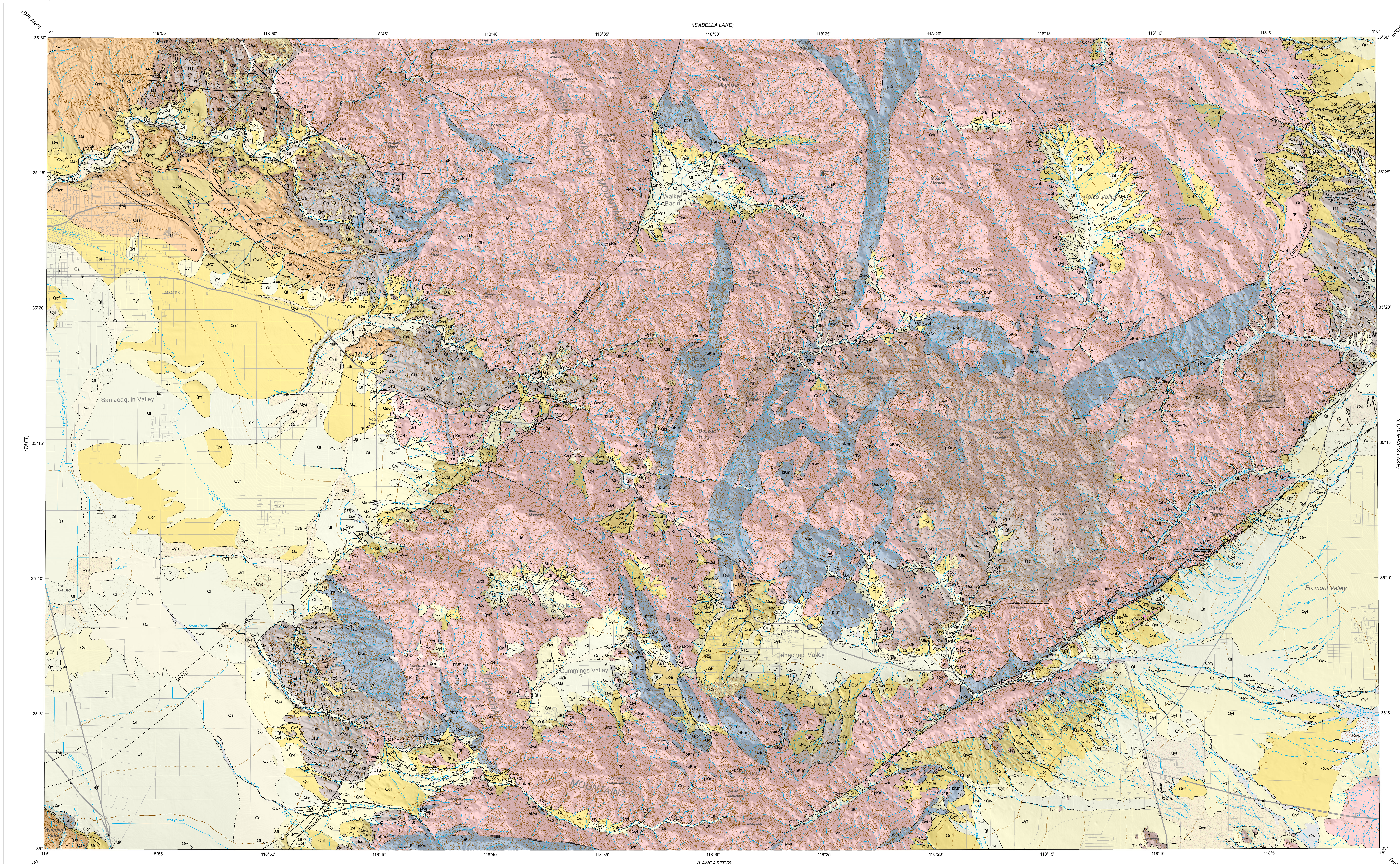


MAP UNITS

Late Holocene (Surficial Deposits)

