# CHAPTER 9
# CONSERVATION

The City's natural resources form an important part of its unique character and quality of life. In Lake Forest, these resources include the City's biological resources, geology and soils, mineral and energy resources, hydrology and water quality, visual resources, and cultural resources.

This Chapter includes the following topics:



*Figures are located at the end of the Chapter.*

## 9.1 BIOLOGICAL RESOURCES

This section describes biological resources in the City of Lake Forest from both a qualitative and quantitative perspective. The results of this assessment may be used in planning and management decisions that may affect biological resources in the City of Lake Forest.

### Key Terms

The following key terms are used throughout this section to describe biological resources and the framework that regulates them:

**Hydric Soils.** One of the three wetland identification parameters, according to the Federal definition of a wetland, hydric soils have characteristics that indicate they were developed in conditions where soil oxygen is limited by the presence of saturated soil for long periods during the growing season. There are approximately 2,000 named soils in the United States that may occur in wetlands.

**Hydrophytic Vegetation.** Plant types that typically occur in wetland areas.

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Nearly 5,000 plant types in the United States may occur in wetlands. Plants are listed in regional publications of the U.S. Fish and Wildlife Service (USFWS) and include such species as cattails, bulrushes, cordgrass, sphagnum moss, bald cypress, willows, mangroves, sedges, rushes, arrowheads, and water plantains.

**Sensitive Natural Community.** A sensitive natural community is a biological community that is regionally rare, provides important habitat opportunities for wildlife, is structurally complex, or is in other ways of special concern to local, State, or Federal agencies. CEQA identifies the elimination or substantial degradation of such communities as a significant impact. The California Department of Fish and Wildlife (CDFW) tracks sensitive natural communities in the California Natural Diversity Database (CNDDB).

**Special-Status Species.** Special-status species are those plants and animals that, because of their recognized rarity or vulnerability to various causes of habitat loss or population decline, are recognized by Federal, State, or other agencies. Some of these species receive specific protection that is defined by Federal or State endangered species legislation. Others have been designated as "sensitive" on the basis of adopted policies and expertise of State resource agencies or organizations with acknowledged expertise, or policies adopted by local governmental agencies such as counties, cities, and special districts to meet local conservation objectives. These species are referred to collectively as "special status species" in this report, following a convention that has developed in practice but has no official sanction. For the purposes of this assessment, the term "special status" includes those species that are:

Federally listed or proposed for listing under the Federal Endangered Species Act (50 CFR 17.11-17.12);

Candidates for listing under the Federal Endangered Species Act (61 FR 7596-7613);

State listed or proposed for listing under the California Endangered Species Act (14 CCR 670.5);

Species listed by the U.S. Fish and Wildlife Service (USFWS) or the CDFW as a species of concern (USFWS), rare (CDFW), or of special concern (CDFW);

Fully protected animals, as defined by the State of California (California Fish and Game Code Section 3511, 4700, and 5050);

Species that meet the definition of threatened, endangered, or rare under CEQA (CEQA Guidelines Section 15380);

Plants listed as rare or endangered under the California Native Plant Protection Act (California Fish and Game Code Section 1900 et seq.); and

Plants listed by the California Native Plant Society (CNPS) as rare, threatened, or endangered (List 1A and List 2 status plants in Skinner and Pavlik 1994).

**Waters of the U.S.** The Federal government defines waters of the U.S. as "lakes, rivers, streams, intermittent drainages, mudflats, sandflats, wetlands, sloughs, and wet meadows" [33 C.F.R. §328.3(a)]. Waters of the U.S. exhibit a defined bed and bank and ordinary high water mark (OHWM). The OHWM is defined by the USACE as "that line on shore established by the fluctuations of water and indicated by physical character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" [33 C.F.R. §328.3(e)].

**Wetlands.** Wetlands are ecologically complex habitats that support a variety of both plant and animal life. The Federal government defines wetlands as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" [33 C.F.R. §328.3(b)]. Wetlands require wetland hydrology, hydric soils, and hydrophytic vegetation. Examples of wetlands include freshwater marsh, seasonal wetlands, and vernal pool complexes that have a hydrologic link to waters of the U.S.

## Federal Regulatory Setting

There are a number of regulatory agencies whose responsibility includes the oversight of the natural resources of the State and nation including the California Department of Fish and Wildlife (CDFW), the U.S. Fish and Wildlife Service (USFWS), the U.S. Army Corps of Engineers (USACE), and the National Marine Fisheries Service (NMFS). These agencies often respond to declines in the quantity of a particular habitat or plant or animal species by developing protective measures for those species or habitat type.

### *Federal Endangered Species Act*

The Federal Endangered Species Act, passed in 1973, defines an endangered species as any species or subspecies that is in danger of extinction throughout all or a significant portion of its range. A threatened species is defined as any species or subspecies that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Once a species is listed it is fully protected from a "take" unless a take permit is issued by the United States Fish and Wildlife Service. A take is defined as the harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting wildlife species or any attempt to engage in such conduct, including modification of its habitat (16 USC 1532, 50 CFR 17.3). Proposed endangered or threatened species are those species for which a proposed regulation, but not a final rule, has been published in the Federal Register.

### *Migratory Bird Treaty Act*

To kill, posses, or trade a migratory bird, bird part, nest, or egg is a violation of the Federal Migratory Bird Treaty Act (FMBTA: 16 U.S.C., §703, Supp. I, 1989), unless it is in accordance with the regulations that have been set forth by the Secretary of the Interior.

### *Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act (16 USC Section 668) protects these birds from direct take and prohibits the take or commerce of any part of these species. The USFWS administers the act, and reviews Federal agency actions that may affect these species.

### *Clean Water Act – Section 404*

Section 404 of the Clean Water Act (CWA) regulates all discharges of dredged or fill material into waters of the U.S. Discharges of fill material includes the placement of fill that is necessary for the construction of any structure, or impoundment requiring rock, sand, dirt, or other material for its construction; site-development fills for recreational, industrial, commercial, residential, and other uses; causeways or road fills; and fill for intake and outfall pipes and subaqueous utility lines [33 C.F.R. §323.2(f)].

Waters of the U.S. include lakes, rivers, streams, intermittent drainages, mudflats, sandflats, wetlands, sloughs, and wet meadows [33 C.F.R. §328.3(a)]. Wetlands are defined as "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" [33 C.F.R. §328.3(b)]. Waters of the U.S. exhibit a defined bed and bank and ordinary high water mark (OHWM). The OHWM is defined by the USACE as "that line on shore established by the fluctuations of water and indicated by physical character of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" [33 C.F.R. §328.3(e)].

The USACE is the agency responsible for administering the permit process for activities that affect waters of the U.S. Executive Order 11990 is a Federal implementation policy, which is intended to result in no net loss of wetlands.

### *Clean Water Act - Section 401*

Section 401 of the CWA (33 U.S.C. 1341) requires an applicant who is seeking a 404 permit to first obtain a water quality certification from the Regional Water Quality Control Board. To obtain the water quality certification, the Regional Water Quality Control Board must indicate that the proposed fill would be consistent with the standards set forth by the State.

### *Department of Transportation Act - Section 4(f)*

Section 4(f) has been part of Federal law since 1966. It was enacted as Section 4(f) of the Department of Transportation (DOT) Act of 1966 and set forth in Title 49 United States Code (U.S.C.), Section 1653(f). In January 1983, as part of an overall recodification of the DOT Act, Section 4(f) was amended and codified in 49 U.S.C. Section 303. This law established policy on Lands, Wildlife and Waterfowl Refuges, and Historic Sites as follows:

It is the policy of the United States Government that special effort should be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites. The Secretary of Transportation shall cooperate and consult with the Secretaries of the Interior, Housing and Urban Development, and Agriculture, and with the States, in developing transportation plans and programs that include measures to maintain or enhance the natural beauty of lands crossed by transportation activities or facilities. The Secretary of Transportation may approve a transportation program or project (other than any project for a park road or parkway under section 204 of title 23) requiring the use of publicly owned land of a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance, or land of a historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if: a) There is no prudent and feasible alternative to using that land; and b) The program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

## State Regulatory Setting

### *Fish and Game Code §2050-2097 - California Endangered Species Act*

The California Endangered Species Act (CESA) protects certain plant and animal species when they are of special ecological, educational, historical, recreational, aesthetic, economic, and scientific value to the people of the State. CESA established that it is State policy to conserve, protect, restore, and enhance endangered species and their habitats.

CESA was expanded upon the original Native Plant Protection Act and enhanced legal protection for plants. To be consistent with Federal regulations, CESA created the categories of "threatened" and "endangered" species. It converted all "rare" animals into the Act as threatened species, but did not do so for rare plants. Thus, there are three listing categories for plants in California: rare, threatened, and endangered. Under State law, plant and animal species may be formally designated by official listing by the California Fish and Game Commission.

### *Fish and Game Code §1900-1913 California Native Plant Protection Act*

In 1977 the State Legislature passed the Native Plant Protection Act (NPPA) in recognition of rare and endangered plants of the State. The intent of the law was to preserve, protect, and enhance endangered plants. The NPPA gave the California Fish and Game Commission the power to designate native plants as endangered or rare, and to require permits for collecting, transporting, or selling such plants. The NPPA includes provisions that prohibit the taking of plants designated as "rare" from the wild, and a salvage mandate for landowners, which requires notification of the CDFW 10 days in advance of approving a building site.

### *Fish and Game Code §3503, 3503.5, 3800 - Predatory Birds*

Under the California Fish and Game Code, all predatory birds in the order Falconiformes or Strigiformes in California, generally called "raptors," are protected. The law indicates that it is unlawful to take, posses, or destroy the nest or eggs of any such bird unless it is in accordance with the code. Any activity that would cause a nest to be abandoned or cause a reduction or loss in a reproductive effort is considered a take. This generally includes construction activities.

### *Fish and Game Code §1601-1603 - Streambed Alteration*

Under the California Fish and Game Code, CDFW has jurisdiction over any proposed activities that would divert or obstruct the natural flow or change the bed, channel, or bank of any lake or stream. Private landowners or project proponents must obtain a "Streambed Alteration Agreement" from CDFW prior to any alteration of a lake bed, stream channel, or their banks. Through this agreement, the CDFW may impose conditions to limit and fully mitigate impacts on fish and wildlife resources. These agreements are usually initiated through the local CDFW warden and will specify timing and construction conditions, including any mitigation necessary to protect fish and wildlife from impacts of the work.

### *Public Resources Code § 21000 - California Environmental Quality Act*

The California Environmental Quality Act (CEQA) identifies that a species that is not listed on the Federal or State endangered species list may be considered rare or endangered if the species meets certain criteria. Under CEQA public agencies must determine if a project would adversely affect a species that is not protected by FESA or CESA. Species that are not listed under FESA or CESA, but are otherwise eligible for listing (i.e., candidate or proposed) may be protected by the local government until the opportunity to list the species arises for the responsible agency.

Species that may be considered for review are included on a list of "Species of Special Concern," developed by the CDFW. Additionally, the California Native Plant Society (CNPS) maintains a list of plant species native to California that have low numbers, limited distribution, or are otherwise threatened with extinction. This information is published in the Inventory of Rare and Endangered Vascular Plants of California. List 1A contains plants that are believed to be extinct. List 1B contains plants that are rare, threatened, or endangered in California and elsewhere. List 2 contains plants that are rare, threatened, or endangered in California, but more numerous elsewhere. List 3 contains plants where additional information is needed. List 4 contains plants with a limited distribution.

### *Public Resources Code § 21083.4 - Oak woodlands conservation*

In 2004, the California legislature enacted SB 1334, which added oak woodland conservation regulations to the Public Resources Code. This new law requires a county to determine whether a project, within its jurisdiction, may result in a conversion of oak woodlands that will have a significant effect on the environment. If a county determines that there may be a significant effect to oak woodlands, the county must require oak woodland mitigation alternatives to mitigate the significant effect of the conversion of oak woodlands. Such mitigation alternatives include: conservation through the use of conservation easements; planting and maintaining an appropriate number of replacement trees; contribution of funds to the Oak Woodlands Conservation Fund for the purpose of purchasing oak woodlands conservation easements; and/or other mitigation measures developed by the county.

#### *California Oak Woodland Conservation Act*

The California Legislature passed Assembly Bill 242, known as the California Oak Woodland Conservation Act, in 2001 as a result of widespread changes in land use patterns across the landscape that were fragmenting oak woodland character over extensive areas. The Act created the California Oak Woodland Conservation Program within the Wildlife Conservation Board. The legislation provides funding and incentives to ensure the future viability of California's oak woodland resources by maintaining large scale land holdings or smaller multiple holdings that are not divided into fragmented, nonfunctioning biological units. The Act acknowledged that the conservation of oak woodlands enhances the natural scenic beauty for residents and visitors, increases real property values, promotes ecological balance, provides habitat for over 300 wildlife species, moderates temperature extremes, reduces soil erosion, sustains water quality, and aids with nutrient cycling, all of which affect and improve the health, safety, and general welfare of the residents of the State.

#### *California Wetlands Conservation Policy*

In August 1993, the Governor announced the "California Wetlands Conservation Policy." The goals of the policy are to establish a framework and strategy that will:

- Ensure no overall net loss and to achieve a long-term net gain in the quantity, quality, and permanence of wetland acreage and values in California in a manner that fosters creativity, stewardship, and respect for private property.
- Reduce procedural complexity in the administration of State and Federal wetland conservation programs.
- Encourage partnerships to make landowner incentive programs and cooperative planning efforts the primary focus of wetland conservation and restoration.

The Governor also signed Executive Order W-59-93, which incorporates the goals and objectives contained in the new policy and directs the Resources Agency to establish an Interagency Task Force to direct and coordinate administration and implementation of the policy.

### Local Regulatory Setting

#### *City of Lake Forest General Plan*

The existing City of Lake Forest General Plan identifies policies related to biological resources in its Recreation and Resources Element. Please see the existing General Plan for additional detail.

### Environmental Setting

The City of Lake Forest is surrounded by the City of Irvine to the west; Whiting Ranch Wilderness Park and an unincorporated area of Orange County to the north; the City of Mission Viejo to the east and south; and the Cities of Laguna Hills and Laguna Woods to the south. Terrain in the City of Lake Forest ranges from the Saddleback Valley in the southern part of the City, to low hills in the north that lead up to the foothills of the Santa Ana Mountains further north of the City. Much of the City of Lake Forest has a gentle southwest slope, with elevations ranging from approximately 300 feet above mean sea level (amsl) at the southwestern corner of the City to approximately 1,500 feet amsl at the northern end of the City.

#### *Bioregions*

Lake Forest is located within the South Coast bioregion. Landscapes in this bioregion range from flatlands to mountains; ecosystems range from ocean to desert. The City is bounded on the north by the southern edge of Los Padres National Forest and the northern base of the San Gabriel and San Bernardino Mountains and bounded on the east by the western edge of the BLM California Desert Conservation Area and on south by the Mexican border. The regions also contains two of California's largest cities (Los Angeles and San Diego) more than any other bioregion urbanization has caused intense effects of natural resources. Urbanization in the south coast bioregion has resulted in the loss of habitat, spread of nonnative species and the loss of native species.

### California Wildlife Habitat Relationship System

The California Wildlife Habitat Relationship (CWHR) habitat classification scheme has been developed to support the CWHR System, a wildlife information system and predictive model for California's regularly-occurring birds, mammals, reptiles and amphibians. When first published in 1988, the classification scheme had 53 habitats. At present, there are 59 wildlife habitats in the CWHR System: 27 tree, 12 shrub, 6 herbaceous, 4 aquatic, 8 agricultural, 1 developed, and 1 non-vegetated.

According to the California Wildlife Habitat Relationship System there are 12 cover types (wildlife habitat classifications) in the City of Lake Forest out of 59 found in the State. These include: Annual Grassland, Barren, Chamise-Redshank Chaparral, Coastal Oak Woodland, Coastal Scrub, Deciduous Orchard, Evergreen Orchard, Lacustrine, Mixed Chaparral, Pasture, Urban, and Valley Foothill Riparian.

Table 9-1 identifies the total area by acreage for each cover type (wildlife habitat classification) found in Lake Forest. Figure 9-1 illustrates the location of each cover type (wildlife habitat classification) within Lake Forest. A brief description of each cover type follows.

**Table 9-1 Cover Types - California Wildlife Habitat Relationship System**

| NAME | CITY ACRES |
|---|---|
| Annual Grassland | 539.17 |
| Barren | 188.07 |
| Chamise-Redshank Chaparral | 76.79 |
| Coastal Oak Woodland | 247.72 |
| Coastal Scrub | 1,366.39 |
| Deciduous Orchard | 28.71 |
| Evergreen Orchard | 128.76 |
| Lacustrine | 2.89 |
| Mixed Chaparral | 527.31 |
| Pasture | 41.81 |
| Urban | 7,448.39 |
| Valley Foothill Riparian | 146.60 |
| Total | 10,742.61 |

*Source: City of Lake Forest GIS, CWHR 2018.*

*Developed Cover Types*

Deciduous Orchard in California is typically open single species tree dominated habitats. Depending on the tree type and pruning methods they are usually low, bushy trees with an open understory to facilitate harvest. Deciduous orchards include trees, such as, almonds, apples, apricots, cherries, figs, nectarines, peaches, pears, pecans, pistachios, plums, pomegranates, prunes and walnuts. Trees range in height at maturity for many species from 5 to 10 meters (m) (15 to 30 feet) (ft), but may be 3 m (10 ft) or less in pomegranates and some dwarf varieties, or 18 m (60 ft) or more in pecans and walnuts. Crowns usually touch, and are usually in a linear pattern. Spacing between trees is uniform depending on desired spread of mature trees. The understory is usually composed of low-growing grasses, legumes, and other herbaceous plants, but may be managed to prevent understory growth totally or partially, such as along tree rows. Within the City limits, there are 28.71 acres of deciduous orchard habitat.

Evergreen Orchard in California is typically open single species tree dominated habitats. Depending on the tree type and pruning methods they are usually low, bushy trees with an open understory to facilitate harvest. Evergreen orchards include trees, such as, avocados, dates, grapefruit, lemons, limes, olives, oranges, tangerines, tangelos and tangors. Trees range in height at maturity for many species from 5 to 10 m (15 to 30 ft), but may be 3 m (10 ft) or less in some dwarf varieties, or 18 m (60 ft) or more in date palms. Crowns often do not touch, and are usually in a linear pattern. Spacing between trees is uniform depending on desired spread of mature trees. The understory is usually composed of low-growing grasses, legumes, and other herbaceous plants, but may be managed to prevent understory growth totally or partially, such as along tree rows. Within the City limits, there are 128.76 acres of evergreen orchard habitat.

Urban habitats are not limited to any particular physical setting. Three urban categories relevant to wildlife are distinguished: downtown, urban residential, and suburbia. The heavily-developed downtown is usually at the center, followed by concentric zones of urban residential and suburbs. There is a progression outward of decreasing development and increasing vegetative cover. Species richness and diversity is extremely low in the inner cover. The structure of urban vegetation varies, with five types of vegetative structure defined: tree grove, street strip, shade tree/lawn, lawn, and shrub cover. A distinguishing feature of the urban wildlife habitat is the mixture of native and exotic species. Within the City limits, there are 7,448.36 acres of urban habitat.

### *Herbaceous Cover Types*

Annual Grassland habitat occurs mostly on flat plains to gently rolling foothills. Climatic conditions are typically Mediterranean, with cool, wet winters and dry, hot summers. The length of the frost-free season averages 250 to 300 days. Annual precipitation is highest in northern California. Within the Lake Forest city limits, there are 539.17 acres of annual grassland habitat.

Pasture habitats comprise a mix of perennial grasses and legumes that normally provide 100 percent canopy closure. Height of vegetation varies, according to season and livestock stocking levels, from a few inches to two or more feet on fertile soils before grazing. Pastures often occur in association with agricultural habitats. The mix of grasses and legumes varies according to management practices such as seed mixture, fertilization, soil type, irrigation, weed control, and the type of livestock on the pasture. Plan species seeded in pastures also vary with geographic area. In southern California, Bermuda grass is prevalent. Within the Lake Forest city limits, there are 41.81 acres of pasture habitat.

### *Hardwood Woodland Cover Types*

Coastal oak woodland habitats occupy a variety of Mediterranean type climates that vary from north to south and west to east. Precipitation occurs in the milder winter months, almost entirely as rainfall, followed by warm to hot, dry summers. Near the coast, the summers are tempered by fogs and cool, humid sea breezes. Mean annual precipitation varies from about 40 inches in the north to about 15 inches in southern and interior regions. Mean minimum winter temperatures are 29 to 44 °F, and the mean maximum summer temperatures are 75 to 96 °F. The growing season ranges from six months (180 frost-free days) in the north to the entire year in mild coastal regions to the south. The soils and parent material on which coastal oak woodlands occur are extremely variable. In San Luis Obispo County alone they are found on over fifteen different parent materials ranging from unconsolidated siliceous sand to diatomaceous earth to serpentinite to volcanic ash and basalt. Coastal oak woodlands generally occur on moderately to well-drained soils that are moderately deep and have low to medium fertility. Within the Lake Forest city limits, there are 247.72 acres of coastal oak woodland habitat.

Valley foothill riparian habitats are found in valleys bordered by sloping alluvial fans, slightly dissected terraces, lower foothills, and coastal plains. They are generally associated with low velocity flows, flood plains, and gentle topography. Valleys provide deep alluvial soils and a high water table. The substrate is coarse, gravelly, or rocky soils more or less permanently moist, but probably well aerated. Frost and short periods of freezing occur in winter (200 to 350 frost-free days). This habitat is characterized by hot, dry summers and mild and wet winters. Temperatures range from 75 to 102 °F in the summer to 29 to 44 °F in the winter. Average precipitation ranges from 6 to 30 inches, with little or no snow. The growing season is 7 to 11 months. Within the Lake Forest city limits, there are 146.30 acres of valley-foothill riparian habitat.

### *Shrub-Dominated Cover Types*

Coastal scrub habitat is typified by low to moderate-sized shrubs with mesophytic leaves, flexible branches, semi-woody stems growing from a woody base, and a shallow root system. Coastal Scrub seems to tolerate drier conditions than its associated habitats. It is typical of areas with steep, south-facing slopes; sandy, mudstone or shale soils; and average annual rainfall of less than 12 inches. However, coastal scrub habitat also regularly occurs on stabilized dunes, flat terraces, and moderate slopes of all aspects where average annual rainfall is up to 24 inches. Stand composition and structure differ markedly in response to these physiographic features. Within the Lake Forest city limits, there are 1,366.39 acres of coastal scrub habitat.

Chamise-Redshank Chaparral habitat structure is influenced by fire. Mature Chamise-Redshank Chaparral is single layered, generally lacking well-developed herbaceous ground cover and overstory trees. Shrub canopies frequently overlap, producing a nearly impenetrable canopy of interwoven branches. Chamise-dominated stands average 1 to 2 m (3.3 to 6.6 ft) in height, but can reach 3 m (9.8 ft). Total shrub cover frequently exceeds 80 percent, but may be considerably lower on extremely xeric sites with poor soils. Redshank stands are slightly taller, averaging 2 to 4 m (6.6 to 13.1 ft) but occasionally reaching 6 m (19.7 ft). Mature redshank frequently is more open than chamise and can have sparse herbaceous cover between shrubs. Composition In southern California includes white sage, black sage, and California buckwheat are common at lower elevations and on recently disturbed sites. Within the Lake Forest city limits, there are 76.79 acres of chamise-redshank chaparral habitat.

Mixed Chaparral is a structurally homogeneous brushland type dominated by shrubs with thick, stiff, heavily cutinized evergreen leaves. Shrub height and crown cover vary considerably with age since last burn, precipitation regime, aspect, and soil type. At maturity, cismontane Mixed Chaparral typically is a dense, nearly impenetrable thicket with greater than 80 percent absolute shrub cover. Canopy height ranges from 1 to 4 m (3.3 to 13.1 fl), occasionally to 6 m (19.6 fl). Mixed Chaparral is a floristically rich type that supports approximately 240 species of woody plants. Composition changes between northern and southern California and with precipitation regime, aspect, and soil type. Dominant species in cismontane Mixed Chaparral include scrub oak, chaparral oak, and several species of ceanothus and manzanita. Within the Lake Forest city limits, there are 527.31 acres of mixed chaparral habitat.

*Aquatic Cover Types*

Lacustrine habitats are inland depressions or dammed riverine channels containing standing water. These habitats may occur in association with any terrestrial habitats, Riverine, or Fresh Emergent Wetlands. They may vary from small ponds less than one acre to large areas covering several square miles. Depth can vary from a few inches to hundreds of feet. Typical lacustrine habitats include permanently flooded lakes and reservoirs, and intermittent lakes and ponds (including vernal pools) so shallow that rooted plants can grow over the bottom. Most permanent lacustrine systems support fish life; intermittent types usually do not. Within the Lake Forest city limits, there are 2.89 acres of lacustrine habitat.

