4.3 GEOLOGY AND SOILS

4.3 GEOLOGY AND SOILS

INTRODUCTION

The geologic and geomorphic conditions within the lower Cache Creek basin present important controls on the feasibility of the improvement plans developed under the CCRMP. The geologic setting of the area provides the opportunity for sand and gravel deposition, which has promoted historical aggregate mining. The transport and deposition of high-quality aggregate by Cache Creek result from a complex fluvial system that is influenced by active tectonics and geologic structure. The same system is responsible for the deposition of fine-grained overbank deposits on which valuable agricultural soils are developed.

This section of the EIR describes the geologic and soils setting of the planning area for the CCRMP. The impact analysis was prepared on the basis of review of published geologic reports and maps for the region, site reconnaissance, site-specific reports prepared by consultants for mining projects within the lower Cache Creek basin, and the technical studies for the Cache Creek Resource Management Plan (CCRMP). The geologic data were critically reviewed by the EIR preparers and were found to be generally consistent with appropriate geotechnical methods and standards.

SETTING

Regional Geology

The planning area is located on the western margin of the Sacramento Valley, the northern portion of the Great Valley Geomorphic Province of California. The Sacramento Valley is a large structural trough formed between the Coast Ranges to the west and the Sierra Nevada to the east. The Valley is filled with a thick sequence of sedimentary rocks and sediments that range from Upper Jurassic age (150 million years old) marine rocks through modern alluvial deposits. The sedimentary sequence was apparently deposited on igneous and metamorphic basement[1] rocks of the Sierran structural block.

The Coast Ranges are actively being deformed by compressional forces related to relative movements of the Pacific and North American tectonic plates. These forces resulted in development of major faults and folds (oriented N30W) in the Cache Creek basin. The Coast Ranges began uplifting about three to four million years ago resulting in a eastward tilting and erosion of Cretaceous Great Valley Formation and younger Tertiary sedimentary rocks overlying the Franciscan basement bedrock. Sedimentary rocks eroded from these uplifted ranges were deposited as the Tehama Formation until about one million years ago,

[1]"Basement" rock is a general geologic term for the deepest known bedrock.

when continued eastward tilting uplifted the Tehama Formation (Cache Creek Streamway Study, 1994).

The western margin of the Sacramento Valley represents a major geologic boundary between the Coast Range structural block to the west and the Sierran structural block to the east. This regional boundary, typically referred to as the Coast Range-Sierran Block Boundary Zone (CRSBBZ), has been the subject of recent geologic and seismic research; it is interpreted to represent not only a regional geologic and geomorphic boundary but a regional fault or suture zone (Wong and others, 1988).

The higher mountains that define the modern (i.e., current) range front of the Coast Ranges are separated from the Sacramento Valley by a northwest-trending set of low hills. The hills include the Dunnigan Hills, which extend from near the town of Dunnigan to the north to just south of Cache Creek. The relatively lower southward extension of the Dunnigan Hills is referred to as the Plainfield Ridge. The low hills have long been recognized as representing a block of older alluvial deposits uplifted above the surrounding younger alluvial deposits (Bryan, 1923).

Recent research (Unruh and Moores, 1992) indicates that the low hills east of the Coast range front have formed as the result of active folding and thrust faulting caused by compression across the Coast Range-Sierran Block Boundary. The folding and faulting deform the Tehama Formation indicating that the deformation is middle Pleistocene (approximately one million years ago) or younger in age.

The hills correspond to upward folds called anticlines. The folding has also resulted in the formation of structural valleys (called synclines). Within the study area, Cache Creek crosses the Madison Syncline, the Dunnigan Hills Anticline, and their associated faults. Active folding at the Madison Syncline and Dunnigan Hills Anticline have contributed to the historic channel profile of Cache Creek and may affect the elevation and gradient of subsurface groundwater. The Dunnigan Hills have been uplifted approximately 90 meters (297 feet) since the beginning of compression deformation 200,000 to 400,000 years ago. The average rate of uplift, therefore, has been approximately 0.2 to 0.5 millimeter (0.008 to 0.018 inch) per year (Munk, 1993). Subsidence of the ground surface has been observed east of the Dunnigan Hills in the vicinity of the City of Woodland. The subsidence is likely related to high rates of groundwater withdrawal from the underlying aquifer. The approximate amount of subsidence measured in the this area during the period 1942 to 1987 was -2.25 feet (NHC, 1995).

The Madison Syncline comprises the northwest-trending structural valley, Hungry Hollow, separating the Dunnigan Hills-Plainfield Ridge from the Capay Hills (a.k.a. Rumsey Hills). This structural valley is filled with Pleistocene and younger alluvial sediments that are up to 150 feet thick. The sediments that fill Hungry Hollow were transported to the area and deposited by Cache Creek.

The headwaters (source) of Cache Creek are located in the upland area of the Coast Ranges to the northwest. The upstream reaches along Cache Creek contain areas of active erosion that are the primary sources of sediment supply, which are transported and deposited downstream. The Creek flows southeastward through the Capay Valley to the southern end of the Capay Hills. From the town of Capay, the Creek flows eastward across Hungry Hollow. Through this reach, the Creek is a wide, braided stream with a relatively low gradient. At the eastern margin of Hungry Hollow, the Creek flows in a more constricted, higher-gradient reach through the southern Dunnigan Hills. The Creek then widens and the bed slope decreases as it emerges onto the Sacramento Valley near the town of Yolo.

Regional Seismicity

The tectonic setting of western California creates a relatively high potential for the occurrence of moderate to large earthquakes. Large earthquakes can cause damaging ground shaking throughout a large area. The active and potentially active faults potentially affecting the project site are shown on Figure 4.3-1. The characteristics of these faults are summarized in Table 4.3-1.

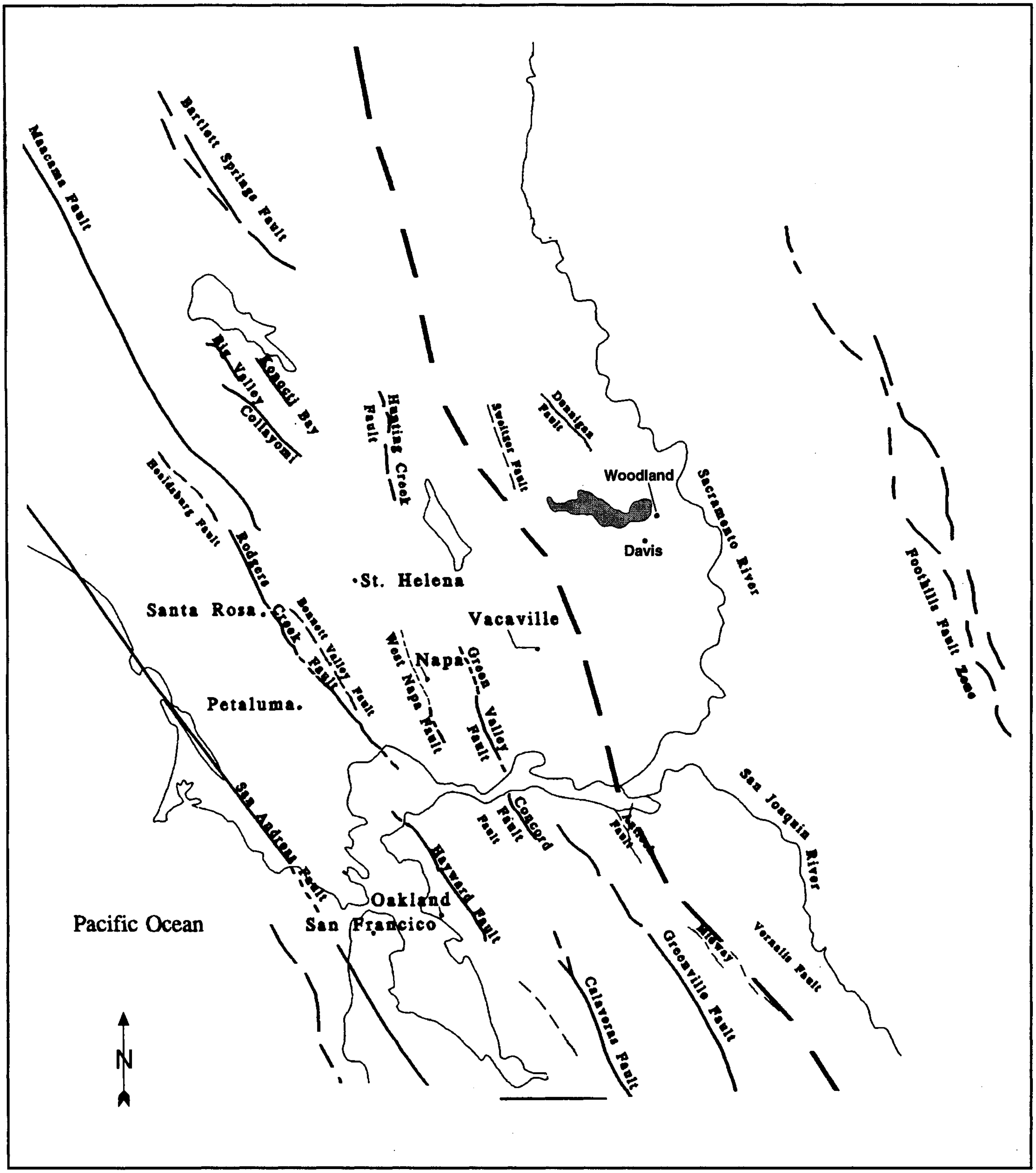
In general, the regional fault zones, including the San Andreas, Hayward, Calaveras, and Rodgers Creek fault zones, are typically characterized as strike-slip faults with the major component of movement being horizontal and right-lateral.[2] Moderate to large earthquakes (M 5[3] or greater) are considered capable of causing rupture of the ground surface. Major (M 7 or greater) right-lateral strike-slip earthquakes within the region in historic time have occurred on the San Andreas (1838, 1906, 1989) and on the Hayward faults (1836, 1868). These earthquakes were felt over large areas. Western Yolo County experienced moderate ground shaking (up to MMI[4] VII) during large earthquakes generated on these major fault zones to the west. The combined probability of a major earthquake (M 7 or greater) occurring on the major strike-slip faults of the San Francisco Bay region is estimated to be 67 percent (USGS, 1990). This probability represents a minimum because not all faults capable of generating a large earthquake (including the Calaveras and San Gregorio-Seal Cove fault zones) were included in the development of the estimate.

The northern San Andreas fault system includes additional fault zones that could generate earthquakes, which could cause moderate to strong ground shaking at the project site. The Maacama fault zone, extending from central Sonoma County to northwestern Mendocino County, is capable of generating a M 7.25 earthquake. The Bartlett Springs

[2]Right-lateral motion is a convention defined by the observation of the direction of movement across the fault when looking across the fault. Within the San Andreas Fault Zone, the observer would recognize that the western side of a fault has moved northward after right-lateral displacement along the fault.

[3]M 5 denotes Richter Magnitude 5.

[4]MMI denotes Modified Mercalli Intensity Scale, described in Appendix F.



Active Fault - Fault has evidence of surface displacement within the last 11,000 years

Potentially Active Fault - Fault has evidence of surface displacement within the last 2 million years

Coast Range-Sierran Block Boundary

Yolo County MRZ Area

Figure 4.3-1 Regional Fault Map

SOURCE: JENNINGS, 1994; MUALCHIN AND JONES, 1992

TABLE 4.3-1: Major Faults Potentially Affecting the Project.

Fault	Approximate Distance from Planning Area (miles)	Maximum Credible Earthquake[1,2] (M_L)	Recurrence Interval[3] (years)	Expected Maximum Peak Ground Acceleration during MCE[4] (g)	Expected Ground Shaking Intensity at the Site (MMI)
Bartlett Springs	49	6.75	NA	0.04	VI
Big Valley Fault	50	6.25	2,675	0.04	VI
Konocti Bay Fault Zone	41	6.25	NA	0.05	VI
Maacama Fault Zone	41	7.25	696	0.08	VII
Hunting Creek	22	6.75	NA	0.12	VII
Rodgers Creek-Healdsburg	43	7.0	255	0.07	VII
Hayward Fault	50	7.5	264-556	0.08	VII
West Napa	30	6.5	NA	0.07	VII
Foothills	43	6.5	NA	0.05	VI
Green Valley	25	6.75	424	0.10	VII
Coast Range-Sierran Block Boundary Zone	8	7.0	600-1200[5]	0.31	VIII

Notes: NA = Data not available.
MMI = Modified Mercalli Intensity.
g = acceleration of gravity.

1 The maximum credible earthquake (MCE) is the largest earthquake expected under the present geologic framework.
2 Estimated magnitude of MCE from Mualchin and Jones (1992), except where noted.
3 Recurrence interval, or repeat time, is the estimated interval of time between maximum credible earthquakes (Wesnousky, 1986).
4 Expected maximum peak ground accelerations are based on seismic shaking attenuation curves presented in Mualchin and Jones (1992).
5 Estimate by Wakabayashi and Smith (1994).

and Hunting Creek fault zones within the eastern Coast Range are additional seismic sources with the potential to generate M 6.75 earthquakes (Mualchin and Jones, 1992).