- **af** — **Artificial Fill** - deposits of fill resulting from human construction, mining, or quarrying activities; includes engineered fill for buildings, roads, dams, airport runways, harbor facilities, and waste landfills
- **Qsu** — **Undifferentiated Surficial Deposits** - includes colluvium, slope wash, talus deposits, and other surface deposits of all ages; generally unconsolidated but locally may contain consolidated layers
- **Qls** — **Landslide Deposits** - may include debris flows and older landslides of various earth material and movement types; unconsolidated to moderately well-consolidated
- **Qw** — **Alluvial Wash Deposits** - unconsolidated sandy and gravelly sediment deposited in recently active channels of streams and rivers; may contain loose to moderately loose sand and silty sand
- **Qf** — **Alluvial Fan Deposits** - unconsolidated boulders, cobbles, gravel, sand, and silt recently deposited where a river or stream issues from a confined valley or canyon; sediment typically deposited in a fan-shaped cone; gravelly sediment generally more dominant than sandy sediment
- **Qa** — **Alluvial Valley Deposits** - unconsolidated clay, silt, sand, and gravel recently deposited parallel to localized stream valleys and/or spread more regionally onto alluvial flats of larger river valleys; sandy sediment generally more dominant than gravelly sediment
- **Qt** — **Terrace Deposits** - includes marine and stream terrace deposits; marine deposits include slightly to moderately consolidated and bedded gravel and conglomerate, sand and sandstone, and silt and siltstone; river terrace deposits consist of unconsolidated thin- to thick-bedded gravel
- **Ql** — **Lacustrine, Playa, and Estuarine (Paralic) Deposits** - mostly unconsolidated fine-grained sand, silt, mud, and clay from fresh water (lacustrine) lakes, saline (playa) dry lakes that are periodically flooded, and estuaries; deposits may contain salt and other evaporites
- **Qe** — **Eolian and Dune Deposits** - unconsolidated, generally well-sorted wind-blown sand; may occur as dune forms or sheet sand

Holocene to Late Pleistocene (Surficial Deposits)

- **Qyw** — **Young Alluvial Wash Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected sandy and gravelly stream bed sediments in marginal parts of active and recently active washes and river channels
- **Qyf** — **Young Alluvial Fan Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined valley or canyon
- **Qya** — **Young Alluvial Valley Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
- **Qyt** — **Young Terrace Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected marine and stream terrace deposits
- **Qyl** — **Young Lacustrine, Playa, and Estuarine (Paralic) Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected fine-grained sand, silt, mud and clay from lake, playa, and estuarine deposits of various types
- **Qye** — **Young Eolian and Dune Deposits** - unconsolidated to slightly consolidated, undissected to slightly dissected wind-blown sands

Late to Middle Pleistocene (Surficial Deposits)

- **Qow** — **Old Alluvial Wash Deposits** - slightly to moderately consolidated, moderately dissected sand and gravel; typically elevated above modern washes
- **Qof** — **Old Alluvial Fan Deposits** - slightly to moderately consolidated, moderately dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined valley or canyon
- **Qoa** — **Old Alluvial Valley Deposits** - slightly to moderately consolidated, moderately dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers
- **Qot** — **Old Terrace Deposits** - slightly to moderately consolidated, moderately dissected marine and stream terrace deposits

Middle to Early Pleistocene (Surficial Deposits)

- **Qvof** — **Very Old Alluvial Fan Deposits** - moderately to well-consolidated, highly dissected boulder, cobble, gravel, sand, and silt deposits issued from a confined valley or canyon

Quaternary (Bedrock)

- **Qss** — **Coarse-grained formations of Pleistocene age and younger** - primarily sandstone and conglomerate

Tertiary (Bedrock)

