final environmental impact statement

volume II - affected environment • environmental consequences

"FES-86-27"

LAKE MEAD

NATIONAL RECREATION AREA / ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

FINAL ENVIRONMENTAL IMPACT STATEMENT

VOLUME II - AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

LAKE MEAD NATIONAL RECREATION AREA
Mohave County, Arizona, and Clark County, Nevada

CONTENTS

VOLUME II

AFFECTED ENVIRONMENT
- Geographic Planning Zone Descriptions 199
- Environmental Constraints 203
- Natural Environment 205
  - Climate 205
  - Geology 205
  - Minerals 207
  - Wilderness Suitability 211
  - Ecological Communities 219
  - Threatened, Endangered, or Candidate Species 226
  - Floodplains and Wetlands 230
  - Water Resources 237
  - Air Quality 240
  - Visual Quality 241
  - Significant Natural Features 241
- Cultural Environment 247
  - Archeological Resources 247
  - Historical Resources 247
- Socioeconomic Environment 251
  - Regional Landownership 251
  - Regional Land Use and Socioeconomics 251
- Visitor Use Analysis 254
  - Regional Recreation Patterns 254
  - Recreation Area Use Patterns 254
- Facility Analysis 264
  - Roads 264
  - Utilities 265

ENVIRONMENTAL CONSEQUENCES
- Introduction and Derivation of Impact Topics 269
- Environmental Impacts of the Proposed Action 276
  - Impact on Public Safety in Floodplains 276
  - Impact on Property in Floodplains 282
  - Impact on Reservoir Water Quality 289
  - Impact on Desert Spring Ecological Communities 291
  - Impact on Soils 291
  - Impact on Significant Natural Features 295
  - Impact on Threatened, Endangered, or Candidate Species 296
  - Impact on Vegetation 298
  - Impact on Bighorn Sheep 299
  - Impact on Visitor Crowding/Congestion 300
  - Impact on Vacation Cabin Site Residents 301
  - Impact on Trailer Village Residents 301
  - Impact on Level of Concession Services 303
  - Impact on Mineral Leasing Opportunity 305
  - Impact on Wilderness Lands 307
  - Irreversible and Irretrievable Impacts 311

Short-Term Uses Versus Long-Term Productivity of the Environment 312
Adverse Impacts That Could Not Be Avoided 313
Environmental Impacts of the No-Action Alternative 315
Impact on Public Safety in Floodplains 315
Impact on Property in Floodplains 317
Impact on Reservoir Water Quality 318
Impact on Desert Spring Ecological Communities 319
Impact on Soils 321
Impact on Significant Natural Features 322
Impact on Threatened, Endangered, or Candidate Species 323
Impact on Vegetation 325
Impact on Bighorn Sheep 326
Impact on Visitor Crowding/Congestion 327
Impact on Vacation Cabin Site Residents 328
Impact on Trailer Village Residents 328
Impact on Level of Concession Services 329
Impact on Mineral Leasing Opportunity 329
Impact on Wilderness Lands 331
Environmental Impacts of Alternative A 337
Impact on Public Safety in Floodplains 337
Impact on Property in Floodplains 339
Impact on Reservoir Water Quality 340
Impact on Desert Spring Ecological Communities 340
Impact on Soils 340
Impact on Significant Natural Features 342
Impact on Threatened, Endangered, or Candidate Species 342
Impact on Vegetation 343
Impact on Bighorn Sheep 344
Impact on Visitor Crowding/Congestion 344
Impact on Vacation Cabin Site Residents 345
Impact on Trailer Village Residents 346
Impact on Level of Concession Services 347
Impact on Mineral Leasing Opportunity 347
Impact on Wilderness Lands 349
Environmental Impacts of Alternative B 351
Impact on Public Safety in Floodplains 351
Impact on Property in Floodplains 353
Impact on Reservoir Water Quality 354
Impact on Desert Spring Ecological Communities 354
Impact on Soils 354
Impact on Significant Natural Features 356
Impact on Threatened, Endangered, or Candidate Species 356
Impact on Vegetation 357
Impact on Bighorn Sheep 358
Impact on Visitor Crowding/Congestion 358
Impact on Vacation Cabin Site Residents 359
Impact on Trailer Village Residents 360
Impact on Level of Concession Services 361
Impact on Mineral Leasing Opportunity 363
Impact on Wilderness Lands 363

CONSULTATION AND COORDINATION
Scoping Process and Issues and Alternatives Raised 371
Visitor Survey 371
Spring Newsletter 371
Planning Team's Analysis 372
Public Meetings 372
Summer Newsletter 373
Alternatives Workbook 373
Additional Public Input 375
Consultation with Agencies During Preparation of the Proposed Plan 375
Issues, Alternatives, and Impact Topics from Scoping 376
Those Considered 376
Those Not Further Considered 376
Consultation and Coordination on the Draft Environmental Impact Statement 377
List of Agencies and Organizations to Whom Copies of the Statement Were Sent or Distributed 386
Comments and Responses 389

APPENDIXES
A: Legislation 499
B: U.S.F.W.S. Consultations 503
C: Cultural Resource Consultations 510
D: Cooperative Agreements 512
E: Glossary of Planning Terms 514
F: Other Flood Mitigation Methods Considered 517
G: Evaluation of Mineral Resources 518
H: Flood Mitigation Compliance 536

BIBLIOGRAPHY 538

LIST OF PREPARERS 541

INDEX 543

CHARTS

Clark County; Mohave County; Region Landownership 253
Residence 1978-1979 Visitors 255
Monthly Visitation 258
Lake Mead (1979-1983) Visitation by Developed Area 259
Lake Mead (1979-1983) Concession Lodging 260
Lake Mead (1962-1983) Visitor Use Levels 261
Lake Mead (1937-1961) Visitor Use Levels 262
Projected Growth 263

ILLUSTRATIONS

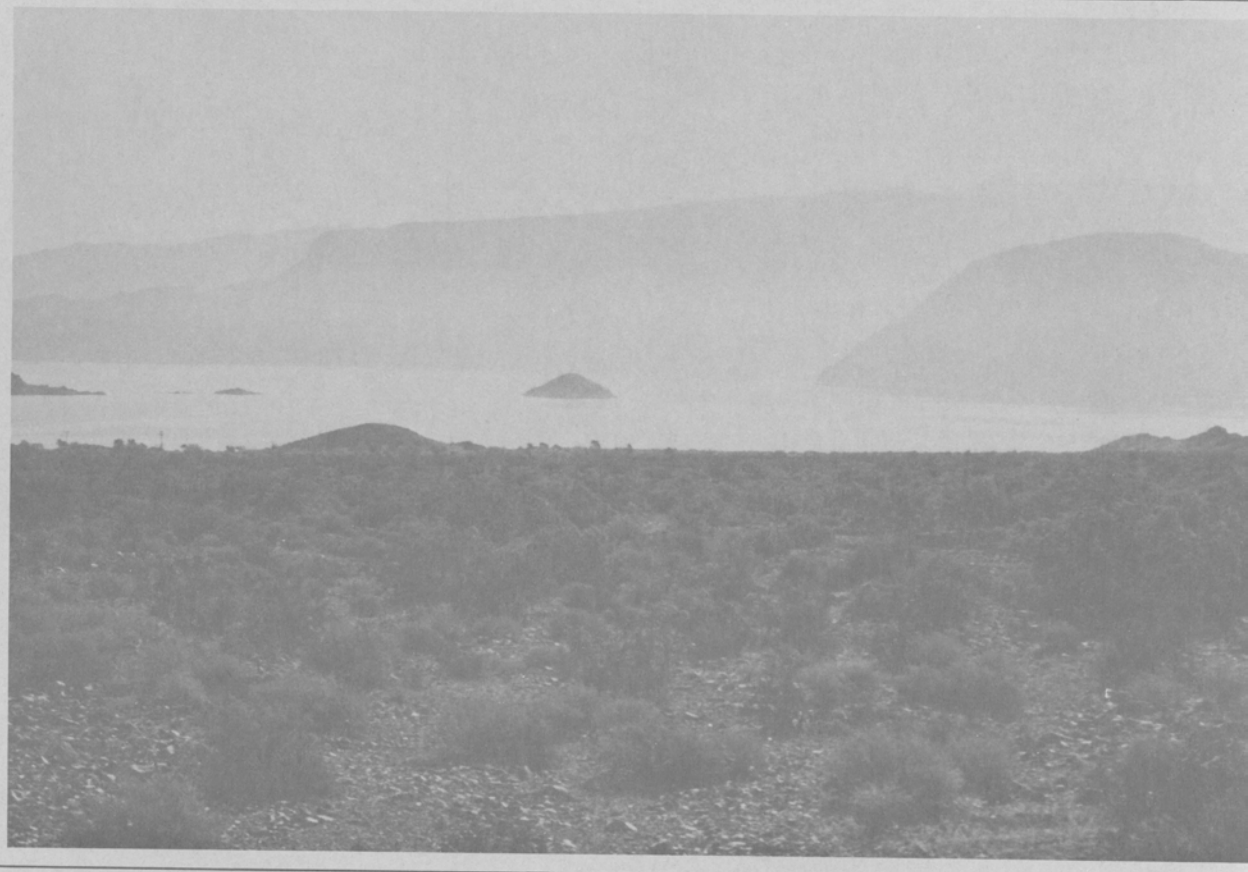
Outstanding Mineral Rights 209
Wilderness Suitability 213
Threatened, Endangered, or Candidate Species 227
Significant Natural Features 245
Cultural Resources 247

TABLES

18: Area of Ecological Communities 220
19: Status of Threatened, Endangered, or Candidate Species 229
20: Status of Floodplain Information 231
21: Developments in the 100-Year and Probable Maximum Flooplain (PMF) 233
22: People in Probable Maximum Flood 237
23: Estimated Costs of Facility Replacement from 100-Year and Probable Maximum Flood 237
24: Estimated number of people in the 100-year floodplain at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans 279
25: Estimated number of people in the probable maximum floodplain at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans 280
26: Existing and proposed development in the floodplain that is left unprotected by structural flood mitigation measures and is vulnerable to flood damage or destruction 284
27: Replacement costs of existing and proposed development in the floodplain that is left unprotected by structural flood mitigation measures and is vulnerable to flood damage or destruction 288
28: Impact on Level of Concession Services, Proposed Action 304
29: Summary of the Effects of the Proposed Action on Lake Mead NRA Lands Meeting or Potentially Meeting Wilderness Act Criteria 310
30: Impact on Level of Concession Services, No-Action Alternative 330
31: Summary of the Effects of No-Action Alternative on Lake Mead NRA Lands Meeting or Potentially Meeting Wilderness Act Criteria 336
32: Impact on Level of Concession Services, Alternative A 348
33: Impact on Level of Concession Services, Alternative B 362
34: Summary of the Effects of Alternative B on Lake Mead NRA Lands Meeting or Potentially Meeting Wilderness Act Criteria 367

PREFACE

This document is divided into two volumes. Volume I describes the general management plan and alternatives. The issues addressed include increasing visitation, congestion and user conflicts, flood mitigation, management zoning, lands suitable for wilderness, illegal use of vehicles off approved roads, resources management, boating carrying capacity, information/interpretation, land protection, trailer and cabin site policy, road problems, Las Vegas Wetlands Park proposal, and NPS and concession development proposals. Volume II describes the affected environment and the environmental consequences of implementing the alternatives and proposed action. A discussion of consultation and coordination, the appendixes, bibliography, and list of document preparers are also included.



AFFECTED ENVIRONMENT

GEOGRAPHIC PLANNING ZONE DESCRIPTIONS

Lake Mead National Recreation Area is so large and complex that it has been divided into several geographic planning zones for ease of discussion. A brief description of each zone follows. The zones are mapped in the "Summary" section in volume I.

Katherine Zone

The Katherine Landing development is the only developed access point within the Katherine zone. This development is a large and highly popular resort area for southern California and Arizona boaters and waterskiers during the summer months; the area also serves local residents year-round as a day use swimming and boat launching area. It is the major houseboat rental center for Lake Mohave. The majority of visitor use for the zone is in the coves immediately surrounding the developed area. Most of these coves are accessible by boat only, and other coves in the zone are accessible only by four-wheel-drive vehicle or by boat and are less used. The flood hazard is severe throughout the main development and in Telephone Cove, and it is considered the third most hazardous developed area in the recreation area for potential flooding.

Cottonwood Zone

A major portion of this zone is Cottonwood Basin, which is the only large basin on Lake Mohave. Access to this area is primarily through Cottonwood Cove, a popular resort during the summer months for water-skiers and boaters. During the fall, winter, and spring the area primarily serves fishermen from nearby communities in Arizona and Nevada. A great variety of watercraft (ski boats, hot boats, fishing boats, and houseboats) uses the marina and day facilities. This area has the second greatest flood hazard of any developed area, with most development being vulnerable.

Willow Beach Zone

The major attraction in this zone is the cold waters of northern Lake Mohave which provide excellent trout fishing. The only developed access point in this zone is a small concession operation that functions primarily as a fishing resort. Overnight accommodations for visitors are currently limited to a motel and short-term trailer sites; the campground has been closed because of flash-flood hazards. This area has the most severe flood hazard of any developed area in the recreation area.

Boulder Basin Zone

The majority of visitors to this zone are day users; overnight accommodations are limited to one small motel at Boulder Beach and four

campgrounds. Most year-round day use is from the Las Vegas metropolitan area, less than 25 miles away. Southern Californians make up a large percentage of the users during summer months, and many of the people attracted to Las Vegas from all parts of the country contribute to day use activities. The main activities are waterskiing, boating, swimming, and fishing. The following developed areas in this zone provide and service day use activities.

Boulder Beach is the largest and most heavily visited development in the recreation area; most of the area is susceptible to shallow sheet flooding across the broad alluvial fan.

Las Vegas Wash is the closest area to Las Vegas and therefore attracts a large number of day use visitors; a severe flood hazard exists only for the boat storage area and launch ramp.

Callville Bay has the largest marina to service boatowners from Las Vegas; it is one of the few developed areas without flood hazard.

Some of the most popular coves within this zone are accessible by boat only. Boats leaving any of the marinas within the zone can reach these coves. Some coves are also accessible by unimproved dirt roads.

Echo Bay Zone

This underutilized access point to the Overton Arm provides a full range of services and facilities for day and overnight use; most visitors are fishermen and houseboaters from Las Vegas and southern California. Despite the well maintained modern facilities, the area has not been heavily used because of its distance from southern California and Las Vegas. However, in response to crowding at developed areas in Boulder Basin, more visitors are seeking less crowded conditions at more distant areas. This trend can be expected to continue as congestion mounts to the south and as the harbor and land-based facilities at Echo Bay are discovered by more people. The area is not threatened by flood hazard.

Stewarts Point provides an additional lake access opportunity within the Echo Bay zone. The access road leads to vacation cabins that dot the bluffs and an unimproved launch ramp.

In addition to the attractive lake areas available within the Echo Bay zone, several features apart from the lake and accessible by the Northshore Road enhance the zone's possibilities for visitor use. Rogers Spring and Bluepoint Spring provide a unique diversion for visitors traveling the highway north or south. Warm water bubbles up from these underground hot springs, creating inviting oases, complete with large trees. Redstone picnic area features large and dramatic appearing sandstone rock outcroppings. Opportunities for exploration and discovery are abundant throughout the geologically varied area.

Overton Beach Zone

A small, uncrowded, developed area provides primary access to the zone. The overnight accommodations are limited to primitive camping areas. Small, nearby communities contribute to visitation and use, but the majority of visitors are from major cities to the north and south. Fall and winter brings retired couples who are escaping cold weather and spring brings local Nevadans for skiing, boating, and fishing. The undeveloped camping area is the only part of the area in a flood-hazard zone.

Virgin/Temple Zone

This zone has great potential for growth and is currently underused. Temple Bar serves as the last concession area (or fuel stop) for boaters traveling east on Lake Mead toward the Grand Canyon. Fishing is the most popular activity; overnight accommodations include a motel, short-term trailer sites, and a 153-site campground. Temple Bar is remote compared to other developments and provides convenient access to less congested portions of the lake. It has the fourth greatest flood hazard risk of any developed area, with most development being vulnerable.

Gregg Basin/Grand Wash Zone

This zone is an undeveloped scenic area of the lake; access is limited to one paved launch ramp at South Cove and one unpaved launch ramp at Pearce Ferry, two improved roads, and several unimproved dirt roads.

Visitors must come prepared because the closest services are at Temple Bar about 15-20 miles away by water. The area is isolated and visitation is low, originating from a variety of locations. Use is primarily overnight beach camping; major activities are boating, skiing, and fishing. Pearce Ferry is a takeout point for river runners in the Grand Canyon and a gateway for trips into the canyon. A flash-flood hazard exists at Pearce Ferry and in many of the undeveloped coves in the zone.

Shivwits Plateau Zone

This area is the most isolated and least visited in the recreation area. It is grazed and visitors are generally limited to hunters, yet it affords some of the most spectacular views of the canyon rim country. Access is over a county dirt road. The road within the recreation area is rough, slow, and suitable for four-wheel-drive vehicles only. Due to a higher elevation (6,400 feet), the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including the only concentration of mule deer to be found in the recreation area. Big game hunting is a favorite recreational pursuit and probably accounts for the majority of visitation to this area (2,000 visitors per year). Additional recreational

activities include nature study, camping with a vehicle, exploring with four-wheel-drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon; there is no flood hazard in use areas.

ENVIRONMENTAL CONSTRAINTS

Environmental constraints restrict development and use of certain areas within the recreation area. These constraints include climate, unstable soils, vegetation/wildlife, floodplains, and cultural resources.

The climate of the park is typical of the arid desert. Temperature extremes are common (32° to 110°F or 0° to 35°C), and temperatures can vary greatly within a single day. Precipitation averages 3 to 5 inches annually. Snow falls in the highest elevations of the park on the Shivwits Plateau. Late summer and early fall thunderstorms create flash floods in both developed and undeveloped visitor use areas.

Soils within the recreation area are generally shallow, friable, wind-deposited, or alluvial materials that are very susceptible to wind and water erosion. Erosive forces cause significant, sometimes dramatic, and long-lasting changes in physiography. Evaporation rates are much greater than precipitation and this creates extremely low soil moisture conditions throughout the year, which severely restricts plant growth. Modification by use or development causes loss of soils; this soil damage is slow to heal because of sparse plant growth. Unstable gypsum soils occur in several areas along the Overton Beach access road and in the Detrital Bay area.

Vegetation in general does not present any constraints except that once it is disturbed, the recovery period is usually long. The exotic species, tamarisk, which invades wet areas, often becomes so thick that it limits usable beach space and drys up wildlife water sources. There are several species of plants (see significant natural features under natural environment in "Affected Environment" section) that are significant because, for example, they reach their northern most limits within the park. There are no plant species, however, that are officially listed as threatened or endangered by the U.S. Fish and Wildlife Service. Several species are being considered for listing, many of which are already listed by the states of Arizona and Nevada or are species of local concern. It is NPS policy to treat such plants as if they were officially listed.

The bonytail chub, Gila elegans, and the bald eagle, Haliaeetus leucocephalus, Peregrine falcon, Falco pregrinus, are the only three animal species found in the recreation area which are officially listed as threatened or endangered by the U.S. Fish and Wildlife Service. As with plants, there are several animal species that would potentially be listed or are listed by the two states, such as the gila monster and desert tortoise. Again, they would be treated by the National Park Service as if they were officially listed. Desert bighorn inhabit many areas within the recreation area and their habitat requirements are quite crucial. Some herds, for example, the River Mountain herd, are among the most productive in the region.

Because of the requirements of Executive Order 11988, "Floodplain Management" 3 CFR 121 (Supp. 1977), Executive Order 11990, "Protection of Wetlands" 3 CFR 121 (Supp. 1977), and the final NPS procedures for implementing these orders, certain restrictions must be placed on use in

the recreation area. Mapping of the 100-year and the probable maximum floodplains was performed by the U.S. Army Corps of Engineers, U.S. Geological Survey, National Park Service, and private consulting firms for all developed areas, several existing and proposed improved access points, and many popular undeveloped visitor use areas. Once the plan is implemented, all the existing or proposed developments that now occur in hazardous flash-flood areas would be designed to protect the structures and provide for human safety.

Fluctuating reservoir levels are also major constraints. Originally the National Park Service, after consulting with the Bureau of Reclamation, considered the maximum reservoir level to be 1,221 feet above sea level for Lake Mead. However, because of abnormally high snowpack in the Rocky Mountains in 1983, the reservoir level reached 1,226 feet. Damage to facilities occurred in the 1,221-foot to 1,226-foot zone. Accordingly, the National Park Service now considers maximum high water to be 1,230 feet above sea level. Any facilities that could be damaged by water would not be allowed below that elevation. Daily fluctuations on Lake Mohave are more than those on Lake Mead; however, the annual fluctuations on Lake Mohave are much less. No facilities would be built below the 650-foot contour, which is considered to be the high waterline for Lake Mohave.

Archeological and historic resources of significance have been nominated for inclusion to the National Register of Historic Places. Adverse effects on these significant archeological and historic resources would be mitigated or avoided.

NATURAL ENVIRONMENT

CLIMATE

The variety of topographical features and elevation differences within the Lake Mead region create numerous microclimates. The lower elevations along the Colorado River and the broad valleys between mountain ranges have an arid climate typical of the Mohave Desert. Precipitation is low, averaging only 3 to 5 inches per year. Humidity is also low and averages about 28 percent. Winters are mild, with daily temperatures in January ranging between 32°F and 55°F on many days. In summer an average July maximum temperature reaches nearly 105°F. Evaporation rates are extremely high and exceed 80 inches per year at the surface of Lake Mead.

Most of the precipitation occurs during the winter months and during July through September. There is a period every late summer when warm, moist, tropical air dominates weather conditions in this area, creating higher than average humidity and scattered thundershowers that cause flash-flooding with rapid runoff and severe erosion. Washes that have been dry for the rest of the year can flow without warning. At Lake Mead the greatest hazard to life and property occurs where developed areas were built in flash-flood washes before the danger was fully understood. Virtually every wash in the recreation area can be the path of a flash flood from time to time. Precipitation during the winter is usually from regional storms of low intensity and longer duration. Less than 2 inches of snow per year falls at lower elevations, and it only remains on the ground for a day or two.

Elevation has a marked effect on climatic conditions. Precipitation increases and temperature decreases toward the higher elevations of the area, and the climate becomes more semiarid and steppe-like. Above elevations of about 5,000 feet, the temperature averages approximately 10°F cooler than the lowlands. Summer temperatures on the Shivwits Plateau have average highs in the 90s and lows in the 60s. Winter temperatures may drop as low as -10°F. Snow may fall at any time between October and April, with total yearly amounts averaging between 18 and 33 inches above elevations of 5,000 feet.

Clear weather is the hallmark of the Lake Mead region. There are few overcast, rainy days during the year. The area along the lower Colorado River, south of Willow Beach, is one of four places on earth having more than 4,000 hours of sunshine each year.

GEOLOGY

Lake Mead National Recreation Area contains approximately 2,350 square miles of biologically and geologically diversified land and water environments. The Grand Wash Cliffs mark the boundary between the Colorado Plateau Province of the eastern portion of the recreation area and the Basin and Range Province of the central and western portions of the recreation area.

The Basin and Range Province is characterized by generally north-south trending mountain ranges separated by broad, shallow valleys. Many of these intervening valleys have no exterior drainage and form enclosed basins. The mountains are dissected by deep ravines that open into broad alluvial fans. Commonly, adjoining fans coalesce and form a continuous alluvial apron along the base of the mountains. These slopes extend outward into the valleys where they merge with the valley floor, or extend across the valley and join opposing slopes that form an alluvial divide. The valley floors are usually nearly level and often contain one or more playas, or dry lakes, where silt, clay, evaporites, and weakly cemented gravels have been deposited. In the tilted, fault-block mountains, the age of strata ranges from Precambrian to Tertiary, while the sediments in the intervening structural basins are all younger than the Mesozoic and consist chiefly of late Tertiary and Quaternary deposits.

The portion of the Colorado Plateau Province within the recreation area lies east of the Grand Wash Cliffs and north of the Grand Canyon of the Colorado River. It encompasses the southern portion of the Shivwits Plateau, the extreme southwestern portion of the Uinkaret Plateau, and a small portion of the inner-canyon platform known as the Esplanade.

Most of the upland plateau is a gently rolling but dissected tableland. A number of lava-capped buttes rise above the general landscape, culminating in 7 million-year-old Mount Dellenbaugh, which at an elevation of 6,990 feet is the highest point in the recreation area. The southern edge of the plateau drops away precipitously toward the Colorado River.

The sedimentary rock column includes strata ranging in age from Lower Cambrian to Middle Triassic and overlies a basement complex of Precambrian granite and schist. The sedimentary formations are nearly horizontal and generally have a dip of less than 5° to the east and northeast.

Most of the faults in this section of the recreation area are high-angle and dip-slip, with some having a scissors movement. Structurally and topographically, this portion of the Colorado Plateau contrasts sharply with the deep structural basins, block-faulted ranges, and tilted blocks of strata that are characteristic of the Basin and Range Province to the west.

This portion of the Colorado Plateau provides a classic example of landscape development in nearly horizontal sedimentary rocks with different resistance to erosion under semiarid conditions. In general the landscape is composed of five classes of features: steep to vertical-walled canyons developed in resistant strata; beveled surfaces of the inner canyon of the Colorado River where the massive crystalline rocks of the Precambrian and lower Paleozoic carbonate strata have a more uniform resistance to erosion; stripped surfaces that are developed on a particularly resistant stratum overlain by less resistant strata, typified by the Kaibab uplands and the Esplanade; scarps, either erosional or tectonic, such as the Hurricane and Grand Wash Cliffs; and surfaces of aggradation, most notably represented by lava flows, talus, and colluvial slopes. The three broad soil associations represented in Lake Mead National Recreation Area are as follows.

Lithosols are thin, stony surface soils derived from rocky parent materials which characterize the slopes and crests of parallel desert ranges. These soils support scant growths of desert shrubs. Areas include desert ranges, such as Eldorado, Newberry, Black, River, Muddy, and Virgin mountains; the crests, rocky slopes, and upper part of some associated alluvial slopes; and steep-walled canyons.

Red desert soils are pinkish, reddish, and brownish-gray soils, which are commonly only slightly leached, rich in lime and mineral plant nutrients. They are derived from alluvial outwash from a great variety of rocks in the mountain ranges (metamorphic, granitic, volcanic, sedimentary). Red desert soils include stony to gritty alluvium of fan deposits and finer basin interior deposits. These soils support creosotebush, leguminous trees, cacti, etc. Areas include desert basins, Detrital Wash, Eldorado Valley, and others.

Catron soils are dark brownish-gray to black calcareous soils with moderately high organic content. They are derived from calcareous shales, sandstones, and hard limestone bedrock. Catron soils support a pinyon/juniper grassland association of plants. Areas include the Colorado Plateau section of the recreation area in regions interrupted by outcropping ledges, abrupt cliffs, and deep stream-carved canyons.

MINERALS

The principal source of the following summary of known mineral occurrences and their significance is O'Brien (1982). His report (contracted by the National Park Service, see appendix G) is a compilation of the existing minerals information at the time of writing and is supplemented by mineral occurrence information from U.S. Geological Survey, Nevada Bureau of Mines, U.S. Bureau of Mines, Arizona Bureau of Mines, and a 1985 report from Morrison-Knudsen prepared under contract to the National Park Service. The mineral resource information presented below reflects all these sources and is expressed in section 3031 of the Bureau of Land Management's manual concerning mineral potential reports.

The mineral resources of Lake Mead region are found in widely scattered areas throughout the recreation area. Although there has been a long history of mineral exploration in the area, dating from the early 1860s, mineral production has been minimal. The only recorded production within the last 25 years of leasing at Lake Mead is 60 pounds of tungsten concentrate. For ease of discussion, the mineral resources have been subdivided into metallics, nonmetallics, and energy resources.

Metallic Minerals: Gold in lode deposits has been found in several locations along the west side of Lake Mohave, in the Newberry Mountains and Eldorado Mountains in Nevada, and near Davis Dam in Arizona. Mine production ceased in these areas in 1941. New bulk mining processes for precious metals may make these old mining areas inside and outside the national recreation area (NRA) valuable

for gold production. The Capitol Camp patented mining claim is currently being explored for a gold surface mine. A high potential exists for finding gold deposits within and outside the national recreation area.

Low-grade manganese ores are found in lenticular pockets in the Muddy Creek formation within the NRA. The Three Kids Mine, which was the biggest manganese producer in the state, operated from 1917 to 1961. Lowe (1985) lists four principal manganese deposits within or adjacent to the NRA. A high mineral potential exists for manganese deposits being found within and outside the NRA.

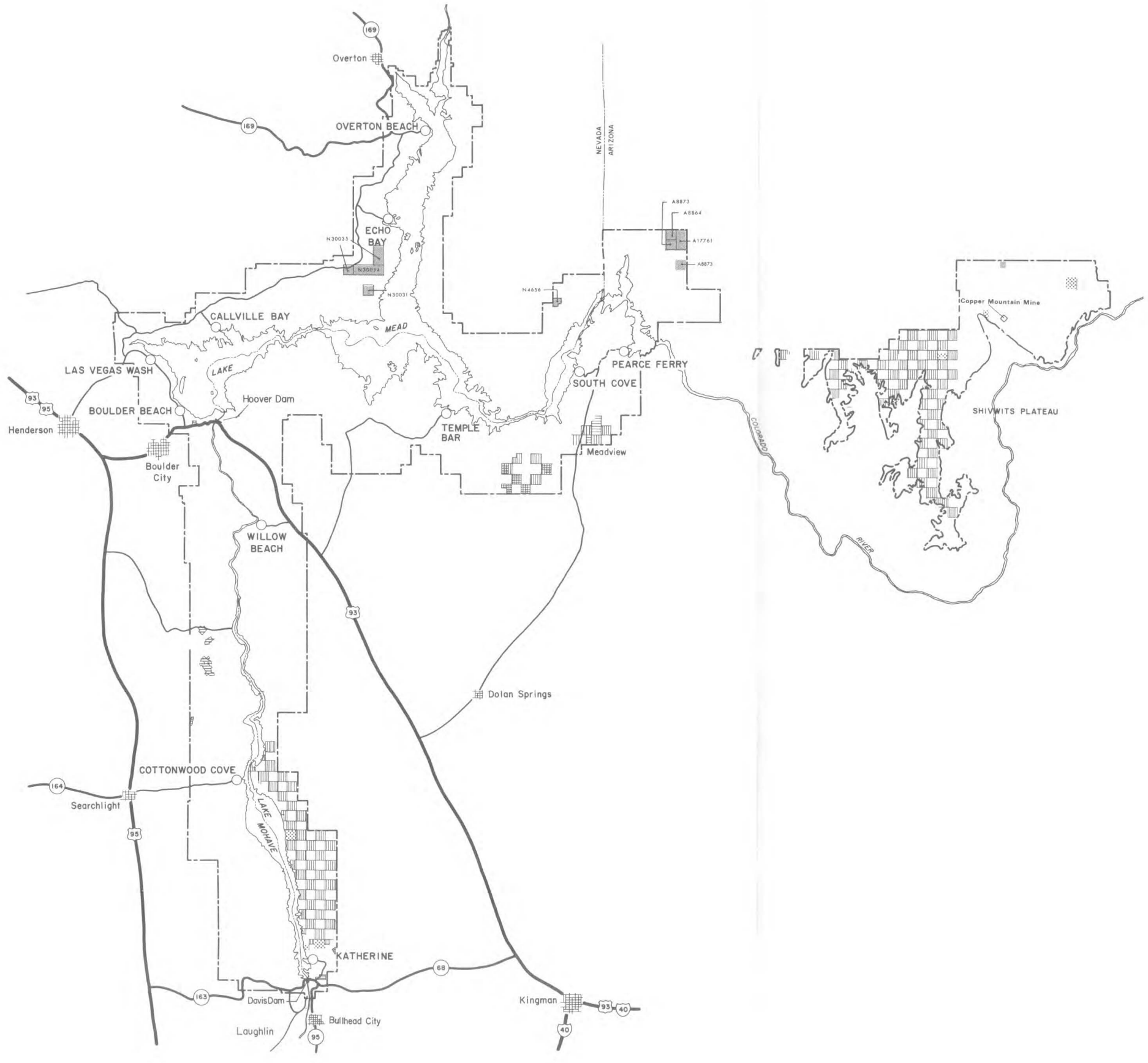
Base metals such as lead, zinc, and copper have been mined at several locations, mostly outside the NRA. These minerals have been produced as by-products of gold and silver mining. Lowe (1985) shows several lead, zinc, and copper occurrences in and adjacent to the NRA, but none are listed as principal deposits. A medium potential exists for lead, zinc, or copper mineral deposits being found within the NRA.

A small deposit of tungsten occurs near Iceberg Canyon within the recreation area. The deposit has been under lease for over 20 years and has produced 60 pounds of concentrate during that time.

Nonmetallic Minerals: Silica is mined outside the recreation area near Overton, Nevada, but there are no reported deposits within the recreation area. Large deposits of salt were mined near St. Thomas Wash and Overton Beach before completion of Hoover Dam but have since been inundated by the waters of Lake Mead. There are subsurface deposits of salt under Detrital and Hualapai valleys outside the recreation area in Arizona, but the need for massive amounts of water to extract the mineral may limit the possibility of using these deposits.

Energy Minerals: Oil and gas leasing has occurred within and adjacent to the recreation area since its establishment and for many years before. However no recent wells have been drilled within the recreation area and no producing fields occur in the region. Recent interest in oil and gas in the area is the result of speculation on the southern trend of the overthrust belt, a productive region in northwest Utah, southwest Wyoming, and northwest Colorado which may also extend into the recreation area. In recent years, several deep wells have been drilled west of the Overton Arm, adjacent to the park boundary, but they have failed to find any promising shows of oil or gas or to confirm the existence of the overthrust belt through stratigraphic testing. Since the last of these holes were drilled in 1980, 64 leases within the recreation area have been withdrawn by their owners. Oil and gas resources have a low potential for occurrence in the recreation area.

Uranium occurs in breccia pipes throughout the Grand Canyon region and extending into the recreation area. Some of these geologic features have been explored for their copper, silver, and gold content.



MINERAL LEASES

BLM Lease #	Acres	Type	Lessee	Date Effective	Annual Rental
NEVADA (4 Leases)					
N4656	400	Mineral	Gentry	4/1/71	$ 100
N30031	640	O&G	IMC Expl.	12/1/82	$ 640
N30034	1,920			9/1/82	$1,920
N30035	1,920				$1,920
ARIZONA (4 Leases)					
A8864	639	O&G	Wahl–Yee	3/1/80	$ 639
A8873	1,280			8/1/80	$1,280
A17761	1,279	O&G	Kenderdine	6/1/82	$1,280

8,078 TOTAL ACRES UNDER LEASE IN NRA — **TOTAL $ 7,779**

4,880 acres leased in Nevada
3,198 acres leased in Arizona

OTHER MINERAL INTERESTS

	ACRES
Copper Mountain Mine (UNPATENTED CLAIMS)	83
PATENTED CLAIMS	941.65
NON FEDERAL SUBSURFACE MINERAL RIGHTS	55,000
STATE LANDS	2,654
TOTAL	**58,678.65**

N

5 0 5 10 15 MILES
5 0 5 10 15 20 KILOMETERS

OUTSTANDING MINERAL RIGHTS

LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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> Interest in uranium exploration centers around the Parashant-Whitmore Canyon area on the Shivwits Plateau where several applications for prospecting permits have been filed in the last few years. Energy Fuels Corporation (oral communication, Sept. 19, 1984) alone found over 3,000-4,000 circular structures which, when field examined, yielded 68 breccia pipe-like structures. Twenty-six of these had ore grade uranium; one is within the NRA. Three operating uranium mines are on the Shivwits, outside the NRA, in similar breccia pipe structures. Some breccia pipes have been drilled and yield little uranium of value. Two of these unsuccessful exploration drill holes are within the NRA. Nonetheless, there is a high potential for finding uranium deposits within and outside the NRA.

