Geologic Conditions

This section of the Background Report describes the existing conditions of the City of Elk Grove relative to Geologic Conditions.

Setting

The Planning Area is located within the Great Valley geomorphic province, which is primarily described as a relatively flat alluvial plain, about 50 miles wide and 400 miles long, with thick sequences of sedimentary deposits of Jurassic through Holocene age. The Great Valley geomorphic province is bounded on the north by the Klamath and Cascade mountain ranges, on the east by the Sierra Nevada Mountains, and on the west by the California Coast Mountain Range.

Surface elevations within the Great Valley generally range from several feet below mean sea level (msl) to more than 1,000 feet above sea level. The major topographical feature in the Sacramento Valley is the Sutter Buttes (a volcanic remnant), which rises approximately 1,980 feet above the surrounding valley floor. The ground surface elevation in the vicinity of the Planning Area, as shown on a collection of USGS Topographic Map quadrangles, ranges from approximately 10 to 150 feet above msl.

Geotechnical Conditions

Structural Support

The San Joaquin soil type is the predominant soil series in the developable portion of the Planning Area. The Soil Conservation Service, United States Department of Agriculture, has classified these soils as moderately well drained and as moderately deep over a cemented hardpan. This base geologic condition does not lend to structural failures such as sinkholes. Since these soils are located at shallow depths, they are conducive to urban development. Properly designed foundations, buildings, and roads, can help to prevent potential damage caused by the high shrink-swell potential and low subsoil strength.

Geologic Hazards

Faults and Seismicity

The severity of an earthquake can be expressed in terms of both *intensity* and *magnitude*. For detailed descriptions of these terms, please see **Table 6-1**.

No known active faults or Alquist-Priolo earthquake hazard zones (formerly known as special study zones) occur in the City of Elk Grove Planning Area, although several inactive subsurface faults are identified in the Delta. **Table 6-2** identifies known faults in the vicinity of the Planning Area and the maximum magnitude associated with each fault.

According to the *Fault Activity Map of California*, the nearest faults to the City with activity within the last 200 years are the Concord, Hayward, and Cleveland Hill faults. The closest known fault to the City of Elk Grove is the Willows fault zone, located approximately 10 miles north of the City. The *Safety Element of the County of Sacramento General Plan* (1993) identified two major subsurface fault zones on the eastern and western sides of the Planning Area. The Midland Fault Zone is located approximately 20 miles west of the Planning Area, while the Bear Mountain Fault Zone is located approximately 20 miles east of the Planning Area. The closest known active subsurface fault is the Dunnigan Hills Fault, located approximately 25 miles northwest of the City of Elk Grove.

Ground Shaking

In populated areas, the greatest potential for loss of life and property damage is a result of ground shaking from a nearby earthquake. The degree of damage depends on many interrelated factors. Among these factors are the Richter magnitude, focal depth, distance from the causative fault, source mechanism, duration of shaking, high rock accelerations, type of surficial deposits or bedrock, degree of consolidation of surficial deposits, presence

of high ground water, topography, and design, type, and quality of building construction.

Table 6-1: Earthquake Magnitude and Intensity

Magnitude	Intensity	Description
1.0 - 3.0	I.	Not felt except by a very few under especially favorable conditions.
3.0 - 3.9	II - III	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.
4.0 - 4.9	IV - V	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. V. Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
	VI - VII	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.
6.0 - 6.9	VIII - IX	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.
7.0 and higher	X or higher	X. Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent. XI. Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly. XII. Damage total. Lines of sight and level are distorted. Objects thrown into the

Source: United States Geological Survey National Earthquake Information Center.

Table 6-2: Faults in the Vicinity of Elk Grove City

Name	Approximate Distance from Planning Area (Miles)	Maximum Magnitude (MW)
Foothills Fault System	21	6.5
Great Valley Fault (segment 5)*	27	6.5
Great Valley Fault (segment 4)*	29	6.6

Name	Approximate Distance from Planning Area (Miles)	Maximum Magnitude (MW)
Greenville Fault	41	6.9
Concord –Green Valley Fault	42	6.9
Hunting Creek – Barryessa Fault	45	6.9
West Napa Fault	49	6.5
Calaveras Fault	50	6.8
Rodgers Creek Fault	56	7.0
Hayward Fault	59	7.1
Bartlett Springs Fault	72	7.1
Maacama Fault (south)	73	6.9
Collayomi Fault	76	6.5
Ortigalita Fault	76	6.9
San Andreas Fault (1906)	76	7.9
San Gregorio Fault	78	7.3
Monte Vista - Shannon Fault	80	6.8
Mohawk Valley-Honey Lake Fault Zone	82	7.3
Point Reyes Fault	*82*	*6.8*
Genoa	*87*	*6.9*
Sargent	*91*	*6.8*
Zayante-Vergeles	*94*	*6.8*

** Nine segments of the Great Valley Fault are located approximately 27 to 91 miles west of the City and have maximum magnitudes of 6.4 to 6.8*
Source: Wallace-Kuhl Associates, August 14, 2000.