- **Tss** — **Coarse-grained Tertiary age formations** - primarily sandstone and conglomerate
- **Tsh** — **Fine-grained Tertiary age formations** - includes fine-grained sandstone, siltstone, mudstone, shale, siliceous and calcareous sediments
- **Tv** — **Tertiary age formations of volcanic origin**

Mesozoic and Older (Bedrock)

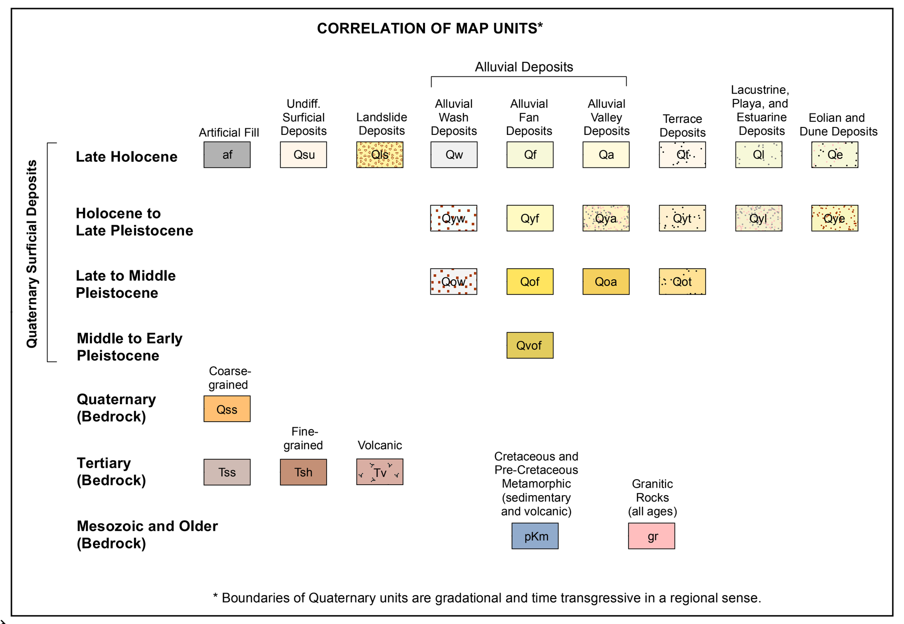
- **pKm** — **Cretaceous and Pre-Cretaceous metamorphic formations of sedimentary and volcanic origin**
- **gr** — **Granitic and other intrusive crystalline rocks of all ages**

SYMBOL EXPLANATION

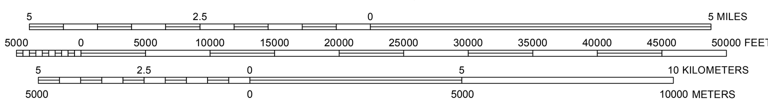
For geologic line symbols: lines are solid where location is accurate, long-dashed where location is approximate, short-dashed where location is inferred, dotted where location is concealed. Queries added where identity or existence may be questionable.

- Contact
- Gradational contact
- Fault -- Includes strike-slip, normal, reverse, oblique, and unspecified slip
- Folds -- Showing direction of plunge where appropriate
  - Anticline
  - Syncline
- Stream
- Spring
- Road
- County boundary

CORRELATION OF MAP UNITS*



* Boundaries of Quaternary units are gradational and time transgressive in a regional sense.



CONTOUR INTERVAL 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

GEOLOGIC MAP OF QUATERNARY SURFICIAL DEPOSITS IN SOUTHERN CALIFORNIA
TEHACHAPI 30' X 60' QUADRANGLE

A Project for the Department of Water Resources by the California Geological Survey

by

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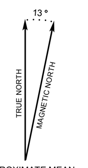
Digital preparation by

Solomon McCrea and Shannon Utley

December 2011

Projection: Universal Transverse Mercator, Zone 11 North, North American Datum of 1983.

