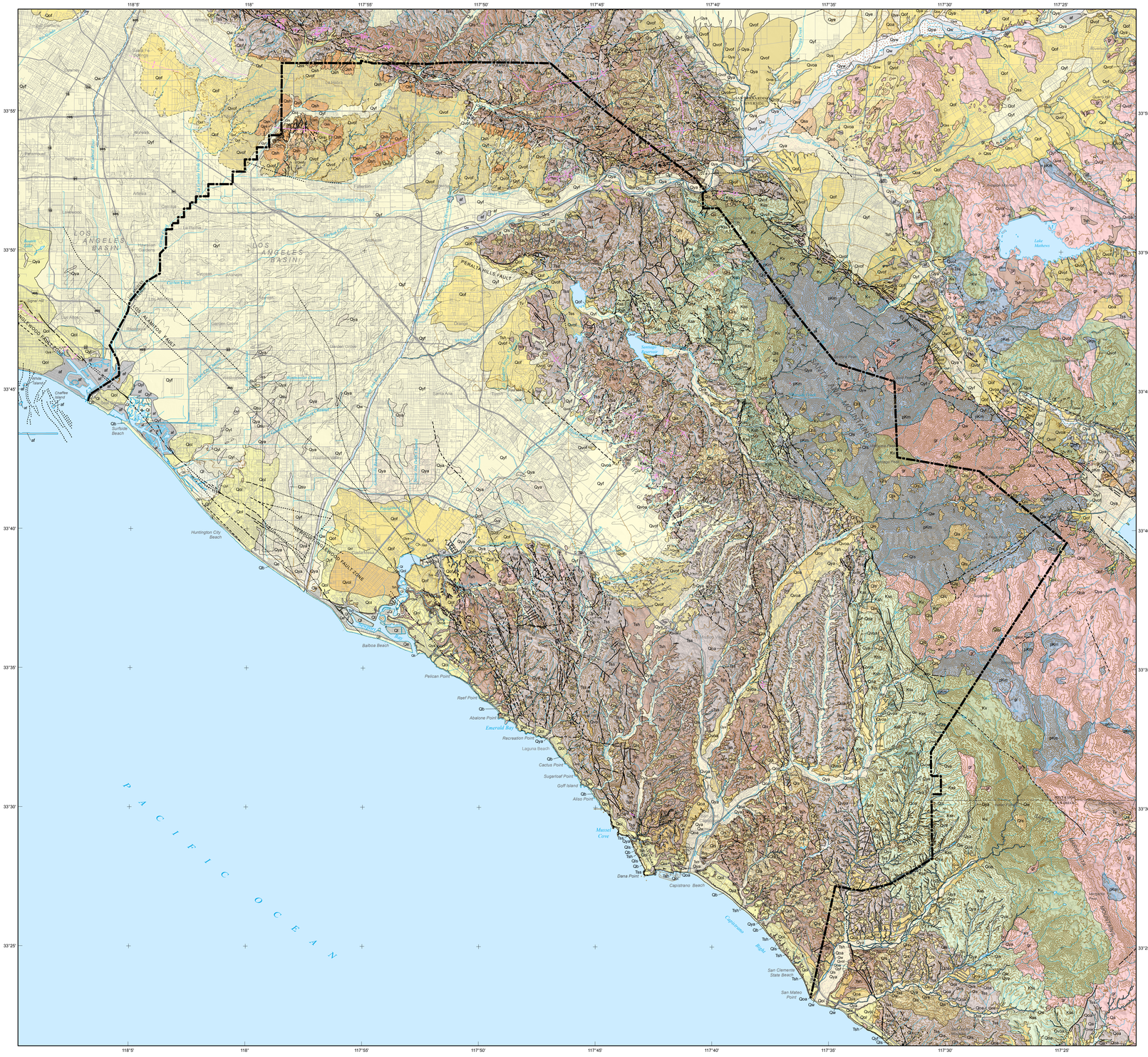



## MAP UNITS

### 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

Qb — **Beach Deposits** - unconsolidated marine beach sediments consisting mostly of fine- and medium-grained, well-sorted sand

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

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/Qf — **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

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)

Qof/Qaf — **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

Qol — **Old Lacustrine, Playa, and Estuarine (Paralic) Deposits** - slightly to moderately consolidated, moderately dissected fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types

