



## Slope & Soil Instability Hazards

Covering approximately 7,310 square miles and spanning from the Colorado River at the Arizona border to within ten miles of the Pacific Ocean, Riverside County contains a variety of topographical and geological conditions that pose various slope and soil instability hazards. Mass wasting, which includes landslides, rockfalls, and debris flow, is associated with the mountainous regions primarily composed of igneous and metamorphic rock, while subsidence and hydroconsolidation are concentrated in valleys filled with sediments.

The intent of these policies is to reduce the occurrence and costs of slope and soil instability hazards, and eliminate human contribution to their occurrence.

### Landslides, Rockfalls, and Debris Flows

Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, often with disastrous results. As human populations expand over more of the land surface, these processes become an increasing concern.

There are predictable relationships between local geology and landslides, rockfalls and debris flows. Knowledge of these relationships can improve planning and reduce vulnerability. Slope stability is dependent on many factors and their interrelationships, including rock type, pore water pressure, slope steepness, and natural or man-made undercutting. Slope and geologic conditions are identified in Figures S-5 and S-6, respectively.

For new development, the County Building and Safety Department enforces current building codes. Building codes establish specific site investigation requirements and define various standards by which hillside projects are assessed.

Landslide Management Zones (LMZs) identify regions susceptible to slope instability. This instability can include deep-seated landslides, rockfalls, soil slumps, and debris flows. Without the presence of extensive flood control devices, including large debris basins, the areas outlined by an LMZ may be subject to debris flow inundation. Most often, debris flow inundation results in roadways and improvements blocked by boulders. Rarely do debris-flow-generating storms affect the entire county.

Most of the area within Landslide Potential Management Zones of the County, as shown on Figure S-4, are designated for open space or rural development. Investigations and stability evaluations should be conducted prior to any proposed grading, if conditional use permits or variances are granted. Within a Landslide Potential Management Zone, mitigation of existing and/or potential slope problems can be required when substantial improvements are proposed.



*In a typical year in the United States, mass wasting causes 25 to 50 deaths and over \$1.5 billion in damages.*



*The greatest southern California debris flow events of the 20th century occurred in 1934, 1938, 1969 and 1978, but there is generally a destructive event each decade.*



### **Policies:**

- S 3.1 Require the following in landslide potential hazard management zones, or when deemed necessary by the California Environmental Quality Act: (AI 104)
  - a. Preliminary geotechnical and geologic investigations.
  - b. Evaluations of site stability, including any possible impact on adjacent properties, before final project design is approved.
  - c. Consultant reports, investigations, and design recommendations required for grading permits, building permits, and subdivision applications be prepared by State-licensed professionals.
- S 3.2 Require that stabilized landslides be provided with redundant drainage systems. Provisions for the maintenance of subdrains must be designed into the system.
- S 3.3 Before issuance of building permits, require certification regarding the stability of the site against adverse effects of rain, earthquakes, and subsidence.
- S 3.4 Require adequate mitigation of potential impacts from erosion, slope instability, or other hazardous slope conditions, or from loss of aesthetic resources for development occurring on slope and hillside areas.
- S 3.5 During permit review, identify and encourage mitigation of onsite and offsite slope instability, debris flow, and erosion hazards on lots undergoing substantial improvements.
- S 3.6 Require grading plans, environmental assessments, engineering and geologic technical reports, irrigation and landscaping plans, including ecological restoration and revegetation plans, as appropriate, in order to assure the adequate demonstration of a project's ability to mitigate the potential impacts of slope and erosion hazards and loss of native vegetation.
- S 3.7 Support mitigation on existing public and private property that sits on unstable hillside areas, especially slopes with recurring failures where County property or public right-of-way is threatened from slope instability, or where considered appropriate and urgent by the County Engineer, Fire, or Sheriff Department. (AI 100)

### **Subsidence and Expansive & Collapsible Soils**

*Subsidence* refers to the sudden sinking or gradual downward settling and compaction of soil and other surface material with little or no horizontal motion. It may be caused by a variety of human and natural activities, including earthquakes.