level of development	0	
Distance from highway access	0	
Slope of the land§	0	
User Characteristic		
Number of other activities§	++	N
Group size§	++	P
Age	+	P
Experience§	+	N
Travel time to project area§	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 317 to 323 for possible rationales.

317. Accessibility to water body. Greater spacing is preferred where accessibility is greater. This may be because: (a) sites adjacent to sites with accessibility also are likely to have accessibility, hence, are more likely to be occupied, or (b) the slope of the lakeshore may decrease the amount of usable space.

318. Visibility of water body. Greater spacing is preferred where visibility is greater. This may be because: (a) sites adjacent to sites with visibility also are likely to have visibility, hence, are more likely to be occupied, or (b) the sloped terrain which may afford visibility may decrease the amount of usable space.

319. Slope of the land. Greater spacing might be preferred where slopes are steeper. Level picnic areas provide a higher percentage of usable area.

320. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

321. Group size. Greater spacing is preferred by larger groups. This may be because: (a) larger groups may require more usable space, or (b) groups of different sizes prefer different levels of privacy.

322. Experience of user. Greater spacing is preferred by picnickers who seldom went picnicking the previous year. This may be because: (a) picnickers who seldom go picnicking have idealized expectations of spacing, or (b) picnickers who seldom go picnicking prefer greater levels of privacy.

323. Travel time to project area. Greater spacing is preferred by picnickers travelling from nearby locations. This may be because nearby users have greater site selection opportunities, hence, higher expectations of spacing.

Table 81

Factors Affecting Social Capacity Based Upon the User Survey

Shoreline Fishing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Degree of control	++	N
Catching fish	++	
Amount/location of facilities	+	N
User Characteristic		
Age§	++	P
Experience§	++	P
Group size§	+	N
Travel time	+	P
Number of other activities§	0	

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 324 to 327 for possible rationales.

324. Age of user. Greater spacing is preferred by older users. This may be because: (a) users in different age groups prefer different levels of privacy or safety, or (b) users in different age groups may prefer the same levels of privacy or safety, but value spacing differently.

325. Experience of user. Greater spacing is preferred by shoreline fishermen with more experience. This may be because shoreline fishermen with more experience prefer greater levels of privacy.

326. Group size. Greater spacing is preferred by small groups of shoreline fishermen (1-2). This may be because small groups of shoreline fishermen prefer greater levels of privacy.

327. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to

experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

Table 82

Factors Affecting Social Capacity Based Upon the User Survey

Sunbathing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Level of development	++	N
Degree of control	++	N
Amount/location of facilities	++	N
Water quality	++	N
Maintenance of facilities	+	N
Slope	0	
Distance from highway access	0	
User Characteristic		
Number of other activities§	++	P
Travel time	++	P
Group size§	++	P
Experience§	++	N
Age§	+	P

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 327 to 331 for possible rationales.

328. Number of other activities. Greater spacing is preferred by users participating in a greater number of activities. This may be because users participating in a greater number of other activities require more space to store the equipment used in other activities.

329. Group size. Greater spacing is preferred by larger groups. This may be because: (a) larger groups may require more usable space, or (b) groups of different sizes prefer different levels of privacy.

330. Experience of user. Greater space is preferred by sunbathers with relatively less experience. This may be because sunbathers with little experience: (a) have idealized expectations for spacing, or (b) prefer greater privacy.

331. Age of user. Greater spacing is preferred by older users. This may be because: (a) users in different age groups prefer different levels of privacy or safety, or (b) users in different age groups may prefer the same levels of privacy or safety, but value spacing differently.

Table 83

Factors Affecting Social Capacity Based Upon the User Survey

Swimming

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Degree of control	0	
Amount/location of facilities	0	
Water quality	0	
User Characteristic		
Age§	++	N
Number of other activities§	+	N
Group size§	+	N
Travel time	0	

* ++ = very important, + = moderately important, 0 = minor to no importance.

** N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 332 to 334 for possible rationales.

332. Age of user. Greater spacing is preferred by younger swimmers. This may be because younger swimmers are more active in the water.

333. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

334. Group size. Greater spacing is preferred by swimmers in smaller groups. This may be because swimmers in different sized groups: (a) prefer different levels of privacy, or (b) are active to different degrees in the water.

Table 84

Factors Affecting Social Capacity Based Upon the User Survey

Waterskiing

Social Capacity Factors	Relative Importance*	Impacts**
Site Characteristic		
Amount/location of facilities	++	N
Level of development	++	N
Degree of control	0	
Water quality	0	
Distance from highway access	0	
Maintenance of facilities	0	
User Characteristic		
Travel time§	++	P
Number of other activities§	++	N
Experience§	+	N
Age§	+	P
Group size§	+	N

* ++ = very important, + = moderately important, 0 = minor to no importance.

** P indicates positive relationship. As the level/amount of the factor increases, the spacing preferred by users increases.

N indicates negative relationship. As the level/amount of the factor increases, the spacing preferred by users decreases.

§ See paragraphs 335 to 339 for possible rationales.

335. Travel time to project area. Greater spacing is preferred by waterskiers travelling from far away locations. This may be because: (a) users from nearby locations are willing to trade off the utility derived from greater spacing for the utility derived from shorter trip duration, (b) users from nearby locations go waterskiing more often, hence, have lower expectations for spacing, or (c) users from far away locations have less opportunity to go waterskiing during off-peak usage periods, hence, expect greater spacing to protect against overcrowding.

336. Number of other activities. Greater spacing is preferred by users who are participating in fewer other activities. This may be because: (a) users who are participating in a greater number of activities have alternative recreational opportunities, hence, are willing to experience closer spacing, or (b) users participating in more activities may be less likely to be recreating to seek solitude.

337. Experience of user. Greater spacing is preferred by waterskiers who seldom went waterskiing the previous year. This may be because: (a) waterskiers with little experience prefer the added safety afforded by greater spacing, or (b) waterskiers with little experience have idealized expectations of spacing.

338. Age of user. Greater spacing is preferred by older users. This may be because: (a) users in different age groups prefer different levels of privacy or safety, or (b) users in different age groups may prefer the same levels of privacy or safety, but value spacing differently.

339. Group size. Greater spacing is preferred by users in smaller groups. This may be because: (a) groups of different sizes may prefer different levels of privacy, or (b) smaller groups may tend to be in smaller boats, hence, prefer the safety afforded by greater spacing.

PART VI: CARRYING CAPACITY GUIDELINES

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PART VI: CARRYING CAPACITY GUIDELINES

Introduction

Purpose of these guidelines

340. The guidelines presented in this Part are intended to be a systematic and easy-to-use method for determining the recreational carrying capacities of individual activity areas in the field. They are based on the management and user survey findings described in Part V. The guidelines can be used at all stages of providing recreational opportunities: planning, site design and development, and administration and operations. Examples of how the guidelines can be used to aid in making different types of planning and management decisions are included in Part VIII.

341. In planning, the guidelines presented in this part can be used to:

a. Evaluate alternative sites and choose the most appropriate size and character of a site with capacity considerations in mind.

b. Predetermine or reevaluate the optimum levels of use in various areas of selected sites, evaluate the suitability of an area for different activities, and examine early in the planning process the implications of exceeding carrying capacities.

342. In site design and development, the guidelines presented in this part can be used to:

a. Assign activities to areas according to the relevant natural assets and limitations.

b. Determine the suitable proximity and level of interrelationship between different activity areas.

c. Design with management objectives and costs in mind.

d. Balance the capacity of recreation areas with the capacity of their respective support facilities.

343. In administration and operations, the guidelines presented in this part can be used to:

a. Determine appropriate use levels in order to assess the need to encourage, discourage, or restrict usage or to

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expand or diminish capacity levels, both at recreation areas and at their respective support facilities.

b. Make more realistic estimates of usership when actual user counts cannot be made.

c. Serve as a basis for a program of continued evaluation of the carrying capacities of individual areas.

Organization

344. The remainder of this part contains two sections: (a) Social Capacity Guidelines and (b) Resource Capacity Guidelines. Each section is one major step in the method for determining the overall carrying capacity for an area. The system has been developed to provide a workable process for guiding decisionmaking, not as a cure-all for dealing with the complex considerations involved in selecting carrying capacities.

Social Capacity Guidelines

Introduction

345. The social capacity guidelines are presented as a method for determining the distance/density levels that users prefer. However, these preferences may not incorporate all of the factors which have an impact on other users or on the resource base. Therefore, the social capacity guidelines developed by this system should always be evaluated with respect to the resource capacity guidelines and other considerations.

The system

346. Based on the results of the user survey, a preference distribution and a social capacity factors table have been developed for each of the study activities (see pages 245 to 255).

347. The preference distribution for each activity defines a planning range: the range of distances within which the majority of users have indicated they prefer to be from other users (see Figure 26). Each preference distribution is made up of several preference groupings. Each grouping identifies the percentage of users who prefer

to be in the distance range of that grouping.* In Figure 26, preference grouping A illustrates that 25 percent of users within the planning range prefer spacing of 1 to 2 units; preference grouping B illustrates that 20 percent of users prefer spacing of 2 to 4 units; preference grouping C illustrates that 30 percent of users prefer spacing of 4 to 6 units; and preference grouping D illustrates that 25 percent of users prefer spacing of 6 to 8 units of distances.

348. The preference distribution for each activity illustrates a planning range and preference groupings as generalized for all values of the different factors which influence the spacing preferences of users. Thus, it does not provide a "best" or "final" distribution. Rather, it serves as a tool to help determine the social capacity for an individual activity area within a project area. In order to tailor the preference distribution to an individual activity area, one must utilize the factors table.

349. The factors table (see Figure 27) for each activity is a list of site characteristics and user characteristics which have been determined (as a result of the user survey) to affect the spacing preferences of users. For each activity, the mean of the preferred distance responses within the planning range was calculated (boating: 462.4 ft; boat fishing: 360 ft; camping: 59.2 ft; picnicking: 52.8 ft; shoreline fishing: 39.1 ft; sunbathing: 21.6 ft; swimming: 21.6 ft; and waterskiing: 402.6 ft). Next, the mean of the preferred distance responses within the planning range for those users contained within each level of each factor tested was calculated (e.g., boating, age: <26: 425.6 ft; 26 to 55: 464.5 ft; and >55: 461.1 ft). Then, the variance of the factor level means from the mean for the activity was calculated (e.g., boating, age: <26: -36.8 ft (425.6 - 462.4); 26 to 55: +12.1 ft (374.5 - 462.4); and >55: -1.3 ft (461.1 - 462.4)). Finally, the variances were rounded off. For activities where the planning range did not exceed 100 ft, variances were rounded to the nearest foot. For

* The user survey revealed that more than one preference grouping existed at all activity areas where a significant number of users were surveyed. (See Part V for project area findings.)

activities where the planning range exceeded 100 ft, variances were rounded to the nearest 5 ft (e.g., boating, age: <26: -35 ft; 26 to 55: +10 ft; and >55: 0 ft). Levels of factors were combined when the variances were equal or when necessary to increase the sample size.

350. Each factor has different levels, each of which is defined in either the table or in Appendix D (e.g., in Figure 27, the factor Level of Development has three levels: "High," "Moderate," and "Limited").

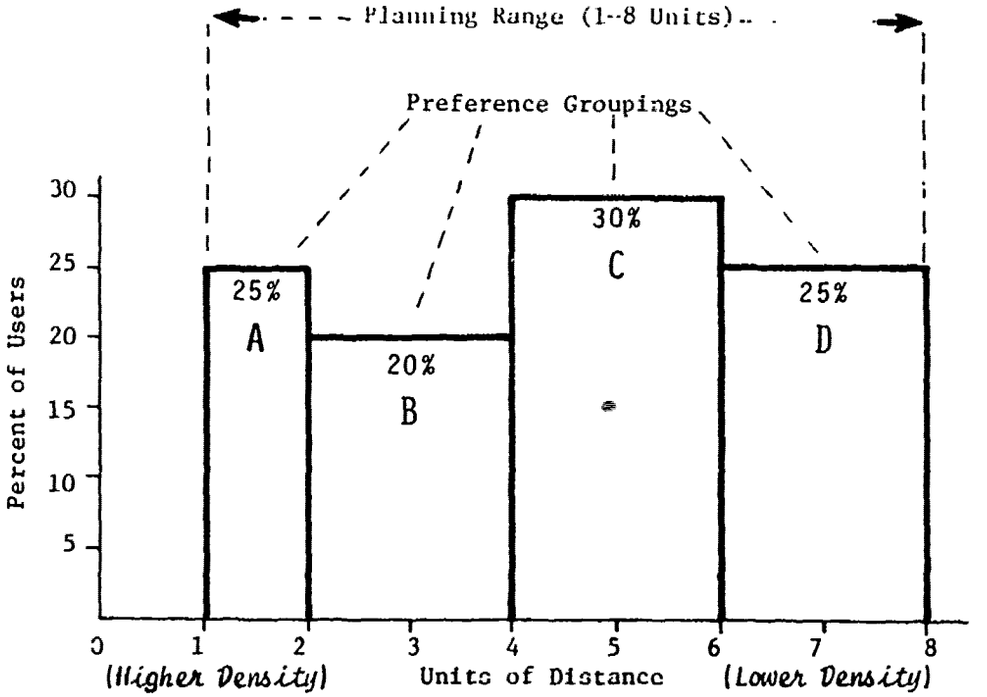


Figure 26: Example of preference distribution

Site Characteristics	Variance	User Characteristics	Variance
Level of Development		Age of Users	
High	-2	<25 (20%)	+2
Moderate	0	26-55 (65%)	0
Limited	+1	56+ (15%)	-1
Distance from Highway Access		Travel Time to Project Area	
0-5 miles	-1	<30 min (40%)	0
>5 miles	+2	>30 min (60%)	+2
Maintenance of Facilities		Number of Other Activities Engaged In	
Pleasant	0	1-3 (65%)	0
Unpleasant	+1	4+ (35%)	+1

Figure 27: Example of social capacity factors table

351. The percentage of users which make up the preference distribution in each factor level has been included in the table for all of the user characteristics (e.g., in Figure 27, 65 percent of the users surveyed participated in 1 to 3 other activities and 35 percent participated in 4 or more activities).