### 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

Qvoa — **Very Old Alluvial Valley Deposits** - moderately to well-consolidated, highly dissected clay, silt, sand, and gravel along stream valleys and alluvial flats of larger rivers; generally uplifted and deformed

Qvol — **Very Old Lacustrine, Playa, and Estuarine (Paralic) Deposits** - moderately to well-consolidated, highly dissected fine-grained sand, silt, mud, and clay from lake, playa, and estuarine deposits of various types

### Quaternary (Bedrock)

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

Qsh — **Fine-grained formations of Pleistocene age and younger** - includes fine-grained sandstone, siltstone, mudstone, shale, siliceous and calcareous sediments

### 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)

Kss — **Coarse-grained Cretaceous age formations of sedimentary origin**

Ksh — **Fine-grained Cretaceous age formations of sedimentary origin**

Kv — **Cretaceous age formations of volcanic origin**

pKm — **Cretaceous and pre-Cretaceous metamorphic formations of sedimentary and volcanic origin**

ks — **Serpentinite of all ages**

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.]

Contacts

Contact

Reference contact -- Used to delineate geologic units that were mapped as separate units on the original source map, but are consolidated on this map.

Fault -- Includes strike-slip, normal, reverse, oblique, and unspecified slip

Folds -- Showing direction of plunge where appropriate

Anticline

Overturned anticline

Syncline

Overturned syncline

Dike

Stream

Spring

Road

Orange County boundary

Other county boundary

## MAP EXPLANATION

This map of Quaternary surficial deposits in Orange County was compiled 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 in 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

This 100,000 scale map of Orange County was derived from the detailed Geographic Information System (GIS) based geologic data set compiled by CGS from recent high resolution geologic mapping available for southern California. The GIS database merges more than 2100 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). 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 California Division of Mines and Geology (2000). While specific variations in age and physical properties exist within units on each source map, CGS retained the basic premise of Matti and Cossette (2007) that surficial deposits within each of the Quaternary derivative map units formed during a particular range of geologic time, have a similar origin, and have generally similar physical properties. Within the 28 derivative 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 from the source geologic maps are divided into 12 categories on the derivative maps, based on age and rock type. CGS rectified inconsistencies along the boundaries of mapped areas to create a seamless Derivative GIS Database, but retained links to the original mapping in the Source GIS Database so that the more detailed basic geologic information can be retrieved. 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.

### Orange County

Orange County lies within the northwestern part of the Peninsular Ranges Province. The northwest third of the county consists of low-relief coastal plains of the southern Los Angeles Basin, while the remaining two thirds are dominated by hilly and mountainous terrain. Areas of low relief are densely populated and/or rapidly urbanizing. When seasonal wildfires in the area are followed by heavy rainfall, devastating debris flows and debris laden floods may occur. The Santa Ana River flows through the northern third of the county. Most Quaternary fluvial-related surficial deposits in the quadrangle originated in the drainage basin of the Santa Ana River (Morton, 2004). Smaller alluvial fans border the west side of the Santa Ana Mountains south of the Santa Ana River and Santiago Creek. Young alluvial valley deposits along Trabuco Arroyo and San Juan Creek, in the southern part of the county, are also subject to flooding, deposition, and erosion.

In preparing this derivative map of Orange County, CGS used geologic source data compiled in digital format by Kennedy and others (2007), Morton and Miller (2006), and Saucedo and others (2009). CGS retained the boundaries of Quaternary age surficial deposits shown on the source maps with very few revisions. Quaternary surficial deposits on the source maps are represented on this map by 21 of the 28 generalized project derivative units; boundaries of more detailed source map subdivisions are shown without label within the generalized derivative unit. This indicates more detailed geologic information is available in the Source GIS Database. For example, an area designated Qyf (young alluvial fan) on this map may have been further divided on the source map as Qyf1, Qyf2 and Qyf3 to distinguish different depositional surfaces and compositions. Bedrock units identified on the source maps are represented on this map by 11 of the 12 project derivative bedrock units (see Map Units and Correlation of Map Units). Quaternary surficial deposits and geologic formation names on the source maps are correlated with derivative categories used by CGS in the Geologic Labels GIS spreadsheets for the Long Beach, Santa Ana, and Oceanside 30´x 60´quadrangles.

