U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
CALIFORNIA DEPARTMENT OF WATER RESOURCES
AND THE
NEVADA DIVISION OF WATER RESOURCES

HYDROLOGIC INVESTIGATIONS
ATLAS HA–726 (SHEET 1 OF 2)

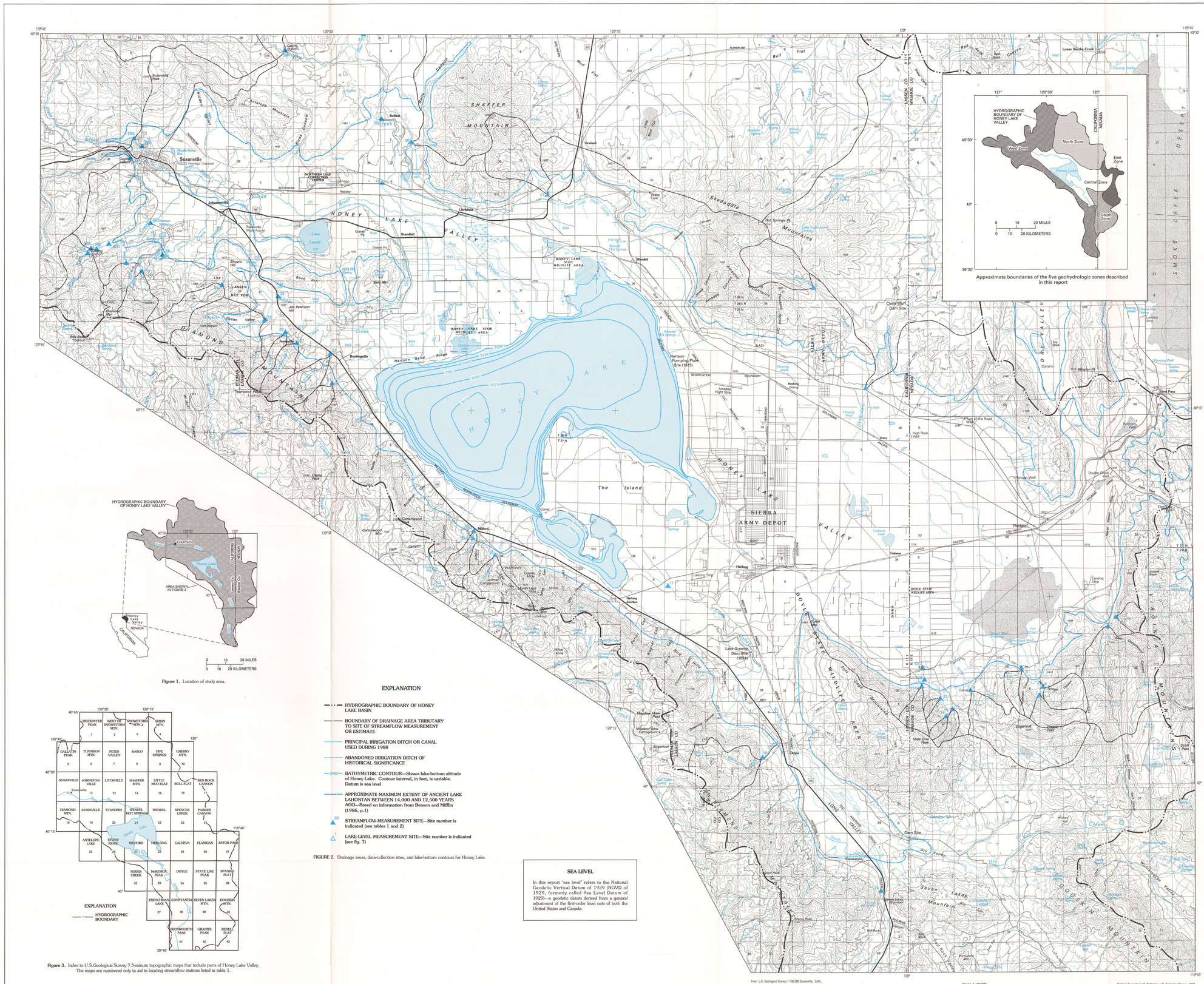

Figure 3. Index to U.S.Geological Survey 7.5-minute topographic maps that include parts of Honey Lake Valley. The maps are numbered only to aid in locating streamflow stations listed in table 1.

Figure 1. Location of study area.

