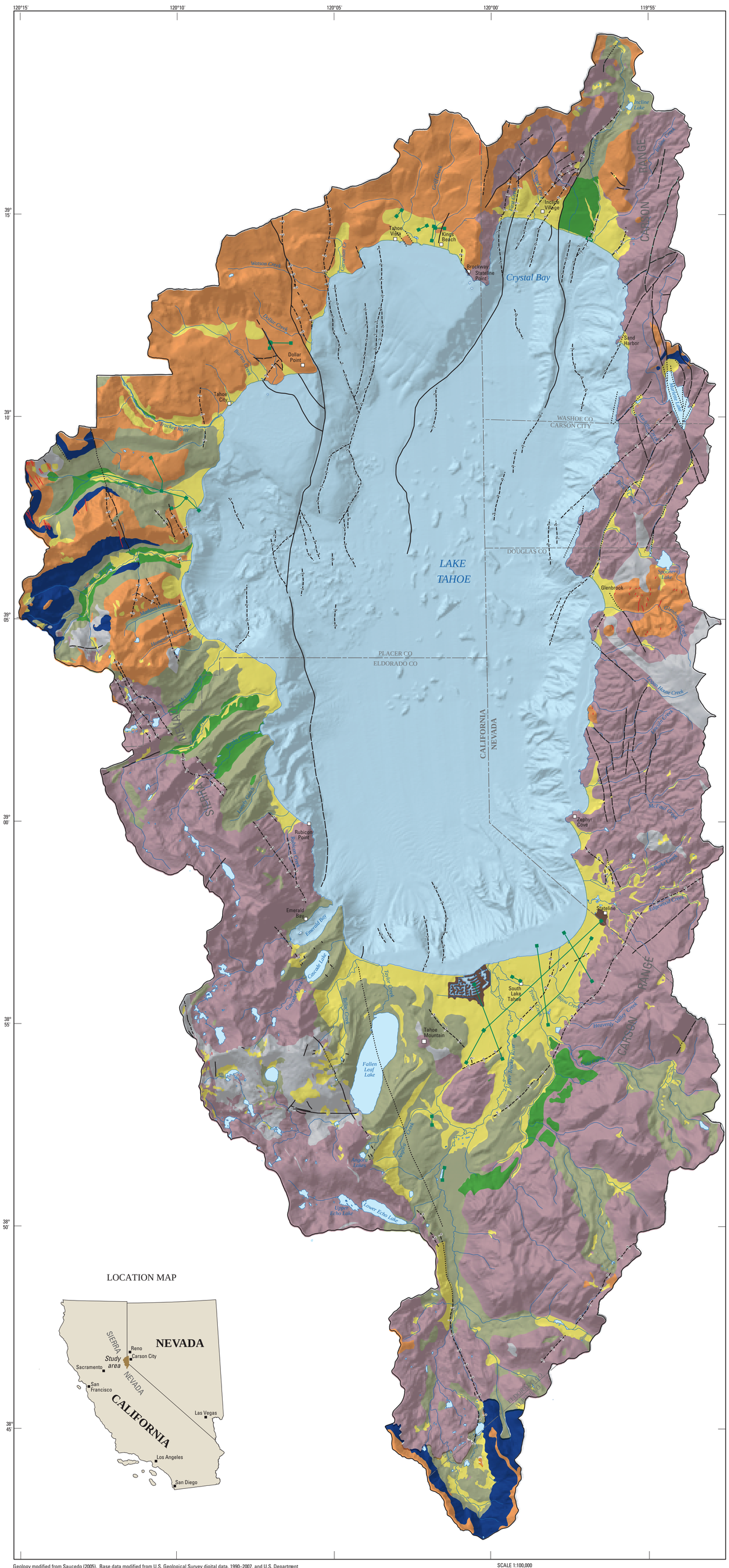
INTRODUCTION

Ground water in the Lake Tahoe basin is the primary source of domestic and municipal water supply and an important source of inflow to Lake Tahoe. Over the past 30–40 years, Federal, State, and local agencies, and research institutions have collected hydrologic data to quantify the ground-water resources in the Lake Tahoe basin. These data are dispersed among the various agencies and institutions that collected the data and generally are not available in a format suitable for basin-wide assessments. To successfully and efficiently manage the ground-water resources throughout the Lake Tahoe basin, the U.S. Geological Survey (USGS) in cooperation with the U.S. Forest Service (USFS) compiled and evaluated the pertinent geologic, geophysical, and hydrologic data, and built a geodatabase incorporating the consolidated and standardized data for the Lake Tahoe basin that is relevant for examining the extent and characteristics of the hydrogeologic units that comprise the aquifers. The Geodatabase can be accessed at http://water.usgs.gov/GIS/dsdl/SIM3063.zip, the shape files can be accessed at http://water.usgs.gov/GIS/dsdl/SIM3063_Shapefile.zip, and the XML Workspace Document can be accessed at http://water.usgs.gov/GIS/dsdl/SIM3063_XML.zip.