352. Each factor level has a variance value, which is the number of the units of distance which that factor level will shift the preference distribution (e.g., in Figure 27, a "High" level of development has a variance value of -2).

Using the system

353. The system for determining the social capacity guidelines of an activity area consists of five steps.

354. Step 1 - Acquire the necessary information. After becoming familiar with the system, acquire the information needed to utilize the system. Use the factors tables included in this part and the social capacity factors in Part V as guides for collection of information. Information on site characteristics should pertain to the area as it is expected to be finally developed, not as it exists before development. The following is an example of a format for listing the hypothetical observed condition for each factor listed in Figure 27:

Factors	Observed Conditions (Step 1)	Effect of Ooserved Condition (Step 2)
Site Characteristics		
Level of Development	High	
Distance from Highway Access	2 miles	
Maintenance of Facilities	Pleasant	
(etc.)		
User Characteristics		
Age	All Ages	
Travel Time	90% will travel >1 hr	
Number of Other Activities	50% will do 4+ activities	
(etc.)		

355. Step 2 - Determine the effect of the observed condition. First, compare the observed condition of each site characteristic with the levels of each site characteristic included in the factors table. Select the level which best represents the observed condition, and identify the variance value for each level selected (see example below). Then review the list of user characteristics in the factors table, and note the percentage of users in each factor level. From these percentages, determine if the observed condition for each user characteristic differs significantly from the users whose preferences make up the preference distribution. When they are significantly different, select the factor level which best corrects the difference and identify the variance value for each factor level so selected.* For example, if the factor table in Figure 27 is used, the following variance values are obtained:

Factors	Observed Conditions (Step 1)	Effect of Observed Conditions (Step 2)
Site Characteristics		
Level of Development	High	-2
Distance from Highway Access	2 miles	-1
Maintenance of Facilities	Pleasant	0
User Characteristics		
Age	All Ages	—
Travel Time	90% will travel 1 hr	+2
Number of Other Activities	50% will do 5+ activities	—
	Net Effect (Step 3)	-1

356. Step 3 - Modify the preference distribution. First, total the variance values identified for each observed conditions to obtain the net effect (-1 in the example above). Then, modify the preference distribution to reflect this net effect by shifting the preference distribution the number of distance units equal to the net effect. A positive net effect will shift the preference distribution to the right (to greater

* See demonstration, pages 313 to 325, for examples of this procedure.

spacing and lower density), while a negative net effect will shift the preference distribution to the left (to smaller spacing and higher density). For example, shifting the preference distribution illustrated in Figure 26 by the net effect of the factors of the above example (-1) would produce the following modified preference distribution (Figure 28). Because the net effect can shift the preference groupings in such a way that they are no longer realistic (e.g., if all of group A falls below 0), the guidelines should always be evaluated.

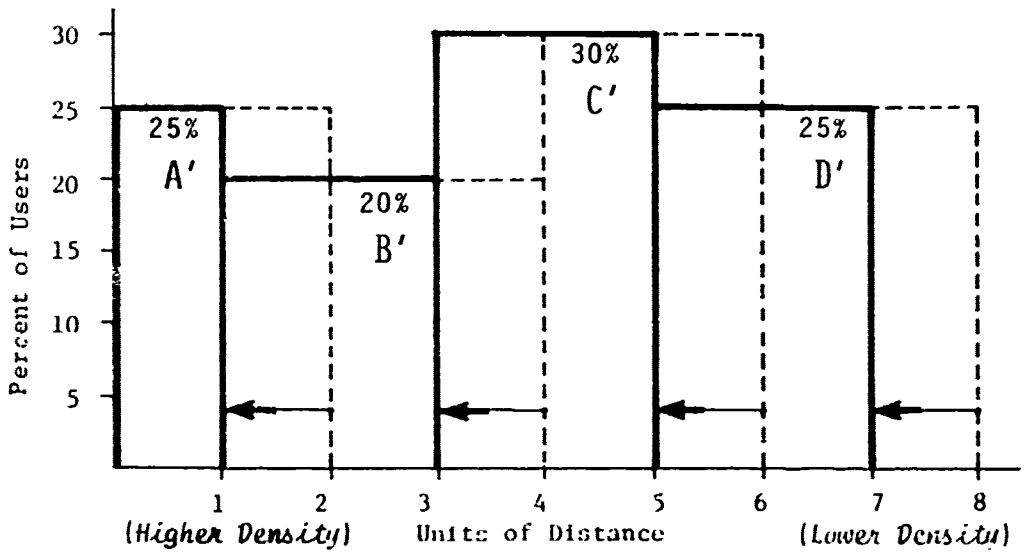


Figure 28: Modified preference distribution

357. Step 4 - Establish distance/density guidelines. Select a midpoint in the distance range of each modified preference grouping to serve as a distance guideline. Table 86 on page 256 summarizes the planning range and preference grouping ranges and midpoints for each activity. Our example yields distance guidelines of 1/2, 2, 4, and 6 units. It is important to recognize that the system will yield a guideline that will satisfy the preferences of each preference grouping. Thus, in our example, 25 percent of the users will prefer spacing of 1/2 unit, 20 percent will prefer 2 units, 30 percent will prefer 4 units, and 25 percent will prefer 6 units. Ideally, areas should be developed to meet these preferences.

358. These distance guidelines can easily be converted to area guidelines by squaring the distance guideline (e.g., 4 units^2 = 4 x 4 = 16 square units). These area guidelines can easily be converted to density guidelines by dividing the area guidelines into one unit of area (e.g., 1 square unit ÷ 16 square units per user = 0.0625 users per square unit). A distance/area/density conversion table is provided in Appendix F. These area/density guidelines do not include the area required by roads, support facilities, etc.

359. Step 5 - Evaluate the distance/density guidelines. Evaluate the guidelines to determine if they are acceptable based upon prior experience. If the guidelines seem unacceptable, review the list of factors used and determine if certain factors need to be included or excluded. Determine if the guidelines are acceptable based on the resource capacity of the area. This evaluation is outlined in the "Resource Capacity Guidelines" section of this Part.

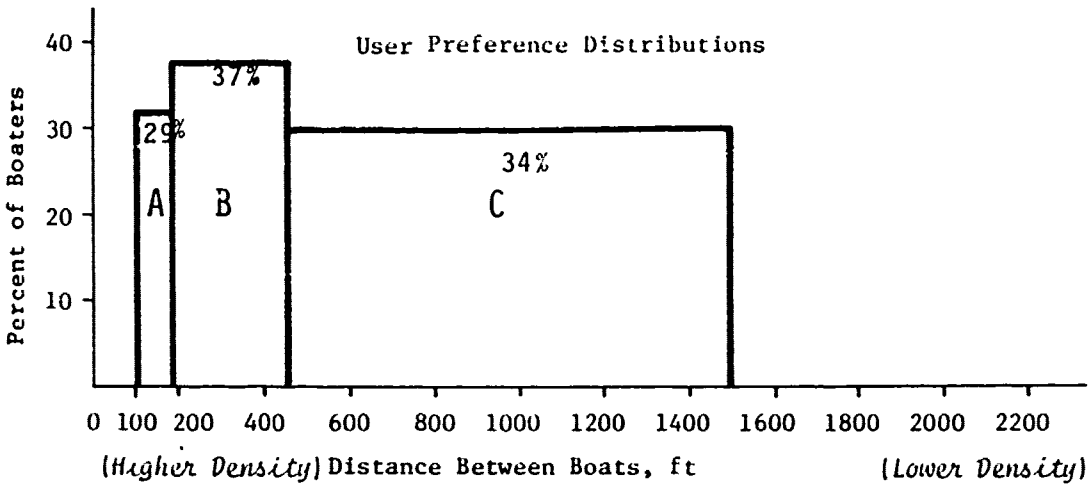
360. Determine if the guidelines are acceptable for meeting projected recreational demand. If the guidelines seem unacceptable, evaluate different development and management strategies for modifying the social capacity of the area to meet demand, and evaluate the implications of not meeting projected demand.

361. After an area has been developed, project management should implement a system to monitor social and resource capacity. Such a monitoring system is described in Part IX.

Social capacity guidelines by activity

362. Figures 29-39 present, respectively, a preference distribution and social capacity factors table for: boating, boat fishing, boat launching, camping, hiking, off-road vehicle riding, picnicking, shoreline fishing, sunbathing, swimming, and waterskiing. These figures provide the tools necessary for addressing social capacity as previously outlined in this Part.

Boating

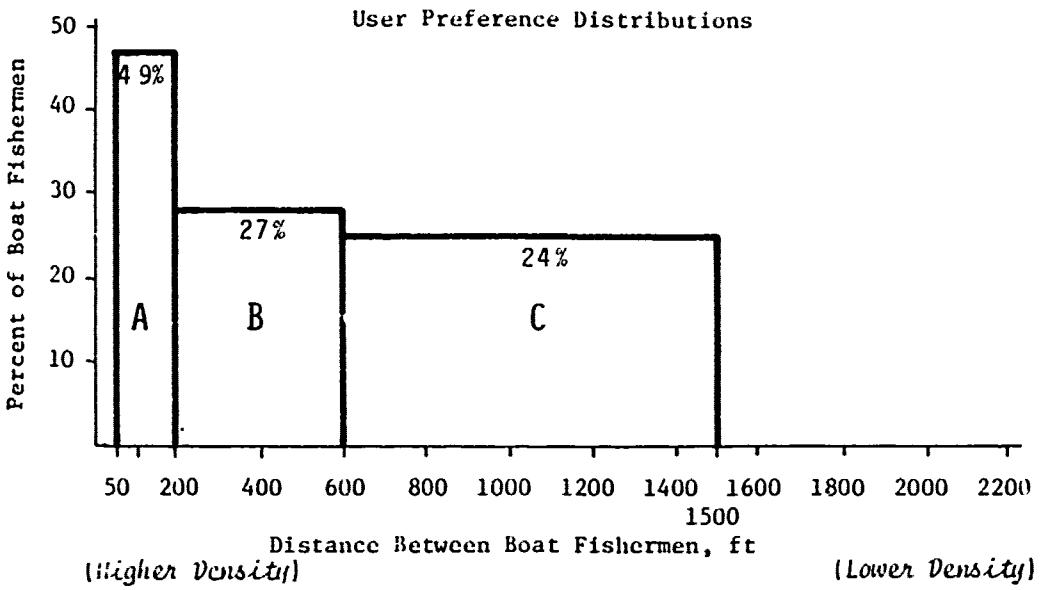


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Type of Area/Boat		Number of Other Activities	
Power	-35	<3 (48%)	+ 36
Nonpower	+156	>3 (52%)	- 65
		Experience	
		None/Little (25%)	+ 60
		Some (22%)	- 10
		Much (53%)	- 25
		Travel Time	
		<30 min (39%)	- 40
		>30 min (61%)	+ 25
		Age	
		<26 (22%)	- 35
		26-55 (70%)	+ 10
		>56 (8%)	0
		Group Size	
		1-2 (17%)	- 20
		>2 (83%)	+ 5

Figure 29: Preference distribution and social capacity factors table for boating

Boat Fishing

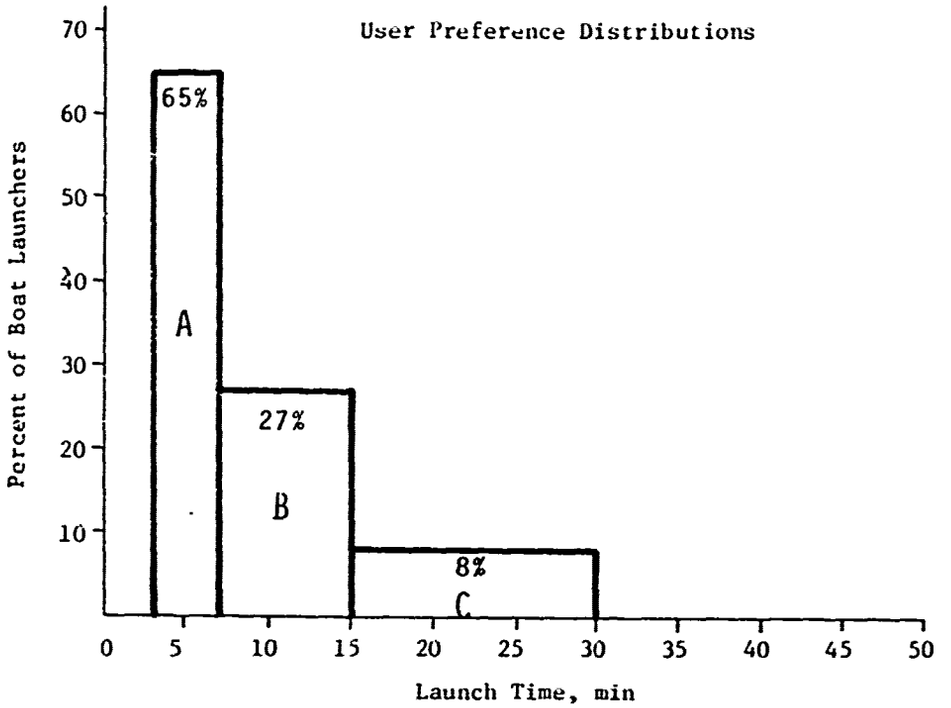


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Amount/Location of Facilities		Number of other Activities	
Pleasant	- 45	<1 (24%)	+195
Unpleasant	+450	2-3 (39%)	- 10
		>3 (37%)	-215
Degree of Control		Equipment	
High	-165	Power Boat ≤25hp (31%)	-115
Mod . 'Low	+ 15	Power Boat >25hp (69%)	+ 70
Catching Fish		Group Size	
Pleasant	- 65	1-2 (54%)	+ 70
Unpleasant	+105	>2 (46%)	- 85
		Experience	
		None/Little/Some (31%)	+100
		Much (69%)	- 45
		Age	
		<26 (15%)	-100
		26-55 (65%)	+ 40
		>55 (20%)	- 55
		Travel Time	
		≤1 hr (53%)	+ 35
		>1 hr (47%)	- 40

