2. Valley Alluvium

The depth of alluvium in Refugio Valley varies from 11.5 feet in the southeast portion of the valley to about 80 feet near the valley mouth. Most of the upper valley is blanketed with an expansive, adobe-type soil. The adobe-like topsoil is generally underlain to the bedrock formation with firm to still alluvial soils. However, in some locations, compressible fresh water marsh deposits are present, which become thicker and closer to the ground surface in the lower portions of Refugio Valley. Near the mouth of Refugio Valley, in the vicinity of the site of the former Hercules Incorporated dynamite plant, very weak and compressible younger bay muds are present. The depth of the younger bay muds near the valley mouth ranges from about 45 feet to about 70 feet. Older bay muds and/or residential soils of variable depths underlie the younger bay muds.

3. Existing Fills

Overlying the valley alluvium and some overburden soil deposits are several generally small and shallow embankment fills. Most of these fills are in Refugio Valley and vary in depth from the few feet up to ten feet. One large fill, in the Lower Refugio Valley, consists of approximately 100,000 cubic yards and averages about four feet in depth.

4. Ground Water, Seepage and Ponding

A generally shallow, thin zone of ground water will be encountered in most of Refugio Valley at depths ranging between three and five feet. Somewhat deeper ground water levels exist in the upper portions of the valley. Shallow ground water levels are also expected adjacent to Pinole and Rodeo Creeks. Several small springs and areas of surface seepage are present in the City, usually located in the foot or toe areas of landslides or at the base of sharp breaks in slope. During the wet winter months, numerous, generally small areas of water ponding are observed throughout the confines of Refugio Valley. Most ponds were the result of site grading for plant facilities over the years.

5. Erosion

Unprotected soils and highly weathered bedrock will be subject to erosion. Protective measures are especially needed for construction on highly erosive soils (Tierra Loam, Los Osos Clay Loam, and Sehon Clay).

D. FIRE HAZARDS

The major fire hazard areas within Hercules are the open space areas. The open spaces include brush and grass covered hills and forested areas. The blue gum Eucalyptus trees are particularly flammable. As the City grows and develops with more open spaces, the potential for wildland fires will increase.

1. Fire Service

Fire protection services to the City of Hercules are provided by the Rodeo-Hercules Fire Protection District. The District provides 24-hour protection to the City of Hercules and the unincorporated areas of Rodeo. A 24-hour dispatch service is provided to the District under contract with the City of Pinole. The District has an automatic response agreement with the Pinole Fire Department.

The District has two fire stations; a four-bay station at 326 Third Street in Rodeo and a three-bay station at 1680 Refugio Valley Road in Hercules. District equipment includes: one 1500-gpm pumper, one 1,250-gpm pumper, two 1,000-gpm pumpers, two 500-gpm Wildland units, two 200-gpm Wildland units, one rescue truck, one utility truck and four staff vehicles.

The District responds to all fire and rescue-related emergencies within the District's boundaries. In 1992. The response time goal of the District is to reach an emergency scene in built-up areas of the District within five minutes 90 percent of the time.

The District receives revenue from property taxes, fire impact fees levied on new development (developer fees), and benefit assessment fees levied pursuant to a District ordinance. Assessment fees are recurring annual fees collected according to a sliding scale based on risk factors according to the land use on the parcel. All parcels are assigned risk units based on the size and type of development; the number of risk units is multiplied by the unit fee to determine the assessment fee. The benefit assessment fees are used by the District for the purchase of new and replacement equipment and to support personnel costs.

Fire impact fees are levied on all new development within the District, both in the City of Hercules and in the unincorporated community of Rodeo. The total square footage of a project, whether industrial, commercial or residential, is multiplied by the fire impact fee rate to arrive at the total fee. Impact fees are used for the purpose of buying new and replacement capital equipment required to meet the demand that new development places on the District's fire suppression capabilities. Development fees may not be used to fund ongoing operations.