Geology modified from Saucedo (2005). Base data modified from U.S. Geological Survey digital data, 1990–2007, and U.S. Department of Agriculture Soil Survey Geographic Database (SSURGO), 2007. Universal Transverse Mercator projection, Zone 10; North American Datum of 1983. Shaded-relief base from 10-meter Digital Elevation Model. Bathymetry from the Lake Tahoe Clearinghouse (http://tahoe.usgs.gov), with sun illumination from the northwest 45° above horizon.

EXPLANATION

Geologic units

Construction fill—Lithology unknown.

Younger alluvium (Holocene and Pleistocene)—Moderately sorted sand and gravel of beach and lacustrine terrace deposits; clay, silt, sand, and gravel of flood plains; clay, silt, and sand of lake deposits; sandy-gravelly debris and coarse angular blocks of landslides and talus deposits; sand, gravel, and boulders of alluvial fans.

Glacial till (Pleistocene)—Clay, silt, and sand to large weathered granitic boulders; mostly preserved as moraines.

Glacial outwash deposits (Pleistocene)—Unconsolidated, poorly sorted boulders, cobbles, gravel, sand, and silt.

Older alluvium (Pliocene and Miocene)—Fluvial and lacustrine conglomerate, sandstone, and shale; rockslide-avalanche deposits consisting of large volcanic blocks in matrix of mudstone and ash.

Volcanic rocks (Pleistocene to Oligocene)—Rhyolitic tuffs of Oligocene age, mudflows of Pliocene and Miocene age, lava flows, and shallow intrusive bodies of Pleistocene, Pliocene, and Miocene age composed of basalt, andesite, latite, and dacite. Mostly found in northern and northwestern parts of the basin.

Intrusive igenous rocks (Cretaceous and Jurassic)—Compositions include granodiorite, diorite, quartz monzonite, granite, adamellite, alaskite, gabbro, and aplite dikes. Forms the bedrock basement of the Lake Tahoe basin.

Metamorphic rocks (Jurassic and Triassic)—Metamorphosed volcanic rocks, sandstone, siltstone, and limestone. Forms a small part of the bedrock basement west of Fallen Leaf Lake and east and southeast of Glenbrook.

Faults

Fault—Dashed where approximately located; dotted where concealed; short dashed where inferred; queried where uncertain. Can function as conduits for ground-water flow because rock is generally fractured along the fault zone. However, gouge, consisting of finely pulverized rock along the fault zone, also can function as an impermeable seal.

Dike—Andesite, basalt, latite, and mafic dikes.

Resistivity or seismic reflection soundings—soundings from Blum, 1979; Niblack, 1988; and Markiewicz, 1992.

Figure 1. Geologic Map.

EXPLANATION

East Shore Aquifers

The East Shore Aquifers encompass 15 individual watersheds from the east side of the Incline Village area to the north side of the Stateline area (U.S. Army Corps of Engineers, 2003).Younger alluvium, underlain by weathered granitic rocks and in the Glenbrook area by metamorphic and volcanic rocks, is dispersed along the shoreline, is not continuous, and thus is not a contiguous aquifer. Aquifers of limited extent are at Sand Harbor, Glenbrook, and Zephyr Cove.

Aquifer materials are younger alluvium and adjacent granitic and metamorphic rocks. One well at Sand Harbor and six at Glenbrook penetrated silt, sand, gravel, and cobbles interbedded with clay from 19 to 274 feet below land surface. Additionally some granite, in places fractured, occurs from 97 to 480 feet below land surface. Specific capacity at the Sand Harbor well was 1 gallon per minute per foot and ranged from 0.2 to 0.5 gallon per minute per foot at the Glenbrook wells. Ten wells at Zephyr Cove penetrated sand and gravel to depths of 18 to 114 feet below land surface and granite, in places fractured, to depths of 55–321 feet. Specific capacity at the wells ranged from 0.1 to 0.9 gallon per minute per foot.