*Non-vegetated Habitats*

Barren habitat is defined by the absence of vegetation, and habitat with <2% total vegetation cover by herbaceous, desert, or non-wildland species, and <10% cover by tree or shrub species. Structure and composition of the substrate is largely determined by the region of the state and surrounding environment. Urban settings covered in pavement and buildings may classified as barren as long as vegetation, including non-native landscaping, does not reach the % cover thresholds for vegetated habitats. Within the Lake Forest city limits, there are 188.07 acres of barren land.

## Special-Status Species

The following discussion is based on a background search of special-status species that are documented in the California Natural Diversity Database (CNDDB), the California Native Plant Survey (CNPS) Inventory of Rare and Endangered Plants, and the USFWS endangered and threatened species lists. The background search was regional in scope and focused on the documented occurrences within a 9 quad (approximately 10 mile), and a 1 mile search area.

*Special Status Plants*

The search revealed documented occurrences of 46 special status plant species within the 9 quad search area. Of these 46 special status plant species within the 9 quad search area, seven species were documented within one mile of Lake Forest.

Table 9-2 provides a list of special-status plant species that are documented within a 9 quad search area (approximately a 10 mile radius) of Lake Forest, and current protective status. Figure 9-2 illustrates the special status species located within one mile of Lake Forest. Figure 9-3 illustrates the special status species located within the 9 quad search area.

**Table 9-2 Special Status Plants Present or Potentially Present (9 Quad Search Area)**

| Scientific Name | Common Name | Federal Status | State Status | CNPS* |
|---|---|---|---|---|
| *Abronia villosa var. aurita* | Chaparral sand-verbena | None | None | 1B.1 |
| *Aphanisma blitoides* | Aphanisma | None | None | 1B.2 |
| *Astragalus brauntonii* | Braunton's milk-vetch | Endangered | None | 1B.1 |
| *Atriplex coulteri* | Coulter's saltbush | None | None | 1B.2 |
| *Atriplex pacifica* | South coast saltscale | None | None | 1B.2 |
| *Atriplex parishii* | Parish's brittlescale | None | None | 1B.1 |
| *Atriplex serenana var. davidsonii* | Davidson's saltscale | None | None | 1B.2 |
| *Baccharis malibuensis* | Malibu baccharis | None | None | 1B.1 |
| *Brodiaea filifolia* | Thread-leaved brodiaea | Threatened | Endangered | 1B.1 |
| *Calochortus plummerae* | Plummer's mariposa-lily | None | None | 4.2 |
| *Calochortus weedii var. intermedius* | Intermediate mariposa-lily | None | None | 1B.2 |
| *Centromadia parryi ssp. australis* | Southern tarplant | None | None | 1B.1 |
| *Chaenactis glabriuscula var. orcuttiana* | Orcutt's pincushion | None | None | 1B.1 |
| *Chorizanthe parryi var. fernandina* | San Fernando Valley spineflower | Proposed Threatened | Endangered | 1B.1 |
| *Chorizanthe polygonoides var. longispina* | Long-spined spineflower | None | None | 1B.2 |
| *Clinopodium chandleri* | San Miguel savory | None | None | 1B.2 |
| *Comarostaphylis diversifolia ssp. diversifolia* | Summer holly | None | None | 1B.2 |
| *Dudleya multicaulis* | Many-stemmed dudleya | None | None | 1B.2 |

| Scientific Name | Common Name | Federal Status | State Status | CNPS* |
|---|---|---|---|---|
| *Dudleya stolonifera* | Laguna Beach dudleya | Threatened | Threatened | 1B.1 |
| *Dudleya viscida* | Sticky dudleya | None | None | 1B.2 |
| *Eriastrum densifolium ssp. sanctorum* | Santa Ana River woollystar | Endangered | Endangered | 1B.1 |
| *Euphorbia misera* | Cliff spurge | None | None | 2B.2 |
| *Helianthus nuttallii ssp. parishii* | Los Angeles sunflower | None | None | 1A |
| *Hesperocyparis forbesii* | Tecate cypress | None | None | 1B.1 |
| *Horkelia cuneata var. puberula* | Mesa horkelia | None | None | 1B.1 |
| *Imperata brevifolia* | California satintail | None | None | 2B.1 |
| *Isocoma menziesii var. decumbens* | Decumbent goldenbush | None | None | 1B.2 |
| *Lasthenia glabrata ssp. coulteri* | Coulter's goldfields | None | None | 1B.1 |
| *Lepechinia cardiophylla* | Heart-leaved pitcher sage | None | None | 1B.2 |
| *Lepidium virginicum var. robinsonii* | Robinson's pepper-grass | None | None | 4.3 |
| *Monardella hypoleuca ssp. intermedia* | Intermediate monardella | None | None | 1B.3 |
| *Monardella macrantha ssp. hallii* | Hall's monardella | None | None | 1B.3 |
| *Nama stenocarpa* | Mud nama | None | None | 2B.2 |
| *Nasturtium gambelii* | Gambel's water cress | Endangered | Threatened | 1B.1 |
| *Navarretia prostrata* | Prostrate vernal pool navarretia | None | None | 1B.1 |
| *Nolina cismontana* | Chaparral nolina | None | None | 1B.2 |
| *Penstemon californicus* | California beardtongue | None | None | 1B.2 |
| *Pentachaeta aurea ssp. allenii* | Allen's pentachaeta | None | None | 1B.1 |
| *Phacelia keckii* | Santiago Peak phacelia | None | None | 1B.3 |
| *Pseudognaphalium leucocephalum* | White rabbit-tobacco | None | None | 2B.2 |
| *Quercus dumosa* | Nuttall's scrub oak | None | None | 1B.1 |
| *Senecio aphanactis* | Chaparral ragwort | None | None | 2B.2 |
| *Sidalcea neomexicana* | Salt spring checkerbloom | None | None | 2B.2 |
| *Suaeda esteroa* | Estuary seablite | None | None | 1B.2 |
| *Symphyotrichum defoliatum* | San Bernardino aster | None | None | 1B.2 |
| *Verbesina dissita* | Big-leaved crownbeard | Threatened | Threatened | 1B.1 |

*Source: CDFW CNDDB 2018*

*Notes: California Native Plant Society (CNPS) Key:*

*1A CNPS – Presumed Extirpated in California and either Rare or Extinct Elsewhere*

*1B CNPS - Rare, Threatened, or Endangered in California and Elsewhere*

*2B CNPS - Rare, Threatened, or Endangered in California, But More Common Elsewhere*

*4 CNPS - Plants of Limited Distribution - A Watch List*

*Ranks at each level also include a threat rank (e.g. 4.3) and are determined as follows:*

*0.1 – Seriously threatened in California (over 80% of occurrences threatened/high degree and immediacy of threat)*

*0.2 – Moderately threatened in California (20-80% occurrences threatened/moderate degree and immediacy of threat)*

*0.3 – Not very threatened in California (less than 20% of occurrences threatened/low degree and immediacy of threat or no current threats known).*

### *Special Status Animals*

The search revealed documented occurrences of 65 special status animal species within the 9 quad search areas. This includes: three amphibians, 26 birds, six fish, 15 mammals, 10 reptiles, and five invertebrates. Of the 65 special status animal species within the 9 quad search areas, 30 species are located within one mile of Lake Forest. Table 9-3 provides a list of the special-status animal species that are documented within the 9 quad search area, and current protective status. Figure 9-2 illustrates the special status species located within one mile of Lake Forest. Figure 9-3 illustrates the special status species located within the 9 quad search area.

**Table 9-3 Special Status Animals Present or Potentially Present (9 Quad Search Area)**

| Scientific Name | Common Name | Federal Status | State Status | CFDW Status |
|---|---|---|---|---|
| **Amphibians** | | | | |
| Anaxyrus californicus | Arroyo toad | Endangered | None | SSC |
| Lithobates pipiens | Northern leopard frog | None | None | SSC |
| Spea hammondii | Western spadefoot | None | None | SSC |
| **Birds** | | | | |
| Falco peregrinus anatum | American peregrine falcon | Delisted | Delisted | FP |
| Haliaeetus leucocephalus | Bald eagle | Delisted | Endangered | FP |
| Passerculus sandwichensis beldingi | Belding's savannah sparrow | None | Endangered | -- |
| Artemisiospiza belli | Bell's sage sparrow | None | None | WL |
| Athene cunicularia | Burrowing owl | None | None | SSC |
| Laterallus jamaicensis coturniculus | California black rail | None | Threatened | FP |
| Eremophila alpestris actia | California horned lark | None | None | WL |
| Sternula antillarum browni | California least tern | Endangered | Endangered | FP |
| Campylorhynchus brunneicapillus sandiegensis | Coastal cactus wren | None | None | SSC |
| Polioptila californica | Coastal California gnatcatcher | Threatened | None | SSC |
| Accipiter cooperii | Cooper's hawk | None | None | WL |
| Buteo regalis | Ferruginous hawk | None | None | WL |
| Aquila chrysaetos | Golden eagle | None | None | FP; WL |
| Ammodramus savannarum | Grasshopper sparrow | None | None | SSC |
| Ardea Herodias | Great blue heron | None | None | -- |
| Vireo bellii pusillus | Least Bell's vireo | Endangered | Endangered | -- |
| Rallus obsoletus levipes | Light-footed Ridgway's rail | Endangered | Endangered | FP |
| Asio otus | Long-eared owl | None | None | SSC |
| Circus cyaneus | Northern harrier | None | None | SSC |
| Empidonax traillii extimus | Southwestern willow flycatcher | Endangered | Endangered | -- |
| Agelaius tricolor | Tricolored blackbird | None | Candidate Endangered | SSC |
| Coccyzus americanus occidentalis | Western yellow-billed cuckoo | Threatened | Endangered | -- |
| Elanus leucurus | White-tailed kite | None | None | FP |
| Coturnicops noveboracensis | Yellow rail | None | None | SSC |
| Setophaga petechia | Yellow Warbler | None | None | SSC |
| Icteria virens | Yellow-breasted chat | None | None | SSC |
| **Fish** | | | | |
| Gila orcuttii | Arroyo chub | None | None | SSC |
| Rhinichthys osculus | Santa Ana speckled dace | None | None | SSC |
| Catostomus santaanae | Santa Ana sucker | Threatened | None | -- |
| Southern California Arroyo Chub/ Santa Ana Sucker Stream | Southern California Arroyo Chub/ Santa Ana Sucker Stream | None | None | -- |

| Scientific Name | Common Name | Federal Status | State Status | CFDW Status |
|---|---|---|---|---|
| Aimophila ruficeps canescens | Southern California rufous-crowned sparrow | None | None | WL |
| Eucyclogobius newberryi | Tidewater goby | Endangered | None | SSC |
| **Mammals** | | | | |
| Taxidea taxus | American badger | None | None | SSC |
| Nyctinomops macrotis | Big free-tailed bat | None | None | SSC |
| Choeronycteris mexicana | Mexican long-tongued bat | None | None | SSC |
| Chaetodipus fallax | Northwestern San Diego pocket mouse | None | None | SSC |
| Perognathus longimembris pacificus | Pacific pocket mouse | Endangered | None | SSC |
| Antrozous pallidus | Pallid bat | None | None | SSC |
| Nyctinomops femorosaccus | Pocketed free-tailed bat | None | None | SSC |
| Neotoma lepida intermedia | San Diego desert woodrat | None | None | SSC |
| Aimophila ruficeps canescens | Southern California saltmarsh shrew | None | None | WL |
| Onychomys torridus ramona | Southern grasshopper mouse | None | None | SSC |
| Dipodomys stephensi | Stephens' kangaroo rat | Endangered | Threatened | -- |
| Eumops perotis californicus | Western mastiff bat | None | None | SSC |
| Lasiurus blossevillii | Western red bat | None | None | SSC |
| Lasiurus xanthinus | Western yellow bat | None | None | SSC |
| Myotis yumanensis | Yuma myotis | None | None | -- |
| **Reptiles** | | | | |
| Arizona elegans occidentalis | California glossy snake | None | None | SSC |
| Lampropeltis zonata (pulchra) | California mountain kingsnake (San Diego population) | None | None | WL |
| Phrynosoma blainvillii | Coast horned lizard | None | None | SSC |
| Salvadora hexalepis virgultea | Coast patch-nosed snake | None | None | SSC |
| Taricha torosa | Coast range newt | None | None | SSC |
| Aspidoscelis tigris stejnegeri | Coastal whiptail | None | None | SSC |
| Aspidoscelis hyperythra | Orange-throated whiptail | None | None | WL |
| Crotalus ruber | Red-diamond rattlesnake | None | None | SSC |
| Thamnophis hammondii | Two-striped gartersnake | None | None | SSC |
| Emys marmorata | Western pond turtle | None | None | SSC |
| **Invertebrates** | | | | |
| Bombus crotchii | Crotch bumble bee | None | None | SSC |
| Tryonia imitator | California brackishwater snail | None | None | -- |
| Danaus plexippu | Monarch butterfly | None | None | -- |
| Streptocephalus woottoni | Riverside fairy shrimp | Endangered | None | -- |
| Branchinecta sandiegonensis | San Diego fairy shrimp | Endangered | None | -- |

*Source: CDFW CNDDB 2018*

*Notes: Status is shown for (Federal, State). (--) indicates no listing status.*

*Abbreviations:*

*FP California Fully Protected*

*SSC CDFW Species of Special Concern*

*WL CDFW Watch List*

*Sensitive Natural Communities*

The California Department of Fish and Wildlife (CDFW) considers sensitive natural communities to have significant biotic value, with species of plants and animals unique to each community. The CNDDB search revealed 12 sensitive natural communities within the 9 quad search area, with four sensitive natural communities within one mile of Lake Forest. The sensitive natural communities within the 9 quad search area include the terrestrial communities of California Walnut Woodland, Canyon Live Oak Ravine Forest, Southern Coast Live Oak Riparian Forest, Southern Cottonwood Willow Riparian Forest, Southern Interior Cypress Forest, Southern Mixed Riparian Forest, Southern Riparian Forest, Southern Riparian Scrub, Southern Sycamore Alder Riparian Woodland, Southern Woodland Scrub, and Valley Needlegrass Grassland, and the aquatic community of Southern Coast Marsh.

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## 9.2 GEOLOGY, SOILS, AND SEISMICITY

This section addresses soil, seismic, and geologic hazards in the City of Lake Forest.

### Federal Regulatory Setting

#### *International Building Code (IBC)*

The purpose of the International Building Code (IBC) is to provide minimum standards to preserve the public peace, health, and safety by regulating the design, construction, quality of materials, certain equipment, location, grading, use, occupancy, and maintenance of all buildings and structures. IBC standards address foundation design, shear wall strength, and other structurally related conditions.

### State Regulatory Setting

The State of California has established a variety of regulations and requirements related to seismic safety and structural integrity, including the California Building Standards Code, the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act.

#### *California Building Standards Code*

Title 24 of the California Code of Regulations, known as the California Building Standards Code (CBSC) or simply “Title 24,” contains the regulations that govern the construction of buildings in California. The CBSC includes 12 parts: California Building Standards Administrative Code, California Building Code, California Residential Building Code, California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Historical Building Code, California Fire Code, California Existing Building Code, California Green Building Standards Code (CALGreen Code), and the California Reference Standards Code. Through the CBSC, the State provides a minimum standard for building design and construction. The CBSC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. It also regulates grading activities, including drainage and erosion control.

#### *Alquist-Priolo Earthquake Fault Zoning Act*

The Alquist-Priolo Earthquake Fault Zoning Act of 1972 sets forth the policies and criteria of the State Mining and Geology Board, which governs the exercise of governments’ responsibilities to prohibit the location of developments and structures for human occupancy across the trace of active faults. The policies and criteria are limited to potential hazards resulting from surface faulting or fault creep within Earthquake Fault Zones, as delineated on maps officially issued by the State Geologist. Working definitions include:

Fault – a fracture or zone of closely associated fractures along which rocks on one side have been displaced with respect to those on the other side;

Fault Zone – a zone of related faults, which commonly are braided and sub parallel, but may be branching and divergent. A fault zone has a significant width (with respect to the scale at which the fault is being considered, portrayed, or investigated), ranging from a few feet to several miles;

Sufficiently Active Fault – a fault that has evidence of Holocene surface displacement along one or more of its segments or branches (last 11,000 years); and

Well-Defined Fault – a fault whose trace is clearly detectable by a trained geologist as a physical feature at or just below the ground surface. The geologist should be able to locate the fault in the field with sufficient precision and confidence to indicate that the required site-specific investigations would meet with some success.

“Sufficiently Active” and “Well Defined” are the two criteria used by the State to determine if a fault should be zoned under the Alquist-Priolo Earthquake Fault Zoning Act.

#### *Seismic Hazards Mapping Act*

The Seismic Hazards Mapping Act, passed in 1990, addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically-induced landslides. Under the Act, seismic hazard zones are to be mapped by the State Geologist to assist local governments in land use planning. The program and actions mandated by the Seismic Hazards Mapping Act closely resemble those of the Alquist-Priolo Earthquake Fault Zoning Act (which addresses only surface fault-rupture hazards) and are outlined below:

- The State Geologist is required to delineate the various “seismic hazard zones.”

- Cities and counties, or other local permitting authority, must regulate certain development "projects" within the zones. They must withhold the development permits for a site within a zone until the geologic and soil conditions of the site are investigated and appropriate mitigation measures, if any, are incorporated into development plans.
- The State Mining and Geology Board provides additional regulations, policies, and criteria to guide cities and counties in their implementation of the law. The Board also provides guidelines for preparation of the Seismic Hazard Zone Maps and for evaluating and mitigating seismic hazards.
- Sellers (and their agents) of real property within a mapped hazard zone must disclose that the property lies within such a zone at the time of sale.

### *Caltrans Seismic Design Criteria*

The California Department of Transportation (Caltrans) has Seismic Design Criteria (SDC), which is an encyclopedia of new and currently practiced seismic design and analysis methodologies for the design of new bridges in California. The SDC adopts a performance-based approach specifying minimum levels of structural system performance, component performance, analysis, and design practices for ordinary standard bridges. The SDC has been developed with input from the Caltrans Offices of Structure Design, Earthquake Engineering and Design Support, and Materials and Foundations. Memo 20-1 Seismic Design Methodology (Caltrans 1999) outlines the bridge category and classification, seismic performance criteria, seismic design philosophy and approach, seismic demands and capacities on structural components, and seismic design practices that collectively make up Caltrans' seismic design.

## Local Regulatory Setting

### *City of Lake Forest General Plan*

The existing City of Lake Forest General Plan identifies policies related to geological resources in its Safety and Noise Element. Please see the existing General Plan for additional detail.

### *City of Lake Forest Municipal Code*

The City of Lake Forest Municipal Code includes Chapter 7.04 that requires a soils report if expansive soils or other problem soils are found, prior to a subdivision. Chapter 8.30 requires that a soil engineering and engineering geology report be prepared for grading projects within Lake Forest, unless otherwise waived by the City Engineer.

## Environmental Setting

The City of Lake Forest is near the coastal margin of the Los Angeles Basin, which includes Orange County, and is underlain by more than 15,000 feet of stratified sedimentary rocks of marine origin. The regional geologic framework of the Los Angeles Basin area can be understood through the theory of plate tectonics. Earth's mantle is composed of several large plates that move relative to each other and are bounded by major fault zones. The San Andreas Fault zone, about 40 miles northeast of the City of Lake Forest, is the boundary between the Pacific Plate, on the west side of the zone, and the North American Plate on the east side. One of the results of the movement of these plates is the regional rock deformation that is expressed in the general northwest trend of valleys and ridges in the Los Angeles Basin. All of the geologic formations in the Los Angeles Basin are on the Pacific Plate.

The Santa Monica and San Gabriel Mountains, about 50 miles north of the City of Lake Forest, form the northern boundary of the Los Angeles Basin, and are part of the Transverse Ranges Geomorphic Province, which is characterized by east-west trending faults, folds, and mountain ranges. The Santa Ana Mountains and adjacent hills are located in the northeastern portion of the City and form the eastern boundary of the Los Angeles Basin. The Santa Ana Mountains are part of the Peninsular Ranges Geomorphic Province, which is characterized by northwest-southeast trending faults, folds, and mountain ranges. Both of these provinces, as well as the Los Angeles Basin, are considered to be highly active seismically.

*Geomorphic Provinces*

California's geomorphic provinces are naturally defined geologic regions that display a distinct landscape or landform. Earth scientists recognize eleven provinces in California. Each region displays unique, defining features based on geology, faults, topographic relief, and climate. These geomorphic provinces are remarkably diverse. They provide spectacular vistas and unique opportunities to learn about Earth's geologic processes and history. As described above, Lake Forest lies within the Los Angeles Basin geomorphic province.

*Regional Geology*

The geology of southern California formed as a result of complex plate tectonics and fault movement. The most notable fault in southern California, the San Andreas Fault, is a right lateral strike-slip (or transform) fault that marks the boundary between the Pacific tectonic plate and the North American tectonic plate (Wallace 1990). Both plates are moving northward, but the Pacific plate is moving at a faster rate than the North American plate and the relative difference in the two rates results in movement along the San Andreas Fault (Wallace 1990). Northwest of the Los Angeles basin, where the southern San Joaquin Valley meets the San Emigdio and Tehachapi Mountains, the orientation of the San Andreas Fault changes from generally northwest to west-northwest (Wallace 1990). This portion of the fault system is known as the "Big Bend" (Singer, 2005). Another large fault in southern California, the left-lateral Garlock Fault, intersects the San Andreas Fault system at this location. This bend in the San Andreas Fault system results in transpressional forces between the two tectonic plates, a geologic result of which was the uplift of the Transverse Ranges, including the San Gabriel Mountains that rise to the north of the City (Wallace 1990).

The compression between the two plates also resulted in the formation of numerous reverse and thrust faults throughout the Los Angeles Basin. Several of these thrust faults are located near the City of Lake Forest and are discussed in more detail below. South of the Big Bend, several other major strike-slip faults, including the San Jacinto and the Elsinore faults, parallel the trace of the San Andreas Fault (Singer 2005).

The Los Angeles Basin is an alluviated lowland, or coastal plain, underlain by a structural depression (Yerkes et al. 1965: A1). Deposition of mostly marine sediments has occurred sporadically since the Late Cretaceous period and continuously since the middle Miocene period (Yerkes et al. 1965: A1). This marine and non-marine deposition over a long geologic timeframe resulted in a layer of organic-rich sediments that is up to several miles thick in some places (Yerkes et al. 1965: A1). These organic-rich sediments are the source of the vast petroleum reserves extracted from the basin throughout the twentieth century (Yerkes et al. 1965: A53).

## Local Characteristics

The City of Lake Forest comprises about 17 square miles in a transition zone between an elevated coastal terrace and the Santa Ana Mountains. The western portion of the City, on the coastal terrace, is about 200 feet amsl. The land becomes progressively higher and steeper to the east, eventually reaching elevations above 1,500 feet amsl along the ridgeline of the Santa Ana Mountains. Traces of fault segments associated with the Newport-Inglewood Fault Zones parallel the ocean edge of the coastal terrace. Traces of the Elsinore Fault Zone follow the ridge of the Santa Ana Mountains (Yerkes 1965).

The geology of the region is complex and has undergone several alternating periods of subsidence and uplift, mass wasting (erosion), and sediment deposition. In the Santa Ana Mountains igneous, metavolcanic, and metasedimentary rocks of Jurassic age (208 million to 144 million years ago) and younger form the core of the range. The exposed rocks in the mountainous areas are slightly metamorphosed volcanics, which have been intruded by granitic rocks of Cretaceous age (144 million to 66.4 million years ago), principally granites, gabbros, and tonalites. Overlying these rocks are about 15,000 feet of younger sandstones, siltstones, and conglomerates of upper Cretaceous age, composed largely of material eroded from the older igneous and metavolcanic rocks now underlying the Santa Ana Mountains.

## Faults

Faults are classified as Historic, Holocene, Late Quaternary, Quaternary, and Pre-Quaternary according to the age of most recent movement (California Geological Survey, 2002). These classifications are described as follows:

**Historic:** faults on which surface displacement has occurred within the past 200 years;

**Holocene:** shows evidence of fault displacement within the past 11,000 years, but without historic record;

**Late Quaternary:** shows evidence of fault displacement within the past 700,000 years, but may be younger due to a lack of overlying deposits that enable more accurate age estimates;

**Quaternary:** shows evidence of displacement sometime during the past 1.6 million years; and

**Pre-Quaternary:** without recognized displacement during the past 1.6 million years.

Faults are further distinguished as active, potentially active, or inactive. (California Geological Survey, 2002).

**Active:** An active fault is a Historic or Holocene fault that has had surface displacement within the last 11,000 years;

**Potentially Active:** A potentially active fault is a pre-Holocene Quaternary fault that has evidence of surface displacement between about 1.6 million and 11,000 years ago; and

**Inactive:** An inactive fault is a pre-Quaternary fault that does not have evidence of surface displacement within the past 1.6 million years. The probability of fault rupture is considered low; however, this classification does not mean that inactive faults cannot, or will not, rupture.

