

**DEPARTMENT OF CONSERVATION**

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DIVISION OF MINES AND GEOLOGY  
DIVISION OF OIL, GAS AND GEOTHERMAL RESOURCES  
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DEPARTMENT OF CONSERVATION,  
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1998 LANDSLIDE INVENTORY

The following information was compiled by Trinda Bedrossian and Rinda Etzold from various reports of landslides received by the Department of Conservation (DOC) Division of Mines and Geology (DMG) from the Governor's Office of Emergency Services (OES), the U.S. Geological Survey (USGS), the California Department of Forestry and Fire Protection, (CDF) and others between February 3 and April 30, 1998.

1. **Rio Nido, Sonoma County** (OES Mission #98-CST7172). On 02/07 a large landslide failed along the Russian River at Canyon Three near Sweetwater Springs Road. The slide was a rotational failure near the ridgetop that split downslope into debris flows affecting houses at the base of two canyons. DMG concluded that deep tension cracks in the source area indicate additional material could fail, putting approximately 200 people at risk. Also, if material fails all at once, a landslide dam could form, causing flooding upstream. DMG provided information used by the county in the evacuation of residents and development of access (re-entry) plans; DMG also recommended monitoring of the slide and retention of a consulting engineering geologist to evaluate on-going conditions at the site. The preliminary report prepared by DMG geologist Wayne Haydon was released on 02/09 and the final report was released on 03/09. On 02/07 six houses slid down a hillside near the Russian River in Sonoma County; 300 other homes were evacuated (Siang Tan, DMG, 02/11).

2. **Clear Lake Oaks, Lake County** (OES Mission #98-CST7200). On 02/10 DMG evaluated two houses in danger of collapsing onto Highway 20, five earthfilled dams, and two damaged roads in the vicinity of Clear Lake. DMG made recommendations regarding removal of one structure, installation of drainage measures on two others under direction of a consultant, drainage of two dams as proposed by Caltrans engineers, and monitoring and removal of debris from the road failures. The report prepared by DMG geologist Mike Manson was released 03/09.

3. **Richmond, Contra Costa County** (OES Mission #98-CST7204). On 02/10 DMG evaluated a cutslope failure, about 80 feet wide and extending about 60 feet south, above Wildcat Creek Road between Highway 80 and Richmond, affecting access to about 25 homes. DMG determined there was no imminent danger to homes upslope from the failure and recommended the private landowners hire a consultant to design measures for de-watering the slide. A report prepared by DMG geologist Chris Wills was released 03/09.

#### 4. **Morro Bay/Pismo Beach, San Luis Obispo County** (OES Mission #98-SOU6106).

A. **Morro Bay.** On 02/12 DMG evaluated reactivation of two landslides that failed in 1995. Approximately 25 houses were built on the toe of one slide, and 15 houses were adjacent to the toe of the other. An underground water pipeline crosses both landslides. DMG concluded that no immediate risk or emergency was evident; however, potential debris flow and earthflow activity could impact the road and several residences during intense rainfall of long duration. DMG recommended a consultant be retained to evaluate existing data, including monitoring and mitigation being conducted by upslope owners. A report prepared by DMG geologist Siang Tan was released on 02/23. Reactivated landslides from 1995 storms affected 34 homes, with seven to eight damaged (USGS Website, 02/26).

B. **Pismo Beach.** On 02/12 five coastal bluff failures affecting city roads were evaluated by DMG for potential threat to pedestrians and residences. Increased sea wave erosion, surface water erosion, and urban irrigation contributed to these failures. DMG discussed feasible mitigations with city engineers. A report prepared by DMG geologist Siang Tan was released 03/09.

5. **Laguna Beach, Orange County** (OES Mission #98-SOU6117). On 02/24 DMG evaluated artificial fill pad erosion downslope from Top of the World School. The school is set back about 30 feet from the edge of the fill. Erosion of silty sand caused deep gullies where an engineered fill drain had failed. DMG determined there was no imminent danger to the building from landsliding; however, continued erosion of the fill could result in potential landsliding if not properly mitigated. The school's consultant was also on site. A report prepared by DMG geologist Russell Miller was released 03/17.

