

**Landslide Inventory Map of the San Jose West Quadrangle  
Santa Clara County, California**  
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**Map Explanation**

**PURPOSE OF THIS MAP AND METHOD OF PREPARATION**

This map presents an inventory of existing landslides in the San Jose West Quadrangle that was prepared as a part of the Seismic Hazard Zonation Program at the California Geological Survey (CGS). The landslide inventory was one of the essential data layers used to delineate earthquake-induced landslide zones of required investigation in the San Jose West Quadrangle (Slater and Aue, 2002). Because of its regulatory status, the Seismic Hazard Zone Map had a public review period and a date on which it became official. Unlike the zone map, this landslide inventory is not regulatory and revisions are allowed when new information regarding landslides is found. Therefore, it is possible that landslides shown on this map were not known when the zone map was prepared in 2002. In addition, new landslides identified after this map is published are likely to be included in later versions of this inventory. Ultimately, the landslides added to this and future inventory maps will be evaluated for inclusion in future revisions to the Seismic Hazard Zone Map.

The inventory map was prepared primarily by geomorphic analysis and interpretation of aerial photographs (the photographs used are listed in the References), and secondarily by field reconnaissance, interpretation of topographic map contours and review of previously published and unpublished geologic and landslide mapping. Landslides identified by these methods were digitally compiled at a scale of 1:24,000 on the U.S. Geological Survey topographic map and a number of characteristics (attributes) were recorded in an associated database. Several key characteristics have been extracted from the database and assigned symbology for visual representation on the map, as described below.

This landslide inventory map is intended to provide users with basic information regarding past occurrences of landslides within the San Jose West Quadrangle. The geologic, terrain and climatic conditions that led to slope failures in the past may provide clues to the locations and conditions of future slope failures, and it is hoped that this map will provide useful information to guide site-specific investigations for future developments.

**LANDSLIDE CLASSIFICATION**

Each landslide shown on this map has been classified according to a number of specific characteristics identified at the time of its interpretation and recorded in a database. The classification scheme was developed by the California Geological Survey based on the terminology of Varnes (1978), Keaton and DeGraff (1996), Cruden and Varnes (1996), and Wieczorek (1994). Several significant landslide characteristics recorded in the database are portrayed with symbology on this map. The specific characteristics shown for each landslide are the activity or recency of landsliding, geologic material type that moved, type of landslide movement, direction of movement, and confidence of landslide interpretation. The symbology used to display these characteristics is explained below.

**LANDSLIDE ACTIVITY:** Each landslide has been classified according to how recently the landslide last moved. Because evidence of active or historic landslide movement is difficult to obtain from air photo interpretation, the primary tool employed in making this map, classification typically is inferred from the youthfulness of observed landslide geomorphic characteristics (see "Limitations" below). The classification of landslide activity is based on the system described by Keaton and DeGraff (1996, Table 9-1). This map display uses color to show the activity.

- ACTIVE or HISTORIC:**  
The landslide appears to be currently moving (at the time the aerial photograph was taken or field observation occurred) or to have moved within historic time.
- DORMANT - YOUNG:**  
The observed landforms related to the landslide are fresh or un-eroded, but there is no evidence of historic movement.
- DORMANT - MATURE:**  
The observed landforms related to the landslide have been smoothed and subdued by erosion and vegetation.
- DORMANT - OLD:**  
The observed landforms related to the landslide have been greatly eroded, including significant gullies or canyons cut into the landslide mass and/or main scarp by small streams.

**LANDSLIDE MATERIALS TYPES AND MOVEMENT:** A two-part classification that records type of landslide material and type of landslide movement is displayed by arrow style. Material types recorded are either rock or soil, and soil is further subdivided into "earth" or "debris" on the basis of predominant particle grain size. There are five categories of landslide movement types: slide, flow, fall, topple and spread. These movement types are combined with material type to form the landslide classification. Not all combinations are common in nature, and only those that are recognized in the San Jose West Quadrangle are included here.

**ROCK SLIDE:**  
A landslide involving bedrock in which the rock that moves remains largely intact for at least a portion of the movement. Rock slides can range in size from small and thin to very large and thick, and are subject to a wide range of triggering mechanisms. The sliding occurs at the base of the rock mass along one to several relatively thin zones of weakness, which are variably referred to in engineering geology reports and literature as "slide planes," "shear surfaces," "slip-surfaces," "rupture surfaces," or "failure surfaces." The sliding surfaces may be curved or planar in shape. Rock slides with curved sliding surfaces are commonly called "slumps" or "rotational slides," while those with planar failure surfaces are commonly called "translational slides," "block slides," or "block glides." Rock slides that occur on intersecting planar surfaces are commonly called "wedge failures."

**CONFIDENCE OF INTERPRETATION:** Each landslide is classified according to a "confidence" that the geologic interpreter assigns to it, and can be regarded as a measure of the likelihood that the landslide actually exists. Landslides are mapped on the basis of characteristic landforms, and the confidence of interpretation is based on the distinctness of those landforms. As a landslide ages after its last movement, erosional processes remove or cover the landforms that formed by landsliding. With time, these distinctive landforms become so subtle that they resemble landforms produced by geologic processes and conditions unrelated to landsliding. The visual display of this landslide characteristic is through the use of different line styles.