The District implements the weed abatement program within Hercules by clearing vegetation on undeveloped land for 40 feet from fencelines with developed areas. The weed abatement is scheduled to be completed prior to the July 4th weekend.

Peakload water supply requirements: The domestic water supply for Hercules is provided by the East Bay Municipal Utility District (EBMUD). EBMUD has several reservoirs within the Bay Area to serve its distribution network. In the event of an emergency, the District is dependent upon the EBMUD system to supply water. The District has a standard for emergency water supply for firefighting of 1000 gpm for residential uses and 1500 gpm for commercial uses.

The District uses a variety of criteria to determine the service impacts associated with new development. The criteria include:

- Size of structure(s), fire flow demands;
- Classification of occupancy (Hazard type);
- Type of building construction and materials;
- Daytime population density;
- Increase in calls for service;
- Code enforcement issues;
- Fire protection features (automatic sprinkler system); and
- Travel time and distance from nearest fire station.

E. LAND USE AND CIRCULATION

The Land Use and Circulation Elements were reviewed in terms of safety considerations. The Circulation Plan provides a framework of arterials and local streets that will provide alternate routes to or from any portion of the City in case of emergency. Long cul-de-sacs present safety problems because of the possibility of blockage preventing access of emergency equipment or evacuation of residents. The current maximum cul-de-sac length allowed by the Rodeo Hercules Fire District is 450 feet.

The blockage of Interstate 80 within the City would have a major impact on the circulation system. The only alternate route for traffic would be San Pablo Avenue. Willow Avenue would be the alternate route in the case of a blockage on Highway 4 freeway.

The Emergency Operations Plan of the City designates primary and secondary evacuation routes along with emergency equipment routes and shelters. The primary emergency equipment and evacuation routes are San Pablo Avenue, Highway 4 freeway, I-80 Freeway, Sycamore Ave., Refugio Valley Road, Falcon Way, Turquoise Ave., and Pheasant Drive. The minimum emergency road width clearance to be maintained along the evacuation routes is 20 feet. The clearance widths exclude parking and other impediments to traffic flow.

Approved Red Cross emergency shelters are designated within the Community Center at 2001 Refugio Valley Road, Ohlone Community Center at 1616 Pheasant Drive, Hercules School at 1919 Lupine Road, and Lupine Child Care Center at 1905 Lupine Road.

F. FLOOD HAZARDS

Potential causes of flooding in the City include:

- High tides and storm waves
- Creek overflows
- Standing water from excess rainfall

1. High Tides and Storm Waves

The City's northwest land area is adjacent to San Pablo Bay. Pinole Creek, between San Pablo Avenue and the Bay is a tidal waterway which has been improved and realigned by the Corps of

Engineers. A large portion of Refugio Creek has not been improved, thus remaining susceptible to flooding. High tides and storm-driven waves occurring together could overtop embankments and flood low-lying coastal areas.