6. **Fitch Mountain, Sonoma County** (OES Mission #98-CST7243). On 02/21 DMG evaluated a landslide affecting two homes on North Fitch Road near Healdsburg; 60 additional homes were originally thought to be in potential danger. DMG determined that a small slide on the north side of the mountain had liquefied at the toe and had moved downslope onto the road near the two houses; the road did not appear to be impacted by the slide plane. DMG recommended debris be periodically cleared from the road and from behind barriers around the homes made from sand bags and K-rails, and that landowners hire a consultant for longer-term mitigation. A report prepared by DMG geologist Wayne Haydon was released 03/23.

7. **Big Lagoon, Humboldt County** (OES Mission #98-CST7235). On 02/16 DMG evaluated cliff erosion affecting three houses in the Big Lagoon area near Agate Beach, where high energy El Niño storms and seasonally high tides eroded the cliff face at an accelerated rate. The county yellow- and red-tagged several structures. DMG recommended retaining a licensed consultant with experience in coastal erosion to assist in developing formal tagging distances for existing residences. A report prepared by DMG geologist Jim Falls was released 03/23.

8. **Weott, Humboldt County** (OES Mission #98-CST7252). On 02/23 DMG evaluated two landslides along access roads to a sewer treatment facility and city water tank/repeater phone sites. DMG made recommendations as to repairs to be considered. A report prepared by DMG geologist Jim Falls was released 03/12.

9. **Santa Cruz County** overflight (OES Mission #98-CST7255). On 02/24 DMG participated with the OES, USGS, and county staff in an overflight of eight significant landslides and multiple others of concern to the county. One large landslide blocked Eureka Canyon isolating 500 local residents. Debris flow failures were observed in the northern part of county. Larger, deep-seated failures occurred in the mid and southern parts of the county; however, Eureka Canyon was not visible due to fog and bad weather. A report by DMG geologist Tom Spittler was released on 04/30. On 02/25 more than 50 homes were seriously damaged by debris flows and seven homes due to deep-seated landslides (Joe Hanna, Santa Cruz County geologist).

10. **City of Napa, Napa County** (OES Mission #98-CST7256). On 02/24 DMG reviewed three landslides impacting four homes and two county roads providing critical access to remote communities. On 03/11 DMG responded to an additional request to evaluate landsliding affecting a house along Sage Canyon Road and Highway 128, east of Lake Hennessey. A report by DMG geologist Mike Manson was released 04/03.

11. **City of Vallejo, Solano County** (OES Mission #98-CST7263). On 02/10 DMG evaluated a large section of hillside overlooking the Sandy Beach area that developed a large crack and several smaller slides with potential to impact approximately 40 homes at the base of the hill. DMG determined that only two homes were likely to be affected by near-future movement of talus materials at the base of the slope. A report by DMG geologist Chris Wills was released 03/20.

12. **City of San Bruno, San Mateo County** (OES Mission # 98-CST7266). On 02/13 DMG received a request for assistance in evaluating numerous failures in San Mateo County. On 03/12 DMG evaluated debris flows that were undermining structures and public property in three areas that continue to experience debris flow movement, creep, and slippage. The Crestmore Drive slide involves the backyards of homes on Crestmore Drive and Madison Avenue and a city-owned parcel. The Crestmore Canyon area includes several small slides which endanger houses or yards at the top of the surrounding slopes, with the potential to become larger and more damaging, similar to what has occurred at the Crestmore Drive slide. A report by DMG geologist Chris Wills was released 04/08.

13. **City of Fremont, Alameda County** (OES Mission # 98-CST7267). On 04/07 DMG received a request to assist the City of Fremont with mapping and evaluation of the Mission Peak landslide. This is a large complex landslide, 1,000 feet wide by 4,000 feet long, with portions that might be several hundred feet deep, and 40 to 70 feet deep in the toe area. The apparent lower toe was uplifting one to 1.5 feet per day and moving four feet horizontally on 03/27. Properties on Grapevine Terrace, Rutherford Place, Rutherford Court, and possibly Vista Del Sol may be affected by the slide. The

slide is too large to determine the immediate threat without evaluation. An initial report on the slide was prepared on 04/08 by DMG geologist John Schlosser who was assigned to this project under the direction of the city's consultant. A final report was released 05/20.