Approximate boundaries of the five geohydrologic zones described in this report

EXPLANATION

- Hydrographic boundary of Honey Lake basin
- Boundary of drainage area tributary to site of streamflow measurement or estimate
- Principal irrigation ditch or canal used during 1988
- Abandoned irrigation ditch of historical significance
- 3980 Bathymetric contour—Shows lake-bottom altitude of Honey Lake. Contour interval, in feet, is variable. Datum is sea level
- Approximate maximum extent of ancient Lake Lahontan between 14,000 and 12,500 years ago—Based on information from Benson and Mifflin (1986, p.1)
- 38 Streamflow-measurement site—Site number is indicated (see tables 1 and 2)
- 1 Lake-level measurement site—Site number is indicated (see fig. 7)

FIGURE 2. Drainage areas, data-collection sites, and lake-bottom contours for Honey Lake.

SEA LEVEL

In this report "sea level" refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called Sea Level Datum of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada.

From: U.S. Geological Survey 1:100,000 Susanville, Calif., 1984, and 1:100,000 Kunivia Peak, Nev.- Calif., 1984.

SCALE 1:100 000

Bathymetry by Glenn E. Patterson, U.S. Geological Survey, 1987
(bathymetric contours are in feet; topographic contours on base are in meters)

INTRODUCTION

Honey Lake Valley straddles the State line of California and Nevada; it is about 35 mi north of Reno and about three-fourths of the area is in California. In this report, Honey Lake Valley (also referred to as "the basin") includes the entire area within the hydrographic boundary shown in figure 1. Susanville, Calif., in the northwestern part of the basin, is the largest town. Population is increasing rapidly in the Susanville area and in the Reno area of adjacent Washoe County, Nev. Lassen and Washoe Counties have identified water resources in Honey Lake Valley as a possible source to meet their needs for future development. An important component of an assessment of the availability of additional long-term supply is an appraisal of surface-water resources.

The U.S. Geological Survey, in cooperation with the California Department of Water Resources and the Nevada Division of Water Resources, began a hydrologic assessment of the area in 1987. The study was primarily an appraisal of ground-water resources, but it also included an assessment of surface-water resources. The purpose of this map report is to present the results of the surface-water assessment, including (1) a broad overview of surface-water conditions in the basin, (2) an estimate of mean annual streamflow to the valley floor, and (3) an evaluation of the characteristics of Honey Lake. Results of the study related to ground-water resources of the basin are discussed in a separate report by Handman and others (1990) and are summarized in a short "Water Fact Sheet" by Handman (1990).

HISTORICAL BACKGROUND

Man has been active in the Honey Lake basin for thousands of years. Indian camp sites dot the shoreline of ancient Lake Lahontan of Pleistocene age, of which Honey Lake is a remnant. Many of the camp sites are located along channels that presently sustain no perennial streamflow, which indicates that human habitation occurred during wetter periods. In 1850, Peter Lassen made the first documented exploration into the basin by Anglo settlers. Four years later, Isaac Roop and his family established the first permanent residence at what is now the town of Susanville (Middleton, 1963).

A major concern in any arid environment is water—where is it? how much is there? and how good is its quality? When Roop started the search for a water supply in 1856, he claimed ". . . the privilege to take all of the water out of Smith Creek [now Piute Creek] at the junction of the two forks where the stake stands . . ." (Middleton, 1963, p. 55). The search for and development of available water in Honey Lake Valley is discussed by Arnesbury (1967) and Middleton (1963). Activity intensified during the late 1800's after the passage of the Desert Land Act in 1877. This Act allowed any person to claim 640 acres by attempting to bring irrigation water to the land. However, few of the water projects in the basin succeeded. Abandoned ditches, canals, and dam sites of historical significance are shown in figure 2. Interest in surface water waned with the development of deep water wells that provided a steady supply of water suitable for irrigation. However, recent proposals to export ground water from the basin (R.W. Beck and Associates, 1987; Westpac Utilities, 1989) have renewed interest in the hydrology of the basin.

GEOHYDROLOGIC SETTING

The elongated and irregular-shaped Honey Lake basin is approximately 80 mi long by 40 mi wide; its longer axis trends northwest to southeast. The total drainage area is about 2,200 mi², of which about 600 mi² is the valley floor. Honey Lake is the central feature of the closed basin. The primary industries are agriculture on the valley floor, timber harvest in the mountains, and livestock throughout the basin.

