



GEOLOGIC HAZARDS

-  Tsunami Zone
-  Flood Zone
-  Landslide - Slope Failure Zone
-  50 Year Line of Cliff Retreat

**HALF MOON BAY
LOCAL COASTAL
PROGRAM**

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CHAPTER 4: HAZARDS

4.1 Coastal Act Policies

- 30253 New development shall: (1) minimize risks to life and property in areas of high geologic, flood, and fire hazard; (2) assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.
- 30235 Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. Existing marine structures causing water stagnation contributing to pollution problems and fish-kills should be phased out or upgraded where feasible.
- 30236 Channelizations, dams, and other substantial alterations of rivers and streams shall incorporate the best mitigation measures feasible, and be limited to (1) necessary water supply projects; (2) flood control projects where no other method for protecting existing structures in the flood plain is feasible and where such protection is necessary for public safety or to protect existing development, or (3) developments where the primary function is the improvement of fish and wildlife habitat.

4.2 Planning Issues

The primary hazards affecting future land use and development in Half Moon Bay involve flooding, cliff retreat, landslides and rockfalls, and tsunami (tidal waves). The extent of these hazards is widespread and susceptible to augmentation by alteration of the environment by human activities. The public ownership of significant beach and cliff areas and existing greenbelt zoning designations mitigate potential damage. However, existing plans and policies are deficient with regard to protecting several specific areas and in lack of development policies and standards in locations of identified hazard potential.

Flood Hazards

The Federal Insurance Administration (Department of Housing and Urban Development) has recently rescinded their flood hazard boundary map for the City of Half Moon Bay, having determined to their satisfaction that there is no substantial danger of a 100-year or 500-year flood in any part of the City. However, as a precautionary measure, the Administration recommends that a zone of approximately 200 feet be used as the boundary of flood hazard where the stream corridor is less than this width. In addition, it cautions against development which would aggravate potential flood hazards. The City's existing creek greenbelt zoning district generally has a minimum width of 200 feet, with greater widths in areas of full channel width. A full assessment of potential inundation from upstream dam failure has not been completed. Based upon preliminary analysis, the zone of potential inundation from dam failure is wider than 200 feet along some portions of Pilarcitos Creek. This zone ranges in width from 200 to 600 feet. Studies are now in preparation to determine the potential for future dam failure resulting from seismic events.

The existing Pilarcitos Creek channel's capacity to accommodate heavy flows between Main Street and Highway 1 appears to have been reduced by construction of the bridge on Main Street and heavy overgrowth and dumping in the creek between Main Street and Highway 1. Some channel improvements may be required in order to eliminate hazards to existing or new structures in this area, possibly including ultimate reconstruction of the bridge to expand the effective channel for water flows. Hazards west of Highway 1 may be more effectively avoided by controls on new development, although some existing structures may be in the zone of potential inundation from dam failure.

Erosion: Coastal Bluff Retreat and Upland Slope Failure

Erosion-related hazards in the Half Moon Bay Coastal Zone comprise two areas of concern: coastal bluff instability or seacliff retreat and upland slope failure. Bluff erosion poses a major immediate threat in certain areas and a long-term hazard along the entire Half Moon Bay shoreline.

Current rates of seacliff retreat north of Magellan Road indicate that major areas could be lost within 50 years. (See Study Paper on "Marine and Water Resources, Hazards and Sensitive Habitats", Figure 2: "Shoreline"). This would make the construction of permanent structures hazardous.

Artificial stabilization of the coastal bluffs has been proposed to protect Highway 1, yet the necessary extent and long-range implications of such measures remain unknown. Any stabilizing measures should protect existing structures as well. Parking facilities or roads near the bluff edge could increase cliff and

foredune erosion and reduce run-off absorption essential for cliff stability. Further development along Miramontes Point and irrigation of the golf course, if properly developed, should not accelerate cliff retreat and erosion, posing hazards for any permanent structures and potential loss of golf course land.