14. **Laguna Beach, Orange County** (OES Mission #98-SOU6123). On 03/23 OES requested technical assistance on the geologic analysis of slopes that are in continued threat of mudslides and landslides, for preliminary determination of potential slope movement and mitigation suggestions. A report prepared by DMG geologist Siang Tan was released 04/17. On 12/06/97 three beach-side homes were evacuated and 20 others were severely damaged (Tan, DMG, 02/11). On 02/17 a hill slipped and sent boulders tumbling toward a restaurant (Tan, DMG, 02/19). On 02/22 Laguna Canyon Road was closed due to mudslides (Tan, DMG, 03/05). On 02/23 in Canyon Acres, a home partially collapsed under a slide, and part of a bungalow on Victory Walk was crushed. Other slide areas include Laguna Canyon Road, Bluebird Canyon Drive, and a trailer park near Aliso Pier (Tan, DMG, 03/05). On 02/24 the rainfall forced 550 people from their homes. A wall of mud roared down hillsides, killed one man, injured nine people, and destroyed four homes in the Castle Rock community. One man was killed when a mudslide slammed into his cottage on Victory Walk. On Canyon Acres Drive, three houses were destroyed and five others damaged. Damaged houses were reported in Laguna Canyon Road. A total of at least 14 homes and several businesses were destroyed (Tan, DMG, 03/05). A wall of mud in Laguna Beach Canyon killed one person and injured 10, two homes were damaged, and eight homes were evacuated (Gerry Wiczorek, USGS, 02/24). On 02/26 city officials alerted the residents of 25 canyon homes that their properties might be unsafe based on a city-hired geologist investigation (Tan, DMG, 03/05).

15. **Laguna Niguel, Orange County**. On 12/05/97 the storm increased movement on a landslide in Laguna Niguel and damaged five condominiums which were abandoned (Siang Tan, DMG, 02/11). On 03/18 a crumbling hillside threatened to destroy at least 14 homes in Laguna Niguel. For at least five years, the 125 feet high slope has slowly slipped. The storms in December accelerated its movement and forced the evacuation of five homes at the top of the slope on Via Estoril Drive and five condominiums at the bottom of San Felipe Drive; additionally, four condominiums were threatened. The backyard of one of the Via Estoril homes dropped up to five feet (Tan, DMG, 04/02). On 03/19 two houses on Via Estoril collapsed. Seven more houses at the same street were threatened and evacuated; twelve condominiums were damaged and nine more evacuated (Tan, DMG, 04/02). On 03/20 a third home on Via Estoril toppled down the headscarp of the landslide (Tan, DMG, 04/02). On 03/24 DMG received one other report from the USGS of continued movement on the Laguna Niguel landslide where at least 10 condos were evacuated and five were destroyed. On 03/29 a fourth house, adjacent to the other three collapsed homes on Via Estoril, split in half and plunged into the graben of the slide (Tan, DMG, 04/02).

16. **Various locations, Orange County.** On 12/06 floods and mudslides were reported in Costa Mesa, Irvine, Lake Forest, San Juan Capistrano, and Laguna Beach. Mudslides occurred in Black Star, Baker, and Santiago Canyons. Many road closures were reported along the Santa Ana Freeway at Laguna Freeway, Laguna Canyon Road, Pacific Coast Highway in Newport Beach, and in Huntington Beach (Siang Tan, DMG, 02/11). On 02/17 runoff undermined sections of Santiago Road in Orange County (Tan, DMG, 02/19). On 02/23 the storm forced the evacuation of eight to 10 residents in Holy Jim Canyon near the Orange-Riverside County line; a half-dozen other residents declined to evacuate despite the growing slide threat (Tan, DMG, 03/05).

17. **City of Orange, Orange County.** On 12/23 movement of an active landslide in the Anaheim Hills accelerated. The landslide, which is located within a DMG mapped landslide area (Siang Tan, DMG OFR 95-11), has been active for the past two years. This "Vista Summit Way" landslide damaged two or three houses and affected three city blocks. The engineer with the City of Orange has been in contact with DMG concerning this matter (Tan, DMG, 02/19).

18. **Silverado Canyon, Orange County.** On 12/06 four homes were condemned and evacuated due to a mudslide and rockfall (Siang Tan, DMG, 02/11). On 02/23 one home was endangered in Silverado Canyon (Tan, DMG, 03/05).