Topographic contours derived from USGS 1/3 arc-second National Elevation Dataset (NED). Shaded topographic relief derived from USGS 1 arc-second NED. Base map of hydrography from National Hydrography Dataset Plus (NHDPlus) and California Department of Fish and Game. Base map of geographic names from USGS Geographic Names Information System (GNIS).



APPROXIMATE MEAN DECLINATION, 2011

MAP LOCATION

MAP EXPLANATION

This map of Quaternary surficial deposits of the Tehachapi 30' x 60' quadrangle was created by the California Geological Survey (CGS) for the Department of Water Resources (DWR) to assist in identifying where flooding and deposition of sediment occurred in the geologically recent past. The focus of this project is on Quaternary (Q) surficial deposits (less than 1.8 million years) on alluvial fans, floodplains, and basins where such deposits are subject to a number of geologic hazards including flooding, amplification of seismic shaking, liquefaction, and collapsible soils. In general, areas of most recent deposition during Late Holocene time (within the last 500 years) have a greater potential to be areas of future flooding and deposition than those underlain by older surficial deposits.

Project Overview

The Tehachapi 30' x 60' quadrangle represents one of several 100,000 scale quadrangles included in the detailed Geographic Information System (GIS) based geologic data set compiled by CGS from recent high resolution geologic mapping available for southern and central California. The GIS database merges more than 1400 geologic units from source maps published primarily by the U.S. Geological Survey (USGS) and by CGS (Source GIS Database) into a common format that depicts 40 derivative categories of surficial deposits and bedrock for the entire area (Derivative GIS Database). Because published source geologic mapping at the 100,000 scale was not available for the Tehachapi quadrangle, CGS used the derivative map units as a basis for new Quaternary mapping within the quadrangle. Quaternary surficial deposits are divided into 28 categories modified from the methodology of Matti and Cossette (2007), the Southern California Areal Mapping Project (SCAMP, 2000), and the USGS and CGS (2000). While specific variations in age and physical properties exist within each unit, CGS retained the basic premise of Matti and Cossette (2007) that surficial deposits within each of the Quaternary map units formed during a particular range of geologic time, have a similar origin, and have generally similar physical properties. Within the 28 Quaternary surficial units, progressively older surficial deposits are typically better consolidated and more highly dissected by erosion, have more developed and/or eroded soil profiles with stronger degrees of weathering and surface armoring, and occupy a higher topographic position within alluvial fan and floodplain terrains. Geologic bedrock formations are divided into 12 categories, based on age and rock type. The bedrock categories can be used to aid in a general understanding of the relative erodibility of the upland materials and the general character of the derived sediments. CGS also rectified inconsistencies along the boundaries of mapped areas to create a seamless Derivative GIS Database with other 30' x 60' quadrangles previously compiled under CGS Special Report 217. Correlation of equivalent deposits across the whole southern California project area is represented in the GIS table entitled Correlation of Derivative and Source Geologic Map Units.