In the area of the project site, seven distinct segments of the CRSBBZ at the western edge of the Sacramento Valley have been identified as being capable of generating M 6 or greater earthquakes (Wakabayashi and Smith, 1994). These potential seismic sources include the North and South Dunnigan Hills fault segments identified in the area of project site.

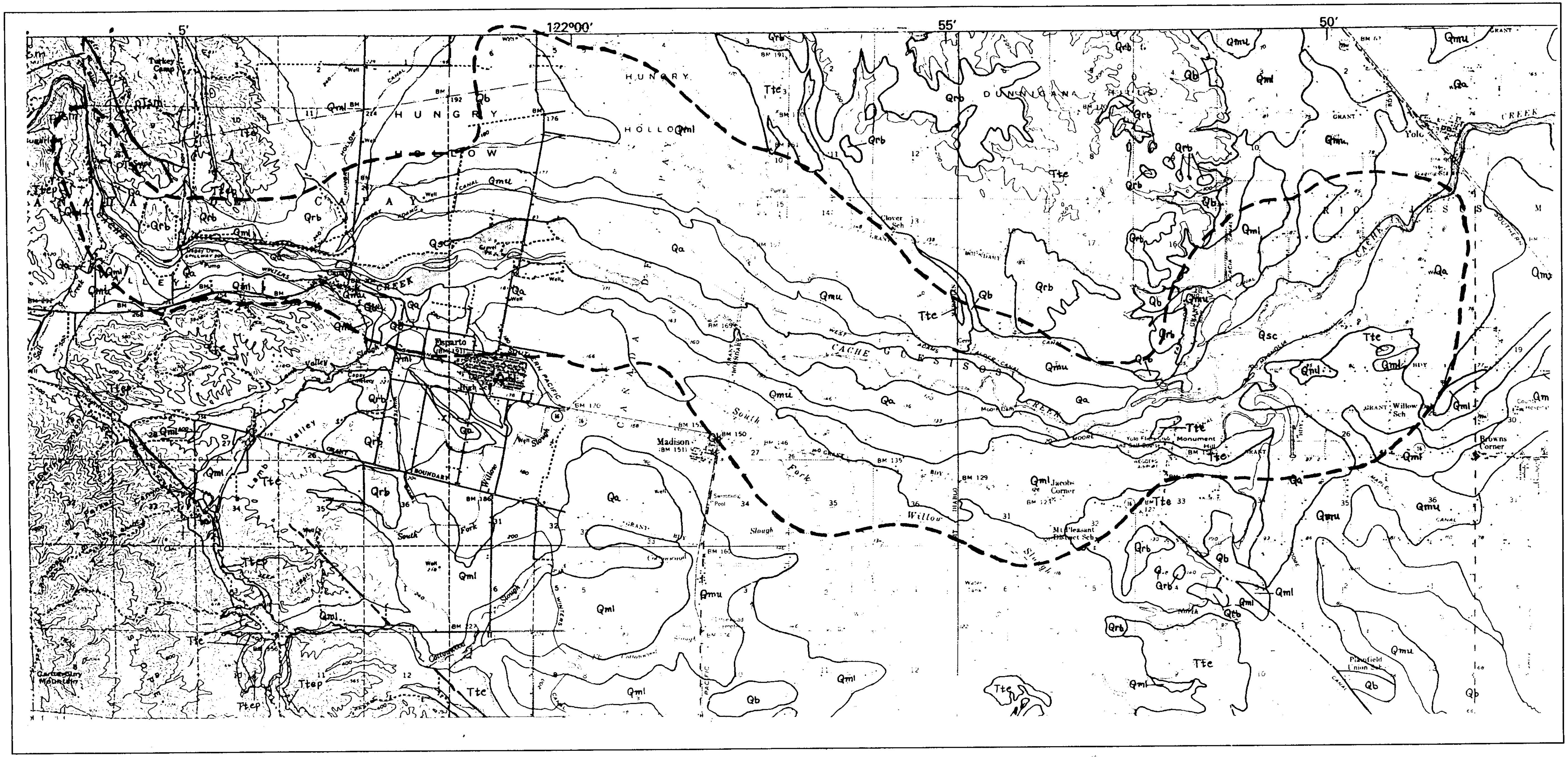
Interpretation of historic records for earthquakes affecting central California indicates that possibly eleven earthquakes of M 6 or greater have been generated along the CRSBBZ (Wakabayashi and Smith, 1994). An evaluation of more recent earthquakes (recorded by seismographs) indicate that the earthquakes of the southwestern Sacramento Valley region are characteristically caused by reverse or thrust faulting. Wong and others (1988) suggest that clusters of seismicity recorded within the western Sacramento Valley near Williams in Colusa County during the period 1980 to 1985 are representative of earthquakes on reverse faults. Their evaluation of recorded earthquakes for the period 1969 to 1985 also indicates clusters of seismicity beneath the Dunnigan Hills and in the area southwest of Madison. An M 4.2 earthquake near Madison in 1978 was also characterized as a reverse fault earthquake.

The maximum expected earthquake for the CRSBBZ is estimated to be an approximate M 7 event (Mualchin and Jones, 1992), which could occur on numerous known, suspected, or unidentified faults within the zone. The average recurrence interval (i.e., period between characteristic earthquakes) within the CRSBBZ is estimated to be 360 to 440 years. The North and South Dunnigan Hills fault segments are expected to generate M 6.1 and M 5.8 earthquakes.

In addition to the potential for earthquakes within the San Andreas fault system and the CRSBBZ, earthquakes along the Sierran Nevada Frontal fault system could occur. This fault system, developed along the western flank of the Sierra Nevada, includes the Foothills and Melones fault zones; that system has an estimated maximum credible earthquake of M 7.8 (Mualchin and Jones, 1992).

Local Geology

The planning area is located on alluvial terraces along Cache Creek within Hungry Hollow and south of the Dunnigan Hills. The planning area is mapped (Helley and Harwood, 1985) primarily as active stream channel (Qsc) deposits (Figure 4.3-2), defined roughly as lying within the banks of the active channel, and young alluvium (Qa). Portions of the planning area are underlain by basin deposits (Qb) and older alluvial terraces and fans of the Modesto Formation (Qmu).



Holocene
- Qsc — STREAM CHANNEL DEPOSITS: Deposits of open, active stream channels
- Qa — ALLUVIUM: Unweathered gravel, sand, and silt
- Qb — BASIN DEPOSITS, UNDIVIDED: Fine-grained silt and clay

Pliocene
- Qmu — MODESTO FORMATION Upper Member: Unconsolidated, unweathered gravel, sand, silt, and clay
- Qml — MODESTO FORMATION Lower Member: Unconsolidated, slightly weathered gravel, sand, silt, and clay
- Qrb — RED BLUFF FORMATION: Thin veneer of distinctive, highly weathered gravels

Pliocene Pre-Tertiary
- Tte - Ttep — TEHAMA FORMATION: Sandstone and siltstone with lenses of crossbedded pebble and cobble conglomerates. Putal Tuff Member: Poorly to well-sorted, moderately consolidated, vitric pumiceous tuff.
- Ptsm — METAMORPHIC, INTRUSIVE, AND SEDIMENTARY ROCKS

N

Figure 4.3-2 Generalized Geology Map

SOURCE: HELLEY, AND HARWOOD, 1985

Subsurface information available from borings and mining excavations in the vicinity of the planning area provide information on the stratigraphy (i.e., layering) of the aggregate deposits. The uppermost overbank deposits are clayey silts and silty clays that extend from the surface to an average depth of six feet. The thickness of the fine-grained overbank deposits reportedly increases to the south, away from the Creek, to more than 20 feet (Russo, 1995b). The fine-grained surficial deposits are directly underlain by two feet or more of sands and clayey sands,[5] which change gradationally downward to sandy gravels and gravels. These deposits are informally called the "shallow sand and gravel" and are generally underlain by a "middle clay." The top of the middle clay has been encountered at depths ranging from 21 to 38 feet south of Capay Creek. The thickness of the clay, where present, ranges from 8 to 13 feet.

The middle clay is underlain by the "lower sands and gravels." These coarse-grained sediments range in thickness from 12 to 30 feet. Where the middle clay is absent, the total thickness of sand and gravel deposits (including minor silt and clay layers or lenses) measured south of Capay Creek is 50 to 58 feet. The lower sands and gravels overlie the "bottom clay," where present. The depth to the top of the bottom clay ranges from about 58 feet near the active channel of Cache Creek to approximately 65 feet in the area south of Cache Creek and east of I-505. In some areas, including near the proposed Teichert Reiff site, the depth to the clay is greater than 150 feet below the ground surface.

The fine-grained surficial deposits, middle clay, and bottom clay represent overbank deposition from low-energy (slow-moving) water during and after flood events. These overbank sediments consist of clays, silts, and fine sands deposited on the margins of a stream. The sand and gravel sediments are higher-energy stream channel deposits. Migration, or shifting, of the channel can result in burial of overbank deposits (e.g., areas where the middle clay or bottom clay is present) or removal (erosion) of these deposits.

The surficial Quaternary alluvial and stream channel deposits are composed of sediments primarily eroded from Franciscan, Great Valley, Tehama, and Cache Formations. The Franciscan Formation is located in the upper reaches of Cache Creek basin and constitutes a heterogeneous assemblage of rock types consisting of deformed volcanic and marine sediments. The important rock types of the Franciscan Formation that comprise gravels within Cache Creek include metamorphosed volcanic rocks, chert, greywacke (sandstone), and quartz. The Great Valley Formation is composed of various layers of greywacke sandstone, shale or siltstone, and conglomerate. The less abundant sandstones and conglomerates constitute important lithologies in the gravels of Cache Creek. The Tehama Formation consists of weakly cemented conglomerates and sandstones. The rock types of the pebbles in the conglomerates are comprised primarily of those of the Franciscan Formation. The Tehama Formation is exposed in the bed and banks of Cache Creek, most notably near Capay and Dunnigan Hills. The Cache

[5]The fine-grained silty, clayey, and sandy overbank deposits are not marketable aggregate products and are collectively called overburden, distinguishing them from deeper well-graded sand and gravel aggregate resources.

Formation is similar to the Tehama Formation and is likely an important contributor of gravel to Cache Creek. Tertiary to Recent volcanic rocks, common around Clear Lake, also may constitute 5 to 20 percent of the gravels in lower Cache Creek (NHC, 1995).

The surficial deposits of the Dunnigan Hills, located north of the planning area, are mapped primarily as the Pliocene Tehama Formation and the younger Red Bluff Formation. The Tehama Formation overlies the Great Valley Formation and as mentioned above is comprised of sandstones, siltstones, and conglomerates eroded from the Coast Ranges to the west. The Red Bluff Formation consists of a thin veneer of highly weathered gravels overlying the Tehama Formation (Helley and Harwood, 1985).

Cache Creek Morphology and Processes

Stream Morphology

The shape, or morphology, of a stream channel is a function of the characteristics of the flow (volume and velocity) carried by the stream and the composition of sediments forming its banks and stream bed. Cache Creek, as it flows through Capay Valley, has sufficient channel slope to move substantial sediment loads during periods of high runoff. Periods of moderate to low flow are characterized by aggradation and accumulation of sediment. Lateral tributaries, bank erosion, and occasional landslides provide additional localized sedimentary loads.

The geology and geomorphology indicate that the area between Capay and the Dunnigan Hills has been a depositional zone throughout recent geologic time. The current creek has an incised and narrow channel rather than the expected broad, shallow channel in an alluvial depositional zone. The incision of the creek channel has been attributed to a combination of complex influences. The influences that have contributed to this condition include:

- Decreased sediment supply caused by entrapment of sediment behind dams within the Cache Creek system;
- Regional narrowing of the channel related to reclamation of active floodplain to agriculture;
- Extraction of sand and gravel;
- Local narrowing of the channel at bridge crossings.

In-channel gravel extraction in this area has lowered the channel thalweg more than ten feet for several miles and narrowed the channel to more than 1,200 feet upstream and downstream from the Esparto and Stevens Bridges. Downstream of the active gravel extraction operations, the channel is leveed and deeply incised in many locations. Final deposition occurs in the Yolo By-Pass Settling Basin. Nine geomorphic subreaches from Capay Dam to the Settling Basin have been identified within Cache Creek. These include Capay Valley, Capay, Hungry Hollow, Madison, Guesisosi, Dunnigan Hills, Hoppin, Rio Jesus Maria, and the Settling Basin (NHC, 1995). A brief description of channel morphology and hydraulics of each of the subreaches (see Figure 4.4-6 in the Hydrology and Water Quality section) within the CCRMP planning area is presented in the following sections.

Capay Subreach

The Capay subreach extends downstream from the Capay Dam to the Capay bridge. This subreach is relatively steep (average channel gradient of 0.0020), confined, and incised. The channel has incised through relatively thin coarse-grained alluvial deposits into the underlying Great Valley Sequence bedrock. The resistant bedrock confines the creek in a narrow, straight channel. The channel widens in the downstream portion of the subreach, suggesting that in this area the bed and banks of the creek are formed in less resistant alluvium.