19. **Modjeska Canyon, Orange County.** On 02/23 at least one house was damaged by mud (Siang Tan, DMG, 03/05).

20. **San Francisco, San Francisco County.** On 01/18 a small car was caught in a huge sinkhole on John Muir Drive in San Francisco. Blocked sewers caused flooding, which caused the road to collapse. The latest storm caused widespread power outages, downed trees, and flooded roads (*The Davis Enterprise*, 01/19). On 02/12 a slipping hillside was reported in San Francisco's Sea Cliff neighborhood (Siang Tan, DMG, 02/19). On 03/03 mudslides near Mt. Davidson (Mira Loma Park area) resulted from poor drainage of city pipes upslope from failures; a retaining wall constructed after 1995 and 1997 failures failed again (Pam Dickey, San Francisco resident). A Bay View Hill landslide occurred near Candlestick Park (Bob Schuster, Jeff Coe, and Dave Howell, USGS, 03/13, personal communication).

21. **Oakland Hills, Alameda County.** Between 02/02 and 02/07 three homes were affected by slides. In addition, numerous small slides blocked roads along the coast in both northern and southern California (Trinda Bedrossian, DMG, 02/05). On 02/25 a dramatic landslide in the Oakland Hills destroyed two homes. Seven homes were red-tagged, an additional seven homes were yellow-tagged, and 11 others were monitored for potential trouble (USGS Website, 02/26).

22. **San Francisco Bay Region.** Recent debris flows were observed in the eastern part of the region from Niles to Oakland. Deep-seated landslides in the area from Daly City to Moss Beach moved (Gerry Wiczorek, USGS, 02/25). A few newly initiated

debris flows and several others reported earlier show signs of recent activity (USGS Website, 03/12).

23. **Mill Valley, Marin County.** On 02/02 two homes were affected by slides (Trinda Bedrossian, DMG, 02/05).

24. **Highway 50, El Dorado County.** Highway 50 was blocked for about 12 hours by a cutbank failure. The failure, about 50 feet wide and 25 feet high, was of outer surface sloughing from pore water pressure. The failure was located just west of the active Whitehall landslide being monitored by USGS and Caltrans. The Cleveland Corral landslide continued to move and erosion occurred on the Mill Creek slide (Ken Cole, Caltrans). A landslide previously reported along Highway 50 between Twin Bridges and Sly Park was a snow avalanche (Gerry Wieczorek, USGS, 02/25).

25. **San Mateo County.** On 02/03, the northern California storm was blamed for one death in San Mateo County (Siang Tan, DMG, 02/11). On 02/10 a landslide on park lands threatened a home in Montara near Montara Beach (Len Miller, OES). On 02/24 Devil's slide failed along Highway 1 south of the 1995 failure (Channel 3 News, 02/28). On 02/26 a landslide in San Mateo County threatened a 96-inch Hetch Hetchy pipe that provides water to San Francisco. San Francisco Water Department is monitoring the slide; the pipe may need to be relocated (Gerry Wieczorek and Randy Jibson, USGS, 02/26).

26. **Bodega Bay, Sonoma County.** On 02/05 high waves and wind-blown rains took a toll on the bluffs above Gleason's Beach where several homes were in danger of sliding into the surf. All of the residents were evacuated (*The Davis Enterprise*, 02/05). On 02/11 heavy rains continued to trigger landslides in both northern and southern California. Numerous homes were impacted along the Sonoma County coastline at Gleason's Beach north of Bodega Bay and in Monte Rio (Trinda Bedrossian, DMG, 02/11).

27. **Los Angeles, Los Angeles County.** On 02/06, mud crashed into an apartment building in Westlake area after the storm toppled a 15-foot retaining wall; more than 100 residents were evacuated. Water swept across Pacific Coast Highway and the Ventura, Harbor, and Santa Ana Freeways (Siang Tan, DMG, 02/11). On 02/13 a home in Los Feliz was declared unsafe because rains had eroded its foundation (Tan, DMG, 02/19). On 03/01 a slide rumbled down a slope and flattened a house in the 3900 block of Eureka Drive in Studio City, pushing it into a backyard swimming pool. The houses on both sides of the pancaked house were yellow-tagged. The slope failure left four other homes (on Laurie Drive) perched precariously at the edge of an abyss. The residents left the destroyed house after the City of Los Angeles red-tagged the structure as a precaution (Tan, DMG, 03/05). On 03/01 a moderate-size landslide cascaded from a steep slope in Studio City and destroyed a house and several cars. The house had been evacuated due to concerns about the stability of the slope. This slide occurred more than five days after the rain stopped and illustrates the problem of delayed triggering of deeper landslides (Sue Cannon, USGS, 03/02). On 03/01 in the San Fernando Valley, the City of Los Angeles red- or yellow-tagged about 50 dwellings