Tehachapi Quadrangle

The Tehachapi quadrangle consists primarily of fault bound mountain ranges bordered by extensive alluvial fans and floodplains. Several large interior basins are also underlain by large alluvial fans and floodplains. The western portion of the quadrangle contains Quaternary age alluvial fan and floodplain sediments associated with the Kern River, Caliente Creek, Tunis/El Paso Creek and Tejon Creek drainage systems. As these drainages flow westward into the San Joaquin Valley, they form a series of early Pleistocene to late Holocene age alluvial fan and wash deposits in the vicinity of, and upstream from, the communities of Arvin and Bakersfield. Typically, the more recent Holocene age deposits are adjacent to the major drainages while the older Pleistocene age alluvial fans are located along the topographically higher margins of the valleys. Isolated remnants of the early Pleistocene fan deposits occupy the tops of numerous side ridges along many of the drainages (Bartow, 1984). Other Holocene deposits within the western portion of the quadrangle include wind-blown sands and lake bed deposits. Sand dunes are present in two places south of Arvin, between Caliente Creek and Tejon Creek. Lake bed deposits are present near the Kern Lake Bed and to the north along the western edge of the quadrangle. Late Tertiary to early Quaternary age non-marine rocks are also present along the northwest edge of the quadrangle, while pre-Quaternary sedimentary, granitic, volcanic, and metamorphic rocks of the southern Sierra Nevada and the Tehachapi Mountains form the majority of the central and eastern portions of the Tehachapi quadrangle. Several medium to large internal basins within the mountains are underlain by extensive Quaternary alluvial fan, lakebed, and wash deposits in the vicinity of Cummings Valley, Bear Valley, Tehachapi Valley, Kelso Valley, and Walker Basin. In places, the constrained nature of the basins contributes to variations in alluvial fan morphology and shapes characteristic of the typical alluvial fan profile. Large alluvial fans and floodplains containing Holocene age lake bed, eolian, and wash deposits are also present in the desert terrain of the Fremont Valley, in the southeast corner of the quadrangle near Mojave, and along the far eastern edge of the quadrangle. Quaternary-age faults within the quadrangle include: the White Wolf, Edison, and Springs faults along the western edge of the mountains; the Breckenridge Fault to the north near Walker Basin; and the Garlock and Sierra Nevada faults along the southeastern and eastern edges of the mountains, respectively. Displacements along these faults have gradually uplifted the mountains, causing deposition, uplift, and erosion of the older fans and providing gradient and source materials for the younger fans.

In preparing this map of the Tehachapi quadrangle, CGS used geologic source data from: Bartow (1981, 1984, 1986a, 1986b); Bartow and Dibblee (1981a, 1981b); Bartow and Doukas (1976a, 1976b); Dibblee and Chesterman (1953, 1959); Dibblee and Warne (1970); Dibblee and Louke (1970); Dibblee and Minch (2005, 2008); Smith (1964); soil surveys (USDA, 2009; Cole and others, 1945); and aerial photography compiled in digital format (Google Earth Pro, 2011; NAIP, 2009; ESRI, 2011) to aid in the mapping of Quaternary surficial deposits. Areas with older alluvial fans were identified as being moderately to extensively dissected, indicating their relative age compared to the younger fan systems. The youngest fans were recognized by their distinct geomorphic shape, topography, lack of dissection, and usually were located immediately adjacent to modern washes and downhill from a distinct hydrologic break-in-slope. In many locations such as the San Joaquin Valley and Cummings Valley, agriculture has masked alluvial fan, river and wash features, and recognition was therefore dependant on indirect observations (e.g., soil surveys, topographic maps and digital orthorectified quadrangles). Qsu (Quaternary sediments, undifferentiated) was mapped throughout the quadrangle, typically in linear valleys underlain by fan and fluvial materials indistinguishable at the mapping scale, along fault zones, or in colluvium-filled valleys or bowl-shaped depressions. Quaternary faults were compiled from Smith (1983, 1984a, 1984b), Wills (1989), California Division of Mines and Geology (1976, 1985a, 1985b, 1990), USGS and CGS (2011) and Bryant (2005). Quaternary surficial deposits are represented on this map by 20 of the 28 generalized project derivative units. Bedrock geology and faults were compiled primarily from Ross (1989) and Bartow (1984). Bedrock units identified in the study area are represented on this map by 6 of the 12 project derivative bedrock units (see Map Units and Correlation of Map Units).

This map, along with others in the Geologic Compilation of Quaternary Surficial Deposits in Southern California Derivative GIS Database, is regional in nature and should not be used as a substitute for detailed geologic studies in any specific area. It is intended only for rapid identification of areas subject to previous and potential future flooding and other geologic hazards on alluvial fans and floodplains.