The most significant active fault traces in the vicinity of the City of Lake Forest are along the Newport-Inglewood and Elsinore fault zones, which are considered active. Figure 9-4 illustrates the location of local faults within the vicinity City of Lake Forest. There are numerous active faults located in the regional vicinity of Lake Forest. Below is a brief summary of the most notable faults in the regional vicinity:

**Newport-Inglewood Fault:** The Newport-Inglewood Fault zone was responsible for both the 1933 Long Beach Earthquake (magnitude M6.3) and the 1920 Inglewood Earthquake (estimated magnitude M4.9). This zone is visible on the surface as a series of northwest trending elongated hills extending from Newport Beach to Beverly Hills, including Signal Hill and Dominguez Hills. The fault zone exhibits as much as 6,000 feet of right lateral displacement that has occurred since mid-Pliocene time, about 3.4 million years ago, with a maximum displacement of 10,000 feet since late Miocene time, at least 5.3 million years ago (Woodward-Clyde Consultants 1979). An estimated characteristic earthquake of MW 7.1 is assigned to the zone based on its estimated rupture length and slip rate. Active or potentially active fault segments of the Newport-Inglewood Fault zone closest to Lake Forest include the north and south branches of the Newport-Inglewood Fault. The City of Lake Forest is 10 to 14 miles northeast of these fault segments, which places it just outside the CBC Near-Source Area for known active faults.

**Palos Verdes Fault:** The Palos Verdes Fault zone trends southeast offshore through San Pedro Bay about 26 miles southwest of Lake Forest. The fault is thought to contain active segments (CBC Seismic Source Type B) that could produce severe seismic shaking in the City of Lake Forest. One of several major faults of similar trend in Southern California, the Palos Verdes Fault is nearly parallel in orientation to the Newport-Inglewood Fault zone. The characteristic earthquake for the Palos Verdes Fault is MW 7.1, based on comparisons with the Newport-Inglewood zone.

**San Andreas Fault:** The San Andreas Fault zone trends east-southeast about 43 miles northeast of Lake Forest. This fault is widely recognized as the longest and most active fault in the state. It has been mapped from Cape Mendocino in northern California to an area near the Mexican border, approximately 500 miles. Abundant evidence of historic earthquakes indicates that the fault is active, including those that have caused extensive surface rupture and displacement of recent sediments. Current work indicates that large earthquakes have occurred along the fault at widely varying intervals, but averaging 160 years. A maximum probable earthquake of M 8.3 (magnitude of 8.3 on the Richter Scale) has been assigned to the San Andreas in Southern California (City of Lake Forest NHMP 2012).Lo

**San Jacinto Fault:** This active fault is similar to the San Andreas in that it is a large strike-slip fault that has been active for several million years. It has been the principal focus of historical release of strain in Southern California between the North American continental plate and Pacific Ocean plate. Surface rupture has been associated with several historic earthquakes on the fault. A maximum probable earthquake for the San Jacinto of M 7.2 is based upon historic seismicity and rupture length. (City of Lake Forest NHMP 2012). The San Jacinto Fault Zone trends southeast about 35 miles northeast of Lake Forest. The fault contains active segments (CBC Seismic Source Type A) that would cause severe seismic shaking in the City.

**Santa Monica-Raymond Fault:** The Santa Monica–Raymond Fault Zone trends east about 42 miles northwest of Lake Forest. The fault is thought to contain active segments (CBC Seismic Source Type B) that could produce severe seismic shaking in the City. The characteristic earthquake for the Santa Monica and Raymond faults is MW 6.6. There is evidence that at least eight surface-rupturing events have occurred along the fault in this area during the last 36,000 years, but none in historic times.

**Sierra Madre Fault:** The Sierra Madre Fault Zone Segment E (Cucamonga Fault Zone) trends east about 32 miles north of Lake Forest. The fault is thought to contain active segments (CBC Seismic Source Type B) that could produce severe seismic shaking in the City. The characteristic earthquake for the Cucamonga fault is MW 7.0. Segment E represents the easternmost part of the Sierra Madre Fault Zone, and at its eastern end, it meets several other faults including several; traces of the San Jacinto Fault. The general trend of the fault zone continues east along the base of the San Gabriel Mountains.

**Whittier-Elsinore Fault:** This active fault parallels the San Jacinto Fault and is approximately 14 miles northeast of the City. In 1987, an M 5.9 earthquake occurred along a previously unknown thrust fault attached to this system. A maximum probable of M6.7 is assigned to the combined Whitter-Elsinore Fault (City of Lake Forest NHMP 2012). The fault contains active segments (CBC Seismic Source Type A) that would cause severe seismic shaking in the City. At 112 miles in length, the Elsinore Fault Zone is one of the largest in Southern California, and in historic times, has been one of the least active. At its northern end, the Elsinore fault splays into two segments, the Chino fault and the Whittier fault.

*Seismic Hazards*

Seismic hazards include both rupture (surface and subsurface) along active faults and ground shaking, which can occur over wider areas. Ground shaking, produced by various tectonic phenomena, is the principal source of seismic hazards in areas devoid of active faults. All areas of the state are subject to some level of seismic ground shaking.

Several scales may be used to measure the strength or magnitude of an earthquake. Magnitude scales (ML) measure the energy released by earthquakes. The Richter scale, which represents magnitude at the earthquake epicenter, is an example of an ML. As the Richter scale is logarithmic, each whole number represents a 10-fold increase in magnitude over the preceding number. Table 9-4 represents effects that would be commonly associated with Richter Magnitudes:

**Table 9-4 Richter Magnitudes and Effects**

| Magnitude | Effects |
|---|---|
| < 3.5 | Typically not felt |
| 3.5 – 5.4 | Often felt but damage is rare |
| 5.5 – 6.0 | Damage is slight for well-built buildings |
| 6.1 – 6.9 | Destructive potential over ±60 miles of occupied area |
| 7.0 – 7.9 | "Major Earthquake" with the ability to cause damage over larger areas |
| ≥ 8 | "Great Earthquake" can cause damage over several hundred miles |

*Source: USGS, earthquake program.*

Historically active regional faults and their associated size and frequency are shown in Table 9-5.

**Table 9-5 Principal Historically Active and Active Faults in the Region**

| Fault | Maximum Moment Magnitude | Historical Seismicity (Last 150 Years) | Slip Rate (mm/year) |
|---|---|---|---|
| Newport-Inglewood | 7.1 | M 6.4 (1933) | 1.0 |
| Palos Verdes | 7.3 | -- | 3.0 |
| San Andreas (Mojave section) | 7.4 | M 7.0 (1899) | 30.0 |
| San Jacinto | 7.2 | -- | -- |
| Santa Monica | 6.6 | -- | 1.0 |
| Sierra Madre (San Fernando section) | 6.7 | M 6.4 (1971) | 2.0 |
| Whittier-Elsinore | 6.8 | M 5.9 (1987) | 2.5 |

*Source: California Geological Survey, 2003, 2010.*

The 2015 Uniform California Earthquake Rupture Forecast, Version 3, or UCERF3, is the latest official earthquake rupture forecast (ERF) for the state of California. It provides estimates of the likelihood and severity of potentially damaging earthquake ruptures in the long- and near-term. Combining this with ground motion models produces estimates of the severity of ground shaking that can be expected during a given period (seismic hazard), and of the threat to the built environment (seismic risk). This information is used to inform engineering design and building codes, planning for disaster, and evaluating whether earthquake insurance premiums are sufficient for the prospective losses.

UCERF3 was prepared by the Working Group on California Earthquake Probabilities (WGCEP), a collaboration between the United States Geological Survey (USGS), the California Geological Survey (CGS), and the Southern California Earthquake Center (SCEC), with significant funding from the California Earthquake Authority (CEA). The UCERF3 Model represents the latest model from the Working Group on California Earthquake Probabilities (WGCEP) (WGCEP, 2014). Results for the Los Angeles region faults based on the UCERF3 are shown in Table 9-6.

**Table 9-6 Likelihood of Having One or More Earthquakes by Size in the Next 30 Years (Starting From 2014)**

| Magnitude (Greater than or Equal to) | Average Repeat Time (years) | 30-year Likelihood of One or More Events | Readiness |
|---|---|---|---|
| 5 | 1.4 | 100% | 1.0 |
| 6 | 10 | 96% | 1.0 |
| 6.7 | 40 | 60% | 1.1 |
| 7 | 61 | 46% | 1.2 |
| 7.5 | 109 | 31% | 1.3 |
| 8 | 532 | 7% | 1.3 |

*Source. U.S. Department of the Interior U.S. Geological Survey (2015)*

*Notes: Tabulated values represent the likelihood of having one or more earthquakes in the next 30 years (starting from 2014). "Readiness" indicates the factor by which probabilities are currently elevated, or lower, because of the length of time since the previous large earthquake.*

The Working Group on California Earthquake Probabilities, (UCERF32015) predicts that the probability that an earthquake will occur in the Los Angeles region within the next 30 years is:

- 60% that an earthquake measuring magnitude 6.7 will occur
- 46% that an earthquake measuring magnitude 7 will occur
- 31% that an earthquake measuring magnitude 7.5 will occur

In contrast, other scales describe earthquake intensity, which can vary depending on local characteristics. The Modified Mercalli Scale (MM) expresses earthquake intensity at the surface on a scale of I through XII. The Lake Forest areas could experience considerable ground shaking generated by faults within or near the City of Lake Forest. For example, Lake Forest could experience an intensity of MM X generated by seismic events occurring along the Sierra Madre fault. Table 9-7 represents the potential effects of an earthquake based on the Modified Mercalli Intensities.

**Table 9-7 Modified Mercalli Intensities and Effects**

| MM | Effects |
|---|---|
| I | Not felt except by a very few under especially favorable conditions. |
| II | Felt only by a few persons at rest, especially on upper floors of buildings. |
| III | Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated. |
| IV | Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably. |

| MM | Effects |
|---|---|
| V | Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop. |
| VI | Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight. |
| VII | Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken. |
| VIII | Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. |
| IX | Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations. |
| X | Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. |
| XI | Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground. |
| XII | Total damage. Waves seen on ground. Objects thrown up into air. |

*Source: USGS General Interest Publication 1989-288-913*

### *Seismic Hazard Zones*

### *Alquist-Priolo Fault Zones*

An active earthquake fault, per California's Alquist-Priolo Act, is one that has ruptured within the Holocene Epoch (≈11,000 years). Based on this criterion, the California Geological Survey identifies Earthquake Fault Zones. These Earthquake Fault Zones are identified in Special Publication 42 (SP42), which is updated as new fault data become available. The SP42 lists all counties and cities within California that are affected by designated Earthquake Fault Zones. The Fault Zones are delineated on maps within SP42 (Earthquake Fault Zone Maps).

Southern California is a region of high seismic activity. Similar to most cities in the region, the City of Lake Forest is subject to risks associated with potentially destructive earthquakes. The Plan Area is located in the seismically active southern California region, but not within an Earthquake Study Zone defined by the Alquist-Priolo Earthquake Hazards Act

### *Seismic Hazard Zones*

The State Seismic Hazards Mapping Act (1990) addresses hazards along active faults. The Southern California counties affected by the Program include San Bernardino, Los Angeles, Orange, and Ventura. Seismic hazard zones are currently mapped in Lake Forest, and include areas mapped for liquefaction and earthquake induced landslide hazards.

### *Liquefaction*

Liquefaction, which is primarily associated with loose, saturated materials, is most common in areas of sand and silt or on reclaimed lands. Cohesion between the loose materials that comprise the soil may be jeopardized during seismic events and the ground will take on liquid properties. Thus, liquefaction requires specific soil characteristics and seismic shaking. Liquefaction susceptibility based on soil types, deposit, and age is presented below.

Liquefaction Zones are areas where historical occurrence of liquefaction, or local geological, geotechnical and ground water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required. Figure 9-5 shows liquefaction seismic hazard zones mapped within the City of lake Forest, which delineates areas where liquefaction may occur during a strong earthquake. Areas along existing waterways, such as Borrego Canyon Wash, Serrano Creek, and Aliso Creek, are defined as having the greatest potential for liquefaction. Table 9-8 provides liquefaction potential based on sediment type and age of deposit.

**Table 9-8 Liquefaction Potential Based on Sediment Type and Age of Deposit**

| Sediment | Susceptibility Based on Age of Deposits (Years Before Present) | | | |
|---|---|---|---|---|
| | Modern (< 500) | Holocene (< 10,000) | Pleistocene (< 2 Million) | Pre-Pleistocene (> 2 Million) |
| River Channel | Very High | High | Low | Very Low |
| Flood Plain | High | Moderate | Low | Very Low |
| Alluvial Fan/Plain | Moderate | Low | Low | Very Low |
| Lacustrine/Playa | High | Moderate | Low | Very Low |
| Colluvium | High | Moderate | Low | Very Low |
| Talus | Low | Low | Very Low | Very Low |
| Loess | High | High | High | - ? - |
| Glacial Till | Low | Low | Very Low | Very Low |
| Tuff | Low | Low | Very Low | Very Low |
| Tephra | High | High | - ? - | - ? - |
| Residual Soils | Low | Low | Very Low | Very Low |
| Sebka | High | Moderate | Low | Very Low |
| Un-compacted Fill | Very High | NA | NA | NA |
| Compacted fill | Low | NA | NA | NA |

*Source: Youd and Perkins, 1978.*

*Earthquake-Induced Landslide*

Earthquake-Induced Landslide Zones Areas where previous occurrence of landslide movement, or local topographic, geological, geotechnical and subsurface water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required. Figure 9-6 shows the earthquake-induced landslide seismic hazard zones mapped within the City of Lake Forest. Most areas susceptible to landslides are located in the higher-elevation portions of the City.

## Other Geologic Hazards

*Soils*

According to the Natural Resource Conservation Service (2018), there are 30 different soil series located in the City of Lake Forest. Table 9-9 below, and Figure 9-7 presents the soils located in the City of Lake Forest.

**Table 9-9 City of Lake Forest Soils**

| Soils Type | Acres |
|---|---|
| Alo Clay/clay variant | 67.23 |
| Anaheim clay loam | 85.43 |
| Balcom clay loam | 395.76 |
| Blasingame stony loam | 4.32 |
| Bosanko clay | 308.16 |
| Bosanko-Balcom complex | 36.99 |
| Botella loam/clay loam | 70.74 |
| Calleguas clay loam | 828.06 |
| Capistrano sandy loam | 944.80 |
| Chino silty clay loam | 9.44 |
| Cieneba sandy loam | 2,487.08 |
| Cieneba-Rock outcrop complex | 310.46 |
| Corralitos loamy sand | 458.52 |
| Cropley clay | 72.80 |
| Metz loamy sand | 0.32 |
| Mocho loam | 46.57 |
| Modjeska gravelly loam | 9.94 |
| Myford sandy loam | 3,218.91 |
| Pits | 8.19 |
| Rincon | 15.10 |
| Riverwash | 218.53 |
| Rock outcrop-Cieneba complex | 39.31 |
| San Andreas sandy loam | 147.68 |
| San Emigdio fine sandy loam | 8.56 |
| Soboba cobbly loam sand | 10.95 |
| Soper loam/gravelly loam | 21.24 |
| Sorrento loam/clay loam/sandy loam | 799.11 |
| Water | 6.87 |
| Xeralfic arents, loamy | 42.38 |
| Yorba cobbly/gravelly sand loam | 68.82 |
| Total | 10,742.61 |

*Source: Natural Resource Conservation Service, 2018.*

### *Erosion*

The U.S. Natural Resource Conservation Service (NRCS) delineates soil units and compiles soils data as part of the National Cooperative Soil Survey. The following description of erosion factors is provided by the NRCS Physical Properties Descriptions:

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. Erosion factor Kw indicates the erodibility of the whole soil, whereas Kf indicates the erodibiity of the fine soils. The estimates are modified by the presence of rock fragments.

Soil erosion data for the City of Lake Forest were obtained from the NRCS. As identified by the NRCR web soil survey, the erosion factor K within the City of Lake Forest varies widely. The NRCS does not provide erosion factors for the urban land soils in the City, however, the erosion potential for the urban land soils in the City is considered to be low.

### *Expansive Soils*

The NRCS delineates soil units and compiles soils data as part of the National Cooperative Soil Survey. The following description of linear extensibility (also known as shrink-swell potential or expansive potential) is provided by the NRCS Physical Properties Descriptions:

"Linear extensibility" refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

The linear extensibility of the soils within Lake Forest ranges from Low to Very High. Figure 9-8 illustrates the shrink-swell potential of soils in the City of Lake Forest. The majority of the City of Lake Forest has low potential for expansive soils, including most of the developed land. The areas with moderate to high expansive soils represent only a small portion of the City of Lake Forest, and would require special design considerations due to shrink-swell potentials.

### *Landslide*

The California Geological Survey classifies landslides with a two-part designation based on Varnes (1978) and Cruden and Varnes (1996). The designation captures both the type of material that failed and the type of movement that the failed material exhibited. Material types are broadly categorized as either rock or soil, or a combination of the two for complex movements. Landslide movements are categorized as falls, topples, spreads, slides, or flows.

Landslide potential is influenced by physical factors, such as slope, soil, vegetation, and precipitation. Landslides require a slope, and can occur naturally from seismic activity, excessive saturation, and wildfires, or from human-made conditions such as construction disturbance, vegetation removal, wildfires, etc.

Figure 9-9 illustrates the landslide potential (for non-seismically included potential) in the vicinity of the City of Lake Forest. The landslide potential is relatively low in the southwestern portion of the City, where elevation change is relatively low. However, the landslide potential increases in the central and northern portions of the City, which contains areas with increased elevation change.

### *Subsidence*

Subsidence is the settlement of soils of very low density generally from either oxidation of organic material, or desiccation and shrinkage, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Drainage sufficient to create subsidence is uncommon within the City of Lake Forest.

*Collapsible Soils*

Hydroconsolidation occurs when soil layers collapse, or settle, as water is added under loads. Natural deposits susceptible to hydroconsolidation are typically aeolian, alluvial, or colluvial materials, that have a high apparent strength when dry. The dry strength of the materials may be attributed to the clay and silt constituents in the soil and the presence of cementing agents (i.e., salts). Capillary tension may tend to act to bond soil grains. Once these soils are subjected to excessive moisture and foundation loads, the constituency including soluble salts or bonding agents is weakened or dissolved, capillary tensions are reduced and collapse occurs resulting in settlement. Existing alluvium within the City of Lake Forest may be susceptible to collapse and excessive settlements, which could create the risk of hydroconsolidation if these soils were exposed to excessive moisture.

*Naturally Occurring Asbestos*

The term "asbestos" is used to describe a variety of fibrous minerals that, when airborne, can result in serious human health effects. Naturally occurring asbestos is commonly associated with ultramafic rocks and serpentinite. Ultramafic rocks, such as dunite, peridotite, and pyroxenite are igneous rocks comprised largely of iron-magnesium minerals. As they are intrusive in nature, these rocks often undergo metamorphosis, prior to their being exposed on the Earth's surface. The metamorphic rock serpentinite is a common product of the alteration process. There is no naturally occurring asbestos mapped within Lake Forest.

*Tsunami/Seiches*

Tsunamis and seiches are standing waves that occur in the ocean or relatively large, enclosed bodies of water that can follow seismic, landslide, and other events from local sources (California, Oregon, Washington coast) or distant sources (Pacific Rim, South American Coast, Alaska/Canadian coast). The City of Lake Forest is not within a tsunami or seiche hazard area.

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## 9.3 MINERAL AND ENERGY RESOURCES

This section describes mineral and energy resources in the City of Lake Forest from both qualitative and quantitative perspectives. The results of this assessment may be used in planning and management decisions that may affect mineral and energy resources in the City of Lake Forest.

### State Regulatory Setting

#### *Surface Mining and Reclamation Act of 1975*

The California Department of Conservation Surface Mining and Reclamation Act of 1975 (§ 2710), also known as SMARA, provides a comprehensive surface mining and reclamation policy that permits the continued mining of minerals, as well as the protection and subsequent beneficial use of the mined and reclaimed land. The purpose of SMARA is to ensure that adverse environmental effects are prevented or minimized and that mined lands are reclaimed to a usable condition and readily adaptable for alternative land uses. The production and conservation of minerals are encouraged, while giving consideration to values relating to recreation, wildlife, range and forage, as well as aesthetic enjoyment. Residual hazards to public health and safety are eliminated. These goals are achieved through land use planning by allowing a jurisdiction to balance the economic benefits of resource reclamation with the need to provide other land uses.

If a use is proposed that might threaten the potential recovery of minerals from an area that has been classified mineral resource zone 2 (MRZ-2), SMARA would require the jurisdiction to prepare a statement specifying its reasons for permitting the proposed use, provide public notice of these reasons, and forward a copy of the statement to the State Geologist and the State Mining and Geology Board (Cal. Pub. Res. Code Section 2762). Lands classified MRZ-2 are areas that contain identified mineral resources.

### Local Regulatory Setting

#### *Lake Forest Sustainability Plan*

The Lake Forest Sustainability Plan includes the goals related to reducing the amount of fossil fuels consumed within the City of Lake Forest including the following goals: (1) Reduce energy consumption in homes and businesses, and (2) Expand the use of renewable energy throughout the community.

#### *Lake Forest Municipal Code*

The existing Lake Forest Municipal Code contains Chapter 9.150 (Surface Mining and Land Reclamation Regulations), which includes provisions for regulating surface mining and quarrying, and the processing of these materials, consistent with SMARA.

### Environmental Setting

#### *Mineral Resource Classification*

Pursuant to SMARA, the California State Mining and Geology Board oversees the MRZ classification system. The MRZ system characterizes both the location and known/presumed economic value of underlying mineral resources. The mineral resource classification system uses four main MRZs based on the degree of available geologic information, the likelihood of significant mineral resource occurrence, and the known or inferred quantity of significant mineral resources. The four classifications are described in Table 9-10 below.

**Table 9-10 Mineral Resources Classification System**

| Classification | Descriptions |
|---|---|
| MRZ-1 | Areas where adequate information indicates that no significant mineral deposits are present, or where it is judged that little likelihood exists for their presence. |
| MRZ-2 | Areas where adequate information indicates that significant mineral deposits are present, or where it is judged that a high likelihood exists for their presence. |
| MRZ-3 | Areas containing mineral deposits, the significance of which cannot be evaluated. |
| MRZ-4 | Areas where available information is inadequate for assignment to any other MRZ classification. |

*Source: California Department of Conservation Division of Mines and Geology, 2002.*

*Mineral Resources*

Mineral resources include commercially viable oil and gas deposits, and nonfuel mineral resources deposits. Nonfuel mineral resources include metals such as gold, silver, iron, and copper; industrial metals such as boron compounds, rare-earth elements, clays, limestone, gypsum, salt, and dimension stone; and construction aggregate, including sand, gravel, and crushed stone. California is the largest producer of sand and gravel in the nation.

According to Orange County's existing General Plan, Orange County has a significant amount of mineral resources. As identified in California Geological Survey's Special Report 143, Parts III and IV, for the Orange County Region, the areas classified and designated as deposits containing significant sand and gravel resources are located in portions of the Santa Ana River, Santiago Creek, San Juan Creek, Arroyo Trabuco, as well as other scattered areas. The California Geological Survey also identifies fire clay and industrial sand as having historically been produced in large quantities within Orange County.

Orange County is located in the State of California Department of Conservation's Santa Ana 30' x 60' Quadrangle (the Santa Ana quadrangle). The Santa Ana quadrangle includes some of the most complex and varied terrain in the United States. The California Geological Survey estimates that there is demand for 1,079 million tons and current permitted reserves of 862 million tons of supply over the next fifty years (California Geological Survey, 2018).

In addition to the County, the City of Lake Forest contains many important natural resources and features, including mineral resource areas and other open lands. Extractions of mineral resources in the City of Lake Forest include sand and gravel. According to the City's existing General Plan, approximately 62 acres of land in the eastern portion of the City is designated as MRZ-2. The MRZ-2 resource area in the eastern portion of the City is currently excavated for sand and gravel materials. Specifically, the area is classified as an important MRZ for Portland cement concreate (PCC) grade aggregate by the State Department of Conservation (DOC). PCC-grade aggregate is valuable in Southern California where it used for a variety of construction purposes.

*Location of Permitted Aggregate Mines*

The California Office of Mine Reclamation periodically publishes a list of qualified permitted aggregate mines regulated under SMARA that is generally referred to as the AB 3098 List. The Public Contract Code precludes mining operations that are not on the AB 3098 List from selling sand, gravel, aggregates or other mined materials to State or local agencies. As of August 21, 2018, there are two aggregate mines on the AB 3098 list in Orange County: Lapeyre Industrial Sands, Inc; and Ortega Rock). None of the two listed mines are within the City of Lake Forest.