Figure 30: Preference distribution and social capacity factors table for boat fishing

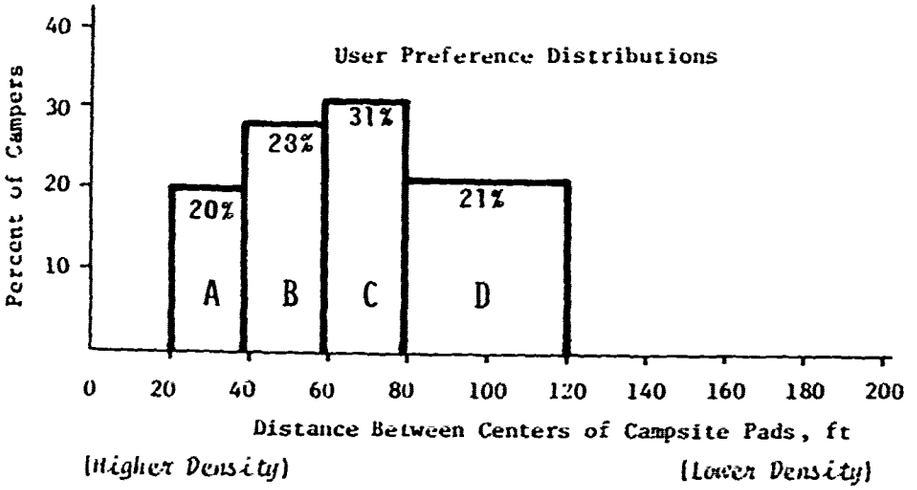
Boat Launching



(Because of the uniformity of launch time responses, i.e., 65 percent of responses between 3 to 7 min), a factor table has not been developed for boat launching. For a listing of factors which may affect the social capacity of launch ramps, see Table 48, page 183.)

Figure 31: Preference distribution and social capacity factors table for boat launching

Camping



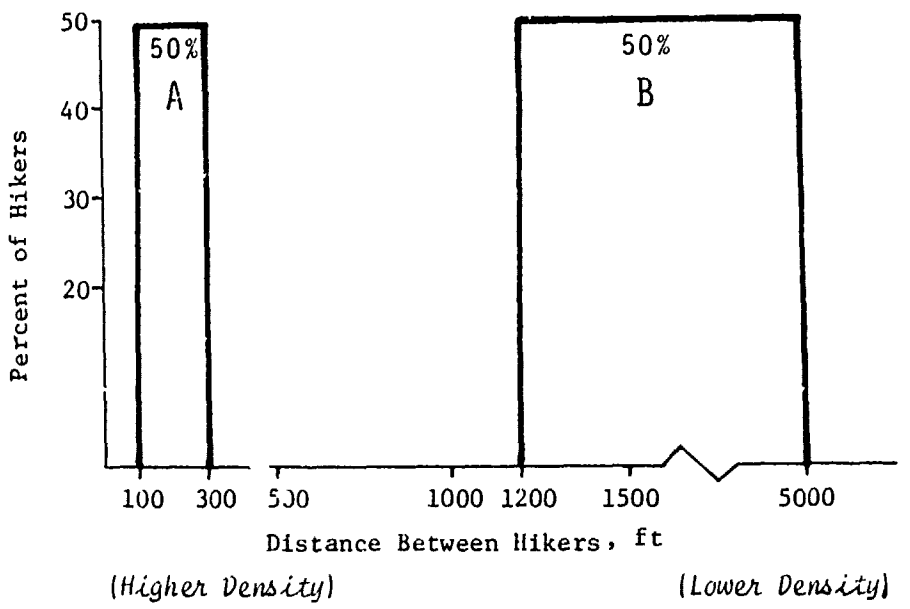
Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Accessibility to Waterbody		Age	
Obstructed	-8	<26 (15%)	+6
Unobstructed	+6	26-55 (69%)	0
Visibility of Water Body		>55 (16%)	-7
Obstructed	-7		
Unobstructed	+6	Travel Time	
Slope		<30 min (17%)	+12
Level (0-5%)	-3	30 min-1 hr (27%)	+2
Moderate (5-10%)	+7	>1 hr (56%)	-1
Level of Development		Group Size	
High	-5	1-2 (26%)	-3
Moderate/Limited	+3	3-8 (65%)	+1
Distance from Highway Access		>8 (9%)	+5
0-5 miles	-1	Number of Other Activities	
>5 miles	+5	1-3 (42%)	-4
Maintenance of Facilities		>3 (58%)	+3
Pleasant	0	Equipment	
Unpleasant	+4	Tent (28%)	+5
Degree of Control		Campers, Trailers, Vans, etc. (72%)	-2
High	-1		
Moderate.Limited	+3	Experience	
Vegetation		None (11%)	+1
Open	-3	Little/Some (61%)	-1
Moderate/Dense	+1	Much (28%)	+1
Condition of Trees/Grass			
Pleasant	0		
Unpleasant	+2		
Amt/Location of Facilities			
Pleasant	0		
Unpleasant	+1		

Figure 32: Preference distribution and social capacity factors table for camping

Hiking

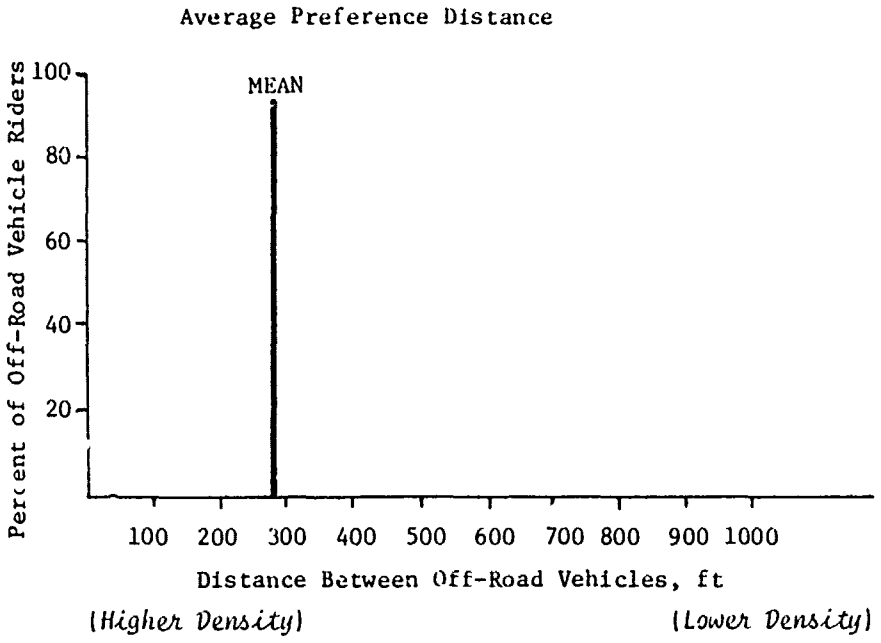
User Preference Distributions



Because of the low number of preferred distance responses from hikers, a factors table has not been developed for hiking. For a listing of factors which may affect the social capacity of hiking trails, see page 185. (See also, Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity, URDC (1977)).

Figure 33: Preference distribution and social capacity factors table for hiking

ORV Riding

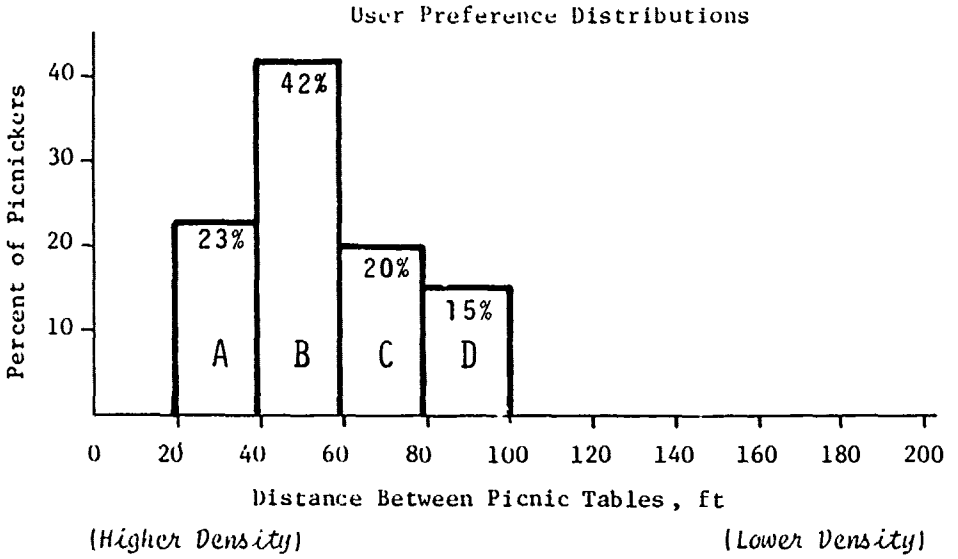


(Because of the low number of preferred distance responses from off-road vehicle riders, a Preference Distribution has not been developed (see page 220). Instead, the mean of the preferred distance responses is provided.)

(Also, because of the low number of preferred distance responses, a factors table has not been developed. For a listing of factors which may affect the social capacity of ORV trails and areas, see page 186. See also, Guidelines for Understanding and Determining Optimum Recreation Carrying Capacity, URDC (1977).

Figure 34: Preference distribution and social capacity factors table for off-road vehicle riding

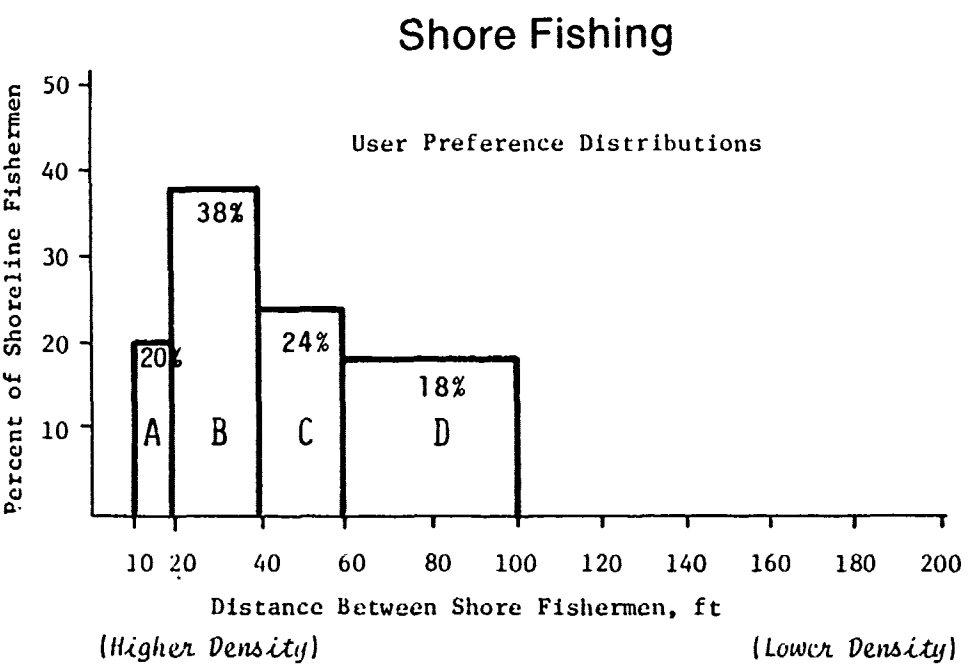
Picnicking



Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Vegetation		Number of other Activities	
Open	+2	1 (13%)	+10
Moderate	-3	>1 (87%)	-1
Dense	-9		
		Group Size	
Amount/Location of Facilities		1-2 (9%)	-5
		3-8 (71%)	0
Pleasant	-2	>8 (20%)	+1
Unpleasant	+5		
		Age	
Relationship to other Activity Areas		≤25 (21%)	-3
		>25 (79%)	+1
Adjacent	-1		
Separate	+4	Experience	
		None/Little (39%)	+2
Accessibility to Water Body		Some (27%)	-1
		Much (34%)	-2
Obstructed	-3		
Unobstructed	+2	Travel Time	
		≤30 min (53%)	+2
Degree of Control		>30 min (47%)	-2
High	-3		
Moderate/Limited	+1		
Visibility of Water Body			
Obstructed	-2		
Unobstructed	+2		

Figure 35: Preference distribution and social capacity factors table for picnicking

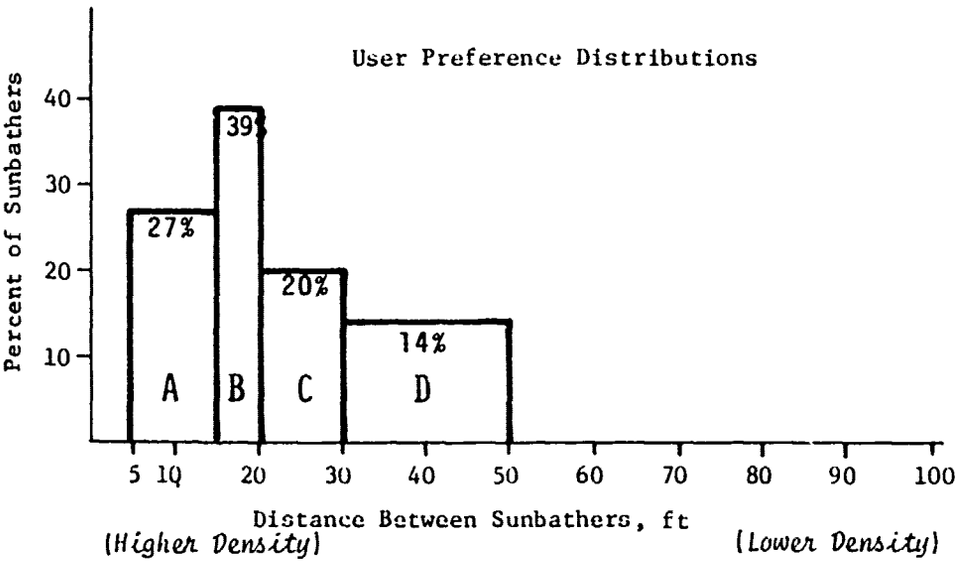


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Degree of Control		Age	
Moderate	-5	<26 (25%)	-8
Little/None	+10	26-55 (60%)	+2
		>55 (15%)	+7
Catching Fish			
Pleasant	-2	Experience	
Unpleasant	+10	None/Little/Some (32%)	-5
		Much (68%)	+2
Amount/Location of Facilities		Group Size	
Pleasant	-2	1-2 (66%)	+1
Unpleasant	+2	>2 (34%)	-3
		Travel Time	
		≤1 hr (72%)	0
		>1 hr (28%)	+1