O'Brien (1982) found no mineral occurrences of sufficient quality and quantity to affect the nation's supply of any given commodity. There is, however, high to medium potential for finding deposits of several mineral commodities inside and outside the NRA. The probability of future mineral commodity shortages (demand) for which the medium or high potential commodities becoming so important as to override the benefits of protecting wilderness and park values is remote.

WILDERNESS SUITABILITY

The Wilderness Act of 1964 directed the secretary of the interior to review all roadless areas within units of the national park system and to make recommendations as to the suitability or nonsuitability of each area to the president and the Congress. The act defined wilderness as

> an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined to mean . . . an area of undeveloped Federal land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which: (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable; (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation; (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition; and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value.

The act further stated:

> Nothing in this Act shall modify the statutory authority under which units of the national park system are created. Further, the designation of any area of any park, monument, or other unit of the national park system as a wilderness area pursuant to this Act shall in no manner lower the standards evolved for

the use and preservation of such park, monument, or other unit of the national park system in accordance with the Act of August 25, 1916, the statutory authority under which the area was created, or any other Act of Congress which might pertain to or affect such area.

Based on the above criteria, the National Park Service initiated a wilderness review of all the lands within Lake Mead National Recreation Area. This initial review was completed by the National Park Service in 1974, when 409,000 acres were proposed for wilderness. In the president's transmittal to Congress, the recommendation was made to defer action on the Lake Mead proposal, pending a study of western power needs by the Bureau of Reclamation. When this study was completed, the National Park Service initiated a new wilderness review using the information provided by the Bureau of Reclamation. This review was completed in 1979 when 418,000 acres were proposed for wilderness and an additional 262,000 acres were proposed as potential wilderness additions (to be designated wilderness when nonqualifying conditions no longer existed). Revisions to this proposal and the Draft Environmental Statement were being prepared based on public comment when the GMP was initiated. At that time, the National Park Service decided to delay completion of the Wilderness Plan so it would not preclude options for any other authorized uses that might surface during preparation of the GMP.

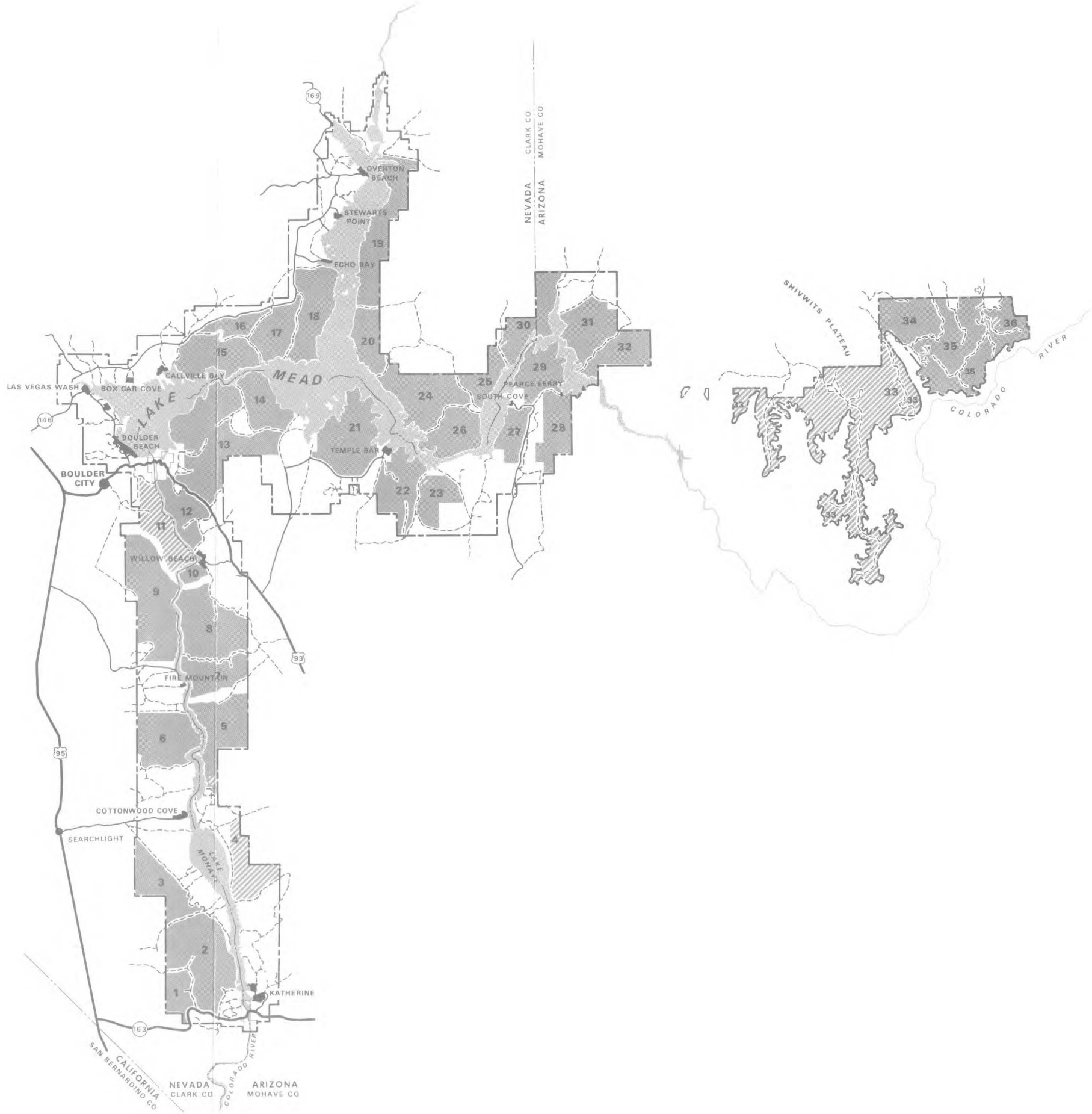
Nothing is proposed for wilderness designation in the GMP. The map included in this section indicates those lands which meet (558,675 acres) or potentially meet (115,700 acres) the criteria of the Wilderness Act of 1964. Following completion of the GMP, a wilderness plan will be prepared. Lands proposed for wilderness designation in that plan will be taken from the lands indicated on this map; other NRA lands will not be affected.

Concerns of conservation organizations over this issue resulted in a lawsuit by the Sierra Club in 1983 (Sierra Club v. Dickenson, civil no. 83-1657 (D.C., Arizona)). The effect of this lawsuit has been to stop mineral leasing within the NRA. The National Park Service anticipates that once the GMP and the MMP have been approved, the mineral leasing program will be reactivated. Thus, all lands possessing wilderness values will be protected until the general management plan has been approved. Once it is approved, mineral leasing will be permitted only in the resource utilization subzone.

The following units are keyed by number to the Wilderness Criteria map. These units which meet or potentially meet the criteria of the Wilderness Act include most of the lands in the recreation area with primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 - Newberry Mountains, Christmas Tree Pass

These units consist of 40,605 acres. They are bordered on the north by the Empire Wash access road, on the east by a 300-foot



WILDERNESS Lands meeting the Wilderness Act Criteria)

POTENTIAL WILDERNESS (Lands potentially meeting the Wilderness Act Criteria)

	WILDERNESS	POTENTIAL WILDERNESS
1	7,650	0
2	32,955	0
3	15,870	0
4	0	15,295
5	17,970	640
6	17,635	0
7	15,145	0
8	25,605	0
9	29,665	0
10	2,045	0
11	0	14,645
12	13,030	0
13	40,835	0
14	13,875	0
15	17,115	0
16	6,680	0
17	14,545	0
18	18,820	0
19	24,040	0
20	10,610	0
21	25,580	0
22	16,665	0
23	9,885	80
24	22,095	0
25	8,545	0
26	14,620	0
27	7,720	0
28	14,020	0
29	13,895	0
30	15,143	460
31	16,480	0
32	12,100	0
33	0	83,980
34	14,905	0
35	32,215	0
36	10,710	600
TOTAL	558,675	1115,700

N

5 0 5 10 15 MILES

5 0 5 10 15 20 KILOMETERS

WILDERNESS SUITABILITY

LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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setback on Lake Mohave, and on the west and south by the boundary of the recreation area and Highway 71. The area centers on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave Power Plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit.

Unit 3 - Nellis Wash

This 15,870-acre unit includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred within the unit. However, it is not obtrusive and no active mining occurs within the unit. A powerline corridor and access road form a boundary to the north and east. The Empire Wash access road bounds the unit on the south, and the recreation area boundary forms its western edge.

Unit 4 - Cottonwood Valley

Cottonwood Valley potentially meets the criteria of the Wilderness Act because of outstanding mineral reservations. However, this outwash trending to the west provides solitude and isolation in a primitive setting north of a major development at Katherine Landing. This 15,295-acre unit is bounded on the north, south, and west by existing access roads and on the east by the recreation area boundary. The terrain slopes gently westward toward Lake Mohave. This unit is adjacent to the Black Mountain North Wilderness study area (WSA) (2-009) managed by the Bureau of Land Management (BLM).

Unit 5 - Black Mountains

The Black Mountains, capped by 2,000-foot Mount Davis, provide a scenic background to users of Lake Mohave. Approximately 17,970 acres are included within this unit. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. The Four Corners-Eldorado Transmission Line forms the north boundary. The west boundary is 300 feet from the high waterline of Lake Mohave, the south boundary follows a series of roads of the Cottonwood Valley system, and the east boundary is the recreation area boundary line. This unit is adjacent to the Mount Davis (2-021) and mockingbird (2-008) WSAs managed by BLM.

Unit 6 - Opal Mountain

Within this unit is a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion and isolation in a setting of scenic splendor. The unit is bounded on the north by the Aztec powerline

road, on the east by a 300-foot setback from Lake Mohave, on the south by the Opal Mountain Road, and on the west by the recreation area boundary. Approximately 17,635 acres are included within this unit.

Units 7, 8, 10, 11, and 12 - Fire Mountain and Black Canyon

These units contain some of the most spectacular and rugged terrain within the NRA. They consist of steep barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. These units consist of 70,470 acres and combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a noted spot for visitors to see sharp and abrupt canyon walls and a myriad of geology. Unit 11 only potentially meets the criteria of the act because the Bureau of Reclamation has identified this area as a potential location for reclamation facilities ranging from modification of Hoover Dam to new transmission line corridors. Each of these potential facilities could require a considerably larger area for construction activities than the principal construction, owing to required site for access roads, transmission and utility lines, and borrow pits. Unit 7 is adjacent to the Van Deeman WSA (2-007) managed by BLM.

Unit 9 - Eldorado Mountains

Contained within this 29,665-acre unit are the picturesque and rugged Eldorado Mountains. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. State Highway 60 forms the southern boundary; the Colorado River/Lake Mohave 300-foot setback constitutes the east boundary, the northeast side is bounded by the Mead-Liberty Transmission Line, and the recreation area boundary forms the west unit boundary.

Unit 13 - Kingman Wash

Approximately 40,835 acres are included within this unit. It is bordered on the north by the 300-foot horizontal setback from the high waterline of Lake Mead; on the west by Kingman Wash access road; on the south by U.S. 93; and on the east by access roads. An area used for intensive recreation and an area which may be needed as a powerline corridor are identified as nonwilderness along the east boundary. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. This unit is adjacent to the Mount Wilson WSA (2-001A) managed by BLM.

Unit 14 - Bonelli Landing

This unit comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum

beds of unit 21. This unit contains some historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is primarily by the road to Bonelli Landing and to Temple Bar.

Units 15, 16, and 17 - Pinto Valley

These three units comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks within the area and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, which is where steep cliffs or barren rock enter the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is formed within these units and exemplifies a much photographed topography because of the red sandstone at outcroppings which merge with the green desert vegetation and the grays, browns, and yellows of the desert floor.

Unit 18 - Cathedral Wash

This 18,820-acre unit is bounded on the north, by the Echo Wash access road; on the east and south, by the 300-foot setback from the high waterline of Lake Mead; and on the west, by Nevada State Highway 167 and the Boathouse Cove access road. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts directly with the flat surface of Lake Mead.

Unit 19 - Overton

Most of this 24,040-acre unit consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular contrasts found within other units. This unit has a typical desert landscape. It has retained its primitive condition and affords an opportunity for seclusion and an unconfined type of recreation. On the north, the unit is bordered by the Narrows South access road; on the east, by the recreation area boundary; on the south, by the Catclaw access road; and on the west, by the 300-foot setback from Lake Mead.

Unit 21 - White Hills, Unit 22 - Temple Bar, and Unit 23 Gregg's Hideout

These units are located within the White Hills. They are characterized by isolation, seclusion, scenic views, and historic significance. This rolling hill country includes some evidence of earlier historic mining activities and trails associated with these efforts. The early methods of mining did not scar the area excessively, and many scars have healed to the point of not being noticeable. However, areas further to the west do not meet the Wilderness Act criteria because they have been severely scarred by

modern exploration techniques and road construction. Unit boundaries consist of access roads, setbacks from Lake Mead, development areas, and recreation area property lines. Access to the area is possible from existing roads, hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain approximately 52,130 acres.

Unit 20 and Units 24 through 32

These units are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units contain rugged mountain ranges which provide a scenic background for the Virgin Basin section of Lake Mead. Gently sloping outwash fans extend from the mountain fronts to plunge abruptly into the reservoir.

The units are bounded by a network of roads that provide access to developed areas or the lakeshore, by recreation area boundaries, and the lakeshore setback. The interior portions of these units are readily accessible from adjacent roads. Unit 20 contains 10,610 acres and units 24 through 32 contain approximately 125,078 acres. Unit 28 is adjacent to the Grapevine Wash WSA (2-014) managed by BLM.

Unit 33 - Shivwits Plateau

Approximately 83,980 acres are included within this unit. A diversity of activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests. Therefore, it also contains a wider variety of wildlife, including the highest number of mule deer to be found in the recreation area. Big game hunting is a favorite recreational pursuit and probably accounts for the majority of visitation to this area. The cooler, wetter climate also provides for some of the better grasslands that sustain larger numbers of cattle per unit of area than other sections of the recreation area. Additional recreational activities include nature study, dry camping with a vehicle, rockhounding, exploring with four-wheel-drive vehicles, and hiking the superlative rim country. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon.

Because there are 66,350 acres of land within this unit which are subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act.

Unit boundaries follow rims, internal access roads, and recreation area boundaries.

Several of the units may appear to be narrow and splintered by access roads. However, when considered along with the adjacent

proposed wilderness in Grand Canyon, it is apparent that these would form a significant contiguous wilderness unit.

Unit 34 - Andrus Point, Unit 35 - Whitmore Point, and Unit 36 - Lava

These three proposed wilderness units consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character with the imprint of man's work substantially unnoticeable. It provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons.

Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon, which is of interest to the scientific and educational communities. Also of interest to these communities are the archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes. Unit 36 is adjacent to the designated Mount Leyan Wilderness Area (Arizona Wilderness Act of 1984).

Grazing has occurred in this region for over 100 years, and the Lake Mead establishing act identifies grazing as an acceptable use. Roads and tanks or water pockets found to be needed for current grazing operations and requiring road access are excluded from the wilderness proposal. All roads in this area and on the Shivwits Plateau serve dual roles in providing access for recreation and for grazing support purposes.

Unit boundaries consist of road systems, recreation area boundaries, and plateau rims. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs.

ECOLOGICAL COMMUNITIES

The ecological communities of Lake Mead can be most conveniently divided, like geology, into the Basin and Range Province and Colorado Plateau Province. The best way to describe wildlife in the park is to relate it to habitats represented by vegetational communities. There are five primary vegetation complexes in the two provinces with numerous subcommunities. The following describes all communities represented in Lake Mead, with emphasis on those communities that would be directly affected by the proposed action.

Desert Shrub Complex

In the Basin and Range Province of the recreation area the desert shrub complex is the most prevelant. Within the complex two distinct communities exist--the creosotebush and blackbrush communities. Because most proposals in the draft plan focus on the lake at existing or proposed developed areas and improved access points, the most affected community would be the creosotebush community. It generally exists around both lakes between 500 and 3,500 feet elevation. However, in many cases access to the lakes would necessitate going through the blackbrush community, which ranges between 3,000 and 4,000 feet elevation, and following washes that comprise the transzonal desert riparian community.

Table 18: Area of Ecological Communities

	Acreage	Percentage
Basin and Range Province		
Creosote Community	1,040,000	70.2
Blackbrush Community	35,000	2.4
Pinyon/Juniper Community	2,800	0.2
	1,077,800	72.8
Colorado Plateau Province		
Pinyon/Juniper Community	107,000	7.2
Sagebrush Community	59,000	4.0
Blackbrush Community	30,000	2.0
Creosote Community	12,000	0.8
Oak Woodland Community	1,200	0.1
	209,200	14.1
Aquatic Areas		
Reservoir Community	186,000	12.50
Stream/Riparian Community	2,000	0.10
Springs Community	100	0.01
	188,100	12.61
Developed Area		
Disturbed Communities	7,300	0.50
Total	1,482,400	100.00

The creosotebush community is found in the western and central portions of the recreation area. The most extensive stands are found northeast of Lake Mead in the Twin Springs and Scanlon Wash areas. It is locally well developed on lower bajadas, alluvial fans, and playas. It may be found occasionally at higher elevations on arid, south-facing slopes. Near the Colorado River, the topography occupied by this community is especially rocky and rugged. Soils typically develop on gray alluvium and generally have high salt-alkali contents that often form caliche hardpans. This community has extreme fluctuations of daily and seasonal temperatures and precipitation. Vegetation cover is sparse in this community and dominated by creosotebush and bursage. Other species common to this community are Mormon tea, brittlebush, range ratany, and indigo bush. Following

the period of above-average precipitation, profusions of annual wildflowers can be observed.

Diurnal lizards and nocturnal snakes are relatively common reptiles in this community. The Gila monster reaches its northernmost range in this area, but like the chuckwalla and the desert tortoise, it is not abundant. Densities of bird species are low. Gambel's quail, raven, desert sparrow, horned lark, roadrunner, and the cactus and rock wrens occur in this community. Five species of bats are common to abundant as are seven species of small rodents. The blacktail jackrabbit and the desert cottontail sometimes become locally abundant. Carnivores such as the coyote, kit fox, badger, and bobcat are relatively common, depending on the supply of smaller animals. The feral burro, wild horse, and domestic livestock graze within this community, and the desert bighorn is rarely found in rugged terrain of this community.

The blackbrush community is similar but of greater density than the creosotebush community. Although small in total area, it is widely scattered throughout the recreation area. This community is predominate in Grand Wash and is secondary in areas adjacent to the Colorado River from Callville Bay to Davis Dam. Small isolated stands are occasionally found at higher elevations. The soils of this community are generally more porous, have lower salt content, are more permeable, and have slightly higher organic contents than the soils of the creosotebush community.

Plants frequently associated with this community include blackbrush, Joshua tree, Mormon tea, rabbitbrush, matchweed, and flat-topped buckwheat. While the herbaceous composition is generally the same as the creosotebush community, perennial grasses such as Indian rice grass and needle grass are more abundant.

Reptiles are well represented in the blackbrush community, but there are not as many as in the creosotebush community. Sage sparrow, ladder-backed woodpecker, raven, and cactus and rock wrens are the more abundant resident birds. Most mammals that are residents of the creosotebush community also inhabit this community. Desert bighorn graze in the upper elevations. Other grazing animals include nonnative burros, horses, and domestic cattle. Competition exists among these animals for forage and water. Desert bighorn and burros frequently compete for scarce water sources, but with the reservoirs available this competition is reduced. Grazing impacts on rare, threatened, or endangered plants has not been adequately studied to know the level of effect.

The desert riparian community comprises vegetation in local desert washes, which is not dramatically different in growth-form from that of the surrounding desert shrub communities. Plants are comparable but usually occur in greater density in the desert riparian community. As a result, it is commonly recognized as a transzonal rather than distinct community. Like its Sonoran counterpart, it is scattered like fingers through the landscape. Roadsides are quite similar to these washes because of concentrated water runoff from the pavement surface. Soils are usually silty to sandy but become quite rocky at the higher

elevations. As would be expected, increased subsurface water may be available, allowing greater densities of plants. Mesquite, catclaw acacia, desert willow, cheeseweed, and non-native tamarisk give this community a slightly more developed appearance. On portions of the Colorado River upstream from Lake Mead, ocotillo can be found along the edges of this community. This transzonal complex also extends into major laterals such as Whitmore and Andrus canyons.

Animal species are also similar to those of the surrounding communities; the major difference is that they occur more frequently. Desert wood rats are frequently found in this environment because it offers more abundant food and cover sources than do the adjoining communities. These factors undoubtedly account for the greater density of desert birdlife found here. Feral burros and domestic cattle also use this ecosystem.

Woodland Vegetation Complex

This complex in the Basin and Range portion of the recreation area is represented by only the pinyon/juniper community. The Newberry Mountains area near the southwest corner,is the only area exhibiting this higher growth-form and more complex interrelationship of plant and animal life. Nothing has been proposed which would directly affect this area.

Generally surrounded by the blackbrush community, this area receives a greater amount of annual precipitation that supports the more developed community. The dominant species of plants in this community are the California juniper and the pinyon or single-leaf pine. Herbaceous plants are well represented.

Reptiles are not as well represented here as in the communities at lower elevations. Bird species include rock wren, red-tailed hawk, common bushtit, western bluebird, and Gambel's quail. Mammals are well represented, and the area is a major locality for upland game hunting. Several signs and positive sightings of desert bighorn have recently been made nearby. Common carnivores include bobcat, coyote, and gray fox. Domestic livestock and feral burros have frequented and continue to use this community. Except for occasional trespass, domestic livestock and feral burros do not use this community in the Newberry Mountains.

Aquatic Community Complex

This complex contains four distinct communities in the recreation area--desert spring, lake, stream, and stream riparian communities. Evidence concerning the desert spring community indicates that a larger number of desert springs flowed historically. A major concentration of active springs occurs on each side of the Colorado River between Hoover Dam and Willow Beach where no new proposals have been made. However, proposals have been made at Rogers and Bluepoint springs north of Echo Bay.

Many springs are thermal, and water temperatures vary slightly on an annual basis. Various aquatic plant species can be expected, and the peripheries of springs may have a number of sedges, rushes, cattails, salt grass, and salt-tolerant shrubs. Cottonwoods, mesquite, desert willow, palms, and tamarisk may also be found in these mesic soils. Formerly active springs or water catchments provided greater water availability, indicated by the presence of cottonwoods, mesquite, scrub oak, and wild grape.

Although use of local springs as watering sites by resident and migrant birds may not be as great as during preimpoundment days, the springs continue to provide considerable shelter for the park's bird populations.

The lake community contains several variables that influence vegetation and distributions of game fish. This community would only be affected by proposals to use fill to reclaim land from the lakes and in construction of new launch ramps.

Lake Mohave, with its cold upstream water temperatures, has long been known for its excellent trout fishing. Rainbow trout are planted by the U.S. Fish and Wildlife Service directly into Lake Mohave from the Willow Beach Hatchery. The state of Nevada has previously planted kokanee salmon on an experimental basis with little success. Late each spring, the transition zone between colder uplake and warmer downlake waters provides an extremely vivid rust-to-near-orange display of algae in the Chalk Cliff to Monkey Cove area. A noticeable change in game fish composition is associated with this six-mile transition zone. Below the transition zone one can expect fewer trout and an increasing number of largemouth bass. However, this fact is less noticeable today because of increased downlake stocking of rainbow trout and other salmonids. Although it has not been determined how striped bass entered Lake Mohave, it has been confirmed that they are now established in the Lake. This introduction may affect the trout fishing in the future.

Use of the lake community by birds such as western and eared grebes, gulls, egrets, herons, several species of shorebirds, bald and golden eagles, white pelicans, and ospreys is significant. Although not all use the lake community for the basic necessities of food, shelter, or escape cover, most are closely associated to the lake, stream riparian, and stream communities.

The stream community is limited to the waters of the Colorado River (upstream from Lake Mead), Muddy and Virgin rivers, and to the clear or relatively nonsilted lower reaches of Las Vegas Wash and the Colorado River below Hoover and Davis dams. Nothing has been proposed which would affect these areas.

Several variables, including turbidity, depths, widths, velocity, and temperature, influence vegetation within this community. Numerous endemic nongame and nonnative fishes currently inhabit the community. Carp, striped bass, and channel catfish predominate in the waters of the

Colorado River. The introduced striped bass and rainbow trout provide a major sport fishing resource in river waters below Davis Dam. Beaver, and soft-shelled turtle are reportedly found in the Virgin and Muddy rivers and below Davis Dam in the Colorado River.

The stream riparian community is found along Las Vegas Wash and the Muddy, Virgin, and Colorado rivers. Narrow mesic canyons of the Newberry Mountains containing intermittent flows also support riparian vegetation. In addition, limited and scattered shoreline environments of Lakes Mead and Mohave display similar characteristics when lake elevation fluctuations are minimized. For the most part, this is not a natural situation, but rather is manipulated by man as lake levels fluctuate and exotics invade disturbed areas. Proposals that might affect this community are limited to shoreline areas.

Fremont poplar, willow, desert willow, cattail, mesquite, and the nonnative tamarisk might exist. Sedges, rush, monkey flower, and grasses can also be found within this community. Amphibians are represented by the spade-foot toad, the red spotted toad, the introduced bullfrog, and by the tiger salamander introduced in larval form as fishing bait. Beavers, desert bighorns, feral burros, domestic cattle, and coyotes are particularly noticeable in this community.

Colorado Plateau

Although this province contains communities representative of the three vegetational complexes, noted in the Basin and Range Province, they are discussed separately for two reasons. First, because of the differences in elevation and climate from the Basin and Range Province, the composition and density of similar communities can be dramatically different. Second, there is little proposed which will have an effect on the Shivwits Plateau so a detailed description is not necessary. Five distinct communities and one transzonal community are in the area.

The most abundant community on the Shivwits Plateau, the pinyon/juniper association, extends from Snap Point east to Andrus Canyon. Although the Utah juniper and pinyon pine are the dominant plants, ponderosa pine and big sagebrush stands are scattered throughout this community along major drainages. Therefore, portions of this association might vary considerably, with the typical woodland merging into a forest association of ponderosa pine or an extremely sparse stand of juniper with a dense understory of big sagebrush. Plants frequently found in this community are Gambel oak, gooseberry, squawbush, snowberry, and fleabane.

The sagebrush community consists mainly of sagebrush and rabbitbrush and dominates large portions of the Shivwits Plateau. Other plants frequently associated with these indicators are matchweed, rubberweed, cliffrose, Apache plume, and on limestone outcrops, agave.

The pinyon/juniper and sagebrush communities comprise the major areas used for cattle grazing. Mule deer, wild turkey, coyote, badger, wood rat, gopher, deer mouse, cottontail, and blacktail jackrabbit, Gambel's quail, common flicker, raven, scrub jay, Oregon junco, white breasted

nuthatch, rattlesnakes, and several lizards are some of the resident and transient wildlife.

Although more extensive areas of the oak woodland community are adjacent to the recreation area (Mt. Trumbull and Oak Grove Hill), some isolated stands occur in areas of limited exposure on Mt. Dellenbaugh. Southerly exposures support a sparse stand of Gambel oak with an impenetrable understory of manzanita, while northern exposures are more diverse and support Gambel oak, the New Mexico locust, pinyon and ponderosa pine, Utah juniper, barberry, and chokecherry.

The blackbrush and the creosotebush communities are dominant at lower elevations in the Colorado Plateau province of the park. These communities are similar in structure to those described previously for the Basin and Range portion.

The sheer cliffs that separate the Shivwits and Sanup plateaus comprise the transzonal community in the area. Vegetation and wildlife are generally rare in this community, with the exception of several species of bats and small rodents that utilize the many caves in the cliffs. Desert bighorn are known to be transient throughout the community while they range between plateaus.

Developed/Improved Access Areas

There are dramatic differences between these man-made areas and the natural vegetational communities that surround them. All existing and proposed developed areas occur in the creosotebush community close to the lakes. The vegetation in these areas is a sampling of non-native and native species. Intermingled with islands of natural vegetation typical of the creosotebush community are manicured lawns, oleanders, fan palms, flower gardens, and other non-native species. Natural drainages and runoff patterns have been altered by flood-control structures, roads, parking areas, and buildings causing changes in soil moisture content and subsequently species composition. Wildlife species typical of the surrounding community occasionally enter or pass through developed areas, but this is a rare occurrence because of the noise and activity associated with the areas.

It is relatively safe to assume that virtually everything within the confines of developed areas has been previously disturbed.

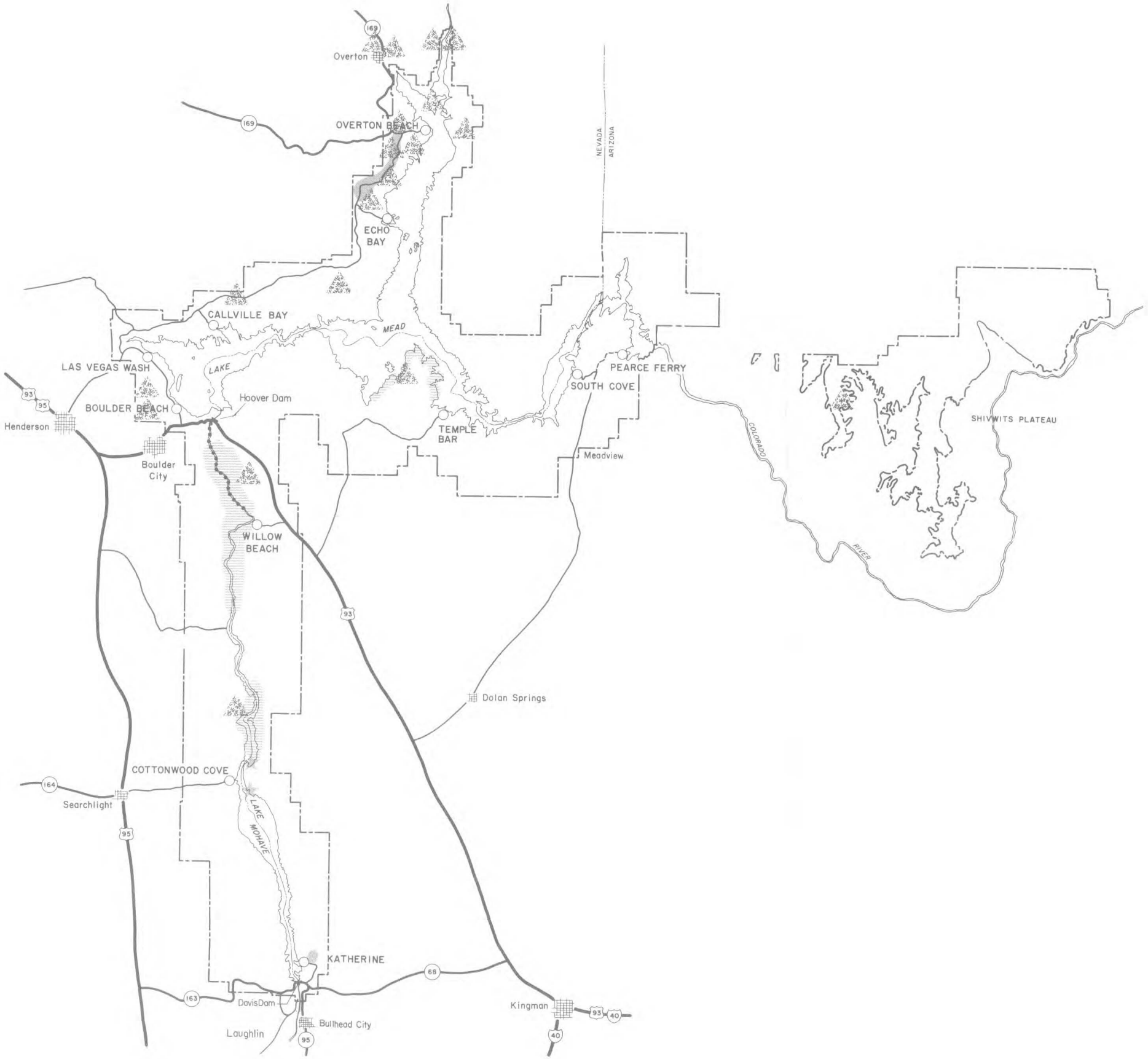
Although not as dramatic, many existing and proposed improved access points have been altered by man. Points not located at the mouths of washes but near the shoreline are also within the creosotebush community. Because of the flood hazard, new access points have not been proposed in washes but access may be through the wash or nearby development. All affected washes comprise the desert riparian, transzonal community. Some isolated stream riparian communities may also be nearby. No improved access point has been proposed which has not historically been used by visitors for camping. The disturbance is not as drastic as in developed areas, but roads, trails, and popular campsites have altered the natural vegetation and wildlife habitats.

THREATENED, ENDANGERED, OR CANDIDATE SPECIES

Pursuant to section 7 of the Endangered Species Act of 1973, as amended, a list of threatened, endangered, or candidate plants and wildife and critical habitat that are present or may be present in the recreation area was requested from the U.S. Fish and Wildlife Service (USFWS) on February 24, 1983. Their reply, dated April 8, 1983 (see appendix B), is the most up-to-date information available at this time. There are no threatened, endangered, or candidate species of plants or their critical habitat in Lake Mead NRA. The endangered bonytail chub, Gila elegans; and falcon, Facco peregrines; bald eagle, Haliaeetus leucocephalus are the only federally listed animal species that are known to occur within the recreation area (see Threatened, Endangered, or Candidate Species map and table 19).

Although not officially listed, there are a number of species that do or could occur in the recreation area that are listed as candidate species. Some of these species are listed as threatened, endangered, or species of concern by the states of Arizona and Nevada. Refer to table 18 for the status and legal classification of all these threatened, endangered, or other rare species. Of these 24 species, 20 are known to occur in the recreation area. Of the 20, six are rare migratory transients in the recreation area with wide distributions outside the area. Thus, only 14 are of concern.

Those 14 species' ranges (peregrine excepted) in the recreation area are shown on the Threatened, Endangered, or Candidate Species map. They will be protected by the National Park Service and will be constraints on planning within the recreation area.