in danger of mudslide hazard in recent weeks, mostly along the slopes of the Santa Monica Mountains (Tan, DMG, 03/05).

28. **Newport Beach, Orange County.** On 02/06 a mudslide crushed two cars (Siang Tan, DMG, 02/11). On 02/26 parts of a yard tumbled from a hilltop home on Muir Beach Circle, blocking off an area of Goleta Point Drive, in the Spyglass Hill area (Tan, DMG, 03/05).

29. **Daly City, San Mateo County.** On 02/06 unstable slopes threatened seven homes in Avalon Canyon (Siang Tan, DMG, 02/11). On 02/12 a collapsing hillside in Daly City threatened sea-front homes as continuing storms caused mudslides (Tan, DMG, 02/19).

30. **Malibu, Los Angeles County.** On 12/06/97 homes in Malibu were damaged by waves and seacliff erosion. On 02/07 Malibu Canyon Road closed due to mudslides and rockfalls (Siang Tan, DMG, 02/11). On 02/08 an ocean-eroded cliff buckled, causing one home to collapse and threatening two others. The homes along Broad Beach Road were undermined by high tides (Tan, DMG, 02/11). On 02/16 several houses along the beach of Malibu were damaged by the high surf and rainstorms (Tan, DMG, 02/19). On 02/23 Pacific Coast Highway, Topanga Canyon Boulevard, and Malibu Canyon Road were blocked by mudslides. A Union Pacific railroad trestle was undermined by the surging flows of the Ventura River and was not reopened to rail traffic for weeks (Tan, DMG, 03/05). On 02/24 in Malibu's Las Flores Canyon, officials called for evacuation of about a dozen homes because of unstable ground. Also, more mudslides on Pacific Coast Highway forced officials to close the local courthouse (Tan, DMG, 03/05). On 02/25 a 140-foot-long retaining wall partially collapsed, damaging two homes above the slide on Calle del Barco. The 20-year-wall, along a narrow road (Rambla Orienta) just above Pacific Coast Highway, began to give away during the evening of 02/24 (Tan, DMG, 03/05).

31. **Santa Barbara, Santa Barbara County.** On 02/07 officials closed roads because of mudslides and evacuated a mobile home park (Siang Tan, DMG, 02/11). A Sycamore Canyon home was ripped from its foundation by a mudflow. No injuries were reported (Gerry Wiczorek, USGS, 02/24).

32. **San Clemente, Orange County.** On 02/08 high tide and rain caused damage to shoreline properties; nine homes at a mobile home park were damaged (Siang Tan, DMG, 02/11). On 03/01 a landslide forced the evacuation of four homes in the 300 block of Paseo de Cristobal, piled dirt and large boulders onto the railroad tracks, and cut off rail service. One of these houses was condemned (Tan, DMG, 03/05).

33. **Dana Point, Orange County.** On 02/08 the Holiday Inn Express was evacuated when a mudslide flowed into the underground parking structure. Cars flowed out of the building into the street with the mud (Siang Tan, DMG, 02/11).

34. **Brea, Orange County.** On 02/08 a rock and mudslide closed Carbon Canyon Road. Other road closures occurred on Pacific Coast Highway, Laguna Canyon Road, and El Toro Road (Siang Tan, DMG, 02/11). On 02/24 Carbon Canyon Road was closed after a hillside slid across half of the road at the La Vida Hot Springs Resort (Tan, DMG, 03/05).

35. **San Benito County.** On 02/11 DMG received a call from OES regarding the river jumping a channel and undercutting banks near a home (Trinda Bedrossian, DMG, 02/11).

36. **Magalia, Butte County.** On 02/11 DMG received a call from an individual in regard to a sinkhole that collapsed approximately 20 feet from a house (Trinda Bedrossian, 02/11). The sinkhole may be related to the collapse of an old mining shaft, but this has not been verified.