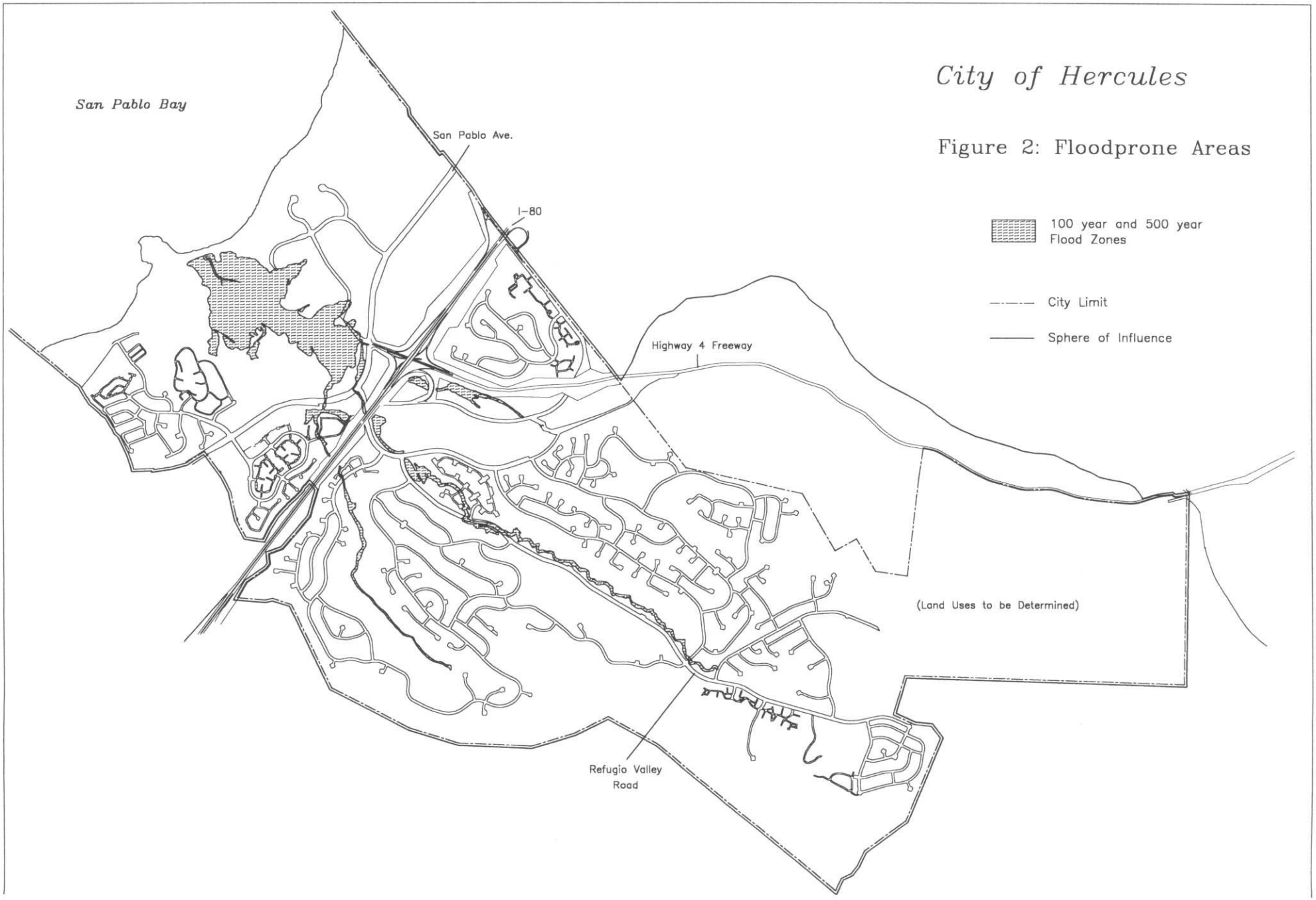
2. Creek Overflows

When the surface runoff exceeds the capacity of the creek channel to carry the flow, creek overflows result. Pinole and Rodeo Creeks drain relatively small portions of the City while the drainage basin of Refugio Creek covers most of the City and extends well beyond the City boundary to the east. Pinole and Rodeo Creeks are adjacent to the northern and southern City boundaries and drain the neighboring communities of Pinole and Rodeo.

The lower channel of Refugio Creek is inadequate with a history of overflowing. The upper channel is on a slumping of slide slopes. Areas of 100-year flooding can be seen in Figure 2. For specific elevations of flooding, please see the Flood Insurance Rate map (Community Panel Number 060434 0008 B and 060434 0009 B) on file with the City of Hercules.

3. Standing Water from Excess Rainfall

Standing water from excess rainfall could occur in low-lying and level areas if the natural drainage channels were interrupted or modified by grading or impervious soils prevented the rapid infiltration of rainfall into the ground. Protection and improvement of drainage channels should be provided.