No active or potentially active faults underlie the City of Elk Grove based on published geologic maps. The Planning Area is not located within an Alquist-Priolo Fault Study Zone and surface evidence of faulting has not been observed. However, due to the proximity to the San Andreas Fault Zone and other active faults, the Planning Area may experience ground shaking, but would not experience major catastrophes.

Liquefaction

Liquefaction is the loss of soil strength due to seismic forces generating various types of ground failure. The potential for liquefaction must account for soil types and density, the groundwater table, and the duration and intensity of ground shaking.

Based upon known soil, groundwater, and ground shaking conditions within the Planning Area, the potential for liquefaction beneath the Planning Area is considered low. The potential for ground lurching, differential settlement, or lateral spreading occurring during or after seismic events in the Planning Area is also considered to be low.

Expansive Soils

Soils that contain a relatively high percentage of clay minerals have the potential to shrink and swell with changing moisture conditions. The main soil types found in the Planning Area, specifically the San Joaquin soil group, contain approximately 5 inches of claypan in the subsoil, and contain a surface layer of brown silt loam between 11 and 23 inches thick. The shrink-swell potential is high in this soil type due to the high percentage of claypan.

Other Potential Geologic Hazards

There is a risk for subsidence, the gradual settling or sinking of the earth's surface with little or no horizontal motion, within the Elk Grove Planning Area. There are five causes of subsidence that affect the Planning Area – compaction by heavy structures, erosion of peat soils, peat oxidation, fluid withdrawal, and compaction of unconsolidated soils by earthquake shaking. The pumping of water from subsurface water tables for residential, commercial, and agricultural uses causes the greatest

amount of subsidence within the Planning Area.

There is little potential in the Planning Area for landslides to occur, since there are no major slopes in the area. The maximum land surface slope within the Planning Area is approximately 3 percent. There are no oceans, large bodies of water, or volcanoes in the Planning Area, so there is little or no possibility for seiches, tsunamis, or volcanic eruptions to occur.

Soil Conditions

The City of Elk Grove Planning Area mostly consists of the San Joaquin soil group, as classified by the Sacramento County Soil Survey, prepared by the United States Department of Agriculture. Soils within this group were formed in alluvium derived from granitic rock and are suited to hay, pasture and other irrigated crops. The specific soil types found in the Planning Area primarily consist of San Joaquin silt loam (0 to 1 and 0 to 3 percent slopes), the San Joaquin-Durixeralfs complex (0 to 1 percent slopes), the San Joaquin-Galt complex (0 to 1 and 0 to 3 percent slopes), and Redding gravelly loam (0 to 8 percent slopes).

A listing of their physical constraints, hydrologic capacities and engineering characteristics are tabulated in **Table 6-3**.

Mineral Resources

Using data contained in SMARA Special Report 156, titled *Mineral Land Classification: Portland Cement Concrete Grade Aggregate in the Sacramento-Fairfield Production Consumption Region* (1988), the Planning Area was classified for its mineral resource potential. According to SR 156, a large portion of the northern section of the Planning Area is covered by the MRZ-2 classification. Sites described by this classification are considered to be "areas for which data indicate there is a high likelihood that significant deposits of PCC-grade aggregate exist." This area is located north of Gerber Road, south of Jackson Highway (Highway 16), east of Grant Line Road, and west of Elk Grove-Florin Road.

Both the City of Elk Grove as well as the remainder of the Planning Area are covered by the MRZ-3 classification. These areas are those "containing aggregate deposits, the significance of which cannot be evaluated from available data."

Table 6-3
Soil Mapping Units

Map Unit Name	Erosion Potential	Drainage	Sub Soil Permeability	Effective Depth	Limitations For Road Construction
Redding gravelly loam - 0-8% slopes	Low/Moderate	Well	Very Slow	20-40"	Moderate
San Joaquin silt loam, leveled - 0-1% slopes	None/Low	Well	Very Slow	23-40"	Severe
San Joaquin silt loam - 0-3% slopes	Low	Well	Very Slow	23-40"	Severe
San Joaquin-Durixeralfs complex - 0-1% slopes	None/Low	Well	Very Slow	23-40"	Severe
San Joaquin-	None/Low	Well	Very Slow	24-40"	Severe

Map Unit Name	Erosion Potential	Drainage	Sub Soil Permeability	Effective Depth	Limitations For Road Construction
Galt complex, leveled - 0-1% slopes					
San Joaquin-Galt complex - 0-3% slopes	None	Well	Very Slow	23-40"	Severe

ND = No data