37. **San Fernando Valley, Los Angeles County.** On 02/13 a rain-soaked hillside collapsed in West Hills, Canoga Park, tearing away a garage, forcing the evacuation of five homes, and threatening several other residences farther down the hill. The slide ripped a 200-foot-long, 30-foot-deep gash under a house, leaving a bedroom dangling over a chasm. The garage slid down the slope 12 to 30 feet and 20 feet away (laterally), with a car still parked inside, and was wedged against the back of a downslope home (Siang Tan, DMG, 02/19).

38. **Ventura, Ventura County.** On 02/14 a hillside gave way and an oil pipeline ruptured, sending 8,000 gallons of crude oil flowing into the ocean and severing a natural gas line that sparked a 100-foot flame (Siang Tan, DMG, 02/19). On 02/22 10 people were evacuated from an apartment building threatened by a mudslide and 12 families were forced to flee from another building on the same block of west Ventura's Cedar Street. A mudslide caused the rupture of a crude oil pipeline in the hills north of Ventura, spilling 168 gallons (Tan, DMG, 03/05). On 02/16 storms brought debris down to the bottom of Hall Canyon to form a small lake. Residents of 50 homes were notified that the dam might break and were required to evacuate. Residents of an additional 100 homes were notified that they may have to evacuate (Tan, DMG, 02/19). A 12-unit hillside apartment building was flattened by a mudslide; 300 residents were evacuated (Gerry Wiczorek, USGS, 02/24). On 03/03 previous shallow-seated failures turned into deeper-seated failures; 20 percent of the buildings were red- or yellow-tagged (Bob Prodehl, City of Ventura). Well heads in the Ventura fields were damaged due to landslide activity (Ken Henderson, Division of Oil and Gas and Geothermal Resources, 03/13).

39. **Bel Air and Culver City, Los Angeles County.** On 02/16 shallow slope failures affected houses in Bel Air and Culver City (Siang Tan, DMG, 02/19).

40. **Scotts Creek, Santa Cruz County.** Many draws were blown out by debris flows, translational-rotational slides, and slumps. Most of the debris appears to be from residual landslide deposits that moved during previous storms (Roberta Smith-Evernden, consultant, 02/17). On 03/03 DMG received a request from CDF to examine



slides resulting from storms on a Timber Harvesting Plan (THP) previously reviewed by DMG. DMG examined erosion control measures implemented in the THP, particularly along a newly constructed road near Scott's Creek. One debris flow occurred in brush lands outside of the managed area and several old fills on existing roads had begun to crack and fail. DMG made several recommendations for additional drainage control measures along the road (Tom Spittler, DMG, 03/10).

41. **Hollywood Hills, Los Angeles County.** On 02/23 the storm threatened houses on an unstable hillside (Siang Tan, DMG, 03/05).

42. **Sherman Oaks, Los Angeles County.** On 02/25 a slope failure along a 60-foot-long section of hillside closed a stretch of the 14800 block of Mullholland Drive (Siang Tan, DMG, 03/05).

43. **Ukiah, Mendocino County.** On 02/25 a house was affected by a rotational slide below the house. The house was red-tagged; 12 feet of movement occurred in two days in an area previously mapped as landslide by Robert Sydnor and Julie Bawcom for Mendocino County (Sydnor and Bawcom, DMG OFR 91-16). Four other houses were red-tagged in the area mapped. Use of a consultant was recommended (Bawcom, DMG, 02/25).

44. **Davenport, Santa Cruz County.** On 02/25 there were many debris flows, some affecting homes in the bottom of draws. Some failures were related to timber harvesting, mostly in the northern part of the county. In the mid-county area larger slumps and translation-rotational slides occurred. Near Corralitas, very large old slides were reactivated (Tom Spittler, DMG, 02/25).

45. **Santa Maria, Santa Barbara County.** A portion of the bank of the Cuyama River collapsed along Highway 166, 13 miles east of Santa Maria, taking along a tractor-trailer rig and a half dozen cars, including a California Highway Patrol cruiser. Two people were reported killed (USGS Website, 02/26).