Topography (shown in more detail on maps indexed in fig. 3), vegetation, precipitation, geology, and soil characteristics differ greatly throughout the basin. However, the basin can be divided into five geohydrologic zones within which characteristics are similar (inset, fig. 2). These zones are discussed below.

WEST ZONE—DIAMOND MOUNTAINS AND SOUTHERN CASCADE RANGE

The west zone has an area of approximately 750 mi². A manmade channel from Horse Lake (north of area shown in fig. 2) into Peters Creek diverts the drainage of Horse Lake basin into the Honey Lake basin. Altitudes range from 4,000 ft above sea level at the valley floor to more than 8,000 ft in the upper reaches of the Susan River. Mean annual precipitation ranges from about 10 in. in the lower southern areas to more than 30 in. in the highest altitude northwestern part of the zone. At the higher altitudes, slopes are covered with conifer forests. At the lower altitudes, vegetation is mostly desert shrubs with some alders and aspens near the springs and creeks.

The Diamond Mountains consist primarily of granitic rocks; some are overlain by sedimentary and volcanic rock formations. This range is uplifted along the northwest-trending Honey Lake fault. The range is further fractured and deformed by numerous other faults and extensive erosion. The Cascade Range to the northwest is composed of well preserved volcanic cones and lava flows. These two ranges form the basin's western and northwestern drainage divides.

The Susan River is the main source of inflow to the floor of Honey Lake Valley. Approximately 30 percent of the estimated total inflow originates in the Susan River drainage area. The only significant storage of surface water for irrigation in the basin is in the Susan River drainage. McCoy Flat and Hog Flat Reservoirs (both west of the area shown in fig. 2) and Lake Leavitt (on the valley floor northwest of Honey Lake) were built in the 1880's to supply irrigation water to farms in the Standish area. The system has been expanded over the years and is still in operation.

Streamflow in the northern part of this zone is maintained during most years by precipitation in the form of snow in the higher altitudes. Long Valley Creek and other streams in the southern part of the zone do not receive as much snowmelt runoff and are largely ephemeral.

NORTH ZONE—SHAFFER, SKEDADDLE, AND AMEDEE MOUNTAINS AND MODOC PLATEAU

The north zone has an area of approximately 510 mi², including the southern part of the Modoc Plateau. Altitudes range from 4,000 ft on the valley floor to about 7,500 ft at Hot Springs Peak in the Skedaddle Mountains. Mean annual precipitation ranges from less than 6 in. in the lower altitudes to as much as 15 in. in the higher altitudes.

Vegetation throughout the north zone is characterized by desert shrubs and a few scattered junipers. The few existing springs and spring-fed creeks support some small alder and aspen thickets.

The Shaffer-Skedaddle-Amedee Mountain complex consists of volcanic cones that are about 12 million years old (Diggles and others, 1988, p. 9). Shaffer Mountain retains much of its original shape, but the Skedaddle and the Amedee Mountains are highly eroded and modified by extensive faulting. This area is in a transition zone between the Modoc Plateau and the Basin and Range province. The transition zone includes a broad volcanic plateau that extends northward for several miles to Snowstorm Mountain. The uplifted Modoc Plateau and associated mountains form the northern drainage divide.

The four main streams—Shaffer, Balls Canyon, Spencer, and Skedaddle Creeks—and the other streams in the zone are ephemeral in all but the wettest years. Most runoff occurs during short, intense snowmelt periods and during heavy Pacific-front storms. Small springs maintain flow in the upper reaches of Skedaddle Creek; this water is used for livestock and irrigates some natural pasture. Streamflow in Skedaddle Creek can be high at times because the stream receives runoff from a large drainage area. In February 1891, heavy rains brought Skedaddle Creek to flood stage. The nearly completed Chalk Bluff dam was overtopped and washed out, sending a large flood wave down the canyon (Lassen County court case 578: *John C. Davis v. Honey Lake Water Company*). To date (1989), no attempt has been made to rebuild the dam. Balls Canyon Creek is diverted at the mouth of the canyon into the Wards Lake irrigation system north of Standish. Except for a small stock pond, Spencer Creek has not been developed and seldom discharges water beyond the mountain block. Shaffer Creek, which is completely dry during most years, flows for only short periods during wet years.