PEREGRINE FALCON - one successful breeding pair, (not shown)

DESERT TORTOISE - infrequent occurrence throughout NRA, except Shivwits plateau (not shown)

RAZORBACK SUCKER

WINTERING BALD EAGLE HABITAT

KNOWN GILA MONSTER HABITAT

BONYTAIL CHUB RECOVERY COVE

PLANT SPECIES (Eriogonum viscidulum, Arctomecon californica, Penstemon bicolor ssp. roseus, Astragalus geyeri var. Triquetrus, Cryptantha insolita, Opuntia basilaris var. treleasei, and Rosa stellata)

N

3 0 5 15 MILES

5 0 5 10 15 20 KILOMETERS

THREATENED, ENDANGERED, OR CANDIDATE SPECIES

LAKE MEAD NATIONAL RECREATION AREA

ARIZONA-NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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Table 19: Status of Threatened, Endangered, or Candidate Species

		Status				Legal Classification		
		R	E	V	D	USFWS	NV	AZ
Mammals								
Spotted bat	Euderma maculatum	--	--	--	0	C	T	
Fishes								
Razorback sucker	Xyrauchen texanus	1	1	1	1	C		T
Bonytail chub	Gila elegans	3	3	3	1	E	E	E
Birds								
Bald eagle	Haliaeetus leucocephalus	1	2	1	1	E	E	E
Peregrine falcon	Falco peregrinus	3	1	1	1	E	E	T
White-faced ibis	Plegadis chihi	0	--	--	1	C	--	--
Swainson's hawk	Buteo swainsoni	0	--	--	1	C	--	--
Ferruginous hawk	Buteo regalis	0	--	--	1	C	--	--
Western snowy plover	Charadrius alexandrinus nivosus	0	--	--	1	C	--	--
Mountain plover	Charadrius montanus	--	--	--	0	C	--	--
Long-billed curlew	Numeius americanus	0	--	--	1	C	--	--
Western yellow-billed cuckoo	Coccyzus americanus occidentalis	0	--	--	1	C	--	--
Reptiles								
Desert tortoise	Scaptochelys agassizii	1	1	1	1	C	T	T
Gila monster	Heloderma suspectum	1	1	1	1	C	T	
Plants								
Sticky buckwheat	Eriogonum viscidulum	3	3	1	2	C	E	
Bear paw poppy	Arctomecon californica	1	1	1	2	C	E	
Bicolored penstemon	Penstemon bicolor ssp. roseus	2	3	1	2	C	C	--
milk-vetch	Astragalus geyeri var. triquetrus	3	3	2	2	C	--	--
catseye	Cryptantha insolita	3	3	3	2	C	--	--
Bakersfield beavertail cactus	Opuntia basilaris var. treleasei	3	3	2	2	C	--	--
rose	Rosa stellata	1	1	1	1	C	--	--
evening primrose	Camissonia exilis	--	--	--	--	C	--	--
Thompson's wild buckwheat	Eriogonum thompsonae	--	--	--	--	C	--	--
rock daisy	Perityle megalocephala var. intricata	--	--	--	--	C	--	--

Status

R-Rarity

- 0 Uncommon or rare transient throughout the recreation area
- 1 Uncommon, of limited distribution, but distributed widely enough within the recreation area that potential for extirpation is currently low
- 2 Rare, occurrence confined to several populations or one extended population within the recreation area
- 3 Occurs in very few highly restricted populations

E-Endangerment

- 1 Not endangered within the NRA
- 2 Population within NRA endangered or threatened in part of range
- 3 Population within NRA endangered or threatened on all or the greater part of its range

V-Vigor

- 1 Stable or increasing
- 2 Declining
- 3 Approaching extirpation

D-Distribution

- 0 No confirmed records of occurrence in the recreation area
- 1 Widely distributed outside Lake Mead National Recreation Area but of limited abundance
- 2 Regional endemic (restricted to counties surrounding Lake Mead in Nevada and/or Arizona)

Legal Classification (All animals are protected within the recreation area)

- E - Endangered (or equivalent state designation)
- T - Threatened (or equivalent state designation)
- C - Candidate Species
- USFWS - U.S. Fish & Wildlife Service
- NV - Nevada
- AZ - Arizona

FLOODPLAINS AND WETLANDS

National wetlands inventory maps are not available for the area. However, wetland environments are rare within the recreation area, and none exist along the lakeshores because of the wide variation in water levels. Wetland areas include Rogers and Bluepoint springs, the stream riparian environment in Las Vegas Wash, and the mudflats of the Virgin and Muddy rivers at the north end of the Overton Arm.

Many of the popular visitor use areas at the recreation area both developed and undeveloped, are subject to flash flooding. NPS guidelines define flash flood as one in which the flood waters rise so rapidly that there is insufficient time for warning and evacuation of persons threatened by the flood. NPS guidelines classify such flash-flood areas as high hazard areas and require that specific management actions be taken to reduce the flood hazard. Thus, when studies reveal that existing structures or facilities are subject to flash flooding, as they are in the recreation area, a plan of action must be prepared.

This plan defines the probable maximum floodplain (PMF) and 100-year floodplain. The 100-year flood is the flood that has a 1 percent chance of occurring in any given year. Floods of this magnitude occur frequently enough to pose a serious threat to all facilities and people. The PMF is the largest flood that can ever be expected to occur in an area; however, these floods are rare, and their statistical probability of occurring is uncertain. They have occurred on occasion; for example, in 1974 at Eldorado Canyon on Lake Mohave a flood occurred that was 7.6 times larger than the calculated 100-year flood and two-thirds of the calculated PMF (USDI, GS 1949).

Methodology for Estimating Flood Flows and Designing Mitigation Measures

The National Park Service produced a series of "Flood Hazard Studies" (USDI, NPS 1982c) that analyzed 100-year and probable maximum floodplains and presented alternative designs for structural flood mitigation measures. The major developed areas analyzed in these studies included Katherine Landing, Cottonwood Cove, Willow Beach, Boulder Beach, Las Vegas Wash, Overton Beach, and Temple Bar. Because the design of these facilities is so critical for protecting life and property, the National Park Service wanted to test their efficiency. Flood Loss Reduction Associates was hired to provide an independent evaluation (1983) of the National Park Service structural mitigation proposals for Temple Bar, Cottonwood Cove, and Katherine Landing. Their analysis did not reveal any major flaws, but it did recommend several minor changes that would improve the designs. These recommendations have been incorporated into the structural mitigation plans that are presented in the development concept plans.

The calculations for flash-flood flow take into consideration the rate of precipitation, size of drainage, time of flood concentration, length of drainage, change in elevation within the drainage, duration of precipitation, and amount of runoff after absorption in the soil.

Precipitation for the 100-year thunderstorm was determined using the procedures in NOAA Atlas 2, Volume XI, prepared by the National Oceanic and Atmospheric Administration. Precipitation for the probable maximum thunderstorm was determined using the procedures as prescribed in Design of Small Dams, Second Edition, prepared by the Bureau of Reclamation. Runoff was determined by the procedures described in Design of Small Dams. Flood extents were determined using Manning's formula with "n" values of 0.045. Cross sections showing flood flows at strategic locations within each drainage were calculated. This information was then converted to topographic maps. The 100-year and PMF extents are shown on the Development Concept Plan maps for all areas that have flash-flood hazards--Katherine, Cottonwood, Willow Beach, Las Vegas Wash, Overton Beach, and Temple Bar.

Table 20 describes the level of floodplain information available for each developed area.

Table 20: Status of Floodplain Information

	Floodplain Mapped			Agency			
Developed Area	100	500	PMF	NPS	USGS	CORPS	Pvt.
Katherine Landing	X	X	X	X	X		
Cottonwood Cove	X	X	X	X	X		X
Willow Beach	X	X	X	X	X		X
Boulder Beach*	X			X			
Las Vegas Wash	X	X	X	X		X	
Callville Bay	No hazard						
Echo Bay	No hazard						
Overton Beach	X		X	X			
Temple Bar	X	X	X	X		X	
South Cove	X		X			X	
Pearce Ferry	X		X			X	

*Cross sections only

The Corps of Engineers has also mapped the 100-year, 500-year, and PMF floodplain for the following undeveloped, but popular, visitor use areas: Gypsum Wash, Government Wash, Boxcar Cove, Kingman Wash, Detrital Bay, Gregg's Hideout, Hualapai Wash, and Aztec Wash.

Because the National Park Service did not have extensive experience with nonstructural flood mitigation measures (warning systems, emergency preparedness, and facility relocation), Flood Loss Reduction Associates was hired to do a preliminary evaluation (1982) of nonstructural flood loss reduction measures. Their study recommendations have been included in the development concept plan proposals. They are also proceeding with a

study to refine the proposed nonstructural flood mitigation measures--design of needed warning systems, emergency preparedness measures, evacuation plans, and flood information/education plans.

Floodplain Conditions

Flood hazard is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain.

The floodplain for Boulder Beach is on a broad alluvial fan. Flood flows across such fans often change course during flood events and are otherwise unpredictable. Their flows can concentrate, but generally tend to spread out in sheet flows that are not as dangerous to human safety as flash-flood flows concentrated in canyons. Currently earth dikes above the area's developments concentrate flows in drainage channels that run between facilities. These earth dikes are not designed to withstand a major flood event, and their failure could result in substantial sheet flows reaching developments. Because of the uncertain structural integrity of the earth dikes and the changing nature of the flood flows at Boulder Beach, a map of the floodplain would be misleading and inaccurate; and therefore, was not produced. To portray the situation accurately, all facilities and property should be considered to be in jeopardy of damage from locally concentrated flows or sheet flows (a foot or two deep, but usually shallower), but they would not be destroyed. People are not likely to be killed by sheet flows (some danger remains especially for children, elderly, or the disabled), but locally concentrated flows tend to be deeper and could threaten life. The flood-hazard zone that shows on the DCP graphic for Boulder Beach is a drainage channel that has had numerous flood flows concentrated in it in the past. Otherwise the entire area is susceptible to low sheet flows or unpredictable, locally concentrated flows.

At the existing improved access points, South Cove and Pearce Ferry improvements are out of the flash floodplain or have been signed to warn visitors of the hazard. At the proposed improved access points there is either no flood hazard or no space to locate improvements out of the floodplain. Location of floodplains is shown on the maps for the individual development concept plans.

Table 21 lists developments in the 100-year and PMF. Structures in the floodplain might be damaged or destroyed if a flood occurred. Structures listed in the 100-year floodplain are also in the PMF. However, to avoid repetition, only structures that are in the PMF but not the 100-year floodplain are listed in the PMF column.

Table 21: Development in the 100-Year and Probable Maximum Flood (PMF)

	Existing Conditions	
	100-year	PMF
Katherine Landing		
Access No. & So. Telephone Coves primitive use area and access	1.9 mi., gravel	
Circulation roads to NPS housing	1,950 feet, gravel	
Parking East of motel		700-car, gravel
West of motel		500-car, paved
Launch ramp/ready lane		8 lanes, 150 feet x 200 feet, paved
NPS maintenance		Two 800 sq. ft. bldgs. 1.5 acres unpaved storage 800' fence
NPS and concession housing		1 permanent single family
Trailer Village		33 short-term sites to be relocated
Motel		52 units
Dry boat storage	210 spaces	
Icehouse		Small bldg.
Comfort station	Small bldg.	
Cottonwood Cove		
Access roads*		5 miles, paved
Circulation		2.6 miles, paved
Parking	290 paved 148 gravel	200 paved 90 gravel

	Existing Conditions	
	100-year	PMF
Ranger station	1,800 sq. ft. bldg.	
NPS maintenance	3,000 sq. ft. bldg. pave 25,000 sq. ft. add 600' fence	
NPS housing	Three 1,200 sq. ft. houses, 700-800 sq. ft. trailers, 1,070' paved road	
Picnic area	4 tables 1 large ramada	
Campgrounds (2)*		149 sites
Trailer village*		206 long-term sites; 75 short-term sites
Motel		24 units
Restaurant*		35 seats
Store*		1,200 sq. ft.
Dry boat storage	350 spaces	
Concession maintenance	4,400 sq. ft. bldg. 35,600 sq. ft. paved storage	
Concession housing*		6 trailers 300' gravel road
Gas station*		2 pumps
Comfort station*		Small bldg.
Fish-cleaning station	Small bldg.	

*The 100-year flood was contained in existing earth dikes and channels (see DCP maps) in the Cottonwood area. However, the study indicates that the dike above the employee housing area would probably be breached or overtopped by the 100-year flood and could be in a hazardous location depending on the location of the dike overtopping or breeching. Larger floods may endanger the campgrounds and NPS housing area. The 850-foot section of the dike that parallels the trailer village on the north may only control the 50-year flood. Breeching or overtopping of this section of the dike would allow floodwaters to enter the trailer village and perhaps the store, restaurant, motel, associated parking area, gas station, and comfort station.

	Existing Conditions	
	100-year	PMF
Willow Beach		
Access roads		
Main access 2 of 4 miles in floodplain	2 mi, 2 lane paved	
Trailer village access	1/2 mi, gravel	
Parking	164 paved spaces	
Launch ramp	8 lanes	
Ranger station	1,000 sq. ft.	
NPS maintenance	1,500 sq. ft. bldg. 7,200 sq. ft. paved area 250' fence	
NPS housing (closed)	Four 1,200 sq. ft. houses	
Trailer village	57 long-term sites 18 short-term sites	
Motel	24 units	
Restaurant	100 seats 4,900 sq. ft.	
Store	Part of restaurant	
Dry boat storage	120 spaces	
Concession housing (trailer village)	Ten 1,200 sq. ft. trailers	
Water well buildings	Three 10' x 10' bldgs.	
Canoe/raft takeout	Graded area	
Sewage lagoons		One 1 acre; one .5 acre

	Existing Conditions	
	100-year	PMF
Boulder Beach**		
Las Vegas Wash		
Launch ramp		5 lanes
Overton Beach		
Swim beach	1 acre	
Campground		100 primitive sites
Temple Bar		
Parking		95 spaces paved
Launch ramp		4 lanes
NPS maintenance		2,000 sq. ft. bldg. 22,000 sq. ft. paved area 850' fence
NPS housing		1,500 sq. ft., single family
Campground***		153 sites
Trailer village***		122 sites
Motel***		22 units
Restaurant		76 seats
Store		1,500 sq. ft.
Concession housing		14 trailers
Gas station		2 pumps
Icehouse		Small bldg.
Comfort Station		400 sq. ft.

** Refer to the preceding discussion in this section on the floodplain at Boulder Beach. All facilities are assumed to be in the probable maximum floodplain.

***Although the mapped 100-year floodplain (see DCP graphic) shows flood flows contained by existing earth dikes and channels, those structures are not likely to hold up during such a flood event. Their failure would especially jeopardize the campground, trailer village, and motel.

If a PMF level flood occurred at the recreation area, people would most likely be adversely affected. Table 22 shows an estimate of the numbers of people that would be in the PMF on an average summer weekend day.

Table 22: People in Probable Maximum Floodplain

Developed Area	Existing Conditions Day	Existing Conditions Night
Katherine	1,095	1,120
Cottonwood	1,735	1,590
Willow Beach	490	360
Las Vegas Wash	40	0
Overton Beach	315	550
Temple Bar	1,170	1,250
Total	4,845	4,870

The totals from table 22 represent 5 percent of the total visitation of approximately 96,000 that Lake Mead would have on an average summer weekend day.

In the event of flooding at the recreation area, structures would be damaged or lost. Table 23 provides estimates of the costs of repairing the damage caused by the 100-year and PMF. The costs do not include items such as utilities, furnishings, equipment, vehicles, debris removal, or search and rescue. Expenses of victims, such as those for medical help, funeral expenses, and lost wages caused by death or injury are not included.

Table 23: Estimated Costs of Facility Replacement from 100-Year and Probable Maximum Flood

Developed Area	100-Year	Probable Maximum Flood
Katherine	$ 533,860	$ 3,148,420
Cottonwood	2,049,960	9,535,320
Willow Beach	3,990,600	4,095,600
Las Vegas Wash	0	31,250
Overton Beach	4,280	0
Temple Bar	0	3,644,370
Total	$ 6,578,700	$20,454,960

WATER RESOURCES

The springs in the recreation area vary widely in water quality and in flow characteristics. Many are intermittent, seasonal, and contain high concentrations of dissolved salts. Groundwater exists in several water-bearing aquifers, primarily ancient streams and river gravels capped by basaltic lava.

The major rivers supplying water to the recreation area are the Colorado, Virgin, and Muddy rivers. Flows from the major source, the Colorado

River, are controlled upstream by the Glen Canyon Dam, which intercepts 80-85 percent of the sediment which formerly entered Lake Mead. Most of the streams in the recreation area are intermittent or ephemeral and are subject to seasonal flash flooding primarily in the late summer and early fall months. Las Vegas Wash generally flows year-round because it is the outflow for treated municipal and industrial wastewater from Las Vegas.

Lakes Mead and Mohave are the primary water resources in the region. Lake Mead has a 247-square-mile (157,900-acre) water surface capacity, while Lake Mohave has a 45-square-mile (28,800-acre) capacity. Except for the extremely cold water below Hoover Dam, the lakes are ideal for swimming during the summer and fall months. Boating and water-skiing are other primary uses during the same period. Fishing in both lakes is a primary activity throughout the year.

All developed areas have water and sewage systems. Potable water is obtained from a Basic Management Incorporated (BMI) waterline at Las Vegas Wash; from wells about 150 feet deep at Cottonwood Cove, Willow Beach, and Temple Bar; and directly from the lakes at the remaining areas. It is then filtered, chemically treated, and stored for use in NPS and concession facilities. Wastewater is disposed of by evaporation from lined sewage lagoons at all areas, except Callville Bay where lagoons are unlined. Most of the developed areas have relatively new systems capable of handling much greater demand. Only the systems at Callville Bay and Willow Beach developed areas need to be expanded. All systems comply with state and local health standards and are monitored regularly. Although potable water is not provided at undeveloped access points around the lakes, heavily used areas generally have pit or chemical toilets.

Water quality standards of the state of Arizona specify that Lake Mead and Lake Mohave are to be protected for aquatic life (as a cold water fishery) and wildlife, full body contact recreation, agricultural irrigation, agricultural livestock watering, and as a domestic water source. These standards include allowable limits for various water quality parameters for each of these protected uses.

The state of Nevada water quality standards do not specify protected uses for the Colorado River but do identify numerical (and narrative) standards that must be met at various locations within Lake Mead NRA. These locations include Las Vegas Wash, 0.5 mile downstream of Willow Beach, and 0.5 mile downstream of Davis Dam.

Based on available water quality data and the protected uses of water within Lake Mead NRA, water quality in Lake Mead and Lake Mohave is generally in compliance with established water quality standards throughout the year. However, isolated instances do occur where bacteriological pollution threatens the use of water in the NRA for full body contact recreation. This type of water use includes swimming, water-skiing, and other similar activities during which water may be ingested accidentally and certain sensitive body organs (e.g., eyes and nose) may be exposed to water. Although water quality standards have been established for full body contact recreation for various physical water quality characteristics (e.g., temperature and turbidity) and trace

substances (e.g., arsenic, cadmium, and mercury), the critical water quality parameter for full body contact recreation in Lake Mead NRA is the level of fecal coliforms. The allowable maximum limits for fecal coliforms (in units/100ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5 sample minimum), 400 in 10 percent of samples for a 30-day period; and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. It should also be pointed out that bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (discussed in more detail below). It should be noted that water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions.

The overall water quality at the lakes was the subject of the Arizona Clean Lakes Classification Study (1982) recently conducted by the state. The purpose of the study was to determine the water quality characteristics of all lakes in the state and prioritize them according to those lakes requiring quality restoration work. In the overall ranking of 56 lakes, Lakes Mead and Mohave ranked 48 and 47 respectively, i.e., they require little restoration work. In specific catagories such as Secchi disk visibility, chlorophyl a, phosphates, dissolved oxygen, and nitrogen/nitrates, both lakes ranked consistently high. This speaks well of water quality in the lakes especially when the amount of visitor use is considered. Lakes Mead and Mohave ranked first and third respectively for overall recreation visitor days.

The Las Vegas Wash and Bay area has been a water quality problem on Lake Mead for a number of years. This is principally caused by the use of the wash as an outflow for treated municipal and industrial wastewater from the metropolitan Las Vegas area. In cooperation with Clark County, the state of Nevada, University of Nevada at Las Vegas, and the Environmental Protection Agency, the problem has been regularly monitored and studied since the early 1970s to assess the impacts on the lake and to work with pollution sources to find mitigating measures. The situation is especially critical because this area of the lake receives heavy visitor use. In the 1977 monitoring program report produced by UNLV and submitted to the Clark County Sanitation District, it was established that this is a localized incident that does not influence water quality on the rest of the lake or in Lake Mohave, primarily due to the dilution that occurs in the Boulder Basin. The problem has improved significantly. The Clark County Sanitation District has recently completed a new tertiary sewage treatment plant that is now operational. Industrial waste

evaporation ponds in Henderson, Nevada, which have been monitored as a possible pollution source, are currently being lined to prevent the percolation of contaminants into the groundwater table.

Another water quality problem common throughout the lower Colorado River is the increasing salinity levels. Present levels of salinity have been attributed to a number of sources, with about half coming from natural sources, irrigated agriculture contributing about 37 percent, reservoir evaporation causing 12 percent, out-of-basin exports responsible for 3 percent, and municipal and industrial uses causing 1 percent. Salinity increases result from two processes: salt loading and salt concentration. Salt loading increases the quantity of salt in a given amount of water, and salt concentration decreases the amount of diluting water for a given quantity of salt. Salt loading is seen in the discharge of mineral salts from natural and man-made sources to the river system. Salt concentration occurs through the consumptive use of water in the basin and in the diversion from the basin of water with a low salt concentration. High levels of salinity have adverse economic effects on agricultural, municipal, and industrial water users in the United States and Mexico. A basinwide federal/state program for salinity control is underway.

AIR QUALITY

The air quality of the Lake Mead region is generally good, especially in the Colorado Plateau portion of the recreation area. However, air quality degradation is increasingly evident throughout the lower elevations of the Basin and Range Province. Air pollutants drain into the basin of the Colorado River from all directions and are of particular concern during periods of atmospheric inversion.

The major existing source of air pollutants within the recreation area is the coal-fired Fort Mohave steam generating plant of Southern California Edison Company, about 2 miles from the extreme southern park boundary in Clark County, Nevada. Pollution generated in the Las Vegas Basin west of the recreation area drains into the Boulder Basin along Las Vegas Wash. The automobile is the major generator of this pollution; however, the Henderson Industrial Park, 7 miles to the west of the recreation area, provides a local source of industrial pollution from chemicals, metal processing, and cement production. Other regional sources of pollution include the coal-fired power plant at Moapa, Nevada, about 15 miles northwest of the Overton Arm of Lake Mead; gypsum and some mineral processing plants north of the Boulder Basin; and dust from areas where the desert environment has been disturbed. Under appropriate atmospheric conditions, photochemical oxidants from the Los Angeles Basin are a major source of air pollutants. Since monitoring began in 1968, there has been a decline in air quality.

Background air quality data are not available for the recreation area; therefore, the impact of pollution on the ambient air quality cannot be quantified. However, a 1973 emissions inventory for Clark County, Nevada, carried out by the Air Pollution Control Division of the District Board of Health of Clark County, indicates that motor vehicles are the

major contributors to air pollution in the county by accounting for 97 percent of the carbon monoxide, 81 percent of the hydrocarbons, and 52 percent of the nitrogen oxide emissions. Power plants discharge 89 percent of the sulfur dioxides and 22 percent of the total particulates. Mobile sources account for approximately 245,000 tons of pollutants in the air per year, power plants 83,000 tons, and industrial processes 56,000 tons.

The National Park Service is currently monitoring the visibility at Lake Mead through the use of a teleradiometer and camera. This data will be used to establish baseline air quality information.

VISUAL QUALITY

Visitors at Lake Mead NRA find spectacular scenic vistas from the park roads, lake surface, and hiking routes. Because the desert vegetation tends to be low and sparse, the views are uninhibited for miles. Striking backdrops for all recreational activities include deep canyons, dry washes, sheer cliffs, distant mountain ranges, the lakes, colorful soils and rock formations, mosaics of different vegetation, and changing cloud formations. A panorama of such intriguing features depends on clean dry air and is one of the most important resources in the recreation area.

Preserving the high visual qualities of the area is integral to preserving the high quality of the recreation experience. This is one reason why the National Park Service is so concerned about surface ground disturbance from mineral, oil, and gas leasing; illegal ORV use; and uncontrolled expansion of developed areas.

SIGNIFICANT NATURAL FEATURES

Throughout the recreation area there are many natural features that are important enough to require special attention when considering any planning proposals. These include resources in the outstanding natural features and protected natural area subzones (see "Management Zoning" section); rare, threatened, or endangered species habitat; and areas important for visitor use and appreciation. Uniqueness, critical habitat protection, and aesthetic or recreational value are the criteria for outstanding natural features. Examples of outstanding resources are warm springs, unique geologic formations and plant communities, scenic vistas, desert bighorn lambing grounds, and coves that are popular for their sandy beaches or scenic beauty. These features are identified on the Outstanding Natural Features map and were considered environmental constraints when evaluating development proposals.

Lake Mead affords special protection to some areas or features by including them in special natural area subzones. Starting south on Lake Mohave and moving north, these areas as numbered on the graphic include the following:

1. Mouth of Grapevine Canyon - northernmost occurrence of smoke trees (*Dalea spinosa*) in Nevada and only stand in the recreation area

2. Newberry Mountains - scenic geologic formations in the Christmas Tree Pass and Spirit Mountain areas

3. Cholla Forest - a fascinating dense stand of teddy bear cholla cactus straddling the boundary north of the Cottonwood Cove access road

4. Palo Verde (Cercidium sp.) Forest - northernmost natural occurrence of palo verde trees in the United States and only stand in the recreation area

5. Fire Mountain Area - scenic geologic formations of volcanic origin permeated by very colorful Andesitic flows

6. Black Canyon of the Colorado River - significant geologic and scenic values, with numerous hot and warm water springs and winter habitat for bald eagles

7. Fortification Hill/Paint Pots - colorful and scenic geologic examples of volcanic activity and erosion

8. River Mountains - desert bighorn lambing grounds and habitat (most productive herd in Nevada)

9. Redstone - impressive and scenic geologic formations of Aztec Sandstone

10. Boulder Canyon - spectacular geologic and significant scenic values

11. Pinto Valley - impressive and scenic geologic mix of smooth Aztec sandstone and jagged granite outcrops demonstrating the mountain building geologic process of tilting

12. Rogers and Bluepoint Springs - interesting warm water springs

13. Stewarts Point Area - exposed or close to the surface salt deposits and habitat for rare bearpaw poppy

14. Overton Wildlife Management Area - protected aquatic habitat area managed by the state of Nevada

15. Gypsum Beds - fascinating crystaline gypsum formations and wintering bald eagle habitat

16. Iceberg Canyon - scenic geologic formation demonstrating tilting and unique distribution of the locally limited ocotillo plant

Wintering bald eagle sightings within the recreation area have increased in the last few years. Although isolated sightings have been made in areas, such as Swallow Bay and the Overton Wildlife Management Area, the heaviest concentrations seem to be along the Black Canyon between Eldorado Canyon and Hoover Dam and along the gypsum bed shoreline between Temple Bar and Bonelli Bay. Because this endangered species is

only known to winter but not nest in the recreation area, the chances of conflict with heavy summer visitor use are minimal. Migrant and/or breeding peregrine falcon also appear safe due to their seasonal use of this recreation area and isolation from human disturbances. However, facilities that would encourage increased winter visitor activity should be discouraged. The gila monster is listed as a species of concern by the states of Nevada and Arizona and currently under review for an official listing by U.S. Fish and Wildlife Service, but more data needed. The species has a habitat that generally includes the entire Mojave Desert, a large part of the recreation area. Sightings have been made in many areas, but the majority occur in the Katherine area and along the Northshore Road between the Echo Bay and Overton Beach access roads. Also listed as a species of concern by both states and under review by the U.S. Fish and Wildlife Service is the desert tortoise. The habitat for the tortoise encompasses most of the recreation area, and sightings do not seem to be concentrated in any one area. The bonytail chub is known in the wild in Lake Mohave, one of the only places for this species in the United States. The Arizona Game and Fish Department and the Colorado River Fishes Recovery Team intend to use two coves across the lake from Cottonwood Cove to introduce fingerlings into their natural habitat.

Although there are no federally listed plant species that occur in the recreation area, six species are presently under review for listing by the U.S. Fish and Wildlife Service. These species and their locations within the recreation area are noted in appendix B.

Bighorn sheep are significant because of their value as a game species and as a species that many visitors enjoy viewing. Important bighorn sheep habitats and lambing grounds are identified on the Significant Natural Features map. Population levels of this native species are currently increasing within the NRA.

Nearly 300 identifiable, named coves are on Lake Mead and about 200 on Lake Mohave. Some of these coves are not well suited for any activities while others may be suitable for only one or two activities. Of the 500 coves, only 12 are considered excellent for houseboating, beach camping, and waterskiing, three of the primary activities at Lake Mead. These coves were identified during the 1979 Carrying Capacity Study for both lakes by a team that visited every cove and rated the physical characteristics contributing to the coves' desirability. The activities and characteristics of the coves are as follows:

Houseboating	Waterskiing	Camping
Soft ground-sandy beach	Steep dropoffs	Shade
Steep dropoffs	Sandy beach	Sandy beach
Sheltered cove	Sheltered	Visual screening
Lack of hazards	Sufficient size	Sheltered
	Lack of hazards	Flat area

The following coves are most desirable for the above recreational use:

Lake Mead	Lake Mohave
Road Runner	Davis
Sandy	Chili Pepper
Calico Bay	Cottontail
Bluepoint Bay	Owl Point
Faltons Reef	
Kline Hole	
Glory Hole	
North Bay	

The few coves that have such high desirability ratings have been included as outstanding natural features. The planning process must consider the competition for, traditional use, and accessibility of these resources when making proposals. In some cases it may be advantageous to enhance the coves and in others it may be best to avoid them entirely.

Consideration of significant natural features must go beyond protecting the integrity of the feature itself. The spectacular views these features provide from points around the recreation area must also be considered. For example, the Newberry Mountains have been protected by zoning and their unique geology and scenic value recognized. However, to place a facility or a road scar outside the zone but in the foreground of the view as seen from the heavily visited Katherine developed area would detract from the overall scenic value of the mountains. Likewise, to make development around the Black Canyon visible from U.S. 93 on the Arizona side of Hoover Dam would compromise the scenic integrity of the canyon. Therefore, these and the following outstanding views as shown on the Significant Natural Features map are also constraints to be considered during the planning process.

Newberry Mountains viewed from Katherine area

Black Canyon viewed from U.S. 93

View corridor from Colorado River through Black Canyon

Fortification Hill/Paint Pots viewed from Boulder Beach area

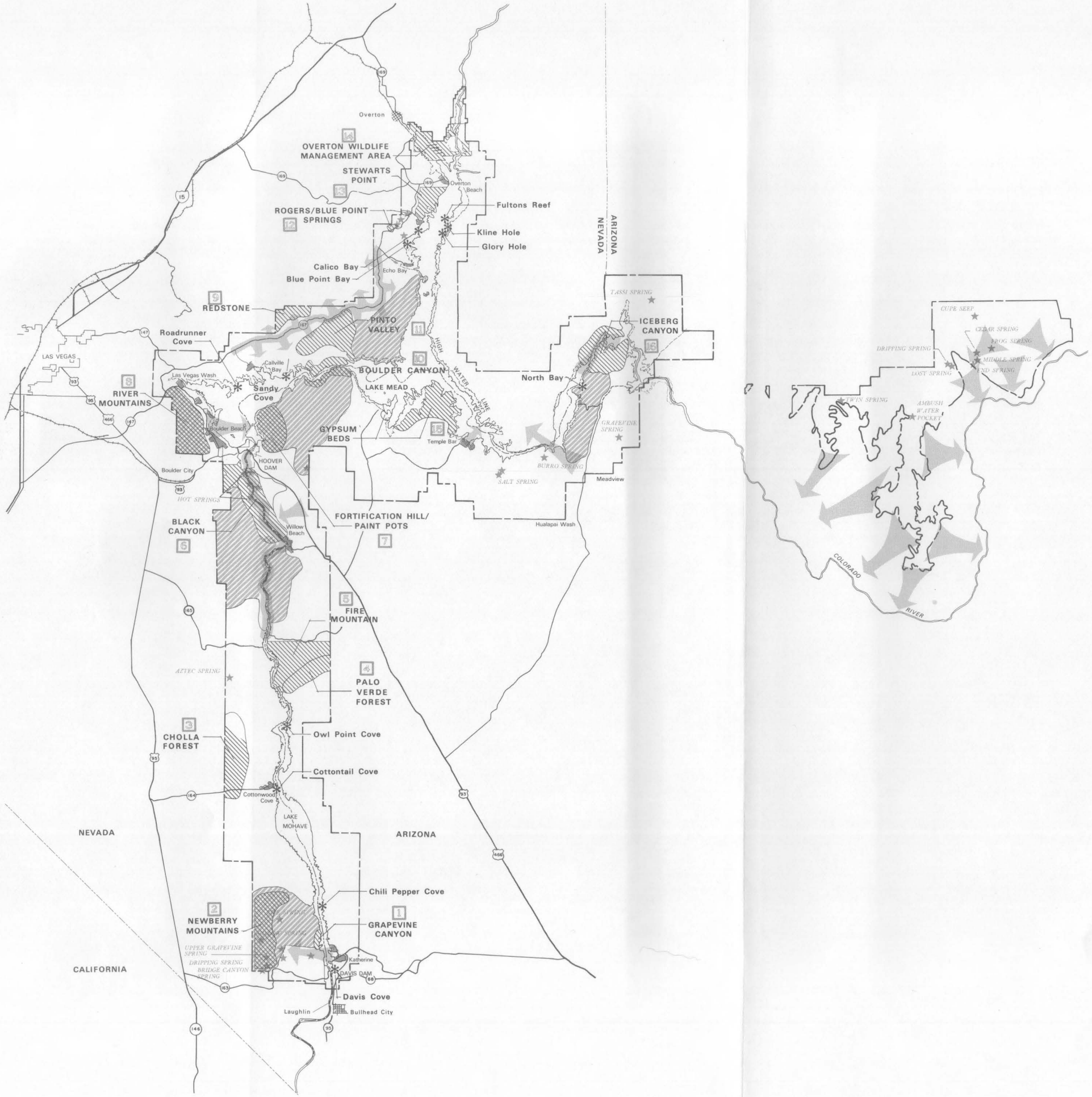
View corridor from Northshore Road between Callville and Echo Bay access roads

The Temple viewed from Temple Bar area

View corridor from water through Iceberg Canyon

Temple and Virgin Basin viewed from Pearce Ferry Road near Meadview

Grand Canyon viewed from rim of Shivwits Plateau



SIGNIFICANT NATURAL FEATURES

BIGHORN SHEEP HABITAT

OUTSTANDING COVE

SPRINGS

VIEW

NUMBERS KEYED TO TEXT

N

5 0 5 10 15 MILES

0 5 10 15 20 KILOMETERS

SIGNIFICANT NATURAL FEATURES

LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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MAR 86|DSC

CULTURAL ENVIRONMENT

ARCHEOLOGICAL RESOURCES

The Lake Mead area has been the subject of extensive archeological, anthropological, and ethnographical studies. Early 20th century research was primarily conducted by private institutions, while work from the 1930s to the 1960s was primarily government-funded and related to the creation of Lakes Mead and Mohave. More recent work has been carried out in conjunction with management of cultural resources at Lake Mead NRA.

Many of the archeological resources now lie beneath the waters of Lakes Mead and Mohave. Still, over 800 archeological sites have been identified above the waterline, and researchers estimate that a complete survey of the recreation area would produce some 2,000 sites. To avoid the loss of archeological resources because of visitor use and development, research priorities in recent years have concentrated on the developed areas near the lakeshores. The backcountry and wilderness areas have been less extensively surveyed.