MAP REFERENCES

IMAGERY USED

ESRI, 2011, ArcGIS Image Service: http://services.arcgisonline.com/ArcGIS/services, I3_Imagery_Prime_World_2D, various scales and years, last accessed September 29, 2011

Google Earth Pro, 2011, Google maps, kh.google.maps, last accessed September 29, 2011

National Agriculture Imagery Program, 2009, NAIP 2009 CIR: ArcGIS Image Service, http://imaps.dfg.ca.gov/arcgis/services, Base_Remote_Sensing\NAIP_2009_CIR, last accessed July 5, 2011

North West Geomatics Ltd. and Fugro Earthdata, Inc., 2005, Digital stereo imagery flown for the USDA National Agriculture Imagery Program (NAIP): Image lines L106042145, flown 6/04/2005, and L106052220, flown 6/05/2005; approximate ground sample distance (GSD; aka pixel dimension) 0.81 to 0.87 meters. Last accessed April 11, 2011

United States Department of Agriculture, Farm Service Agency-Aerial Photography Field Office, National Agriculture Imagery Program, 2009, Mosaic county image for Kern, California: MrSID compressed color image, 1-meter resolution, ortho_1-2_1n_s_ca029_1.sid and ortho_2-2_1n_s_ca029_2009_1.sid

United States Department of Agriculture, National Digital Orthophoto Program, 1994, Digital orthophoto quadrangles: MrSID compressed black and white image, 1-meter resolution, for 7.5 minute quadrangles Arvin, Bear Mountain, Bena, Breckenridge Mountain, Cache Peak, Cinco, Claraville, Cross Mountain, Cummings Mountain, Dove Springs, Edison, Emerald Mountain, Keene, Lamont, Loraine, Mettler, Mojave, Mojave NE, Monolith, Mount Adelaide, Oil Center, Oiler Peak, Pinyon Mountain, Piute Peak, Rio Bravo Ranch, Sanborn, Tehachapi NE, Tehachapi North, Tehachapi South, Tejon Hills, Tejon Ranch and Weed Patch, scale 1:24,000

REFERENCES USED IN PREPARING LEGENDS AND MAPS FOR QUATERNARY UNITS

Matti, J. C., and Cossette, P.M., 2007, Classification of surficial materials, Inland Empire Region, southern California: conceptual and operational framework: U.S. Geological Survey, Open-File Report (in progress).

Southern California Areal Mapping Project (SCAMP), 2000, A proposed classification for surficial geologic materials in southern California, version 1.0.

U.S. Geological Survey and California Division of Mines and Geology, 2000, Classification of Quaternary deposits, Southern California Areal Mapping Project (SCAMP), a working model, version 1.0: (09/10/2000).

REFERENCES USED IN PREPARING MAP (see Index for other references)

Amoroso, L., and Miller, D.M., 2006, Preliminary surficial geologic map of the Cuddeback Lake 30' x 60' quadrangle, California: U.S. Geological Survey, Open-File Report OF-2006-1276, scale 1:100,000.

Bartow, J.A., 1981, Geologic map of the Rio Bravo Ranch quadrangle, California: U.S. Geological Survey, Open-File Report 81-152, scale 1:24,000.

Bartow, J.A., 1984, Geologic map and cross sections of the southeastern margin of the San Joaquin Valley, California: U.S. Geological Survey, Miscellaneous Investigations Series I-1496, scale 1:125,000.

Bartow, J.A., 1986a, Geologic map of the Bena quadrangle, California: U.S. Geological Survey, Open-File Report 86-188, Sheets 4 and 5 of 5, scale 1:24,000.

Bartow, J.A., 1986b, Geologic map of the Oil Center quadrangle, California: U.S. Geological Survey, Open-File Report 86-188, Sheets 3 and 5 of 5, scale 1:24,000.

Bartow, J.A. and Dibble, T.W., Jr., 1981a, Geologic map of the Arvin quadrangle, Kern County, California: U.S. Geological Survey, Open-File Report 81-297, Sheet 1 of 2, scale 1:24,000.