Hungry Hollow Subreach

Within the Hungry Hollow Subreach, Cache Creek has a relatively wide and braided alluvial channel. Multiple, shallow channels characterize low flow conditions. This subreach extends from the Capay bridge to approximately one mile downstream of the Esparto bridge. The low flow channel is not well-defined due to active seasonal in-channel aggregate extraction. The channel gradient remains relatively steep, suggesting that the form of the channel is controlled by the extensive in-channel mining operations that have been conducted within this subreach.

Madison Subreach

The Madison subreach is approximately 2.5 miles long and extends downstream to the Interstate 505 (I-505) bridge. The channel narrows in a downstream direction and has a relatively steep gradient (0.0023). In-channel aggregate mining occurs in the upstream half of the subreach. The channel hydraulics are influenced by numerous berms, jetties, aggregate haul roads, and localized bank protection. The low flow channel is not very well defined in this subreach due to active aggregate mining.

Guesisosi Subreach

The Guesisosi subreach extends 2.3 miles from the I-505 bridge to just upstream of the location the Moore Dam. The channel is relatively narrow, relatively gentle (0.0012), and deep (incised), with relatively fine-grained bed materials.

Dunnigan Hills Subreach

The Dunnigan Hills subreach extends 2.8 miles downstream to the Stevens bridge. The channel is relatively narrow and the gradient is relatively steep (0.0019). The reach is characterized by multiple low flow channels separated by heavily vegetated islands and midchannel bars. This subreach has well-developed meander bends. The subreach traverses the axis of the Dunnigan Hills anticline, an area of active uplift, which may contribute to the relative steepness of the channel. Alluvial terraces along this reach may reflect preservation of abandoned stream channels related to the uplift. This is a "gaining reach" of the creek as shallow groundwater table contributes to flow in the channel. These groundwater conditions support the dense riparian vegetation in this subreach. Former in-channel mining pits are separated or partially separated from the active channel by levees.

Hoppin Subreach

The Hoppin subreach extends 3.3 miles downstream from the Stevens bridge to approximately 1.4 miles upstream of the I-5 bridge. The channel in this subreach is characterized by midchannel bars and multiple low flow channels. The gradient is gentle (0.0013) compared to the Dunnigan Hills subreach. Shallow groundwater provides flow to the creek and supports dense vegetation on the banks and mid-channel bars. The bed materials are fine. Active and inactive mining areas are separated from the active channel by levees.

Jesus Maria Subreach

The upstream 1.4 miles of the Jesus Maria subreach is located within the CCRMP planning area. The overall reach is 7.5 miles long. The channel is narrow and confined by levees. The levees form steep, high banks. The channel gradient is relatively gentle (0.0013). The channel form is characterized by heavily vegetated midchannel bars.

Channel Stability

Throughout most of the CCRMP planning area, the Cache Creek channel is in an unbalanced condition. This condition has resulted from a variety of influences to which the creek is constantly adjusting. A natural stream system generally develops a condition referred to as "dynamic equilibrium" under which the system maintains a balance between the energy available to transport sediment delivered to the stream (provided by the water flowing in the stream) and the amount and type of sediment entering the system. Under this condition, the stream develops a morphology (channel shape and slope) that most efficiently moves sediment through the stream. This balance or equilibrium is continually adjusted to changes that affect the energy available with the energy necessary to transport sediment. Natural changes in the energy available to a stream are commonly presented by changes in the amount and rate of water entering the system (generally controlled by climate). However, changes in "base level," the theoretical lowest elevation to which a system can erode, can also affect channel morphology. Changes in base level can result from long-term gradual changes such as fluctuation of sea level (a climatic response) or tectonic uplift or subsidence of the land surface.

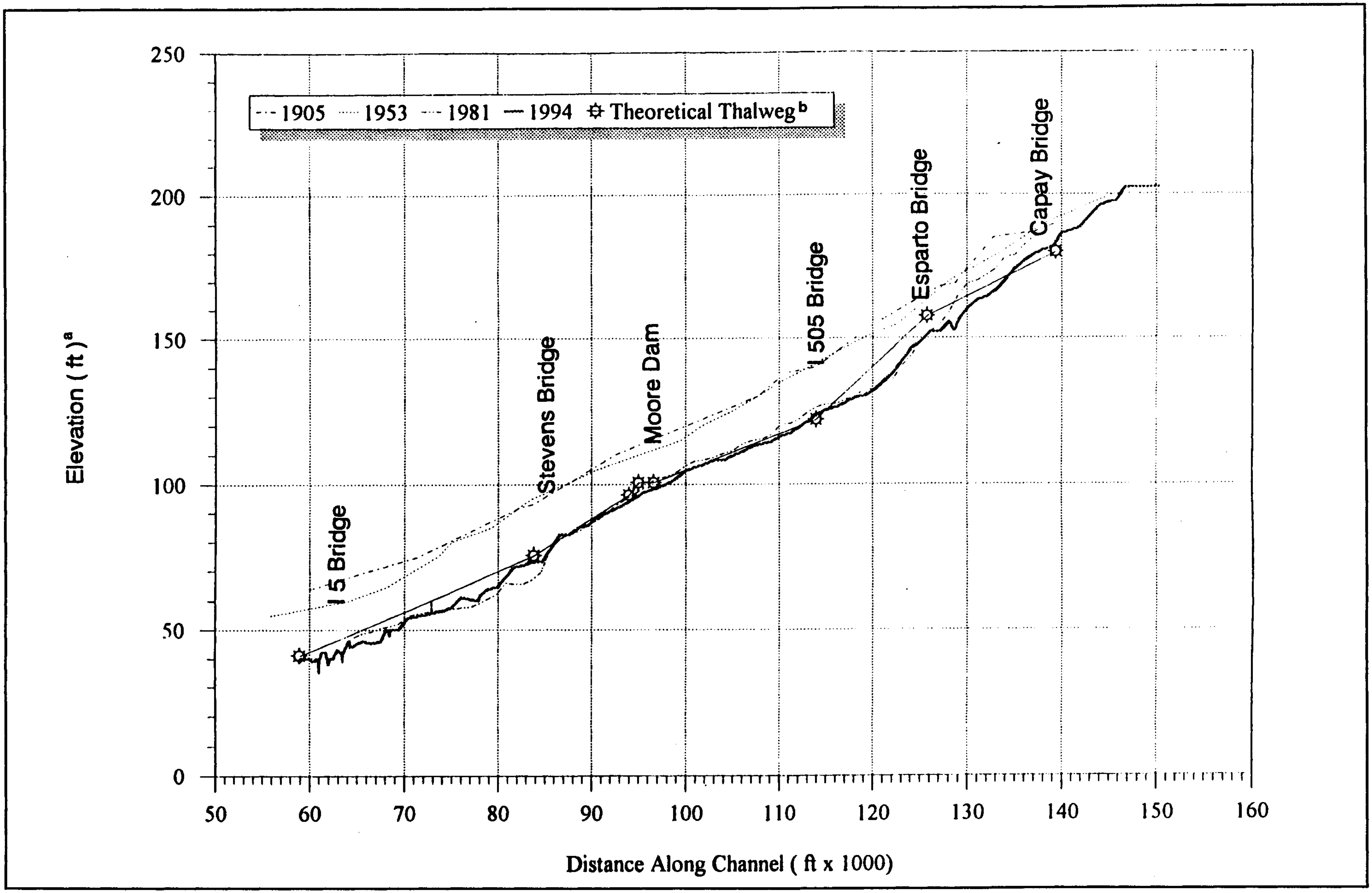
The energy available to a stream system controls its ability, or capacity, to transport sediment delivered to the stream. A stream in equilibrium with the amount and sizes of sediment entering the system is able to efficiently move the sediment through the system without significant adjustments to channel form. However, changes in the amount or rate of sediment delivered to the system will result in changes in the stream's ability to transport sediment. When excess sediment is delivered to a stream system, the capacity of a the stream is exceeded and deposition of sediment results. The location of deposition is related to stream channel conditions, which can be locally variable. High sediment loads can result in deposition or aggradation in localized areas of low stream energy, including areas of relatively low gradient or the inside of meander bends (point bar aggradation). When sediment loads are decreased, the stream may have excess energy, resulting in erosion of its bed (incision) or banks (lateral migration). In addition to potential changes in energy available within the system, changes in the energy required to maintain a channel can result in disruption of the "dynamic equilibrium." The channel will respond to these changes by adjustments in its morphology, which reflect its pattern of erosion and deposition of sediments within and adjacent to the stream.

The current and historic Cache Creek channel has responded to natural and man-induced changes to the balance of available and required energy to transport sediment. Substantial incision, or stream bed lowering, has been documented during historic times along Cache Creek. During the period from 1959 to 1980, the stream bed was lowered by an average of 15 feet (Collins and Dunne, 1990). The incision has resulted in increased channel depth and a corresponding increase in cross-sectional area of the stream and floodwater capacity. The incision of the channel is reflected in longitudinal profiles measured along the creek from the period 1905 to 1994 (Figure 4.3-3).

Streams are natural systems in dynamic equilibrium that adjust continually to changes in sediment supply, volume or velocity of flow, and irregularities within the channel. Channel incision on Cache Creek has been directly linked to the effects of gravel extraction caused by historic in-stream mining (summarized by Collins and Dunne, 1990). However, incision can also be related to reduced sediment supply in Cache Creek caused by interception of sediment by dammed reservoirs upstream of the subject reach. Although the dams also reduce the peak of some flood flows, the Creek is clearly capable of transporting sand and gravel bedload. If sediment supply is not provided to a stream capable of transporting these materials, the stream will erode its banks or bed. The width of the active floodplain of Cache Creek has been significantly reduced due to encroachment of agricultural lands into the floodplain. For example, the average width of the active channel in the Capay subreach has been decreased from approximately 3,500 feet prior to 1937 to less than 500 feet at present (NHC, 1995). In addition, narrow bridge spans constrict the channel width, locally affecting flood flow depth and velocity. Restrictions on the width of channel and protection of adjacent lands against lateral migration of the channel significantly contribute to the tendency for incision.

Local Soils

Soil, as described in this section, is the natural formation on the surface of the earth consisting of mineral and organic material. Soils can develop on unconsolidated sediments and weathered bedrock. The development of a soil is typically dependent on five major



[a] A National Geodetic Vertical Datum

[b] Longitudinal profile set by Yolo County in 1979 to define the minimum elevation to which in-channel mining along Cache Creek could occur.

Figure 4.3-3 Longitudinal Channel Profiles

SOURCE: NHC, 1995

influences: climate, topography, biologic activity, parent material, and time. Differences in soil types are, therefore, caused by changes in these influences. Within the planning area, 12 different soils have been identified by the U.S. Soil Conservation Service (USDA, 1972) on the basis of characteristics that reflect relatively subtle but important changes in the soil formation factors. In general, the topography is relatively flat, the climate is similar, and biological activity is comparable. The major difference in the soils of the area is the topographic position relative to the active channel of Cache Creek and the associated differences in the consistency and age of the alluvial deposits. A generalized soils map for the planning area is presented in Figure 4.3-4. Characteristics of the soils are summarized in Table 4.3-2.

The surface soils that mantle the planning area include excessively drained to recent coarse-grained alluvial sediments and well-drained to poorly-drained soils on alluvial fans, basin rims, terraces, and in basins. All of the area soils are formed on alluvium derived from sedimentary rock. Slopes range from zero to two percent except on channel banks. Soils in the planning area that are characterized by finer grained deposits, such as silty clayey loam soils, generally have a moderate to high shrink-swell potential and slow to moderate permeabilities. Coarser grained deposits that contain sands and gravels generally have a low shrink-swell potential and higher permeabilities. The soils in the planning area generally have a low or negligible erosion hazard if undisturbed (USDA, 1972).

The soil types that have been identified within the planning area by the Yolo County Soil Survey (USDA, 1972) are listed in Table 4.3-3. The recent alluvial deposits within the Cache Creek channel are identified as Riverwash (Rh). This soil mapping unit is characterized by excessively drained sandy and gravelly stream deposits. These soils are generally found in and adjacent to the active channel of Cache Creek. These sediment deposits characterize the bedload of Cache Creek and are, therefore, erodible, especially during high flow events in the creek. These deposits are high grade aggregate resources but provide no agricultural value.

Portions of the stream channel and low terraces along the channel also contain Loamy Alluvial Land (Lm) and Soboba gravelly sandy loam. The Loamy Alluvial Land mapping unit includes nearly level mixed, stratified recently deposited fine-grained alluvium. The soil types are extremely variable but include sand, sandy loam, and silt loam. This mapping unit is widely variable and difficult to characterize. However, the soils generally have low clay content and little to no cohesion. The granular soils typically have high permeability and low shrink-swell potential.

Soils that have developed on the higher terraces along Cache Creek are generally suitable for irrigated agriculture. Soil mapping units include Brentwood silty clay loam (BrA), Yolo silt loam (Ya), Yolo silty clay loam (Yb), and Zamora loam. These soils generally have a moderate to high shrink-swell potential and moderate to rapid permeability. On level, undisturbed topography, these soils have low to negligible erosion hazards. Erosion hazards are higher on exposed cut slopes, including channel banks.