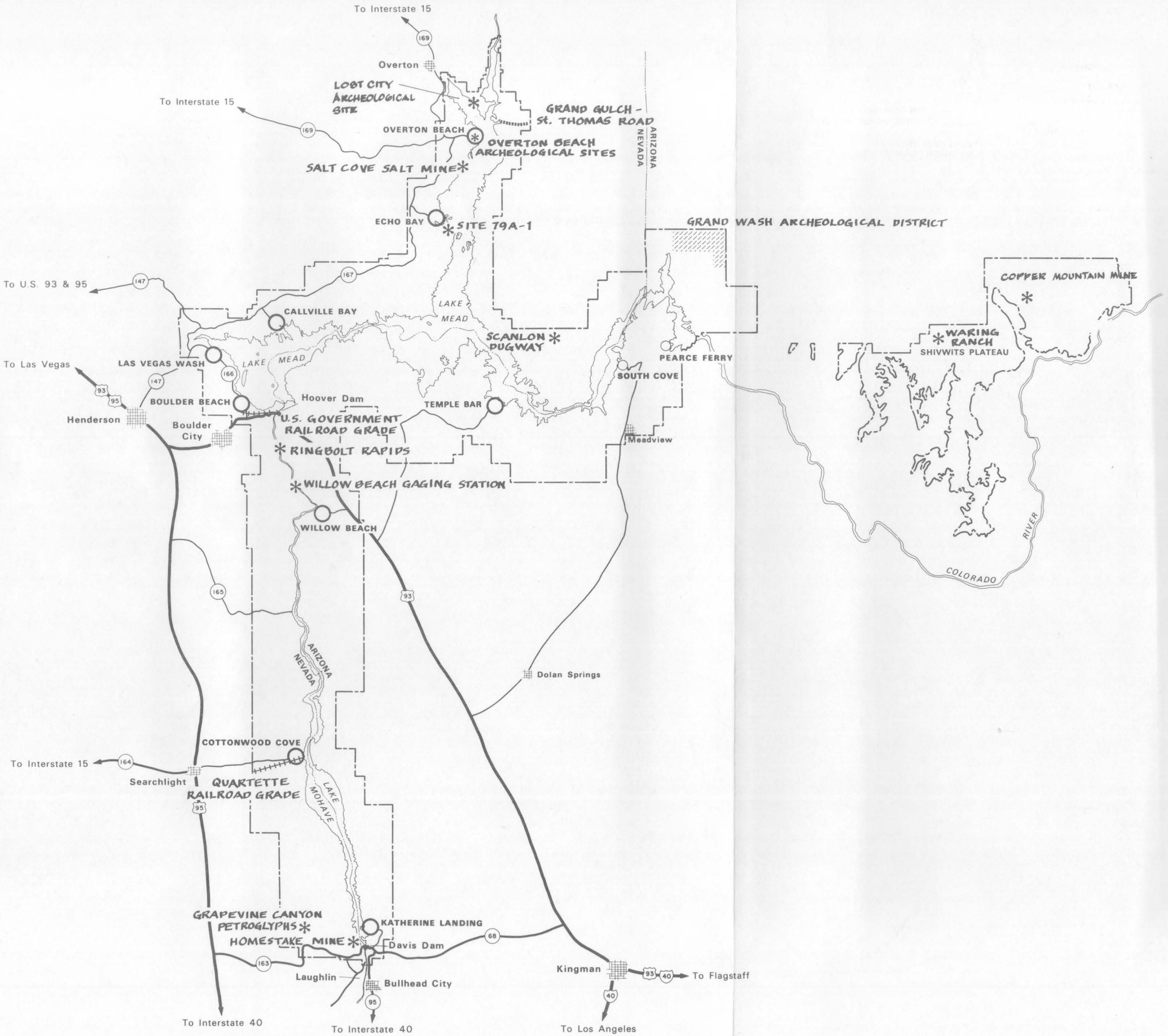
Three archeological complexes currently listed on the National Register of Historic Places are the Grand Wash archeological district, the Overton Beach archeological district, the Lost City archeological sites, and the Grapevine Canyon petroglyphs. In addition the Salt Cove Saltmine is in the process of being nominated to the National Register.

HISTORIC RESOURCES

Many of the historic sites of the Lake Mead area, such as early river crossings and ferries, townsites, and mines, are now submerged beneath the waters of Lakes Mead and Mohave. Two historic sites within the recreation area are currently on the National Register of Historic Places. Three additional properties have been determined eligible for listing on the National Register. On the basis of recent research, three historic sites are now in the process of being nominated to the National Register. The status of all eight of these historic sites is as follows:

Homestake Mine (on National Register)
Grand Wash-St. Thomas Road (nominated)
Scanlon Dugway (nominated)
Waring Ranch (Howe Valley Ranch, on National Register)
Ringbolt Rapids (nominated)
Quartette Mining Company Railroad Grade (eligible)
U.S. Government Railroad Grade (eligible)
Willow Beach Gaging Station (eligible)

Lake Mead has 38 structures included on its List of Classified Structures; 23 are associated with the National Register sites listed above. The remaining 15 structures are associated with the Golden Mile Mine, Golden Gate Mine, Joker Mine, Pearce Ferry Seismograph Station, Pine Valley Cabin, Tassi Ranch, Bonelli Landing Road, Pearce Ferry Road, and the Six Companies Railroad Grade. All of these latter sites were evaluated by NPS historians in 1982 and were not considered to possess National Register significance.



* CULTURAL RESOURCE SITES

○ MAJOR DEVELOPED AREA

○ EXISTING IMPROVED ACCESS POINT

N

5 0 5 10 15 20 MILES

5 0 5 10 15 20 25 30 KILOMETERS

CULTURAL RESOURCES

LAKE MEAD NATIONAL RECREATION AREA

ARIZONA - NEVADA

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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SOCIOECONOMIC ENVIRONMENT

REGIONAL LANDOWNERSHIP

Lake Mead NRA's immediate socioeconomic environment consists of a region composed of Clark County, Nevada (5,039,360 acres), and Mohave County, Arizona (8,458,880 acres). Landownership patterns in the two counties and in the composite region are shown on diagrams at the end of this section.

As elsewhere in both Nevada and Arizona, a very large proportion of the land in Lake Mead's region is owned and administered by the federal government (78%), with BLM being the largest administrator in both counties. Some 10 percent of the lands in Clark County and 11 percent in Mohave County are administered by the National Park Service. Nineteen percent of the composite region is in private, state, or local government ownership, ranging from 8 percent in Clark County to 25 percent in Mohave County.

REGIONAL LAND USE AND SOCIOECONOMICS

As a composite, the region of Clark and Mohave counties has a population density of 24.6 persons per square mile. However, the two counties differ markedly in population density because of the influence of the Las Vegas urban area, which brings Clark County's figure to 58.8 persons per square mile, compared to Mohave County at 4.2 persons per square mile. Some 85 percent of the two-county population lives in Las Vegas.

Although a full spectrum of land uses takes place in the region, the predominance of federally owned land has led to primary public uses of recreation, power generation, and leased lands for mineral extraction and grazing. On private lands adjacent to recreational lands, increasing development of residential retirement and second homes is occurring, along with privately developed commercial facilities serving the recreational public.

The regional population has shown dramatic increases of an average of 12 percent annually from 1960 to 1980, with a total increase of 240 percent over the 20-year period. This growth is principally related to migrations into the Las Vegas urban area, which accounted for almost half the region's increase. However, substantial growth was also recorded within the rural and small town areas immediately surrounding Lake Mead.

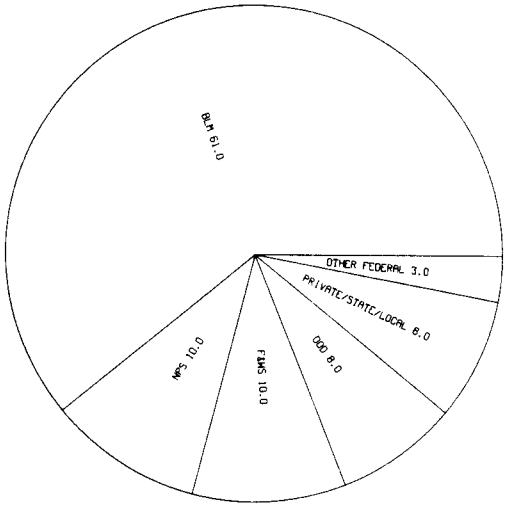
Per capita income in 1980 was $6,673 in Mohave County and $8,453 in Clark County, compared to $7,313 nationally. Regional unemployment has been running slightly lower than the national average. For 1980 the national unemployment average was 6.6 percent, while unemployment in Clark County was 3.1 percent and Mohave County was 5.4 percent.

The economy of Las Vegas is dominated by the gambling and entertainment industries, which attract over 12 million visitors annually. Elsewhere in Lake Mead's region, local economies depend heavily on

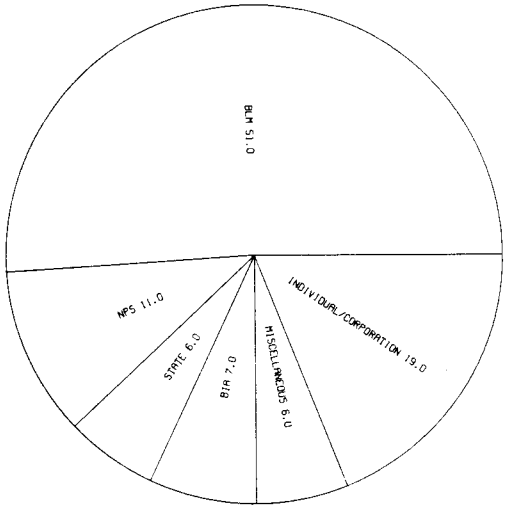
tourism and recreation-oriented activities, with Lakes Mead and Mohave being the principal recreational destination. Mining and minerals extraction and grazing are locally significant economic contributors, as are federal employment and power generation and export.

Laughlin, Nevada, across the Colorado River from Bullhead City, Arizona, is a rapidly expanding gambling and entertainment center. In 1980 its population was 92, but its population is anticipated to reach 25,000 by 1990 (personal communication with Laughlin Chamber of Commerce).

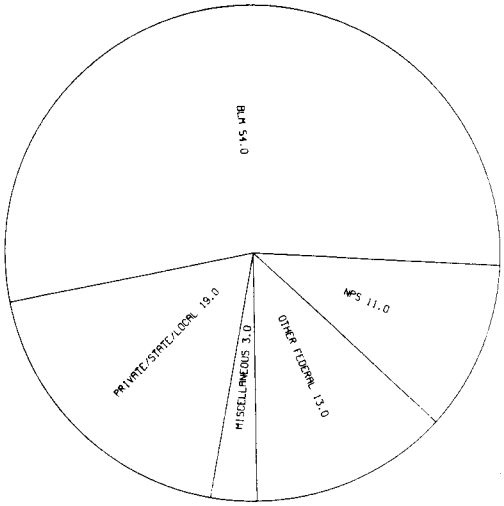
Clark County
Landownership



Mohave County
Landownership



Region
Landownership



VISITOR USE ANALYSIS

Lake Mead NRA reports the number of recreational and nonrecreational visitors on a monthly basis. Use is measured in terms of visits, defined as the entry of a visitor into the park. Nonrecreational use is figured as commuters, inholders, tradesmen, and employees of any federal (not National Park Service), state, or local agency or business in the park as measured by traffic counters. Recreational visitors are counted at 22 to 29 different traffic counter locations at the recreation area, primarily at entrances to developed areas and primitive access points.

A visitor use study was conducted in 1978 and 1979 by the National Park Service. The surveys were conducted through a nonstatistical random sample, with the goal being the most responses possible. The questionnaires were handed out at developed areas and the Alan Bible Visitor Center; respondents were requested to return the completed survey by mail. The sample population was comprised of approximately 6,470 visitors, yielding a total of 1,585 respondents.

REGIONAL RECREATION PATTERNS

The two-county region contains one national recreation area, a portion of a national park, one national forest, and two state parks. These units vary from arid canyonlands to forested mountains, and recreational opportunities range from hiking and boating to snow-skiing. Camping is available on federal lands and at many private campgrounds.

The principal scenic and recreational attractions are the lower portions of the Colorado River in Grand Canyon National Park, Lake Mead National Recreation Area, and Red Rock Canyon recreation lands managed by Bureau of Land Management. The recreation area reported 6,128,254 recreational visits in 1983. The majority of these visitors considered Lake Mead to be their destination, with no other stops on their way to or from the area.

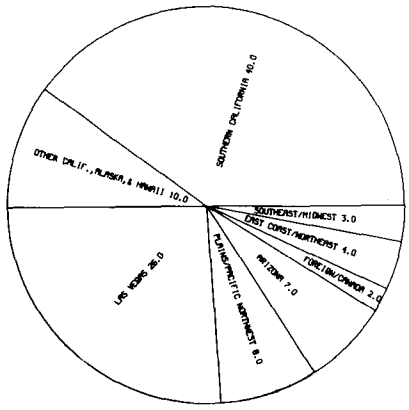
The typical visitor to the recreation area comes as a member of a family group and spends one night, resulting in one to seven days at the area within a year's time.

RECREATION AREA USE PATTERNS

Visitor Residence

As shown in the following pie chart, over one-third of the visitors surveyed in 1978 and 1979 were from southern California and one-fourth were from Las Vegas.

Residence
1978-1979 Visitors



Visitor Activities

The region's climate facilitates year-round recreation at Lake Mead. Beach use and water sports are greatly limited during the winter, but the best lake fishing occurs at this time, and the increase in the number of fishermen tends to offset the decrease in the number of other kinds of recreationists. Hot summertime temperatures tend to discourage backcountry use west of the Grand Wash Cliffs, and most of the summer recreation in this part of the recreation area occurs on or near the lakes. The cooler climate of the Colorado Plateau, east of the cliffs, tends to favor use of the backcountry in this area during the summer, but physical isolation and poor roads have limited such use.

Park visitors participate in the following activities in the proportions shown below:

97%	relax	64%	water ski
93%	view scenery	33%	rock hunt
89%	swim	19%	attend evening programs
80%	camp	11%	sail
77%	picnic	10%	four-wheel
76%	motor boat	8%	dirt bike
76%	hike/walk	8%	scuba dive
73%	photograph scenery	6%	backpack
70%	fish	3%	hunt

A majority of visitors have indicated a desire to see new areas developed in the recreation area, although there was no concensus on location(s).

Visitation Patterns

The peak use days of the year usually occur during Memorial Day weekend. In 1983, there were about 253,791 visitors (33% increase over

1982) during the three-day period. Labor Day weekend and the Fourth of July weekend fluctuate on being the second highest peak public use periods; in 1983, the three-day period for the Fourth of July had 162,928 visitors (36% increase over 1982), while the four-day Labor Day weekend had 121,887 visitors. The majority of these visitors are in the Lakeshore Road (Boulder Beach and Las Vegas Wash) and Katherine Landing areas. The Lakeshore Road area tends to attract day users, while Katherine Landing attracts more overnight visitors.

Through 1983, April/May and July/August are the peak use periods as shown on the Monthly Visitation graph. About 50 percent of the total year's visitation occurs from April through August, with 75 percent occurring from March through October. Visitation at the developed areas has been relatively uniform over the last five years (see Visitation by Developed Area graph). Likewise, overnight stays at concession lodging have not changed significantly over the last five years (see Concession Lodging graph). From 1979 to 1982 there was a +0.3 percent growth per year in overnight stays at concession lodging. This static trend is expected to continue in the near future or occupancy could increase if any number of factors change. Specific events can alter this trend. In 1983 use of concession lodging decreased, but it is attributed to the recession and extreme high water levels on Lake Mead. It is noteworthy that while use of overnight facilities decreased in 1983 compared to 1982, total visitation increased. People came to see the lake flowing over the Hoover Dam spillways, but because of the recession they did not stay overnight as often as in 1982. The trend from 1979 to 1982 for all other overnight stays (NPS and concession campgrounds, trailer villages, and RV sites) in developed areas was a +2 percent increase. Again 1983 was left out because of the specific events that decreased the use of facilities.

Occupancy rate information would be very useful for determining facility use trends, but such data are not available for Lake Mead.

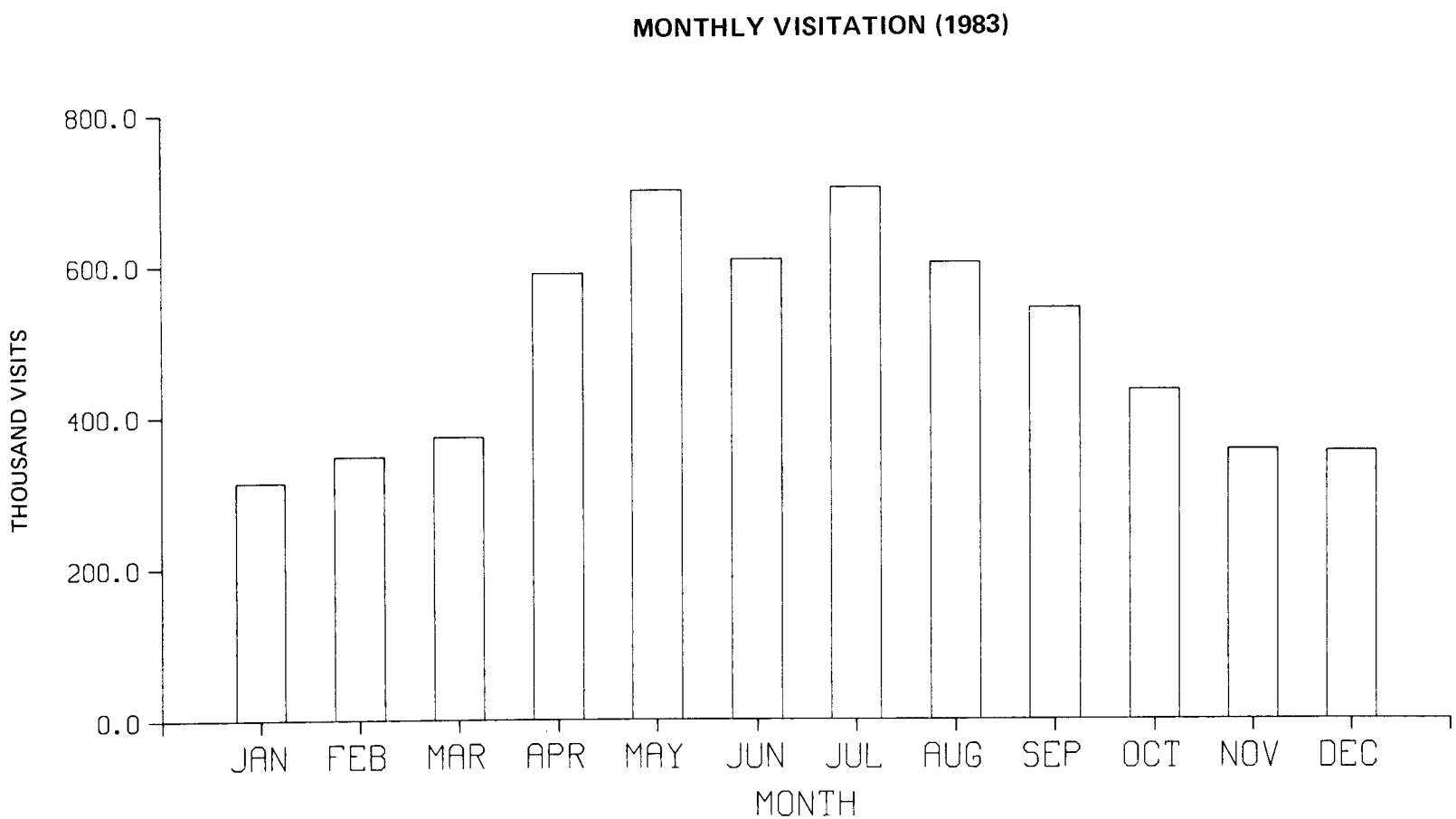
Facility use is dependent on the economy, quality of the facilities and associated services, price, and quantity of available facilities. Nearly static use, as observed for overnight stays at concession lodging, can result from one or more factors, and it is not known which ones are currently responsible. Since the use of the less expensive overnight options (campgrounds, trailer villages, and RV sites) increased during the same time frame, lodging costs and the state of the economy may be the cause for the near static use of concession lodging.

Discussing trends with only a few years worth of data may be misleading. A more realistic evaluation of visitation trends at Lake Mead can only be made by looking at visitation over the long term, which is not possible at this time for overnight stays because of the inconsistency of existing data. The overall visitation trend gives a clearer picture of the potential use of facilities, depending on the types of factors discussed previously.

Since the mid 1940s, visitation to Lake Mead has increased fairly steadily (see Visitor Use Levels graphs). The growth rate from 1962 through 1983 averaged 156,343 more visits each year. Growth during the last decade has not been unduly affected by gasoline shortages in 1974 and 1979.

Because a large portion of the visitors are from Las Vegas and other close areas, they will tend to continue visiting Lake Mead NRA in times of gasoline shortages.

Future trends in visitation to Lake Mead National Recreation Area can be projected by observing the trends in the past two decades (see Projected Growth graph), especially as the major urban areas it serves are continually growing. The line labeled "continued growth" is a projection based on visitation from 1937, while the line labeled "back to 1962" reflects growth potential, considering only the more recent years when growth in the region expanded.

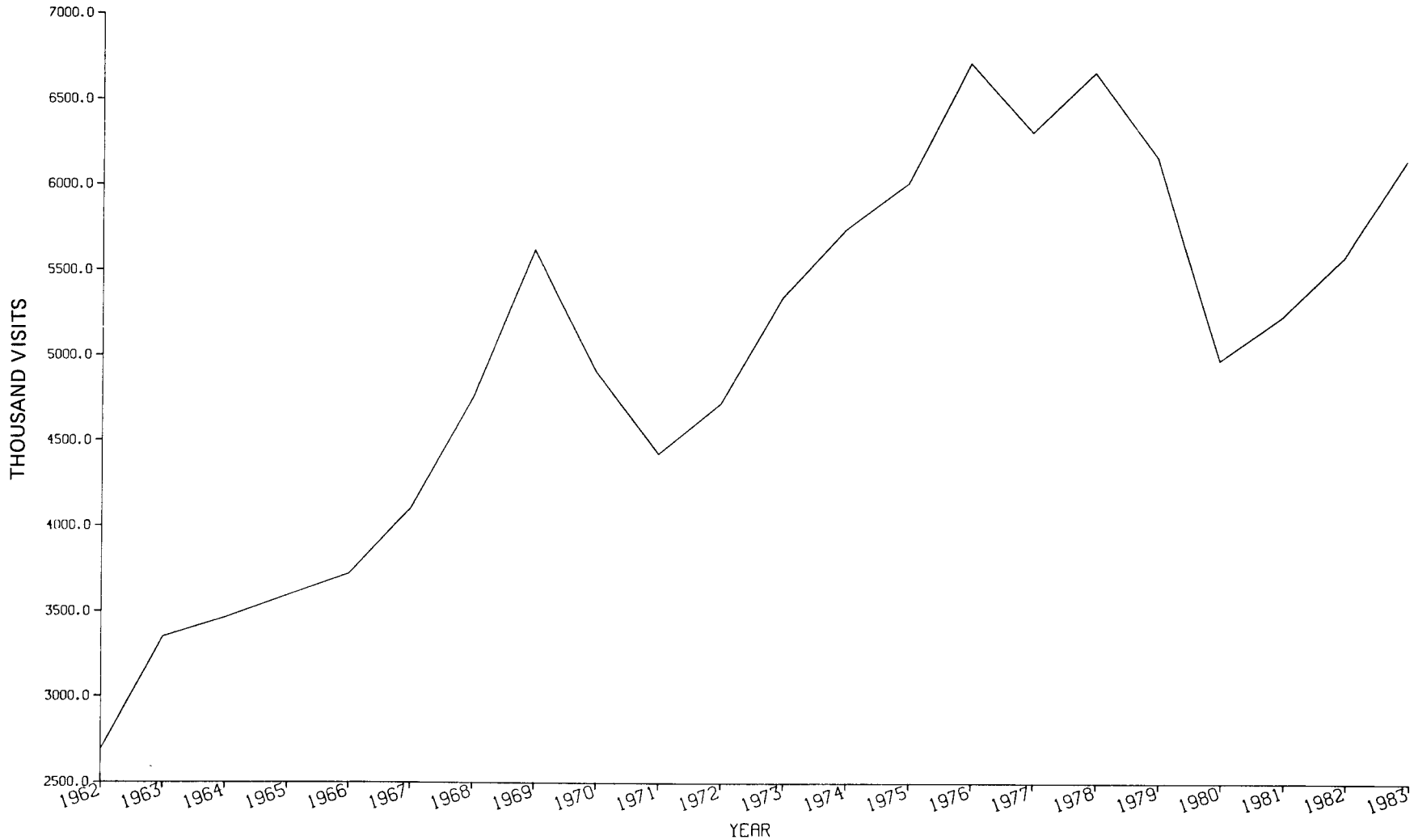

MONTHLY VISITATION (1983)
THOUSAND VISITS
800.0
600.0
400.0
200.0
0.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
MONTH

LAKE MEAD NRA VISITATION BY DEVELOPED AREA (1979 - 1983)

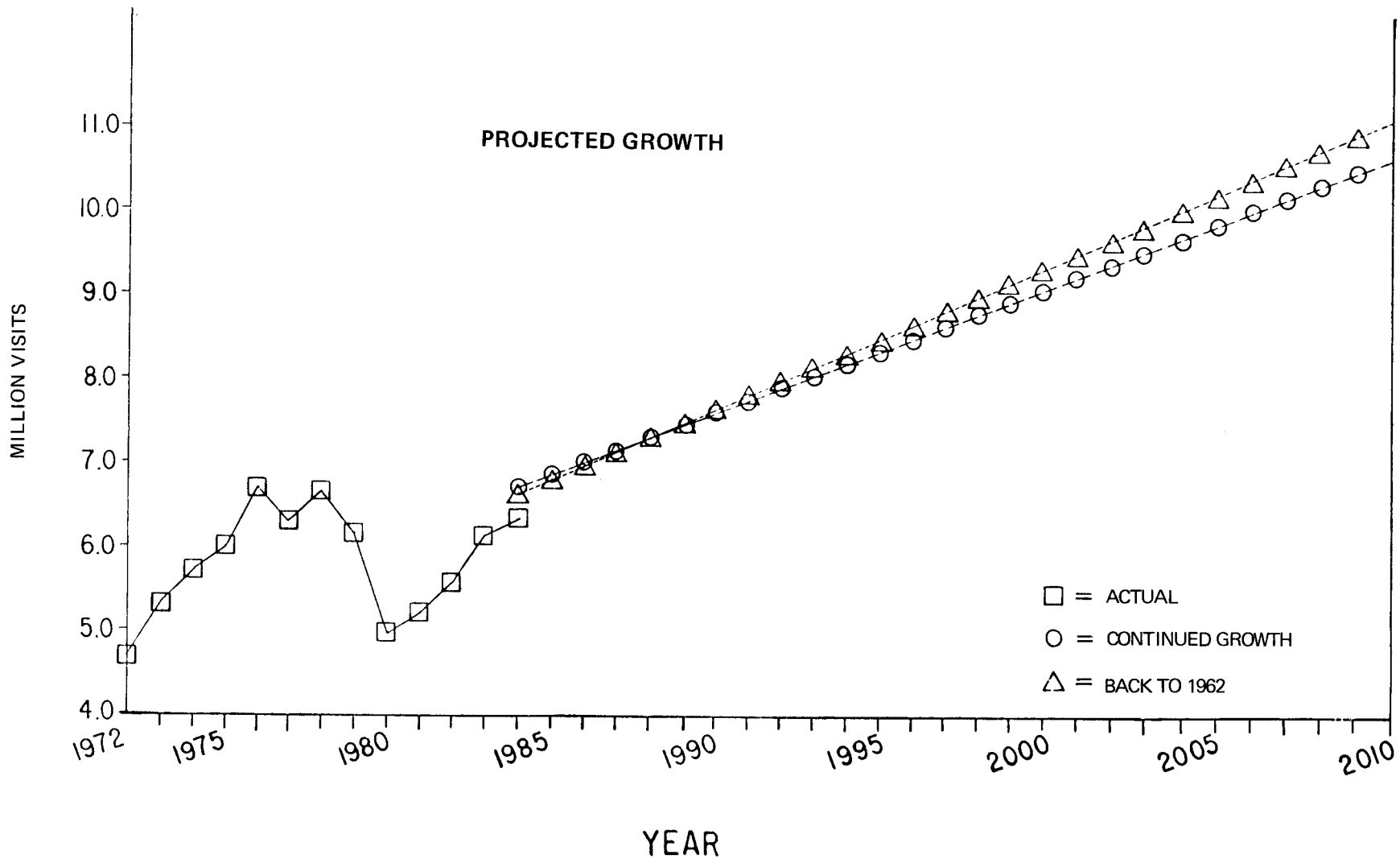
LAKE MEAD NRA CONCESSIONER LODGING (1979 - 1983)

* Correct 1981 data unavailable

LAKE MEAD VISITOR USE LEVELS (1962 - 1983)



LAKE MEAD VISITOR USE LEVELS (1937 - 1961)


PROJECTED GROWTH
MILLION VISITS
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
1972
1975
1980
1985
1990
1995
2000
2005
2010
YEAR
□ = ACTUAL
O = CONTINUED GROWTH
△ = BACK TO 1962

FACILITY ANALYSIS

A full description of existing facilities can be found in the "Alternative Development Concept Actions" section under the no-action alternative column of the Actions charts. Following is a discussion of roads and utilities, which are more clearly explained in the Actions charts. However, an understanding of access and utilities are basic to all development proposals.

ROADS

The major paved and dirt roads that are primarily used by visitors are part of this facility analysis.

Nevada 163 and Arizona 68 is the major paved road in the southern portion of the recreation area, which connects U.S. 95 with U.S. 93. It is a two-lane road that has considerable use because it is one of the limited number of road crossings of the Colorado River. This road is maintained by the states. The other major road through the recreation area is U.S. 93, a major two-lane highway connecting Phoenix to Las Vegas. This state-maintained road has one pullout, overlooking Willow Beach and the Colorado River.

Other paved roads around Lake Mohave include the access roads to Katherine Landing (3 miles), Willow Beach (4 miles), Cottonwood Cove--NV 164 (5 miles), and NV 165, which terminate at a Colorado River overlook/turnaround above Eldorado Canyon. These roads within the NRA boundary are maintained by the National Park Service.

The area around Lake Mohave has two major dirt roads that are maintained by the National Park Service after entry into the recreation area's boundary. They are Christmas Tree Pass Road (9 miles) and Cottonwood Cove East Road (4 miles). The Christmas Tree Pass Road has two turnouts for interpretation and an area designated for camping.

Within the Boulder Basin area are three major paved roads. U.S. 93 bisects the lower portion of this district and crosses Hoover Dam. This highway is maintained by the state and is a major southwest connecting route. Lakeshore Road, which is maintained by the National Park Service, runs from a junction with U.S. 93, traverses 14 miles, and then terminates at Henderson, Nevada. Northshore Road begins at a junction with Lakeshore Road and terminates north of the recreation area's boundary in the town of Overton. This 64-mile-long road is maintained by the National Park Service within the boundary. Lake Mead Boulevard (6 miles), the access road to Callville (4 miles), and the access road to Hemenway launch ramp (1.5 miles) all begin or terminate on one of the previously mentioned roads that the Park Service maintains and services.

In other parts of the recreation area access is provided to Temple Bar, of which the Park Service maintains 14 miles; and to South Cove launch ramp, of which the Park Service maintains 13 miles. This road begins at

a junction with U.S. 93 and goes through the town of Dolan Springs to the NRA boundary.

Three major dirt roads are maintained: Temple Bar to Gregg's Hideout Road (34 miles); Gregg's Hideout access road (8 miles); and Pearce Ferry access road (3 miles).

UTILITIES

The following discussion describes the utility systems that are currently provided at developed areas throughout the recreation area.

Katherine Landing

This area has a 500,000-gallon water storage tank and a treatment system that distributes water to the developed area. Water is taken out of Lake Mohave and pumped to the treatment facility. The sewage system consists of three lagoons that treat the sewage. The power and telephone systems are provided by Citizen's Utility Company of Kingman, Arizona.

Cottonwood Cove

California Pacific Power supplies electricity to Cottonwood Cove, and Centel of Nevada supplies telephone services. Cottonwood Cove has a three-cell sewage treatment facility and two wells that pump into a 325,000-gallon storage tank and treatment facility.

Willow Beach

Two wells currently supply a 200,000-gallon water storage tank and treatment facility. Power and telephone are supplied by Citizen's Utility Company. Two lagoon cells provide necessary sewage treatment. When the flood mitigation is completed, water and sewage systems will need to be rebuilt.

Boulder Beach Area

Within the Boulder Beach area all power is supplied by Nevada Power, and all telephone services are provided by Centel of Nevada. Sewage is treated by four lagoons. The water is pumped from Lake Mead into a treatment plant and distributed from a 2,455,000-gallon storage system.

Las Vegas Wash

Water for this area is taken from a private pipeline, treated, and then distributed from a 100,000-gallon storage tank. All sewage is treated through a three-cell lagoon system. Power is provided by Nevada Power, and telephone service is supplied by Centel Telephone Company.

Callville Bay

Telephone service for this area is provided by Centel Telephone. Nevada Power provides electricity, but it is inadequate. The water system at Callville Bay consists of an intake on Lake Mead, with a 100,000-gallon storage tank, treatment and distribution system. Two cells treat the sewage generated at Callville Bay. This system must be redone to handle any future needs that may be generated.

Echo Bay

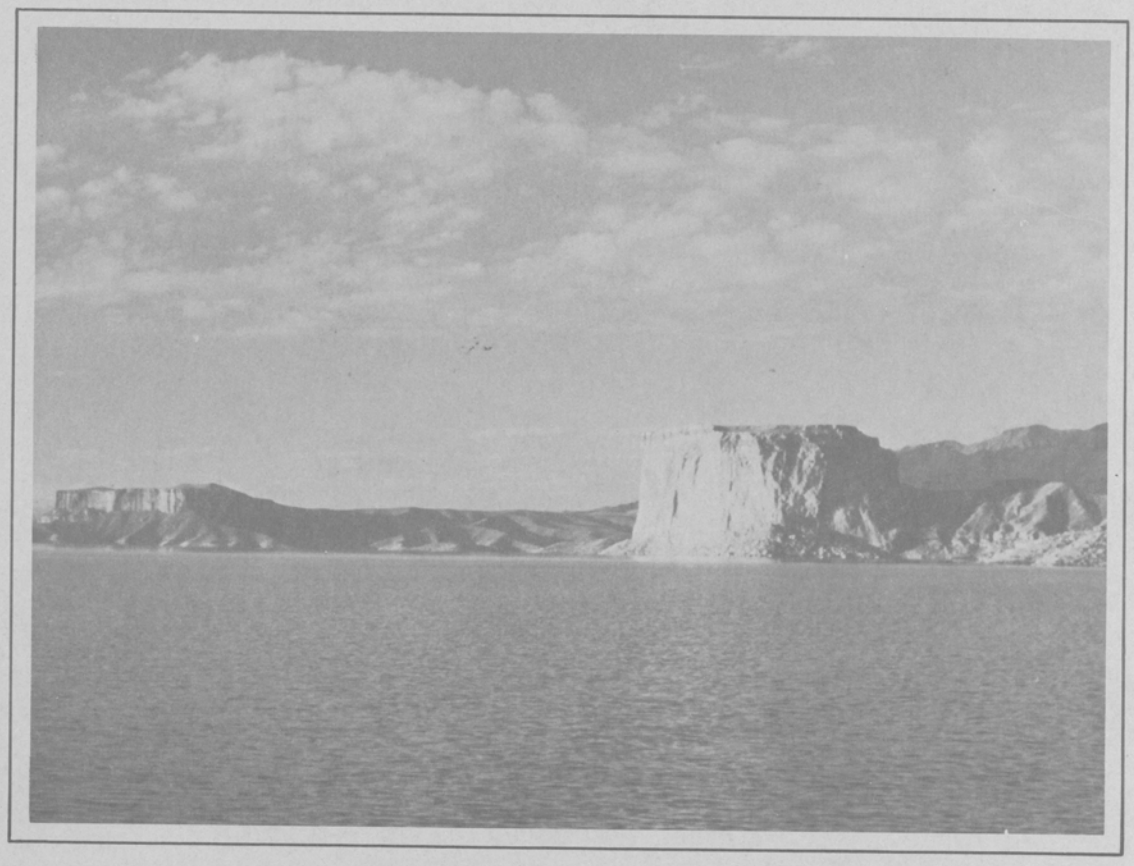
Overton Power District and Moapa Valley Telephone, both of Nevada, supply utilities to this area. The water system consists of a lake intake system and a 601,000-gallon storage system. There is a four-cell sewage system at Echo Bay.