EAST ZONE—NEVER SWEAT HILLS AND VIRGINIA MOUNTAINS

The east zone is an area of approximately 120 mi². Altitudes range from 4,000 ft at the valley floor to nearly 7,000 ft at Vinegar Peak. The Never Sweat Hills and the Virginia Mountains are typical of the Basin and Range province and are composed of highly faulted volcanic rocks (Bonham and Papke, 1969, p. 50). Precipitation patterns and vegetation types are similar to those in the north zone. Mean annual precipitation ranges from 4 in. in the lower altitudes to 14 in. in the higher altitudes. The snowmelt season is short, and most runoff results from Pacific-front storms and short-duration thunderstorms. Generally, flow from springs is too small to sustain any streamflow. Cottonwood Creek is an exception; it flows along the large north-south-striking fault that borders the Virginia Mountains, and seepage along this fault maintains perennial flow. The creek is diverted near the canyon mouth to irrigate a few acres of pasture. The Virginia Mountains form the drainage divide to the east.

SOUTH ZONE—FORT SAGE, DOGSKIN, AND PETERSEN MOUNTAINS

The south zone has an area of approximately 230 mi² and includes Dry Valley and Red Rock Creeks, which drain Dogskin and Petersen Mountains to the south (Petersen Mountain is south of area shown in fig. 2). Altitudes range from 4,000 ft at the valley floor to 7,990 ft at State Line Peak in the Fort Sage Mountains. Mean annual precipitation ranges from about 8 in. in the valley to about 14 in. in the higher altitudes. Vegetation consists mostly of desert shrubs and includes dense alder thickets, cottonwood groves, and scattered aspens near the springs. Scattered pines and junipers grow on the higher slopes.

The Fort Sage Mountains are part of the Sierra Nevada province. The mountains are composed of highly weathered granitic rocks; their general structure is similar to the Diamond Mountains. The large vertical displacement that has occurred along the faults on the northern side of the Fort Sage Mountains has created a steep escarpment (Grose, 1984). The northern side of the Fort Sage Mountains features numerous small spring-fed creeks that drain small areas and rarely discharge much water to the valley floor. However, Fish Springs Creek, which emanates from a faulted transition zone between the Fort Sage and the Virginia Mountains, has a relatively large drainage area and, during wet years, discharges substantial flow to the valley floor. The southern side of the Fort Sage Mountains is drained by Dry Valley Creek, which then flows into Long Valley Creek.

To the south, the Dogskin and Petersen Mountains, including the Dry Valley and Red Rock Creek basins, receive little precipitation during normal years. However, they contribute significant runoff to the Honey Lake basin as a result of Pacific-front storms. The Fort Sage Mountains and other uplifted blocks to the south complete the closure of the basin.

CENTRAL ZONE—VALLEY FLOOR

The central zone, which has an area of approximately 590 mi², includes the area within the high-water line of ancient Lake Lahontan (fig. 2). The altitude averages about 4,000 ft. Mean annual precipitation in the western part is about 10 in., and in the eastern part, as little as about 5 in.

The valley floor is in the Basin and Range province. Geologic formations range from recently deposited alluvium in the Susan River delta and lake sediments around Honey Lake to older lake deposits as much as 5,000 ft thick that underlie the valley floor (California Department of Water Resources, 1963, p. 207; Handman and others, 1990, p. 8-11). The soils east and south of Honey Lake tend to be highly alkaline and are of little use for agriculture. The valley floor is crisscrossed by major and minor faults. Several hot springs discharge from fault zones in the vicinity of Wendel.

The dominant feature in the central zone is Honey Lake (fig. 2). The area around the lake is heavily cultivated and has little native vegetation. The western part of the zone, however, is relatively wet and lush because of extensive irrigation for agriculture. In the eastern part, vegetation is entirely desert shrub, except for some agricultural development along the Skedaddle Creek fan and in the vicinity of Fish Springs Ranch. Occasionally, the large alkali flats and playas in the eastern part are flooded.

In most years, little surface water flows onto the valley floor; most flow infiltrates into alluvial fans shortly after crossing mountain-block faults, and flow from the Susan River maintains Honey Lake. In dry years, the only flow to reach the lake is a small amount of irrigation-return water, some water from seeps and springs in the lake bottom, and some water discharged from geothermal power projects in the vicinity of Wendel and Amedee.

SURFACE–WATER HYDROLOGY OF HONEY LAKE VALLEY, LASSEN COUNTY, CALIFORNIA, AND WASHOE COUNTY, NEVADA

By
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