Incline Village Aquifer

The Incline Village aquifer is bounded by outcrops of granitic rocks that form Stateline Point on the west and the Carson Range on the east, and by the shoreline of Crystal Bay. Younger alluvium and glacial till and outwash cover much of the area, average about 150 feet in thickness (U.S. Army Corps of Engineers, 2003), and thicken to 1,000 feet near the lake shore (Markiewicz, 1992, p. 18).

Aquifer materials are predominantly sand with lesser amounts of boulders, clay, and silt. Deposits penetrated by 27 wells consist of sand, gravel, and boulders with interbedded clay to depths of 50–180 feet below land surface. Specific capacity of seven wells ranged from 0.5 to 40 gallons per minute per foot. One well penetrated granitic bedrock from land surface to 163 feet, and the specific capacity was 0.5 gallon per minute per foot.

Kings Beach/Tahoe Vista Aquifer

The Kings Beach/Tahoe Vista aquifer extends from Dollar Point on the west to Brockway on the east. Younger alluvium is limited to a thin strip along the shoreline except along Carnelian Creek, at Tahoe Vista, and Kings Beach where deposits extend 1–2 miles inland. In much of the area, the younger alluvium overlies volcanic rocks that overlie older alluvium (Muehlberg and others, 2003). Volcanic rocks also comprise uplands between Tahoe Vista and Carnelian Creek.

Aquifer materials range in grain size from clay to boulders and are up to 100 feet thick. Three wells in sections 11 and 12, T16N, R17E (fig. 3) penetrate mostly fractured rocks, probably volcanic, to depths of 860–890 feet. Specific capacity at these wells was 2, 12, and 540 gallons per minute per foot, respectively. Four other wells in sections 14 and 15, T16N, R17E and sections 6 and 19, T16N, R18E penetrated mostly interbedded clay, sand, gravel, and boulders to depths of 65–225 feet. Specific capacity at these wells ranged from 0.1 to 10 gallons per minute per foot. The well in section 6, T16N, R 18E penetrated granitic bedrock at a depth of 148 feet.

South Lake Tahoe/Stateline Aquifer

The South Lake Tahoe/Stateline aquifer extends from Emerald Bay on the southwest side of Lake Tahoe to north of Stateline, Nevada, on the southeast side (U.S. Army Corps of Engineers, 2003). Younger alluvium and glacial till and outwash generally range from 200 to 800 feet in thickness. These sediments can be as thick as 1,200 feet thick between Fallen Leaf Lake and Tahoe Mountain; however, this thickness includes a morainal ridge of glacial till that rises about 500 feet above the surrounding area (Woodling, 1987).

At land surface, aquifer materials consist of glacial outwash and till and younger alluvium. At depth the aquifer materials consist of three sand and gravel beds separated by laterally extensive clay beds between Tahoe Mountain and the Upper Truckee River (U.S. Army Corps of Engineers, 2003). Between Tahoe Mountain and Stateline, the deposits consist of interbedded sand, gravel, and clay. Sand and gravel beds range from 10 to 150 feet thick and clay beds from 10 to 100 feet thick (U.S. Army Corps of Engineers, 2003). Interbedded coarse- and fine-grained deposits likely results in a multi-layered aquifer system that includes a shallow, unconfined (water-table) aquifer and one or more deeper confined aquifers.

Tahoe City/West Shore Aquifer(s)

The Tahoe City/West Shore aquifer extends from Dollar Point on the north to Rubicon Point on the south, a shoreline distance of about 18 miles (U.S. Army Corps of Engineers, 2003). In the Tahoe City area, the sediments are about 590 feet thick consisting of interbedded lacustrine clay, silt, and sand that overlie Pliocene volcanic flows, which in turn overlie older sands and gravels (Markiewicz, 1992, p. 27, and Muehlberg and others, 2003). In the West Shore area, glacial processes dissected the area into eight watersheds, each underlain by glacial outwash and fluvial deposits (mostly sands and gravels) that overlie volcanic rocks. Ridges separating the watersheds consist of intrusive igneous rocks that in places are capped by glacial moraines or volcanics.

Aquifer materials penetrated by 31 wells consist of clay, silt, sand, gravel, and boulders, in places interbedded with volcanic rocks, to depths of 56–805 feet. The specific capacity of these wells ranged from 0.1 to 30 gallons per minute per foot.

Undesignated Areas

Areas not designated aquifer areas by the U.S. Army Corps of Engineers are uplands on the east, southwest, and south sides of the basin, and are underlain mostly by igneous intrusive rocks. Fourteen wells on the east side of the basin penetrated varying thicknesses of decomposed, fractured, and solid granite to depths of 72–230 feet. Specific capacity of the wells ranged from 0.1 to 1.1 gallons per minute per foot.