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

DIGITAL GEOLOGIC DATA FILES USED IN GIS COMPILATION OF QUATERNARY UNITS

Kennedy, M.P., and Tan, S.S., 2007, Geologic map of the Oceanside 30´x 60´ quadrangle, California: http://conservation.ca.gov/cgs/rghm/rgm/Pages/preliminary_geologic_maps.aspx: California Geological Survey, Regional Geologic Map No. 2, scale 1:100,000.

Morton, D.M. and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30´ x 60´ quadrangles, California: A digital database, http://ngmdb.usgs.gov/Prodesc/proddesc_76686.htm: U.S. Geological Survey, Open-File Report 06-1217, scale 1:100,000.

Saucedo, G.J., Greene, H.G., Kennedy, M.P., and Bezore, S.P., 2009 (in progress), Geologic map of the Long Beach 30´ x 60´ quadrangle, California: http://conservation.ca.gov/cgs/rghm/rgm/Pages/preliminary_geologic_maps.aspx: California Geological Survey, Preliminary Geologic Map, scale 1:100,000.

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).

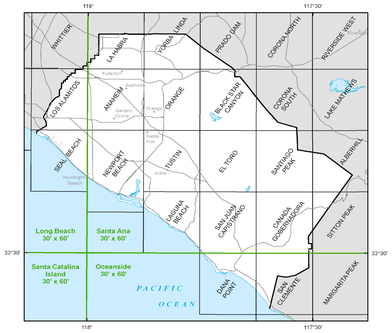
Southern California Areal Mapping Project (SCAMP), 2000, A proposed classification for surficial geologic materials in southern California, version 1.0.

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).

OTHER REFERENCES CITED

Morton, D.M., 2004, Preliminary digital geologic map of the Santa Ana 30´ x 60´ quadrangle, southern California, version 2.0: U.S. Geological Survey, Open-File Report 99-172.

## INDEX TO USGS 7.5' QUADRANGLES




## CORRELATION OF MAP UNITS*

| | Artificial Fill | Undiff. Surficial Deposits | Landslide Deposits | Beach Deposits | Alluvial Wash Deposits | Alluvial Fan Deposits | Alluvial Valley Deposits | Lacustrine, Playa, and Estuarine Deposits | Eolian and Dune Deposits |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Alluvial Deposits | | | | |
| Quaternary Surficial Deposits: Late Holocene | af | Qsu | Qls | Qb | Qw | Qf | Qa | Ql | Qe |
| Holocene to Late Pleistocene | | | | | Qyw/Qf | Qyf | Qya | Qyl | Qye |
| Late to Middle Pleistocene | | | | | Qaf/Qf | Qof | Qoa | Qol | |
| Middle to Early Pleistocene | | | | | | Qvof | Qvoa | Qvol | |

| | Coarse-grained | Fine-grained | Volcanic | Cretaceous and Pre-Cretaceous Metamorphic (sedimentary and volcanic) | Serpentinite (all ages) | Granitic Rocks (all ages) |
|---|---|---|---|---|---|---|
| Quaternary (Bedrock) | Qss | Qsh | | | | |
| Tertiary (Bedrock) | Tss | Tsh | Tv | | | |
| Mesozoic and Older (Bedrock) | Kss | Ksh | Kv | pKm | ks | gr |

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

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).

# GEOLOGIC COMPILATION OF QUATERNARY SURFICIAL DEPOSITS IN SOUTHERN CALIFORNIA
# ORANGE COUNTY

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

Compiled from existing sources by
Trinda L. Bedrossian, CEG and Peter D. Roffers

Digital preparation by
Solomon McCrea, Barbara Wanish and Jim Thompson

July 2010

SCALE 1:100 000

5 2.5 0 5 MILES

5000 0 5000 10000 15000 20000 25000 30000 35000 40000 45000 50000 FEET

5 2.5 0 5 10 KILOMETERS

5000 0 5000 10000 METERS

CONTOUR INTERVAL 50 METERS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

MAP LOCATION

APPROXIMATE MEAN DECLINATION, 2010

www.conservation.ca.gov/cgs

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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.