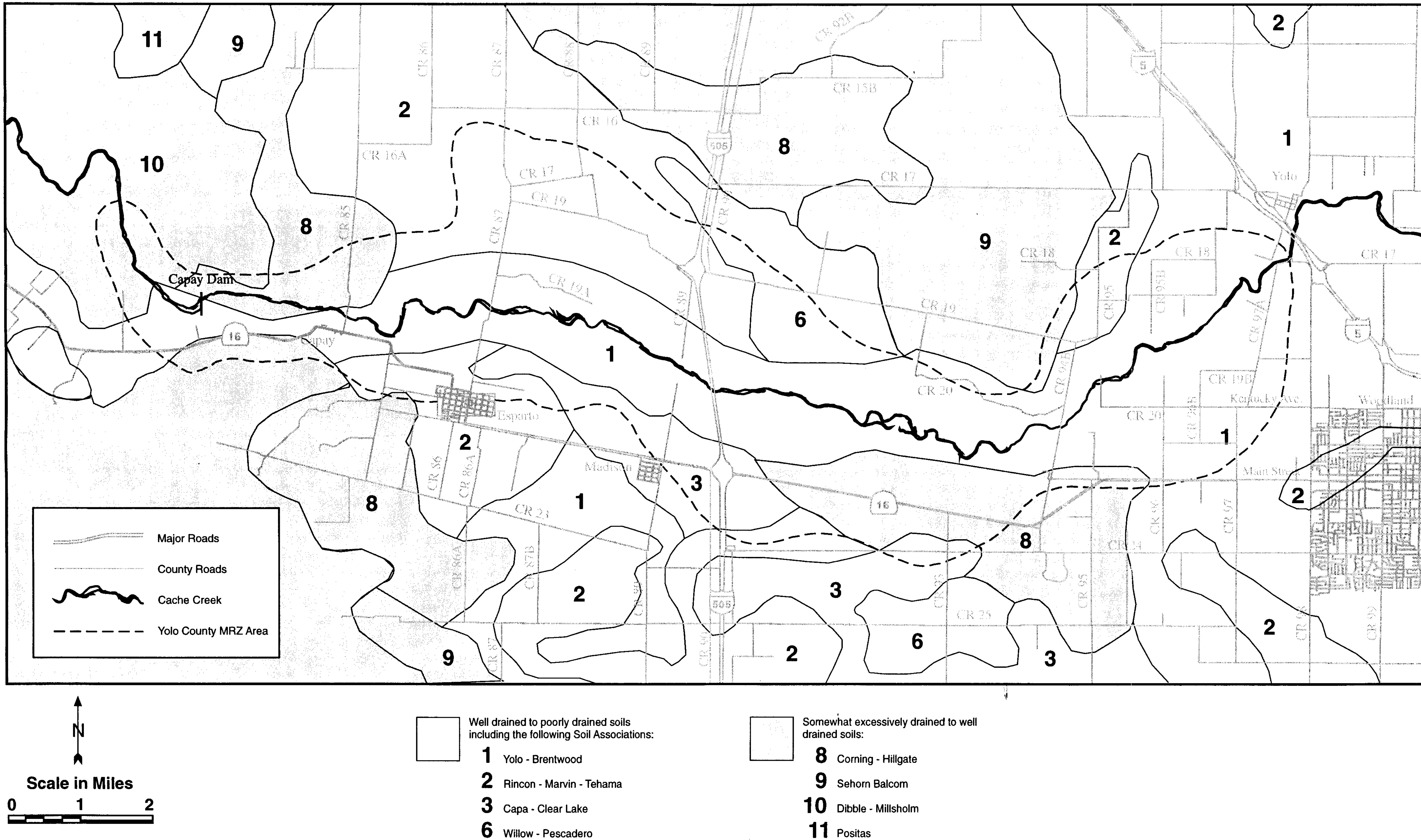


Figure 4.3-4 Generalized Soils Map

SOURCE: USDA, 1972

TABLE 4.3-2: Soil Types - Physical Properties

Map Symbol	Soil Series Name	Shrink/Swell Potential[1]	Permeability[2] (inches/hour)	Erosion Hazard[3]	Corrosivity[4]
BrA	Brentwood silty clay loam	High	0.06-0.20	Slight to none	High
Lm	Loamy alluvial land	N/A	N/A	Slight to none	N/A
Rg	Rincon silty clay loam	Moderate	0.2-0.63	Slight to none	Moderate
Rh	Riverwash	N/A	N/A	N/A	N/A
Sn	Soboba gravelly sandy loam	Low	>20	Slight to none	Low
So	Sycamore silt loam	Moderate to high	0.2-2.0	Slight to none	High
TaA	Tehama loam	Moderate	0.06-2.0	Slight to none	Low to Moderate
Ya	Yolo silt loam	Moderate	0.63-2.0	Slight to none	Low
Rb	Reiff gravelly loam	Low	2.0-6.3	Slight to none	Low
SmD	Sehorn-Balcom complex	Moderate	0.2-0.63	Slight to moderate	Moderate
Yb	Yolo silty clay loam	Moderate	0.2-2.0	Slight to none	Moderate
Za	Zamora loam	Moderate	0.63-2.0	Slight to none	Low to moderate

Source: U.S. Department of Agriculture, Soil Conservation Service, 1972, Soil Survey of Yolo County, California.

1 Shrink-swell potential is the extent to which the soil shrinks as it dries or swells when wet. A high shrink-swell rating indicates a hazard to structures.
2 Permeability is the ability of a soil to transmit air or water.
3 Erosion hazard is the propensity of a soil to erode when tilled or exposed.
4 Corrosivity pertains to the potential for soil-induced chemical action that dissolves or weakens uncoated steel.

Aggregate Resources

The Quaternary alluvial deposits in the Cache Creek area are recognized as a major source of aggregate for the production of concrete, asphaltic concrete, and road base materials. Aggregate mining has occurred in and along Cache Creek since the early 1900s. An estimated 80 to 90 million tons of aggregate have been removed from Cache Creek since the beginning of mining (Collins and Dunne, 1990). The majority of aggregate mined from the lower Cache Creek basin is suitable for the production of Portland Concrete Cement (PCC). The specifications for PCC-grade aggregate are more restrictive than specifications for other aggregate products, criteria that increase the usefulness and marketability of these deposits.

A mineral land classification of aggregate materials in the Sacramento-Fairfield region conducted by the California Division of Mines and Geology (Dupras, 1988) presents an evaluation of the availability of aggregate resources within the lower Cache Creek watershed. Evaluation of aggregate resources throughout the State is required by the California Surface Mining and Reclamation Act (SMARA). Provisions of SMARA require that the CDMG determine the boundaries of major aggregate Production-Consumption (P-C) regions, identify aggregate resource areas within the regions, and evaluate the availability and supply of those resources. Assessment of the aggregate resources includes the classification of Mineral Resource Zones (MRZs) on the basis of existing geologic data. Identified zones, where sufficient data indicate the likelihood for occurrence of significant aggregate deposits is high, are designated MRZ-2. If land uses within MRZ-2 zones are compatible with aggregate mining, the zones are classified as "sectors." Under the State mineral lands classification system, the available tonnage of aggregate resources within sectors is then estimated.

The planning area is entirely located within an identified MRZ-2 zone (Dupras, 1988). This designation of the area identifies the aggregate resources as "significant mineral deposits" under the State Mining and Geology Board's *Guidelines for Classification and Designation of Mineral Lands.* The estimated resource within the Cache Creek channel (below the theoretical thalweg) is approximately 111 million tons of PCC-grade aggregate (Dupras,1988).

REGULATORY SETTING

SMARA and Related Regulations

The California Surface Mining and Reclamation Act (SMARA) was enacted in 1975 to provide a means of identifying potential mineral resources throughout the State and to provide for reclamation of mined lands. The stated intent (Section 2712) of SMARA is to ensure that:

a) Adverse environmental effects are prevented or minimized and that all mined lands are reclaimed to a usable condition which is readily adaptable for alternative land uses;

b) The production and conservation of minerals are encouraged, while giving consideration to recreation, watershed, wildlife, range and forage, and aesthetic enjoyment;

c) Residual hazards to the public health and safety are eliminated.

The entire planning area is located within an area classified by the CDMG as a MRZ-2 Mining Resource Zone. The area has also been classified as part of several mineral resource "sectors" by CDMG. The classification of an area as a source of significant mineral deposits requires lead agencies to establish resource management policies that will emphasize the conservation and development of identified mineral deposits" (Section 2762 of SMARA). The Yolo County Off-Channel Mining Plan for the Cache Creek area and associated ordinances are currently under environmental review. The OCMP and mining ordinances specifically address surface mining and reclamation issues.

The CCRMP would not allow commercial mining in the Cache Creek channel. Although mining has occurred within the channel since before the beginning of the 20th century, The Technical Studies for the CCRMP (NHC, 1995) have confirmed that active mining operations under existing ordinances have contributed to the current instability of the channel. Implementation of the CCRMP would result in cessation of mining within the channel, initiate a comprehensive creek monitoring program, and control improvement projects to promote stabilization of the creek channel. The improvement projects would likely result in the initial excavation of significant quantities of sand and gravel resources from within the Cache Creek channel over the first five years. These excavations would be required to produce a more hydraulically stable channel. Although some of the excavated materials would be needed as fill for areas of the channel requiring reconstruction as channel banks or channel gradient improvements, some of the excavated materials would be exported from the improvement projects. It is expected that marketable aggregate materials would be sold.

Because the aggregate extraction expected under the CCRMP would be performed for the primary purpose of improving channel stability, these activities may qualify for an exemption under SMARA. Section 2714 of SMARA provides exceptions for the following activities that may relate to improvement projects under the CCRMP:

a) Excavations or grading conducted for farming or onsite construction or for the purpose of restoring land following a flood or natural disaster.

b) Onsite excavations and onsite earthmoving activities which are an integral and necessary part of a construction project that are undertaken to prepare a site for construction of structures, landscaping, or other land improvements, including the related excavation, grading, compaction, or the creation of fills, road cuts, and embankments, whether or not surplus materials are exported from the site, subject to all of the following conditions:

    (1) All required permits for the construction, landscaping, or related land improvements have been approved by a public agency in accordance with applicable provisions of state law and locally adopted plans and ordinances, including but not limited to, Division 13 (commencing with Section 21000).

(2) The lead agency's approval of the construction project included consideration of the onsite excavation and onsite earthmoving activities pursuant to Division 13 (commencing with Section 21000).

(3) The approved construction project is consistent with the general plan or zoning of the site.

(4) Surplus material shall not be exported from the site unless and until actual construction work has commenced and shall cease if it is determined that construction activities have terminated, have been indefinitely suspended, or are no longer being actively pursued.

The improvement projects under the CCRMP could reasonably be assumed to meet these requirements for exemption from SMARA. These projects would be construction activities directed toward stabilization and restoration of the creek channel. As such, the projects could be considered "landscaping or related land improvements." Because it is recognized that the current channel conditions must be managed to prevent further damage or threat of damage to bridges, canals, and other structures related to flood flows in the creek, the projects could also be considered necessary "for the purpose of restoring land following a flood or natural disaster."

f) Any other surface mining operations that the board determines to be of an infrequent nature and which involves only minor surface disturbances.

The improvement project under the CCRMP could reasonably be assumed to meet the requirements for exemption under SMARA. Removal of aggregate would not exceed the previous year's deposition and may be less. Extraction would only be permitted for the purposes of improving channel stability or erosion prevention of adjoining lands, and would occur under the review of a Technical Advisory Committee set up to monitor channel conditions. Aggradation will be encouraged, where appropriate, so that aggregate removal would be limited on scope of frequency. As the channel stabilizes over time, it is expected that the need for maintenance activities will decrease. Furthermore, all existing mining permits within the active channel would be withdrawn under the CCRMP.

Yolo County General Plan

The channel modification (including extraction of aggregate resources) and habitat restoration activities under the CCRMP are addressed in several goals and policies contained in the Yolo County General Plan. The general goals that relate to these activities include:

- Provide for industrial growth in the County to provide employment, services, and tax base while minimizing hazards and nuisances and while conserving resources and agricultural lands.
- Provide for seismic safety.
- Control erosion and practice soil management.
- Conserve natural resources.

The General Plan also includes the following safety (S) and conservation (CON) policies that relate to activities proposed under the CCRMP:

S 1 Yolo County shall regulate, educate, and cooperate to reduce death and injuries or damage to property and to minimize the economic and social dislocation resulting from ... geologic hazards.

CON 2 Yolo County shall foster conservation of its resources and avoid natural hazards by planning, encouraging, and regulating the development and use of these resources.

CON 3 Plans, projects, and programs shall treat land as a resource rather than as a commodity.

CON 9 Yolo County shall ensure the protection, maintenance, and wise use of the State's natural resources, especially scarce resources and those that require special control and management.