Figure 36: Preference distribution and social capacity factors table for shoreline fishing

Sunbathing

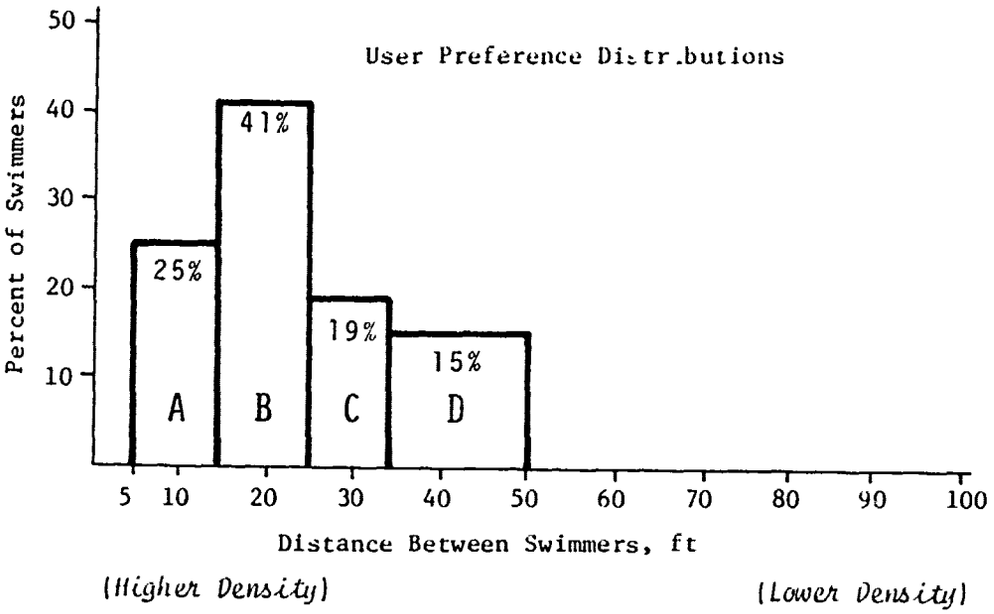


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristic	Variance
Level of Development		Number of other Activities	
High	-2	1 (57%)	-3
Moderate/Limited	+7	2-3 (34%)	-1
		>3 (9%)	+3
Degree of Control			
High	-2	Travel Time	
Moderate/Limited	+2	< 30 min (63%)	-1
		30 min-1 hr (24%)	+1
Amount/Convenience of Facilities		> 1 hr (13%)	+5
Pleasant	-1	Group Size	
Unpleasant	+3	1-2 (43%)	-1
		3-8 (53%)	0
Water Quality		>8 (4%)	+5
Pleasant	-1		
Unpleasant	+3	Experience	
		None/Little/Some (30%)	+2
Maintenance of Facilities		Much (70%)	-1
Pleasant	0		
Unpleasant	+2	Age	
		≤25 (55%)	-1
		>25 (45%)	+1

Figure 37: Preference distribution and social capacity factors table for sunbathing

Swimming

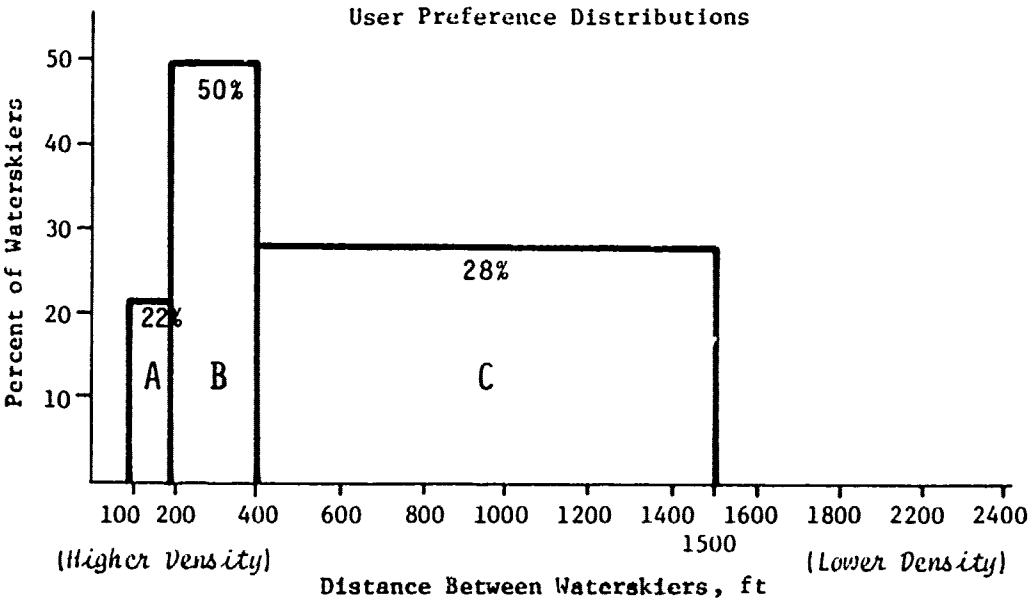


Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
(No site factors were found to be significant.)		Age	
		≤ 25 (50%)	+2
		≥ 26 (50%)	-2
		Number of other Activities	
		1 (58%)	+1
		≥2 (42%)	-1
		Group Size	
		1-2 (43%)	0
		≥3 (57%)	-1

Figure 38: Preference distribution and social capacity factors table for swimming

Waterskiing



Social Capacity Factors Table

Site Characteristics	Variance	User Characteristics	Variance
Amount/Location of Facilities		Travel Time	
Pleasant	-5	≤ 1 hr (57%)	-90
Unpleasant	+140	>1 hr (43%)	+120
Level of Development		Number of Other Activities	
High	-75	1 (14%)	+80
Moderate/Limited	+5	2-3 (34%)	+20
		>3 (52%)	-30
		Experience	
		None/Little/Some (44%)	
		Much (56%)	+50
			-20
		Age	
		≤ 25 (53%)	-20
		26-55 (47%)	+20
		Group Size	
		1-8 (88%)	0
		>8 (12%)	-15

Figure 39: Preference distribution and social capacity factors table for waterskiing

Table 86

User Survey Preferred Distance Responses - Summary by Activity

ACTIVITY	PLANNING RANGE	PREFERENCE GROUP A			PREFERENCE GROUP B			PREFERENCE GROUP C			PREFERENCE GROUP D		
		Range	%*	Midpoint	Range	%*	Midpoint	Range	%*	Midpoint	Range	%*	Midpoint
Boating	100'-1500'	100'-199'	29%	150'	200'-450'	37%	325'	451'-1500'	34%	975'	-	-	-
Boat Fishing	50'-1500'	50'-199'	49%	125'	200'-599'	27%	400'	600'-1500'	24%	1050'	-	-	-
Boat Launching	3 min-30 min	3-7 min		5 min	8-15 min		10 min	16-30 min		23 min	-	-	-
Camping	20'- 120'	20'- 39'	20%	30'	40'- 59'	28%	50'	60'- 79'	31%	70'	80'-120'	21%	100'
Hiking	-	100'-199'	50%	200'	1200'-5000'	50%	3000'	-	-	-	-	-	-
Off-Road Vehicle Riding	Since there are so few responses (8) and they are not clustered, no Planning Range has been developed. Eliminating the outliers at each end of the range, produces a range of 50 feet to 660 feet. The mean of the responses in this range is 287 feet.												
Picnicking	20'- 100'	20'- 39'	23%	30'	40'- 59'	42%	50'	60'- 79'	20%	70'	80'-100'	15%	90'
Shoreline Fishing	10'- 100'	10'- 19'	20%	15'	20'- 39'	38%	25'	40'- 59'	24%	50'	60'-100'	18%	80'
Sunbathing	5'- 50'	5'- 14'	27%	10'	15'- 20'	39%	18'	21'- 30'	20%	26'	31'- 50'	14%	40'
Swimming	5'- 50'	5'- 14'	25%	10'	15'- 24'	41%	20'	25'- 34'	19%	30'	35'- 50'	15%	42'
Waterskiing	100'-1500'	100'-199'	22%	150'	200'- 400'	50%	300'	401'-1500'	28%	950'	-	-	

*Percent of planning range.

Resource Capacity Guidelines

Introduction

363. In addition to providing satisfactory recreation experiences to today's users, Corps recreation managers also have the goal of protecting recreation resources so that they can sustain the quality and quantity of recreational opportunities available to tomorrow's users. Resource overuse reduces the achievement of this second goal. Because management has the two goals of achieving social capacity and resource capacity, it is possible to consider resource capacity as a potential constraint to the development and use of an area at its social capacity.

364. Resource capacity is a function of environmental and other site characteristics. It is difficult to develop a model of resource capacity because of the large number of factors that affect it, the range of variation of each factor, and the complexity of the interaction of these factors. Furthermore, many factors which have a significant impact on resource capacity cannot be controlled or modified by management.

365. Therefore, the resource capacity guidelines in this section are intended to provide a systematic and easy-to-use method for identifying the impact that various resource capacity factors could have on the resource base. This information also provides recreation planners and managers with an awareness of the implications of development and management decisions and serves as the foundation for implementing a program of monitoring.

Identifying potential impacts

366. Table 87 indicates the potential impacts that various factors have on the resource base. The left column of this table is organized into groups of factors (e.g., environmental, developed/physical, etc.). Each group is made up of different factors, each of which has an impact on some area of the resource base. These factors are those which management most frequently identified as being important during the management survey. This listing is not intended to be all-inclusive, and the reader should feel free to develop additional factors.

Table 87

Resource Capacity Guidelines: Potential Impacts on the Resource Base

● Major Impact
O Impact

FACTORS AFFECTING RESOURCE CAPACITY	RESOURCE BASE CONCERNS: WATER BODY: Particulate Matter	WATER BODY: Chemical Pollution	WATER BODY: Eutrophication/Bacteria	WATER BODY: Obstacles/Hazards	WATER BODY: Type and Amount of Vegetation	WATER BODY: Flow	WATER BODY: Temperature	SOILS: Compaction	SOILS: Erosion	ANIMALS: Type, No., and Habits: Endangered Species	ANIMALS: Type, No., and Habits: Game	ANIMALS: Type, No., and Habits: Other	VEGETATION: Type, No., and Condition: Ground Cover	VEGETATION: Type, No., and Condition: Understory	VEGETATION: Type, No., and Condition: Trees	OTHER: Excessive Wear to Corps Facilities	OTHER: Level of Scenic Quality	OTHER: Amount of Usable Space	OTHER: Noise Level	OTHER: Air Quality
ENVIRONMENTAL																				
Type of Wildlife			O		O					●	●	●	●	●	●		O		O	
Type of Vegetation	O		O	O	O	O	O	O	O	●	●	●	●	●	●		O	O	O	
Amount of Tree Cover/Shade							O	●	●	O	O	O	●	●	●		O			
Type of Ground Surface	●				O	O	O	●	●	O	O	O	●	●	●	O		O		
Slope/Drainage	●		O			●	O		●				●	O	O			●		
Wind/Amount of Wave Action	●			O		O	O		●							●			O	O
Climate/Microclimate			●		●	O	●	O	●	●	●	●	●	●	●	●	O			O
DEVELOPMENT/PHYSICAL																				
Level of Development	O	O	O	O	O	O	O	O	O	●	●	●	O	O	O	O	●	O	●	O
No. of Activity Areas	O									O	O	O	O	O	O		O	●	O	O
Activity Area Size	O									O	O	O	O	O	O		O	●	O	O
Activity Area Shape										O	O	O	O	O	O		O	●	O	
Activity Area Design	O	O	O					●	●	O	O	O	O	O	O	●	O	O	O	
WATER BODY																				
Depth of Water	O	O	O	O	O	O	O			●	●	●								
Shoreline Configuration	O			O		O	O		O	O	O	O						O	O	
Pool Fluctuation	●	O		●	O	●	O		●							●	O	O		
Water Quality	O	O	O	O	●	O	O			●	●	●				V	O			
MANAGEMENT																				
Degree of Control	V	O	O	O				●	●	O	O	O	●	O	O	●	O	O	●	●
Degree of Maintenance				O				O	●	O	O	O	●	O	O	●	O	O		
Degree of Off-Season Restoration	O	O	O	O				O	●	O	O	O	●	O	O	●	O			
USER																				
Type of Activity	●	O	O					●	O	●	●	●	O	O	O	O		O	●	O
Type of Equipment	O	O						●	●	O	O	O	●			O		O	O	O
Group Size								O	O				O			O		O	O	

367. The remainder of the table columns are organized by different areas of the resource base (e.g., water body, soils, etc.). Each area is divided into areas of concern, some of which are problems, while others are the subject of problems. Again, the list is not intended to be all-inclusive, and the reader should feel free to develop additional areas of concern.