City of Hercules
Figure 2: Floodprone Areas
100 year and 500 year Flood Zones
City Limit
Sphere of Influence
San Pablo Bay
San Pablo Ave.
I-80
Highway 4 Freeway
(Land Uses to be Determined)
Refugio Valley Road

III. SAFETY GOALS, OBJECTIVES, AND POLICIES

A. GOALS

The basic goal of the Safety Element is to reduce loss of life, injuries, damage to property and economic and social dislocations resulting from seismic, geological, flood and fire hazards. Subgoals are to:

1. Identify hazards and minimize exposure to hazards from either natural or human-related causes.
2. Establish adequate design and safety standards to reduce risks.
3. Incorporate safety considerations into the planning process
4. Provide adequate fire protection throughout the city.
5. Anticipate the potential for disasters; maintain continuity of life-support functions during an emergency; and maximize efforts for post-emergency recovery.

B. OBJECTIVES, POLICIES AND PROGRAMS

OBJECTIVE 1

Consider potential seismic, geologic, flood and fire hazards and introduce adequate safety measures in development plans and proposals.

Policy 1A

Seismic, geologic, flood and fire safety policies will be integrated into other mandatory elements of the General Plan. Administration and enforcement of municipal regulations provide positive measures for implementing safety policies.

Program 1A.1 Planning Review

1. Planned development plans must be prepared and adopted for all new development projects. Safety measures will be incorporated into these planned development plans to provide adequate protection from seismic, geologic, flood and fire hazards.

2. The review and approval of zoning applications, tentative maps and planned development plans shall include consideration of safety policies and standards contained in the General Plan and other area plans .

Program 1A.2 Subdivision, Zoning and Grading Regulations

1. The subdivision, zoning and grading regulations govern the subdivision of land, and the design and construction of site improvements. Minimum road widths and clearances around structures for emergency access shall be specified. Seismic,

geologic, flood and fire hazards shall be considered in the review and approval of tract maps, grading and improvement plans.

Program 1A.3 Building and Fire Codes

The City Council has adopted the Uniform Building Code and the Uniform Fire Code. Fire zones have also been designated in the City.

1. The Uniform Building Code provides minimum safety standards by regulating the design, construction, materials use and occupancy of buildings and structures within the City.
2. The Fire Code governs the maintenance of buildings by regulating the storage and handling of dangerous materials and by requiring adequate egress facilities .
3. Fire Zones limit the potential fire size, thereby preventing major conflagrations. All commercially zoned land in the City is designated Fire Zone 2 and the remainder is in Fire Zone 3 . Fire Zone restrictions involve building construction and the division of large building areas by fire walls.

Program 1A.4 Emergency Operations Plan

An Emergency Operations Plan has been prepared and should be maintained to provide responsibilities and procedures in the event of a major disaster or emergency in the City. This plan is compatible with the State of California and the Office of Emergency Services. The Emergency Operations Plan designates emergency evacuation routes.

Program 1A.5 Capital Improvements Plan

The Capital Improvements Program is a five-year program for municipal capital expenditures which is evaluated annually. Capital improvements which promote safety in the City, such as a fire station, will be evaluated and ranked with the other needs in the community .

Program 1A.6 Geologic and Seismic Hazard Mapping Update.

The geologic and seismic hazard maps relating to the Safety Element of the General Plan shall be updated and incorporated through amendment of the Safety Element. If hazards are discovered that are not currently addressed, the Safety Element shall be revised and amended to include policies and programs related to these hazards.

OBJECTIVE 2

Minimize exposure of public facilities and development to seismic hazards.

Policy 2A

No critical facility or school shall be permitted in areas subject to very strong ground shaking or ground failure until an evaluation of alternative sites with reduced seismic hazards are completed.

Program 2A.1

For each proposal, require a feasibility study to determine whether any proposed critical facilities (emergency response centers, police stations, and hospitals) and schools could be sited in areas with lesser seismic hazards. An alternative site feasibility assessment shall include a consideration of sites in areas with lesser seismic hazards in addition to evaluations of service area, accessibility, and economic considerations. (Geology-1a)

Policy 2B

Projects proposed for all critical facilities including schools, high-population facilities (such as shopping malls) and industries using or generating significant amounts of hazardous materials within areas subject to very strong earthquake ground shaking or ground failure shall conduct geotechnical studies and structural design evaluations.