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## 9.4 HYDROLOGY AND WATER QUALITY

This section describes the regulatory setting, regional hydrology and water quality, and local hydrology and water quality.

### Key Terms

Groundwater: Water that is underground and below the water table, as opposed to surface water, which flows across the ground surface. Water beneath the earth's surface fills the spaces in soil, gravel, or rock formations. Pockets of groundwater are often called "aquifers" and are the source of drinking water for a large percentage of the population in the United States. Groundwater is often extracted using wells which pump the water out of the ground and up to the surface. Groundwater is naturally replenished by surface water from precipitation, streams, and rivers when this recharge reaches the water table.

Surface water: Water collected on the ground or from a stream, river, lake, wetland, or ocean. Surface water is replenished naturally through precipitation, but is lost naturally through evaporation and seepage into soil.

### Federal Regulatory Setting

*Clean Water Act (CWA)*

The Federal Water Pollution Control Act, also known as the Clean Water Act (CWA), is the primary statute governing water quality. The CWA establishes the basic structure for regulating the discharges of pollutants into the waters of the United States and gives the US Environmental Protection Agency (EPA) the authority to implement pollution control programs. The statute's goal is to regulate all discharges into the nation's waters and to restore, maintain, and preserve the integrity of those waters. The CWA sets water quality standards for all contaminants in surface waters and mandates permits for wastewater and stormwater discharges. The CWA also requires states to establish site-specific water quality standards for navigable bodies of water and regulates other activities that affect water quality, such as dredging and the filling of wetlands. The following CWA sections assist in ensuring water quality for the water of the United States:

CWA Section 208 requires the use of best management practices (BMPs) to control the discharge of pollutants in stormwater during construction

CWA Section 303(d) requires the creation of a list of impaired water bodies by states, territories, and authorized tribes; evaluation of lawful activities that may impact impaired water bodies, and preparation of plans to improve the quality of these water bodies. CWA Section 303(d) also establishes Total Maximum Daily Loads (TMDLs), which is the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards

CWA Section 404 authorizes the US Army Corps of Engineers to require permits that will discharge dredge or fill materials into waters in the US, including wetlands.

In California, the EPA has designated the State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCBs) with the authority to identify beneficial uses and adopt applicable water quality objectives.

*National Pollutant Discharge Elimination System (NPDES)*

National Pollutant Discharge Elimination System (NPDES) permits are required for discharges to navigable waters of the United States, which includes any discharge to surface waters, including lakes, rivers, streams, bays, oceans, dry stream beds, wetlands, and storm sewers that are tributary to any surface water body. NPDES permits are issued under the Federal Clean Water Act, Title IV, Permits and Licenses, Section 402 (33 USC 466 et seq.)

The RWQCB issues these permits in lieu of direct issuance by the Environmental Protection Agency, subject to review and approval by the EPA Regional Administrator (EPA Region 9). The terms of these NPDES permits implement pertinent provisions of the Federal Clean Water Act and the Act's implementing regulations, including pre-treatment, sludge management, effluent limitations for specific industries, and anti-degradation. In general, the discharge of pollutants is to be eliminated or reduced as much as practicable so as to achieve the Clean Water Act's goal of "fishable and swimmable" navigable (surface) waters. Technically, all NPDES permits issued by the RWQCB are also Waste Discharge Requirements issued under the authority of the CWA.

NPDES permitting authority is administered by the California State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCB). The Plan Area is in a watershed administered by the LARWQCB. Individual projects in the City that disturb more than one acre would be required to obtain NPDES coverage under the California General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit). The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) describing Best Management Practices (BMP) the discharger would use to prevent and retain storm water runoff. The SWPPP must contain a visual monitoring program; a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs; and a sediment monitoring plan if the site discharges directly to a waterbody listed on the 303(d) list for sediment.

## State Regulatory Setting

### *California Fish and Wildlife Code*

The California Department of Fish and Wildlife (CDFW) protects streams, water bodies, and riparian corridors through the streambed alteration agreement process under Section 1600 to 1616 of the California Fish and Game Code. The California Fish and Game Code establishes that "an entity may not substantially divert or obstruct the natural flow or substantially change the bed, channel or bank of any river, stream or lake, or deposit or dispose of debris, waste, or other material containing crumbled, flaked, or ground pavement where it may pass into any river stream, or lake" (Fish and Game Code Section 1602(a)) without notifying the CDFW, incorporating necessary mitigation and obtaining a streambed alteration agreement. The CDFWs jurisdiction extends to the top of banks and often includes the outer edge of riparian vegetation canopy cover.

### *California Water Code*

California's primary statute governing water quality and water pollution issues with respect to both surface waters and groundwater is the Porter-Cologne Water Quality Control Act of 1970 (Division 7 of the California Water Code) (Porter-Cologne Act). The Porter-Cologne Act grants the SWRCB and each of the RWQCBs power to protect water quality, and is the primary vehicle for implementation of California's responsibilities under the Federal Clean Water Act. The Porter-Cologne Act grants the SWRCB and the RWQCBs authority and responsibility to adopt plans and policies, to regulate discharges to surface and groundwater, to regulate waste disposal sites, and to require cleanup of discharges of hazardous materials and other pollutants. The Porter-Cologne Act also establishes reporting requirements for unintended discharges of any hazardous substance, sewage, or oil or petroleum product.

Each RWQCB must formulate and adopt a Water Quality Control Plan (Basin Plan) for its region. The regional plans are to conform to the policies set forth in the Porter-Cologne Act and established by the SWRCB in its State water policy. The Porter-Cologne Act also provides that a RWQCB may include within its regional plan water discharge prohibitions applicable to particular conditions, areas, or types of waste.

### *State Updated Model Landscape Ordinance*

Under Assembly Bill (AB) 1881, the updated Model Landscape Ordinance requires cities and counties to adopt landscape water conservation ordinances by January 31, 2010 or to adopt a different ordinance that is at least as effective in conserving water as the updated Model Ordinance (MO). Chapter 9.146 of the Lake Forest Municipal Code (Water Efficient Landscape Regulations) includes landscaping water use standards.

### *California Department of Health Services*

The Department of Health Services, Division of Drinking Water and Environmental Management, oversees the Drinking Water Program. The Drinking Water Program regulates public water systems and certifies drinking water treatment and distribution operators. It provides support for small water systems and for improving their technical, managerial, and financial capacity. It provides subsidized funding for water system improvements under the State Revolving Fund ("SRF") and Proposition 50 programs. The Drinking Water Program also oversees water recycling projects, permits water treatment devices, supports and promotes water system security, and oversees the Drinking Water Treatment and Research Fund for MTBE and other oxygenates.

### *Consumer Confidence Report Requirements*

California Code of Regulations (CCR) Title 22, Chapter 15, Article 20 requires all public water systems to prepare a Consumer Confidence Report for distribution to its customers and to the Department of Health Services. The Consumer Confidence Report provides information regarding the quality of potable water provided by the water system. It includes information on the sources of the water, any detected contaminants in the water, the maximum contaminant levels set by regulation, violations and actions taken to correct them, and opportunities for public participation in decisions that may affect the quality of the water provided.

### *Urban Water Management Planning Act*

The Urban Water Management Planning Act has as its objectives the management of urban water demands and the efficient use of urban water. Under its provisions, every urban water supplier is required to prepare and adopt an urban water management plan. An "urban water supplier" is a public or private water supplier that provides water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. The plan must identify and quantify the existing and planned sources of water available to the supplier, quantify the projected water use for a period of 20 years, and describe the supplier's water demand management measures. The urban water supplier should make every effort to ensure the appropriate level of reliability in its water service sufficient to meet the needs of its various categories of customers during normal, dry, and multiple dry years. The Department of Water Resources must receive a copy of an adopted urban water management plan.

#### *Senate Bill (SB) 610 and Assembly Bill (AB) 901*

The State Legislature passed SB 610 and AB 901 in 2001. Both measures modified the Urban Water Management Planning Act.

SB 610 requires additional information in an urban water management plan if groundwater is identified as a source of water available to an urban water supplier. It also requires that the plan include a description of all water supply projects and programs that may be undertaken to meet total projected water use. SB 610 requires a city or county that determines a project is subject to CEQA to identify any public water system that may supply water to the project and to request identified public water systems to prepare a specified water supply assessment. The assessment must include, among other information, an identification of existing water supply entitlements, water rights, or water service contracts relevant to the identified water supply for the proposed project, and water received in prior years pursuant to these entitlements, rights, and contracts.

AB 901 requires an urban water management plan to include information, to the extent practicable, relating to the quality of existing sources of water available to an urban water supplier over given time periods. AB 901 also requires information on the manner in which water quality affects water management strategies and supply reliability. The bill requires a plan to describe plans to supplement a water source that may not be available at a consistent level of use, to the extent practicable. Additional findings and declarations relating to water quality are required.

#### *Senate Bill (SB) 221*

SB 221 adds Government Code Section 66455.3, requiring that the local water agency be sent a copy of any proposed residential subdivision of more than 500 dwelling units within five days of the subdivision application being accepted as complete for processing by the City or county. It also adds Government Code Section 66473.7, establishing detailed requirements for establishing whether a "sufficient water supply" exists to support any proposed residential subdivisions of more than 500 dwellings, including any such subdivision involving a development agreement. When approving a qualifying subdivision tentative map, the City or county must include a condition requiring availability of a sufficient water supply. The applicable public water system must provide proof of availability. If there is no public water system, the City or county must undertake the analysis described in Government Code Section 66473.7. The analysis must include consideration of effects on other users of water and groundwater.

### Local Regulatory Setting

#### *Orange County Water District Groundwater Management Plan 2015 Update*

The Orange County Water District's (OCWD) first Groundwater Management Plan was published in 1989; the Groundwater Management Plan 2015 Update is the fifth update. In 2014, the California Sustainable Groundwater Management Act was passed. The new law provided authority for agencies to develop and implement Groundwater Sustainability Plans or alternative plans that demonstrate the basin has operated within its sustainable yield over a period of at least 10 years. This plan was developed to help the OCWD manage the Orange County Groundwater Basin.

#### *South Orange County (San Juan Hydrologic Unit) Water Quality Improvement Plan*

The South County Water Quality Improvement Plan for the San Juan Hydrologic Unit was developed through a regulatory partnership comprising the cities of Aliso Viejo, Dana Point, Laguna Beach, Laguna Hills, Laguna Niguel, Laguna Woods, Lake Forest, Mission Viejo, Rancho Santa Margarita, San Clemente, San Juan Capistrano, the County of Orange and the Orange County Flood Control District, who operate an interconnected stormwater sewer system (MS4) which discharges stormwater and urban runoff. The partnership developed the Plan to address the adverse impacts to surface waters, often collectively referred to as "urban stream syndrome" that can arise from the imprint of urbanization on the landscape.

#### *City of Lake Forest General Plan*

The existing City of Lake Forest General Plan principles, policies, and actions related to hydrology and water quality in its Recreation and Resources Element. Please see the existing General Plan for additional details.

### *City of Lake Forest Municipal Code*

The City of Lake Forest is required to implement procedures with respect to the entry of non-storm water discharges into its municipal storm water system. The City of Lake Forest regulates storm water discharge in accordance with the NPDES permit through Chapter 15.14 of the Lake Forest Municipal Code, Stormwater Quality Management. Additionally, Chapter 8.30 provides erosion control and protection measures.

## Environmental Setting

The State of California uses a hierarchical naming and numbering convention to define watershed areas for management purposes. This means that boundaries are defined according to size and topography, with multiple sub-watersheds within larger watersheds. Table 9-11 shows the primary watershed classification levels used by the State of California. The second column indicates the approximate size that a watershed area may be within a particular classification level, although variation in size is common.

**Table 9-11 State of California Watershed Hierarchy Naming Convention**

| Watershed Level | Approximate Square Miles (Acres) | Description |
|---|---|---|
| Hydrologic Region (HR) | 12,735 (8,150,000) | Defined by large-scale topographic and geologic considerations. The State of California is divided into ten HRs. |
| Hydrologic Unit (HU) | 672 (430,000) | Defined by surface drainage; may include a major river watershed, groundwater basin, or closed drainage, among others. |
| Hydrologic Area (HA) | 244 (156,000) | Major subdivisions of hydrologic units, such as by major tributaries, groundwater attributes, or stream components. |
| Hydrologic Sub-Area (HSA) | 195 (125,000) | A major segment of an HA with significant geographical characteristics or hydrological homogeneity. |

*Source: Calwater, California Interagency Watershed Mapping Committee, 2008.*

### *Hydrologic Region*

The City of Lake Forest is located within the South Coast Hydrologic Region (HR), a large coastal watershed in southern California (DWR 2003: 148). The South Coast HR spans approximately 6.78 million acres and is bounded on the west by the Pacific Ocean, on the north by the Transverse Ranges, on the east by the Colorado River HR, and on the south by the international boundary with Mexico.

### *Hydrologic Unit*

Within the South Coast HR, the City of Lake Forest is located within two hydrologic units (HU), the San Juan HU and Santa Ana River HU. The San Diego Regional Water Quality Control Board (SDRWQCB) governs basin planning and water quality within the San Juan HU and the Santa Ana Regional Water Quality Control Board (SARWQCB) governs basin planning and water quality within the Santa Ana River HU. Figure 9-10 shows Hydrologic Units within and surrounding the City.

### *Hydrologic Area*

For purposes of planning on a city-wide basis, hydrologic areas (HA) are generally considered to be the appropriate watershed planning level. Within the Santa Ana River HU, the Lower Santa Ana River HA is located in the western half of the City of Lake Forest; within the San Juan HU, the Laguna HA is located in the eastern half of the City of Lake Forest. Figure 911- shows the Hydrologic Areas within and surrounding the City.

### *Hydrologic Sub-Area*

There are several hydrologic sub-areas within and throughout City of Lake Forest. Analysis of hydrologic sub-areas is appropriate for the review of individual projects, but is not appropriate for the watershed analysis of the City's General Plan.

### *Creeks and Waterways*

The City of Lake Forest lies within the Aliso Creek Watershed and the Newport Bay Watershed. Aliso Creek is a natural creek located along the west side of El Toro Road. The creek flows through open space and urban development and outlets at the ocean at Aliso Creek Beach. Aliso Creek's watershed encompasses 23,000 acres, and includes natural open space, rural and urban development, agriculture and ranching, regional parks and other recreational facilities. The Newport Bay Watershed covers 112.2 square miles in central Orange County. Its main tributary, San Diego Creek, drains into Upper Newport Bay. Small tributaries include Serrano Creek, Borrego Canyon Wash, Agua Chinon Wash, Bee Canyon Wash, Peters Canyon Wash, Sand Canyon Wash, Bonita Canyon Creek, and the Santa Ana Delhi Channel. Figure 9-11 (Hydrologic Areas) shows local waterways in relation to the City.

### *Groundwater*

The City of Lake Forest is underlain by the Orange County Groundwater Basin (OCWD 2015). The Orange County Groundwater Basin, as defined by DWR Bulletin 118 Basin 8-1, can be subdivided into subbasins and the coastal region can be distinguished by higher and lower elevation areas. The Main Basin is the largest sub-basin, where the majority of groundwater production occurs (note: the City of Lake Forest is located above the Main Basin).

The Orange County Groundwater Basin stores an estimated 66 million acre-feet of water, although only a fraction of this can be sustainably pumped without causing physical damage such as seawater intrusion or potential land subsidence. The basin underlies north and central Orange County beneath broad lowland known as the Tustin and Downey plains. The basin covers an area of approximately 350 square miles, bordered by the Coyote and Chino Hills to the north, the Santa Ana Mountains to the northeast, and the Pacific Ocean to the southwest. The basin boundary extends to the Orange County-Los Angeles line to the northwest, where groundwater flow is unrestricted across the county line into the Central Basin of Los Angeles County.

The groundwater basin was formed in a synclinal, northwest-trending trough that deepens as it continues beyond the Orange-Los Angeles county line. The Newport-Inglewood fault zone, San Joaquin Hills, Coyote Hills, and Santa Ana Mountains form the uplifted margins of the syncline. The total thickness of sedimentary rocks in the basin surpasses 20,000 feet, of which only the upper 2,000 to 4,000 feet contain fresh water.

OCWD subdivided the groundwater basin into three major aquifer systems. The three aquifer systems, known as the Shallow, Principal, and Deep, are hydraulically connected, as groundwater is able to flow between them via leakage through the intervening aquitards or discontinuities in the aquitards. The Shallow Aquifer system overlies the entire basin and includes the prolific Talbert Aquifer. It generally occurs from the surface to approximately 250 feet below ground surface. The majority of groundwater from the shallow aquifer is pumped by small water systems for industrial and agricultural use, although the cities of Garden Grove and Newport Beach, and the Yorba Linda Water District, operate wells that pump from the shallow aquifer for municipal use.

Over 90 percent of groundwater production occurs from wells that are screened within the Principal Aquifer system at depths between 200 and 1,300 feet. A minor amount of groundwater is pumped from the Deep Aquifer, which underlies the Principal Aquifer system and is up to 2,000 feet deep in the center of the basin. Hindering production from the Deep Aquifer system is the depth and the presence of amber colored groundwater in some areas.

### *Water Quality*

Surface water quality is affected by point source and non-point source pollutants. Point source pollutants are those emitted at a specific point, such as a pipe, while non-point source pollutants are typically generated by surface runoff from diffuse sources, such as streets, paved areas, and landscaped areas. Point source pollutants are controlled with pollutant discharge regulations or WDRs. Non-point source pollutants are more difficult to monitor and control although they are important contributors to surface water quality in urban areas.

Stormwater runoff pollutants vary based on land use, topography, the amount of impervious surface, and the amount and frequency of rainfall and irrigation practices. Runoff in developed areas typically contains oil, grease, and metals accumulated in streets, driveways, parking lots, and rooftops, as well as pesticides, herbicides, particulate matter, nutrients, animal waste, and other oxygen-demanding substances from landscaped areas. The highest pollutant concentrations usually occur at the beginning of the wet season during the "first flush."

Water quality in the City is governed by the SDRWQCB and the SARWQCB, which set water quality standards in their Water Quality Control Plan for the respective basins (Basin Plans). The Basin Plans identify beneficial uses for surface water and groundwater and establishes water quality objectives to attain those beneficial uses.

The Clean Water Act (CWA) 303(d) list is a register of impaired and threatened waters which the CWA requires all states to submit for Environmental Protection Agency approval. The list identifies all waters where the required pollution control measures have so far been unsuccessful in reaching or maintaining the required water quality standards. Waters that are listed are known as "impaired." CWA Section 303(d) lists four water bodies within the City of Lake Forest: Aliso Creek, Serrano Creek, Borrego Creek (from SR 241 to Irvine Boulevard), and San Diego Creek Reach 2. These are described in more detail as follows (with estimated Total Maximum Daily Load completion date in parenthesis):

Aliso Creek is listed as impaired from the following pollutants: benthic community effects (2025), indicator bacteria (2011), malathion (2029), nitrogen (2019), phosphorus (2019), selenium (2021), and toxicity (2019).

Serrano Creek is listed as impaired from the following pollutants: ammonia (2021), benthic community effects (2027), indicator bacteria (2021), and toxicity (2027).

Borrego Creek (from SR 241 to Irvine Boulevard) is listed as impaired from the following pollutants: ammonia (2021), and indicator bacteria (2021).

San Diego Creek Reach 2 is listed as impaired from the following pollutants: benthic community effects (2027), indicator bacteria (2021), nutrients (1999), and sedimentation/siltation (1999).

Storm water runoff may play a role in the water quality impairments described above. Runoff that occurs as overland flow across yards, driveways, and public streets is intercepted by the storm water drainage system and conveyed to local drainages before eventually being routed to the Pacific. This storm water can carry pollutants that can enter the local waterways and result in the types of water quality impairments described above. Common sources of storm water pollution in the City include litter, trash, pet waste, paint residue, organic material (yard waste), fertilizers, pesticides, sediments, construction debris, metals from automobile brake pad dust, air pollutants that settle on the ground or attach to rainwater, cooking grease, illegally dumped motor oil, and other harmful fluids.

### *Flooding*

The City of Lake Forest is a participant in the National Flood Insurance Program (NFIP). Communities participating in the NFIP must adopt and enforce minimum floodplain management standards, including identification of flood hazards and flooding risks. Participating in the NFIP allows communities to purchase lower-cost insurance protection against losses from flooding. During the 100-year and 200-year flood events, flooding would be localized around the City's existing water bodies (California Department of Water Resources, 2018). Figure 8-3 within the Utilities section of this document demonstrates the location of expected location of flooding during the 100-year flood event.

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# 9.5 CULTURAL RESOURCES

This section describes the buildings, sites, structures, or objects that may have historical, architectural, archaeological, cultural, or scientific importance. Preservation of the city's cultural heritage should be considered when planning for the future. Information in this section was taken from a paleontological and cultural resource assessment of Lake Forest prepared by Cogstone Resource Management Inc..

## Key Terms

Archaeology. The study of historic or prehistoric peoples and their cultures by analysis of their artifacts and monuments.

Complex. A patterned grouping of similar artifact assemblages from two or more sites, presumed to represent an archaeological culture.

Ethnography. The study of contemporary human cultures.

Midden. A deposit marking a former habitation site and containing such materials as discarded artifacts, bone and shell fragments, food refuse, charcoal, ash, rock, human remains, structural remnants, and other cultural leavings.

Paleontology. The science of the forms of life existing in former geologic periods, as represented by their fossils.

## Federal Regulatory Setting

### *National Historic Preservation Act*

Most regulations at the Federal level stem from the National Environmental Policy Act (NEPA) and historic preservation legislation such as the National Historic Preservation Act (NHPA) of 1966, as amended. NHPA established guidelines to "preserve important historic, cultural, and natural aspects of our national heritage, and to maintain, wherever possible, an environment that supports diversity and a variety of individual choice." The NHPA includes regulations specifically for Federal land-holding agencies, but also includes regulations (Section 106) which pertain to all projects that are funded, permitted, or approved by any Federal agency and which have the potential to affect cultural resources. All projects that are subject to NEPA are also subject to compliance with Section 106 of the NHPA and NEPA requirements concerning cultural resources. Provisions of NHPA establish a National Register of Historic Places (The National Register) maintained by the National Park Service, the Advisory Councils on Historic Preservation, State Historic Preservation Offices, and grants-in-aid programs.

### *American Indian Religious Freedom Act and Native American Graves and Repatriation Act*

The American Indian Religious Freedom Act recognizes that Native American religious practices, sacred sites, and sacred objects have not been properly protected under other statutes. It establishes as national policy that traditional practices and beliefs, sites (including right of access), and the use of sacred objects shall be protected and preserved. Additionally, Native American remains are protected by the Native American Graves and Repatriation Act of 1990.

### *Other Federal Legislation*

Historic preservation legislation was initiated by the Antiquities Act of 1966, which aimed to protect important historic and archaeological sites. It established a system of permits for conducting archaeological studies on Federal land, as well as setting penalties for noncompliance. This permit process controls the disturbance of archaeological sites on Federal land. New permits are currently issued under the Archeological Resources Protection Act (ARPA) of 1979. The purpose of ARPA is to enhance preservation and protection of archaeological resources on public and Native American lands. The Historic Sites Act of 1935 declared that it is national policy to "Preserve for public use historic sites, buildings, and objects of national significance."

## State Regulatory Setting

### *California Register of Historic Resources (CRHR)*

California State law also provides for the protection of cultural resources by requiring evaluations of the significance of prehistoric and historic resources identified in documents prepared pursuant to the California Environmental Quality Act (CEQA). Under CEQA, a cultural resource is considered an important historical resource if it meets any of the criteria found in Section 15064.5(a) of the CEQA Guidelines. Criteria identified in the CEQA Guidelines are similar to those described under the NHPA. The State Historic Preservation Office (SHPO) maintains the CRHR. Historic properties listed, or formally designated for eligibility to be listed, on The National Register are automatically listed on the CRHR. State Landmarks and Points of Interest are also automatically listed. The CRHR can also include properties designated under local preservation ordinances or identified through local historical resource surveys.

### *California Environmental Quality Act (CEQA)*

CEQA requires that lead agencies determine whether projects may have a significant effect on archaeological and historical resources. This determination applies to those resources which meet significance criteria qualifying them as "unique," "important," listed on the California Register of Historic Resources (CRHR), or eligible for listing on the CRHR. If the agency determines that a project may have a significant effect on a significant resource, the project is determined to have a significant effect on the environment, and these effects must be addressed. If a cultural resource is found not to be significant under the qualifying criteria, it need not be considered further in the planning process.

CEQA emphasizes avoidance of archaeological and historical resources as the preferred means of reducing potential significant environmental effects resulting from projects. If avoidance is not feasible, an excavation program or some other form of mitigation must be developed to mitigate the impacts. In order to adequately address the level of potential impacts, and thereby design appropriate mitigation measures, the significance and nature of the cultural resources must be determined. The following are steps typically taken to assess and mitigate potential impacts to cultural resources for the purposes of CEQA:

- identify cultural resources,
- evaluate the significance of the cultural resources found,
- evaluate the effects of the project on cultural resources, and
- develop and implement measures to mitigate the effects of the project on cultural resources

Treatment of paleontological resources under CEQA is generally similar to treatment of cultural resources, requiring evaluation of resources in a project's area of potential affect, assessment of potential impacts on significant or unique resources, and development of mitigation measures for potentially significant impacts, which may include monitoring combined with data recovery and/or avoidance.