46. **Blucher Valley, Sonoma County.** On 03/09 two houses were affected by the reactivation of the Blucher Valley landslide. The slide, which is located on very gentle (10 to 20 degrees) dip slopes of the Wilson Grove Formation, originally moved in 1983. DMG geologist Tom Spittler visited the site on 03/09. Fractures were present down the face of the slide and the toe had migrated upslope 50 to 100 feet, i.e., the toe of the original failure in 1983 was acting as a buttress to prevent movement, causing the ground above the toe to buckle. Two houses on the toe were affected; one was yellow-tagged, one was red-tagged.

47. **Russian River, Sonoma County.** On 03/04 DMG received a request from CDF to examine slides resulting from storms on a THP previously reviewed by DMG. DMG examined two small landslide failures along roads within Little Whiskey Creek, a tributary drainage to the Russian River in Sonoma County. No sediment had reached the watercourses. DMG made recommendations for removal of debris from the roads and future stabilization of the slides (Tom Spittler, DMG, 03/10).

48. **La Honda, San Mateo County.** On 02/19 in La Honda nine homes were threatened by a mudslide; three houses were red-tagged (Siang Tan, DMG, 03/05). On 03/13 a large, slow-moving, deep-seated slide affected 25 homes. The main slide had been moving continually since 02/11, but recent rain accelerated movement. Three houses at the head of the slide were red-tagged and five other houses are on or adjacent to it. The slide appears to be enlarging in the downslope direction. USGS employees mapped the landslide to determine its relationship to another, smaller landslide downslope from it. San Mateo County drilled three wells in a road that crosses the slide and has been pumping the wells since 02/26. Trenches were also dug and lined with plastic to provide drainage. The county geologist plans to drill exploratory borings based on USGS input (USGS Website, 03/20).

49. **Big Sur, Monterey County.** On 03/13 landslides blocked Highway 1 at Hurricane Point, eight miles northwest of Big Sur (Bob Schuster and Jeff Coe, USGS, 03/13).

50. **Interstate 5, Lake Shasta, Shasta County.** On 02/11 a fill failure along the shore of Lake Shasta closed the outside lane of Interstate 5 (Bob Schuster and Jeff Coe, USGS, 03/13).

51. **Highway 96, Siskiyou County.** On 02/14 a debris flow with an estimated length of 1,000 to 2,000 feet blocked 2/3 of the channel of the Klamath River and covered several hundred feet of highway about 13 miles north of Humboldt County (Bob Schuster and Jeff Coe, USGS, 03/13).

52. **Las Lomas, Monterey County.** On 03/10 a slide moved toward Las Lomas Drive. The toe reached into the yards of three homes on Las Lomas Drive. Seven homes on the west side of Las Lomas Drive were considered for evacuation if sewers or other utilities were disrupted (Bob Schuster and Jeff Coe, USGS, 03/12). On 03/19 the slide continued to move at a reduced rate. Houses on the slide held together; the two worst-damaged homes were in the middle of Flora Drive. Access and utility problems continued (Rex Baum, USGS, 03/20).

53. **Cloverdale/Geysers Road, Sonoma County.** A chronic earthflow showed renewed movement. The earthflow passes under an existing viaduct on Highway 101 between Cloverdale and Squaw Rock (USGS Website, 03/12). The Cloverdale/Geysers Road was closed due to landslide activity (Ken Henderson, Division of Oil and Gas and Geothermal Resources, 03/13).

54. **Sebastopol, Sonoma County.** A landslide damaged three homes in a rural area two miles west of Sebastopol. The slide, which is roughly 1,000 feet long by 200 feet wide, knocked one of the homes off its foundation. A second home slid down a hill and a third was heavily damaged (USGS Website, 02/26). On 04/21 DMG received an inquiry for historical information about a deep-seated translational landslide that affected several properties on Gold Ridge Road on 02/19. The slide occurred at the interface between the steep slopes below and flatter ground above under geologic conditions similar to the Blucher Valley landslide (see # 46, Tom Spittler, DMG, 04/29).

55. **Grass Valley, Nevada County.** On 05/08 DMG participated in a news briefing regarding the collapse of the Old Brunswick shaft of the Idaho-Marilyn Mine Complex near Grass Valley in the vicinity of new \$400,000 homes (Bob Hill, DMG, 05/11).