368. Table 87 is used as follows. When the social capacity guidelines for an area are developed, review the resource capacity factors listed in Table 87 and identify those which are relevant (include any relevant factors which are not included in Table 87). Identify those areas of concern of the resource base listed in Table 87 which will be impacted (include any other impacted areas which are relevant). Analyze the type, level, and duration of each of the potential impacts. Finally, review the use level and the factors for the area and consider modifications where warranted or consider the implementation of a monitoring program (monitoring suggestions are included in Part IX).

PART VII: TECHNIQUES FOR CAPACITY MANAGEMENT

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PART VII: TECHNIQUES FOR CAPACITY MANAGEMENT

Description of Techniques

369 Virtually every aspect of planning and management affects recreational carrying capacity in some way. Techniques for capacity planning and management, therefore, cover many levels of decisionmaking, from those applied at the concept planning stage of a project area to the day-to-day judgments of resource managers, rangers, and maintenance personnel.

370. Some techniques are easy to define, clear, simple to apply, and direct; others are troublesome to define, confusing, difficult to administer, and subtle. Various carrying capacity problems, conditions, and situations may require the application of different techniques. Also, several techniques may be applied in conjunction with each other to prevent or correct carrying capacity related problems or to achieve appropriate carrying capacity levels developed from Part VI.

371. Management objectives are the subject of much discussion in Corps recreation planning and management circles. However, there is little evidence that management objectives other than those which represent broad Corps policies receive early, consistent, and comprehensive attention in the recreation master planning and plan updating process. The technique of thoroughly identifying and clarifying targeted management objectives pertaining to recreation resource use at Corps projects can avoid later problems of overuse and overcrowding.

372. Clear management objectives should be developed immediately following an analysis of recreation resource use potential and an examination of user needs and levels of demand for the project area. These objectives will provide the overall directions for subsequent master planning, site planning, and management planning.

373. Carrying capacity calculations should be made and carrying capacity options should be considered in formulating, evaluating, and selecting appropriate, realistic management objectives. Once desired carrying capacity levels are decided upon, their implications on such

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items as operation and maintenance costs, personnel, and public acceptability should be considered before capacity guidelines and the master plan are finalized.

374. A few examples of planning oriented management objectives are listed below. Some of the examples have different levels of specificity. While these examples are not intended to be recommended objectives for any project area, they do show: (a) various subjects and levels of detail that management objectives can address, and (b) how master plans can be given definitive direction through clearly defined management objectives. A few examples are as follows:

a. Provide for the greatest variety of recreation opportunities possible, given the capability of resources to sustain such activities.

b. Build the least possible lineal footage of access roads.

c. Maximize use of the area consistent with the objective of retaining normal maintenance levels.

d. Minimize the amount of physical development necessary to meet documented user needs and demands.

e. Plan areas in a manner which will allow densities to be increased or decreased as easily as possible once they are developed.

f. Plan areas so that resource use and capacity controls can be initiated with a minimum of cost, effort, and public displeasure.

g. Plan only for those uses and densities which provide the least impact on the natural resources.

h. Plan for use of the resource at the highest possible density level, regardless of the levels of control and maintenance required to do so.

i. Make improvements to concentrated, critical high priority areas first rather than spread financial resources across the project area.

j. Close the gates before areas reach predetermined levels of overcrowding.

k. Provide only enough parking spaces to accommodate the predetermined levels of use appropriate for each recreation area.

l. Allow as few additional private docks on the lake as possible, or allow no additional docks.

m. Allow vehicles off of paved roads or paved or hardened pads in as few instances as possible.

n. Rely more heavily on public information and education, than on site planning to control overcrowding.

o. Allow only nonpower and limited power boating.

p. Allow development of moveable or only flood resistant facilities in certain areas which are or may be inundated.

q. Provide every camping area with its own swimming area.

375. Thorough identification and classification of management objectives require maximum cooperation and coordination between recreation planners and resource managers early in and throughout the master planning process.

376. This Part of the report uses three categories to recognize the major differences and similarities of the carrying capacity techniques presented:

a. General Planning and Activity Relationships

b. Site Planning and Design

c. Management Techniques

(1) Rules and Regulations
(2) Policies
(3) Services

377. The following sections introduce several techniques under each of the three categories. It provides examples of how the techniques can be applied and used to achieve appropriate carrying capacity levels. Many of the techniques (e.g., changing natural surfaces by hardening) influence the factors (e.g., level of development and control) which affect carrying capacity. The last section of this Part discusses the acceptability of techniques determined from the user survey. A summary table listing each technique and its major features is provided at the end of Part VII.

General Planning and Activity Relationship Techniques

378. General planning and activity relationship techniques can be very effective in achieving appropriate carrying capacity levels (URDC 1978). In addition to their effectiveness, planning techniques generally

tend to be preventive, subtle, readily accepted by users, and less costly and more easily applied than remedial problem solving techniques.

379. The Corps master planning process can provide an overall framework for addressing carrying capacity at both the project area and activity area levels. The guidelines in Part VI of this report are tools for use in planning total project areas, recreation areas (parks or multiple activity areas), and individual activity areas. With little effort and expense, together with an overall awareness of the factors which affect carrying capacity, problems of overuse, overcrowding, and underuse can be minimized through more effective master planning.

Dispersing activity areas to reduce overcrowding and overuse

380. Dispersed activity areas can help prevent overcrowding and overuse. Master planners can disperse recreation areas throughout a project area rather than concentrating them at one or a few locations, thus providing more evenly distributed use of the resource. While distributing campgrounds, launching ramps, fishing access points, picnic areas, and other activity areas throughout a project area may be advantageous from a carrying capacity standpoint, operation and maintenance costs may be higher than when activity areas are concentrated in a few areas. The merits and disadvantages of this technique can be weighed during the initial recreation planning process. It seems likely that most users would find this technique very acceptable. Dispersed recreation areas are used and work well at Hartwell, Ouachita, Milford, Barkley, and several other study project areas.

Varrying levels of accessibility to reduce overcrowding and overuse or to encourage use

381. Different carrying capacities can be achieved by discouraging or encouraging access. Accessibility is an important carrying capacity factor which can be addressed during project master planning. Making vehicular access to areas more difficult by providing only narrow dirt or gravel entrance roads rather than wide paved roads, and locating areas far from a highway rather than near a highway, will tend to discourage heavy use of an area.

382. Making vehicle access less convenient, however, was cited as being unacceptable to most of the users surveyed in this study. Making access inconvenient is a technique that is not widely used by the Corps, although ditches, berms, and other barriers have been used to protect areas from unwanted vehicles and users. It would seem that limiting access to areas can work best when trying to achieve a desired carrying capacity for nonintensive activities, such as walk-in tent camping or nature study, at more remote locations.

383. Activity areas planned to afford easy access are more likely to receive heavier use. Good roads and proximity to the highway, therefore, are important factors to address when planning recreation areas, especially those intended for heavier use levels (e.g., multiple-use areas).

Providing selected impact areas
to reduce overuse and overcrowding

384. Overuse, overcrowding, and use conflicts can be reduced or eliminated by directing activities which tend to be more punishing to the environment (e.g., group camping, ORV riding, partying, and group picnicking) to specially selected impact areas. This technique involves carefully selecting impact areas for heavy use, areas capable of sustaining intense and more destructive use. These areas can be identified and mapped during the initial planning stages at the same time environmentally sensitive areas are also being identified and mapped.

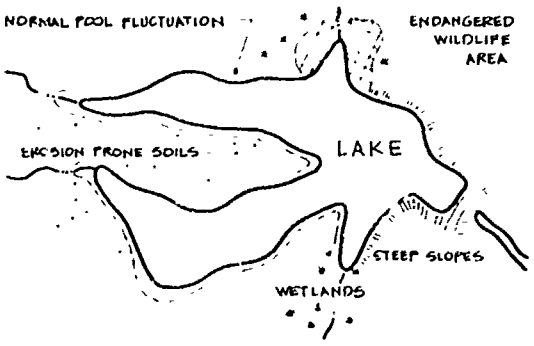
385. Areas which have already experienced degradation or those which have limited social value could be potential impact areas. The major disadvantage of using this technique is that overuse and overcrowding may occur in the selected impact area. Therefore, management should be prepared to consider these areas as ones which can be sacrificed in order to protect and enhance user experiences in other areas.

386. This selected impact area technique is currently being used by Shenango, Milford, and Somerville to control off-road vehicle (ORV) riding. These project areas have designated old sand and gravel quarry areas, where the natural resource has already been heavily scarred or destroyed, for ORV riding. The technique has been successful at these

projects because ORV riders are given opportunities for ORV play while other recreation resources are being protected from ORV use. Excavation areas for dam construction or road materials could become later ORV sites where quarries do not exist. Somerville provides another example of how this technique can be used. Somerville's strategy is to upgrade one area at a time by implementing controls, channeling traffic, and adding gate attendants to targeted areas.

Planning activity areas outside environmentally sensitive areas

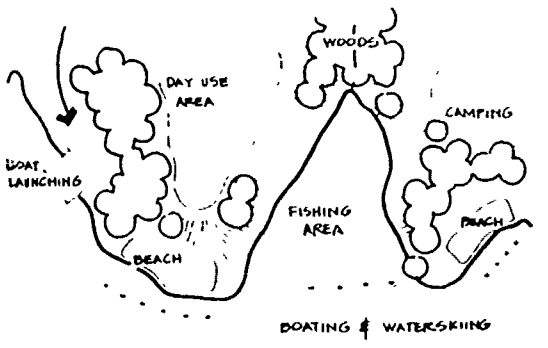
387. Recreation areas should be located away from environmentally sensitive areas such as flood-prone areas, steep slopes, and erosion-prone soils, thus avoiding or minimizing the potential for resource overuse. Applying this technique involves first identifying and mapping sensitive areas and the more resilient areas within the project. (Unfortunately, some of the most sensitive areas (stream valleys, steep slopes, etc.) are also the most attractive recreation resources.) The more sensitive areas can be avoided or used for less intense activities, such as nature study or hiking, or perhaps serve as a wildlife preserve. More resilient areas can sustain more use and can be planned for more intense activities such as trailer camping, picnicking, and group activities. Applying this technique initially will be much less costly than correcting problems caused by resource overuse. Most study project areas are aware of this technique and have used it in the past. Yet there are several instances where environmentally sensitive Corps resource areas have been developed and are now overused.



ENVIRONMENTALLY SENSITIVE AREAS

Separating major conflicting
activities to reduce user conflicts

388. Keeping incompatible recreation activities separated from one another can reduce user conflicts. By separating day use from camping areas, waterskiing from boat fishing areas, off-road vehicle riding from camping areas, and other conflicting activity areas from one another, each individual activity area can achieve a higher carrying capacity and increase user satisfaction as a result of fewer user conflicts. Some Corps day use activity areas are located within camping areas, but Corps project planners have generally tried to separate day use areas from camping areas. New Hogan and Shenango have attempted to reduce boat fishing/waterskiing conflicts by marking areas for low speeds only. Most recreators interviewed during the user survey cited these techniques as being very acceptable. Application of this technique required knowledge about the basic incompatibilities of various activities and participants. Although this technique can be used remedially to solve conflicting activity situations, it is less costly and more advantageous to separate potentially conflicting activity areas during initial project planning.



SEPARATING CONFLICTING ACTIVITIES & USERS

Zoning areas on the lake
surface to reduce conflicts

389. The carrying capacity of a lake can be increased by zoning for certain uses. By designating separate areas on the lake for activities which normally conflict (e.g., boat fishing, waterskiing, general boating, and swimming), more boats can be added to the lake because of fewer boater conflicts. Also, an entire lake surface can be zoned only for limited power and nonpower boating. The major disadvantage of this technique is its difficulty of enforcement. Also, it might be costly because several patrol boats and rangers might be required. Most boaters surveyed cited lake zoning as an acceptable technique for solving overcrowding on the lake surface. It seems as though zoning might be most acceptable if applied to newly developed project areas where boating patterns have not yet been established. Lake zoning of boats is used by a few of the project areas visited (Shenango, New Hogan); where it is used, it is designed to control the speed of boats rather than the type of boating activity. Examples of how this technique could be applied include:

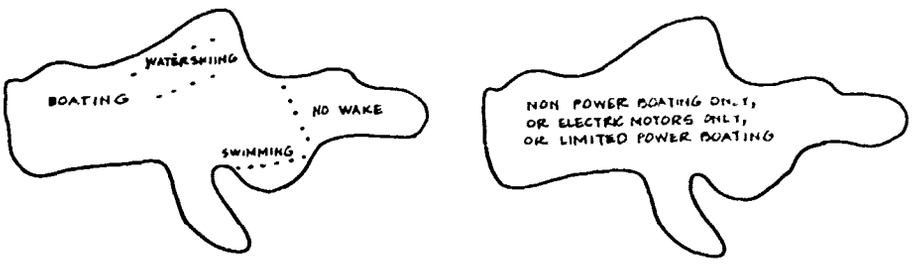
a. Designating portions of the lake surface for different activities.

b. Designating the type of boating over the entire lake.

c. Installing buoys on the lake to designate waterskiing lanes or to restrict boating in coves, swimming, or other designated areas.

d. Establishing a no wake area around swimming areas, boat ramps, and shoreline fishing areas.

e. Installing a double line of floats and no wake buoys around a swimming area to reduce conflicts between swimmers and boaters. No wake area reduces waves in swimming areas that are sometimes a problem for children.



Planning different areas for
a variety of user experiences

390. Planning different types of areas to provide for different user experiences can reduce overcrowding and increase an area's social capacity. Areas used by similar socioeconomic, age and interest groups can generally be developed at a higher carrying capacity than areas used by dissimilar groups. This occurs because similar types of users or user groups generally will tend to have similar likes and dislikes and, therefore, fewer conflicts than dissimilar user groups. The need to provide areas for a variety of user types is emphasized by survey results showing varying distance/density responses. The preparation of planning goals and objectives and efforts to obtain public input to the planning process should address the various experiences desired by users. This technique is used, to different degrees, by most study project areas and appears acceptable to Corps recreators and should be utilized more. Somerville has had success with this technique where some areas meet the needs of teenagers and younger adults, and other areas provide for more family-oriented recreation experiences.