In 2015, CEQA was amended to require lead agencies to determine whether projects may have a significant effect on tribal cultural resources. (Public Resources Code [PRC] § 21084.2). To qualify as a tribal cultural resource, the resource must be a site, feature, place, cultural landscape, sacred place, or object, which is of cultural value to a California Native American Tribe and is listed, or eligible for listing, on the national, state, or local register of historic resources. Lead agencies may also use their discretion to treat any notable resource as a tribal cultural resource. To determine whether a project may have an impact on a resource, the lead agency is required to consult with any California Native American tribe that requests consultation and is affiliated with the geographic area of a proposed project (PRC § 21080.3.1). CEQA requires that a lead agency consider the value of the cultural resource to the tribe and consider measures to mitigate any adverse impact.

### *State Laws Pertaining to Human Remains*

Section 7050.5 of the California Health and Safety Code requires that construction or excavation be stopped in the vicinity of discovered human remains until the county coroner can determine whether the remains are those of a Native American. If the remains are determined to be Native American, the coroner must contact the California Native American Heritage Commission. CEQA Guidelines (Section 15064.5) specify the procedures to be followed in case of the discovery of human remains on non-Federal land. The disposition of Native American burials falls within the jurisdiction of the Native American Heritage Commission.

Several sections of the California Public Resources Code protect paleontological resources.

Section 5097.5 prohibits "knowing and willful" excavation, removal, destruction, injury, and defacement of any "vertebrate paleontological site, including fossilized footprints," on public lands, except where the agency with jurisdiction has granted express permission. "As used in this section, 'public lands' means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof."

California Public Resources Code, Section 30244 requires reasonable mitigation for impacts on paleontological resources that occur as a result of development on public lands.

The sections of the California Administrative Code relating to the State Division of Beaches and Parks afford protection to geologic features and "paleontological materials" but grant the director of the State park system authority to issue permits for specific activities that may result in damage to such resources, if the activities are in the interest of the State park system and for State park purposes (California Administrative Code, Title 14, Section 4307 – 4309).

#### *Senate Bill 18 (Burton, Chapter 905, Statutes 2004)*

SB 18, authored by Senator John Burton and signed into law by Governor Arnold Schwarzenegger in September 2004, requires local (city and county) governments to consult with California Native American tribes to aid in the protection of traditional tribal cultural places ("cultural places") through local land use planning. This legislation, which amended §65040.2, §65092, §65351, §65352, and §65560, and added §65352.3, §653524, and §65562.5 to the Government Code, also requires the Governor's Office of Planning and Research (OPR) to include in the General Plan Guidelines advice to local governments on how to conduct these consultations. The intent of SB 18 is to provide California Native American tribes an opportunity to participate in local land use decisions at an early planning stage, for the purpose of protecting, or mitigating impacts to, cultural places. These consultation and noticing requirements apply to adoption and amendment of both general plans (defined in Government Code §65300 et seq.) and specific plans (defined in Government Code §65450 et seq.).

#### *Assembly Bill 52*

Assembly Bill (AB) 52, approved in September 2014, creates a formal role for California Native American tribes by creating a formal consultation process and establishing that a substantial adverse change to a tribal cultural resource has a significant effect on the environment. Tribal cultural resources are defined as:

1) Sites, features, places, cultural landscapes, sacred places, and objects with cultural value to a California Native American tribe that are either of the following:

A) Included or determined to be eligible for inclusion in the CRHR

B) Included in a local register of historical resources as defined in PRC Section 5020.1(k)

2) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in PRC Section 5024.1 (c). In applying the criteria set forth in PRC Section 5024.1 (c) the lead agency shall consider the significance of the resource to a California Native American tribe.

A cultural landscape that meets the criteria above is also a tribal cultural resource to the extent that the landscape is geographically defined in terms of the size and scope of the landscape. In addition, a historical resource described in PRC Section 21084.1, a unique archaeological resource as defined in PRC Section 21083.2(g), or a "non-unique archaeological resource" as defined in PRC Section 21083.2(h) may also be a tribal cultural resource if it conforms with above criteria.

AB 52 requires a lead agency, prior to the release of a negative declaration, mitigated negative declaration, or environmental impact report for a project, to begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project if: (1) the California Native American tribe requested to the lead agency, in writing, to be informed by the lead agency through formal notification of proposed projects in the geographic area that is traditionally and culturally affiliated with the tribe, and (2) the California Native American tribe responds, in writing, within 30 days of receipt of the formal notification, and requests the consultation.

## Local Regulatory Setting

### *City of Lake Forest General Plan*

The existing City of Lake Forest General Plan identifies goals and policies related to cultural resources. Please see the existing General Plan for additional detail.

## Geological and Paleontological Setting

The City of Lake Forest is in the northern portion of the California Geomorphic Province known as the Peninsular Ranges. The Peninsular Ranges geomorphic province extends from Mount San Jacinto in the north, through the tip of Baja, Mexico in the south. Subparallel to these ranges on the east is the San Andreas Fault Zone. The northwestwards motion of the Pacific Plate has created these ranges and their corresponding valleys (Wagner 2002).

The City has a complicated paleoenvironmental history which began at the age of dinosaurs about 66 million years old (66 Ma). The past 66 Ma has seen the City transition from coastal lowlands during the Paleocene to Oligocene, to shallow marine during the early Miocene, to deep marine during the early to early-late Miocene, back to shallow marine in the latest Miocene through the Pliocene, and finally to increasingly arid terrestrial deposits from the Pleistocene to the Holocene (Cogstone, 2018).

## Ethnography

The City of Lake Forest is primarily located within the traditional boundaries of the Tongva (Gabrielino) tribal territory. The City is also located along the boundary of the territory of the Acjachemen (Juaneño) (McCawley 1996). Ethnographically, Aliso Creek was recorded as the boundary between the Gabrielino to the northeast and the Juaneño to the southwest (Kroeber 1976). Therefore, both of these native traditions are culturally relevant for the City. The names Juaneño and Gabrielino were names imposed on Native Americans by Spanish missionaries to identify the indigenous peoples who occupied the surrounding areas of Mission San Juan Capistrano and Mission San Gabriel Arcángel, respectively (Cogstone, 2018).

### *Tongva*

The Tongva speak a language that is part of the Takic language family. At the time of Spanish contact, their territory encompassed a vast area stretching from Topanga Canyon in the northwest, to the base of Mount Wilson in the north, to San Bernardino in the east, Aliso Creek in the southeast and the four Southern Channel Islands, in all an area of more than 2,500 square miles (Bean and Smith 1978, McCawley 1996).

The Tongva are considered to have been one of the wealthiest tribes and to have greatly influenced tribes they traded with (Kroeber 1976:621). Houses were domed and circular structures thatched with tule or similar materials (Bean and Smith 1978:542). The best known artifacts were made of steatite and were highly prized. Many common everyday items were decorated with inlaid shell or carvings reflecting an elaborately developed artisanship (Bean and Smith 1978:542).

The main food zones utilized were marine, woodland, and grassland (Bean and Smith 1978). Plant foods were, by far, the greatest part of the traditional diet at contact. Acorns were the most important single food source. Villages were located near water sources necessary for the leaching of acorns, which was a daily occurrence. Grass seeds were the next most abundant plant food used along with chia. Seeds were parched, ground, and cooked as mush in various combinations according to taste and availability. Greens and fruits were eaten raw or cooked or sometimes dried for storage. Bulbs, roots, and tubers were dug in the spring and summer and usually eaten fresh. Mushrooms and tree fungus were prized as delicacies (Cogstone, 2018).

The principal game animals were deer, rabbit, jackrabbit, woodrat, mice, ground squirrels, antelope, quail, dove, ducks and other birds. Most predators were avoided as food, as were tree squirrels and most reptiles. Trout and other fish were caught in the streams, while salmon were available when they ran in the larger creeks. Marine foods were extensively utilized. Sea mammals, fish and crustaceans were hunted and gathered from both the shoreline and the open ocean, using reed and dugout canoes. Shellfish were the most common resource, including abalone, turbans, mussels, clams, scallops, bubble shells, and others (Bean and Smith 1978:538-540).

### *Acjachemen*

The Acjachemen (Juaneño) speak a language that is part of the Takic language family also. Their traditional tribal territory was situated partly in northern San Diego County and partly in southern Orange County (Figure 5). The boundaries were Las Pulgas Creek (south), Aliso Creek (north), the Pacific Ocean (west) and the Santa Ana Mountains (east). Villages were mostly along San Juan Creek, Aliso Creek, Trabuco Creek and San Mateo Creek (O'Neil and Evans 1980).

## Historic Period Background

### *Spanish Exploration*

Juan Cabrillo was the first European to sail along the coast of California in 1542 and was followed in 1602 by Sebastian Vizcaino (Bean and Rawls 1993). The Spanish colonization of what was then known as Alta California began with the 1769 overland expedition led by Gaspar de Portolá with a crew of 63 men in order to explore the land between San Diego and Monterey (Fox 1979). Between 1769 and 1822 the Spanish had colonized California and established missions, presidios, and pueblos and documented the people and landscape along the way (McCawley 1996).

Portola and his expedition crossed the area north of Lake Forest in July 1769, naming the perennial creek that empties from the Santa Ana Mountains "aliso", the Spanish work alder; an error on the Spanish identifier, since they were in fact, referring to the sycamore tree, which still grow along the creek. It should be noted that the Juaneño term for the creek was Seeevenga, meaning "at the sycamores" (O'Neil 1988). However, historically, alder and sycamore trees were much more prominent, particularly in the riparian and floodplain areas where an oak-woodland habitat existed. During the Mission period, many of the trees along the creek, including alder, oak, sycamore, and other species were cut down for the construction of ships and structures, charcoal production, and other uses (Nasser 2003).

Following the Portolá Expedition, vast tracts of land were granted to the Missions. The seventh of the Franciscan missions in California was Mission San Juan Capistrano, founded in 1776; shortly after Portolá's visit to the area. The goals of the missions were tri-fold: they helped establish a Spanish presence on the west coast, allowed for a means to Christianize the native peoples, and served to exploit the native population as laborers. The Spanish also hoped each mission would become a town center, whereas, "the pueblo would receive a ground of four square leagues of land… and other property would be parceled out among the Indians". The missionaries, or padres, would essentially serve as a mayor, or head of the town (Bean 1968:29-30).

### *Mexican Period*

In 1821 Mexico won its independence from Spain and eventually appropriated the vast mission lands that existed and redistributed them in the form of land grants, to private owners (Bean and Rawls 1993; Robinson 1948). The lands were often granted to soldiers who proved their loyalty to the Mexican government. One these Mexican soldiers was José António Fernando Serrano who was the youngest son of Francisco Serrano, former Acalade (mayor) of the Pueblo of Los Angeles (Fox 1979). José António Fernando Serrano was granted the 10,688-acre Rancho Canada De Los Alisos, or "glen of the alders", which was enlarged in 1846 by a second grant (Robinson 1948). The two combined grants made the rancho closely mirror the shape of the present-day City of Lake Forest (Figure 6). The boundaries of the land grant were El Camino Real to the west, Aliso Creek and Rancho Trabuco to the south, Santiago Road and the Santa Ana Foothills to the east, and Rancho san Juaquin and Lomas Santiago to the north.

Rancho Canada de Los Alisos, like the other ranchos that previously existed in what is now Orange County, was centered on cattle husbandry and was a self-sustaining operation at its conception (Arbuckle 1980). Cattle dominated and transformed the landscape. As the hide and tallow industry grew, and rancheros began trading their raw goods for manufactured good that came by the way of ship in the Bay (Bahía) of San Juan Capistrano, what is now present-day Dana Point. The area was long known as "El Toro" after the steers who roamed Canada de Los Alisos, whose loud, bellowing sounds could be heard from great distances (Arbuckle 1980).

Serrano used the local Native American population as well as the Mestizo (Spanish and Native) population to build, plant, plow, and tend to the livestock of the rancho, resembling the feudal system (Osterman 1992). In addition to cattle, Serrano bred Mustangs and sheep, he also grew grain, corn, watermelons, and grapes. José Serrano acted as the Juez de Campo, or judge of the fields, an official role that was tasked with settling disputes between rancheros over livestock ownership as well as presiding over (Arbuckle 1980).

### *American Period*

Following the cession of California to the United States after the Mexican-American War, a claim for the Rancho was filed with the Public Land Commission in 1852 as required by the Land Act of 1851, and the grant was eventually patented to Serrano in 1871 after much litigation (Carpenter 2003). After the cession of California to the United States, a stagecoach route passed through the El Toro as early as the late 1850s and a stagecoach stop was established just south of El Toro (Fox 1979). Stagecoaches primarily carried mail, but carried passengers as well. The El Toro stop became a popular holdover for passengers traveling to the coast via Laguna Canyon.

A series of droughts affected the area from 1863 until 1883 causing the death of Serrano's herds as well as the herds of the surrounding ranchos (Fox 1979). Serrano eventually went bankrupt and was forced to mortgage and ultimately foreclose the ranch to J.S. Slauson, a Los Angeles banker. Slauson subdivided the land into ten parcels and leased a portion of the rancho lands to families that settled into the Saddleback Valley. Settlers raised cattle and sheep, planted vineyards and fruit trees. By 1886 the majority of the Saddleback Valley was planted in grapes, until plant disease called the "Anaheim Disease" decimated the vineyards. Orange and walnuts trees soon replaced the failed vineyards (Arbuckle 1980).

By the time Bostonian Dwight Whiting purchased 10,000 acres of the former Rancho de Los Alisos in 1884, the area was already a stagecoach stop that connected San Diego and Los Angeles, with later diversions to Santa Ana and Laguna Beach (Figure 7). Whiting intended to establish a new town inhabited by English gentlemen farmers. Whiting was able bring the San Bernardino and San Diego Railway Co. through his land in 1887, thus founding the town of Aliso City (Arbuckle 1980) (Figure 8). The railroad "boom" brought an influx of people into southern California and numerous cities were proposed. On paper, many of these cities were absorbed by larger ones, while most, like Aliso City, remained small towns (Osterman 1992). Whiting established a 400 acre of dense Eucalyptus tree forest located between present day Ridge Route, Jeronimo, Lake Forest and Serrano Road. The Eucalyptus is now a ubiquitous characteristic of the present day Lake Forest, the city's name originating from Whiting's man-made forest (Arbuckle 1980).

In the 1890s, the Saddleback Valley was dry framed by tenant farming, in which farmers did not own their land, but rented it from their landlords, also known as sharecropping (Osterman 1992). Dry farming crops included barley (the major grain crop), and hay for the livestock. Black-eyed beans were also dry farmed and, while more difficult to farm, turned a higher profit (Osterman 1992). It wasn't until the 1920s that citrus came to the Saddleback Valley. Charles Bennet, an early pioneer attracted to the former Aliso City, pioneered the citrus industry in El Toro by drilling deeper wells (Osterman 1992). Despite the success in citrus in El Toro, the City remained small, serving as the Saddleback Valley's shipping and social center (Osterman 1992)

#### *Modern Period*

In 1942, El Toro Marine Corps Air Station was established and was designated as a Master Jet Station and after World War II all United States Presidents landed in Air Force One at this base. After World War II the agricultural land was developed into residential, commercial, and industrial areas. In 1999 the Marine Corps Air Station El Toro was decommissioned.

In 1958, Whiting sold the Rancho to V.P. Baker and associates. In 1969, the Bakers sold the property to the Deane Bros. who later incorporated into the Occidental Petroleum, Land Development Division. They started the residential development of the area, executing a master planned community that eventually became the City of Lake Forest. During the 1960s, a steady supply of water brought in by aqueducts from Northern California, as well as from the Colorado River, facilitated the transformation of the Saddleback Valley from and agricultural community to the multi-city, suburban sprawl it is known as today (Osterman 1992). The City of Lake Forest was incorporated in 1991 and is named for the two man-made lakes within the city as well as the man-made Eucalyptus forest (Cogstone, 2018).

### Cultural Resources in Lake Forest General Plan Study Area

The City of Lake Forest currently has 93 previously recorded archaeological sites and six built historic resources within the City boundaries (refer to Table 9-12). A search of the California Historic Resources Inventory System (CHRIS) at the South Central Coastal Information Center (SCCIC) located on the campus of California State University, Fullerton (CSUF) was conducted on March 28, 2018 by Cogstone archaeologist Megan Wilson. The records search covered the entire 10,748.50-acres of the City of Lake Forest and covered portions of the El Toro, San Juan Capistrano, and Santiago Peak USGS 7.5 topographic maps. Results of the record search indicate that 167 previous cultural resources studies have been completed within the boundaries of the City of Lake Forest.

The records search determined that 138 previously recorded cultural resources are located within the City boundaries (Table 9-12). Of these 138 resources, one resource includes a portion of the Upper Aliso Creek Archaeological District, 87 prehistoric archaeological sites, 36 prehistoric archaeological isolates, five multicomponent sites, one historic archaeological site, two historic isolates, six historic resources, one historic district listed (Heritage Hill Historical Park) on the NRHP and CHL.

The site labelled P- 30-156547 in Table 9-12, consists of a historic district, the Heritage Hill Historical Park located at 25151 Serrano Road, Lake Forest CA 92630-2534. This site is registered on the National Register of Historic Places (NR No. 7600050), California Historical Landmark (No. 199), and is registered as an Orange County Historical Landmark. The Site consists of the original location of the Serrano Adobe (1868) as well as the relocated Bennet Ranch House (1908), the El Toro Grammar School (1890), and the St. George's Episcopal Mission (1891). In prehistory, the Acjachemen had a patrilineal society and lived in groups with other relatives. These groups had established claims to places including the sites of their villages and resource areas. Marriages were usually arranged from outside villages establishing a social network of related peoples in the region. There was a well-developed political system including a hereditary chief. Religion was an important aspect of their society. Religious ceremonies included rites of passage at puberty and mourning rituals (Kroeber 1925:636-647).

Houses were typically conical in shape and thatched with locally available plant materials. Work areas were often shaded by rectangular brush-covered roofs (ramada). Each village had a ceremonial structure in the center enclosed by a circular fence where all religious activities were performed (Bean and Shipek 1978:553).

Women are known to have been the primary gathers of plants foods, but also gathered shellfish and trapped small game animals. Men hunted large game, most small game, fished, and assisted with plant food gathering, especially of acorns. Adults were actively involved in making tools including nets, arrows, bows, traps, food preparation items, pottery and ornaments. Tribal elders had important political and religious responsibilities and were involved in education of younger members (Bean and Shipek 1978:555).

**Table 9-12 Previously Recorded Cultural Resources Within the City of Lake Forest**

| Primary No. | Other Identifier | Site Type | Site Description | Year Recorded | Maps |
|---|---|---|---|---|---|
| P-30-000016 | CA-ORA-000016 | Prehistoric Archaeological Site | Lithic scatter | 1949 | San Juan Capistrano |
| P-30-000037 | CA-ORA-000037 | Prehistoric Archaeological Site | Unidentified | 1949 | El Toro |
| P-30-000038 | CA-ORA-000038 | Multicomponent Site | Multicomponent | 1949 | El Toro |
| P-30-000039 | CA-ORA-000039 | Prehistoric Archaeological Site | Lithic scatter | 1949, 1976,1978 | El Toro |
| P-30-000040 | CA-ORA-000040 | Prehistoric Archaeological Site | Lithic scatter | 1949 | El Toro |
| P-30-000042 | CA-ORA-000042 | Prehistoric Archaeological Site | Lithic scatter | 1949, 1980 | El Toro |
| P-30-000176 | CA-ORA-000176 | Prehistoric Archaeological Site | Lithic scatter | 1966, 1991 | El Toro |
| P-30-000438 | CA-ORA-000438 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1995, 1997, 2001 | El Toro |
| P-30- 000439 | CA-ORA- 000439 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2001 | El Toro, Santiago Peak |
| P-30-000440 | CA-ORA-000440 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2001 | El Toro |
| P-30-000441 | CA-ORA-000441 | Prehistoric Archaeological Site | Lithic scatter, cairn | 1973, 2001, 2007, 2014 | El Toro |
| P-30-000442 | CA-ORA-000442 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2007 | El Toro |
| P-30-000443 | CA-ORA-000443 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2001, 2007 | El Toro |
| P-30- 000444 | CA-ORA- 000444 | Prehistoric Archaeological Site | Lithic scatter | 1974, 1994, 20017 | El Toro |
| P-30-000445 | CA-ORA-000445 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2001, 2007 | El Toro |
| P-30-000446 | CA-ORA-000446 | Prehistoric Archaeological Site | Lithic scatter | 1973, 2001, 2007 | El Toro |
| P-30-000447 | CA-ORA-000447 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1978, 2007 | El Toro |
| P-30-000448 | CA-ORA-000448/H | Multicomponent Site | Lithic scatter, foundations | 1974, 2001 | El Toro |

| Primary No. | Other Identifier | Site Type | Site Description | Year Recorded | Maps |
|---|---|---|---|---|---|
| P-30- 000449 | CA-ORA- 000449 | Prehistoric Archaeological Site | Lithic scatter | 1974, 2001 | El Toro, Santiago Peak |
| P-30- 000450 | CA-ORA- 450 | Prehistoric Archaeological Site | Lithic scatter | 1974, 2001 | El Toro, Santiago Peak |
| P-30-000451 | CA-ORA-000451 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1982 | Santiago Peak |
| P-30-000452 | CA-ORA-000452 | Prehistoric Archaeological Site | Lithic scatter, projectile points | 1974, 2001 | El Toro |
| P-30- 000453 | CA-ORA- 000453 | Multicomponent Site | Rockshelter, lithic scatter, historic carving “1887/4” | 1974, 2001 | El Toro |
| P-30-000454 | CA-ORA-000454 | Prehistoric Archaeological Site | Lithic scatter | 1974, 2001 | El Toro |
| P-30-000455 | CA-ORA-000455 | Prehistoric Archaeological Site | Lithic scatter | 1974, 2001 | El Toro |
| P-30-000456 | CA-ORA-000456 | Prehistoric Archaeological Site | Lithic scatter | 1974, 1978, 2001 | El Toro |
| P-30-000460 | CA-ORA-000460 | Prehistoric Archaeological Site | Lithic scatter | 1974 | El Toro |
| P-30-000489 | CA-ORA-000489 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1980, 2004 | El Toro |
| P-30-000490 | CA-ORA-000490 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1982 | El Toro |
| P-30-000491 | CA-ORA-000491 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1980, 1980 | El Toro |
| P-30-000510 | CA-ORA-000510 | Prehistoric Archaeological Site | Lithic scatter | 1975, 1994 | El Toro |
| P-30- 000514 | CA-ORA- 000514 | Prehistoric Archaeological Site | Habitation site, diiscoidal | 1976, 1977 | El Toro |
| P-30-000536 | CA-ORA-000536 | Prehistoric Archaeological Site | Lithic scatter | 1976 | El Toro |
| P-30-000544 | CA-ORA-000544 | Prehistoric Archaeological Site | Lithic scatter | 1976, 1977 | El Toro |
| P-30-000566 | CA-ORA-000566 | Prehistoric Archaeological Site | Lithic scatter | 1973, 1977 | El Toro |
| P-30-000579 | CA-ORA-000579 | Prehistoric Archaeological Site | Shell scatter | 1975 | San Juan Capistrano |
| P-30- 000594 | CA-ORA- 000594 | Prehistoric Archaeological Site | Lithic scatter | 1977 | El Toro |
| P-30-000602 | CA-ORA-000602 | Prehistoric Archaeological Site | Lithic scatter | 1976, 2002 | El Toro |
| P-30- 000612 | CA-ORA- 000612/H | Multicomponent Site | Lithic scatter, habitation debris, and historic refuse scatter. Serrano-Whiting Adobe Site | 1977 | El Toro |
| P-30- 000628 | CA-ORA- 000628 | Prehistoric Archaeological Site | Lithic scatter | 1977 | El Toro |