56. **Oroville, Butte County.** On 04/23 DMG received a request for assistance from the Office of Mine Reclamation regarding a citizen in Oroville whose property was collapsing due to old mining tunnels. DMG geologist, Bob Hill visited the site and prepared a short report. DMG staff are researching historical mine activity to determine the extent of underground mine tunnels in the Oroville area. This appears to be an area-wide problem, not an isolated incident (Hill, DMG, 04/25).

57. **Highway 80, Solano County.** Throughout the 1997-98 season, a large-scale, deep-seated complex landslide on Highway 80 west of the Red Top exit continued to move slowly. The slide has disrupted Highway 80 and the nearby frontage road for several years, possibly due to the undercutting of the toe by the stream channel below. The slide measures about 2,000 feet wide and 3,000 feet long with an estimated depth of approximately 100 to 150 feet. Significant cracking along the frontage road 1,000 to 2,000 feet southwest of the main landslide suggests activation of a new landslide in this area (Donn Ristau, consultant, 04/13).

58. **Petaluma, Sonoma County.** In December 1997 a slide disrupted Sonoma Mountain Road, east of Petaluma (north of the residence at 550 Sonoma Mountain Road). The failure appears to be the reactivation of an older, deep-seated slide complex that flanks the western boundary of the Rodgers Creek fault zone. The slide is approximately 400 feet in length and approximately 150 feet wide. The northeast lateral margin of the slide resulted in vertical displacement (down) of the road four feet. The vertical relief in the headscarp of the failure indicates the upper portion of the slide dropped approximately eight to ten feet. The depth of the failure is estimated to be at least 15 feet in the central portion of the slide mass (Donn Ristau, consultant, 05/19).

59. **Carmel Valley, Monterey County.** In December 1997 a series of debris slides failed on the northern flank of Saddle Mountain in Carmel Valley and impacted the Saddle Mountain Recreation Area. Failures were typically 50 to 100 feet in length, 30 to 50 feet in width and three to six feet deep. The underlying bedrock is a massive sandstone and pebble conglomerate on which weathered residual soils liquefied. Steeply dipping, out-of-slope fractures apparently resulted in the sloughing of weathered slabs of rock. In several areas the debris slides triggered the additional failure of outboard fill slopes (Donn Ristau, consultant, 05/19).

60. **Santa Rosa, Sonoma County.** On 03/03 DMG was notified of the reactivation of the Lost Acres landslide in the Bennett Valley area of Santa Rosa that was active during the winter storms of 1995 and 1997 (Norman Dolan, homeowner, 03/03). The Lost Acres landslide is a large, deep-seated rotational failure that covers about 12 acres and encompasses a hillside bench and flanking slopes of the adjacent drainages, beneath an east-north facing slope. Four residences were tagged for limited entry and one house was tagged for no entry in 1997 (Wayne Haydon, DMG, 03/05/97).

61. **Pacifica, San Mateo County.** Residents of seven homes were evacuated on Esplanade Drive on 02/22 as a result of sliding and erosion of the cliffs. During the previous two weeks, the 30-foot-tall cliff retreated ten feet to the rear edge of the homes (USGS Website, 02/27). On 03/03 seacliff slumping affected several homes in Pacifica (Channel 3 News, 03/03). Although the rate of cliff erosion, soil falls, and rock falls decreased, water was still seeping from the face. Material that failed was mainly a fluvial deposit on top of a marine terrace deposit. Seawall and other mitigative designs were being considered (USGS Website, 03/12).

62. **Orinda, Contra Costa County.** Three houses remained in precarious situations after a mudslide threw them off their foundations (USGS Website, 02/26).

63. **San Leandro, Alameda County.** A massive landslide threatened seven homes on Hillside Drive, including two that had to be moved off their foundations on 02/21 and 02/22 to save them from the encroaching wall of mud. The slide is about 90 feet high by 200 feet wide (Bill Cotton, consultant, 02/22). The San Leandro slide now has a volume of 65,000 to 70,000 cubic yards; it has moved a total of about five to six feet on a slope of 1.5 to 1. The slide is a translatory failure in decomposed and highly sheared gabbro near the Hayward fault. The subdivision was built in the late 1970s and early 1980s. Two homes were moved by the slide. The slide was mapped and inclinometers were positioned on the slide. Remedial measures were being planned (USGS Website, 03/11).