Overton Beach

The Overton Power District and Moapa Valley Telephone supply utilities. Sewage is treated in a new four-cell treatment facility, and the water system consists of a lake water intake with a 165,000-gallon storage tank and treatment plant.

Temple Bar

Citizen's Utility Company of Kingman, Arizona, supplies power and telephone service to Temple Bar. Water treatment consists of two wells that supply a 600,000-gallon storage tank and treatment system. Sewage is treated in a new four-cell system.



ENVIRONMENTAL CONSEQUENCES

INTRODUCTION AND DERIVATION OF IMPACT TOPICS

A summary of environmental impacts is presented in the "Summary" section at the beginning of this document. Impacts of the proposed action and alternatives are addressed. As described in the "Management Strategy" section, many development proposals are the maximum allowable, rather than the optimum based on current or projected demand. The following environmental consequences evaluate the worst-case situation. The actual level of development would most likely be less than the maximums, so that the resultant impacts would be less severe than those described. All impacts take into account the trend of increasing visitation described under recreation area use patterns in the "Visitor Use Analysis" section, and the impacts would be greater or lesser depending on how actual visitation varied from the predicted trend.

The impacts that mineral leasing might have on other natural and cultural resources under the alternatives have not been assessed in detail because of the highly speculative nature of mineral resources within the recreation area. Specific impacts are outlined for the development of mineral commodities that can realistically be expected to be mined within the next decade. Impacts associated with the development of other mineral commodities are discussed in less detail because of the improbability of development. Following completion of the GMP, the minerals management plan (MMP) and the accompanying evironmental compliance document will present typical mineral development scenarios and a cumulative impact analysis of those scenarios. Then as lease or permit applications are received, the environmental assessment (EA) required to process the application can be tiered to the cumulative impact analysis contained in the environmental document accompanying the MMP. This eliminates duplication of environmental analyses and allows the EA to concentrate on site-specific impacts and mitigation.

To focus on the most significant impact topics, the issues, alternatives, and impacts were evaluated throughout the GMP planning process. The issues and alternatives are presented in the previous section, and the scoping process and its results are described in the "Consultation or Coordination" section. A few impact topics, like threatened or endangered species, were raised by the public in the scoping process. However, all impact topics were evaluated by the GMP planning team and narrowed to specific topics that include only those of significant environmental concern. An explanation of how each impact topic was generated follows.

Broad Impact Subjects	Impact Topics
Floodplains	
Lake Mead's flash-flood zones are associated with altered dry washes in existing developed areas that	Public Safety in Floodplains Property in Floodplains

lack natural values which regulations intended to protect--no recharge of water tables, no diverse riparian environment, no wetland or riparian species, etc. There are some developments in flash-flood zones where people and property are jeopardized.

Floodplain capacity would not be affected by changes in development or even structural flood mitigation measures. The location of the flood flow could be altered, but the capacity would not change. Thus, floodplain capacity is not a significant issue.

Water Quality

Wind-induced wave action overrides all other sources of siltation. Construction activities involving earth movement will not add measurably to siltation. The dry wash bottoms and alluvial slopes are either 1) dry and soil movement cannot affect the lake's water quality, or 2) flooded very briefly during a flashflood which carries a full sediment load to the lake whether construction activity is in the flood path or not. Construction of marinas is done from the marina or barges and siltation from anchor placement is not measurable compared to wind-induced wave action. Salt and heavy metal concentrations are Colorado River Basin problems and do not stem from any GMP issues. Microbial contamination of lake water from human waste in areas of concentrated visitor use poses a problem.

Reservoir Water Quality

Wetlands

U.S. Fish and Wildlife Service lists no wetlands in Lake Mead. However, desert spring communities are critical wetland habitat in small isolated areas. They are not as critical for free-roaming animals as they once were, because those animals can also get water from

Desert Spring Ecological Communities

the reservoirs. Only two springs are located where they might be affected by GMP development proposals. Others might be affected by mineral leasing. The riparian habitat along the Virgin River and Las Vegas Wash would not be affected by any GMP proposals

Soils

There is no parkwide information on soils, but what is known indicates no soils of inherent value--no farmland or productive soils, no rare soils. Most soils are unconsolidated alluvial material lacking soil profiles. Some soils with high shrink-swell properties could affect the development proposals. Because significant soils cannot be identified due to lack of data, a general analysis of impacts on soils will be presented.

Soils

Significant Natural Features

Unique, rare, scientifically important, or scenic natural features--see "Affected Environment" section for full listing. Many of these features are critical for their scenic or visual resource values. None affected except from potential mineral development.

Significant Natural Features

Vegetation

Most vegetation types are regionally common or are already disturbed by man. Accordingly, threatened or endangered species and desert spring communities (already considered) are the critical issues.

Development proposals are all in previously disturbed areas of the creosote bush community, which dominates almost three quarters of the recreation area. Mineral leasing could affect vegetative communities that are more significant. Thus, the impacts from mineral leasing on

Threatened or Endangered Species
Vegetation

vegetation in general will also be thoroughly considered to ensure protection to unknown threatened, endangered, or candidate plants.

Wildlife

Most species are regionally common. Bighorn sheep are important for viewing, hunting, and restocking of depleted herds in other areas; threatened or endangered species are important because of their rarity and legally protected status.	Threatened, Endangered, or Candidate Species Bighorn Sheep

Visitor Use

Much of the plan is directed at managing visitor use. The major areas for potential impacts are cabin sites, trailer villages, and visitor crowding/congestion. Traffic levels, circulation, and congestion are serious concerns addressed under visitor crowding/congestion. Impact on off-road vehicle use is not addressed because all use of vehicles off approved roads is illegal, and the current system of approved roads that can be used by off-road vehicles is not changed by any alternative.	Visitor Crowding/Congestion Vacation Cabin Site Residents Trailer Village Residents

Concession Services

The level of services offered by concession operations directly affects visitor use and is therefore an important component of the Lake Mead environment.	Level of Concession Services

Mineral Leasing

There is potential for major impacts on mineral leasing and development from zoning alternatives. The GMP addresses management of future mineral leasing. None of the alternatives affect existing mineral interests whether they arise from a valid mining claim, existing lease,	Mineral Leasing Opportunity

or nonfederal mineral ownership. Based on what is known about mineral resources within the NRA, uranium appears to be the most probable mineral to be developed within the immediate future. Sporadic exploration for oil and gas may continue in the future; however, major field development is not expected and impacts would be minimal from the sporadic exploration activity. Exploration for other hard-rock minerals might occur in scattered locations, and some minor production might occur in older existing mines, but based on past trends no major new mines would be expected.	
Wilderness Values	
Lands meeting the criteria of the Wilderness Act have been identified. There is potential for major impacts on these lands from zoning alternatives.	Lands Possessing Wilderness Values
Air Quality	
Air quality problems are in a regional airshed which contains major population centers and power plants. Dust from dirt roads is not significant locally by comparison to regional problems. Although visitation is projected to increase, no proposals under any alternative could significantly alter existing air quality.	Not Considered Further
Cultural Resources	
As described in the "Affected Environment" section, all significant cultural resources have been identified. However, none of these would be affected by any development proposals. To ensure protection of any unknown cultural resources, preconstruction or premineral leasing surveys would be conducted for all land that could be	Not Considered Further

affected by specific construction or leasing proposals.

Land Protection Issues

The GMP summarizes decisions already made in the Land Protection Plan and does not propose any new actions. The LPP had its own assessment. See the "Land Protection" section for a full description of the issues and management direction on:

- boundary revisions
- state and private lands
- Santa Fe Pacific mineral rights
- Arizona indemnity selection program
- Hualapai Indian Reservation lands
- Bureau of Reclamation withdrawal lands
- easements and utility corridors
- special activities on nonfederal lands

Not Considered Further

Resources Management Issues

The GMP summarizes decisions already made in the Resource Management Plan and does not propose any new actions, except for mining/minerals management and actions related to illegal use of vehicles off approved roads. The RMP had its own assessment. See the "Natural and Cultural Resources Management" section for a full description of the issues and management direction on:

natural resources management

- fishing, hunting, and trapping management
- tamarisk control
- non-native plant and wildlife species control
- air and water quality monitoring
- fire management
- threatened or endangered species management
- grazing management

Not Considered Further

cultural resources management
- cultural resource surveys
- archeological site management
- historic site management
- contemporary native American concerns
- collections management

Public Safety on Highways

A leading accident-prone road within the national park system and several others with high accident rates are in the recreation area. These issues and associated road maintenance problems are being addressed by a separate planning process done in conjunction with the Federal Highway Administration. The GMP summarizes decisions made in this separate process.	Not Considered Further

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

A summary of the following impacts is presented in the "Summary" section at the beginning of volume I.

IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flood hazard is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Flooding at Boulder Beach can concentrate unpredictably in localized flows but more often takes the form of sheet flows up to 2 feet in depth. Therefore flooding at Boulder Beach is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas in the NRA, and no potential victims or damage to structures are shown for Boulder Beach under the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation of floodplain conditions. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

The proposed action would mitigate the impact of floodwaters to the 100-year level with structural measures, mitigate the effects of floods larger than the 100-year flood with warning systems and evacuation plans, and rely on relocation of facilities for some areas. Removal of structures that would be used by people or relocation of the structures out of the floodplain provides the best protection. Structural measures offer the next best method. Warning systems provide less protection than either of the former two methods. The "Alternative Development Concept Actions" section of this document has full details on proposals. The discussion on floodplains and wetlands in the "Affected Environment" section describes flood probabilities.

The proposed action would involve implementation of nonstructural (not requiring major construction) flood mitigation measures in all developed areas having flood hazard. These measures are as follows:

> Provide education and information about the potential flood hazard and what to do in case of such an emergency.
>
> Install flood warning systems that provide early identification of an impending flood; analyze the magnitude, severity, and potential impact of an impending flood; disseminate appropriate warnings to parties likely to be affected by an impending flood.

Prepare evacuation plans. Evacuation planning for developed areas at Lake Mead NRA is influenced by two factors. First, flooding can occur very rapidly, so people must respond rapidly to a warning to save their lives. Second, some of the developments are located such that safe refuge is either some distance away or difficult to reach because of steep slopes.

All three of these nonstructural measures are collectively referred to as the warning system package in the discussions that follow. Two developed areas, Willow Beach and Cottonwood Cove, already have warning system packages in operation.

The following is a summary of the most important structural measures that would be implemented under the proposed action. A complete discussion of flood mitigation actions for the proposed action can be found in the "Alternative Development Concept Actions" section.

Katherine Landing

one earth/concrete/gabion-lined diversion canal 1,550 feet long
concrete-lined channel 2,437 feet long
650-foot concrete-lined diversion dike ,

Cottonwood Cove

three concrete/gabion-lined diversion dikes totaling 1,700 feet in length
two concrete-lined channels totaling 5,911 feet in length

Willow Beach

550 feet of riprap dike
626 feet of concrete wall

Boulder Beach

armoring of existing earth dikes with gabions

Temple Bar

four armored diversion dikes 2,595 feet long
two concrete channels with a combined length of 3,955 feet

Facilities that would be relocated out of the floodplain include:

Katherine - NPS maintenance
Cottonwood Cove - NPS housing and maintenance area and swim beach

Willow Beach- NPS housing and maintenance, ranger station, campground, trailer village, concession housing and maintenance
Las Vegas Wash - dry boat storage, concession maintenance
Overton Beach - campground

Structural measures for protecting people and development are less effective than relocating the people and development out of the floodplain because the former rely on man-made attempts to change the shape of the natural floodplain into a configuration that is more convenient to man, and they must be adequately designed, constructed, and maintained to be effective. Sometimes structural measures provide the basis for a false sense of security to people in the floodplain, and people fail to evacuate the floodplain in case of potential flooding.

Warning systems provide the least protection of the three measures discussed. To be effective, warning systems must receive and interpret incoming data correctly and give the warning signal, the Park Service personnel must receive the warning signal and put the evacuation plan into effect. Occupants of the floodplain must then cooperate in getting to higher ground. There are no statistics available on the likelihood of a warning system failure. Some people might not receive the warning, and others might refuse to follow evacuation instructions. Thus, the possibility of injury or loss of life exists for the people in the greater than 100-year floodplain at the time of such a flood event.

Under the proposed action, structural measures would protect up to the level of the 100-year floodplain. Any flood greater than the 100-year flood would be mitigated by warning systems only.

Under the proposed action, on an average summer weekend, an estimated 160 people would be in the 100-year floodplain at any one time in the daytime and none would be there at night. For the possible maximum flood, the numbers would be approximately 4,155 for day and 3,860 for night. Of the 96,000 people expected to be in the recreation area on a summer weekend day, 0.2 percent would be expected to be in the 100-year floodplain and about 4 percent would be in the PMF. For the 100-year flood, these figures are 13 percent of the figures for a daytime flood and 0 percent of the number of potential victims for a nighttime flood. For the probable maximum flood, these figures are over 90 percent of the figures for existing conditions. The figures presented in the preceding narrative and in tables 24 and 25 are based on the number of people that would be expected to be in the floodplain at any one time on an average summer weekend day. The potential hazard to people in the probable maximum floodplain would be mitigated under the proposed action by warning systems, evacuation plans, and emergency procedures.

After all the mitigation measures were taken for the 100-year flood, there would be very few people in the floodplain. The hazard for them, as well

Table 24: Estimated number of people in the 100-year floodplains of Lake Mead NRA at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans

	No-Action Alternative (Same as existing conditions)		Alternative A		Alternative B		Proposed Action	
	Day	Night	Day	Night	Day	Night	Day	Night
Katherine Landing	605	800	5	0	5	0	10	0
Cottonwood Cove	100*	30*	0	0	25	0	0	0
Willow Beach	465	395	50	0	90	0	70	0
Las Vegas Wash	40	0	40	0	40	0	40	0
Overton Beach	40	0	40	0	40	0	40	0
Temple Bar	0*	0*	0	0	0	0	0	0
NRA Grand Total	1,250*	1,225*	135	0	200	0	160	0
Percentage of Existing Conditions	100%	100%	11%	0%	16%	0%	13%	0%

*The 100-year floodplain was mapped at Cottonwood Cove and Temple Bar based on the assumption that existing earth dikes and channels would withstand the 100-year flood. However, those structures are not likely to withstand such a flood, and the number of people in the floodplain for those areas and the grand total are unrealistically low. No attempt was made to estimate numbers of people in the floodplain because of dike and channel failures, because the sites of the potential failures and the extent of resulting inundation are too unpredictable.

Table 25: Estimated number of people in the probable maximum floodplains of Lake Mead NRA at any one time on an average summer weekend who would only be protected by warning systems and evacuation plans

	No-Action Alternative (Same as existing conditions)		Alternative A		Alternative B		Proposed Action	
	Day	Night	Day	Night	Day	Night	Day	Night
Katherine Landing	1,095	1,120	5	0	5	0	570	520
Cottonwood Cove	1,735	1,590	0	0	280	0	1,830	1,825
Willow Beach	490	360	50	0	50	0	100	0
Las Vegas Wash	40	0	40	0	40	0	40	0
Overton Beach	315	550	40	0	40	0	40	0
Temple Bar	1,170	1,250	0	0	0	0	1,575	1,515
NRA Grand Total	4,845	4,870	135	0	415	0	4,155	3,860
Percentage of Existing Conditions	100%	100%	3%	0%	8%	0%	86%	79%

as people in the probable maximum flood, would be mitigated with warning systems and other methods. However, there would be little difference between the proposed action and existing conditions with regard to the number of people in the PMF. Examining each developed area explains this situation.

Under the proposed action, at the Katherine area approximately 630 people (daytime) would be protected from the probable maximum flood by prohibiting use of the North and South Telephone coves primitive use areas and access and from other minor changes. An additional 105 people would be at risk from a daytime probable maximum flood compared to existing conditions at the expanded motel. The net result at Katherine is about 525 fewer people in the PMF.

At Cottonwood Cove approximately 40 fewer people would be in the probable maximum floodplain in the daytime compared to the no-action alternative because of the relocation of NPS maintenance, NPS housing, the picnic area, and concession housing out of the floodplain. About 140 additional people would be in the probable maximum floodplain in the daytime compared to existing conditions because of expansion of the motel, restaurant, store, parking, dry boat storage, and concession maintenance. Here there would be about 100 more people in the probable maximum floodplain.

At Willow Beach approximately 200 fewer people would be in the probable maximum floodplain in case of a daytime flood because of relocation of NPS maintenance, the trailer village, and concession housing. About 170 people would be protected from a daytime flood by diverting floodwaters with structures. About 10 additional people might be in the probable maximum floodplain on an average summer weekend day at any given time because they would be using the new trailer dump station/gas station. Overall about 380 fewer people would be in the probable maximum floodplain.

At Boulder Beach aproximately 353 additional people would be in the zone of sheet flooding due to expansion of the campground, trailer village, motel, and store. Installation of a warning system would be the only protection afforded these people in the probable maximum floodplain. However, sheet flows of 1 to 2 feet in depth are not expected to be life threatening to many visitors.

There would be no change in the numbers of potential victims of the probable maximum flood at Las Vegas Wash.

At Overton Beach relocation of the campground would remove approximately 275 people from the probable maximum floodplain. This action would also be taken under the no-action alternative. The swim beach would remain, leaving some people in the floodplain. Accordingly, there is no difference between the no-action alternative and the proposed action.

Flood safety at Temple Bar would be improved over existing conditions by protecting two daytime residents from the probable maximum flood through diversion of floodwaters. An estimated 370 additional people would be at

risk from a daytime probable maximum flood because of expansion of the parking, motel, restaurant, and store. The net change here would be about 370 more people being in the floodplain under the proposed action.

The number of people in the 100-year floodplain would be greatly reduced under the proposed action compared to existing conditions (160 compared to 1,250). There would be a net decrease in the number of people in the probable maximum floodplain because the number of people protected through site closures or relocation of structures would more than offset the increased number of people in the probable maximum floodplain because of expansion of facilities. The decrease in the number of people in the probable maximum floodplain would be about 365. However, this is a small 8 percent reduction, and about 4,155 people would still be estimated to be in the probable maximum floodplain in developed areas during a summer day. The potential hazard to them would be reduced by the warning system, evacuation plan, and emergency preparedness efforts.

Conclusion: A flood of the 100-year magnitude would not pose a significant hazard to people, but over 4,000 people are in probable maximum floodplains. The degree of hazard would depend on how well the warning systems and evacuation plans worked. During such a large flood event it is likely that injuries or fatalities would result even if the nonstructural mitigation package operated properly. There would be a 14 percent reduction during the day and a 21 percent reduction at night of people in the probable maximum floodplain compared to existing conditions.

IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flood hazard is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains can be found in the "Affected Environment" section of this document. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

Table 26 shows existing and proposed development in the floodplain for the proposed action and each alternative. The proposed action would mitigate the impact of floodwater to the 100-year level with structures, mitigate the effects of floods larger than the 100-year flood with warning systems and evacuation plans, and rely on relocation for some areas. Warning systems and evacuation plans would not provide any protection for property in the floodplains. Consequently, some property in the flood hazard zone would remain susceptible to flood damage and could be damaged or destroyed in the event of a flood. The cost of replacing structures left unprotected in the 100-year floodplain would be $327,970;

for replacing those in the probable maximum floodplain approximately $20.1 million. These costs do not include utilities, furnishings, equipment, vehicles, flood control devices, debris removal, search and rescue, or expenses of victims. The cost to replace facilities damaged by the 100-year flood would be approximately 5 percent of the cost of replacing structures in the 100-year floodplain under existing conditions.

Conclusion: A flood of the 100-year magnitude would not pose a significant hazard to structures but one of the PMF size would. During a 100-year flood, damage to structures would probably be $327,970 or only 5 percent of what it would be under no action. A PMF would probably cause significant damage to structures because very little would be done under this alternative to protect structures. It is estimated that damage to structures under the proposed action from the PMF would be $20,094,340, or 98 percent of that expected under existing conditions.

Table 26: Existing and proposed development in Lake Mead NRA floodplains that are left unprotected by structural flood mitigation measures and are vulnerable to flood damage or destruction.

Structure	No-Action Alternative 100-year	No-Action Alternative PMF	Alternative A 100-year	Alternative A PMF	Alternative B 100-year	Alternative B PMF	Proposed Action 100-year	Proposed Action PMF
Katherine Landing								
Access								
N&S Telephone Cove primitive use area & access	1.9-mi gravel							
Circulation roads to NPS housing	1,950-ft gravel				1,950-ft gravel			
Parking								
east of motel		700-car gravel						700-car paved
west of motel		500-car paved						500-car paved
Launch ramp/ ready lane		8 lanes/150 × 200' paved						8 lanes/200 × 200' paved
NPS maintenance		2 800-sf bldgs 1.5-ac unpaved storage 800' fence						
NPS & concession housing		1 permanent single-family						1 permanent single-family
Trailer village		33 short-term sites						33 short-term sites
Motel		52 units						104 units* add pool*
Dry boat storage	210 spaces		420 spaces	210 spaces			420 spaces	
Ice house		small building						small building
Comfort station	small building							small building
Cottonwood Cove**								
Access roads		5-mi paved				5-mi paved		5-mi paved
Circulation		2.6-mi paved				2.6-mi paved		2.6-mi paved
Parking	290 paved 148 gravel	200 paved 90 gravel			290 paved 148 gravel	200 paved 90 paved		490 paved* 238 gravel*
Ranger station	1,800-sf building							1800 sf building comfort station
NPS maintenance	3,000-sf building, pave 25,000 sf, add 600' fence							
NPS housing	Three 1200-sf houses; seven 800-sf trailers 1,070-ft paved road							

Structure	No-Action Alternative 100-year	No-Action Alternative PMF	Alternative A 100-year	Alternative A PMF	Alternative B 100-year	Alternative B PMF	Proposed Action 100-year	Proposed Action PMF
Picnic area	4 tables 1 large ramada				4 tables 1 large ramada			
Campground #4 & 17 DCP map		149 sites						149 sites
Trailer village		206 long-term sites; 75 short-term sites						206 long-term 75 short-term
Motel		24 units						48 units*
Restaurant		35 seats						70 seats*
Store		1,200 sf						2400 sf*
Dry boat storage	350 spaces							470 spaces*
Concession maintenance	4,400-sf building 35,600-sf paved storage							6,900-sf building* 35,600-sf paved storage
Concession housing		6 trailers 300' gravel road						
Gas station		2 pumps						2 pumps
Comfort station		small building						small building
Fish-cleaning station	small building							small building
Willow Beach								
Access roads main access	2-mi, 2-lane paved		2-mi, 2-lane paved		2-mi, 2-lane paved			2-mi, 2-lane paved
trailer village access	1/2-mi gravel		1/2-mi gravel				1/2-mi gravel	
Parking	164 space paved				164 spaces paved			
Launch ramp	8 lanes				8 lanes		8 lanes	
Ranger station	1,000 sf						1,000 sf (storage only)	
NPS maintenance	1,500-sf building 7,200-sf paved area 250' fence							
NPS housing (closed)	four 1,200-sf houses							
Trailer village	57 long-term 18 short-term							
Motel	24 units							
Restaurant	100 seats 4,900 sf							

Structure	No-Action Alternative 100-year	No-Action Alternative PMF	Alternative A 100-year	Alternative A PMF	Alternative B 100-year	Alternative B PMF	Proposed Action 100-year	Proposed Action PMF
Store	part of restaurant							
Dry boat storage	120 spaces		120 spaces		120 spaces		120 spaces	
Concession housing trailer village	ten 1,200-sf trailers							
Water well buildings	three 10'x10' buildings							
Canoe/raft takeout	graded area		graded area		graded area		graded area	
Trailer dump station/ gas station/storage							1 pump	
Sewage lagoons		one 1-ac one 0.5-ac		one 1-ac one 0.5-ac				one 1-ac one 0.5-ac
Boulder Beach								
Campground		338 sites (Hemenway)						338 sites (10 group, two 500-sf comfort stations)
Trailer village		293 sites						368 sites*
Motel		44 units						88 units*
Store		5,500 sf						8,250 sf*
Las Vegas Wash								
Launch ramp		5 lanes				5 lanes		5 lanes
Overton Beach								
Swim beach	1 ac		1 ac		1 ac		1 ac	
Campground		100 primitive sites						
Temple Bar***								
Parking		95 spaces paved				95 spaces paved		365 spaces paved*
Launch ramp		4 lanes				4 lanes		8 lanes*
Ranger station								1,000-sf bldg*
NPS maintenance		2,000-sf bldg 22,000-sf paved area 850' fence						2,000-sf bldg 22,000-sf paved area 850' fence
NPS housing	1,500-sf, single family							1,500-sf, single-family

Although data are available and cross sections have been developed for Boulder Beach, no maps of 100-year and probable maximum floodplains are available. The following structures are in low, flat areas; therefore, all development is shown in the PMF. Boulder Beach is on a broad alluvial fan and the flood hazard is from shallow sheet flows or unpredictable localized concentrations. This hazard is low compared to all other areas with flood hazard.

Structure	No-Action Alternative 100-year	No-Action Alternative PMF	Alternative A 100-year	Alternative A PMF	Alternative B 100-year	Alternative B PMF	Proposed Action 100-year	Proposed Action PMF
Campground		153 sites						153 sites
Trailer village		122 sites						122 sites
Motel		22 units						90 units* 1,200-sf pool*
Restaurant		76 seats						228 seats*
Store		1,500 sf						3,500 sf*
Concession housing		14 trailers						14 trailers
Gas station		2 pumps						2 pumps
Ice house		small building						small building
Comfort station		400 sf						400 sf

Note: Structures listed in the 100-year floodplain are also in the probable maximum floodplain; however, to avoid repetition, only structures that are in the PMF but not the 100-year floodplain are listed in the PMF column.

* Indicates development that is within the probable maximum floodplain and is being expanded. These new or expanded facilities would be vulnerable to floods larger than the 100-year up to the PMF.

** For existing conditions (no-action alternative), the 100-year floodplain was mapped based on the assumption that existing earth dikes and channels would withstand such a flood. However, USDI Open File report 80-1216 "Potential flood and debris hazards at Cottonwood Cove, Lake Mead National Recreation Area, Clark County, Nevada," prepared in cooperation with the National Park Service, indicates that the dike above the employee housing area would be breached or overtopped by the 100-year flood, and the housing could be in a hazardous location depending on the location of the dike overtopping or breeching. Larger floods might endanger the campground and mobile home area. The 850-foot section of the dike that parallels the trailer village on the north might only control the 50-year flood. Breeching or overtopping of this section of the dike would allow flood waters to enter the trailer village and perhaps the store, restaurant, motel, associated parking area, gas station, and comfort station.

***For existing conditions (no-action alternative) the 100-year floodplain was mapped based on the assumption that existing earth dikes and channels would withstand such a flood. However, those existing structures are not likely to withstand a 100-year flood, and most of the facilities listed in the PMF would be susceptible to flood damage from a 100-year flood.

Table 27: Replacement costs of existing and proposed development in Lake Mead NRA floodplains that are left unprotected by structural flood mitigation measures and are vulnerable to flood damage or destruction

	No-Action Alternative		Alternative A		Alternative B		Proposed Action	
	100-Year	PMF	100-Year	PMF	100-Year	PMF	100-Year	PMF
Katherine Landing	$ 533,860	$ 3,148,420	$ 50,000		$ 25,000		$ 83,860	$ 3,116,860
Cottonwood Cove	2,049,960	9,535,320	-0-		470,330	$4,012,300	-0-	9,412,080
Willow Beach	3,990,600	4,095,600	965,830	$1,070,830	1,129,030		239,830	1,194,830
Las Vegas Wash	-0-	31,250	-0-	31,250	-0-	31,250	-0-	31,250
Overton Beach	4,280		4,280		4,280		4,280	
Temple Bar	-0-	3,644,370	-0-	-0-	-0-	148,500	-0-	6,339,320
Grand Total	$6,578,700	$20,454,960	$1,020,110	$1,102,080	$1,628,080	$4,192,050	$327,970	$20,094,340

IMPACT ON RESERVOIR WATER QUALITY

Based on available water quality data and the projected uses of water within Lake Mead NRA, water quality in Lakes Mead and Mohave is generally in compliance with established water quality standards throughout the year. However, isolated instances do occur where bacteriological pollution threatens the use of water in the NRA for full body contact recreation. The pollution results from improper disposal of human waste from visitors in the shoreline zone around the lakes. Concentrations of visitors at swim beaches and popular coves increases the probability of pollution. The health risk results from water use like swimming, water skiing, and other similar activities during which water may be ingested accidently, and certain sensitive body organs (e.g., eyes and nose) might be exposed to water.

The allowable maximum limits for fecal coliforms (measure of bacteriological pollution in units/100 ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5-sample minimum); 400 in 10 percent of samples for a 30-day period; and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. It should be pointed out that bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (pollution from Las Vegas is discharged from Las Vegas Wash into Lake Mead).

Water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions. When unsafe conditions are noted, that particular area is more closely monitored and may be closed to public use. The Las Vegas Wash swim beach has been closed since 1976, and several heavily used shoreline areas like Boulder Beach and the Katherine swim beaches have had conditions on several occasions that nearly dictated their closure.

Up to now, no recorded cases of serious infectious diseases have been contracted from contact with water from either lake. The existing conditions just described would, however, be expected to get worse over the life of the plan as visitation increased. During that time visitation would be expected to increase about 1.38 times the current levels. Although pollution levels would likely increase with visitation, the mathematical correlation between visitor use and associated pollution cannot be determined with existing data, so the levels of pollution cannot

be projected. As pollution levels increased, risk of shoreline users contracting diseases from contaminated water would increase, but the degree of increase can also not be determined.

The proposed action includes several items which would minimize or reduce the impact of increased visitation on water quality and the related public health. These actions include the following:

> Change shoreline visitation patterns by opening new improved access points, relocating problem swim beaches, and redesigning existing developed areas. These actions are designed to resolve existing crowding and congestion problems and to otherwise improve the visitor experience. By reducing concentrations of visitors, the impact on water quality and the resultant public health hazard would be reduced.
>
> Implement improved, regularly scheduled water quality monitoring programs, particularly during high visitation periods at heavily visited coves and developments. The water quality monitoring program should make the risk of contaminated water to shoreline users insignificant by continuing to assess the risk and determining when remedial actions are necessary. Temporary swim beach closures or closures of popular coves might become necessary if levels of bacteriological pollution were to exceed state standards.
>
> Improve existing sanitation and trash removal programs. Additional restroom facilities would be placed in existing heavily used coves and designated swim beaches, and existing facilities would be improved. Restroom facilities would be placed at all new improved access points and at areas indicated as problems from the water quality monitoring program.

The existing situation at Katherine Landing and Cottonwood Cove would be improved because swim beaches would be relocated. The water quality would be improved and the resulting health hazard reduced, because the new swim beach locations would be more exposed to the main body of lake water and increased wave action. That situation results in greater mixing of the water with accompanying dilution of pollution. Thus, even with increased use, the new swim beaches would be less likely to pose public health hazards.

The new designated swim beaches at Temple Bar and Cottonwood Cove would concentrate visitors at improved shoreline locations. Both locations would be exposed to the main body of the lakes and, as described previously, would not tend to pose public health hazards. To ensure that the public health risk is insignificant, both areas would be included in the water quality monitoring program.

Conclusion: Although visitation is expected to increase, the proposed action includes several mitigating measures which would minimize the effect of such visitation on water quality and related public health in the

recreation area; the hazard would be reduced compared to existing conditions at Katherine Landing and Cottonwood Cove by relocating the swim beaches.

IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

Rogers and Bluepoint springs are easily accessible and heavily used warm water springs. They contain native and exotic fish, provide habitat for waterfowl and shorebirds during their migrations, contain aquatic and emergent vegetation, and provide a rare moist habitat and water source for small mammals, reptiles, amphibians, and nesting birds. While such desert spring ecological communities are rare and important habitats, they are not as critical as they once were because the reservoirs provide some comparable shoreline habitat. Spring communities amount to less than 100 acres or less than .01 percent of the recreation area. Rogers and Bluepoint springs amount to less than 10 acres. Paths have formed around both springs from visitor use.

The proposed action at Rogers Spring calls for expansion and paving of an existing gravel parking area, addition of five covered picnic tables, addition of a small composting toilet, and rehabilitation of an existing interpretive wayside. At Bluepoint Spring one covered picnic shelter with three picnic tables would be added. Desert spring ecological communities would not be affected by mineral leasing because none of them would be in areas subject to leasing.

The proposed developments at these two springs would not directly affect any of the spring community habitat. All development would be in desert shrub or previously disturbed and developed areas. The only impacts to the spring communities would result from increased use by visitors. If visitation to these springs increased 38 percent, as projected for the recreation area over the life of the plan, footpath use around the springs would be expected to increase by at least that much. Emergent vegetation and other moist terrestrial vegetation would be destroyed, and the spring water could be polluted by improperly disposed trash and human waste. The degree of these impacts cannot be determined. The spring communities would be monitored by the recreation area's resource management staff, and if increases in impacts from visitor use were noted, corrective measures would be taken, including boardwalks or fences to constrain visitor movement and information to educate visitors about these sensitive habitats. Such mitigating measures have been very successful with sensitive habitats elsewhere in the national park system.

Conclusion: The proposed action would not directly affect Rogers or Bluepoint springs, but indirect impacts from increasing visitor use could result in trampled vegetation or polluted waters.

IMPACT ON SOILS

Soils in the recreation area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of

these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Off-road vehicles rut soils with their tires, pulverize and disperse surface soil and compact the subsurface soil, demolish chemically bonded surface crusts and protective layers of desert pavement, and crush and destroy plants including fungus, algae, and lichens that bind the soil together. Once the desert lithosols in the recreation area have been broken by offroad vehicles crossing them, they are exceptionally vulnerable to wind, water, and mechanical erosion.

Visitors are permitted to drive land vehicles only on approved roadways in the recreation area under existing regulations. However, law enforcement, information services, and physical barriers have not been successful in curbing the illegal activity of driving off designated roads. Staffing is inadequate to provide the necessary personnel for air, water, and land detection patrols and to apprehend violators of the offroad vehicle regulations. They often escape punishment by claiming there was no way for them to have known of the regulations.