CON 10 Yolo County shall plan, encourage, and regulate public and private agencies to prevent wasteful exploitation, destruction and/or neglect of the State's resources.

CON 35 Yolo County shall adopt a Cache Creek Management Program for the carefully managed use and conservation of Cache Creek and its sand and gravel resource, its riverside environment, its relationship to ground and surface water characteristics, and its value as a fishery and recreation resource.

The proposed project is generally in compliance with each of these goals of the General Plan. Inconsistency or incompatibility of the CCRMP with the General Plan is addressed below.

IMPACTS AND MITIGATION MEASURES

Standard of Significance

The project would have a significant effect on geology and soils if it would result in:

- Exposure of people or property to geologic hazards, including but not limited to:
  - Fault rupture on active faults;
  - Seismic shaking (accelerations greater than 0.1g);
  - Seismically-induced ground failure, including liquefaction;
  - Landslides or mudflows (includes excavated slopes);
  - Erosion, changes in topography or unstable soil conditions from excavation, grading, or fill;
  - Subsidence of the land; or
  - Expansive soils.
- Destruction, covering, or modification of unique geologic or physical features.
- Result in the loss of availability of a known mineral resource that would be of future value to the region.

Impact 4.3-1
Impacts of Sediment Deposition and Removal Potentially Affecting Creek Stability and Causing Lateral Erosion of the Channel Bed or Banks, Resulting in Loss of Agricultural Lands or Other Valuable Improvements, Such as Roads, Bridges, or Other Structures

The unstable condition of Cache Creek within the CCRMP planning boundary presents a threat to the integrity and stability of important resources including bridges, irrigation canals, roads, and productive farmland. The Technical Studies for the CCRMP (NHC, 1995) have demonstrated that current and historic hydraulic conditions along the creek have resulted in damage to and present an ongoing threat to the stability of the Capay, Esparto, I-505, and Stevenson bridges. Collapse of the Madison (County Road 89) bridge and closure of the Capay bridge in 1995 were the direct result of uncontrolled, adverse hydraulic conditions. Erosion of the creek bank on the north side of the creek directly upstream of the Capay bridge has required extensive bank protection to prevent damage to the West Adams Canal.

<u>Draft CCRMP</u>

The CCRMP proposes to eliminate commercial mining within the Cache Creek channel. The plan acknowledges that the current channel instability will persist after mining is eliminated in the channel. Therefore, the plan proposes initiation of a program to monitor and improve the stability of the creek. The plan includes a conceptual model of a more stable creek configuration, the Test 3 model, and promotes improvement projects to adjust the channel to this model. The following policies of the CCRMP relate to improving the stability of Cache Creek:

Goal 2.1-1: Recognize that Cache Creek is a dynamic stream system that naturally undergoes gradual and sometimes sudden changes during high flow events.

Goal 2.2-2: Promote development of more natural channel floodway capable of conveying flood waters without damaging essential structures, causing excessive erosion, or adversely affecting adjoining land uses.

Goal 2.2-3: Coordinate land uses and improvements along Cache Creek so that the adverse effects of flooding and erosion are minimized.

Goal 6.2-2: Provide for effective and systematic monitoring and reclamation of aggregate removal activities within Cache Creek.

These goals are supported by the following Objectives, Actions, and Performance Standards:

Obj. 2.3-5: Restrict the amount of aggregate removed from Cache Creek, except where necessary to promote channel stability, prevent erosion, protect bridges, or to ensure 100-year flood protection, in order to allow the streambed to aggrade and create a more natural channel system.

This objective does not specify how the County would restrict the mining of aggregate in the Cache Creek channel. The CCRMP should include a performance standard that commits the County to a prohibition of in-channel mining within the CCRMP. The commitment should be expressed in the CCRMP and CCIP implementing ordinances.

Action 2.4-2: Limit the amount of aggregate removed from the channel to the average amount of sand and gravel deposited during the previous year (approximately 200,000 tons on average), except where bank excavation is necessary to widen the channel as a part of implementing the Test 3 Run Boundary, or where potential erosion and flooding problems exist. The amount and location of in-channel aggregate removal shall be carried out according to the ongoing recommendations of the Technical Studies and the Technical Advisory Committee, with the voluntary cooperation of the landowners involved.

This action is intended to mitigate the impacts on channel stability associated with the past overextraction of sand and gravel from the Cache Creek channel. Overexcavation results from removal of more aggregate than the amount deposited within the channel over a given period. This is an important goal for reducing channel instability. The action should, however, be modified to limit extraction to the actual, not "average" amount of gravel deposited in a given year. In years of low sediment replenishment, removal of the "average" amount of aggregate could result in adverse hydraulic conditions and channel instability.

Action 2.4-2 is supported by the following performance standards:

PS. 2.5-1: All proposed grading and/or construction projects within the channel shall require approval from the County Floodplain Administrator, as required under the Yolo County Flood Ordinance.

This performance standard identifies the permitting authority for the improvement projects conducted under the CCRMP. The performance standard should be modified to reflect the role of the TAC as an advisory body for the County Community Development Agency in administration of the Yolo County Flood Ordinance. All projects should be reviewed by the TAC and approval should be contingent on incorporation of TAC recommendations for modification of projects.

PS. 2.5-5: The Technical Advisory Committee shall review topographic data and such other information as is appropriate, to determine the amount and location of aggregate to be removed from the channel. Aggregate removal from the channel shall only be recommended in order to provide flood control, protect existing structures, minimize bank erosion, or implement the Test 3 Run Boundary. Except for bank excavation to widen the channel, annual aggregate removal shall not exceed the amount of sand and gravel deposited the previous year, as determined by aerial photography analysis.

This performance standard presents a general guideline for the method of determining the locations and volumes of channel materials that would be removed under the CCRMP. However, the CCRMP should include a Cache Creek Improvement Program (or CCIP as provided in Section 7.3) that provides a framework for the analysis performed by the TAC. The CCIP should also specifically describe the responsibilities of the TAC. The TAC will not have the authority to specify requirements for flood control or protection of public structures. The CCRMP should include a performance standard that defines the authority and responsibilities of the TAC as an advisory committee.

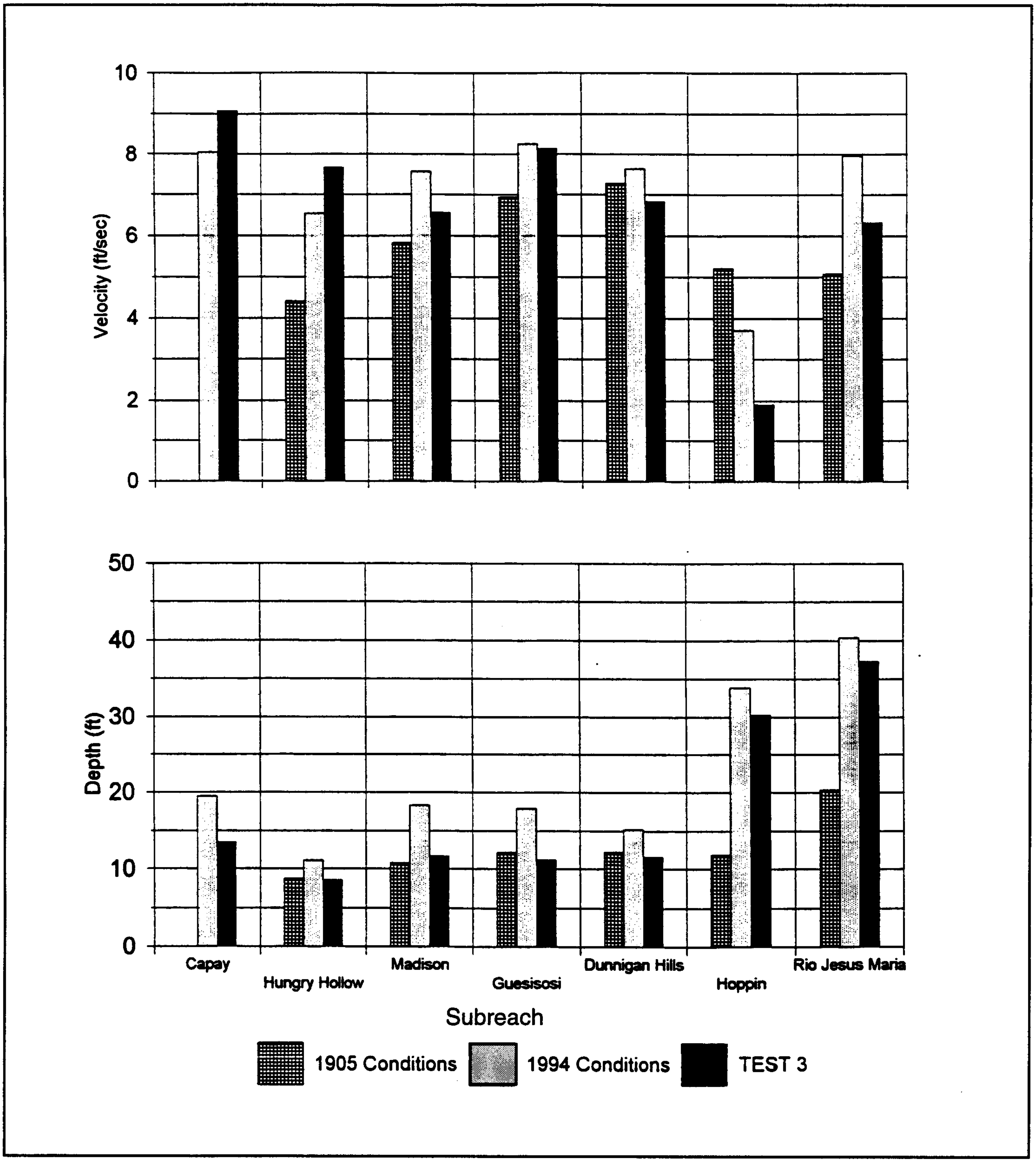
Action 2.4-3: Implement the Test 3 Run Boundary described in the Technical Studies to reshape the Cache Creek channel. Altering the channel banks and profiles will return the creek to a form that is more similar to its historical condition. This will result in reduced erosion, increased in-channel recharge, and additional riparian habitat opportunities.

The Test 3 Run was developed under the Technical Studies (NHC, 1995) as an iteration of the HEC-6 sediment transport model. The purpose of the model "run" was to evaluate the expected channel response to a modified channel configuration. Under Test 3, channel form was "smoothed" to a shape that made the channel width more uniform, widening the major constricted (narrow) areas and narrowing widened areas of the channel. Although the existing bridge widths were not changed for Test 3, channel sections upstream and downstream of the bridges were modified to allow smooth flow transitions through the bridge openings. The advantage or improvement over existing conditions resulting from this modified channel form was more efficient and uniform sediment transport throughout the system. The results of the Test 3 Run indicated that flow depths would be reduced in all reaches of the creek within the CCRMP relative to existing conditions. Flow velocity would be reduced in all reaches except the upstream Capay and Hungry Hollow reaches. The expected changes in flow velocities and depth under Test 3 conditions are shown in Figure 4.3-5.

In general, the Test 3 conditions would result in more uniform transport of sediment throughout the system. Expected sediment load changes during the 100-year flood are shown on Figure 4.3-6. At bridge locations, net deposition would be expected under Test 3 compared with expected scour under existing conditions. Under Test 3, continued deposition would be expected in the downstream Hoppin and Jesus Maria subreaches. The expected sediment load changes during the 100-year flow event under Test 3 are shown in Figure 4.3-7.

The hydraulic modeling presented in the Technical Studies indicate that implementation of the Test 3 model as a preferred channel configuration would result in significant improvements in channel stability. Smoothing of the channel shape would reduce the occurrence of fluctuations in channel hydraulics, which could result in adverse deposition or erosion patterns. Sediment distribution during high flow events would be improved.

Although the hydraulic modeling indicate significant advantages related to implementation of the Test 3 Boundary, it is important to understand that the channel modification to meet the Test 3 conditions would depend on the voluntary cooperation of individual landowners and may not occur or may take many years to complete. The Test 3 model should, therefore, be understood as a goal of the CCIP. All channel improvement projects should be reviewed by the TAC to evaluate whether the design of the projects are consistent or compatible with the Test 3 model channel. As improvement projects are completed, the channel will be in a transitional state. Systematic and continued monitoring of channel



*Capay Reach characteristics not available for 1905.