- DEFINITE:**  
Landslide exhibits many of the diagnostic landforms, including, but not limited to, prominent scarps, open cracks, rounded toes, offset streams, well-defined mid-slope benches, closed depressions, springs, and irregular or hummocky topography, or has clear records of prehistoric, historic or ongoing activity from reports, aerial photography or instrumental monitoring.
- PROBABLE:**  
Landslide exhibits several of the diagnostic landforms commonly associated with slope movement. These landforms may be modified by erosion or obscured by vegetation such that other explanations are possible. However the preponderance of evidence strongly suggests that a landslide does exist.
- QUESTIONABLE:**  
Landslide exhibits only one or a few of the diagnostic landforms associated with slope movement. The landforms may be heavily modified by erosion, altered by grading, obscured by dense vegetation, or formed by other geologic processes such as differential erosion of lithologic and structural features in the underlying bedrock.

**GEOLOGY AND LANDSLIDES IN THE SAN JOSE WEST QUADRANGLE**

The San Jose West 7.5-minute Quadrangle covers approximately 155 square kilometers (~60 square miles) in northwestern Santa Clara County. Most of the map area is occupied by the gently sloping floor of the Santa Clara Valley. The valley floor is heavily urbanized and is drained by several creeks that flow north to San Francisco Bay. A small hilly area is present on the southwest part of the quadrangle, rising to an elevation of about 200 feet above the valley floor. This hilly area is at the edge of the Santa Cruz Mountains.

The majority of the map area is underlain by Quaternary-age alluvium deposited on the floor of the Santa Clara Valley (Wentworth and others, 1999). There are no mapped landslides in these deposits although there may be small unmapped landslides locally present along steep creek banks on the valley floor. The hills in the southwestern part of the quadrangle are underlain by the non-marine Plio-Pleistocene Santa Clara Formation. This unit consists of weakly consolidated boulder to pebble conglomerate, sandstone, siltstone and thin-bedded lacustrine mudstone. All of the mapped landslides in the map area occur in the hills underlain by the Santa Clara Formation. Most of these slides are on slopes adjacent to streams with steep stream banks that have eroded downward into the Santa Clara Formation beds. At the eastern edge of the quadrangle, there is a small area with serpentinite exposed at the surface. This area has little relief and there are no mapped landslides in the exposed serpentinite.

Seismic Hazard Zone Report 058 provides a more detailed discussion of geology and landslides in the San Jose West Quadrangle and also includes a list of pertinent geologic references. This report can be downloaded from CGS's website at <http://www.conservacion.ca.gov/cgs/shzp/Pages/Index.aspx>

**LIMITATIONS**

The landslides shown on this map were interpreted from small- to intermediate-scale aerial photography (1:40,000- to 1:24,000-scales) and were then located on a 1:24,000-scale topographic map. Identifying landslides smaller than about 50 meters (~200 feet) in maximum dimension is often difficult at these photo scales, and accurately locating them on the topographic base map can present additional challenges. Debris flows, in particular, often fall into this size category. As a result, landslides this size or smaller are not routinely included in the landslide inventories. CGS sometimes includes small landslides if they are provided by a local governmental agency, a site- or area-specific study report, or a local area landslide expert, and found to be accurately located. However, it should be noted that when displayed at a scale of 1:24,000 such as on this map, small landslides are often indistinguishable from features on the base map.

It can be expected that the geological interpreter will not recognize some landslides as a result of air photo quality, scale, vintage, sun angle, vegetation, cloud cover, or other characteristics. The geologist's experience level and experience with landslides in the immediate area also play a role in the quality of the inventory map. CGS addresses these problems by having the geologist interpret multiple sets of aerial photographs, review previously prepared maps, visit areas of suspected landsliding, and by incorporating an internal peer review process.

Landslide activity is a relative expression of geomorphic youthfulness highly dependent upon the local geologic and climatic environment. For example, landslides in arid regions that appear to have recently moved actually may be quite old. Conversely, landslides in more humid environments that might be classified as "dormant-old" can sometimes be shown to be actively or intermittently moving. The geomorphic expressions of landslide activity described on this map should never be used as a substitute for landslide-specific field investigations.

Earthworks related to development on hillsides usually remove the geomorphic expressions of past landsliding, which can result in landslides being missed in the inventory. This limitation can sometimes be addressed by viewing aerial photographs that pre-date development. However, because CGS does not review or monitor grading practices to ensure that past slope failures have been adequately mitigated, slope failures identified on the pre-development photographs are included in the landslide inventory, whether or not surface expression currently exists.