Under the proposed action more adequate maps and information services would be provided; regulatory signs would be posted at all entrances to the recreation area, including backcountry off-road access points that do not connect to the approved road system. In the Northshore Area between Las Vegas Wash and Callville Bay developments, where the most damage has occurred, existing gravel roads would be improved and new spur roads would be added to provide better access roads to the reservoirs. Improved information services would include off-site talks to off-road vehicle organizations, identification of federal lands where off-road vehicle use is not restricted, and distribution of appropriate information through off-road vehicle distributors near the recreation area. This latter action might be done in cooperation with other federal land management agencies in Utah, Arizona, Nevada, and California. Under the proposed action, the land between the Northshore Road and the lake would be zoned as a scientific research area to study the effectiveness of various rehabilitation methods. These methods would probably include sweeping out ruts, scattering gravel to replace displaced desert pavement, and seeding with native plants to reestablish a diverse and self-reproducing vegetative cover. Off-road driving for management or enforcement purposes and for access permits would be restricted.

Once off-road vehicle use was eliminated, the soils and plant cover would restore themselves at an extremely slow rate; invading weed species would generally replace native species, greatly simplifying a once complex soil-building plant and animal community.

A motorcycle driven so as to have the smallest impact on the desert soils would affect 1 acre of land for ever 20 miles it traveled. A four-wheel-drive vehicle driven in a similar manner would affect 1 acre of land for every 6 miles it traveled. About 350 acres of the recreation area

have been damaged severely enough to need some form of rehabilitation, and an additional 30 to 40 acres are being scarred each year. A description of these soils is shown on the Resource Damage map.

The information services, maps, and signing described under the proposed action would ensure that cooperative visitors with offroad vehicles would not inadvertently damage soils in the recreation area.

Similarly, visitors reaching the reservoirs on approved roads would be less tempted to break new ground for a more private setting if approved roads already extended along the lakeshore. The Northshore Area Road improvements would reduce off-road use by providing access to highly desired areas along the lake and by providing a route for detection and enforcement personnel. The soil damage created by off-road vehicle drivers who are less inclined to be cooperative would not be curbed by the proposed action because it does not call for additional enforcement personnel and equipment to maintain a strong detection and enforcement function. Thus, the proposed action would reduce the rate at which soils are being destroyed, but it would not be expected to bring it to a halt.

The rehabilitation research efforts of the proposed action would eliminate visual scars and greatly reduce the rate of wind, rill, and gully erosion on about 100 acres of the recreation area and restore a semblance of desert pavement and native plant cover. Rehabilitation, however, cannot really reclaim severely damaged areas in the sense of restoring the original ecosystem that took many years to form. Successful methods of restoration arising from research would be applied to all areas in the recreation area that have been damaged by off-road vehicle use and by any other activities that similarly mark the land.

Facilities in developed areas have destroyed or severely damaged the natural soils on about 800 of the recreation area's 1.5 million acres (about .0005 percent of the area). The proposed roadways and visitor facilities would add about 503 acres to the total area of lands devoted to these purposes. Although rehabilitation and landscaping would mute the scars from construction and prevent the loss of soil through erosion, the natural productivity of these soils would be lost.

The construction of facilities under the proposed action would compact adjacent soils and create impermeable surfaces which would increase local runoff and erosion in the short expanse between the activity or structure and the lake. Because most facilities are immediately adjacent to major natural washes that feed immediately into the reservoirs, this erosion would be minor and very limited in area. Roadway construction, however, blocks and channelizes runoff as well as increases it. Slopes downhill from the roadway are deprived of overland flow, and downhill gullies and washes are depleted or augmented by the location of road culverts. Upslope gullies and slopes would flood and pond if the water was not sent under the roadway by culverts, increasing sediment deposition. The patchy soil moisture regime thus created would express itself in stands of vegetation that were more or less robust than average. The more robust communities would probably balance the less robust in

the amount of sediment eroded by rainsplash and carried in overland flow.

The proposed roadways would require approximately 1,450,000 cubic yards of material to be removed in cuts. The only major cuts would be along a 3-mile section of the Lakeshore Road where cuts of 30 to 40 feet would have to be made. Such cuts often reveal geologic features in the bedrock that are otherwise masked by soils and overburden. With adjacent pulloff areas, some of these cuts can serve both educational and interpretive purposes. Roadways and flood prevention fill at developed areas would require approximately 1,700,000 cubic yards of material--about 250,000 cubic yards more than that removed in cuts. Some suitable material could be obtained where excavation deepened washes at their mouths in the developed areas as protection against flash flooding. For the most part, however, the additional fill would be brought into the recreation area from established borrow pits or rock waste sites.

The proposed action restricts mineral leasing to the resource utilization subzone, as shown on the Proposed Action Management Zoning map, which is consistent with NPS management zoning policies as defined in the "Planning Process Guideline." This represents an 87 percent reduction in area currently available to leasing consideration, from the current 1,162,550 acres to 148,970 acres. Where leases exist on lands outside the proposed resource utilization subzone, the National Park Service would not renew these leases once the full term of the lease expired, unless that lease was held by production (see the Outstanding Mineral Rights map.) Where other outstanding mineral rights (i.e., mining claims or private mineral rights) exist in areas other than the resource utilization subzone, the National Park Service would manage the surface according to the surrounding land classification, and any proposed development of those mineral rights would continue to be evaluated individually to determine appropriate protection options. Only the resource utilization subzone would be available for mineral leasing consideration, while existing leases would be gradually phased out on the remainder of the recreation area as their terms expired. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR 3100 and 3500) would be revised to reflect these changes. All pending prospecting permits and lease applications that occur in areas other than the resource utilization subzone would be rejected once the regulations were revised. Pending applications inside the resource utilization subzone would not be processed until the minerals management plan was completed.

Under the proposed action, up to 20,000 acres could be subjected to mineral development on 8,238 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 560 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic

exploration on the 7,678 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in Gregg Basin/Grand Wash and the Virgin/Temple zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation, erosion, and compaction with additional damage expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods would be reduced in these disturbed soils by erosion and accelerated weathering, and compaction and abnormally high soil temperatures could also occur. In addition, removal of vegetation and stockpiling of topsoil has been demonstrated to significantly reduce soil microorganisms, which are essential for nutrient cycling and soil development. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil damage. Because of the diversity of soils in the recreation area, site-specific soils data would be acquired, and detailed impact assessment and reclamation planning completed before mining approval.

Mineral leasing would not be expected to significantly affect soils in any area of the park under the proposal. Some damage or loss could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under the proposed action the rate of damage and erosion from off-road vehicles would be moderately diminished, and about 350 acres of damaged soils would be rehabilitated. Developments would destroy or severely damage about 500 acres of lithosols and red desert soils and cause minor disruptions in drainage patterns, which would temporarily increase erosion potential. Damage to recreation area soils resulting from mineral leasing activities would not be significant over the next decade, assuming mineral development activity followed historical trends.

IMPACT ON SIGNIFICANT NATURAL FEATURES

Significant natural features include unique geological areas, outstanding scenic vistas, outstanding coves, and areas in the environmental protection subzone or outstanding natural feature subzone. Under the proposed action, none of these areas would be available for mineral leasing, so no impacts from pending permits would be expected.

IMPACT ON THREATENED, ENDANGERED, OR CANDIDATE SPECIES

The endangered bonytail chub, Gila elegans, Peregrine falcon, Falco peregrinus, and bald eagle, Haliaeetus leucocephalus, are the only three federally listed animal species that are known to occur. There are no threatened or endangered plant species, candidate species, or critical habitats in the NRA. There are several federal candidate species that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as threatened or endangered species, or species of concern. Table 19 identifies the status and legal classification of all threatened, endangered, and candidate species.

The proposed action restricts mineral leasing to the resource utilization subzone as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in the "Planning Process Guideline." This represents an 87 percent reduction in the area currently available to leasing consideration, from 1,162,550 acres to 148,970 acres. Where leases exist on lands outside the proposed resource utilization subzone, the National Park Service would not renew these leases once the full term of the lease expired, unless that lease was held by production (see the Outstanding Mineral Rights map). Where other outstanding mineral rights (i.e., mining claims or private mineral rights) exist in areas other than the resource utilization subzone, the National Park Service would manage the surface according to the surrounding land classification, and any proposed development of those mineral rights would continue to be evaluated individually to determine appropriate protection options. Only the resource utilization subzone would be available for mineral leasing consideration, while existing leases would be gradually phased out on the remainder of the recreation area as their terms expire. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR 3100 and 3500) would be revised to reflect these changes. All pending prospecting permits and lease applications that occur in areas other than the resource utilization subzone will be rejected once the regulations were revised. Pending applications inside the resource utilization subzone would not be processed until the mineral management plan was completed.

Under the proposed action, up to 20,000 acres of the NRA could be subject to mineral development on 8,238 acres of existing leases and 11,650 acres of pending permits (if approved). The most likely mineral activity would be exploration for hardrock minerals on 560 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 7,678 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be

minimal. Over half the acreage under application would be in Gregg Basin/Grand Wash and Virgin/Temple zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

The proposed action would place 1,050,030 acres or 70 percent of the NRA, in the natural zone. Known habitat or potential habitat for rare, threatened, or endangered plant and animal species would be further protected by placement in the environmental protection or outstanding natural feature subzone of the natural zone. Areas open to mineral leasing would be the 148,970 acres in the resource utilization subzone and the existing leases and pending prospecting permits described below.

About 20,000 acres have the highest potential for mineral development--8,238 acres of existing leases and 11,640 acres of pending prospecting permits (if approved). None of these leases and pending permits are in areas where they could potentially affect any threatened or endangered wildlife species. Two existing leases and one pending prospecting permit are located within 5 miles of known locations of candidate threatened or endangered plant species. Additional surveys on these leases or permits could reveal additional populations of these plants. Potential threats to these plants include physical destruction of populations or habitat and illegal collection. When specific mineral development proposals were received in these areas, surveys would be conducted and protective stipulations applied to the plan of operation. However, it is not certain that all threats would be avoided.

Proposed developments that could affect rare, threatened, or endangered plant and wildlife candidate species include the Fire Mountain developed area and access points in the Cottonwood East vicinity and at Detrital Bay. None of the developments would be in areas identified as habitat, but they would all be close to identified habitat areas. Visitor movement around these areas could cause conflicts. Any effects on threatened or endangered species would be due to the increased visitation disturbing these species in habitat areas near these new developments. Peregrine falcons would not be affected.

Areas used by the endangered bald eagle and peregrine falcon are high cliffs, well above the water. These areas are remote and are lightly used by eagles only during the winter (the season of lowest visitor use); they are not used for nesting. The cliffs are not satisfactory for rockclimbing, and direct disturbance on the cliffs would not occur even if more people were present. Boating use along shoreline areas could affect their feeding activities. Although boating use would likely increase because of the new Fire Mountain developed area and Detrital Bay access point, it would remain very low during winter months and would not likely affect the eagles.

Visitation is now very light in the Cottonwood East vicinity, where the proposed access point improvements could affect the endangered bonytail chub recovery cove. The Colorado River Fishes Recovery Team would be

consulted before locating the access point, to preclude impacts on the bonytail chub. Closing the cove or nearby areas to visitor use would be another mitigating measure applied when needed.

The effects of new developments on threatened or endangered species would be further evaluated and mitigation developed in consultation with the Fish and Wildlife Service during the period before construction (about 10 years). Monitoring methods would be developed and refined during these consultations. All species would be closely monitored as visitation increased. Management recommendations based on this monitoring would be designed to allow the areas to be developed with minimal effects on these species. If impacts on threatened or endangered species could not be mitigated, the new areas would not be developed.

Conclusion: Impacts on threatened or endangered species resulting from the proposed action would not occur. To assure that this assessment is correct, studies will be initiated to evaluate visitors' impacts on the species of concern and recommend any mitigation. If impacts on threatened or endangered species could not be mitigated, the new areas would not be developed.

IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type of the Mohave desert. Vegetation typical of higher elevations includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the Basin and Range and Colorado Plateau provinces.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation of disturbed sites to pristine conditions may be as much as 50 to 75 years.

The proposed action restricts mineral leasing to the resource utilization subzone, as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in NPS-2 "Planning Process Guideline." This represents an 87 percent reduction in the area currently available to leasing consideration, from the current 1,162,550 acres to 148,970 acres. Where current leases exist on lands outside the proposed resource utilization subzone, the Park Service would not renew these leases once the full term of the lease expired, unless that lease was held by production (see the Outstanding Mineral Rights map). Where other outstanding mineral rights (i.e., mining claims or private mineral rights) exist in areas other than the resource utilization subzone, the Park Service would manage the surface according to the surrounding land classification, and any proposed development of those minerals would continue to be evaluated individually to determine appropriate protection options. About 148,970 acres would be available for mineral leasing consideration, while existing leases would be gradually

phased out on the remainder of the recreation area as their terms expire. Following finalization of the GMP, the excepted areas regulations (43 CFR 3100 and 3500) would be revised to reflect these changes. All pending prospecting permits and lease applications that occur in areas other than the resource utilization subzone would be rejected once the regulations were revised. Pending applications inside the resource utilization subzone would not be processed until the mineral management plan was completed.

Under the proposed action up to 20,000 acres could be subject to mineral development on 8,238 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 560 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes might be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 7,678 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in the Gregg Basin/Grand Wash and Virgin/Temple zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

Impacts to vegetation under the proposed action would be greatest if an ore deposit was discovered and production of a mine initiated. Over a hundred acres of vegetation could potentially be destroyed through development of mine surface facilities, access roads, and tailings piles. However, given the history of Lake Mead leasing, this level of development is unlikely. Exploration activities on mineral and oil and gas leases would disturb only a small amount of native vegetation.

Conclusion: Only minor impacts to vegetation under this alternative would likely occur.

IMPACT ON BIGHORN SHEEP

Under the proposed action, no bighorn sheep habitat would be available for mineral leasing; therefore, no impacts from pending permits would be expected. However, existing oil and gas leases in the Pinto Valley, totaling 4,480 acres, are in an area of bighorn sheep habitat. If current owners of these leases pursued exploration activities in this area, impacts to bighorn sheep could be expected. Seismic exploration could cause more stress on the herd due to increased human presence and noise from blasting and vehicle travel. Continued stress in bighorn populations elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations would reduce this threat.

A quarterly population and distribution survey would be conducted on mineral leases and adjacent lands to mitigate impacts to bighorn sheep populations, if the leases have active mineral operations taking place on them. A program to collect and record data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada at Las Vegas. This program will gather baseline population data and annual herd movements for all bighorn sheep populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All mineral related operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late in December to early April). If significant detrimental impacts to a bighorn population from exploration or mining operations were found, a temporary shutdown of operation would be made until corrective actions could be made to prevent further detriment to the herd.

Conclusion: Under the proposed action, no bighorn sheep habitat would be available for mineral leasing; therefore, no impacts from pending permits would be expected. Existing oil and gas leases in the Pinto Valley totaling 4,480 acres are, however, located in an area of bighorn sheep habitat. Seismic exploration would have the potential to cause adverse impacts on the herd. Based on implementation of proposed mitigating measures and the assumption that activity would remain sporadic as in the past, impacts to the sheep population should not be significant enough to affect overall population health.

IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas, confusing circulation systems frustrate first-time visitors who are trying to find their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas become full.

The proposed action would accommodate increasing visitor use and solve existing crowding/congestion problems by expanding and improving existing developed areas, improving existing access points to the lakeshores, and providing new developed areas. (For a full discussion of these actions, refer to the "Alternative Development Concept Actions" section.) These actions would include many proposals intended to accommodate increasing visitation or to solve crowding/congestion. To understand the magnitude of these proposals, the increases in parking, overnight accommodations, and launch ramps are used as examples. The

proposed action would include an increase of 7,470 parking spaces (19,660 spaces exist), or a 38 percent increase. There are 1,755 overnight accommodation units (a unit is either one campsite, one motel room, or one RV site). The proposed action would increase the number of units by 1,180 or an increase of 67 percent. There would be 73 launch ramp lanes, and the proposed action would add 22, an increase of 30 percent.

Over the life of the plan visitation is expected to increase by about 68 percent, and most visitor facility proposals call for increases from 35 to 85 percent above existing levels. This parity between expected use and capacity of proposed facilities indicates that crowding/congestion would not get any worse than it is now. However, it should be less than current levels because of other proposals that cannot be quantified. For example, circulation improvements would facilitate vehicle and pedestrian movements in several developed areas.

Conclusion: The proposed facility improvements and expansions would reduce current crowding/congestion compared to existing levels, while accommodating increasing numbers of visitors.

IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are Katherine, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within Lake Mead. Under the proposed action, cabin site occupancy would continue at existing levels at the three developed areas. Extensions of leases up to five years would continue to be granted until the need for public use of the cabin site areas dictated termination. The determination of public need would be made two years in advance of the common expiration date. As part of the GMP planning effort, a determination of public need for the cabin site areas was made. The cabin sites were found to be compatible with public use, and there was no projected public need for these sites.

Conclusion: The proposed action would have no effect on cabin site residents.

IMPACT ON TRAILER VILLAGE RESIDENTS

NPS trailer village policy allows for short- (30-day occupancy or less) and long-term sites, and currently most of the developed areas around the lakes have concessioner-operated trailer villages for long- and short-term visitors. Under the proposed action, to meet an existing demand for RV sites, some concessioner trailer villages might be expanded or converted to provide for more short-term sites. The number of long-term, short-term, and RV sites that are available at each area and the changes under the proposed action are as follows:

Area	Existing Number of Sites Long/Short/RV	Proposed Action
Katherine Landing	104/39/0	Add 40 RV sites
Cottonwood Cove	223/75/0	Retain existing
Fire Mountain	0/0/0	Add 50 RV sites
Willow Beach	60/18/0	Relocate 50 long-/18 short-term sites Add 50 RV sites
Boulder Beach	215/75/0	Add 75 short-term sites
Las Vegas Wash	0/ 0/0	Add 80 RV sites
Callville Bay	94/6/0	Add 29 RV sites
Boxcar Cove	0/ 0/0	Add 50 RV sites
Echo Bay	69/58/0	Add 42 RV sites
Overton Beach	19/13/0	Relocate/convert to 15 long-term, 30 RV sites
Temple Bar	103/13/0	Remove 10 long-and 7 short-term sites
Totals	887/297/0	

The proposals to add RV sites at most of the developed areas would have no effect on existing trailer village residents. The effects of converting long-term sites to short-term sites would be mitigated by converting them as current residents vacated the sites. Trailer village residents would be most affected in the following areas: Willow Beach, where 50 of the 60 long-term and all 18 short-term residents would be relocated out of the flood-hazard zone to a safer area; Overton Beach, where 15 long-term and 13 short-term residents would be relocated, and 4 long-term sites would be removed; and Temple Bar, where 10 long-term and 7 short-term residents would be removed to provide for a high-water parking area.

The social impact resulting from these trailer village relocations would be felt most by the four long-term residents at Overton Beach and 10 long-term residents at Temple Bar. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants, who have spent as many as 30 years in their trailers. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees. The number of long-term sites adversely affected at these areas is 14 out of 887 for the entire NRA, or 2 percent of the total long-term sites. Only seven of the 297 short-term sites, or 2 percent, would be affected. These impacts would be mostly mitigated, because the National Park Service would first rely on normal attrition before any action would be taken to force residents from their trailer spaces.

Conclusion: The proposed action would have little or no effect on existing trailer village residents at most developed areas. Trailer village

residents affected by the proposal would be those at Willow Beach, where long-term and short-term occupants would be relocated to a safer area, and those at Overton Beach and Temple Bar.

IMPACT ON LEVEL OF CONCESSION SERVICES

The following table summarizes the level of services to be provided by the concessioner under the proposed action.

Conclusion: Comparing the proposed concession services to existing conditions, there would be an increase in the level of services in eight out of the nine categories. These increases would range from 34 percent in rental boats to 161 percent in the number of motel units. In one of the nine categories--long-term trailer villages--the number of spaces would decrease by 2 percent.

Table 28: Impact on Level of Concession Services, Proposed Action

	Trailer Village Long-Term/ Short-term Sites	Motel Units	Restaurant Seats	Store Square Feet	Marina Slips/Moorings	Rental Boats Houseboats/ Other	Dry Boat Storage Spaces	Gas Station # Pumps	Gas Dock # Boat Capacity
Katherine Zone									
Katherine Landing	104/79	104	234	7,200	805/0	75/41	420	2	14
Lower Mohave East	0	0	0	2,000	0	0	0	0	4
Cottonwood Zone									
Cottonwood Cove	223/75	48	70	2,400	535/0	25/31	465	2	8
Fire Mountain	0/50	25	50	3,000	200/0	0/0	120	0	0
Willow Beach Zone									
Willow Beach	60/68	48	100	1,000	270/16	0/40	120	1	
Boulder Basin Zone									
Boulder Beach	215/150	88	314	8,250	875/0	0/78	275	0	
Las Vegas Wash	0/80	0	54	3,300	630/3	0/70	200	0	4
Callville Bay	94/30	30	60	1,000	1,045/0	15/33	166	2	
Boxcar Cove	0/50	35	50	3,000	0/0	0	120	0	
Echo Bay Zone									
Echo Bay	69/100	104	120	11,000	530/0	90/25	200	4	
Overton Beach Zone									
Overton Beach	15/30	0	0	1,800	0/140	0/12	65	2	3
Virgin/Temple Zone									
Temple Bar	93/6	88	228	3,500	980/0	45/15	300	2	
Totals: Proposed Action	873/718	570	1,280	47,450	5,870/159	250/345	2,451	15	33
Existing Conditions	887/297	218	834	25,600	3,317/99	170/258	1,328	11	24
Net change	-14/+421	+352	+446	+21,850	+2,553/+60	+80/+87	+1,123	+4	+9
Percent change	-2/+42	+1604	+53	+85	+77/+61	+47/+34	+85	+36	+38

IMPACT ON MINERAL LEASING OPPORTUNITY

The proposed action restricts mineral leasing to the resource utilization subzone, as shown on the Proposed Action/Management Zoning map, which is consistent with NPS management zoning policies as defined in the "Planning Process Guideline." This represents an 87 percent reduction in area currently available to leasing considertion, from the current 1,162,550 acres to 148,970 acres. Where current leases exist on lands outside the proposed resource utilization subzone, the Park Service would not renew these leases once the full term of the lease expired, unless that lease was held by ongoing production (see Outstanding Mineral Rights map). Where other outstanding mineral rights (i.e., mining claims or private mineral rights) exist in areas other than the resource utilization subzone, the Park Service would manage the surface according to the surrounding land classification, and any proposed development of those mineral rights would continue to be evaluated individually to determine appropriate protection options. About 148,970 acres would be available for mineral leasing consideration, while existing leases would gradually be phased out on the remainder of the recreation area as their terms expire. Following finalization of the GMP, the excepted areas regulations for Lake Mead (43 CFR 3100 and 3500) would be revised to reflect these changes. All pending prospecting permits and lease applications that occur in areas other than the resource utilization subzone would be rejected once the regulations were revised. Pending applications inside the resource utilization subzone would not be processed until the minerals management plan was completed.

Under the proposed action, up to 20,000 acres of the NRA could be subject to mineral development on 8,238 acres of existing leases and 11,640 acres of pending permits (if approved). The most likely mineral activity would be exploration for hard-rock minerals on 560 acres of existing mineral leases and 11,640 acres of pending prospecting permits. Exploration activities normally involve collection of rock samples, magnetic surveys, geochemical analysis, and core drilling. Each drill site requires about ¼ acre, and five to 25 holes may be drilled to locate and determine characteristics of an ore body. Acreage necessary for development of an ore deposit would depend on location and size of the deposit and mining method. Seismic exploration on the 7,678 acres of existing oil and gas leases could also potentially occur under the proposed action. Acreage disturbed by these activities would depend on whether existing roads were available in the lease block, but in most cases impacts would be minimal. Over half the acreage under application would be in Gregg Basin/Grand Wash and Virgin/Temple zones of the NRA; the remaining applications would fall in the Willow Beach and Cottonwood zones. Most of the 21,000 acres under application that fall in zones not open to mineral leasing are in the Shivwits Plateau zone.

The most immediate impact of removing the remaining 1,333,505 acres of the park from mineral leasing consideration would be on applicants who have applied for 17,590 acres of uranium prospecting permits in the Shivwits Plateau zone. Under this alternative these applications would be rejected. The areas having the highest potential for mineral resources within the Shivwits Plateau zone are in mineralized breccia pipes of which

approximately 10 are known to exist in the area. Breccia pipes are often not mineralized, but substantial production of uranium, copper, and other metals has been produced from breccia pipes in the Arizona strip country, including Hack Canyon, Kanab Creek, and Pigeon mines northeast of the NRA. The proposed action would leave two of the known pipes open to development: the Copper Mountain pipe (currently under claim) and the "mule pipe" (currently under lease). The remaining eight pipes would be removed from further mineral leasing consideration. However, two of these eight pipes might be located within Grand Canyon National Park and therefore are currently not available for mineral leasing. Another pipe, the "Parashant pipe" was drilled by the Cotter Corporation in 1968, and although anomalous radioactivity was present, no commercial grade uranium was found (USDI 1977). The other five pipes have not been drilled. The only known resources are currently in the Copper Mountain pipe, which would still be available for development.

Energy Fuels Corporation (September 19, 1984) stated there were over 26 breccia pipe-like structures with ore grade uranium found within the area. Of these, none are in the park. Therefore, the proposed restrictions on mineral leasing will affect less than 4 percent of the high potential uranium exploration targets.

There is a high potential that gold and silver mineral deposits may be located within the NRA. There are also hundreds of known gold and silver deposits outside the NRA available to the public. Therefore, exclusion of gold and silver mining within the NRA will not greatly reduce the number of high potential exploration targets for gold and silver in the local or national economy. Lowe (1985) identified 51 principal gold deposits within the state of Nevada, only one of which was within or adjacent to the national recreation area.

Another impact of the proposed action would be on noncompetitive oil and gas lessees, who have historically represented the majority of mineral leasing activity at the recreation area. However, in the last 20 years, since establishment of the NRA, no oil and gas wells have ever been drilled on the oil and gas leases that have been issued to date, and no oil and gas deposits have been identified within the recreation area. Therefore, removal of most of the NRA from leasing would have a minimal impact on the petroleum industry. A few individuals and corporations would be prevented from acquiring leases in the NRA, and the treasury would lose several thousand dollars annually in lease rental fees. However, because 148,870 acres would still be open to leasing in the NRA, and since the same geologic structures may be reached from outside the NRA, this impact is expected to be minimal.

During the period 1955-1983, applications for over 700 federal leases were reviewed by the NRA. Although less than 200 acres have been disturbed to date, an undetermined portion of this acreage was disturbed prior to recreation area establishment, this widely scattered disturbance has resulted in production of only 60 pounds of tungsten, and the stockpiling of approximately 10 tons of tungsten ore awaiting shipment for processing since 1972. Over 200 leases have been issued in the recreation area since the beginning of 1972 for the following commodities:

Gold	Pumice
Silver	Fluorspar
Copper	Titanium
Tungsten	Turquoise
Sodium	Uranium
Perlite	Thorium
Oil and Gas	

Mineral leasing in Lake Mead National Recreation Area has not yielded commercial production of any other fossil fuel, nonmetallic or metallic minerals. A contracted analysis of known mineral occurence by the National Park Service in 1982 concluded that increasing the area excepted from mineral leasing under the proposed action would have no measurable impact on present or future mineral production (O'Brien 1982, see appendix G).

Conclusion: It is not anticipated that a reduction of 87 percent of the area currently available for mineral leasing consideration would significantly affect current or future mineral and fossil fuel production opportunities locally or nationally.

IMPACT ON WILDERNESS LANDS

Management zoning under the proposed action would place 148,970 acres in the resource utilization subzone of the special use zone. These lands would be open to mineral leasing. Although no lands are proposed for wilderness designation, the Wilderness Suitability map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. The following units are keyed by number to that map and include most of the lands in the recreation area that possess primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 (total, 40,605 acres) center on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave power plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit. The resource utilization subzone would include 3,755 acres within these units on the lower alluvial slopes adjacent to the Nellis Wash unit.

Unit 3, Nellis Wash, includes portions of the isolated Newberry Mountains along the western side of the recreation area. Finger-like drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has previously occurred within the unit. All of the 15,870 acres within this unit would be placed in the resource utilization subzone under the proposed action.

Unit 4, Cottonwood Valley, potentially meets the criteria of the Wilderness Act in spite of outstanding mineral reservations. This 15,295-acre gently sloping wash provides solitude in a primitive setting just to the north of a major development at Katherine Landing. The resource utilization subzone would include 4,950 acres within this unit at the southern end closest to Katherine Landing.

Unit 5, the Black Mountains capped by 2,000-foot Mount Davis, provides a background for Lake Mohave. Approximately 17,970 acres are included within this unit. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. The resource utilization subzone would include 10,580 acres within this unit in the eastern portion and adjacent to the NRA boundary.

Unit 6, Opal Mountain (17,635 acres), contains a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and gently sloping alluvial fans provide opportunities for seclusion in a setting of scenic splendor. The resource utilization subzone would include the 8,125 acres of gently sloping alluvial fans behind Opal Mountain and far from the lake.

Units 7, 8, 10, 11, and 12, Fire Mountain and Black Canyon, contain some of the most spectacular and rugged terrain within the recreation area. They consist of steep, barren rocky crags, which begin at an elevation of 645 feet and rise to approximately 2,200 feet. These units consist of 70,470 acres and combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a popular spot for visitors to see sharp and abrupt canyon walls and a myriad of geologic features. Unit 11 only potentially meets the criteria of the Wilderness Act because the Bureau of Reclamation has identified this area as a potential location for reclamation facilities ranging from Hoover Dam modifications to new transmission line corridors. The resource utilization subzone would include 11,850 acres within these units that are adjacent to the NRA boundary and are not visible from the lake or major access roads.

Unit 9, Eldorado Mountain, contains approximately 29,665 acres of this picturesque and rugged mountain range. The unit is a maze of peaks and side canyons with vertical cliffs extending to the edge of the Colorado River. The resource utilization subzone would include the 4,270 acres immediately north of an active mining area.

Unit 13, Kingman Wash, contains approximately 40,835 acres. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. The resource utilization subzone would include the 1,845 acres within the unit adjacent to highway 93.

Unit 14, Bonelli Landing, comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is by the road to Bonelli Landing and Temple Bar. None of these lands would be open to mineral leasing.

Units 15, 16, and 17, Pinto Valley, comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks in the area and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock extend into the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is a much-photographed topography, with red sandstone outcroppings that merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. None of these lands would be open to mineral leasing.

Unit 18, Cathedral Wash, contains 18,820 acres. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts with the flat surface of Lake Mead. None of these lands would be open to mineral leasing.

Unit 19, Overton (24,040 acres), consists of flat to "badland-like" lands sloping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular constrasts found in other units and portray a typical desert landscape. This unit has retained its primitive characteristics and affords an opportunity for seclusion and an unconfined type of recreation. None of these lands would be open to mineral leasing.

Unit 21--White Hills, unit 22--Temple Bar, and unit 23--Gregg's Hideout, all in the White Hills offer isolation, scenic views, and historic attractions. This rolling hill country includes some evidence of earlier mining activities and trails. These activities did not scar the area excessively, and many scars have healed to the point of not being noticeable. Access to the area is possible by car on existing roads, by hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain approximately 52,130 acres. The resource utilization subzone would include 10,720 acres in units 22 and 23. These areas are remote from the lake and already show some evidence of earlier historic mining activities and trails.

Units 20 and 24-32 are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs, Iceberg Ridge, South Cove, and Pearce Ferry. The units (total 135,688 acres) contain rugged mountain ranges that provide a scenic background for the Virgin Basin, Virgin Canyon, Gregg Basin, Iceberg Canyon, and Pearce Ferry sections of Lake Mead. Gently sloping outwash fans extend from the mountains to plunge abruptly into the reservoir. The resource utilization subzone would include 9,320 acres within these units--4,200 acres in unit 24 and 5,120 acres in unit 30--all hidden from view of the lake.

Unit 33, Shivwits Plateau, contains approximately 83,980 acres. Diverse activities occur in this remote section of Lake Mead, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests and a wider variety of wildlife than can be found in the rest of the recreation

Table 29: Summary of the Effects of the Proposed Action on Lake Mead NRA Lands Meeting or Potentially Meeting Wilderness Act Criteria

	Acres Meeting the Criteria		Acres Affected by Proposed Action	
	Wilderness	Potential Wilderness	Wilderness	Potential Wilderness
1	7,650			
2	32,955		3,755	0
3	15,870		15,870	0
4	0	15,295	0	4,950
5	17,970	640	10,580	
6	17,635	0	8,125	
7	15,145		1,710	0
8	25,605		10,240	0
9	29,665		4,270	0
10	2,045			0
11	0	14,645		
12	13,030	0		
13	40,835		1,845	0
14	13,875			
15	17,115			
16	6,680			
17	14,545			
18	18,820			
19	24,040			
20	10,610			
21	25,580			
22	16,665		6,145	0
23	9,885	80	4,575	0
24	22,095		4,200	0
25	8,545			
26	14,620			
27	7,720			
28	14,020			
29	13,895			
30	15,143	460	5,120	0
31	16,480			
32	12,100			
33	0	83,980		
34	14,905	0		
35	32,215	0		
36	10,710	600		
Totals	558,675	115,700	76,435	4,950
Percentage	100	100	14	4

area. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon. Because most of the land within this unit is subject to nonfederal mineral rights, the unit only potentially meets the criteria of the Wilderness Act. This unit, like several others, appears to be narrow and splintered by access roads. However, when considered along with the adjacent proposed wilderness in Grand Canyon, it is apparent that these would form a significant contiguous wilderness unit. None of these lands would be open to mineral leasing.

Unit 34--Andrus Point, unit 35--Whitmore Point, and unit 36--Lava consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous and scenic side canyons that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character, and it provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons. Geologic formations and processes in evidence here might provide information on the origin of the Grand Canyon. Archeological sites of several Indian cultures, including the Virgin Anasazi and more recently the Paiutes, are also found here. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs. None of these lands would be open to mineral leasing. See table 28 for a summary of wilderness acres affected.

Conclusion: Leaving 148,970 acres open to mineral leasing consideration within the NRA would affect 76,435 acres, or 14 percent of those lands that meet the criteria of the Wilderness Act, and 4,950 acres, or 4 percent of those lands that potentially meet the criteria. These are lands which primarily meet the roadless requirements of the Wilderness Act and do not possess outstanding natural beauty or other significant resource values. Mining activities as a result of mineral leasing in these areas could unnaturally scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

If a flood caused the death of one or more individuals, such a loss would be irreversible and irretrievable. Likewise, flooding has the potential to cause injuries that would result in irreversible and irretrievable damage to the person as well as to a person's capability to participate in some activities.

Destruction of up to 500 acres of lithosols and red desert soils from development of NPS and concessioner structures, and damage and erosion of soils from offroad vehicles, would be irretrievable losses of these soils.

Irretrievable damage to soils might result from mineral exploration activities. Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation, erosion, and compaction, with additional damage expected from associated

excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by exposure of the soils to erosion and accelerated weathering while soil compaction and abnormally high soil temperatures could also occur. In addition, removal of vegetation and stockpiling of topsoil have been demonstrated to significantly reduce soil microorganisms, which are essential for nutrient cycling and soil development. All factors could reduce the reclamation potential of the disturbed area unless proper care was taken to mitigate soil damage. Under the proposed action, soil damage caused by exploration and development over the next 10 years would be expected to be fewer than 300 acres provided that present mineral development trends in the area continued.

Irreversible and irretrievable loss of vegetation could result from implementation of the proposed action. In the unlikely event that an ore deposit was discovered and a mine began to produce, over a hundred acres of vegetation could be destroyed through development of mine surface facilities, access roads, and tailings piles. Whether vegetation could be reestablished would depend on the success of mitigation designed to maintain the productivity of the soil. Reclamation of mined areas to pristine conditions would take a minimum of 50 to 75 years.