| Primary No. | Other Identifier | Site Type | Site Description | Year Recorded | Maps |
|---|---|---|---|---|---|
| P-30-000647 | CA-ORA-000647 | Prehistoric Archaeological Site | Quarry site, lithic tools and scatter | 1977, 1986, 1994 | El Toro |
| P-30-000648 | CA-ORA-000648 | Prehistoric Archaeological Site | Temporary habitation area | 1977, 1994 | El Toro |
| P-30-000693 | CA-ORA-693 | Prehistoric Archaeological Site | Lithic Scatter | 1977, 1978 | El Toro |
| P-30-000694 | CA-ORA-000694 | Prehistoric Archaeological Site | Lithic Scatter | 1977, 1978 | El Toro |
| P-30- 000695 | CA-ORA- 000695 | Prehistoric Archaeological Site | Lithic Scatter | 1977, 1978 | El Toro |
| P-30-000696 | CA-ORA-000696 | Prehistoric Archaeological Site | Habitation area, lithic scatter | 1977, 1978 | El Toro |
| P-30-000697 | CA-ORA-000697 | Prehistoric Archaeological Site | Lithic scatter | 1977, 1978 | El Toro |
| P-30-000698 | CA-ORA-000698 | Prehistoric Archaeological Site | Lithic scatter | 1977 | El Toro |
| P-30-000699 | CA-ORA-000699 | Prehistoric Archaeological Site | Lithic scatter | 1977, 1978 | El Toro |
| P-30-000739 | CA-ORA-000739 | Prehistoric Archaeological Site | Lithic scatter | 1978 | El Toro |
| P-30-000742 | CA-ORA-000742 | Prehistoric Archaeological Site | Lithic scatter | 1978 | El Toro |
| P-30-000743 | CA-ORA-000743 | Prehistoric Archaeological Site | Lithic scatter | 1978 | El Toro |
| P-30-000741 | CA-ORA-000741 | Prehistoric Archaeological Site | Lithic scatter | 1978 | El Toro |
| P-30-000756 | CA-ORA-000756 | Prehistoric Archaeological Site | Lithic scatter | 1978, 1996 | El Toro |
| P-30-000773 | CA-ORA-000773 | Prehistoric Archaeological Site | Lithic scatter | 1978 | El Toro |
| P-30-000825 | CA-ORA-000825 | Prehistoric Archaeological Site | Lithic scatter | 1979, 1997, 2014 | El Toro |
| P-30- 000826 | CA-ORA- 000826 | Prehistoric Archaeological Site | Lithic scatter | 1979, 1982, 1997 | El Toro |
| P-30-000827 | CA-ORA-000827 | Prehistoric Archaeological Site | Lithic scatter | 1979, 1995 | El Toro |
| P-30-000828 | CA-ORA-000828 | Prehistoric Archaeological Site | Lithic scatter | 1979, 1980 | El Toro |
| P-30-000905 | CA-ORA-000905 | Prehistoric Archaeological Site | Lithic scatter | 1980, 1982 | El Toro |
| P-30-000949 | CA-ORA-000949 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30- 000950 | CA-ORA- 000950 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30- 000951 | CA-ORA- 000951 | Prehistoric Archaeological Site | Rockshelter, habitation area, midden, lithic scatter, hearth | 1980 | El Toro |
| P-30-000952 | CA-ORA-000952 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30-000953 | CA-ORA-000953 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |

| Primary No. | Other Identifier | Site Type | Site Description | Year Recorded | Maps |
|---|---|---|---|---|---|
| P-30-000954 | CA-ORA-000954 | Prehistoric Archaeological Site | Lithic scatter, shell scatter | 1980 | El Toro |
| P-30-000955 | CA-ORA-000955 | Prehistoric Archaeological Site | Bedrock milling features | 1980 | El Toro |
| P-30-000957 | CA-ORA-000957 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30-000958 | CA-ORA-000958 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30-000959 | CA-ORA-000959 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30- 000960 | CA-ORA- 000960 | Prehistoric Archaeological Site | Lithic scatter | 1980 | El Toro |
| P-30-001004 | CA-ORA-001004 | Prehistoric Archaeological Site | Lithic scatter | 1981 | El Toro |
| P-30-001057 | CA-ORA-001057 | Prehistoric Archaeological Site | Rock carin, lithic scatter | 1984 | El Toro |
| P-30- | CA-ORA- | Prehistoric Archaeological Site | Rock carin, lithic | 1984 | El Toro |
| P-30- 001146 | CA-ORA- 001146 | Prehistoric Archaeological Site | Lithic scatter, hearth | 1988 | El Toro |
| P-30-001147 | CA-ORA-001147 | Prehistoric Archaeological Site | Quarry, lithic scatter | 1988 | El Toro |
| P-30-001148 | CA-ORA-001148 | Prehistoric Archaeological Site | Lithic scatter | 1988 | El Toro |
| P-30-001149 | CA-ORA-001149 | Prehistoric Archaeological Site | Lithic scatter, hearth | 1988 | El Toro |
| P-30-001150 | CA-ORA-001150 | Prehistoric Archaeological Site | Lithic scatter, hearth | 1988 | El Toro |
| P-30-001171 | CA-ORA-001171 | Prehistoric Archaeological Site | Lithic scatter | 1988, 1994 | El Toro |
| P-30-001242 | CA-ORA-001242 | Prehistoric Archaeological Site | Lithic scatter | 1990 | El Toro |
| P-30-001345 | CA-ORA-001345 | Prehistoric Archaeological Site | 23 hearths | 1992 | El Toro |
| P-30-001362 | CA-ORA-001362 | Prehistoric Archaeological Site | Lithic scatter | 1994 | El Toro |
| P-30-001373 | CA-ORA-001373 | Prehistoric Archaeological Site | Lithic scatter | 1994 | El Toro |
| P-30-001430 | CA-ORA-001430 | Prehistoric Archaeological Site | Lithic scatter | 1995 | El Toro |
| P-30-001496 | | Historic Resource | Concrete and metal troughs, holding pen | 1980 | El Toro |
| P-30-001497 | | Historic Resource | Water tower | 1980 | El Toro |
| P-30-001498 | | Historic Resource | Metal shed | 1998 | El Toro |
| P-30-001500 | CA-ORA-001500H | Historic Resource | Wood water tank | 1998 | El Toro |
| P-30-001501 | CA-ORA-001501H | Historic Archaeological Site | Collapsed shed and structural debris | 1998 | El Toro |
| P-30- 001728 | | Archaeological District | Upper Aliso Creek Archaeological District | 1978, 2001 | El Toro, Santiago Peak |
| P-30-001741 | CA-ORA-001741 | Prehistoric Archaeological Site | Lithic scatter | 1986 | El Toro |
| P-30- | N/A | Prehistoric Isolate | Utilized chert flake | 1977 | El Toro |
| P-30-100187 | N/A | Prehistoric Isolate | Scraper-core fragment and flake | 1977 | El Toro |
| P-30-100188 | N/A | Prehistoric Isolate | Cobble and debitage | 1977 | El Toro |

| Primary No. | Other Identifier | Site Type | Site Description | Year Recorded | Maps |
|---|---|---|---|---|---|
| P-30-100219 | N/A | Prehistoric Isolate | Granitic mano | 2014 | El Toro |
| P-30-100220 | N/A | Prehistoric Isolate | Chert flake | 2014 | El Toro |
| P-30-100276 | N/A | Prehistoric Isolate | Core tool | 1980 | El Toro |
| P-30-100278 | N/A | Prehistoric Isolate | Hammerstone | 1980 | El Toro |
| P-30-100279 | N/A | Prehistoric Isolate | Mano | 1980 | El Toro |
| P-30-100280 | N/A | Prehistoric Isolate | Core tool | 1980 | El Toro |
| P-30- 100281 | N/A | Prehistoric Isolate | Flake tool | 1980 | El Toro |
| P-30-100282 | N/A | Prehistoric Isolate | Mano | 1980 | El Toro |
| P-30-100283 | N/A | Prehistoric Isolate | Core tool | 1980 | El Toro |
| P-30-100285 | N/A | Prehistoric Isolate | Flake tool | 1980 | El Toro |
| P-30-100288 | N/A | Prehistoric Isolate | Flake tool | 1980 | El Toro |
| P-30- 100289 | N/A | Prehistoric Isolate | Metate | 1980 | El Toro |
| P-30-100290 | N/A | Prehistoric Isolate | Core tool | 1980 | El Toro |
| P-30-100294 | N/A | Prehistoric Isolate | Core tool | 1980 | El Toro |
| P-30-100295 | N/A | Prehistoric Isolate | Core | 1980 | El Toro |
| P-30-100296 | N/A | Prehistoric Isolate | Flake tool | 1980 | El Toro |
| P-30-100305 | N/A | Prehistoric Isolate | Utilized flake | 1980 | El Toro |
| P-30-100309 | N/A | Historic Isolate | Concrete foundation/ slab | 1984 | El Toro |
| P-30-100310 | N/A | Prehistoric Isolate | Chert flake | 1998 | El Toro |
| P-30-100311 | N/A | Prehistoric Isolate | Chopper/scraper | 1984 | El Toro |
| P-30-100312 | N/A | Historic Isolate | Concrete trough | 1980 | El Toro |
| P-30-100313 | N/A | Prehistoric Isolate | Quartzite core | 1993 | El Toro |
| P-30- 100371 | N/A | Prehistoric Isolate | Abalone shell fragment | 2006 | El Toro |
| P-30-100438 | N/A | Prehistoric Isolate | Chert scraper | 1984 | El Toro |
| P-30-100439 | N/A | Prehistoric Isolate | Mano fragment | 1984 | El Toro |
| P-30-100444 | N/A | Prehistoric Isolate | Quartzite chopper | 1989 | El Toro |
| P-30-100445 | N/A | Prehistoric Isolate | Chert flake | 1991 | El Toro |
| P-30-100446 | N/A | Prehistoric Isolate | Metate fragment | 1991 | El Toro |
| P-30-100447 | N/A | Prehistoric Isolate | Core | 1991 | El Toro |
| P-30-100448 | N/A | Prehistoric Isolate | Mortar and core | 1991 | El Toro |
| P-30-100449 | N/A | Prehistoric Isolate | Chert flake | 1991 | El Toro |
| P-30-100453 | N/A | Prehistoric Isolate | Flake | 1994 | El Toro |
| P-30- 100463 | N/A | Prehistoric Isolate | 2 utilized chert flakes | 1991 | El Toro |
| P-30-100464 | N/A | Prehistoric Isolate | Chert flake | 1991 | El Toro |
| P-30-100491 | N/A | Prehistoric Isolate | Mano fragment | 2011 | El Toro |
| P-30- 156547 | NR. No 76000505, CHL No. 199, HRI No. 035907, OC Historical Landmark | Historic Resource | Heritage Hill Historic Site; Serrano Adobe, :1856-1860, Bennet House (1908), El Toro School (1890), St. George's Church (1891). | 1935, 1959, 1976, 1980 | El Toro |
| P-30- 176663 | N/A | Historic Resource | Railroad, Aitchison-Topeka-Santa Fe | 2002, 2002, 2007, 2012, 2016 | El Toro, San Juan Capistrano |

In addition to the SCCIC records search, a variety of sources were consulted in February and May 2018 to obtain information regarding the cultural context of the City of Lake Forest (Table 9-13). Sources included the National Register of Historic Places (NRHP) and the California Register of Historic Resources (CRHR) which includes the California Historical Resources Inventory (CHRI), California Historical Landmarks (CHL), and California Points of Historical Interest (CPHI). The Bureau of Land Management (BLM) General Land Office records were also searched (Table 9-14).

**Table 9-13 Additional Sources Consulted**

| Source | Results |
|---|---|
| National Register of Historic Places (NRHP/NR; 1979-2002 & supplements) | Positive: one listing, the Serrano Adobe, NR. 76000505 |
| Historic USGS Topographic (Topo) Maps | Positive: The earliest USGS Topo map for the area is the 1901 30'Southern California Sheet no. 1 that shows the Canada de Ls Alisos Rancho the then Southern California Railroad, El Toro Road (then Los Alisos Avenue), El Camino Real, as well as the town of El Toro and the old stagecoach stop can be inferred from this Topo map. No new information can be gleaned from following Topo maps until the 1942 Santiago Peak 7.5' Topo map that shows El Toro Road (still Los Alisos Avenue at that time) as a secondary highway and shows Highway 101 as a primary highway. More development is present at old El Toro's historic downtown core. The area around Aliso Creek is symbolized as agricultural enterprises and likely included citrus orchards. The 1968 El Toro and San Juan Capistrano 7.5' Topo maps show the completed of Interstate 5 at the former location of Highway 101 and the beginning of small housing tracts near the old El Toro downtown area. |
| Historic US Department of Agriculture Aerial Photographs | The earliest historical aerial for the City dates to 1938 and shows numerous agricultural fields surrounding El Toro Road, then Los Alisos Avenue.<br>Development is concentrated with old El Toro's Historic downtown core and near the area of the Serrano Adobe/Heritage Hill Area. A conspicuous feature on the landscape is Whiting experimental Eucalyptus forest, which can been seen spanning the area north of the railroad to Jeronimo Road, centered along Ridge Route. The landscape dramatically changes in the 1967 aerial with the replacement of Highway 101 with Interstate 5 and the aggressive commercial and residential development south of Jeronimo Road and north of Interstate 5. Development creeps northwest in later years. |
| California Historical Resources Inventory (CHRI/HRI; 1976-2014) | Positive: one listing, the Serrano Adobe HRI No. 035907 |
| California Historical Landmarks (CHL; 1995 & supplements to 2014) | Positive: one listing, the Serrano Adobe, CHL 199 |
| California Points of Historical Interest (CPHI; 1992 to 2014) | Negative |
| Orange County Historical Sites | Positive: one listing, Heritage Hill Historical Park |
| Mills Act Property Contract Program | Negative |
| Historic Bridges | Positive: 55C0212, Ridge Route Drive, Union Pacific:1967 |
| Bureau of Land Management<br>(BLM) General Land Office Records (GLO) | Positive: See Table 6 |
| Local Historical Society, Saddleback Valley Historical Society (SVHS) | Positive: 3572 Prothero, Lake Forest. "Prothero House": 1920<br>23512 El Toro Rd, Lake Forest, CA 92630, Big Shots Pool Hall and El Toro Meat Market, original location of the El Toro General Store (1890s) (Figure 8). |

**Table 9-14 BLM General Land Office Records**

| USGS 7.5 Topographic Quad(s) | Township | Range | Section(s) | Year, Name |
|---|---|---|---|---|
| El Toro | 5S | 7W | 29, | 1866, Southern Pacific Railroad; 1871, Jose Serrano; 1878, Samuel Shrewsbury |
| | | | 30, 31, | 1871, Jose Serrano; |
| | | | 32 | 18591, Joaquin Serrano |
| | | 8W | 36 | 1871, Jose Serrano |
| | 6S | 7W | 07, 08, 18 | 1866, Juan Forster |
| | | 8W | 01 | 1871, Jose Serrano; 1868 Theodocio Yorba |
| | | | 13, 23, 24 | 1866, Juan Forster; 1871, Jose Serrano |
| | | | 22 | 1867 Jose Sepulveda; 1871 Jose Serrano |
| | | | 01, 02, 10, 11, 12, 14, 15, 16, 21 | 1871, Jose Serrano |
| El Toro and San Juan Capistrano | 6W | 8W | 26 | 1866 Juan Forster; 1871, Jose Serrano; 1875 & 1666, George Y. Barry; 1892 Charles M. Salter |
| | | | 27 | 1871, Jose Serrano |
| | | | 28 | 1871, Jose Serrano; 1877, 1882, State of California; |
| San Juan Capistrano | 6W | 8W | 34 | 1871, Jose Serrano; 1883 Hiram H. & Cyrus Rawson, J.E. Bacon |
| | | | 35 | 1871 Jose Serrano |

## Native American Consultation

A Sacred Lands File (SLF) search was requested from the Native American Heritage Commission (NAHC) on March 23, 2018, the NAHC replied the same day and indicated that a search of the SFL was completed with positive results in the Santiago Peak USGS Quadrangle and that the Juaneño Band of Mission Indians should be contacted for more information about the site.

The City of Lake Forest conducted Native American consultations under Senate Bill 18 (Chapter 905, Statutes of 2004), also known as SB18, which requires local governments to consult with Tribes prior to making certain planning decisions and requires consultation and notice for a general and specific plan adoption or amendments in order to preserve, or mitigate impacts to, cultural places that may be affected. In addition to SB18 consultation, the City conducted tribal consultations under the provisions of the California Environmental Quality Act (CEQA) (Public Resources Code section 21080.3.1 subdivisions (b), (d) and (e)), also known as AB 52, which requires consulting for projects within the City of Lake Forest's jurisdiction and within the traditional territory of the Tribal Organizations who have previously requested AB52 consultations with the City. Three Tribal Organizations were contacted under AB52 and 13 were contacted under SB18.

The City of Lake Forest sent letters to all 15 Tribal Organizations on June 4, 2018 via certified mail. Follow up emails were sent on June 26, 2018, and follow up phone calls were made on July 18, 2018; however, additional contact attempts were made to the Juaneño Band of Mission Indians Acjachemen Nation. To date, four responses have been received and are summarized below:

On August 31, 2018 Ms. Joyce Perry of the Juaneño Band of Mission Indians Acjachemen Nation, via phone conversation, requested that the City of Lake Forest notify the Tribe regarding any development projects located within the City limits. She informed that the Santa Ana foothills and area around the Aliso Creek watershed are extremely sensitive for tribal cultural resources including ancestor remains.

On August 31, 2018, Mr. Marcos Guerrero indicated that he believed the UAIC was placed on the City of Forest /Orange County list by accident.

On June 12, 2018 Mr. Ray Teran indicated that Viejas Tribe as determined that the project has little cultural significance to the Viejas Tribe. He recommended that local Tribes be consulted.

On July 18, 2018 the receptionist of the Jamul Indian Village indicated that the City of Lake Forest is off their reservation and outside of their traditional tribal territory and defers to local Tribes.

Although Native American human remains are normally associated with former residential village locations, isolated burials and cremations have been found in many other locations. Future projects may disturb or destroy buried Native American human remains, including those interred outside of formal cemeteries. Consistent with state laws protecting these remains (that is, Health and Safety Code Section 7050.5 and Public Resources Code Section 5097.98), sites containing Native American human remains must be treated in a sensitive manner

## Paleontological Resources

The City has a complicated paleoenvironmental history which began at the age of dinosaurs about 66 million (Ma) years old. Geologic mapping by Morton and Miller (2006) maps the City area as 28 separate units ranging from modern deposits to Paleocene sediments (Table 9-15). Epoch's including Holocene, Pleistocene, Pliocene, etc. are distinctive periods in the history of the earth. Geological units are discussed in order from oldest to youngest based on these time periods in the table below.

**Table 9-15 Geologic units within the City**

| Epoch | Age Range | Unit Name | Paleoenvironment |
|---|---|---|---|
| modern | <200 years | artificial fill (Qaf) | man-made |
| late Holocene | <5,000 years (<5 ka) | very young colluvial deposits (Qc) | slope deposit |
| | | very young landslide deposits (Qls, Qls?) | landslide |
| | | very young slope wash deposits (Qsw) | slope wash |
| late Pleistocene to Holocene | <120 ka | young axial-channel deposits (Qya) | flood-plains |
| | | young alluvial-fan deposits (Qyf) | alluvial fan |
| | | young landslide deposits (Qyls) | landslide |
| early to middle Pleistocene | ~11.7 ka - ~2.6 million years (Ma) | very old axial-channel deposits (Qvoa, Qvoa$_2$, Qvoa$_3$) | flood-plains |
| | | very old alluvial-fan deposits (Qvof) | alluvial fan |
| Pliocene | ~2.6 Ma - ~5.3 Ma | Niguel Formation (Tn) | shallow marine |
| late Miocene to early Pliocene | ~3.6 Ma - ~11.6 Ma | Capistrano Formation (Tc, Tco, Tcs) | shallow-marine |
| late Miocene | ~5.3 Ma - ~11.6 Ma | Puente Formation (Tp, Tplv, Tpsq) | deep marine, submarine fan |
| | | Monterey Formation (Tm) | deep marine |
| middle Miocene | ~11.6 Ma - ~16 Ma | Topanga Group (Tt) | shallow to deeper marine |
| latest Oligocene to latest early Miocene | ~16 Ma - ~23 Ma | Vaqueros Formation (Tv) | shallow marine |
| | | Vaqueros-Sespe Formation (Tvs) | shallow marine - nonmarine |

| | | | |
|---|---|---|---|
| late Eocene to early Miocene | ~16 Ma - ~41.2 Ma | Sespe Formation (Ts) | nonmarine |
| Paleocene | ~56 Ma - ~66 Ma | Santiago Formation (Tsa) | coastal lowland |
| | | Silverado Formation (Tsi, Tsicg, Tsis) | coastal nonmarine to very shallow-marine |

A search for paleontological records was completed by the Natural History Museum of Los Angeles County (LACM; McLeod 2018). Published literature, unpublished paleontological reports, and online databases were also searched for fossil records. Databases included the Natural History Museum of Los Angeles County Invertebrate Paleontology (LACMIP 2018), the Paleobiology Database (PBDB 2018), and the University of California Museum of Paleontology (UCMP 2018). The artificial fill and Holocene sediments do not contain fossil resources due to their age, by nature of their formation, or paleoenvironment. Although the Paleocene Silverado Formation and Santiago Formation, as well as the Pleistocene alluvial deposits have produced fossils within Orange County, there are no records of fossils from these formations from within the City. The rest of the formations have produced fossils from within the City. Formations are discussed from oldest to youngest.

*Paleocene: Silverado Formation*

At least 25 fossils of marine snails and bivalves have been recovered from the northwestern Santa Ana Mountains in Orange County (Schoellhamer et al. 1981). Sixteen localities were recovered from the Black Star Canyon 7.5' USGS topographic quadrangle and a single locality was recovered from the Orange 7.5' USGS topographic quadrangle. The Eastern Transportation Corridor (ETC) database listed one potential Silverado Formation locality from the El Toro 7.5' USGS topographic quadrangle which produced plant fossils.

*Paleocene: Santiago Formation*

At least 100 fossils of marine snails and bivalves have been recovered from this formation in the northwestern Santa Ana Mountains in Orange County. Eleven localities was recovered from the Black Star Canyon 7.5' USGS topographic quadrangle, four localities were recovered from the El Toro 7.5' USGS topographic quadrangle, three localities were recovered from the Orange 7.5' USGS topographic quadrangle, and a single locality was recovered from the Tustin 7.5' USGS topographic quadrangle (Schoellhamer et al. 1981). The Orange County Paleontological Database (OCPC 2018) listed one locality from the Black Star Canyon 7.5' USGS topographic quadrangle which produced a crocodile and plant fossils.

*Late Eocene to Latest Early Miocene: Sespe Formation*

At least 25 fossils of terrestrial animals have been recovered from 17 localities in the Sespe Formation in Orange County. Two localities was recovered from the Lower Bowerman Landfill, nine localities were recovered from the Upper Bowerman Landfill, four localities were recovered from the Foothill Transportation Corridor-Oso segment, a locality was recovered from the San Joaquin Hills, and a locality was recovered from the San Joaquin Hills (Whistler and Lander 2003). The OCPC listed one locality from the El Toro 7.5' USGS topographic quadrangle. These localities have produced fossils of canine, weasel, peccary, oreodont, camel, musk deer, opossum, shrew, pika, squirrel, rodent, and iguana.

*Early Miocene: Vaqueros-Sespe Formation*

At least 2400 fossils of terrestrial animals and plants have been recovered from 122 localities in the Vaqueros-Sespe Formation in Orange County (OCPC 2018, Whistler and Lander 2003, McLeod 2018). These localities have produced fossils of canine, bear, weasel, rhinoceros, horse, peccary, pig-like artiodactyl, oreodont, camel, deer-like artiodactyl, musk deer, hedgehog, shrew, pika, rabbit, squirrel, rodent, opossum, and reptile.

*Early Miocene: Vaqueros Formation*

At least 150 fossils of marine animals have been recovered from 24 localities in the Vaqueros Formation in Orange County (LACMIP 2018, SDNHM 2018, UCMP 2018). These localities have produced fossils of baleen and toothed whales, sea cows, birds, sea turtles, bony fish, sharks and rays, and invertebrates.

*Middle Miocene: Topanga Group*

At least 375 fossils of marine and terrestrial animals have been recovered from 37 localities in the Topanga Group in Orange County (McLeod 2018, UCMP 2018, OCPC 2018). These localities have produced fossils of pinnipeds, baleen and toothed whales, dugongs, sea cows, desmostylians, proboscideans, rodents, birds, sea turtles, bony fish, sharks, rays, and invertebrates.

*Late Miocene: Monterey Formation*

At least 150 fossils of marine animals have been recovered from 31 localities within and near to the City of Lake Forest (McLeod 2018, OCPC 2018, SDNHM 2018, UCMP 2018). These localities have produced fossils of pinnipeds, baleen and toothed whales, dugongs, desmostylians, birds, crocodile, sea turtles, bony fish, sharks and rays, and invertebrates.

*Late Miocene: Puente Formation*

At least 275 fossils of marine animals have been recovered from 32 localities from the La Vida Member (OCPC 2018). These localities have produced fossils of sea lions, desmostylians, bony fish, sharks and rays, and invertebrates. Numerous species of land plants and algae have also been recovered from these localities. A fossil of a herring have been recovered a locality in the Soquel Member (OCPC 2018). Two fossils of bony fish have been recovered two localities in undifferentiated Puente Formation (OCPC 2018).