Figure 4.3-5 Average Flow Characteristics (by subreach) for 100-year Event Under Test 3

SOURCE: NHC, 1995

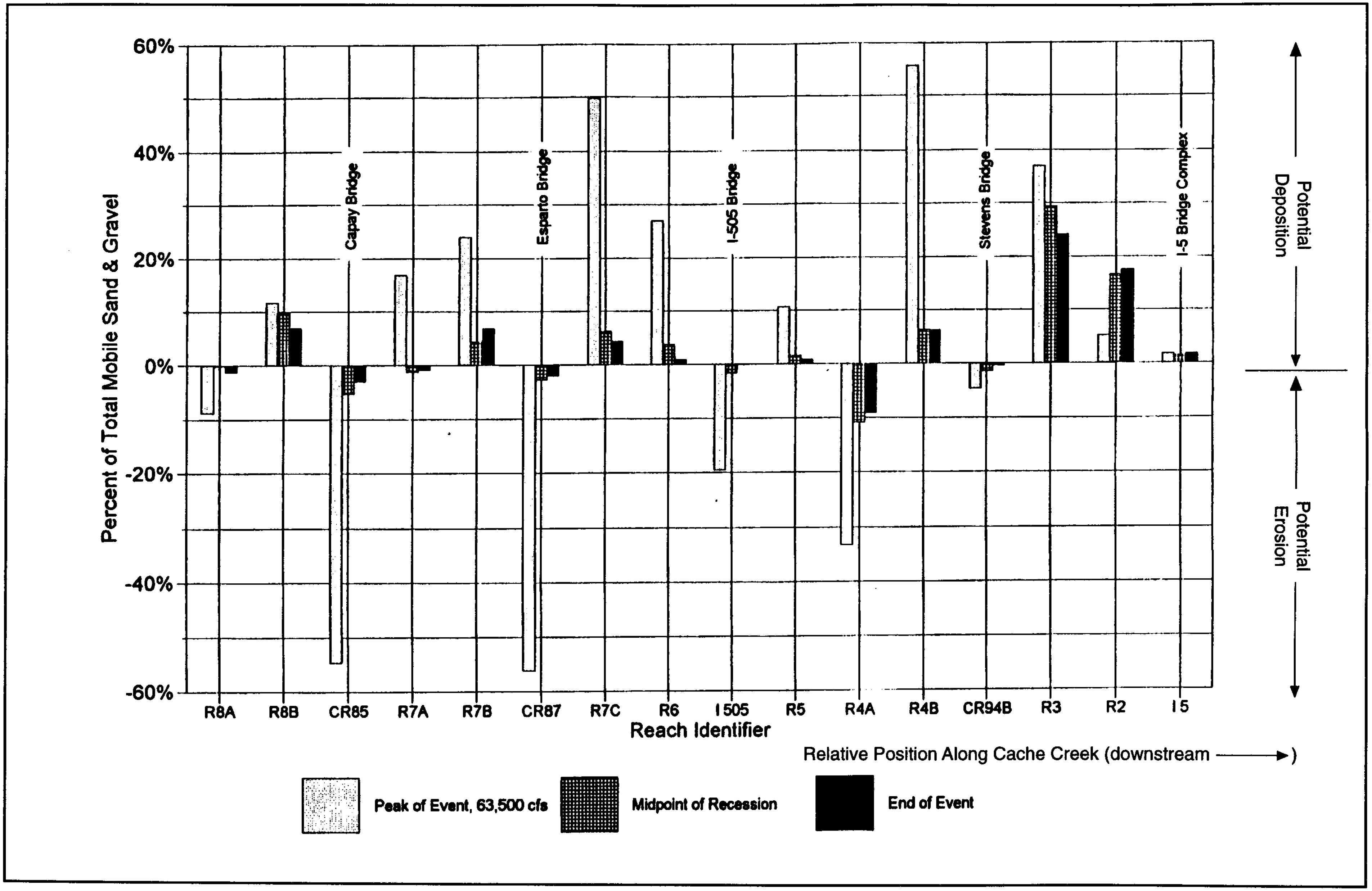


Figure 4.3-6 Average Sediment Load Changes for 100-Year Event Under Existing Conditions

SOURCE: NHC, 1995

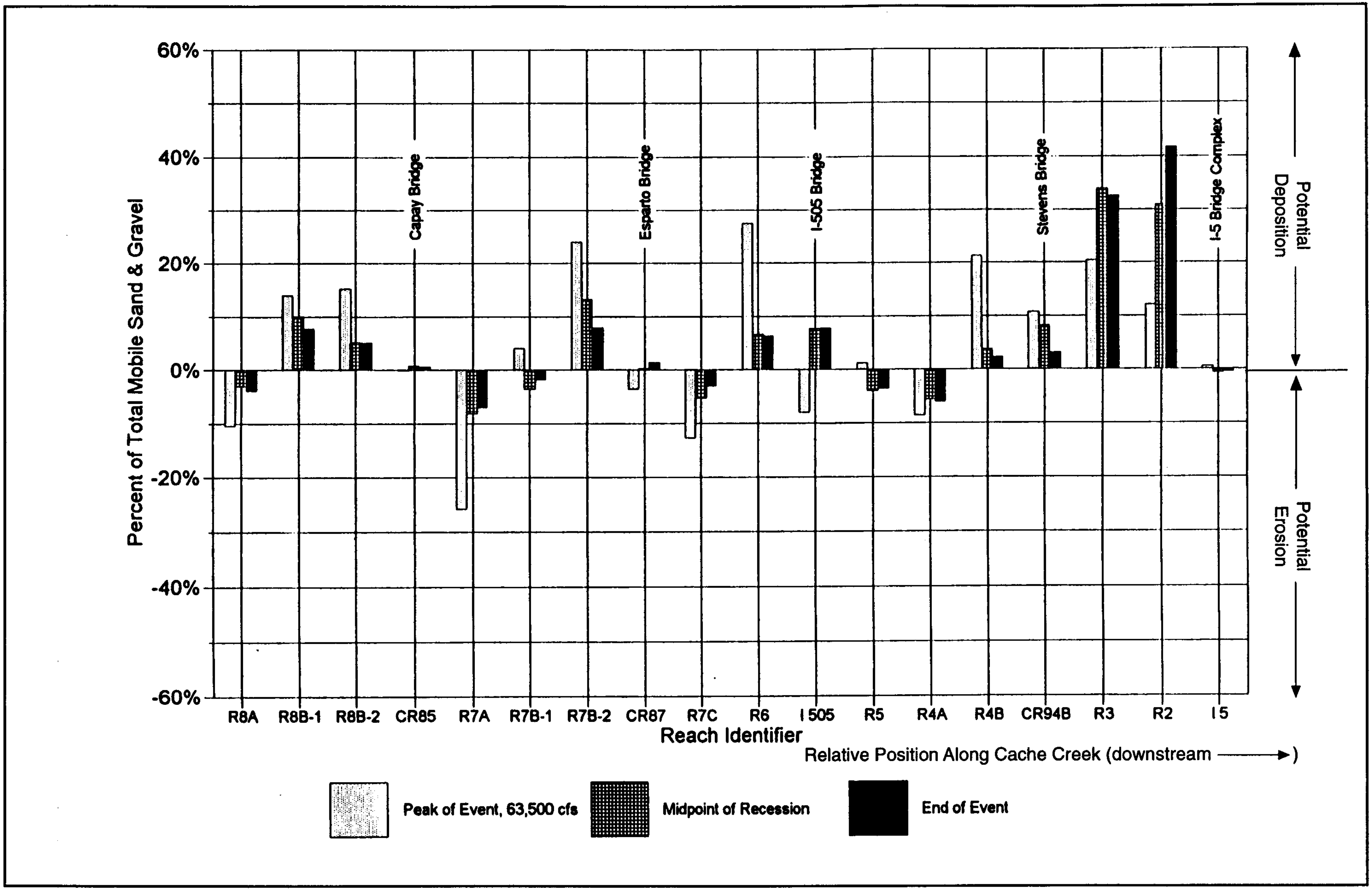


Figure 4.3-7 Average Sediment Load Changes for 100-Year Event Under Test 3

SOURCE: NHC, 1995

responses to the changes caused by improvement projects, including the elimination of mining operations within the channel, will be essential to appropriate management of the creek. The TAC should have the responsibility of recommending modifications to the Test 3 model channel configuration on the basis of monitoring results.

Action 2.4-4: Replace the theoretical thalweg, as defined in 10.3-221 of the Yolo County Mining Ordinance, with specific channel slope standards specific to each reach of the creek.

This Action is supported by the findings of the Technical Studies (NHC, 1995). The theoretical thalweg was adopted in 1979 as the "red line" vertical datum for the depth of allowable in-channel mining. This restriction was adopted in an attempt to control downcutting of the Cache Creek channel. The restriction of the vertical depth of mining does not address important aspects of channel stability. The irregular channel geometry and gradient of the Cache Creek channel, the contributing causes of continued channel instability, have not been significantly improved by enforcement of the theoretical thalweg limitation on mining. This action will not result in an adverse impact as long as other aspects of the CCRMP are adopted and implemented.

Action 2.4-5: Designate the streamway influence boundary described in the Technical Studies as a part of the Cache Creek Resource Management Plan. The boundary describes the general area of the creek which has historically been subject to meandering. The streamway influence boundary also defines the area where in-stream and off-channel issues overlap and are addressed in both plans.

Adoption of this policy is important to the overall management of the Cache Creek channel. Activities occurring within the streamway influence boundary could influence the stability of the Cache Creek channel. Off-channel mining operations and management of storm water runoff and agricultural tailwater should be considered by the TAC as conditions that may present impacts to or opportunities for enhancement of channel stability or habitat restoration.

Action 2.4-8: Enter into a Memorandum of Understanding with the Yolo County Flood Control and Water Conservation District to provide a regular source of surface water flow in Cache Creek throughout the year, when annual precipitation is sufficient. The timing and volume of flows should be established consistent with the Technical Studies, in order to create a stable low-flow channel and allow for the natural revegetation of the streambed, where appropriate.

Continuous flow within the Cache Creek channel could promote stability of the low flow channel. If such flows are of sufficient discharge, these flows could be efficient in removing sediment deposited in the channel by higher flow events occurring during the rainy season. Sediment deposits can cause obstructions to flow that could result in increase erosion potential. The sustained flows would also promote removal of fine-grained sediment from the bed of the low flow channel (winnowing) and the development of an armored bed. An armored bed generally increases the stability of the channel , reducing the potential for bed scour during low flow events. However, during high flow events, higher flow velocities could cause scoring of the bed. Implementation of the channel modifications to meet the

Test 3 model channel configuration would be necessary to reduce the potential for adverse bed scouring during high flow events.

Action 2.4-9: Obtain funding to install a gauge at Capay. This will allow the Technical Advisory Committee to monitor the amount of stream flow and sediment coming into the plan area and compare the results with data obtained from the gauge at Yolo. This information is important in determining how much water is recharged within the plan area, and whether the sediment "budget" is in a net gain or deficit.

This action is an appropriate measure to expand the data needed to more accurately evaluate stream flow and sediment transport conditions within the CCRMP planning area. It is important that systematic monitoring of the proposed gauge and at another location on the creek be performed to provide useful information. The monitoring of the gauge should be coordinated with data measurements made at the USGS gauge on Cache Creek at Yolo. Water and sediment discharges at both gauges should be made, at a minimum, four times per year. More frequent monitoring could be recommended by the TAC if initial data indicate that monitoring frequency is too low to adequately characterize flow conditions or to characterize high flow events. The monitoring program should be included in the CCIP.

Action 2.4-10: Monitor and collect the information necessary to make informed decisions about the management of Cache Creek, including: regular water and sediment discharge data at Capay and Yolo gauge sites, water and sediment discharge data at other sites during high flow events, and topographic data showing the erosion, aggradation, and the alignment of the low-flow channel within the creek. This data should be maintained in the County Geographic Information System, so that staff and the Technical Advisory Committee can coordinate this information with the results of other monitoring programs to develop a comprehensive and integrated approach to resource management. Monitoring may be conducted by either consultants or trained volunteers, including landowners, public interest groups, the aggregate industry, and students, as part of future public education programs associated with Cache Creek.

Action 2.4-11: Create a Technical Advisory Committee (TAC) to provide the County with specific expertise and knowledge in implementing the CCRMP. The TAC will also provide advice during emergency situations, such as flooding, and will assist the County in carrying out its responsibilities under this plan, as well as recommending changes to the Draft CCRMP.

These actions establish the commissioning of a TAC for implementation of the CCRMP and provide for initiation of a data collection and management system. The appropriateness and effectiveness of the TAC would be dependent on its composition and responsibilities. The CCRMP does not provide an adequate description of the structure and role of the TAC. As described in the discussion of Performance Standard 2.5-5, the CCRMP should include a CCIP that defines the authority, responsibilities, and activities of the TAC.

Action 2.4-12: Focus efforts on reshaping the channel banks immediately upstream and downstream of both County and State bridges to minimize scour and erosion. Work on the streambanks could be accompanied by the construction of check dams or weirs within the channel, downstream of the bridges, to encourage aggradation. These measures will not only create a more stable channel, but will also help in preventing structural failure and prolong the life of local bridges. The length of the transitions shall be five times longer than the width of the channel at the bridge site, and shall incorporate guide banks, grade control structures, dikes, berms, vegetation, and other similar measures.

