

U.S. DEPARTMENT OF THE INTERIOR

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**EVALUATION OF SHORELINES ALONG LAKE MEAD,
LAKE MEAD NATIONAL RECREATION AREA,
NEVADA AND ARIZONA**

by

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclature

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Abstract

A photogeologic study of the shorelines of Lake Mead was done in order to assess the carrying capacity of camping beaches used by recreational boaters in the Lake Mead National recreation area. Shorelines along the lake were examined, analyzed, and classified into six categories based on physical parameters that dictate the overall shoreline quality and suitability in regard to recreational use. A digital 1:100,000-scale map presents the five shoreline categories coded by color: (1) steep or rocky shoreline, (2) beach, (3) camping beach, (4) steep shoreline with cliffs, (5) cliffs, and (6) shallow shoreline.

Introduction

The U.S. Geological Survey in 1995 began working with the National Park Service under a new program called "Geology-in-the-Parks". The purpose of this program is to provide practical geological data to the Park Service in order to aid management of park land and its resources, and to assist the Park Service in interpreting the geology for the public. The Lake Mead National Recreation Area was selected for the shoreline studies because: (1) the USGS has considerable expertise in the geology of the region, and (2) Lake Mead is currently the fourth most visited park in the National Park system. The data presented in this report were collected along the shorelines of Lake Mead in the northern part of the Lake Mead National Recreation Area. Shorelines along the lake were examined and analyzed from the Hualapai Indian Reservation, west to Hoover Dam, and north to the Virgin River basin, a distance of over 100 km. This study was completed at the request of the National Park Service in order to provide data for estimating the carrying capacity of camping beaches for boaters along both lakes in the recreation area.

Methods

In this study, shoreline segments were classified into six categories based upon interpretation of a distinct set of physical parameters determined from aerial photographs. The data were rectified by transferring lines from the air photographs to 7 1/2-minute orthophotographic quadrangles of the area. Beach categories were digitized in geodetic coordinates using the GSMCAD program of the USGS (Williams and others, 1996). The resulting file was converted to UTM meter coordinates in ARC/INFO format for publication and distribution.

The information in this report is based upon examination of 1:8,000-scale, natural color, aerial photographs taken by the National Park Service on September 3 and 4, 1977. These photos were chosen because they are the most complete and detailed set of photos for a single lake level on Lake Mead that is near average conditions. Furthermore, the Park Service determined that other features including topography, vegetation, and soil conditions have not changed appreciably since the photographs were taken. The photographs were flown by Cooper Aerial Survey Company under contract number 4000 AMT, and include flight numbers LAME-1 through LAME-105. From information provided by the

Bureau of Reclamation, the water level in the reservoir at the time the photos were flown was at 1180.48 feet above sea level. This water level is very close to average conditions during recent years.

Overlap in adjacent photographs was used to provide a stereoscopic view of the lake and shorelines. Using a mirror stereoscope, I examined the three-dimensional image of the shore, first to determine how steep and rocky the area was within ten to twenty meters of the shoreline. I next examined features such as vegetation density and types, features of stream channels draining into the lake, and size of clasts in the sediment at the shoreline (e.g., silt, sand, pebbles, boulders). Lastly, the density of tents and boats on certain parts of the shoreline was a graphic guide to which sites were preferred by campers on the days the photos were taken.

The observations made from the photos were recorded onto U.S. Geological Survey 7 1/2-minute orthophotographic quadrangles which served as base maps for the study. Data were compiled onto parts of the Frenchman Mountain, Government Wash, Boulder Beach, Callville Bay, Hoover Dam, Boulder Canyon, Petroglyph Wash, Valley of Fire E, Overton Beach, Echo Bay, Lime Wash, Middle Point, Garrett Butte, Bonelli Bay, The Temple, Hiller Mountains, Meadview N, Iceberg Canyon, Azure Ridge, Snap Canyon W, and Columbine Falls quadrangles. The orthophotographs had been prepared from high-altitude aerial photographs taken at 1:80,000-scale on May 24, 1972, on July 25 and October 28, 1973, and on June 3 and October 14, 1977. The shoreline shapes and elevations on the orthophoto quadrangles were virtually identical to those of the low-altitude aerial photos, but where they differed, the latter was used to provide a consistent shoreline shape. Colored lines that represent each shoreline type were drawn along the length of the shoreline on the orthophotographs. As of January 1996, the final map was not field checked.

The shoreline location and color codes were then transferred from the orthophoto quadrangles to a digitized database using a geodetic coordinate system in GSMCAD, a GSMAP compatible program used by the USGS (Williams and others, 1996). The shoreline was thus mapped as a composite linear feature divided into line segments of different attribute codes, the code of the segments representing the classification of the segments. The individual 1:24,000-scale map files were then combined into a composite file at 1:100,000-scale. No point-thinning routine was used, so the original detail at 1:24,000-scale was preserved. The final file was then converted into UTM meter coordinates for input into the UNIX based ARC/INFO format for final compilation. This map was then combined with a shaded relief map derived from 1:250,000-scale USGS 1-degree DEM data in ARC/INFO to create the map that accompanies this report.

Shoreline Classification

The shoreline of Lake Mead was divided into six categories (shown on map). The steepness and rockiness of the shoreline was the primary criterion used for classification. Another criterion was coarseness of beach sediments: however, at the scale of 1:8,000 in the photos, I commonly could not accurately determine this parameter. The groupings and their specific criteria and descriptions are listed below in order of their corresponding attribute code values.

CODE 1 (Black) - Steep or Rocky Shoreline

This category includes most of the shoreline surrounding Lake Mead. Along these stretches, the shore at the water line is steep, so it is difficult to land a boat and virtually impossible to camp near the lake's edge.

CODE 2 (Red) - Beach

This classification is based upon the slope of the shoreline. These shoreline segments are flat enough to provide a good, safe landing for a boat. The actual characteristics of the shore may vary considerably within this category from a good sandy beach to a coarse pebbly beach to a hard bedrock surface. Camping may or may not be appropriate in these locations. Public beaches and boat landings accessible from roads are included in this category.

CODE 3 (Green) - Camping Beach

This category is a subdivision of the "Beach" classification. The shoreline is characterized by a flat landing spot ideal for a boat. Further evidence seen in the photographs verifies these segments as good spots for camping. Either the beach sediments were clearly sand or silt, indicating a nice soft beach, or boats and/or tents were visible along these segments, indicating that these areas had been in use as camp sites. Other "Beaches" may belong in this category but were unoccupied at the time the photos were taken or the sediment was deceptively coarse at the scale of the photos.

CODE 4 (Dark Blue) - Steep Shoreline with Cliffs

These areas are far too steep to land a boat safely. They are characterized by cliffs, many of which have steep talus slopes at their bases or are cut by steep drainages.

CODE 5 (Light Blue) - Cliffs

These segments consist of vertical cliffs rising out of the water. Although probably some of the most scenic stretches of shoreline, boaters and campers should keep their distance due to the danger of rock falls.

CODE 6 (Purple) - Shallow Shoreline

These areas show evidence in the aerial photos of being too shallow or marshy to properly land a boat at the shoreline. Either the shallow lake bottom is visible for some distance out from the shore or thick vegetation extends from the shore into the water and/or inland. Most of these areas represent deltas in which major streams are depositing fine sediment where they flow into the lake. [Note: This fifth category is stored in the database under line code 6 to maintain conformity with the companion map Evaluation of Shorelines Along Lake Mead (Workman, 1996), which used an additional category occupying line code 5.]

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References

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