Bartow, J.A., and Dibblee, T.W., Jr., 1981b, Geologic map of the Tejon Hills quadrangle, Kern County, California: U.S. Geological Survey, Open-File Report 81-297, Sheet 2 of 2, scale 1:24,000

Bartow, J.A. and Doukas, M.P., 1976a, Geology of the Edison quadrangle: U.S. Geological Survey, Open-File Map 76-592, Sheet 4 of 4, scale 1:24,000

Bartow, J.A. and Doukas, M.P., 1976b, Geology of the Lamont quadrangle: U.S. Geological Survey, Open-File Report 76-592, Sheet 3 of 4, scale 1:24,000.

Bryant, W.A. (compiler), 2005, Digital database of Quaternary and younger faults from the Fault Activity Map of California, version 2.0: California Geological Survey, data amended by revisions in progress, 5/16/11, http://www.conserv.ca.gov/CGS/information/publications /QuaternaryFaults_ver2.htm

California Division of Mines and Geology, 1976, Official maps of Special Studies Zones: Arvin, Bear Mountain, Mojave, Monolith, NE ¼ Mojave, NW ¼ Mojave (Cache Peak), SE ¼ Breckenridge Mountain (Oiler Peak), SW ¼ Breckenridge Mountain (Bena), and Tehachapi South quadrangles, scale 1:24,000.

California Division of Mines and Geology, 1985a, Official map of Special Studies Zones: Edison, Mettler, Oil Center, and Rio Bravo Ranch quadrangles, scale 1:24,000.

California Division of Mines and Geology, 1985b, An explanatory text to accompany the 1:750,000 scale fault and geologic maps of California: California Division of Mines and Geology, Bulletin 201, 197 p., 2 plates.

California Division of Mines and Geology, 1990, Official map of Special Studies Zones: Cinco quadrangle, scale 1:24,000.

Cole, R. C., Gardner, R.A., Koehler, L.F., Anderson, W.O., Bartholomew, O.F., and Retzer, J.L., 1945, Bakersfield area, California: U.S. Department of Agriculture Soil Survey, Series 1937, no. 12, 113 p., scale 63,360.

Dibblee, T.W., Jr., 1959, Preliminary geologic map of the Mojave quadrangle, California: U.S. Geological Survey, Mineral Investigations Field Studies, Map MF-219, scale 1:62,500.

Dibblee, T.W. Jr., and Chesterman, C.W., 1953, Geology of the Breckenridge Mountain quadrangle: California Division of Mines, Bulletin 168, Plate 1, scale 1:62,500.

Dibblee, T.W., Jr., and Louke, G.P., 1970, Geologic map of the Tehachapi quadrangle, Kern County, California: U.S. Geological Survey, Miscellaneous Geologic Investigations, Map I-607, scale 1:62,500.

Dibblee, T.W., Jr., and Minch, J.A., (editor), 2005, Geologic map of the Grapevine/South ½ of Mettler quadrangles, Kern County, California: Dibblee Geological Foundation, Map DF-174, scale 1:24,000.

Dibblee, T.W., Jr., and Minch, J.A., (editor), 2008, Geologic map of the Cross Mountain and Saltdale 15 minute quadrangles, Kern County, California: Dibblee Geological Foundation, Map DF-399, scale 1:62,500.

Dibblee, T.W., Jr. and Warne, A.H., 1970, Geologic map of the Cummings Mountain quadrangle, Kern County, California: U.S. Geological Survey, Miscellaneous Geologic Investigations, Map I-611, scale 1:62,500.

Hoots, H. W., 1929, Geology and oil resources along the southern border of San Joaquin Valley, California: U.S Geological Survey, Bulletin 812-D.

Louke, G. P., 1962–1963, Reconnaissance geologic map of the Emerald Mountain quadrangle: Reconnaissance geologic mapping for the State Geologic Map, unpublished, scale 1:62,500.

Miller, D.M., and Amoroso, L., 2007, Preliminary surficial geology of the Dove Spring Off-Highway Vehicle Open Area, Mojave Desert, California: U.S. Geological Survey, Open-File Report OF-2006-1265, scale 1:15,000.