The Technical Studies for CCRMP (NHC, 1995) recognize and describe historic and current adverse hydraulic conditions at each of the bridges that cross Cache Creek within the CCRMP planning area. A fundamental influence on channel instability in the vicinity of the bridges is that the bridges present significant constrictions to flow in the creek, particularly during high flow (flood) events. High flow velocities result as flow is directed through these artificially narrow areas. The computed flow velocities indicate that significant scour should be expected at each of the bridges (particularly at Capay Bridge) during high flow events. In addition to high flow velocities, the potential for scour at the bridges is influenced by other factors, including channel geometry, channel bed materials, alignment of the bridge to the direction of flow and the design of protective structures (including upstream and downstream training works). This action appropriately identifies the improvement to channel conditions as a priority for channel improvement projects. However, the Action does not address a method of implementation. The CCRMP should include a performance standard that identifies how the prioritization of channel improvement projects would be implemented.

Action 2.4-13: Update the Cache Creek Resource Management Plan a minimum of every ten years. This will allow the plan to be amended on a regular basis so that the results of monitoring programs and reclamation efforts can be taken into account.

This action presents an important consideration in implementation of the CCRMP. The action would require that the CCRMP be updated on a regular basis. However, the TAC should have the authority and responsibility, in implementation of the CCIP, to modify aspects of the plan on a continuing basis in response to the results of monitoring of channel stability. Any recommendations for modifications to the plan would be presented in an annual report by the TAC to the Board of Supervisors.

PS. 2.5-2: Check dams or sills should be constructed within the channel to stabilize the streambed so that structures, such as County bridges, are protected from the adverse effects of channel scour. Engineered plans for dams or sills shall be submitted to the County and the Technical Advisory Committee for approval prior to construction.

The construction of check dams could be effective in reducing flow velocities in the vicinity of bridges and the potential for scour if properly designed and constructed. Placement of sills within the channel could provide effective channel gradient controls that could reduce the impacts associated with continued or future channel incision. Therefore, this performance standard provides appropriate opportunities for improved channel stability. The standard appropriately requires the County review of all such improvements. The TAC will also be responsible for identifying priority improvement projects, including the possible construction of velocity controls and channel gradient stabilization.

PS. 3.5-4: Sediment fines generated by aggregate processing shall be used for agricultural soil enhancement, revegetation projects, or shall be placed in settling ponds, designed and operated in accordance with all applicable regulations, and used for backfill materials in off-channel excavations.

This standard promotes appropriate use of aggregate processing fines. The standard acknowledges that fine-grained sediments may be required to perform habitat restoration projects recommended under the CCRMP. Aggregate removed and processed from channel improvement projects could provide a supply of these materials.

PS. 6.5-9: In-channel haul roads shall be located along the toe of the streambank, in order to provide additional bank stabilization and to minimize disturbance of the low-flow channel. Each operation may have no more than two (2) haul roads that cross the low-flow channel. Haul roads shall comply with all requirements of the Department of Fish and Game.

This performance standard is an appropriate mitigation measure for management of the construction of haul roads that would be required for improvement projects that involve large earth moving operations. However, the standard should be modified to prevent destabilization of streambanks during construction of the haul roads.

PS. 6.5-10: No excavation shall take place within thirty (30) feet of the top of the channel bank, in order to protect riparian vegetation and to prevent undermining of the bank toe.

This standard could not be met in areas where the Test 3 model indicates that channel widening or major reshaping are required to improve channel stability. The performance standard should be modified to require that any excavation projects that would result in disturbance of riparian vegetation should provide for replacement of disturbed vegetation and habitat or offset the loss by development of new habitat in an appropriate alternate location.

PS. 6.5-6: Final slopes for in-channel excavations shall conform with the channel slope and sinuosity guidelines shown in Figure 12 [of the CCRMP]. Excavations shall be sloped in a downstream direction, toward the low-flow channel.

PS. 6.5-7: In-channel excavations shall generally conform with the cross-section profiles shown in Figures 13 through 17 [of the CCRMP].

These standards are consistent with the recommendations of the Technical Studies and would be appropriate measures for promoting increased stabilization of the Cache Creek channel under current conditions. However, these standards should be modified to acknowledge that modification of the recommendations of the Technical Studies could be recommended by the TAC in response to the results of channel monitoring and modeling. Channel response to improvement projects, the sequence of implementation of projects, or natural changes within the system could result in modifications to the channel design guidelines.

PS. 6.5-12: Where gravel bars are to be excavated, aggregate removal shall be limited to the downstream portion of the deposit and may not exceed seventy-five (75) percent of the length of the bar. Twenty-five (25) percent of the upstream portion of the gravel bar shall be retained, in order to allow for the establishment of riparian vegetation.

This standard would be consistent with the recommendations of the Technical Studies and with commonly applied design guidelines for gravel bar removal. Preservation of the upstream portion of the gravel bar will promote the preservation of the position of the bar and an opportunity for continued development of riparian vegetation. However, under some conditions, the importance of improving hydraulic stability could require removal of more areas of the bar. The standard should be modified to acknowledge that the TAC may modify this standard to address problematic hydraulic conditions. If riparian habitat is removed in excess of this standard, an offset should be required.

PS. 6.5-13: Aggregate material to be removed from the streambed shall be excavated as soon as is practicable after deposition, prior to the establishment of vegetation. No stockpiles shall be left within the channel after excavation has been completed.

This standard is an appropriate measure for maintaining channel capacity in areas of aggradation of the channel. However, it should be noted that, although the TAC can make recommendations for the removal of aggraded sediments, the performance of the removal would be the responsibility of individual landowners. The scheduling of removal activities would, therefore, be under the control of the landowners and dependent on the processing of required permits for these activities.

PS. 6.5-14: Proposed off-channel excavations located within the streamway influence boundary shall be set back a minimum of seven-hundred (700) feet from the existing channel bank, unless an engineering analysis demonstrates that a smaller distance will not adversely affect channel stability within the reach. If the proposed engineering measures are demonstrated to be feasible, then the minimum setback distance shall be no less than two-hundred (200) feet.

Off-channel mining operations would only be permitted for projects approved under the Off-Channel Mining Plan. Permitting of mining pits within 700 feet of the active channel would not be approved until the engineering analysis reference in this standard is completed and reviewed. The EIR for the OCMP requires that channel stability of Cache Creek be evaluated for a minimum distance of 1,000 feet upstream and downstream of the proposed mining areas. This mitigation would reduce the potential for erosion of the unmined areas or constructed levees between the mining areas and the creek (separators) to a less-than-significant level.

However, protection of the separators against erosion into perpetuity is not guaranteed by this mitigation measure. Continued maintenance of the separators would be the responsibility of the landowner. Proposed mining pits would be permanent features located at the margin of the CCRMP channel boundary. The land uses of the mining areas during mining and reclamation and following reclamation could present priority concerns for the TAC during implementation of the CCRMP. Therefore, the performance standard should be amended to include a requirement for an enforceable agreement with owners of lands on which off-channel mining or reclamation areas are located, which presents commitment to participating in channel improvement projects recommended by the TAC.

Action 4.4-2: Remove vegetation when it threatens channel stability. In particular, the growth of tamarisk, giant reed, and willow on mid-channel gravel bars shall be controlled to prevent stream flows from being diverted towards nearby banks.

This action would promote reduction of the potential for erosion impacts associated with the establishment of vegetation in the Cache Creek channel. Vegetation of the active channel could also increase the roughness of the channel, which could result in reduction of flow velocity and increase flow depths. However, the standard may conflict with policies contained in the CCRMP that promote the development of riparian vegetation along the low flow channel. The standard does not specify how the impacts of vegetation of the channel would be monitored or how mitigation would be implemented. The CCRMP should include a performance standard that specifies the type and frequency of monitoring of vegetation in the channel and the method of evaluation of potential impacts on hydraulics.

Goal 6.2-1: Use the removal of in-channel aggregate deposits as an opportunity to reclaim, restore, and/or enhance the channel stability and habitat of Cache Creek.

This goal is supported by the following actions and performance standards:

Action 2.4-14: Rezone those lands within the Test 3 Run Boundary with an S-G (Sand and Gravel) Zone overlay. This will allow for those excavations necessary to carry out the channel widening envisioned in the Technical Studies, as well as any regular and/or emergency flood control and bank protection activities.

Rezoning of the area within the Test 3 Boundary with an S-G overlay would not be necessary for channel improvement projects. Channel stabilization, floodway management, habitat restoration and future possible recreation uses are consistent with the proposed rezoning of the area within the CCRMP planning boundary to Open Space.

Action 6.4-1: Revise the existing mining and reclamation ordinances contained in the Yolo County Code to incorporate recent amendments to SMARA; performance standards to prevent hazards and reduce potential environmental impacts; and programs to carry out the policies included within the Cache Creek Resources Management Plan.

The revision of mining and reclamation ordinances have been completed and are currently under environmental review. The CCRMP should include a performance standard that requires the projects under the CCRMP to comply to the extent necessary to the adopted mining and reclamation ordinances. The improvement projects could be exempted from SMARA if State Mining and Geology (SMGB) were to recognize these activities as "infrequent and minor." Any applications for Floodplain Development Permits identified by the TAC to be inconsistent with improvement of the stability of the Cache Creek channel should be rejected. The CCRMP should include an Action that recommends a request by the County that the California State Mining and Geology Board (SMGB) exempt all channel improvement projects from the requirements of SMARA.

Action 6.4-2: Require that all existing permits for mining within the active channel be relinquished before off-channel operations may commence. In their place, the County would apply for a mining permit that would encompass the area within the Test 3 Run Boundary, along the entire 14.5 mile reach of Cache Creek contained within the plan area. This will allow emergency work and regular maintenance to be done in areas that are not currently permitted, such as upstream of the Capay Bridge, without going through lengthy permit and environmental review. It should be emphasized, however, that the County will not be exercising eminent domain in applying for this permit.

The CCRMP addresses a broad range of activities that could be implemented as channel improvement projects along Cache Creek, including excavation and fill projects to improve the hydraulic conditions within the channel and riparian habitat restoration. Some of these activities could result in export of marketable aggregate resources from the project site. However, SMARA allows exemption for excavation projects, even those resulting in exportation of aggregate, if the projects are infrequent and minor. The CCRMP would only allow projects that improve the channel hydraulics or enhance habitat along the creek. As discussed above, an alternative to this Action would be to request that the channel improvement projects be exempted by the SMGB.

Action 6.4-4: Provide a mechanism for the widening and ongoing maintenance of Cache Creek by not including any sand and gravel removed from the channel as a part of an operation's maximum annual production. These market incentives would ensure that the necessary work would be accomplished at little cost to the County, while generating royalties for the owner of any property where excavation takes place.

The majority of lands along Cache Creek are under private ownership. The County does not have the authority to require that landowners participate in the management activities proposed by the CCRMP, except possibly in situations that present imminent hazards to human health or property. The CCRMP should, therefore, include incentives for participation in the CCRMP. The action does not specify the mechanism for implementation. The Action 6.4-4 should be modified to so that a mechanism for implementation is defined.

Action 6.4-5: Develop agreements with the mining operators, property owners, and government agencies involved with Cache Creek to allow for channel maintenance and repair. These agreements would permit the removal of channel deposits that affect property and structures, the construction of flood protection and erosion control measures, and the provision of emergency labor, equipment, and materials during and/or after flood events.

This action is not specific regarding the form or intent of the agreements with land owners that may propose channel improvement projects. Land owners would be required to apply for Floodplain Development Permits for any projects that would result in modification of the channel within the 100-year flood hazard zone. This action should be modified to commit County support of channel improvement projects though the availability of channel hydraulic data collected by the TAC, including the maintenance of a channel hydraulic model. The data will provide necessary information for the development of channel improvement designs.

Alternative 1a: No Project (Existing Conditions); and
Alternative 1b: No Project (Existing Permits and Regulatory Condition)

Under Alternatives 1a and 1b, existing commercial aggregate mining would continue and no area-wide channel monitoring program (CCRMP) would be implemented. The TAC would not be formed and, therefore, would not be able to provide technical support during review of Floodplain Development Permit applications. Without the support of the TAC and the monitoring data, the proponent of a channel modification project would need to develop all data and modeling to support the analysis of upstream and downstream effects of channel modification projects.

The Technical Studies (NHC, 1995) identified the current in-stream gravel mining operations as a contributing influence on current and historic channel instability. Two major conditions associated with the mining operations were recognized as adverse to promotion of channel stability. Permitted mining in the channel results in the extraction of more aggregate materials than the estimated average annual sediment yield entering the CCRMP area. The average annual replenishment of sand and gravel to the area is approximately 210,000 tons per year. The existing mining operations within the CCRMP are permitted to process up to 4.4 million tons per year. Mined aggregate can be produced from both in-channel and off-channel mining areas. In 1995, 2.5 million tons of aggregate were produced. The tonnage extracted from the active channel in 1995 is estimated at approximately 1.0 million tons (Morrison, 1996). Although in-channel mining depths are restricted by the current Mining Ordinance to mining above the theoretical thalweg, the potential for mining in excess of replenishment exists under Alternatives 1a and 1b. Removal of aggregate from the system could, therefore, promote degradation of the channel bed, bridge undermining, and streambank instability.

Because mining occurs only in permitted locations along the creek, the aggregate extraction sites are discontinuous. Therefore, channel lowering during gravel extraction occurs only at these sites. The channel is forced to adjust to these changes. The channel adjustments can result in unstable channel gradients. The channel could adjust to these conditions by downcutting or changes in sinuosity, potentially resulting in bank erosion.