Exploration or mining activities as a result of mineral leasing could irretrievably scar the landscape and alter the wilderness character of lands that meet the criteria for wilderness.

SHORT-TERM USES VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

Under the proposed action money would be expended to place development in areas that are known to be prone to flooding. Facilities would be protected by structural measures to the level of the 100-year flood. No protection from the probable maximum flood would be provided to structures. Warning systems and evacuation plans would be developed to protect human life in the event of a 100-year or probable maximum flood. The premise underlying the proposed action is that the chance of the a probable maximum flood occurring is so slight that the expenditure to protect structures against this flood is not justified. Over the long term, there is a chance that structures and human lives might be lost as the result of a probable maximum flood.

Removal of the Shivwits Plateau from any further mineral leasing consideration would favor long-term provision of recreational benefits over short term economic and energy supply gains. Among the benefits provided by Lake Mead National Recreation Area are public recreation, and preservation of scenic, historic, and other important features. Opportunities for primitive, secluded, backcountry experiences on the Shivwits Plateau or in the esplanade and canyon country of the Whitmore-Parashant Canyon area would not be compromised. The long-term gains obtained from preserving the recreational values of the park far outweigh the uncertain, relatively short-term gains from mineral development.

Approximately 500 acres of soil and vegetation would be lost to provide additional recreation benefits for six million to nine million people per year who visit Lake Mead National Recreation Area.

In the event that mining did occur in the recreation area with concomitant destruction of soil and vegetation, public recreational opportunities would be lost in favor of development of the mineral resources. Other industries would benefit from the development of the mineral resources. Over the long term--no less than 50 to 75 years--productive soils and vegetation might be restored in mined areas through reclamation.

ADVERSE IMPACTS THAT COULD NOT BE AVOIDED

In the event of a probable maximum flood occurring under the proposed action, the survival of people within the probable maximum floodplain would depend on the adequacy of the warning system and the evacuation plans, and on the actions taken by themselves and other people in attempting to evacuate the area. National Park Service and concessioner structures probably would be lost. Personal property of visitors such as vehicles probably would be lost.

There is a possibility that increased visitor numbers (about 1.35 times current levels) would increase the level of currently experienced adverse impacts on water quality. Actions such as moving swim beaches at several developed areas might prevent these potential adverse effects from materializing. Should water quality deteriorate below the level required by state standards, some swim beaches and coves might have to be closed to use.

Indirect impacts such as pollution of springs and trampling of vegetation could be aggravated by increased visitor use at Rogers and Bluepoint springs. Under all alternatives, visitation to these special communities is expected to increase by about 38 percent. The difference is that under the no-action alternative and alternative A, there would be no addition of visitor facilities, while under the proposed action and alternative B, additional facilities would be provided and monitoring would be done. The monitoring and subsequent management action under the proposed action is expected to stop adverse impacts as soon as they occurred.

Destruction of up to 500 acres of lithosols and red desert soils from development of NPS and concessioner structures, and damage and erosion of soils from off-road vehicles would be an unavoidable adverse impact on soils. There would be unavoidable adverse impacts on soils structure and productivity from mineral exploration activities. Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation, erosion, and compaction, with additional damage expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by exposure of the soils to erosion and accelerated weathering, while soil compaction and abnormally high soil temperatures could also occur. In addition, removal of vegetation and stockpiling of topsoil have been

demonstrated to significantly reduce soil microorganisms, which are essential for nutrient cycling and soil development. All factors could reduce the reclamation potential of the disturbed area unless proper care is taken to mitigate soil damage. Under the proposed action, soil damage caused by exploration and development over the next 10 years is expected to be fewer than 300 acres, provided that present mineral development trends in the area continued.

Trailer village residents at Willow Beach where 50 long-term residents would be relocated to a safer area approximately a half mile away would experience the inconvenience associated with moving. Removal of four long-term sites at Overton Beach and 10 long-term sites at Temple Bar would adversely affect a total of 14 (2 percent) of the 887 long-term sites in the recreation area. To mitigate the effect on these long-term residents, they would first be reduced by attrition. However, some long-term residents would have to relocate to another developed area or outside the recreation area. Only seven out of the NRA total of 297 or 2 percent of short-term sites would be removed.

The national recreation area has 558,675 acres of land that meet the criteria for wilderness and 115,700 acres that potentially meet these criteria. Under the proposed action 76,435 acres that meet the criteria for wilderness (14 percent of the NRA's total that meet the criteria) would be open to mineral leasing; 4,950 acres (4 percent of the NRA's total acres that potentially meet the criteria) would be affected. Exploration or mining activities as a result of mineral leasing could scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation. These are lands that primarily met the roadless requirements of the Wilderness Act criteria and do not contain other significant resource values.

ENVIRONMENTAL IMPACTS OF THE NO-ACTION ALTERNATIVE

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; and the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, since flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures are shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation of floodplains. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

The number of people in the probable maximum floodplains of the developed areas of the recreation area on an average summer weekend has been estimated at 4,845 during the day and 4,870 at night. A breakdown by developed area is shown in table 25. This number of people in the probable maximum floodplain represents approximately 5 percent of the people in the recreation area on a summer weekend day (96,000). About 1,250 people during the day and 1,225 at night are in the 100-year floodplain on an average summer weekend (see table 24). These numbers are about 1 percent of the people in the recreation area.

Flood mitigation in the no-action alternative would rely mainly on the nonstructural methods of the warning system package discussed in the proposed action and minor maintenance actions, such as regrading of dikes and channels. A few facilities would be removed or relocated from the floodplain.

The specific flood mitigation actions that would occur at each developed area are described below.

> Katherine. The short-term trailers (#17 Katherine Marina Area DCP graphic in volume I) would be removed from the north Katherine Wash area, and the area would be regraded. The existing diversion canal east of the main access road would be regraded to divert flood

flow into Telephone Cove. The warning system package would be installed.

Cottonwood Cove. Existing drainage canals and the warning system package would be maintained.

Willow Beach. The existing warning system package would be maintained; facilities now closed would remain closed.

Boulder Beach. Existing diversion dikes and channels would be maintained and the warning system package would be installed.

Las Vegas Wash. The launch ramp and parking would be protected through nonstructural measures. Dry boat storage and concession maintenance would be relocated. A warning system package would be developed for the launch ramp in the floodplain.

Overton Beach. The campground would be relocated out of the flood-hazard zone.

Temple Bar. The existing diversion dikes and channels would be maintained and the warning system package would be installed.

Removal of facilities from the floodplain would provide the best protection from floods. The warning system would be the second most effective method of reducing the number of flood victims, assuming that it operated correctly and provided a signal in advance of the flood, that people received the signal and respond appropriately, and that the evacuation plan was effective.

While diversion structures would normally be more effective than warning systems, the existing earth dikes and channels are so unsound that they would provide essentially no protection. People would see the diversion dikes and channels and feel a false sense of security because flood protection measures appeared to be in place. At Cottonwood Cove and Temple Bar the 100-year floodplain was mapped assuming that the existing earth dikes and channels would withstand such a flood. The structures would not likely do that, and their failure would jeopardize large numbers of people in campgrounds, trailer villages, etc., at Cottonwood and Temple Bar. Thus, the estimate of the number of people who would be in the floodplain in those areas is unrealistically low.

At the Katherine Landing developed area the potential number of people in the probable maximum floodplain would be reduced by about 65 during the day and 100 at night by removing the short-term trailer village sites. The safety of the remaining 1,030 people in the probable maximum floodplain would depend on the warning system.

There would be no change at Cottonwood Cove, since a warning system is already in place. Therefore, there would be no impact on visitor safety in floodplains.

There would similarly be no change at Willow Beach. However, the warning system that is already in place is less effective than warning

systems at other areas. It only gives notice of an impending flood approximately 20 minutes before the flood strikes. Flood conditions develop relatively rapidly at Willow Beach because water concentrates very quickly in its steep canyons. Floods are difficult to flee at Willow Beach because steep canyons make escape to higher ground difficult. Road access to the area is severed during most floods because the access road follows a narrow canyon bottom.

Installation of warning systems at Las Vegas Wash and Temple Bar would improve the safety of about 1,210 people in the probable maximum floodplain. Due to the shallow sheet-flow-type flooding at Boulder Beach there is little hazard to people in the floodplain, and it has been excluded from the tables. However, a warning system would be installed to even further reduce the hazard for the 1,260 people in the probable maximum floodplain.

At Overton Beach the campground would be relocated out of the floodplain, eliminating the hazard for about 275 people during the day and 350 people at night.

Conclusion: Compared to existing conditions, the no-action alternative would provide additional protection to approximately 2,620 occupants of the probable maximum floodplain and 685 occupants of the 100-year floodplain through installation of warning systems. The degree of hazard would depend on how well the warning systems and evacuation plans worked. During a large flood event it is likely that injuries or fatalities would result.

IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains may be found in the "Affected Environment" section of this document. The development concept plan graphics for each developed area show the extent of the 100-year and probable maximum floods.

Table 21 shows development in the floodplain under each alternative, including no action. The no-action alternative would keep existing structures in their present locations. Protection of these structures would be enhanced somewhat by regrading dikes and channels, but warning systems added to protect human occupants would not provide any protection to property in the floodplain. Consequently, this property would remain susceptible to flood damage. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $6.6 million; and for replacing those in the probable maximum floodplain, approximately $20.4 million. These costs would not cover utilities, furnishings, equipment, vehicles, flood-control devices, debris removal, search and rescue, or expenses of victims.

Conclusion: Under the no-action alternative, the 100-year or probable maximum flood would damage or destroy a large number of structures.

IMPACT ON RESERVOIR WATER QUALITY

Based on available data, water quality in Lakes Mead and Mohave is generally in compliance with established standards throughout the year. However, in isolated instances bacteriological pollution threatens the use of water for full body contact recreation. The pollution results from improperly disposed human waste from visitors using the shoreline zone around the lakes. Concentrations of visitors at swim beaches or popular coves increases the probability of pollution. The health risk occurs during activities like swimming and waterskiing, when water may be ingested accidently and certain sensitive body organs (e.g., eyes and nose) might be exposed to water.

The allowable maximum limits for fecal coliforms (measure of bacteriological pollution in units/100ml) for full body contact recreation in the Arizona and Nevada water quality standards are 200 as a geometric mean (5 sample minimum), 400 in 10 percent of samples for a 30-day period, and 800 in a single sample.

Elevated counts of fecal coliforms generally occur during heavy use days (such as Labor Day), when lake levels are low, and at undeveloped coves accessible only by water where use is low to moderate and no sanitary facilities are available. In the latter case, localized incidents of high fecal coliforms occur when water levels rise and such areas are inundated. Bacteriological pollution is rare in open areas (such as Boulder Beach) where wind and wave action provide adequate mixing; however, in areas where beaches are located in harbors or confined areas, incidents of elevated coliform counts are common by late summer. For example, fecal coliform levels have reached 1,200 at Cottonwood Cove, 1,100 at Temple Bar, and up to 24,000 in Las Vegas Bay (pollution from Las Vegas discharged from Las Vegas Wash into Lake Mead).

Water quality at designated swimming beaches in Lake Mead NRA is regularly monitored in accordance with applicable state and local health codes to identify unsafe water quality conditions. When potentially unsafe conditions are noted, the particular area is more closely monitored and may be closed to public use. The Las Vegas Wash swimming beach has been closed since 1976, and several heavily used shoreline areas, like the swimming beach at Katherine Landing, has had conditions on several occasions that nearly dictated its closure.

The no-action alternative does not propose any actions that would change shoreline visitation patterns and thereby alter water quality. The existing conditions just described would be expected to get worse over the life of the plan as visitation increased. Over the life of this plan visitation would be expected to increase to about 1.38 times the current levels. The mathematical correlation between visitor use and associated pollution cannot be determined with existing data, so the levels of pollution cannot be projected. Temporary swim beach closures or closures of popular coves might become necessary if levels of bacteriological pollution were to exceed state standards.

There would be an increased risk of shoreline users contracting diseases from contaminated water, but the degree of increase cannot be determined. The water quality monitoring program should make this risk insignificant by continuing to assess the risk and determining when remedial actions are necessary. Up to now there have not been any recorded cases of serious infectious diseases being contracted from contact with Lake Mead's water. The monitoring program is explained in the shoreline pollution section of the proposed action.

Conclusion: Even with expected increases in visitation, the no-action alternative would not pose significant health hazards from water pollution.

IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

The Significant Natural Features map identifies 33 springs and seeps within the NRA. Rogers and Bluepoint springs are unique warm water springs. They contain native and non-native fish, provide suitable habitat for waterfowl and shorebirds during their migrations, contain aquatic and emergent vegetation, and provide a rare moist habitat and water source for small mammals, reptiles, amphibians, and nesting birds. While such desert spring ecological communities are rare and important habitats, they are not as critical as they once were because the reservoirs provide some comparable shoreline habitat. Spring communities amount to less than 100 acres or less than .01 percent of the recreation area. Rogers and Bluepoint springs amount to less than 10 acres. The existing picnic areas at Rogers and Bluepoint springs would remain under the no-action alternative. Rogers Spring has a 0.4-mile gravel access road, unpaved parking for about 10 vehicles, two picnic shelters with tables, and pit toilets. Bluepoint Spring has a small parking area and two picnic tables. Paths have formed around both springs from visitor use.

Impacts on the spring communities surrounding Rogers and Bluepoint springs would result from increased use by visitors. If visitation to these springs increased 38 percent, as projected for the recreation area over the life of the plan under existing conditions, the foot paths around the springs would be expected to increase by at least that much. Emergent vegetation and other moist terrestrial vegetation would be destroyed, and the spring water could be polluted by improperly disposed trash and human waste. The degree of these impacts cannot be determined, but impacts on the moist terrestrial vegetation habitat could result in damage or destruction to a fourth or more of rare habitat around these two springs.

Under this alternative, five springs could potentially be affected by uranium mining if the current prospecting applications were approved and mining occurred. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little

activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area land, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area, 5,840 acres are in the Gold Butte area, and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Most of the springs in the area originate in the lower portion of the Supai formation and could be connected with nearby breccia pipes which extend upward from the Redwall limestone, through the Supai formation, into the Toroweap formation. The potential for adverse impacts on these springs from mine development would be greatest where the springs are perennial in nature. It is believed that breccia pipes are capable of transmitting groundwater from the upper perched aquifers (such as the Supai springs) to the undefined aquifers in the Redwall formation. Although there may be natural movement of water through the pipes, mine development could increase this exchange between formations, leading to two potential impacts on local groundwater resources. First, the partial dewatering of a given pipe from mine development could result in reduction or complete loss of flow from seeps and springs that support sensitive ecosystems. Second, contamination of groundwater sources in the Redwall limestone could result from post-operational mine water, leachate from ore stockpiles, accidental spills, and discharges from fuel tanks. The mining of the high-grade ore in the breccia pipes would mobilize the ionic and metallic elements in the low-grade deposits that would not be removed during mining, thereby creating a potential for groundwater contamination when natural aquifer conditions were reestablished upon mine closure. Although arid to semiarid conditions exist throughout the Shivwits Plateau, the potential for leachate production from the ore stockpiles still exists. Impacts on Cedar Spring could be especially serious because it is less than ¼ mile from the known Lone Mountain breccia pipe, an important link in the groundwater transmission system. The proximity of the other four springs to breccia pipes is not known. Although the 1966 excepted areas exclude all lands within ¼ mile of any spring or seep from mineral leasing, these resources might still be affected by mining activities because of potential hydraulic connections between the springs and seeps and breccia pipes.

Conclusion: The no-action alternative would not directly affect Rogers and Bluepoint springs, but impacts from increasing visitor use could result in trampled vegetation or polluted waters. These impacts could easily damage or destroy a fourth or more of the moist vegetation habitat around these springs. The no-action alternative could have adverse impacts on at least five of the 33 springs that support sensitive desert ecological communities, should uranium mining occur. A complete hydrologic assessment would have to be conducted before a new proposal was approved.

IMPACT ON SOILS

Soils of the recreation area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Under the no-action alternative, soil damage resulting from off-road vehicle use would continue. The passive offroad vehicle control elements of the proposed action would be implemented, but lakeside roadways would not be constructed at the ends of approved roads. No new additional access point roads would be added along the reservoirs. Also, there would be no new major developments on the lake to relieve pressure on currently overcrowded areas. The area heavily damaged by offroad vehicles in the Boulder Basin zone would be used for rehabilitation research, but no program would be developed for application of successful methods elsewhere in the recreation area. The roadways and facilities of the proposed action and alternatives A and B would not be built.

Because the no-action alternative would not provide additional outlets for off-road vehicle use and additional access to the lake, off-road vehicle drivers would be expected to continue damaging soils along the reservoirs in attempts to reach less crowded areas. Off-road vehicle driving would damage slightly less than the 30 to 40 acres per year that are currently damaged. Damaged soils in the recreation area would double to about 700 acres in a decade, and these soils would remain damaged unless restoration activities were implemented and law enforcement activities accelerated.

The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity is expected. If the no-action alternative was selected, approximately 32,600 acres, or less than 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Impacts on soils from mineral leasing under the no-action alternative would be expected to be greatest in the Shivwits Plateau area, where nearly 17,000 acres of land could come under lease for uranium exploration if pending prospecting permit applications were approved. Development of the two to three breccia pipes in the Shivwits area could result in damage to 100 to 150 acres of soils through excavation, erosion,

and compaction, with additional damage expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by erosion and accelerated weathering, while soil compaction and abnormally high soil temperatures could also occur. In addition, removal of vegetation and stockpiling of topsoil have been demonstrated to significantly reduce soil microorganisms, which are essential for nutrient cycling and soil development. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil damage. Site-specific soils data would be necessary for detailed impact assessment and reclamation planning before mining approval.

Mineral leasing would not be expected to significantly affect soil in remaining areas of the park. Some damage could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under this alternative, off-road vehicle driving would damage from 750 to 1,000 acres of soils over the life of the plan. There would be no new destruction or damage to soils from construction and no increases in soil erosion from runoff from impervious surfaces. Further, no fill material would have to be imported into the recreation area, and existing soil surfaces would not be covered. Mineral leasing activities could result in damage to soils on approximately 150 acres on the Shivwits Plateau. Effects in other areas would not be expected to be significant.

IMPACT ON SIGNIFICANT NATURAL FEATURES

Significant natural features include unique geological areas, outstanding scenic vistas, outstanding coves, and areas zoned as environmental protection areas or outstanding natural and physical features. Only scenic vistas would be impacted by the activity occurring under this alternative. Outstanding scenic vistas are important because they contribute to the overall visual quality of the NRA. Preservation of the high visual quality found in the NRA has been identified as integral to preserving a high-quality recreational experience. In the Shivwits area, Whitmore and Kelly points provide the only overlooks of the lower Grand Canyon region. From Whitmore Point the views include several intervening levels, each a platform or terrace of irregular width that rise one above the other in precipitous steps hundreds of feet in height. The facades of the cliffs separating the terrace levels are majestic walls or murals that form dramatic visual features.

The only potential source of impacts on scenic vistas would be from operations on federal mineral leases. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources

within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. Since leasing is primarily speculative within the NRA, it is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Uranium development in the Shivwits Plateau area would be the most likely mineral activity to take place within the near future. In the Parashant and Whitmore Canyon areas, uranium development would lead to significant degradation of the scenic vistas from Whitmore Point because most of the activity would take place in the immediate foreground of the views from the point.

Sporadic oil, gas, and mineral exploration in other parts of the NRA would not likely cause significant impact to the scenic vistas because of stringent lease application review procedures designed to protect visual quality.

Conclusion: Uranium development on the Shivwits Plateau could significantly degrade scenic vistas from Whitmore Point.

IMPACT ON THREATENED, ENDANGERED, OR CANDIDATE SPECIES

The endangered bonytail chub, *Gila elegans*, and the threatened bald eagle, *Haliaeetus leucocephalus*, and peregrine falcon, *Falco peregrinus* are the only federally listed animal species that are known to occur within Lake Mead NRA. There are no threatened or endangered plant species or critical habitats in the recreation area.

There are several federal candidate plants and wildlife that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as comparable species of concern. Table 19 identifies the status and legal classification of all threatened, endangered, or candidate species.

The major source of impacts at this time on threatened or endangered species would be from operations on federal mineral leases. The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the

Shivwits Plateau area; 5,840 acres are in the Gold Butte area; the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Sensitive plant or animal species could occur in any of the 78 percent of the NRA remaining open to mineral leasing consideration under this alternative. Specific locations of each species would be determined during the review process for lease applications. Mineral development proposals under the no-action alternative would most likely involve the Shivwits Plateau portion of the NRA. Prospecting permit applications currently on file for uranium total nearly 18,000 acres. In addition, seismic exploration for oil and gas resources could occur throughout the NRA, but it would be most likely in three locations where existing leases are concentrated: the Grand Wash Cliffs, an area south of Temple Bar, and the west side of the Overton Arm south to Pinto Valley.

The impacts of mineral leasing on threatened or endangered species would include direct elimination of individuals or populations through mechanical means, destruction of habitat (or potential habitat), and indirect impacts on reproduction and foraging caused by noise and human presence. Also, harassment or illegal shooting of animals might result from the increased accessibility associated with new road construction or improvement of existing roads.

If threatened or endangered species were known to occur, or were suspected to occur, on lands encompassed by a lease or permit application, appropriate stipulations would be applied to protect these species. If the area was of critical concern to the species, the application might be denied. For officially listed species, a biological opinion would be obtained from the U.S. Fish and Wildlife Service. A "will effect" or "may effect" determination might result in denial of a lease application. If the lease was approved, adequate stipulations would be required to protect the species.

Because the Shivwits Plateau area has only one plant species that is a candidate for federal protection and no known threatened or endangered wildlife, impacts on threatened or endangered species in that area would not be significant. Several candidate threatened or endangered plants are found on the west side of the Overton Arm, and known gila monster habitat occurs in the vicinity of Rogers and Bluepoint springs; however, impacts on these species from oil and gas seismic exploration would not be significant.

Conclusion: This alternative would have the greatest potential for impact on threatened and endangered or candidate plant and wildlife species because 78 percent of the NRA would be open to consideration of mineral leasing. However, these effects would be evaluated in case-by-case environmental assessments of each lease application, and specific mitigating measures would be recommended. Existing leases and pending permits do not occur in areas that pose a significant threat to threatened or endangered species.

IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mohave and Sonoran deserts. Vegetation typical of higher elevations, such as in the Shivwits portion of the NRA, includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common coexisting throughout the Basin and Range Province.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites may be as much as 50 to 75 years.

Impacts to vegetation could occur from mineral leasing under the no-action alternative. This alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Impacts would be expected to be greatest in the Shivwits Plateau area where nearly 18,000 acres of land could come under lease for uranium exploration if pending prospecting permit applications were approved. In addition, sporadic exploration activities associated with oil and gas leases might occur throughout the NRA. Current interest is in three areas; the Grand Wash Cliffs, south of Temple Bar, and the west side of the Overton Arm south to Pinto Valley.

The primary impact to vegetation resulting from activities proposed on leases or prospecting permits would be direct removal of plants. Blading of areas for location of access roads, drill pads, or mine facilities would result in local destruction of vegetation on approximately 50-100 acres for each surface mine, and less than 5 acres for each oil and gas seismic exploration line. Other impacts would occur due to covering of vegetation with spoil materials, diversion of drainage channels, or potential unauthorized offroad use.

Whenever native vegetation was removed from a site through physical means, the disturbed site would sparsely revegetate with a variety of invader species, including several non-native plants such as puncture

vine (Tribulus terrestis) and Russian thistle (Salsola sp.) Propagation of these exotic invaders on large disturbed sites in remote areas would provide a large seed source for introduction of undesirable species into the surrounding native communities. The invading species would also be better adapted to disturbed sites and would out-compete native plants unless an active reclamation program utilizing native species was employed on each disturbed area.

Reclamation of disturbed areas with native species in arid environments would be extremely difficult, particularly in lower elevations. It is unlikely that disturbed areas could be restored to natural conditions in less than 50 to 75 years. Therefore, the loss of vegetation and its indirect effects on wildlife habitat, soil stability, surface erosion, and visual effects would be prolonged for the period of reclamation establishment.

Conclusion: Because the history of mineral leasing in Lake Mead has been primarily speculative and has resulted in almost no surface disturbance in 20 years, the likelihood of future mineral activity is remote. If oil and gas seismic exploration were to proceed, the amount of vegetation lost throughout the NRA would not be significant. If a uranium mine were developed in the Shivwits Plateau area, the effect may be locally significant because of the destruction of vegetation in a largely pristine area.

IMPACT ON BIGHORN SHEEP

Bighorn sheep inhabit many areas within the recreation area and their habitat requirements are quite crucial. Some herds, for example in the River Mountains, are among the most productive in the region. Bighorn are significant because of their value as game species, for visitor viewing enjoyment, and as a source of animals used to restock depleted bighorn ranges outside the recreation area.

The no-action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area; 5,840 acres are in the Gold Butte area; and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the new leased land would be significantly disturbed by mineral development.

Any oil, gas, and mineral exploration activity in Pinto Valley could cause some impact on identified bighorn sheep habitat. Seismic exploration

could cause increased stress on the herd due to increased human presence and noise from blasting and vehicle travel. Continued stresses on bighorn elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations should reduce this threat.

To mitigate impacts on bighorn sheep if mineral leases have active operations taking place on them, a quarterly population and distribution survey would be conducted on those leases and adjacent lands inhabited by the bighorn. A program to collect and record the data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada, Las Vegas. This program will gather baseline population data and annual herd movements for all bighorn populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late December to early April). If significant detrimental impacts to a bighorn population from exploration or mining operations were found, a temporary shutdown of operation would be made until corrective actions could be made to prevent further detriment to the herd.

Conclusion: The no-action alternative has the greatest potential to affect bighorn sheep populations of any of the alternatives because 78 percent of the NRA will remain open to mineral leasing. If, however, exploration activities remained sporadic, as in the past, impacts to the bighorn sheep should not be significant enough to affect overall population health.

IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends during this period are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas confusing circulation systems frustrate first-time visitors from easily finding their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas fill.

The no-action alternative does not propose any solutions to crowding/congestion problems. (For a full discussion of the no-action alternative proposals, refer to the "Alternative Development Concept Actions" section.) Over the life of the plan visitation is expected to increase by about 68 percent. Because this alternative does not propose

any actions to solve crowding/congestion problems, the problems also expected to increase by 68 percent. Crowding/congestion would most likely be significantly worse than that figure because of the way circulation, parking, and overnight accommodation problems compound themselves. The visitors' aggravation and frustration would increase greatly as it took longer to launch boats and became more difficult or impossible to find legally authorized parking spaces and overnight accommodations. Visitation would probably not increase as much as projected because visitors would have such bad experiences that they wouldn't come back as often and would tell friends to stay away.

Conclusion: Because none of the visitor use problems would be solved, crowding/congestion would increase significantly above existing levels. Crowding/congestion would diminish visitor experiences so much that visitation would probably not increase as much as projected.

IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead NRA has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are at Katherine, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within Lake Mead. Under no action, existing conditions would continue. Extensions of leases up to five years would continue to be granted until the need for public use of the cabin site areas dictated termination. The determination of public need would be made two years in advance of the common expiration date.

Conclusion: Since the no-action alternative would mean a continuation of existing conditions, it would have no effect on the cabin site residents.

IMPACT ON TRAILER VILLAGE RESIDENTS

Under the no-action alternative there would be no changes from existing conditions. The following list presents the existing number of long-term, short-term, and RV sites at developed areas.

Area	Existing Number of Sites Number of Sites (Long/Short/RV)
Katherine Landing	104/34/0
Cottonwood Cove	223/75/0
Fire Mountain	0/0/0
Willow Beach	60/18/0
Boulder Beach	215/75/0
Las Vegas Wash	0/0/0
Callville Bay	94/6/0
Boxcar Cove	0/0/0

Echo Bay	69/58/0
Overton Beach	19/13/0
Temple Bar	103/13/0
Totals	883/297/0

Conclusion: The no-action alternative would not affect trailer village residents.

IMPACT ON LEVEL OF CONCESSION SERVICES

Table 30 summarizes the existing level of services provided by the concessioner.

Conclusion: The level of concession services would not change under this alternative.

IMPACT ON MINERAL LEASING OPPORTUNITY

The no action alternative would allow the continued consideration of mineral leasing in all management zones of the recreation area, outside those lands excepted by current regulation. Thus, 78 percent of the recreation area, or 1,162,550 acres, would be open to leasing consideration. Mineral development activity would be expected to continue according to past historical trends and would not be expected to change. Due to few known mineral resources within the recreation area, little activity would be expected. If the no-action alternative was selected, approximately 32,600 acres, or 2 percent of the recreation area, could potentially come under lease within the first year if pending prospecting permits and leases were approved. Over half the acreage under application is in the Shivwits Plateau area, 5,840 acres are in the Gold Butte area, and the remaining 10,000 acres are scattered around the recreation area in smaller parcels. It is difficult to estimate how much of the leased land would be significantly disturbed by mineral development.

Excepted areas identified in 43 CFR are areas of the NRA where mineral leasing would not be considered. In these areas, lease or permit applications received are automatically denied. Approximately 1,162,550 acres (or 78 percent) of Lake Mead NRA are outside these excepted areas and are thus open to consideration of lease and prospecting permit applications. Stringent lease review procedures in these areas require evaluation of each lease application by the NRA for its potential impact on other resource values. In some instances, leases or permits might be denied in areas outside the established excepted areas. In other cases, leases or permits might be approved with protective stipulations to reduce or mitigate potential impacts. Stipulations might include no surface occupancy for all or part of the lease or permit acreage, or operations might be restricted to a particular season to protect wildlife migrations, reproduction areas, or wintering grounds.

Under the no-action alternative, the acreage open to leasing consideration would remain the same, and lease review procedures would be unchanged.

Conclusion: There would be no impact on mineral leasing opportunity under this alternative.

Table 30: Impact on Level of Concession Services, No-Action Alternative

	Trailer Village Long-Term/ Short-term Sites	Motel Units	Restaurant Seats	Store Square Feet	Marina Slips/Moorings	Rental Boats # Houseboats/ # Other	Dry Boat Storage Spaces	Gas Station # Pumps	Gas Dock # Boat Capacity
Katherine Zone									
Katherine Landing	104/33	52	117	3,600	764/0	75/41	210	2	14
Lower Mohave East	--	--	--	--	--	--	--	--	--
Cottonwood Zone									
Cottonwood Cove	223/75	24	35	1,200	237/0	10/31	350	2	4
Fire Mountain	--	--	--	--	--	--	--	--	--
Willow Beach Zone									
Willow Beach	60/18	24	100	1,000	182/16	0/40	120	1	
Boulder Basin Zone									
Boulder Beach	215/75	44	314	5,500	400/0	0/39	100	0	
Las Vegas Wash	0/0	0	36	3,300	595/3	0/35	100	0	3
Callville Bay	94/6	0	36	500	300/0	15/33	111	0	
Boxcar Cove	--	--	--	--	--	--	--	--	--
Echo Bay Zone									
Echo Bay	69/58	52	120	9,000	314/0	70/18	97	4	
Overton Beach Zone									
Overton Beach	19/13	0	0	0	0/50	0/6	40	0	3
Virgin/Temple Zone									
Temple Bar	103/13	22	76	1,500	64/0	0/15	200	2	
Totals--No-Action Alternative	883/297	218	834	25,600	2,856/69	170/258	1,328	11	24

IMPACT ON WILDERNESS LANDS

Under the no-action alternative, the recreation area would be managed according to the Management Zoning map for this alternative (based on the existing Land Management and Use map from the revised 1981 "Statement for Management") and the 1966 Excepted Areas map and regulations that define areas where mineral leasing would be considered on a case-by-case basis and where it is closed to (excepted from) leasing. There is virtually no relationship between these two schemes--the Excepted Areas map was never updated to reflect the more recent Land Management and Use map; the excepted areas are based on precise definitions and reflect general management intent. Accordingly, mineral leasing can be considered on a case-by-case basis in portions of most of the zones and subzones. The only areas of the NRA where leasing is categorically excluded (excepted) are those areas shown on the 1966 Excepted Areas map (NRA-LM 2291-A). These areas are

> all lands within 200 feet of the centerline of any public road, or within 200 feet of any public utility including, but not limited to, electric transmission lines, pipelines, and railroads
>
> all lands within the smallest legal subdivision of the public land surveys containing a spring or water hole, or within ¼ mile thereof on surveyed public land
>
> all land within 300 feet of Lake Mead, Lake Mohave, or the Colorado River, measured horizontally from the shoreline at maximum water surface elevation, and all lands within the area of supervision of the Bureau of Reclamation around Hoover and Davis dams
>
> all lands within any developed and/or concentrated public use area or other area of outstanding recreational significance as designated by the superintendent

Lease applications are considered within all other lands of the NRA, subject to a determination of effect upon surrounding park resources. Applications are reviewed through the NEPA process, which identifies significant resources. Those resources are then either excluded from the lease or stipulations are applied to mitigate the impact to them. Currently 1,162,550 acres of the NRA are open to consideration for mineral leasing.

Some adverse effect could occur to the visitor experience if existing leases were developed and pending permit applications in areas open to mineral leasing under this alternative were issued. However since it is unlikely that existing leases would result in any major new mining or oil and gas operation, the impact to the visitor experience from sporadic exploration activity on these leases is expected to be minimal.

Although none of the NRA lands have been officially designated as wilderness, the Wilderness Suitability map in the "Affected Environment" section indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. The following units are keyed by number to that map and include most of the lands in the recreation area that possess

primitive characteristics. Boundary lines of the units follow topographic features, access roads, the recreation area boundary line, section lines, and a line marking a 300-foot horizontal setback from the high waterlines of Lakes Mohave and Mead.

Units 1 and 2 center on the Newberry Mountains, which rise to an elevation of 5,600 feet and offer a cool refuge from the heat of the surrounding desert lowlands. Davis Dam, the Mohave power plant, Katherine Landing, and Bullhead City are developments visible from the southern and eastern portions of this unit. Of the 40,605 acres contained in these units, 22,940 acres in unit 2 are open to consideration for mineral leasing.

Unit 3, Nellis Wash, 15,870 acres, includes portions of the isolated Newberry Mountains along the western side of the recreation area. Fingerlike drainages and alluvial fans extend eastward from the mountains toward Lake Mohave. Some mining has occurred previously within the unit. All lands within this unit are open to consideration for mineral leasing.

Unit 4, Cottonwood Valley, potentially meets the criteria of the Wilderness Act because of outstanding mineral reservations. However, this gently sloping outwash provides solitude and isolation in a primitive setting north of a major development at Katherine Landing. All of the 15,295 acres within this unit are open to consideration for mineral leasing.

Unit 5, the Black Mountains, capped by 2,000-foot Mount Davis, provides a scenic background to Lake Mohave. Scattered washes and side canyons transect the Black Mountains from east to west as they wend their way to the Colorado River. Of the 18,610 acres contained in this unit, 16,205 acres are open to consideration for mineral leasing.

Unit 6, Opal Mountain, contains a portion of the Eldorado Mountains, gently rolling hills, and outwashes extending to Lake Mohave. Rugged mountains, secluded valleys, and flat alluvial fans provide opportunities for seclusion in a setting of scenic splendor. Of the 17,635 acres contained in this unit, 16,180 acres are open to consideration for mineral leasing.