*Late Miocene to Early Pliocene: Capistrano Formation*

At least 375 fossils of marine and terrestrial animals have been recovered from 33 localities from the Oso Sand of the Capistrano Formation (OCPC 2018, SDNHM 2018). These localities have produced fossils of pinnipeds, rodents, camels, baleen and toothed whales, horses, rhinoceros, mastodon, dugong, sea cows, desmostylians, birds, sea turtles, tortoise, bony fish, sharks and rays, and invertebrates. Numerous species of land plants and algae have also been recovered from these localities.

At least 100 fossils of marine and terrestrial animals have been recovered from 30 localities from undifferentiated deposits of Capistrano Formation (McLeod 2018, UCMP 2018). These localities have produced fossils of pinnipeds, camels, baleen and toothed whales, horses, birds, sea turtles, tortoise, crocodile, bony fish, sharks and rays, and invertebrates.

*Pliocene: Niguel Formation*

An unknown number of fossils of marine and terrestrial animals have been recovered from four localities from undifferentiated deposits of Niguel Formation (McLeod 2018). These localities have produced fossils of camels, baleen whales, dugongs, and bony fish.

*Pliocene To Pleistocene: Niguel Formation- Quaternary Terrace*

A fossil of a sea lion and a camel have been recovered two localities in Niguel Formation – Quaternary terrace deposits (McLeod 2018).

*Pleistocene Deposits*

At least 225 fossils of terrestrial animals have been recovered from 29 localities from Pleistocene deposits outside of the City of Lake Forest (McLeod 2018, OCPC 2018, Jefferson 1991b). These localities have produced fossils of ground sloth, short faced bear, American lion, mammoth, mastodon, horses, ancient bison, shrews, reptiles, and amphibians. The most significant of these localities is Costeau Pit located in the City of Laguna Hills, just south of Lake Forest which has additionally produced coyote, dire wolf, saber-toothed cat, camel, llama, diminutive pronghorn, long-horned bison, rabbits, rodents, and birds.

The following units include Pleistocene sediments:

- Quaternary very old axial channel deposits (Qvoa, $Qvoa_2$, $Qvoa_3$); early to middle Pleistocene
- Quaternary very old alluvial fan deposit (Qvof); early to middle Pleistocene
- Quaternary young axial channel deposit (Qya); late Pleistocene to Holocene
- Quaternary young alluvial fan deposit (Qyf); late Pleistocene to Holocene
- Quaternary young landslide deposit (Qyls); late Pleistocene to Holocene

*Holocene Deposits*

No fossils are known from any of the Holocene deposits as they are all too young to contain fossils. The following units are Holocene in age:

- Very young colluvial deposits (Qc); late Holocene
- Very young slope wash deposits (Qsw); late Holocene
- Very young landslide deposits (Qls); late Holocene
- Artificial fill; modern

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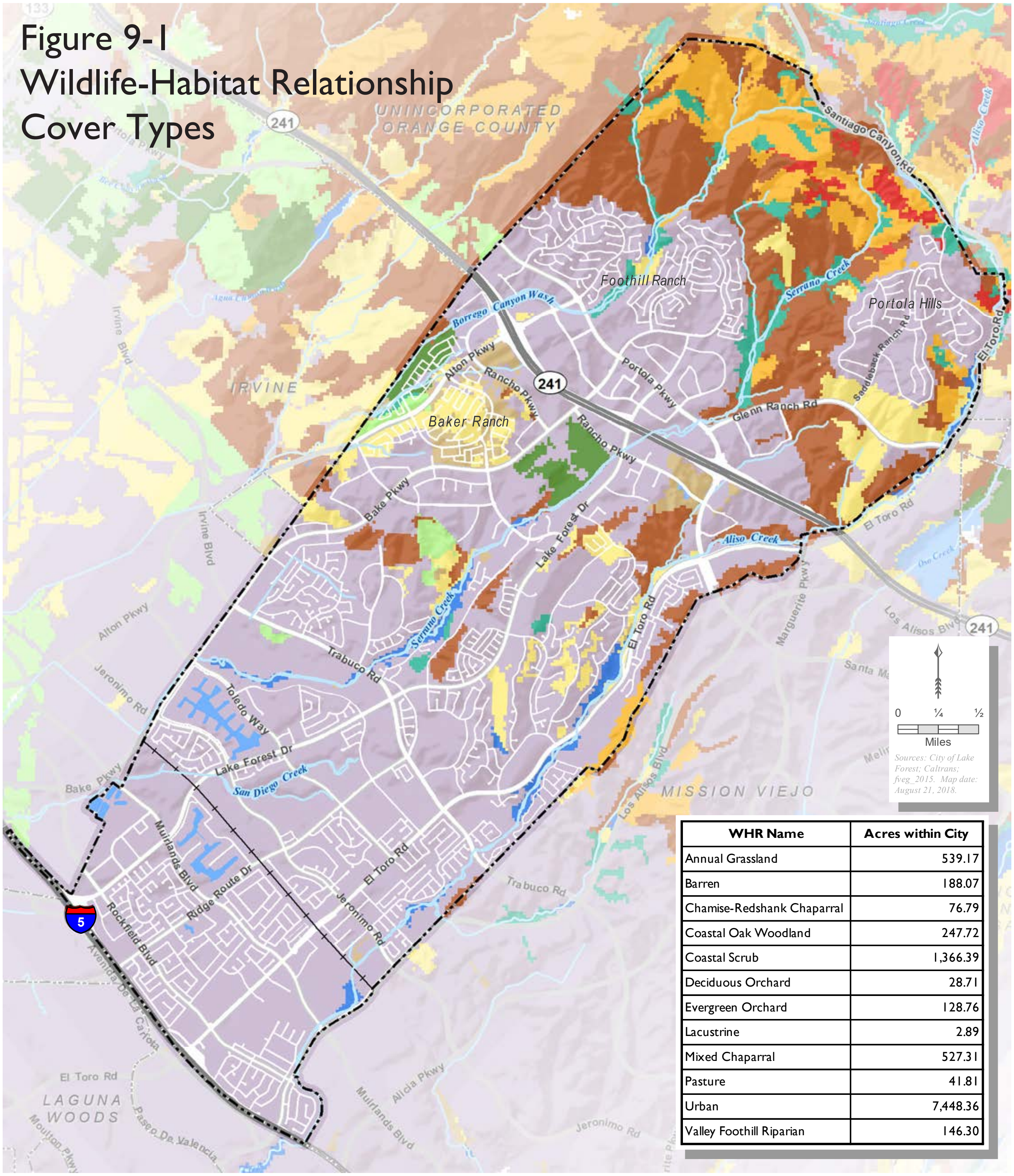
# Figure 9-1
# Wildlife-Habitat Relationship Cover Types




| WHR Name | Acres within City |
|---|---|
| Annual Grassland | 539.17 |
| Barren | 188.07 |
| Chamise-Redshank Chaparral | 76.79 |
| Coastal Oak Woodland | 247.72 |
| Coastal Scrub | 1,366.39 |
| Deciduous Orchard | 28.71 |
| Evergreen Orchard | 128.76 |
| Lacustrine | 2.89 |
| Mixed Chaparral | 527.31 |
| Pasture | 41.81 |
| Urban | 7,448.36 |
| Valley Foothill Riparian | 146.30 |

**Legend**

City of Lake Forest

**Wildlife-Habitat Relationship (WHR) Name**

- Annual Grassland
- Barren
- Chamise-Redshank Chaparral
- Coastal Oak Woodland
- Coastal Scrub
- Deciduous Orchard
- Evergreen Orchard
- Lacustrine
- Mixed Chaparral
- Pasture
- Urban
- Valley Foothill Riparian

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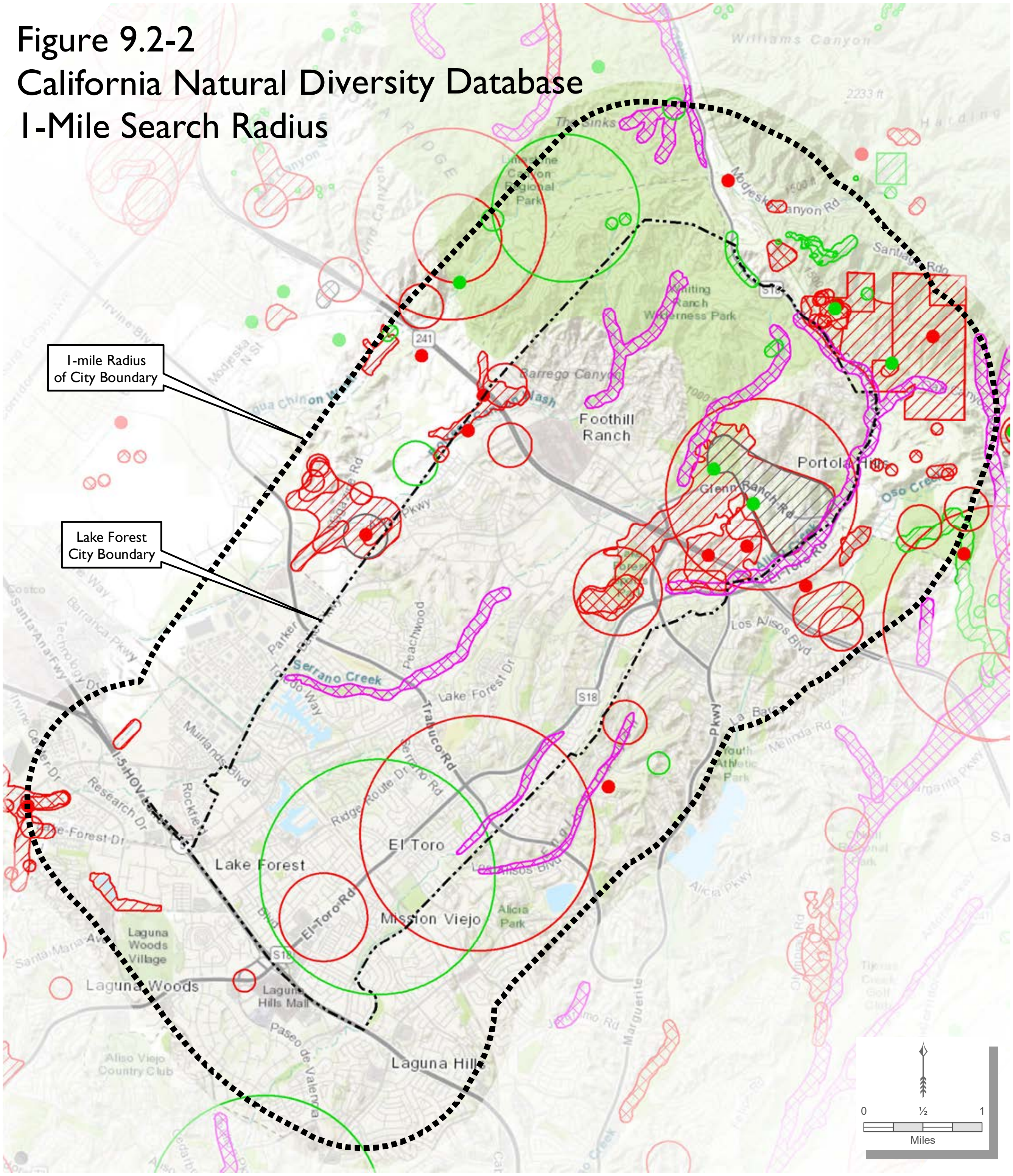
# Figure 9.2-2
# California Natural Diversity Database
# 1-Mile Search Radius




**Special Status Species Occurrences**

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (specific)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)

*CNDDB version 08/2018. Please Note: the occurrences shown on this map represent the known locations of the species listed here as of the date of this version. There may be additional occurrences or additional species within this area which have not been surveyed and/or mapped. Lack of information in the CNDDB about a species or an area can never be used as proof that no special status species occur in an area. Basemap: ArcGIS Online Topographic Map Service. Map date: August 21, 2018.*

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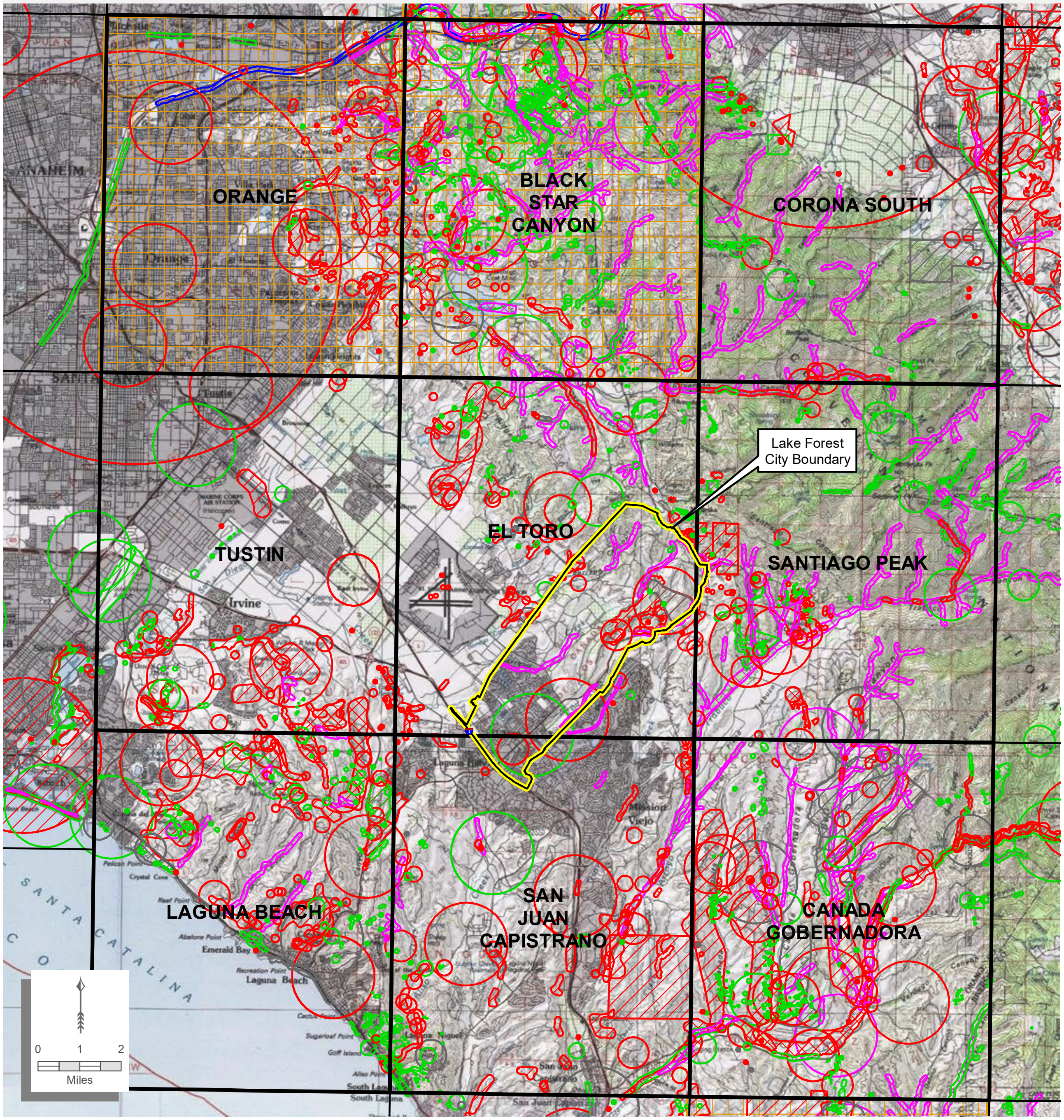
# Figure 9-3 California Natural Diversity Database - 9-Quad Search




**Special Status Species Occurrences**

- Plant (80m)
- Plant (specific)
- Plant (non-specific)
- Plant (circular)
- Animal (80m)
- Animal (specific)
- Animal (non-specific)
- Animal (circular)
- Terrestrial Comm. (specific)
- Terrestrial Comm. (non-specific)
- Terrestrial Comm. (circular)
- Aquatic Comm. (non-specific)
- Multiple (80m)
- Multiple (specific)
- Multiple (non-specific)
- Multiple (circular)
- Sensitive EO's (Commercial only)

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*CNDDB version 08/2018. Please Note: the occurrences shown on this map represent the known locations of the species listed here as of the date of this version. There may be additional occurrences or additional species within this area which have not been surveyed and/or mapped. Lack of information in the CNDDB about a species or an area can never be used as proof that no special status species occur in an area. Basemap: ArcGIS Online Topographic Map Service. Map date: August 21, 2018.*

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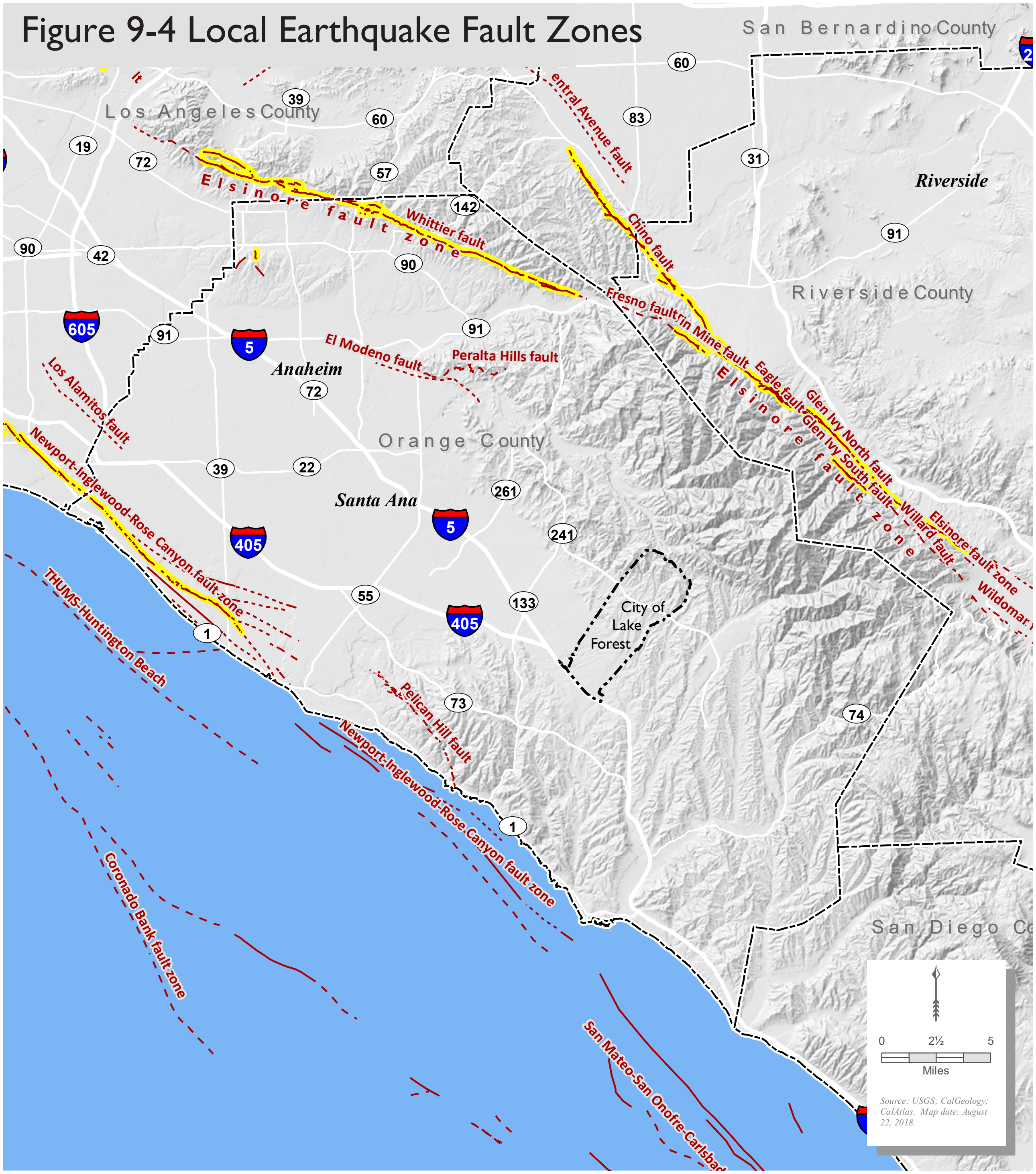
# Figure 9-4 Local Earthquake Fault Zones




**Legend**

Alquist-Priolo Fault Zones

**Quaternary Faults**

Well-constrained

Moderately-constrained

Inferred

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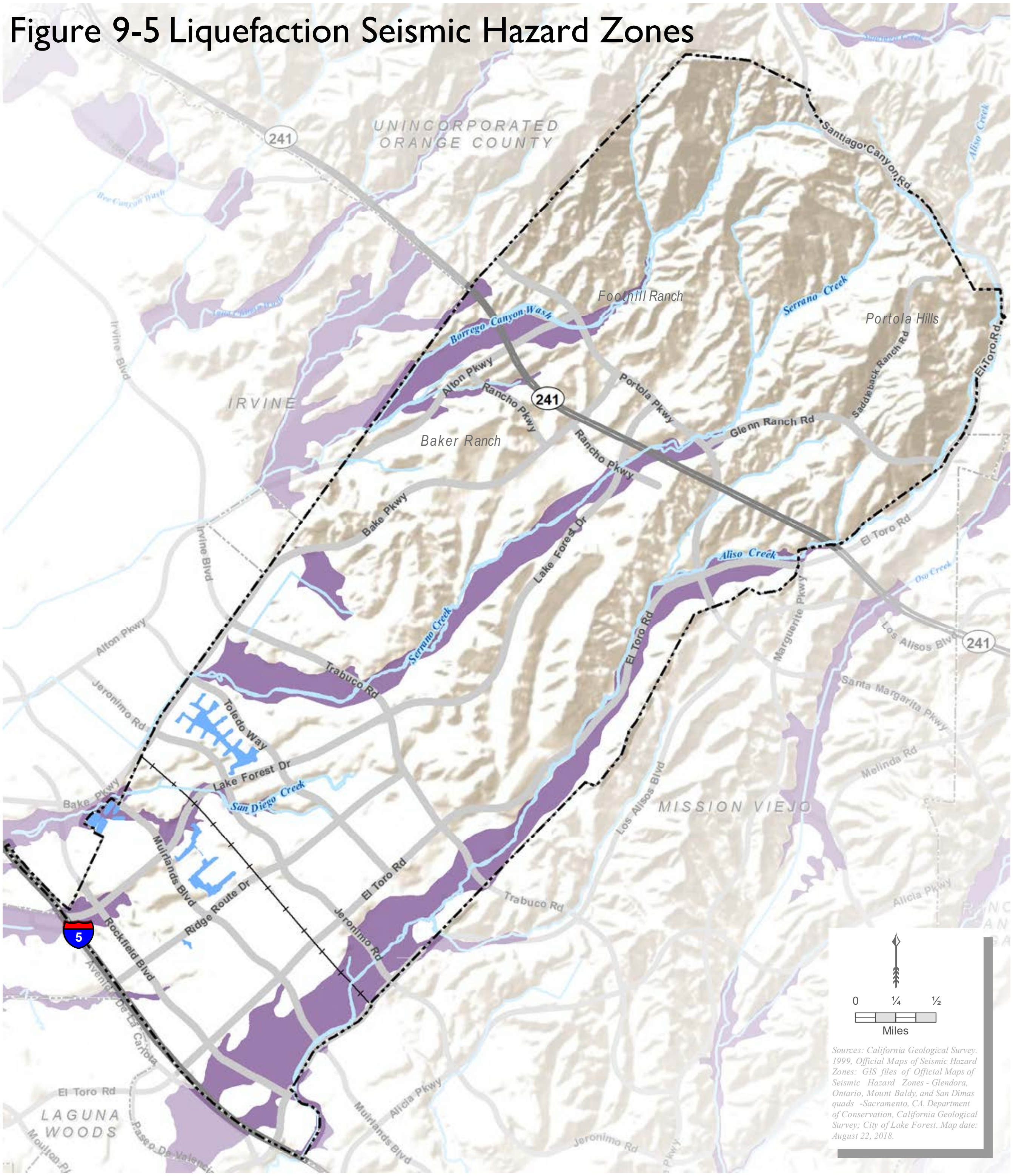
# Figure 9-5 Liquefaction Seismic Hazard Zones