Program 2B.1

If the alternative site feasibility study for a critical facility or school were to indicate that other less hazardous sites are not available, then geotechnical studies and structural design analyses for the facility shall be conducted in compliance with State of California requirements and recommendations of the Seismic Safety Commission. These should include detailed studies of the geologic materials at the site, seismic event response evaluations to identify design criteria, foundation design criteria and dynamic method analyses of proposed structures.

Program 2B.2

For development excluding critical facilities and schools, the alternative site feasibility assessment will be an optional requirement of the City (an alternatives site evaluation may be required under CEQA). A rigorous geotechnical evaluation and structural design analyses will be required to ensure that the proposed structures perform adequately in major earthquakes without creating a safety hazard to occupants or people in surrounding areas.

Policy 2C

The City will update the Earthquake Preparedness and Emergency Response Plan as necessary to establish emergency access points to evaluate the comprehensiveness of the City's evacuation routes in relation to the specific effects of seismic-induced ground shaking, liquefaction, and lurching within the community.

Program 2C.1

The City Manager will coordinate the relevant departments within the City during any update of the Earthquake Preparedness and Emergency Response Plan.

Program 2C.2

Implement an emergency water supply program to provide potable water to the City population in the event that normal water supplies are disrupted due to seismic events or other causes. The emergency water supply should be sufficient to supply the City population with a minimum designated potable water allowance to be determined by the program.

Policy 2D

The administration of subdivision and grading ordinances should allow for flexibility in the review and approval of construction plans to permit sound engineering design in the solution of specific geological problems. Site-specific geotechnical investigations shall be required for every new development.

Program 2D.1

Applications for subdivision and development projects shall include site specific geotechnical investigations prepared by a California certified engineering geologist documenting the geotechnical suitability of the site for the proposed development based on soil and underlying substrate conditions; and the measures required to ensure public safety and the protection of property. The following shall be implemented through adoption as conditions of approval for the project.

1) Loose or improperly compacted existing fills and backfills should be excavated from areas to be filled.
2) All areas to be graded should be stripped of vegetation and the top few inches of highly organic topsoil.
3) Organic topsoil should be stripped and stockpiled and used for landscaping.
4) Lower valley areas where bay mud deposits are exposed or are blanketed by shallow thicknesses of poorly compacted fill will require detailed studies prior to site grading.
5) Sidehill "sliver" cuts and fills should be avoided.

6) Special consideration should be given to slope stability in the steep hillside areas. Site new structures away from steep hillsides and the toes of existing landslide surfaces, reducing the potential for damage from landslide movement or burial.
7) Steep sideslopes should be left in their natural condition where possible.
8) Minimize the potential for creating new landslides or reactivating old ones. Setbacks should be determined based on detailed soils investigations in individual cases opposite landslide prone slopes to reduce the potential for slide damage to improvements.
9) Expansive soils should be considered in the design of road pavement sections.
10) Site planning should consider the potential of differential settlement where compressible soils exist, and employ appropriate approaches to reducing the hazard to an acceptable level of risk.
11) Areas underlain by soft bay mud will require further detailed soils investigations.
12) Slopes should be planted as soon as possible after completion of construction to develop a protective organic mat.
13) Dense pockets of brush and trees located on steep slopes should be left intact where possible to prevent potential landslides.
14) The sides of the stream channel in portions of Refugio Valley should be improved to protect erosion - induced slumping. Care should be taken to maintain the natural appearance of the water-course in the open space areas.
15) Development of the site shall minimize the amount of native soils compacted by construction vehicles and structures, as well as the amount of soil disturbed through grading and excavation. As much as possible, native soils shall be left undisturbed and used for open space and landscaping purposes.
16) Development of the sites shall also maximize the use of pervious materials, including fill, and incorporate proper drainage structures capable of handling anticipated increases in surface runoff.
17) Minimize amount of grading when building on hill sides. No grading shall occur on slopes steeper than 30 percent, and cut slope angles no greater than 33 percent shall be maintained.