391. Somerville project management has felt the need to provide an area (Welch Park) where people can swim, sunbathe, party, picnic, camp, etc., with a limited amount of control. This approach has helped reduce overuse and overcrowding in other recreation areas and has contributed a greater variety of activity situations and experiences. Welch Park is also used for Somerville's overflow camping area.

392. Other situations where this technique could be applied include:

a. Providing separate areas for group camping and group picnicking.

b. Providing separate areas for tent and trailer camping, multifamily camping, walk-in tent camping, semi-wilderness camping, and other camping experiences.

c. Providing areas for physically handicapped recreators.

Locating functionally related
activity areas close together

393. Higher carrying capacities can result from locating functionally related activity areas close together. Some Corps recreation

areas are underused, especially picnic areas and hiking trails, because they are not located in close proximity to other activity areas. Most people who come to Corps lakes participate in a variety of activities. Consideration should be given to planning picnic areas near beaches and hiking trails near major activity areas. Some Corps hiking trails are underused because of their remote location and most hiking trails are interpretive trails which do not connect activity areas. In addition to better location of interpretive trails, pathways can be provided for general hiking to and from activity areas, especially to take advantage of walking for pleasure opportunities near the water or within view of the water. Corps recreation planners are becoming more and more aware of the need to consider, in detail, the relationships and effects of activities located close together.

Using information and exposure to increase or decrease use

394. Informing people about recreation opportunities through the use of signs, maps, brochures, billboards, and other media could help to increase use of underused areas and to better distribute use among more recreation areas within a project. This technique can also be used to direct recreators away from overcrowded and overused areas. Also, planning recreation areas at locations which have good visual exposure from highways reduces the potential for underuse, but inadvertantly might increase the potential for overcrowding and overuse. Making the area's existence less obvious to the general public as a result of few signs and/or poor visual exposure may help to prevent or solve overcrowding and overuse and may, in fact, be very effective in discouraging recreational use. Many Corps recreation areas are already difficult to find, and fewer signs and directions would probably only benefit local users. However, if recreation areas are overcrowded or overused, it would make little sense to promote them or erect more directional signs to them. Most of the users surveyed indicated that making the area less obvious is an unacceptable solution to overcrowding and overuse.

395. The project areas studied make little use of information and visual exposure as a technique to control and direct use. One exception

is at Milford where radio contact is used to direct campers to campgrounds which are not full.

Site Planning and Design Techniques

396. Site planning and design techniques are also effective in achieving and controlling recreational carrying capacities. While site planning and design techniques are best considered during the initial design concept and site planning stages, they are also very effective when applied to remedy problems of overcrowding, overuse, underuse, and user dissatisfaction. Generally, they are better understood and more direct than general planning techniques. Also, site planning techniques affect carrying capacity at a much more site-specific, finite level than general planning techniques. The following section describes a wide variety of site planning and design techniques which can be used to help achieve and control recreational carrying capacity. Some techniques are easy to apply; others are difficult. Some techniques require very noticeable changes in the physical environment; others are subtle and not easily noticed.

Siting activities and facilities in a manner which protects the recreation resource and enhances the users' experience

397. Situating activity areas and facilities on land well suited to their particular development and use, and positioning or arranging sites and facilities in a manner which affords a higher carrying capacity, will maximize recreation opportunities and minimize the potential for resource overuse. Proper site selection for a given activity can preclude or minimize resource overuse. Steep or sensitive areas should be avoided or carefully developed to minimize negative environmental impacts. Some activities need to be on level, well-drained ground (picnicking and sunbathing), some need to occur in or near the lake (swimming, boating, boat launching, fishing), and some can take advantage of upland and marshy areas (hiking, horseback riding, hunting). Arranging sites and facilities in a manner which recognizes user preferences can enhance the recreation experience and increase the social capacity of an activity area. This

technique is not costly and can be very effective if applied during initial site planning and design. Rearranging sites and facilities to solve overcrowding and overuse will be more costly and less popular with users. All of the study project areas are using this technique to some degree, but this technique could be emphasized more during initial activity area development. Some examples of siting techniques include:

a. Situating picnic areas and campsites (as well as access drives and paths) in a place where the soil is neither easily eroded nor too steep, in a place offering good views of the lake, and in a place away from stagnant mosquito-producing water.

b. Allowing for a variety of campsite shapes and types, especially impact sites, to (1) better fit the terrain and (2) suit the various types of camping styles.

c. Arranging tables in picnic areas so they are spaced at different distances apart to provide for individual family, multifamily, and group picnic experiences.

d. Siting picnic and camping areas in wind-sheltered areas.

e. Locating beaches on south facing slopes for best solar exposure, sheltered from prevailing winter winds, and away from heavily used boating areas. Areas which are likely to be eroded should be avoided. Also beaches could be located outside isolated cove areas to ensure cleansing by water action.

f. Orienting campsites to reduce negative impacts such as headlight glare from vehicles.

g. Providing common open space areas adjacent to the lakeshore for the enjoyment of all recreators rather than letting these areas be monopolized by a few. Picnic sites and campsites could still be located relatively close to the lakeshore (e.g., 50 to 100 ft away). This is the current thinking applied to some of the Ouachita areas such as Brady Mountain recreation area.

h. Aligning hiking trails on generally stable soil offering diversity of terrain, plant materials, animal habitats, water features, and views and providing trails linking activity areas.

i. Situating boat ramps adjacent to but outside other use areas to reduce conflicts between boat launchers and other recreators or activities.

Redesigning areas to
solve overuse and overcrowding

398. Areas can be redesigned to deal with overuse and overcrowding. This technique includes rearranging sites within an activity area, such as relocating campsites and picnic tables or realigning hiking trails. Where overcrowding or overuse occurs, campsites, picnic tables, and other recreation facilities could be spaced farther apart or relocated to new, more resilient areas. Also, overcrowded and overused activity areas can be redesigned for less intense activities such as walk-in tent camping or nature study.

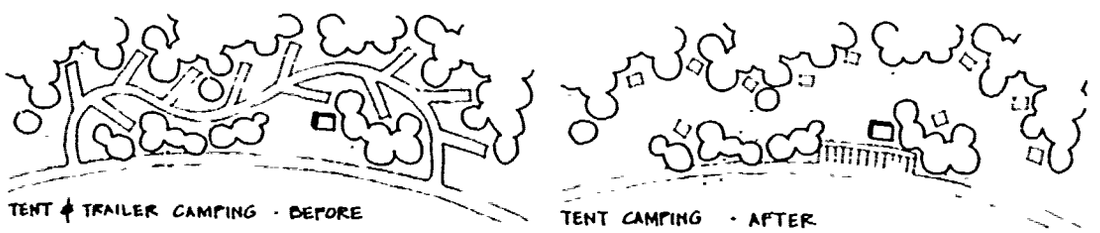
399. Although the technique of redesigning is effective in solving problems of overcrowding and overuse, it generally is costly, and is likely to be unpopular with users if the redesign results in fewer recreation sites. It is a remedial technique that can be avoided if social and resource capacity are addressed at project areas studied largely with regard to campgrounds and picnic areas. Examples of how this technique can be applied include:

a. Relocating closely spaced campsites or picnic sites to new or adjacent areas and arranging them farther apart to prevent overcrowding and overuse (e.g., Ouachita, McNary, and Milford).

b. Converting a tent and trailer camping area to a tent camping area to reduce resource overuse.

c. Changing an activity area from one activity to another, such as from camping to picnicking. This could result in fewer users and reduce impacts.

d. Redesigning the circulation system in an activity area in a manner which better controls access, channels traffic, and reduces overcrowding and overuse.



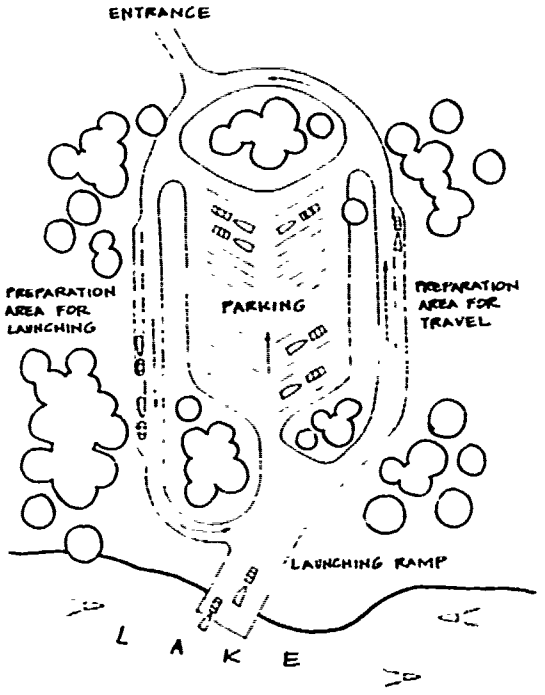
e. Providing a swimming dock which could separate younger swimmers from more experienced swimmers. This could help delimit an area in the water where children could swim without having access to deeper water.

f. Changing the type of facilities in activity areas, such as replacing permanent concrete picnic tables with moveable wooden tables. Tables could then be moved by picnickers to achieve preferred distances and groupings, and the amount of resource wear would be more evenly distributed through the area. Where moveable tables are used at the study project areas there is little evidence of overcrowding and overuse, but tables are sometimes carried out of the area (e.g., Milford, Surry Mountain, and McNary).

g. Upgrading access points near popular boat fishing areas to reduce fishermen's use of ramps in or near campgrounds or day use areas. This would also reduce conflicts between the fishermen with quickly launched boats and the pleasure boaters with less easily launched craft.

h. Redesigning recreation areas so boat ramps are situated adjacent to but outside other activity areas to reduce conflicts between boat launchers and other recreators (e.g., Hartwell, Milford, and New Hogan).

i. Redesigning boat launching facilities by designating areas to prepare boats for launching and to secure boats.



j. Redesigning or arranging waterski docks and/or waterski lanes, launching ramps, the system of buoys, etc., to encourage boating activities in appropriate areas on the lake.

k. Expanding the size of an area or its facilities such as a beach area, lengthening a hiking trail to accommodate more hikers, adding more launching lanes to an existing ramp to reduce overcrowding, etc.

Reducing the number of recreation sites or units to reduce overuse and overcrowding

400. Because techniques which call for reductions in existing opportunities to use recreation resources and facilities are generally disfavored by users, project managers should avoid overdeveloping an area with the idea that selective cutbacks can be accomplished later.

401. This technique of reducing sites has been used at project areas studied largely to reduce overcrowding and overuse at campgrounds. Some examples of how this technique can be applied are:

a. Eliminating campsites that are spaced too close and a problem of overcrowding or resource overuse is evident (e.g., Ouachita and Shenango).

b. Removing picnic tables where they are too close and where a problem of user overcrowding or resource overuse has occurred.

c. Making a campground more primitive by removing support facilities such as individual water and electric hookups at each site, shower buildings, and visitor parking lots.

d. Reducing the number of parking spaces at a day use area, boat launching ramp, or hiking trail. The spaces can be replaced with plantings or other landscape elements.

e. Reducing the number of access points and entrance roads to activity areas.

f. Reducing the number of boat launching ramps and other lake access points when overcrowding of the lake surface is evident. In using this technique, care should be taken to avoid causing congestion at remaining launch ramps.

Using various methods and materials to control circulation and channel traffic

402. One of the best techniques for preventing and correcting overuse and overcrowding is regulating and channeling vehicle and

pedestrian traffic. Numerous methods and materials can be used to control circulation and channel traffic. The most appropriate and effective method will vary from project area to project area and will depend upon the materials and resources at hand. Currently the study project areas are using many different methods and materials to implement this technique. Examples of some methods and materials to control circulation and channel traffic include:

a. Providing a gate attendant who controls access to an activity area such as a campground, picnic area, or boat launching ramp.

b. Using Corps rangers to help control circulation and direct traffic during heavy use periods.

c. Limiting the number of entrance points to an activity area.

d. Posting directional and informational signs at strategic locations to guide recreators.

e. Controlling boat circulation on the lake through a well-planned system of buoys.

f. Requiring boat circulation on the lake to be in one general direction (e.g., counter clockwise).

g. Utilizing buoys to mark designated lanes for water-skiing.

h. Discouraging circulation in unwanted places through the use of signs.

i. Utilizing a wide variety of materials as physical barriers to channel traffic and control circulation.

Changing natural surfaces
by hardening to reduce overuse

403. Changing natural surfaces by hardening them with man-made assistance or improvements to withstand more use can increase resource capacity and prevent overuse. Worn grass and muddy conditions can be alleviated and maintenance reduced. By hardening, the sites also become better defined; this hardening or defining of activity areas also tends to psychologically contain users on the hardened areas, thus reducing overuse and user conflicts.

404. Site hardening can be applied in many situations such as surfacing walkways and hiking trails with wood chips, gravel, wooden

platforms, and steps; paving or using gravel to harden campsite pads; developing impact sites; and using concrete slabs under picnic tables.

405. Hardening can be costly and is mildly acceptable with users. The people surveyed indicated a greater preference for surfaces of wood, fine pea gravel, or small stones than for concrete and asphalt paving. The technique of hardening is better applied initially in the more sensitive recreation resources where overuse is likely. These more sensi-

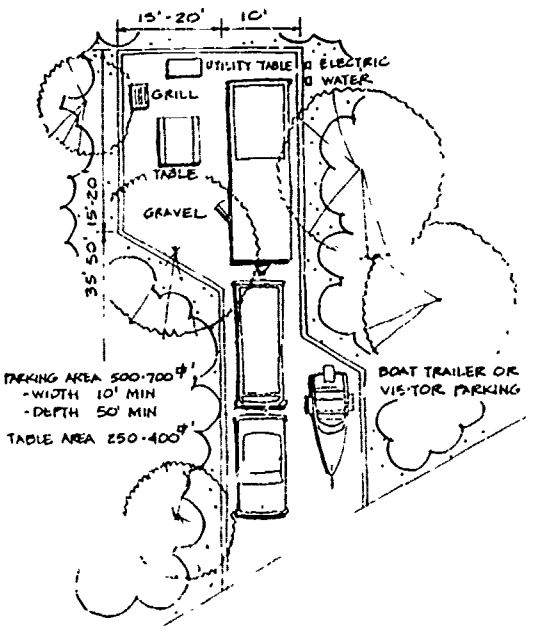
reas can be identified and mapped during the initial planning of

recreation areas.