Seismic and Geologic Hazards

The primary seismic hazards which occur within Half Moon Bay are landslides and bluff failure along the coast, tsunami inundation, and potential liquefaction of unconsolidated and moderately consolidated geologic materials. Although no active faults run through the City itself, the San Andreas Fault traverses the Peninsula to the east and the Seal Cove-San Gregario Fault crosses Half Moon Bay southeast of Pillar Point. Both the unconsolidated marine terrace materials of the coastal bluffs and the vertical cliffs of the Purissima Formation are subject to slumps and rockfalls activated by seismic shock.

All steep slope areas are considered potential sites for landslide activity, where caution should be taken in new development not to aggravate landslide potential and hillside erosion.

Tsunami hazard is present in the low-lying coastal areas, particularly at the mouth of drainages. The inland extent of run-up is not known; it has been mapped to the 20-foot contour. Inundation could be greater, depending on local coastal, tidal, and storm conditions. The potential for liquefaction or ground failure caused by the temporary transformation of granular soils into a liquefied state is low to moderate in Half Moon Bay and generally restricted to alluvial channels and the flat terraces underlaid by consolidated sands and a high water table.

Hazards to Existing and Potential Private Residential or Commercial Development

Existing structures along Mirada Road are threatened by high cliff retreat. Existing riprap may not withstand sea attack or tsunami. Existing and future development in Miramar south of Medio Creek is subject to a high rate of cliff retreat.

The subdivision and shopping center along Pilarcitos Creek is located in potential dam failure inundation area and tsunami zones and may be damaged or lost in the future; additional development within the same area would risk the same hazards. The same area is one of moderate risk of liquefaction potential during earthquakes.

The Half Moon Bay Sewage Treatment Plant and portions of the proposed SAM pipeline are located within zones of inundation from dam failure and tsunami.

Surface-Drainage and Local Flooding

Extensive runoff from the coastal hills results in drainage problems where natural contours, swales and gullies, or channelized areas are unable to handle runoff concentration and protect existing developed areas (e.g. Grandview and Newport Terrace subdivisions). The need for improved drainage presents an opportunity to establish; (1) planning measures which regulate the pattern and location of new development, and (2) development practices which promote on-site infiltration of surface runoff.

Coastal Terrace Irrigation

Irrigation of the coastal terrace for agriculture or landscape irrigation (including parks and golf courses) increases the potential for accelerated coastal erosion and seacliff retreat, as well as localized gullying. Since irrigation is critical to the viability of agriculture in these areas, there is a potential conflict between Coastal Act policies. Where irrigated agriculture is to continue, setbacks from the cliff edge should be instituted. The opportunity exists also to define a "protective" zone appropriate for restoration of coastal vegetative communities for the purposes of reducing soil saturation and enhancing bluff stability. This is to be accomplished in large measure by the policies in Section 3.

4.3 Policies

Seawall and Shoreline Structures

Policy 4-1

Seawalls and cliff-retaining structures shall not be permitted unless the City determines they are necessary for preservation of existing structures, and has determined that there are no other less environmentally damaging alternatives for protection of existing development. If such structures are permitted, they shall be designed to preserve the maximum amount of existing beach, to ensure lateral access along the shoreline, and to assure that all existing endangered development within the area of the improvement is protected as a part of the project; such structures shall not be designed so as to encompass an area larger than that necessary to protect existing structures. An applicant for such a structure shall include a geologic report indicating that the structure will succeed in stabilizing that portion of the shoreline which is subject to severe erosion and will not aggravate erosion in other shoreline areas.

Policy 4-2:

Revetments, breakwaters, groins, harbor channels, seawalls, cliff retaining walls, and other such construction that alters natural shoreline processes shall be permitted when required to serve coastal-dependent uses or to protect existing structures or public beaches in danger from erosion and when designed to eliminate or mitigate adverse impacts on local shoreline sand supply. (Portion of Section 30235 Coastal Act of 1976.)