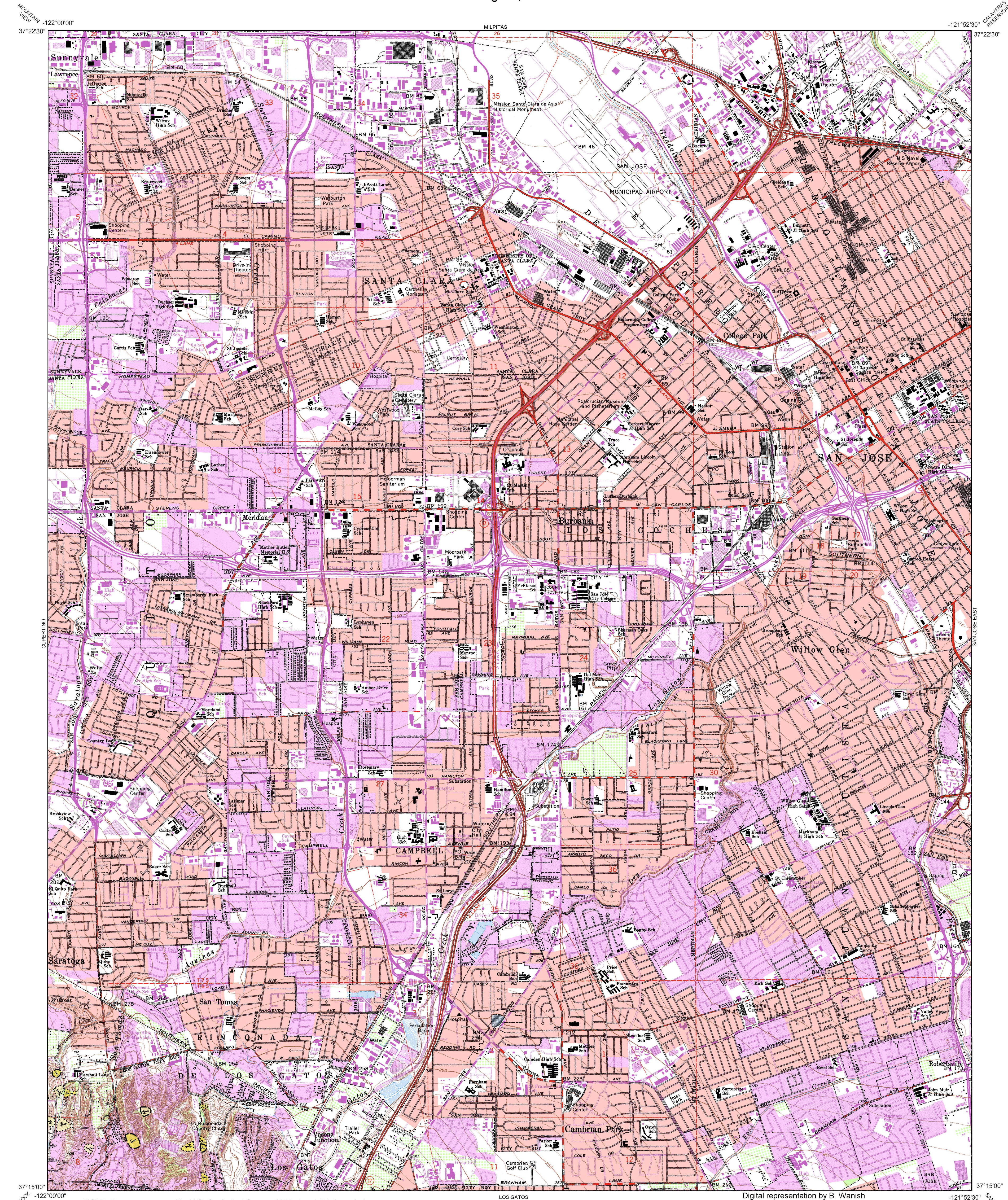
One difference between the landslides shown on this map and those shown on a geologic map lies in the treatment of the main scarps or landslide source areas associated with slope failures. Geologic maps show landslide deposits; landslide scarps are not included with the landslide, but rather with the underlying geologic materials. This map, in contrast, includes scarp areas associated with the landslide deposits because these areas are considered prone to future slope failures.

**ACKNOWLEDGEMENTS**

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**REFERENCES**

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- Wieczorek, G. F., 1994, Preparing a detailed landslide-inventory map for hazard evaluation and reduction: Bulletin of the Association of Engineering Geologists, Vol. 21, No. 3, pp. 337-342.
- AIR PHOTOS**
- United States Department of Agriculture (USDA) dated 7-31-39, photos CIV 286-18 through 20, approximate scale 1:28,000.
- WAC Corporation, Inc. dated 4-13-99, photos WAC-C-99CA, 2-70 through 73, and 2-134 through 137, approximate scale 1:24,000.



NOTE: Basemap prepared by U.S. Geological Survey, 1980. Landslide boundaries may reflect updated digital topographic information that can differ significantly from the contours shown on this map. For basemap legend information see: <http://permanent.access.gpo.gov/web sites/erg.usgs.gov/usb/pubs/booklets/symbols/>

SCALE 1:24,000  
0 0.5 1.0 1.5 Miles  
0 2000 4000 6000 Feet  
0 0.5 1.0 1.5 Kilometers  
Contour interval = 5 feet

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