406. Site hardening is widely used by the study project areas and is very effective in preventing and correcting overuse. It has been used most frequently to solve overuse problems at campsites, around picnic tables, and along hiking trails. Examples of how this technique can be applied include:

a. Employing the use of campground impact sites consisting of a gravel "floor" contained by pressure-treated timber ties. Use of this type of site is suited for wooded and/or sloping areas; impact sites are easily fitted to the terrain and result in little overuse of off-site resources.

Impact sites work well initially where overuse can be expected such as at waterside sites, at shaded sites, at electric and water serviced sites, and where soil and slope conditions are sensitive (e.g., Barkley, Shelbyville, and Hartwell).



IMPACT SITE

b. Paving camper pads so wheels of the unit will not wear the ground surface. Travel trailers are easier to level on paved pads and overuse is reduced where the vehicle rests. The edges of the pad, however, are susceptible to wear; this can be prevented by having wide pads edged with a hardened material (e.g., Ouachita, McNary, and New Hogan).

c. Hardening an erodible site with precast concrete and seeding over it, terracing a sloping site with steps of pressure-treated timber ties, and putting stone and/or concrete riprap around fixtures and pads subject to being washed out by seasonal high water will help reduce overuse (e.g., Shelbyville).

d. Hardening the area around picnic tables and grills by using gravel, concrete, or asphalt paving prevents overuse around the unit (e.g., New Hogan, Somerville, and Benbrook).

e. Stabilizing eroding shorelines with rock riprap, wood bulk heading, plantings, and soil cement to prevent shoreline erosion. These techniques are generally very costly (e.g., Hartwell, Shenango, and Milford).

f. Hardening the shoreline or riverbank where shore fishing occurs to reduce compaction and erosion.

g. Hardening worn pathways to prevent further overuse.

h. Hardening interpretive trail surfaces by installing wood steps, perrons, or boardwalks where poor soil and/or slope conditions result in overuse. Hardening makes the trail less susceptible to adverse weather influences and the hardened surface makes the trail more accessible to physically handicapped and elderly people (e.g., Hartwell and McNary).

i. Providing steps down a bluff or steep bank to the water from picnic or campsites to eliminate worn paths, erosion, and the trampling of ground cover (e.g., New Hogan and Shenango).

j. Hardening the yard areas around restroom, shower, and bathhouse buildings with gravel, wood chips, paving, or sand to prevent overuse. Walkways around the buildings could have a gravel strip between them.

k. Changing grass to sand at sunbathing areas to reduce overuse and muddy conditions.

l. Utilizing plant materials, grasses in particular, which are more resilient to water; this could reduce or delay overuse in heavily used areas (e.g., Ouachita).

m. Paving overflow parking lots when wear reaches a point beyond regeneration of grass.

n. Reseeding ditches and swales to minimize erosion and installing gravel and/or wood, concrete, or asphalt at critical areas such as around culverts, inlets, and outflow pipes to prevent erosion.

o. Developing or using grasses resilient to innundation along shorelines of water fluctuation (e.g., McNary test results).

Using buffers to achieve carrying capacity

407. Conflict-reducing buffers can help prevent overcrowding and increase the carrying capacity of an area. Buffers can be man-made or natural and can consist of plant materials, topographic barriers, or additional open spaces. Landscape buffers such as trees, shrubs, or grass fields may be planted where vegetation is sparse, or may be provided by natural cover which is not cleared when the area is developed. Buffers perform many functions: they provide privacy, control soil erosion, screen views, reduce noise, offer relief, provide shade, control wind, and channel vehicular and pedestrian traffic. Planted buffers can be costly, but little cost is incurred when natural cover is retained when areas are initially developed. The feasibility for using natural buffers can be evaluated when new recreation areas are being planned.

408. Most users surveyed cited the use of buffers as an acceptable solution to overcrowding problems. Some users indicated that buffers are not acceptable because (a) they screen the view of the lake or others recreating, (b) they block breezes which cool campsites, or (c) they harbor ticks and other undesirable insects.

409. Buffers have been used sparingly at the study project areas. Where used, they are intended mainly to create privacy between individual picnic sites or campsites (e.g., Somerville, Milford, and Ouachita) and between hikers (e.g., McNary and Hartwell). Buffers also serve as barriers between day use and camping areas, between off-road vehicle riding areas and other activity areas, and between other incompatible activity areas. Some other examples of how buffers can be applied include:

a. Purposely locating campsites and picnic grounds in areas with sufficient vegetation to serve as buffers or in

areas which offer good potential for planting new materials where necessary.

b. Screening negative or undesirable features from recreators such as screening utility structures and buildings and blocking noise, dust, and headlight glare from vehicles.

c. Spacing campsites closer together in a wooded area. This can result in a higher campsite density but does not necessarily add to overcrowding. Vegetation between sites provides privacy and makes closer spacings acceptable.

d. Using one activity area as a buffer between others, such as situating a grass area with picnic tables and shade trees between a beach and the parking area. This approach buffers sunbathers from traffic and discourages driving on the beach.

e. Providing an adequate buffer of vegetation and/or distance between potentially conflicting activity areas, such as between a hunting area and a campground or a horseback riding trail and sunbathing area.

f. Utilizing buffers to channel traffic and reduce circulation conflicts between walkers and vehicles.

Increasing facilities and
site amenities to increase use

410. Increasing the level of development, services, and facilities can help increase use. An activity area is generally found to be underused because of (a) its lack of certain site amenities desired by users, or (b) its remote location relative to the lake. The installation of certain services and facilities at the site may help to increase the use and enjoyment of underused areas and could relieve overcrowding and overuse in other activity areas. Improvement to areas must be done carefully--possible in stages--to keep from creating an overcrowded condition. This technique is likely to be very effective and acceptable to users, but could be costly. Increasing the number of facilities and site amenities might not help activity areas that are underused because of poor visual exposure, a remote location, poor accessibility, or poor signage.

411. Underuse was observed mostly at picnic areas and hiking trails in the project areas studied. Although some campgrounds and other activity areas were considered to be underused, project managers are aware of these underuse conditions and are planning to either increase the

number of site amenities and facilities or relocate the existing facilities. Examples of this technique include:

a. Providing electric and water service to campsites.

b. Providing showers, ampitheater programs, and outdoor activities for campers.

c. Constructing a bathhouse or food concession facility at a beach.

d. Providing floating docks from which to waterski or swim.

e. Installing fish-cleaning facilities.

f. Situating more picnic tables and campsites closer to the water to facilitate access and visibility without monopolizing the shoreline.

g. Offering activities within or near campgrounds and picnic areas such as ballfields, basketball courts, field game areas, and horseshoe pits. Additional facilities would serve users who desire ancillary activities, especially programs and activities for teens.

h. Developing additional parking spaces, if necessary.

i. Paving access roads and adding pathways to and within activity areas.

j. Installing steps down embankments to the outlet areas to improve access for fishermen.

k. Providing shade trees and shelters if heat is a major reason for underuse.

Employing certain site planning and design principles to increase conveniences and to influence carrying capacity

412. The carrying capacity of camping areas, picnic areas, hiking trails, boat launching ramps, and other activity areas can be increased by applying certain site planning and design principles. Sites which cater to the desires and requirements of users and their equipment can ensure users of an enjoyable stay and will cause minimum wear on the site resources. The application of this technique requires an awareness of user preferences which can be considered during the initial site planning stages of an activity area. Some examples of this technique for increasing carrying capacity are:

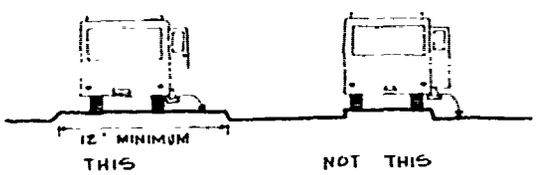
a. Using impact campsites (terrain-fitting gravel-surfaced timber-edged pads). Initial installation of these sites in wooded or less than ideal soil and slope areas will

dramatically reduce the potential for overuse. Where a conventional site is overworn, it could be rehabilitated as an impact site to prevent further overuse. Most campers view the timber edging as a barrier and will not walk between sites or overuse the natural surface; they tend to use only the hardened surfaces. No standard design configuration exists for an impact site, but a typical pad ranges in area from 750 to 1100 sq ft; this area can be reduced or enlarged accordingly depending on whether the site is to be used for tents or as a double site.

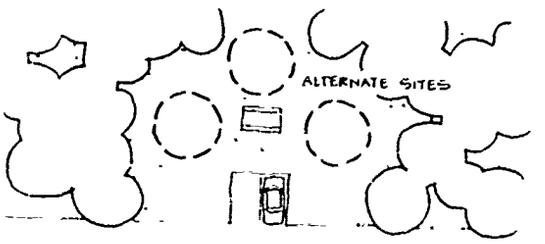
b. Situating support facilities directly serving the camper on an area hardened to sustain extra wear. The area should provide for: camper parking, a table, grill, fire ring, lantern post, service hookups, and trash containers.

c. Locating campsite amenities in a proper arrangement to allow maximum convenience and minimum overuse. When looking from the vehicle entrance of the campsite, the patio area, table, grill, fire ring, lantern post, and trash receptacle should be on the left-hand side. The service hookups should be on the back right-hand side of the pad. The tent pad should be approximately where a camping vehicle would be parked. The boat trailer or extra vehicle space should be a hardened area near the front of the site. Facilities should be situated away from the rear of the pad so that units can be backed in all the way.

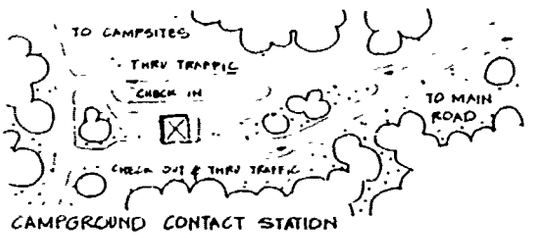
d. Constructing a paved pad, where an impact site is not used, with convenience for the camper in mind; making the pad wide enough to step off the camper onto the paved area rather than the natural surface or the edge of the pad. This technique reduces the wearing away of soil on the pad area, thus avoiding overuse and camper accident hazards. Paved pads should have a maximum longitudinal slope of 4 percent and a cross slope of no more than 2 percent.



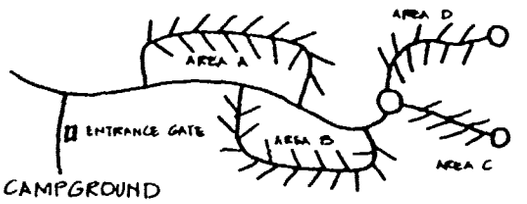
e. Laying out tent sites for greater convenience. A designated tent site pad should have no more than 3 percent cross slope. Tenting sites or areas of grass should have sufficient space with proper slope for a tent to be pitched in a different place than previous campers have used.



f. Providing two traffic lanes on each side of the control gate to expedite traffic flow, particularly for users who do not need to stop each time.



g. Using the "spine" type of road in a picnic area or campground so people don't have all traffic passing their site.



h. Accommodating long recreational vehicles and cars pulling trailers by providing an adequate turning radius so vehicles are not forced to leave the paved surface at intersections, control gates, dumping station, campsites, boat ramps, parking, and turnaround areas.

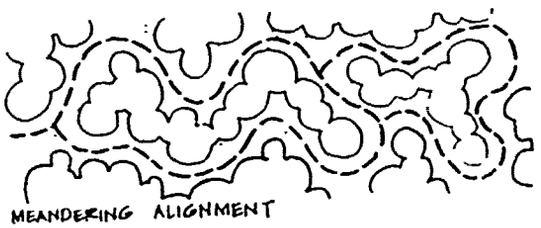
i. Retaining or planting trees while developing campsites in such a manner that there will be adequate distance to easily back a trailer into a site or use an awning on a travel trailer. Trim trees, where necessary, to avoid vehicle damage from low branches.

j. Providing places for storing boat trailers within or near campgrounds where they would be secure at night and would not contribute to overuse.

k. Providing courtesy docks to expedite boat launching, especially for boaters who are alone.

l. Providing benches, parking areas, walkways and other support facilities at popular shore fishing areas to aid in evenly distributing use along the bank.

m. Designing a trail in a meandering alignment which allows more people to use an area at one time, limits visibility to other people, and permits hikers to see more and varied features along the trail.



MEANDERING ALIGNMENT

n. Providing pathways that are totally separate from roadways to reduce circulation conflicts.

Management Techniques

Rules and regulations

413. Rules and regulations tend to be direct, clear, and concise compared to many other capacity management techniques. Rules and regulations are generally enforced by Corps rangers and are authorized by Title 36, "Regulations Governing the Occupancy and Use of Corps of Engineers Water Resource Development Projects."[4] At the study project areas most carrying capacity rules and regulations pertain to user safety and resource protection. Most users surveyed cited "strict enforcement of existing rules and regulations" as an acceptable technique for solving overuse and/or overcrowding; however, most users also indicated that it would be unacceptable to impose more rules and regulations to solve overcrowding or overuse. The following section describes several rule- and regulation-related techniques which can be used to achieve and control carrying capacity.