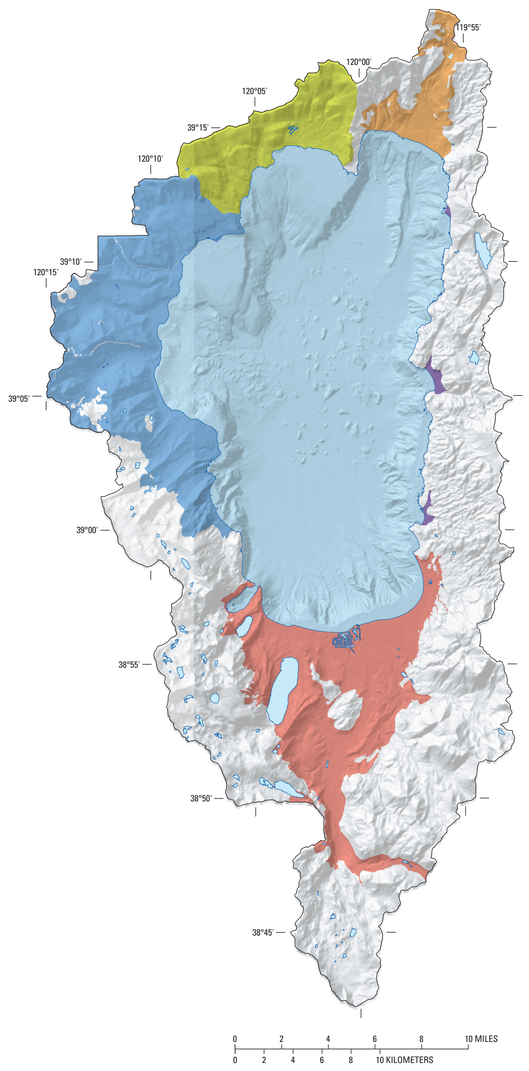
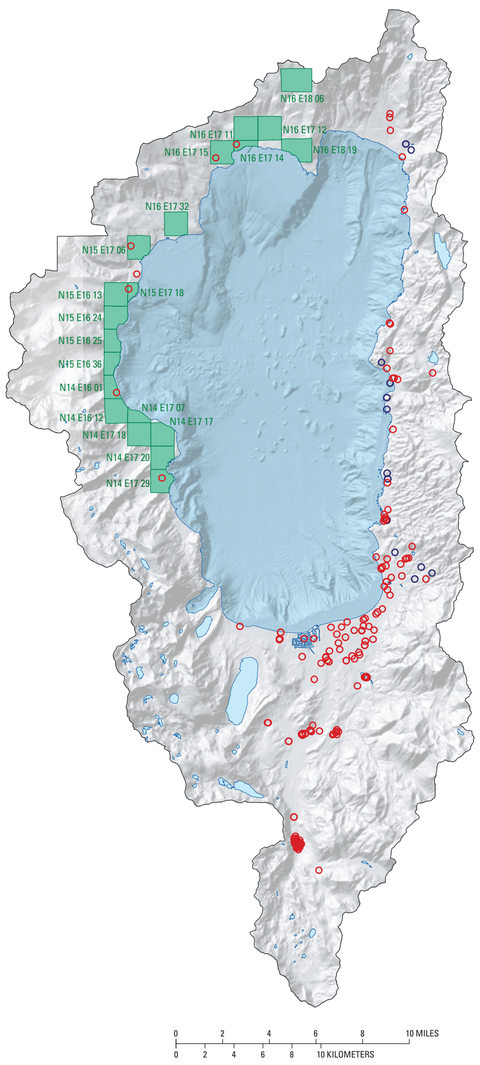


Figure 2. Aquifer areas modified from the U.S. Army Corps of Engineers (2003, p. 3-1, fig. 3-1, and sections 4 through 8).



EXPLANATION

Well in Nevada Division of Water Resources database at http://water.nv.gov/Engineering/wlog/wlog.cfm

Well in USGS National Water Information System (NWIS) database at http://waterdata.usgs.gov/nv/nwis/nwis

N16 E18 06 — Generalized location of one or more wells in California. Specific locations prohibited by statute. Designation refers to section 6, T16N, R18E.

Figure 3. Locations of selected wells.

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HYDROGEOLOGY OF THE LAKE TAHOE BASIN, CALIFORNIA AND NEVADA

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