Policy 4-3:

Development permitted shall comply with the following controls and regulations:

- (A) The area of demonstration of stability includes the base, face, and top of all bluffs and cliffs. The extent of the bluff top considered should include the area between the face of the bluff and a line described on the bluff top by the intersection of a plane inclined a 20 degree angle from the horizontal passing through the toe of the bluff or cliff, or 50 feet inland from the edge of the cliff or bluff, whichever is greater.
- (B) Permit bluff and cliff top development only if design and setback provisions are adequate to assure stability and structural integrity for the expected economic life span of the development (at least 50 years) and if the development (including storm runoff, foot traffic, grading, irrigation, and septic tanks) will neither create nor contribute significantly to erosion problems or geologic instability of the site or surrounding area. Prohibit development on bluff faces except for stairways for public access to the beach.
- (C) Prohibit land divisions or new structures identified in areas described in A and B above that would require the need for bluff protection work.
- (D) Require the submittal of a site stability evaluation report for an area of stability demonstration prepared by a soils engineer or a certified engineering geologist, as appropriate, acting within their areas of expertise, based on an on-site evaluation. The report shall consider:
 - 1. Historic, current and foreseeable cliff erosion, including investigation of recorded land surveys and tax assessment records in addition to the use of historic maps and photographs where available, and possible changes in shore configuration and transport.
 - 2. Cliff geometry and site topography, extending the surveying work beyond the site as needed to depict

unusual geomorphic conditions that might affect the site and the proposed development.

3. Geologic conditions, including soil, sediment and rock types and characteristics in addition to structural features such as bedding, joints, and faults.
4. Evidence of past or potential landslide conditions, the implications of such conditions for the proposed development, and the potential effects of the development on landslide activity.
5. Wave and tidal action, including effects of marine erosion on seacliffs.
6. Ground and surface water conditions and variations, including hydrologic changes caused by the development (e.g., introduction of irrigation water to the ground-water system; alterations in surface drainage).
7. Potential effects of seismic forces resulting from a maximum credible earthquake.
8. Effects of the proposed development including siting and design of structures, landscaping, drainage, grading, and impacts of construction activity on the stability of the site and adjacent area.
9. Any other factors that may affect slope stability.
10. Potential erodibility of site and mitigating measures to be used to ensure minimized erosion problems during and after construction (i.e., landscaping and drainage design).

Bluff Protection

Policy 4-4:

In the absence of a determination supported by a site-specific survey by a qualified geologist and biologist to the contrary, within 100 feet from the bluff or foredune edge, drought-tolerant coastal vegetation capable of enhancing bluff and dune stability shall be installed and maintained as a part of any new development. Grading as may be required to establish proper drainage, to install minor improvement (e.g. trails) and to restore eroded areas and to provide permitted accessways shall direct water runoff away from the edge of the bluff or be handled in a manner so as to prevent damage to the bluff by surface and percolating water.

Policy 4-5:

No development shall be permitted on the bluff face, except for engineered accessways to provide public beach access. Drainage pipes shall be allowed only where no other less environmentally damaging drain system is feasible and the drain pipes are designed and placed to minimize impacts to the bluff face, toe, and beach. Drainage devices extending over the bluff face shall not be permitted if water can be directed away from the bluff face.

Geotechnical Hazards

Policy 4-6:

Applications for grading and building permits and applications for subdivisions shall be reviewed for adjacency to, threats from, and impacts on geologic hazards arising from seismic events, tsunami run-up, landslides, flooding, or other geologic hazards such as expansive soils and subsidence areas. In areas of known geologic hazards, as indicated on the Geologic Hazards Map, a geologic report shall be required. Mitigation measures shall be required where necessary.

Policy 4-7:

In areas of flooding due to tsunamis or dam failure, no new development shall be permitted unless the applicant or subsequent study demonstrates that the hazard no longer exists or has been or will be reduced or eliminated by improvements which are consistent with the policies of this Plan and that the development will not contribute to flood hazards or require the expenditure of public funds for flood control works. Where not otherwise indicated, the flood hazard zone shall be considered to be a zone defined by the measured distance of 100 feet from the centerline of the creek to both sides of the creek. Non-structural agricultural uses, trails, roads, and parking lots shall be permitted, provided that such uses shall not be permitted within the area of stream corridor. (See Policies in Section 3 on Protection of Sensitive Habitats.

Policy 4-8:

No new permitted development shall cause or contribute to flood hazards.

Policy 4-9:

All development shall be designed and constructed to prevent increases in runoff that would erode natural drainage courses. Flows from graded areas shall be kept to an absolute minimum, not exceeding the normal rate of erosion and runoff from that of the undeveloped land. Storm water outfalls, gutters, and conduit discharge shall be dissipated.