Stricter enforcement

414. Stricter enforcement of regulations can help solve and prevent overcrowding and overuse and allow the carrying capacity of an activity area to be achieved. For example, more patrol boats and stricter enforcement of existing regulations could help reduce the number of boater conflicts and increase the carrying capacity of the lake. Application of this technique to solve carrying capacity problems might be costly, especially when additional vehicles, patrol boats, and patrolling rangers are required. Although this technique may be costly and in some instances difficult to administer, it is effective and is acceptable to most users surveyed. Although all study project areas use this technique, more emphasis could be given to applying this technique to control boating on the lake surface where overcrowding and heavy use occur.

Imposing new rules and regulations

415. Increased rules and regulations could help solve overcrowding and overuse. Rules and regulations relating to resource protection (e.g., "walk-in tenting only," "no parking on the grass") and the preferred distances between users (e.g., rules of courtesy which encourage preferred

distances between boats, fishermen, hikers, etc.) could help achieve a desired carrying capacity. The disadvantages of using this technique include: additional rules result in higher administrative and enforcement costs, some rules could be difficult to administer or enforce, and more rules (in general) are unacceptable to users. Imposing more rules and regulations will be acceptable to users only if overuse and/or overcrowding problems become very obvious to a large percentage of the users.

Limiting the number of people per group

416. Limiting the number of people per group or site can help prevent overcrowding and overuse in campgrounds and picnic areas. This technique, as well as limiting the number of vehicles and/or camping units per site, is currently being used by some Corps project areas (e.g., New Hogan, Ouachita, and Somerville). While this technique is effective and not expensive, it is difficult to administer and is unpopular with users. This technique is most feasible when applied to camping and picnicking activities; justification for limiting the people per group is easier when separate group activity areas are provided within the project area.

Policies

417. Administrative policies, strategies, and courses of action can be effective techniques for achieving carrying capacity and preventing problems of overuse and overcrowding. Certain procedures can reduce user dissatisfaction and frustration. The following paragraphs offer several examples of procedural techniques, some of which may require changes in present policy or legislation.

Closing the gate when areas get full

418. This technique is now being used in both Corps camping areas and day use areas and has proven to be a very effective capacity control technique (e.g., Surry Mountain). In addition to being effective, this technique is easy to use, is not costly, and is accepted by most users surveyed. Some of the study project areas indicated they had difficulty deciding when to close the gate. Sometimes entrance gates are closed because of crowded (underdesigned) support facilities (e.g., parking lots)

rather than because of user overcrowding or resource overuse. Ideally, the gate should be closed when or shortly before an activity area's social capacity is reached. The guidelines in Part V of this report provide a sound basis for determining carrying capacity and for justifying the closing of gates.

Closing areas when resource destruction reaches critical point

419. Closing down areas when natural resource destruction reaches a critical point will prevent further resource overuse. Most users surveyed considered this technique very acceptable if and when it would ever have to be applied. A number of the Corps projects visited have utilized this technique (e.g., Somerville, Ouachita, Surry Mountain, and McNary). In some cases, an entire recreation area was closed down for restoration. In other cases, only selected areas such as overused campsites were closed. If this technique is to be effective, it is important for resource managers to be knowledgable about the best indicators or signs of potential overuse. The monitoring of resource change by managers will enable an area to be closed and restored before restoration becomes infeasible. Some examples of related techniques include:

a. Rotating use to different areas each recreation season.

b. Closing down a different loop of a campground or section of a picnic area for a full season.

c. Opening some recreation areas later in the season than others. Shortening the recreation season of areas which are showing signs of overuse will allow more time for natural restoration and reduce maintenance and restoration costs. Generally, it is not necessary to have all the recreation activity areas open during the early and later stages of the recreation season.

Charging or increasing fees

420. Charging or increasing fees may discourage some people from using an activity area and, as a result, may be effective in reducing overcrowding or overuse. Conversely, eliminating or reducing fees could help solve underuse. The charging of fees simply as a technique to solve overcrowding or overuse was unacceptable to most of the users surveyed. Many users indicated a willingness to pay fees for increased levels of service. Charging or increasing fees may cause users to be

more sensitive to and demanding about the level of development and services they receive. Perhaps more importantly is the fact that fees could provide revenue for additional maintenance and services. Differential pricing of campsites (e.g., sites with electric service costing $0.50 more than the others) is presently being used and is being accepted by the Corps campers. Perhaps fees could be higher where sites are most popular or vulnerable.

421. Currently, Federal legislation prohibits the Corps of Engineers from collecting general entrance fees to use project areas. Fees, however, may be collected at improved campgrounds and boat ramps if mechanical or hydraulic boat lifts are provided. Project areas which permit camping must provide at least one primitive, nonfee campground. Fees may not be charged for use in any combination of drinking water, wayside exhibits, roads, overlook sites, visitor centers, scenic drives, toilet facilities, picnic tables or boat ramps (except if mechanical or hydraulic lifts are provided).[5]

Requiring permits to use recreation areas

422. Overcrowding and overuse together with a limited number of campsites, acres of water, picnic sites, or other recreation facilities could cause resource managers to face the difficult task of allocating these recreational spaces to users in a fair and efficient manner. Proper treatment under these conditions may require a permit or rationing system. Permits could be issued on a lottery, price, advanced reservation, merit, or first come first serve basis. Obviously, each method has certain disadvantages and advantages that project managers must carefully consider prior to its application. Although a permit system could be effective, it is more costly, requires more administrative time, and can be unpopular with users. Most of the users surveyed consider this technique to be unacceptable as a solution to overcrowding or overuse.

423. The study project areas use permit systems sparingly. Most activities at the study project areas do not require a permit and most activities are used on a first come first served basis. Where permits are

required, they are issued mainly for group activities such as group camping or group picnicking (e.g., Milford) and for monitoring and controlling the numbers of people visiting the campers.

424. Permit systems are most appropriate and feasible when applied to capacity problems involving boating, camping, picnicking, and off-road vehicle riding. For example, if overcrowding occurs or is anticipated:

a. Boaters could be required to obtain a permit prior to using the lake each season. The fee might only pay for the administrative costs incurred to issue the permit. When a person purchases the permit, he could receive a map of the project area showing the lake and buoy system, a list of boating rules and regulations, and be made aware of any social capacity guidelines regarding preferred boat spacings.

b. Some campgrounds or portions of campgrounds could be selected for prior reservations; this could reduce the frustration of travelling a long way only to find a full campground. If a reservation system is implemented, special care must be taken to ensure that such a system is administered impartially and that users do not believe otherwise.

c. Permits could be required for group picnicking, partying, family reunions, group camping, organized group ORV races or activities, fishing contests, and other special events. At least, the project managers and rangers would know the nature and extent of the activity and event and could determine ahead of time who should be held accountable for group actions.

Creating user turnovers
to reduce overcrowding and
increase carrying capacity

425. This technique involves limiting the length of time a user can engage in an activity. Currently, at the study project areas it is used in campgrounds. At all Corps campgrounds the length of time a camper can stay is no longer than 14 days during any 30-day period.[6] Also, the Corps prohibits the placing of camping equipment on a campsite or intermittent personal appearance at the campsite for the purpose of reserving a designated campsite for future occupancy. This technique works to keep campsites available to many users and to reduce campsite poaching by locals.

426. In addition to camping, this technique might also be feasible

if used to solve overcrowding at small Corps lakes. The type of boating activity on the lake could be varied (sailboating, power boating, waterskiing) at different time intervals and the number of boats using the lake at any one point in time could be controlled by creating and regulating turnover.

427. This technique might also work to eliminate congestion at launching ramps. For example, a flag could be raised at launching ramps indicating it is a good, uncongested time to use the ramp.

Services

428. Services provided by the Corps which help maintain and restore recreation resources and inform users about how these resources can be protected are effective ways of reducing overcrowding and overuse. In addition to being effective, management service-related techniques are generally well accepted by users. Some examples of such techniques are discussed in the following paragraphs.

Increasing maintenance and restoration

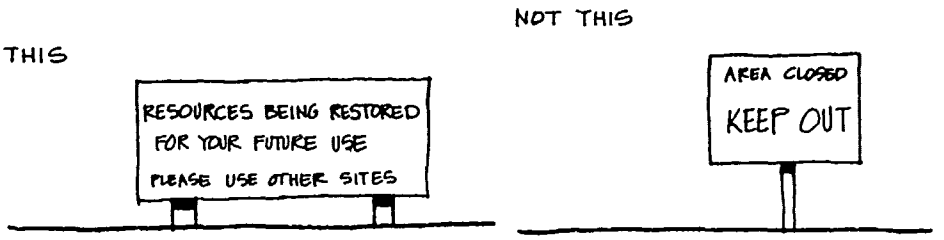
429. Increasing maintenance and restoration can allow for more use, help prevent overuse, and provide more enjoyable recreation experiences. The successfulness of this technique depends upon the severity of the problem and the degree of maintenance and restoration applied. Increasing maintenance and restoration as a technique for solving overuse was found to be very acceptable to most of the users surveyed. Perhaps its major disadvantages are its cost and it could result in having to temporarily close down an activity area. Some overuse problems can be solved simply by more aggressive maintenance and restoration efforts such as reseeding where grass has worn away. Other overuse situations might require bringing in topsoil and seeding, utilizing a hydro-seeder, or application of an intensive restoration program (e.g., Ouachita).

Providing more and better information

430. Providing more and better information on how to properly use the area may help to prevent or solve overcrowding and overuse. This technique is more subtle than most other capacity management techniques. Most of the users surveyed indicated this technique was very acceptable,

although some questioned its effectiveness in actually solving problems of overcrowding and overuse. The study project areas provide information regarding Title 36 and project area rules and regulations. Much of the existing information relates to proper use of campgrounds because they have been the major concern. More and better information could be provided to boaters, fishermen, and other recreators. More and better information, programs, handouts, and brochures could be directed toward educating recreators and making them aware of their role in protecting resources and helping ensure that other recreators have an enjoyable experience. This will help to explain to people why carrying capacity controls are necessary. Also, information presented to users regarding social capacity and preferred spacings could be an effective way of achieving carrying capacity. Carrying capacity information could be presented during interpretive programs, movies, and slide shows; in brochures or handouts; or placed at well-selected sites, such as comfort stations, activity area entrance points, boat ramps, etc.

431. Signs can be used to help prevent overuse and to make recreators more aware of the need for resource protection. Many of the study project areas are using signs to prevent overuse. Signs should have positive wording and explanatory messages. The messages should explain why they are being used; people will better understand the purpose of the sign and have more respect for it. If this is done it is likely that signs could be very effective techniques and also be well accepted by users.



User Acceptance of Techniques

Orientation

432. The problems created by overcrowding and overuse in recreation areas can often be prevented or remedied by more than one carrying capacity control technique. However, equally effective techniques may not be equally acceptable to users. An awareness of user acceptability can assist management in avoiding the use of unpopular techniques where more acceptable techniques are feasible, and can prepare management for expressions of user dissatisfaction where only unpopular techniques are feasible.

433. The user survey asked recreators to assume that problems of overcrowding and overuse existed at the area where they were being interviewed. The survey then asked them to evaluate the acceptability of 22 techniques dealing with overuse and overcrowding problems. Respondents could select one of four responses: "Very Acceptable," "Mildly Acceptable," "Unacceptable," or "Does Not Apply." Respondents who were uncertain of the first three responses were included in "Does Not Apply."

434. The survey results were grouped into two categories for analysis: land-based activities (camping, picnicking, sunbathing, hiking, off-road vehicle riding, shoreline fishing, and boat launching) and water-based activities (boating, waterskiing, boat fishing, and swimming). The activities are grouped because the use of a technique in one recreation area will likely have an impact on more than one type of user. The survey results are summarized in Table 88.

Overall findings - analysis and conclusions

435. Generally, there is significant agreement among recreators participating in land-based activities and recreators participating in water-based activities as to the acceptability of each technique. Because of this agreement, the survey analysis will not distinguish between land-based recreators and water-based recreators, except where there is a significant difference in their evaluations.

Table 88

User Acceptance of Techniques

Techniques	Land-Based Activities*			Water-Based Activities**		
	Percentage of the Users Responding:					
	Very Acceptable	Mildly Acceptable	Unacceptable	Very Acceptable	Mildly Acceptable	Unacceptable
General Planning Techniques:						
Keep Major Recreation Areas more Separated	55	21	19	56	20	21
Make Vehicle Access to Areas Less Convenient	14	19	66	13	19	67
Make Area's Existence Less Obvious	14	16	67	14	19	65
Site Planning Techniques:						
Redesign Area to Accommodate Fewer Users	36	20	40	30	16	40
Design for Greater Distance between People	49	20	21	34	20	15
Reduce Number of Parking Spaces	28	20	50	24	18	55
Change Natural Surface by Hardening	40	23	36	-	-	-
Change Natural Surface by Paving	35	17	45	-	-	-
Provide Landscaped Buffers	43	19	28	-	-	-
Management Techniques:						
Procedures						
Require Prior Reservations	14	16	68	10	17	70
Require Permits	18	16	61	19	18	62
Charge/Increase Fees	14	23	62	16	17	67
Rules and Regulations						
Impose More Rules	1[illegible]	16	68	17	17	64
Provide Stricter Enforcement of Rules	40	22	36	47	18	34
Close Areas When Natural Resource Destruction Reaches Critical Point	78	14	6	75	13	10
Close Areas When They Become "Too Full"	67	14	19	54	19	26
Reduce Number of Activities in Same Area	38	24	35	46	20	32
Limit Number of People in Visitor Groups	20	13	63	9	10	59
Keep Unnecessary Vehicles Out	65	19	14	63	13	19
Services						
Provide More and Better Information	72	18	7	72	18	9
Increase Maintenance and Restoration	69	20	8	63	19	9
Reduce Facilities and Services	9	11	79	9	11	78

NOTE: Percentages are rounded off, and rows do not total 100 percent because of those responding "Does Not Apply."

*Camping, picnicking, sunbathing, hiking, off-road vehicle riding, shoreline fishing, boat launching.

**Boating, boat fishing, waterskiing, swimming.