Ross, D.C., 1989, The metamorphic and plutonic rocks of the southernmost Sierra Nevada, California, and their tectonic framework: U.S. Geological Survey, Professional Paper 1381, 159 p., Plate 1, scale 1:125,000.

Samsel, H.S., 1962, Geology of the southeast quarter of the Cross Mountain quadrangle, Kern County, California: California Division of Mines and Geology, Map Sheet 2, scale 1:39,350.

Smith, A.R., 1964, Geologic map of California, Bakersfield sheet: California Division of Mines and Geology, scale 1:250,000.

Smith, T. C., 1983, Breckenridge Fault, Kern County: California Division of Mines and Geology, Fault Evaluation Report FER-152, 8 p.

Smith, T. C., 1984a, Faults east of Bakersfield, Kern County: California Division of Mines and Geology, Fault Evaluation Report FER-145, 18 p.

Smith, T. C., 1984b, Wheeler Ridge and Pleito Fault Systems, southwestern Kern County: California Division of Mines and Geology, Fault Evaluation Report FER-150.

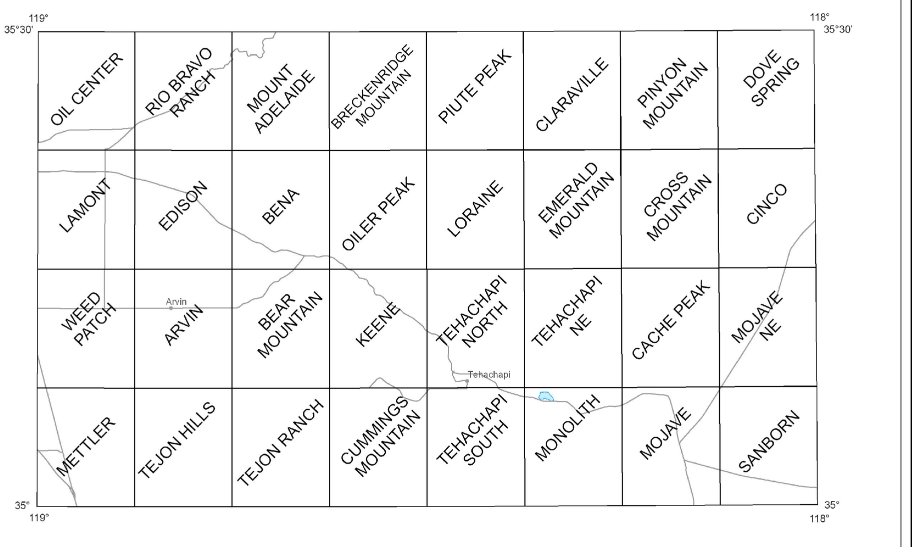
United States Department of Agriculture, Natural Resources Conservation Service, 2009, Soil Survey Geographic (SSURGO) tabular database for Kern County, California, southeastern part: http://SoilDataMart.nrcs.usda.gov/: ca670, 17MUD2_Soil Descriptions.pdf, 193 p.

United States Geological Survey and California Geological Survey, 2011, Quaternary fault and fold database for the United States, accessed September 29, 2011, from USGS website: http://earthquake.usgs.gov/regional/qfaults/

Wills, C.J., 1989, Ground cracks along the Garlock Fault Zone in Fremont Valley, Kern County, California: California Division of Mines and Geology, Fault Evaluation Report FER-197, 7 p.

Zepeda, R. L., 1993, Active tectonics and soil chronology of Wheeler Ridge, southern San Joaquin Valley, California: Ph.D. dissertation, Santa Barbara, University of California, 180 p.

INDEX TO USGS 7.5' QUADRANGLES



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Information on this map is not sufficient to serve as a substitute for the geologic and geotechnical site investigations required under Chapters 7.5 and 7.8 of Division 2 of the California Public Resources Code.