**Legend**

City of Lake Forest

Area where Liquefaction may occur during a Strong Earthquake

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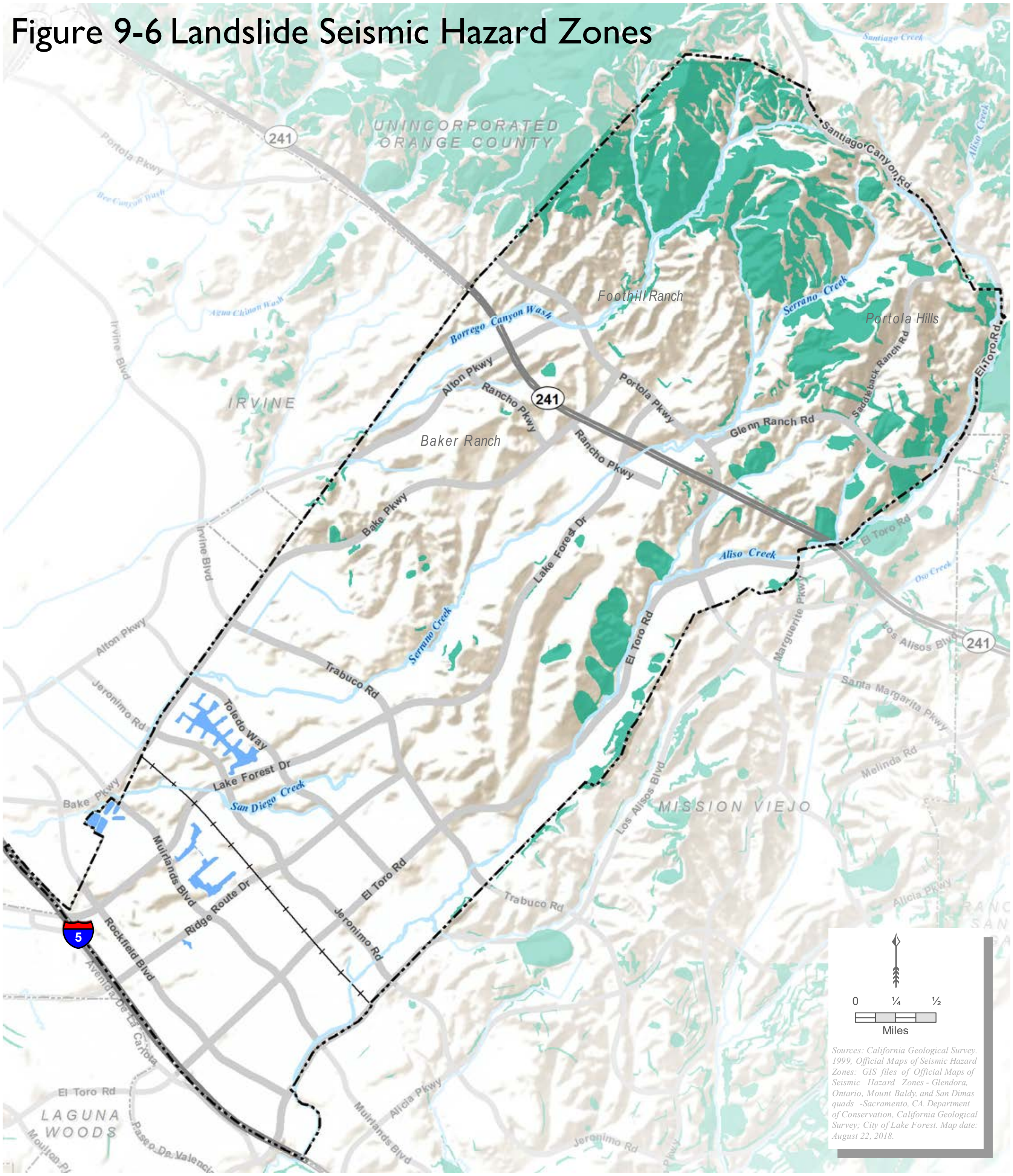
# Figure 9-6 Landslide Seismic Hazard Zones




**Legend**

City of Lake Forest

Area where Landslide may occur during a Strong Earthquake

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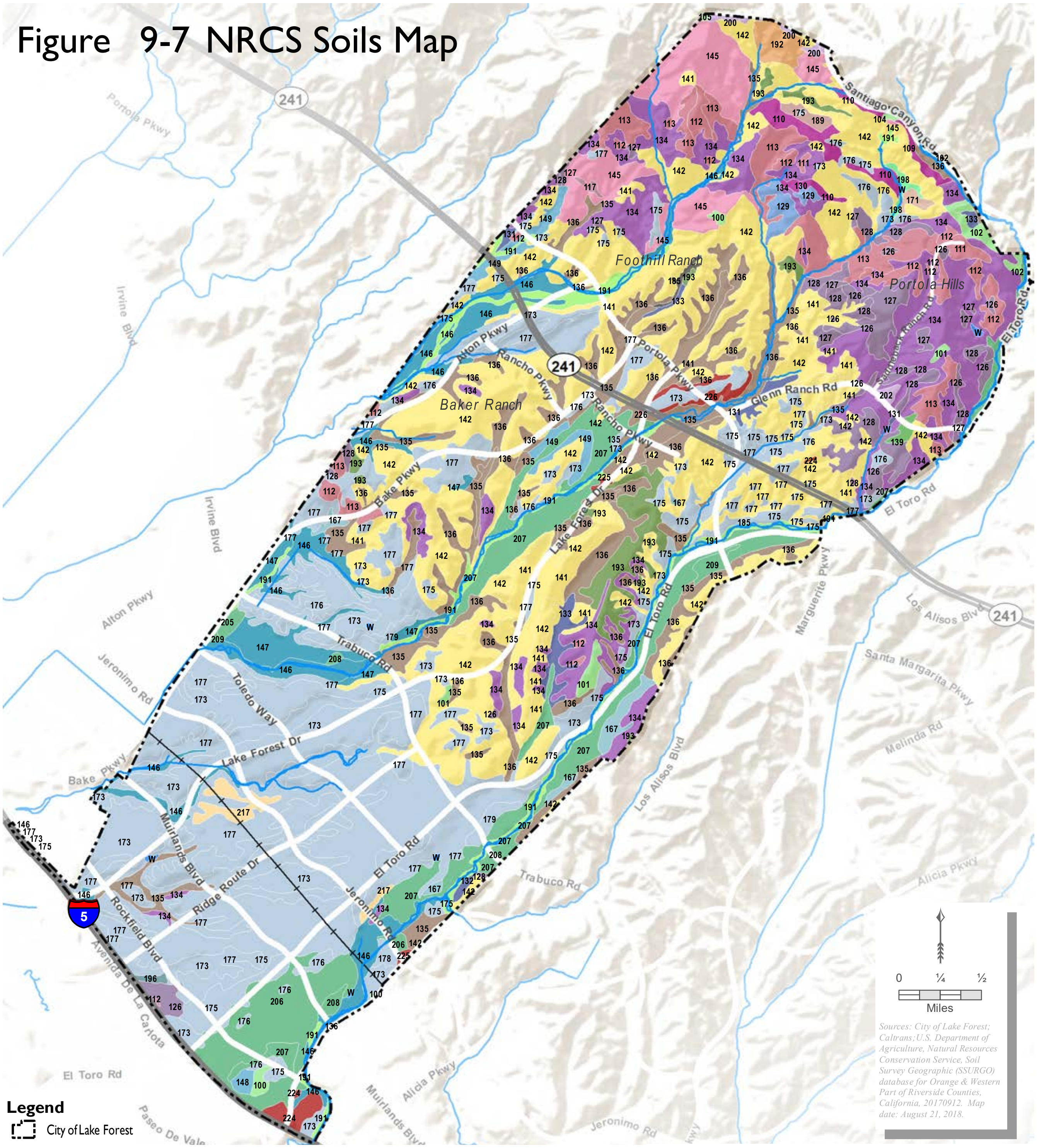
# Figure 9-7 NRCS Soils Map




**Legend**

City of Lake Forest

**NRCS Soil Description**

- Alo clay/clay variant (100-105)
- Anaheim clay loam (109-110)
- Balcom clay loam (111-113)
- Blasingame stony loam (117)
- Bosanko clay (126-128)
- Bosanko-Balcom complex (129-130)
- Botella loam/clay loam (131-133)
- Calleguas clay loam (134)
- Capistrano sandy loam (135-136)
- Chino silty clay loam (139)
- Cieneba sandy loam (141-142)
- Cieneba-Rock outcrop complex (145)
- Corralitos loamy sand (146-147)
- Cropley clay (148-149)
- Metz loamy sand (163)
- Mocho loam (167)
- Modjeska gravelly loam (171)
- Myford sandy loam (173-179)
- Pits (185)
- Rincon clay loam (189)
- Riverwash (191)
- Rock outcrop-Cieneba complex (192)
- San Andreas sandy loam (193)
- San Emigdio fine sandy loam (195-196)
- Soboba cobbly loam sand (198)
- Soper loam/gravelly loam (199-202)
- Sorrento loam/clay loam/sandy loam (205-209)
- Water (W)
- Xeralfic arents, loamy (217)
- Yorba cobbly/gravelly sand loam (224-226)

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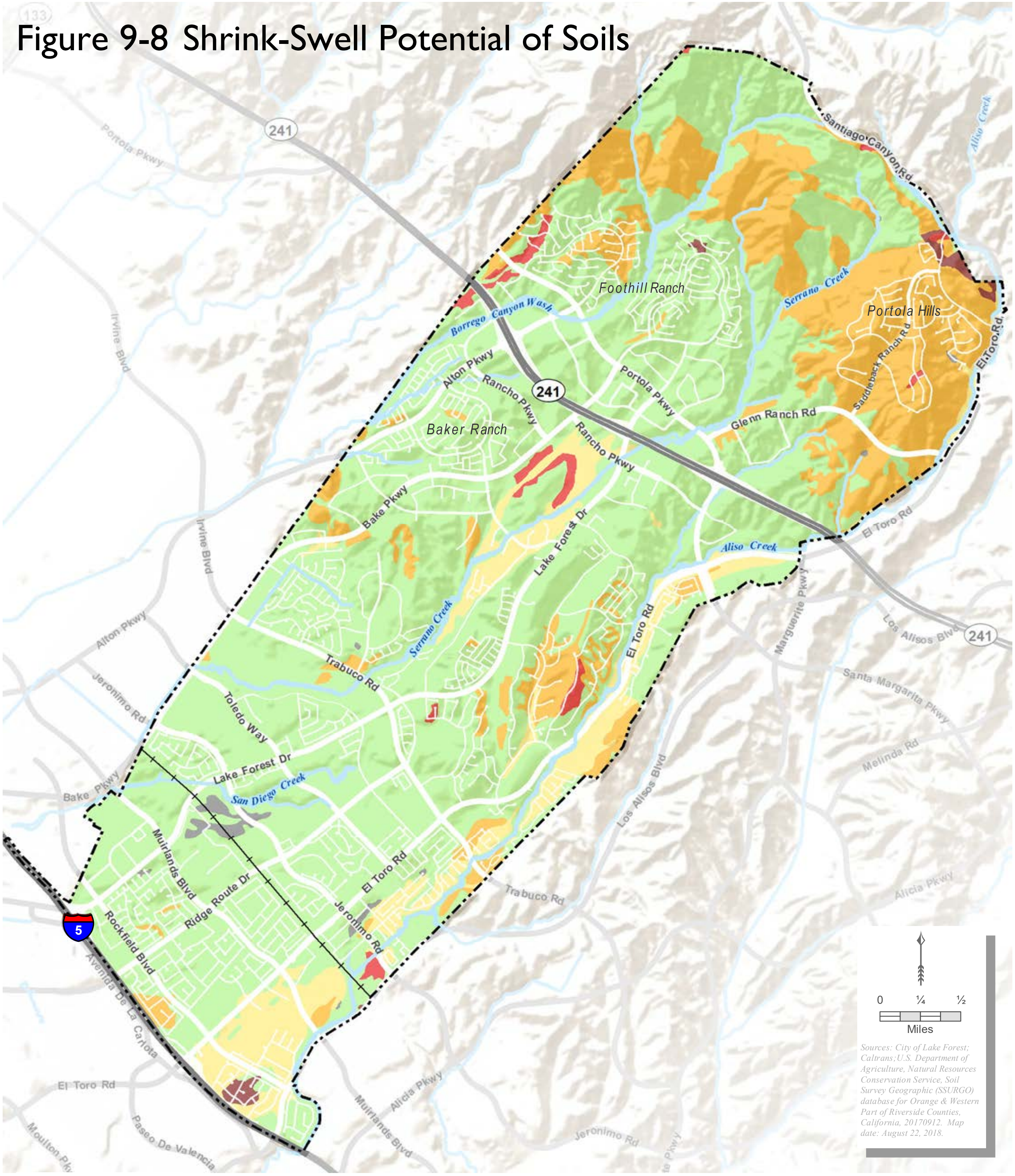
# Figure 9-8 Shrink-Swell Potential of Soils




**Legend**

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**Shrink-Swell Potential* of Surface Horizon**

N/A
Low Potential
Low to Moderate
Moderate
High
High to Very High

**Shrink-Swell Potential is determined by linear extensibility. Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Soils are considered to have low potential when the linear extensibility is less than 3%, moderate if 3-6%, high if 6-9%, and very high if greater than 9%.*

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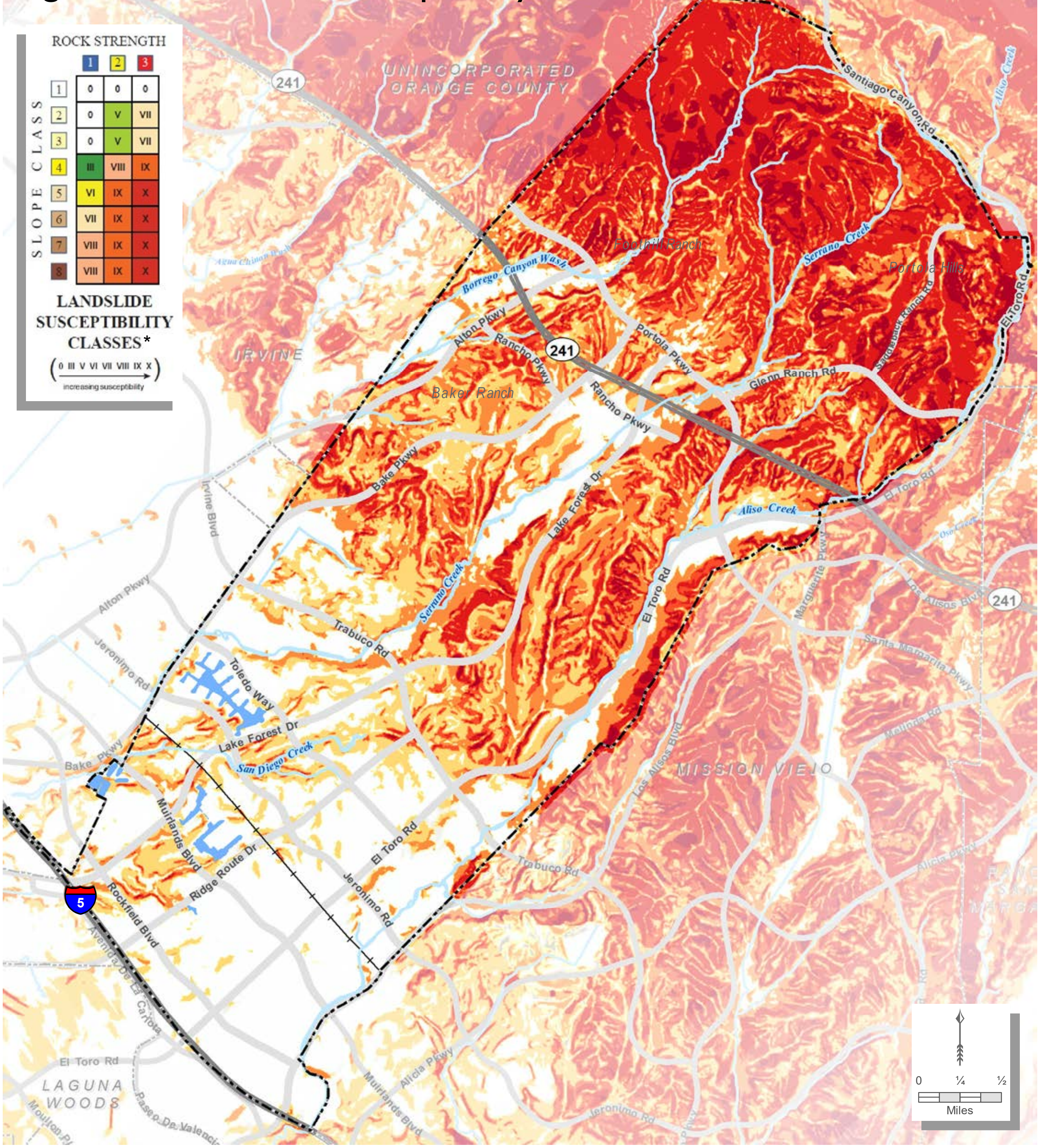
# Figure 9-9 Landslide Susceptibility




**Legend**

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** Rock Strength and slope are combined to create classes of landslide susceptibility. These classes express the generalization that on very low slopes, landslide susceptibility is low even in weak materials, and that landslide susceptibility increases with slope and in weaker rocks. Very high landslide susceptibility, classes VIII, IX, and X, includes very steep slopes in hard rocks and moderate to very steep slopes in weak rocks. Source: "Susceptibility to Deep-Seated Landslides in California, 2011, Map sheet 58, California Geological Survey. Map date: August 22, 2018.*

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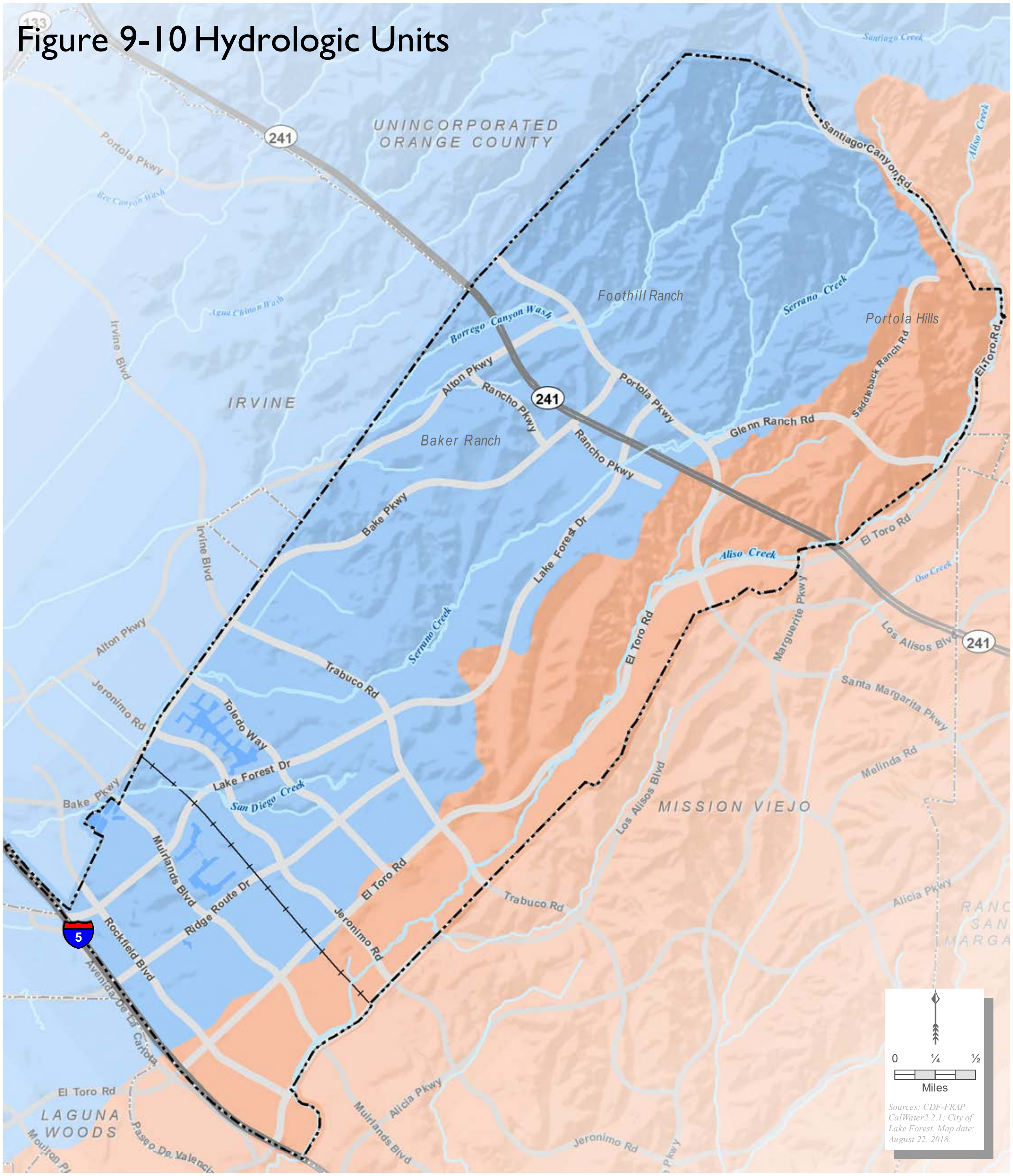
# Figure 9-10 Hydrologic Units




**Legend**

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**Hydrologic Unit Name**

San Juan

Santa Ana River

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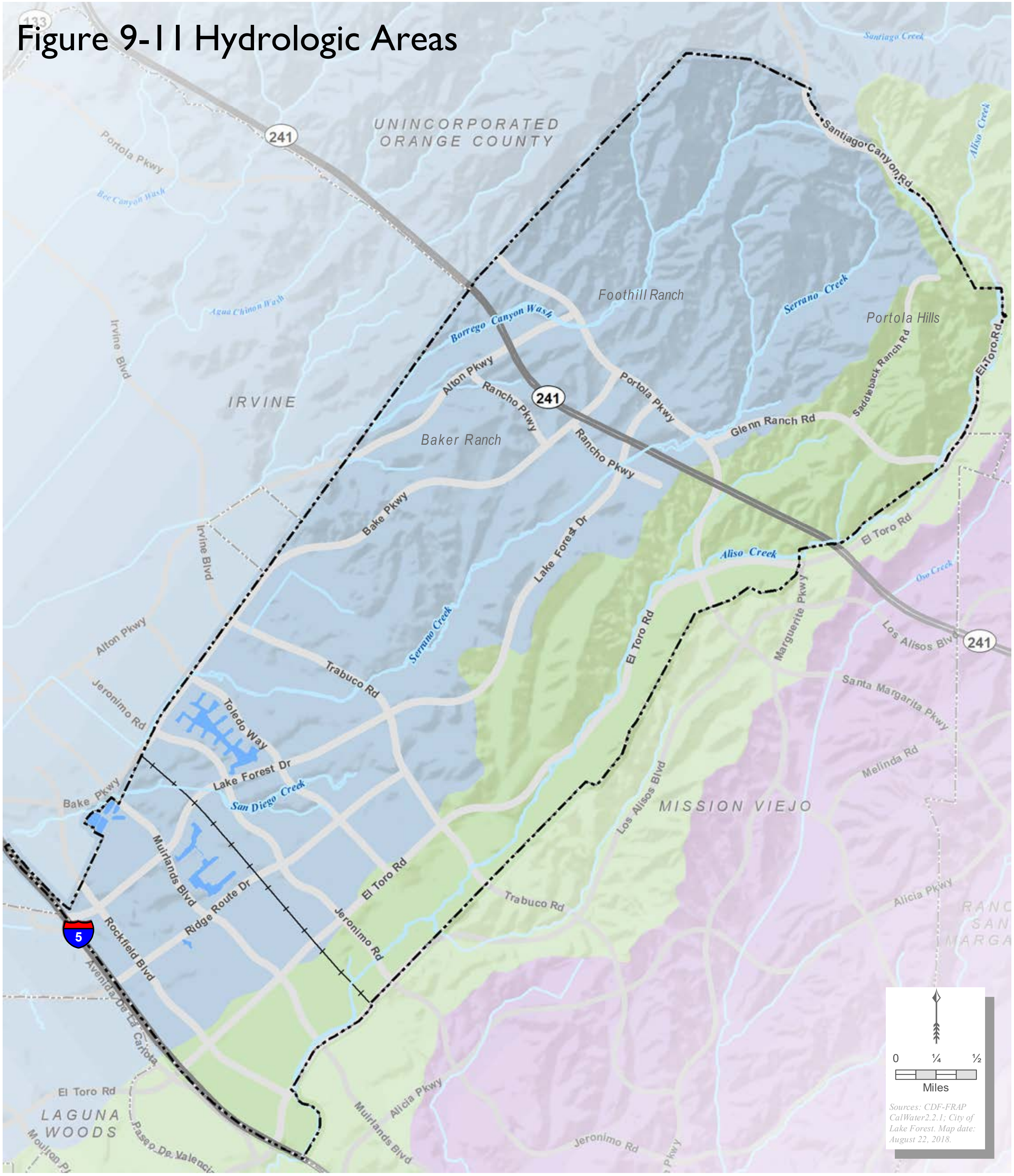
# Figure 9-11 Hydrologic Areas




**Legend**

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**Hydrologic Area Name**

Laguna

Lower Santa Ana River

Mission Viejo

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