Units 7, 8, 10, 11, and 12, Fire Mountain and Black Canyon, contain some of the most spectacular and rugged terrain within the recreation area. They consist of steep barren rocky crags, which begin at an elevation of 645 feet and terminate at an elevation of approximately 2,200 feet. These units combine to form the "Black Canyon" of Lake Mohave, which is noted for its hot springs and cool Colorado River. This area is a popular spot for visitors to see sharp and abrupt canyon walls and a myriad of geology. Unit 11 only potentially meets the criteria of the act because the Bureau of Reclamation has identified this area as a potential location for reclamation facilities ranging from Hoover Dam modifications to new transmission line corridors. Of the 70,470 acres within these units, 54,245 are open to consideration for mineral leasing.

Unit 9, Eldorado Mountains, contains approximately 29,665 acres of this picturesque and rugged mountain range. The unit is a maze of peaks

and side canyons with vertical cliffs extending to the edge of the Colorado River. All lands in this unit are open to consideration for mineral leasing.

Unit 13, Kingman Wash, contains approximately 40,835 acres. The undulating Black Mountains typify the topography of the region. Access to the unit is provided on all sides by existing road corridors. All lands are open to consideration for mineral leasing.

Unit 14, Bonelli Landing, comprises 13,875 acres of mainly alluvial fans and separates the hilly mountainous area of unit 13 from the gypsum beds of unit 21. This unit contains historic mining diggings and some archeological remains in the form of petroglyphs. Access to this unit is primarily by the roads to Bonelli Landing and Temple Bar. All lands are open to consideration for mineral leasing.

Units 15, 16, and 17, Pinto Valley, comprise approximately 38,340 acres of rugged hills and highly scenic valleys. These units contain Guardian Peak, which is one of the highest peaks in the area, and is used as a navigational aid. The northern side of Boulder Canyon is formed by these units, where steep cliffs or barren rock extend into the cool blue waters of Lake Mead in a dramatic fashion. Pinto Valley is a much-photographed topography, with the red sandstone outcroppings that merge with the green desert vegetation and the grays, browns, and yellows of the desert floor. A total of 22,730 acres in these units are open to consideration for mineral leasing.

Unit 18, Cathedral Wash, contains 18,820 acres. Mountainous terrain representing the northeast extremities of the Black Mountains dominates the area and contrasts with the flat surface of Lake Mead. All lands are open to consideration for mineral leasing.

Unit 19, Overton, 24,040 acres, consists of flat to "badland-like" lands lsoping westward from mountainous terrain to a road corridor east of the recreation area boundary. The unit forms the scenic background for lake users and for shoreline users on the west side of Overton Arm. These flat outwashes lack the spectacular contrasts found in other units and portray a typical desert landscape. This unit has retained its primitive characteristics and affords an opportunity for seclusion and an unconfined type of recreation. All lands are open to consideration for mineral leasing.

Unit 21--White Hills, unit 22--Temple Bar, and unit 23--Gregg's Hideout, all in the White Hills, offer isolation, scenic views, and historic attractions. This rolling hill country includes some evidence of earlier mining activities and trails. These activities did not scar the area excessively, and many scars have healed to the point of not being noticeable. Access to the area is possible by car on existing roads, by hiking from developed areas such as Temple Bar, or by boat from Lake Mead. These three units contain a total of approximately 52,130 acres, all of which are open to consideration for mineral leasing.

Units 20 and 24 to 32 are known as Twin Springs, Scanlon Wash, Hiller Mountains, Hell's Kitchen, Indian Hills, Cockscomb, Grand Wash Cliffs,

Iceberg Ridge, South Cove, and Pearce Ferry. The units contain rugged mountain ranges that provide a scenic background for the Virgin Basin, Virgin Canyon, Gregg Basin, Iceberg Canyon, and Pearce Ferry sections of Lake Mead NRA. Gently sloping outwash fans extend from the mountains to plunge abruptly into the reservoir. Of the 135,688 acres within these units, 116,450 acres are open to consideration for mineral leasing.

Unit 33, Shivwits Plateau, contains approximately 83,980 acres. Diverse activities occur in this remote section of the recreation area, ranging from hunting to grazing. Due to a higher altitude, the region is cooler, has more precipitation, and supports pinyon/juniper and ponderosa pine forests and a wider variety of wildlife than can be found in the rest of the recreation area. Kelly Point, Twin Point, and other points along the rim permit spectacular views of the Grand Canyon. Because most of the land within this unit is subject to mineral reservations, the unit only potentially meets the criteria of the Wilderness Act. Much of this unit is splintered by access roads. When considered with the adjacent proposed wilderness in Grand Canyon National Park, it is apparent that these splintered segments would form a significant contiguous wilderness unit. All lands in this unit are open to consideration for mineral leasing.

Should this alternative be selected, the remote undeveloped nature of the Shivwits Plateau could be dramatically altered by potential uranium mining. Because of its unique juxtaposition with Grand Canyon National Park, this area of the NRA provides a scenic, remote and primitive landscape which blends well with the lower portion of the Grand Canyon. Activities such as river float trips, scenic overflights and backcountry use actually focus on the Grand Canyon "nature" of this country, crossing between the national park and national recreation area lands without recognition of the "difference." Inherent to the visitor experience on the Shivwits Plateau is its remoteness and undeveloped nature where unconfined recreational activities can take place.

Mine facilities and operations would create a man-made disturbance out-of-character with the remote, primitive, existing nature of the area. The presence of mining equipment, improved roads, structures, spoil and ore stockpiles would be a sharp, and in some cases irreversible, contrast to the present landscape. Should mining actually take place, significant impact to the visitor experience is expected to occur not only to visitors of the NRA, but also to many of the visitors of the lower Grand Canyon country within Grand Canyon National Park.

Unit 34--Andrus Point, unit 35--Whitmore Point, and unit 36--Lava consist of approximately 58,430 acres in the northeast sector of the recreation area. Contained within these units are Parashant, Andrus, and Whitmore canyons; all are precipitous side canyons of significant grandeur that drain into the Grand Canyon. The entire area is undeveloped land retaining its primeval character, and it provides an opportunity for solitude or a primitive and unconfined type of recreation in a scenic setting of steep escarpments, colorful red walls, and deep canyons. Geologic formations and processes in evidence here may provide information on the origin of the Grand Canyon. Archeological sites of several Indian cultures, including the Virgin Anasazi and more recently

the Paiutes, are also found here. Adjacent primitive areas of Grand Canyon National Park provide for a contiguous unit of primitive lands extending westward from the Pine Mountains across the Sanup and Shivwits plateaus to the Grand Wash Cliffs. All of the lands within these three units are open to consideration for mineral leasing.

See table 31 for summary of wilderness acres affected.

Conclusion: The 1,245,275 acres of the NRA that are open to consideration for mineral leasing could affect 495,390 acres, or 89 percent, of those lands that meet the criteria of the Wilderness Act and 106,380 acres, or 91 percent, of those lands which potentially meet the criteria. Mining activities as a result of mineral leasing in these areas could unnaturally scar the landscape and alter the wilderness character of these lands, making wilderness values on at least part of these lands lost to any future possible designation.

Table 31: Summary of the Effects of the No-Action Alternative on Lake Mead NRA Lands Meeting or Potentially Meeting Act Criteria

	Acres Meeting the Criteria		Acres Affected by this Alternative	
	Wilderness	Potential Wilderness	Wilderness	Potential Wilderness
1	7,650	0	0	0
2	32,955	0	22,940	0
3	15,870	0	15,870	0
4	0	15,295	0	15,295
5	17,970	640	15,565	640
6	17,635	0	16,180	0
7	15,145	0	15,145	0
8	25,605	0	25,605	0
9	29,665	0	29,665	0
10	2,045	0	1,000	0
11	0	14,645	0	5,325
12	13,030	0	7,170	0
13	40,835		40,835	0
14	13,875		13,875	0
15	17,115		12,085	0
16	6,680		2,865	0
17	14,545		7,780	0
18	18,820		18,820	0
19	24,040		24,040	0
20	10,610		10,610	0
21	25,580		25,580	0
22	16,665		16,665	0
23	9,885	80	9,885	80
24	22,095		22,095	0
25	8,545		8,545	0
26	14,620		14,620	0
27	7,720		0	0
28	14,020		12,900	0
29	13,895		6,965	0
30	15,143	460	11,675	460
31	16,480		16,480	0
32	12,100		12,100	0
33	0	83,980	0	83,980
34	14,905	0	14,905	0
35	32,215	0	32,215	0
36	10,710	600	10,710	600
Totals	558,675	115,700	495,390	106,380
Percentage	100	100	89	91

ENVIRONMENTAL IMPACTS OF ALTERNATIVE A

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of occurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor use facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, because flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures will be shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section of this document for a more detailed explanation. The development concept plan graphics for each developed area show the extents of the 100-year and probable maximum floods.

Alternative A would mitigate the flood hazard up to the level of the probable maximum flood by building major structures like dams or channels and by relocating some developments. Removal of structures from the floodplain provides the best protection from floods. Structural measures offer the next best method. Warning systems provide less protection than either of the preceding methods.

The following is a summary of the flood mitigation proposals for each zone of the recreation area. All areas with flood hazard would have warning systems installed even if they were structurally protected.

Katherine Landing. The development would be protected to the level of the probable maximum flood through structural measures such as diversion canals and diversion dikes.

Cottonwood Cove. NPS housing and maintenance areas would be relocated out of the probable maximum floodplain. Other development in the area would be protected to the level of the probable maximum flood through structural measures such as dikes and channels.

Willow Beach. The launch ramp, restaurant, store, campground (at ¼ to ½ its original capacity), ranger station, NPS housing, NPS maintenance facilities, trailer village, concession housing, and concession maintenance facilities would be relocated out of the

probable maximum floodplain. The motel and a portion of the parking area would be protected from the probable maximum flood with a 6-foot-high wall. A riprap dike would protect the sewage lagoons from the 100-year flood.

Boulder Beach. The earth dikes in the Boulder Beach area would be regraded and reinforced with gabions to protect the area to the probable maximum flood level.

Las Vegas Wash. The launch ramp, concession dry boat storage, and concession maintenance area would be relocated out of the probable maximum floodplain. No structural measures or warning system would be used at Las Vegas Wash.

Overton Beach. The campground would be relocated out of the floodplain.

Temple Bar. Diversion dikes and channels would be added to accommodate the probable maximum flood.

A complete discussion of actions that would be taken to protect each development zone from the hazardous effects of a probable maximum flood is found in the "Alternative Development Concept Actions" section under alternative A.

An estimated 135 people would be in the probable maximum floodplain during the day and none would be there at night. This represents approximately 0.1 percent of the people expected to be in the recreation area on a summer weekend day (96,000) and is 97 percent fewer people during the day and 100 percent fewer people at night than would be expected under existing conditions.

Compared with existing conditions, approximately 1,045 additional people would be protected from the probable maximum flood at Katherine Landing by structural measures. The dry boat storage would receive no protection from the probable maximum flood, but fewer than five people would be expected there at any one time.

Relocation of NPS housing and NPS maintenance facilities out of the floodplain at Cottonwood Cove would protect approximately 15 daytime occupants. The additional 1,720 projected summer weekend daytime occupants of the probable maximum floodplain at this location would be protected from the probable maximum flood by structural measures.

At Willow Beach, relocation of the launch ramp, restaurant, store, campground (at ¼ to ½ its original capacity), ranger station, NPS housing, NPS maintenance facilities, trailer village, concession housing, and concession maintenance facilities out of the probable maximum floodplain would mean that approximately 376 fewer people would be expected to be in the probable maximum floodplain on an average summer weekend day than under existing conditions. Protection of the motel and a portion of the parking area from the probable maximum flood with a 6-foot-high wall would provide additional safety to 70 expected occupants

of the probable maximum floodplain. Approximately 50 people would be expected to be in the probable maximum floodplain after the above measures were in place because the only protection for the access roads, dry boat storage, and canoe/raft takeout would be the existing warning system.

The expansion of the campground and trailer village at Boulder Beach would mean that an additional 112 people would be at risk in the probable maximum floodplain as compared with existing conditions. The expected 1,371 people (which includes the additional 112 people) in the probable maximum floodplain would be protected by structural measures and a warning system.

The campground at Overton Beach would be relocated, leaving only the swim beach in the floodplain. This situation would leave about 40 people in the floodplain during the day; the hazard would be mitigated by a warning system.

All probable maximum floodplain occupants would be protected by dikes and channels at Temple Bar.

Conclusion: This alternative would provide the greatest level of protection of any alternative. After all flood mitigation actions were taken, about 135 people in the daytime would remain in the probable maximum floodplain where the hazard would be mitigated only by warning systems. That is a 97 percent reduction compared to existing conditions. At night no people would be in the areas only protected by warning systems. All other people in the probable maximum floodplain (day or night) would be protected by structures like dikes and channels. About 135 people during the day and none at night would remain in the 100-year floodplain protected only by a warning system. That represents an 89 percent and 100 percent reduction respectively compared to existing conditions.

IMPACT ON PROPERTY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. Flooding is the most severe at Willow Beach, followed by Cottonwood Cove, Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach, all development is on a broad alluvial fan, with protection provided by earth dikes. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. A more thorough discussion of floodplains may be found in the "Affected Environment" section which starts on the first page of this volume. The development concept plan graphics for each developed area shows the extent of the 100-year and probable maximum floods.

Table 21 shows development in the floodplain under each alternative including no action. Alternative A would mitigate the flood hazard up to the level of the probable maximum flood by building major structures like

dikes or channels and relocating some developments. However, the property shown in the flood-hazard zone under alternative A would remain susceptible to flood damage or destruction in the event of a flood. The cost of replacing structures left unprotected in the 100-year floodplain would be approximately $1 million; and for replacing those in the probable maximum floodplain, approximately $1.1 million. These costs would not cover utilities, furnishings, equipment, vehicles, flood-control devices, debris removal, search and rescue, or expenses of victims. The cost to replace facilities damaged by the 100-year flood would be approximately 15 percent of the cost of replacing structures in the 100-year floodplain under existing conditions. The cost to replace structures damaged by the probable maximum flood would be about 5 percent of the cost of replacing structures in the same floodplain under existing conditions.

Conclusion: This is the most effective alternative in terms of protecting structures from flood damage.

IMPACT ON RESERVOIR WATER QUALITY

These impacts would be the same as for the proposed action.

IMPACT ON DESERT SPRING ECOLOGICAL COMMUNITIES

These impacts would be the same as for the proposed action.

IMPACT ON SOILS

Soils of the area are extremely variable. Climate, vegetation, parent material, elevation, slope, and aspect affect the development of these soils, which are characterized by a wide range of physical and chemical properties. Texture, permeability, depth, stoniness, organic content, alkalinity, and other properties are highly diverse and change quickly within short distances.

Alternative A would maintain existing areas for visitor use. No new major access points or developments would be constructed along the reservoir shores. The passive off-road vehicle recommendations of the proposed action would be implemented, some lakeside roadways would be eliminated, and accesses to the lakeshore would be reduced. The reduction in lake accesses would encourage offroad drivers to trailbreak their own roads, and the rate of soil damage would increase from its present level of 30 to 40 acres per year. Research on the rehabilitation of off-road vehicle soil damage and implementation of a rehabilitation program would be done as in the proposed action, but this would probably be a losing battle because soils can be damaged at a much faster rate than they can be rehabilitated.

The construction of roadways and expansion of existing facilities under this alternative would destroy or severely damage about 178 acres of

undisturbed soils. Rehabilitation and landscaping would be done around construction sites but natural ecosystems and soil productivity would not be restored. The roadway construction and flood protection measures in this alternative would require about 280,000 cubic yards of material to be removed from cuts and about 500,000 cubic yards of material to be deposited as fill. The deficit of 220,000 cubic yards of fill would have to be imported from existing quarries or obtained from flood-control excavations in the developed areas. This is only 30,000 cubic yards less than the proposed action.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization subzone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration to achieve the objective of resource protection and reduced consumptive uses rather than 148,970 acres under the proposed action. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 9,200 acres of the NRA could be subject to mineral development on 8,238 acres of existing leases and 940 acres of pending prospecting permits (if approved), a reduction of 10,800 acres from the proposed action.

Exploration activities associated with prospecting permits and oil and gas leases could result in damage to soils through excavation, erosion, and compaction, with additional damage expected from associated excavation and removal for road construction and similar earthwork. Soil nutrients that have developed over long periods of time would be reduced in these disturbed soils by exposure to erosion and accelerated weathering and soil compaction and abnormally high soil temperatures could also occur. In addition, removal of vegetation and stockpiling of topsoil have been demonstrated to significantly reduce soil microorganisms, which are essential for nutrient cycling and soil development. The reclamation potential of the disturbed areas would be reduced unless proper care was taken to mitigate soil damage. Because of the diversity of soils in the recreation area, site-specific soils data would be necessary for detailed impact assessment and reclamation planning before mining approval.

Mining as a result of mineral leasing would not be expected to significantly affect soils in any area of the park. Some damage could be expected from sporadic exploration activities; however, the amount of acreage affected would likely be less than 300 acres over the next 10 years if the present mineral development trends continued in the area.

Conclusion: Under alternative A, the rate of damage and erosion from off-road vehicles would increase and only be partially offset by rehabilitation efforts. Developments would destroy or severely damage about 178 acres of lithosols and red desert soils and cause minor disruptions in drainage patterns, which would temporarily increase erosion

potential. Damage to recreation area soils resulting from mineral leasing would not be significant over the next decade, assuming current mineral development activity followed historical trends.

IMPACT ON SIGNIFICANT NATURAL FEATURES

These impacts would be the same as for the proposed action.

IMPACT ON THREATENED, ENDANGERED, OR CANDIDATE SPECIES

The endangered bonytail chub, Gila elegans, peregrine falcon, Falco peregrinus and the bald eagle, Haliaeetus leucocephalus, are the only federally listed animal species that are known to occur within the NRA. There are no threatened or endangered plant species, or critical habitats in Lake Mead. There are several federal candidate plants and wildlife that do, or could, inhabit or visit the recreation area. Some of these species are also listed by the states of Arizona and Nevada as comparable species of concern. Table 19 identifies the status and legal classification of all these threatened, endangered and candidate species.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization subzone. Under this alternative only 51,550 rather than 148,970 acres would remain open to mineral leasing. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Under this alternative, up to 9,200 acres of the NRA could be subject to mineral development on 8,238 acres of existing leases and 940 acres of pending prospecting permits (if approved), a reduction of 10,800 acres from the proposed action.

Under this alternative 1,148,100 acres or 77 percent of the NRA would be placed in the natural zone. Known habitat or potential habitat for candidate threatened, and endangered plant and animal species would be further protected by placement in the environmental protection or outstanding natural feature subzones. Areas open to mineral leasing would be the 51,550 acres in the resource utilization subzone and an additional 9,200 acres of existing leases and pending prospecting permits. No new developments are proposed under this alternative.

About 9,200 acres would have the highest potential for mineral development--8,238 acres of existing leases and 940 acres of pending prospecting permits (if approved). None of the leases and pending permits would be in areas where they could potentially affect any candidate threatened or endangered wildlife. Two existing leases and one pending prospecting permit would be located within 5 miles of known locations of candidate threatened or endangered plants. Additional surveys on these leases or permits could reveal additional populations. Potential threats to these plants would include physical destruction of

populations or habitat and illegal collection. When specific mineral development proposals were received in these areas, surveys would be conducted and protective stipulations applied to the plan of operation, but it would not be certain that all potential effects would be avoided.

Conclusion: Impacts on candidate, threatened, and endangered plants and wildlife resulting from this alternative could occur but are not likely to be significant.

IMPACT ON VEGETATION

Approximately 71 percent of the NRA is dominated by the creosotebush community. This community type is widespread throughout the desert southwest and is the representative low elevation vegetation type in the Mojave Desert. Vegetation typical of higher elevations includes blackbrush, sagebrush, and pinyon/juniper. These vegetation types are common throughout the intermountain region.

Precipitation rates in low elevation communities are generally less than 5 inches annually, while higher elevations receive 5 to 15 inches. Because of these low precipitation rates, revegetation rates on disturbed sites might be as much as 50 to 75 years.

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization subzone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration in order to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Up to 9,200 acres of the NRA could be subjected to mineral development on 8,238 acres of existing leases and 940 acres of pending prospecting permits (if approved).

Impacts to vegetation under this alternative would be greatest if an ore deposit was discovered and production of a mine initiated. Over a hundred acres of vegetation could potentially be destroyed through development of mine surface facilities, access roads, and mine tailings. However, given the history of Lake Mead NRA mineral leasing, this level of development is unlikely. Exploration activities on mineral and oil and gas leases would disturb only a small amount of native vegetation.

Conclusion: None of the impacts to vegetation under this alternative would be significant.

IMPACT ON BIGHORN SHEEP

Under this alternative, no bighorn sheep habitat would be available for mineral leasing; therefore, no impacts from pending prospecting permits would be expected. However, existing oil and gas leases in the Pinto Valley, totaling 4,480 acres, are located in an area of desert bighorn habitat. If current owners of these leases pursued exploration activities in this area, impacts to bighorn sheep could be expected. Seismic exploration could cause increased stress in the herd due to increased human presence and noise from blasting and vehicle travel. Continued stress in bighorn populations elsewhere has led to population die-offs because of increased susceptibility to disease organisms. Careful alignment of seismic lines, placement of remote recorders by hiking into sites, and timing of operations should reduce this threat.

To mitigate impacts to bighorn sheep populations if mineral leases have active operations taking place on them, a quarterly population and distribution survey would be conducted on those leases and the adjacent lands inhabited by the bighorn. A program to collect and record the data needed for this type of survey is being developed by the Cooperative National Park Resources Studies Unit, University of Nevada, Las Vegas. This program will gather baseline population data and annual herd movements for all sheep populations near mineral leases, so that any changes from the normal patterns can be easily identified.

All operations that would occur within known lambing areas would contain a stipulation preventing operations from taking place during the lambing period (normally late in December to early April). If significant detrimental impacts to a bighorn population were to result from exploration or mining operations, a temporary shutdown of operations would occur until corrective actions could be taken to prevent further detriment.

Conclusion: If exploration activities remained sporadic, as in the past, impacts to the bighorn sheep population should not be significant enough to affect overall population health.

IMPACT ON VISITOR CROWDING/CONGESTION

Existing conditions at the developed areas are extremely crowded and congested on weekends during the summer. Holiday weekends are the worst. Memorial Day weekend has had visitation of 254,000. Annual visitation is around 6.5 million and expected to increase to around 9 million by the year 2000. Currently it is not unusual for visitors at several of the larger developed areas to wait up to an hour to launch their boats, and twice that long on a holiday weekend. Several of the popular campgrounds and motels are full during the summer. At several developed areas confusing circulation systems frustrate first-time visitors from easily finding their way around. Illegal parking along road shoulders is a common problem that results when existing parking areas fill.

Alternative A would accommodate increasing visitor use and solve existing crowding/congestion problems by expanding and improving existing developed areas. (For a full discussion of these actions, refer to the "Alternative Development Concept Actions" section.) These actions would include many proposals intended to accommodate increasing visitation or to solve crowding/congestion. To understand the magnitude of these proposals, the increases in parking, overnight accommodations, and launch ramps are used as examples. Alternative A includes an increase of 5,990 parking spaces (19,660 spaces exist) or an increase of 30 percent. There are 1,755 overnight accommodation units (a unit is one campsite, one motel room, or one RV site). Alternative A would increase them by 1,110 units or an increase of 63 percent. There are 73 launch ramp lanes, and alternative A would add 10, an increase of 14 percent.

Over the life of this plan, visitation is expected to increase by about 68 percent and most visitor facility proposals under alternative A call for increases from 30 to 63 percent beyond existing levels. This parity between expected use and proposed facility levels indicates that crowding/congestion would not get any worse than it is now; however, it should be less than current levels. For example, circulation improvements would facilitate vehicle and pedestrian movements in several developed areas.

Conclusion: The proposed facility improvements and expansion would reduce crowding/congestion by an unknown amount compared to existing levels, while accommodating increasing numbers of visitors.

IMPACT ON VACATION CABIN SITE RESIDENTS

Lake Mead NRA has three lakefront areas in which sites may be leased for privately owned vacation cabins. These areas are near Katherine Landing, which has 39 cabin sites, Stewarts Point, which has 60 cabin sites, and Temple Bar, which has 36 cabin sites. Cabin site occupancy is for personal, not commercial, use. Department of the Interior regulations (43 CFR 21) prohibit granting new leases for cabin site occupancy within the recreation area. Under alternative A, to provide for increased use in existing developed areas, the cabin site areas near Katherine Landing and Temple Bar would be removed and replaced with visitor facilities; the cabin sites at Stewarts Point would be retained.

In the vicinity of Katherine Landing, all 39 cabins would be removed and replaced with public facilities, including a 40-table picnic area, 25-site RV trailer park, 24-unit motel, four-lane boat launching ramp, and 300 parking spaces. At Temple Bar all 36 cabins would be removed and replaced with public facilities, including a picnic area, swim beach, and 80 recreation vehicle sites. The social impact resulting from removal of these 75 cabin sites would be most felt by the residents that would no longer be able to live or vacation close to the lake. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants, who have spent as many as 30 years in their cabins. Throughout the years, many have invested their time, energy, and

creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees.

Conclusion: Under alternative A, proposals for removal of the cabin site areas and replacement with public facilities in the vicinity of Katherine Landing and Temple Bar would eliminate 75 vacation cabin sites. Vacation cabin sites at Stewarts Point would not be affected.

IMPACT ON TRAILER VILLAGE RESIDENTS

The general concept for trailer villages under alternative A would be the same as for the proposed action. The number of long-term, short-term, and RV sites available at each developed area and the proposed actions under alternative A are presented below.

Area	Existing Number of Sites (Long/Short/RV)	Alternative A Actions
Katherine Landing	104/34/0	Retain existing sites
Cottonwood Cove	223/75/0	Retain existing sites
Fire Mountain	0/0/0	Same as no action
Willow Beach	60/18/0	Relocate 50 long-term and 18 short-term sites
Boulder Beach	215/75/0	Add 75 short-term sites
Las Vegas Wash	0/0/0	Add 80 RV sites
Callville Bay	94/6/0	Retain existing sites
Boxcar Cove	0/0/0	Same as no action
Echo Bay	69/58/0	Add 42 RV sites
Overton Beach	19/13/0	Relocate/convert to 15 long-term/30 RV sites
Temple Bar	103/13/0	Remove 10 long-term and 7 short-term sites
Total	887/297	

As under the proposed action, adding RV sites at most of the developed areas would have no affect on existing trailer village residents. The effects of converting long-term sites to short-term sites would be mitigated by converting them as current residents vacated the sites. Under alternative A trailer village residents would be most affected in the following areas: Willow Beach, where 50 of the 60 long-term and all 18 short-term residents would be relocated out of the flood-hazard zone to a safer area; Overton Beach, where 15 long-term and 13 short-term residents would be relocated and four long-term sites could be removed; and Temple Bar where 10 long-term and seven short-term residents would be removed to provide for a high-water parking area.

The social impact resulting from these trailer village relocations would be felt most by the four long-term residents at Overton Beach and 10 long-term residents at Temple Bar. These people would have to relocate to other areas within the recreation area or to communities outside the area. This would be a traumatic event to many of these occupants who have spent as many as 30 years in their trailers. Throughout the years, many have invested their time, energy, and creativity in landscaping and home improvements that they hoped to enjoy for the rest of their lives. There could be some economic impact to some of the occupants because the government is not required to relocate renters and lessees. Those impacts would be mostly mitigated, because where long-term trailer residents must be reduced in number, they would be reduced through attrition before any action would be taken to force residents out of their trailer spaces.

Conclusion: Under alternative A, proposals to add RV sites or convert long-term sites to short-term sites would have little or no effect on existing trailer village residents at most developed areas. Trailer village residents affected by the proposal would be those at Willow Beach, where long-term and short-term occupants would be relocated to safer areas, and those at Overton Beach and Temple Bar. At Overton Beach four long-term sites would be removed, and at Temple Bar, 10 long-term sites would be converted to high-water parking. To mitigate the effect on these long-term residents, the Park Service would rely on normal attrition before relocation was attempted. However, some long-term residents would have to relocate to another developed area or outside the recreation area. The number of long-term sites adversely affected at these areas are 14 out of 887 for the entire NRA, or 2 percent of the total long-term sites. Only seven of the 297 short-term sites (or 2 percent) would be affected.

IMPACT ON LEVEL OF CONCESSION SERVICES

Table 32 summarizes the level of services to be provided by the concessioner under alternative A.

Conclusion: There would be an increase in the level of concession services over existing conditions in eight of the nine categories. This increase would range from 21 percent for gas docks to 146 percent for motel units. In one of the nine categories--long-term trailer village spaces--there would be a 2 percent decrease.

IMPACT ON MINERAL LEASING OPPORTUNITY

Under this alternative, 51,550 acres of the NRA would remain open to consideration for mineral leasing (the size of the resource utilization subzone would be 97,420 acres smaller than under the proposed action). Most of the lands removed from leasing consideration would be south of Temple Bar and west of the main body of Lake Mohave. None of these lands have experienced significant mineral development activity, and no significant mineral resources are known to exist.

Table 32: Impact on Level of Concession Services, Alternative A

	Trailer Village Long-Term/ Short-term Sites	Motel Units	Restaurant Seats	Store Square Feet	Marina Slips/Moorings	Rental Boats # Houseboats/ # Other	Dry Boat Storage Spaces	Gas Station # Pumps	Gas Dock # Boat Capacity
Katherine Zone									
Katherine Landing	104/39	104	234	7,200	805/0	75/41	420	2	14
Lower Mohave East	--	--	--	--	--	--	--	--	--
Cottonwood Zone									
Cottonwood Cove	223/75	48	70	2,400	535/0	25/31	465	2	8
Fire Mountain	--	--	--	--	--	--	--	--	--
Willow Beach Zone									
Willow Beach	60/18	24	100	1,000	270/16	0/40	120	1	
Boulder Basin Zone									
Boulder Beach	215/150	88	314	11,000	875/0	0/78	275	0	
Las Vegas Wash	0/80	50	54	3,300	630/3	0/70	200	0	4
Callville Bay	94/6	30	60	1,000	1,045/0	15/33	166	2	
Boxcar Cove	--	--	--	--	--	--	--	--	--
Echo Bay Zone									
Echo Bay	69/100	104	200	9,000	530/0	90/25	200	4	
Overton Beach Zone									
Overton Beach	15/30	0	100	1,000	0/140	0/12	80	2	3
Virgin/Temple Zone									
Temple Bar	93/6	88	226	3,500	980/0	45/15	300	2	
Totals: Alternative A	873/504	536	1,358	39,400	5,670/159	250/345	2,226	15	29
Existing Conditions	887/297	218	834	25,600	3,317/99	170/258	1,328	11	24
Net change	-14/+208	+318	+524	+13,800	+2,353/+60	+80/+87	+898	+4	+5
Percent change	-2/+70	+146	+63	+54	+71/+61	+47/+34	+68	+36	+21

The intent of this alternative is the same as that of the proposed action in that mineral leasing would be restricted to the resource utilization subzone. The difference between the proposed action and alternative A is in the amount of acreage contained in the resource utilization subzone. Under this alternative only 51,550 acres would remain open to mineral leasing consideration to achieve the objective of resource protection and reduced consumptive uses. This alternative would also reduce the amount of land where current prospecting permit applications have been filed from the 11,640 acres available under the proposed action to 940 acres under alternative A. Existing leases, mining claims, and private mineral rights would be unaffected. Up to 9,200 acres of the NRA could be subject to mineral development on 8,238 acres of existing leases and 940 acres of pending prospecting permits (if approved).

Mineral development could still take place on the 8,238 acres covered by existing leases within the NRA. However, of the 32,600 acres of land already applied for prospecting permits, only 940 acres would remain available for exploration. The remaining 31,640 acres would be withdrawn from further mineral leasing consideration. Most of the pending applications that would be affected by this withdrawal are for gold and silver prospecting in the Gold Butte and Malpais Flattop Mesa areas of the NRA, and for uranium on the Shivwits Plateau.

The primary impacts of this alternative on mineral leasing opportunities would be identical to the impacts described under the proposed action--the Shivwits Plateau zone would remain unavailable for further mineral leasing consideration. For a discussion of these impacts on uranium development, see the proposed action.

Removal of additional lands from the resource utilization subzone under this alternative would affect an additional five applicants who currently await action on prospecting permit applications. The lost opportunity for exploration on these lands would mean that geological knowledge regarding the nature, extent, and formation of any mineralized zones would not be gained. In light of the many high potential precious metal exploration activities outside the NRA, it appears the long-term gains obtained from preserving the recreational and wilderness values of the park far outweigh the uncertain, relatively short-term economic gains from mineral development.

Conclusion: This alternative would not have a significant effect on the opportunity to develop a mineral resource.

IMPACT ON WILDERNESS LANDS

The objective of management zoning under alternative A would be maximum protection of natural resources. The only difference between this alternative and the proposed action is that the resource utilization subzone of the special use zone would be smaller because all areas meeting the Wilderness Act criteria would be excluded from mineral

leasing. All areas possessing wilderness values would be in the natural zone, which emphasizes preservation and protection of natural resources.

Conclusion: Although no lands are proposed for wilderness designation, the Wilderness Suitability map indicates those lands that meet or potentially meet the criteria of the Wilderness Act of 1964. None of these lands would be affected under this alternative.

ENVIRONMENTAL IMPACTS OF ALTERNATIVE B

A summary of the following impacts is presented in the "Summary" section at the beginning of this document.

IMPACT ON PUBLIC SAFETY IN FLOODPLAINS

Many areas in the recreation area are subject to flash flooding. The 100-year flood has a 1 percent chance of ocurring in any year. The probable maximum flood is the greatest flood that could ever be expected. Probable maximum floods do occur, but the frequency is uncertain; the likelihood in any year is less than 1/10 of 1 percent. Flooding is most severe at Willow Beach, followed by Cottonwood Cove; Katherine Landing, and Temple Bar. The hazard at Las Vegas Wash and Overton Beach is much less severe because most visitor facilities are out of the floodplain. At Boulder Beach all development is on a broad alluvial fan, with protection provided by earth dikes. Also, because flooding at Boulder Beach takes the form of sheet flows up to 2 feet in depth, it is not considered to present as great a danger to human life or property as the concentrated flows in canyons at other areas of the NRA; therefore, no potential victims or damage to structures are shown for Boulder Beach in the impact sections relating to floodplains. Callville and Echo bays are the only areas where all facilities are out of the flash floodplain. See the discussion of floodplains and wetlands in the "Affected Environment" section for a more detailed explanation. The DCP graphics for each developed area show the extent of the 100-year and probable maximum floods.

Alternative B would mitigate the flood hazard up to the level of the probable maximum flood primarily through nonstructural measures. These include relocation of facilities out of the floodplains and installation of warning systems. Removal of structures from the floodplains would provide the best protection, structural measures would offer the next best method. Warning systems would provide less protection than either of the preceding methods.

The following is a summary of the flood mitigation proposals for each of the major developments in the recreation area under alternative B. All areas with flood hazards would have warning systems installed even if they were structurally protected.

Katherine Landing. The NPS maintenance area and 15 long-term and all 33 short-term trailer sites would be relocated out of the probable maximum floodplain. Use of North and South Telephone Cove as a primitive use area would be prohibited. The remaining development with the exception of the dry boat storage would be protected to the level of the probable maximum flood through structural measures such as diversion canals and diversion dikes.

Cottonwood Cove. The National Park Service would buy out the concessioner, remove the concession facilities, and operate the area as a day use access point to Lake Mohave.