Program 2D.2

Applications for subdivision and development projects shall include site specific erosion control and hillside drainage plans, which shall address the following standards. These standards shall be implemented through adoption as conditions of approval for the project.

1) The use of silt fencing, sediment trapping basins, runoff diversion devices and hydroseeding of barren slopes shall be required to minimize or prevent erosion impacts.
2) Grading in the City shall occur with no increase in discharge of sediments to wetlands, Refugio Creek, or San Pablo Bay.

Program 2D.3

Further investigations of possible fault traces should be made in the vicinity of the Pinole Traces and Pinole Ridge. Setbacks from located fault traces should be based on geological engineering recommendations.

OBJECTIVE 3

Ensure that adequate fire protection is provided throughout the city and that all new structures conform to current fire safety standards.

Policy 3A

The City should continually evaluate the alternatives for providing adequate fire service to meet the changing needs of the City in the most efficient manner.

Program 3A.1

The City shall assist the Rodeo-Hercules Fire Protection District in processing the collection of fire impact fees from all new development within the City.

Program 3A.2

The City shall work with the Rodeo-Hercules Fire Protection District to determine specific needs for fire protection when a particular development proposal is reviewed and ensure that these needs are met.

Fire Station(s) shall be located in the City so that five minutes emergency response time may be achieved by first response units for 90% of all emergency calls. Fire Stations shall be sized to accommodate a minimum of two (2) engines/trucks and three-person, 24-hour crews.

Policy 3B

New development shall be designed to minimize exposure to fire hazards.

Program 3B.1

Subdivision and planned development plan applications shall include measures to promote fire safety. These measures shall be evaluated during application review and implemented through adoption as conditions of approval for the project including:

1) Road circulation for fire access.
2) Access to structures and open spaces

3) Fire flow needs and other peakload water flow needs for emergencies
4) Landscape design

Program 3B.2

Subdivision and planned development plan applications shall include open spaces measures to promote fire safety. These measures shall be evaluated during application review and implemented through adoption as conditions of approval for the project including:

1) A buffer of irrigated landscaping and/or plowed area maintained between open spaces and developed areas.
2) Fire access trails in major open spaces to allow fire equipment to penetrate. These trails could be part of the City-wide system of trails.
3) The use of fire resistant plant materials in open space landscaping.
4) Containment of potential fires where natural vegetation exists in open spaces.
5) Responsibilities for maintenance of fire trails, cleaning vegetated areas and maintaining fire breaks should be clearly defined in planned development plans and conditions of approval.

OBJECTIVE 4

Reduce flood hazards through flood channel improvements and development standards.

Policy 4A

Refugio Creek Channel should be improved to provide adequate capacity for expected flood flows.

Program 4A.1

Development projects along the stream channel shall include plans to improve drainage flows consistent with protection of riparian habitats and wetlands as approved by California Department of Fish and Game and the US Army Corps of Engineers.

(Note: see Open Space and Conservation Element)

Policy 4B

New Development shall be located and designed to minimize generation of and exposure to flood hazards.

Program 4B.1

Subdivision and planned development plan applications shall include measures to promote flood safety. These measures shall be evaluated during application review and implemented through adoption as conditions of approval for the project.

1. Review of any significant project proposals for areas which are not presently in flood zones should include an evaluation of increased downstream flows resulting from the project.

2. Finished floor elevation of all developments must be one foot above the 100 year flood elevations prescribed on the Flood Insurance Rate Map. (See also Growth Management Element standard III.E.7)

3. In order to protect lives and property, intensive development should not be permitted in reclaimed areas unless flood protection in such areas is constructed to the standards of the Flood Disaster Protection Act of 1973.