Alternative 2: No Mining (Alternative Site)

Under Alternative 2, in-channel mining within Cache Creek would not be permitted. Upon termination of mining, the aggregate operators would be required to reclaim in-channel mining areas in compliance with existing approved reclamation plans. Through time, the channel of Cache Creek would adjust to the cessation of mining. The Technical Studies provided an simulation of the expected response of the creek during a 50-year flow event following 100 years of continuous flow under the no mining condition. Under these simulated conditions, the sediment load within the creek is more balanced from reach to reach along the creek. Sediment deficit would persist at the Capay, Esparto, and I-505 bridges but the degree of channel disequilibrium would be reduced relative to existing conditions.

Sediment transport modeling conducted for the Technical Studies (NHC, 1995) included simulations of channel response over 50 and 100 years under existing hydraulic and sediment supply conditions. The results of the simulations indicate that most reaches of the creek would become depositional environments. In general, deposition would occur on the active floodplain adjacent to the low flow channel. Accumulation of sediment would locally (and possibly temporarily) result in reduction of channel capacity. Continued incision of the low flow channel would be expected in some areas. Sediment deficits would be expected to persist at the I-505 bridge and in the upper portion of the Dunnigan Hills reach. Scour at bridges would be expected to continue. The impacts to the change in channel hydraulics under these alternatives would be significant.

Although the channel would likely adjust to a more stable form under this alternative, no area-wide channel monitoring program would be implemented. The TAC would not be formed and, therefore, would not be able to provide technical support to the during review of Floodplain Development Permit applications. Without the support of the TAC and the monitoring data, the applicant for a channel modification project would need to develop all data and modeling to support the analysis of upstream and downstream effects of channel modification projects. The expected impacts on channel hydraulics would be significant under this alternative.

Alternative 3: Channel Bank Widening (Implement Streamway Influence Boundary)

Under this alternative, the bridges within the CCRMP planning area would be extended to reduce (bridge supports would remain within the active channel) the existing channel constriction at these locations. No mining would occur within the Streamway Influence Boundary, which was established on the basis of the historic positions of Cache Creek. No management of the channel would occur under this alternative. The channel would, therefore, be permitted to respond to these changes without controls.

This alternative is similar to the Test 1 scenario evaluated in the Technical Studies. The hydraulic modeling compared the sediment disequilibrium conditions under the Test 1 scenario to existing conditions during a 100-year flow event. The results of this analysis indicate that the sediment disequilibrium values at the bridge locations would be significantly improved if the bridges were widened. The more stable sediment transport conditions would promote channel stability. However, other influences on channel stability, including constricted areas away from the bridges or development of gravel bars or meanders in locations that could cause erosion of farmland or land supporting structures, would not be controlled under this alternative.

The historic period over which the channel occupied this area includes significant events that have had substantial influence on the hydraulics of the channel. The construction of the Indian Springs and Capay Dams and irrigation diversion structures have reduced the sediment loads delivered to the CCRMP area. During high flow events, the potential for erosion is generally increased as a consequence of this change. The reclamation of floodplain areas to agricultural use and construction of levees have restricted the channel width. These influences have combined with others to encourage development of a straightened and incised channel. Although implementation of this alternative would remove some of the controls on the channel, the resulting overall channel form and position would likely persist. Development of meanders may cause lateral erosion, resulting in widening of the channel. Although the erosion could occur within areas of floodplain easements, damage to structures, improvements, or agricultural land could occur. This is a significant impact.

Mitigation Measure 4.3-1a (CCRMP)

To promote and facilitate the performance of appropriate channel improvement projects within the CCRMP planning area the CCRMP shall be amended to include the following additional or modified Actions and Performance Standards:

Action 2.4-2: Limit the amount of aggregate removed from the channel to the ~~average~~ amount of sand and gravel deposited during the previous year (approximately 200,000 tons on average as estimated by the TAC based on channel morphology data), except where bank excavation is necessary to widen the channel as a part of implementing the Test 3 Run Boundary, or where potential erosion and flooding problems exist. The amount and location of in-channel aggregate removal shall be carried out according to the ongoing recommendations of the Technical Studies and the Technical Advisory Committee, with the voluntary cooperation of the landowners involved.

Action 2.4-15: Present a request to the State Mining and Geology Board to grant an exemption from the requirements of SMARA for all channel improvement projects approved under the Cache Creek Improvement Program.

Action 2.4-16: Draft the County In-channel Ordinance to prohibit commercial mining with the CCRMP planning area and specify that aggregate extraction within the area shall be limited to activities necessary to complete channel improvement projects.

Action 6.4-4: ~~Provide a mechanism for the widening and ongoing maintenance of Cache Creek by not including any sand and gravel removed from the channel as a part of an operation's maximum annual production.~~ Draft the County In-channel Ordinance to require that, upon revocation of existing in-channel mining permits, ~~which excludes~~ the tonnage of aggregate removed by an aggregate mining operator in completion of approved channel improvement projects is excluded from the operator's permitted maximum annual production. These market incentives would ensure that the necessary work would be accomplished at little cost to the County. ~~while generating royalties for the owner of any property where excavation takes place~~

Action 6.4-5: ~~Develop agreements with the~~ Provide technical support through the TAC to mining operators, property owners, and government agencies involved with Cache Creek to ~~allow for channel maintenance and repair. These agreements would permit to~~ facilitate the removal of channel deposits that affect property and structures, the construction of flood protection and erosion control measures, and the provision of emergency labor, equipment, and materials during and/or after flood events.

PS. 2.5-6: Require all channel improvement projects to comply with the requirements of the CCIP and implementing regulations ~~County channel improvement ordinance.~~

Mitigation Measure 4.3-1b (CCRMP)

To ensure effective and systematic monitoring and reclamation of aggregate removal activities with in Cache Creek the CCRMP shall be amended to include the Cache Creek Improvements Program provided in Appendix 7.3 of the CCRMP DEIR and the following additional or modified Performance Standards:

PS. 2.5-7: Require the TAC to annually prepare a list of priority channel improvement projects which will be identified and described in an annual report to the Board of Supervisors. Channel improvements which could improve channel stability at the location of bridges or other structures shall maintain a high priority until implementation. Following review by the Board, the TAC shall contact individual landowners to explain recommended channel improvements for their property and describe available resources for design and implementation of the projects.

PS. 6.5-9: In-channel haul roads shall be located along the toe of the streambank, in order to provide additional bank stabilization and to minimize disturbance of the low-flow channel. Construction of the haul roads shall not result in excavation of the toe of the streambank. Each operation may have no more than two (2) haul roads that cross the low-flow channel. Haul roads shall comply with all applicable requirements ~~of the Department of Fish and Game~~.

PS. 6.5-10: ~~No excavation shall take place within thirty (30) feet of the top of the channel bank, in order to protect riparian vegetation and to prevent undermining of the bank toe.~~ Approved channel improvement projects requiring excavation of channel banks and removal of riparian vegetation shall revegetate upon completion of excavation activities or shall develop similar habitat at a suitable off-site location.

PS. 6.5-6: Final slopes for in-channel excavations shall conform with the channel slope and sinuosity guidelines shown in Figure 12 [of the CCRMP]. Excavations shall be sloped in a downstream direction, toward the low-flow channel. When recommended by the TAC, alternate grading plans may be approved.

PS. 6.5-7: In-channel excavations shall generally conform with the cross-section profiles shown in Figures 13 through 17 [of the CCRMP]. When recommended by the TAC, alternate grading plans may be approved.

PS. 6.5-12: Where gravel bars are to be excavated, aggregate removal shall be limited to the downstream portion of the deposit and may not exceed seventy-five (75) percent of the length of the bar. Twenty-five (25) percent of the upstream portion of the gravel bar shall be retained, in order to allow for the establishment of riparian vegetation. Complete removal of gravel bars may be recommended by the TAC only if hydraulic conditions related to the bar are recognized to threaten structures and property.

PS. 6.5-14: Proposed off-channel excavations located within the streamway influence boundary shall be set back a minimum of seven-hundred (700) feet from the existing channel bank, unless an engineering analysis demonstrates that a smaller distance will not adversely affect channel stability within the reach. If the proposed engineering measures are demonstrated to be feasible, then the minimum setback distance shall be no less than two-hundred (200) feet.

Approval of any off-channel mining project located within 700 feet of the existing channel bank shall be contingent upon an enforceable agreement which requires the project operator to participate in the completion of channel improvement projects. The agreement shall also require that the operator provide a bond or other financial instrument for maintenance during the mining and reclamation period of any bank stabilization features approved for the mining project. The *agreement shall also require that a deed restriction be placed on the underlying property which requires maintenance of the streambank protection by future owners of the property. Maintenance of the bank stabilization on features following completion of reclamation shall be the responsibility of the property owner.*

PS. 4.5-23: The TAC shall evaluate the vegetative cover within the CCRMP on an annual basis. At a minimum of once every five years, the existing hydraulic model of the Cache Creek channel shall be updated based on current conditions, including estimates of channel roughness. If sensitivity analysis indicates that the existing vegetation is contributing to adverse channel roughness, the TAC shall recommend removal of vegetation within selected areas of the channel.

Mitigation Measure 4.3-1c (A-1a, A-1b, A-2)

All development projects, including in-channel mining operations, which result in modification of the 100-year flood hazard zones along Cache Creek shall be required to submit applications for Floodplain Development Permits. The applications shall be reviewed by the Yolo County Community Development Agency and the Department of Public Works. Applications for projects that are determined to present conditions, which could cause or contribute to channel instability, shall not be approved.

Mitigation Measure 4.3-1d (A-3)

This alternative would not allow management of channel instability. Therefore, no mitigation is possible.

Implementation of Mitigation Measures 4.3-1a, 4.3-1b, and 4.3-1c would reduce this impact (CCRMP A-1a, A-1b, and A-2) to a less-than-significant level. No mitigation is possible for Alternative 3, and therefore, the impacts of unmanaged channel instability would remain significant and unavoidable.

Impact 4.3-2
Modifications of the Channel During Improvement Projects Could Potentially Result in Unstable Conditions Upstream or Downstream of the Projects

All projects that include modifications of the channel within the CCRMP area could result in changes upstream or downstream of the location of those modifications. A channel will adjust its morphology, if necessary, to balance changes in stream energy within the system. Changes in the geometry of the channel, particularly narrowing, steepening, or shortening of the channel, can result in increased flow velocity and depth. These changes can result in modification of erosion and sedimentation patterns in upstream and downstream reaches. The design of all channel modification projects should account for potential adverse effects to areas upstream and downstream of the location of those projects.

Draft CCRMP

The CCRMP presents a plan to promote stabilization of the channel of Cache Creek. The plan includes provisions for ongoing monitoring of the conditions in the channel and a proposed model for the development of a more stable creek channel. Specific channel improvement projects would be conducted by private landowners. The plan requires the establishment of a TAC (see Performance Standards 2.5-5 and Action 2.4-11 description under Impact 4.2-1) to implement the monitoring program and to review proposed channel improvement projects prior to approval of permits for those projects. The monitoring data collected under the program and project review process would provide the basis of evaluating the potential impacts of proposed projects on channel stability upstream and downstream of the project locations. However, the CCRMP does not include a performance standard that specifically addresses the issue of potential hydraulic impacts caused by proposed projects. The CCRMP should be revised to specify such a performance standard.

Alternative 1a: No Project (Existing Conditions);
Alternative 1b: No Project (Existing Permits and Regulatory Condition);
Alternative 2: No Mining (Alternative Site); and
Alternative 3: Channel Bank Widening (Implement Streamway Influence Boundary)

Under Alternatives 1a, 1b, 2, and 3, no program for areawide channel monitoring program would be implemented. The TAC would not be formed and, therefore, would not be able to provide technical support to the Yolo County Community Development Agency during review of Floodplain Development Permit applications. Without the support of the TAC and the monitoring data, individual channel modification projects under Alternatives 1a, 1b, and 2 (including aggregate mining) would need to develop all data and modeling to support the analysis of upstream and downstream effects of channel modification projects. Although no channel management would occur under Alternative 3, areawide channel hydraulic data would be critical in maintenance of bridges and other structures at the margins of the streamway.

Mitigation Measure 4.3-2a (CCRMP)

The CCRMP shall be modified to include the following performance standard:

PS. 2.5-8: The review by the TAC of all Floodplain Development Permit applications for Cache Creek channel improvement projects within the CCRMP area shall include an evaluation of potential upstream and downstream effects of the proposed channel modifications. The TAC shall evaluate data on hydraulic conditions presented in the permit application. The TAC shall also examine aerial photographs and perform a reconnaissance investigation of the site and surrounding areas to identify potential upstream and downstream effects.

Mitigation Measure 4.3-2b (A-1a, A-1b, A-2)

The Yolo County Community Development Agency shall require analysis of potential changes in hydraulic conditions within 1,000 feet upstream and downstream of the proposed project boundaries for all Floodplain Development Permits along Cache Creek. The analysis shall be performed by a qualified licensed engineer and shall include evaluation of the 2-year, 50-year, and 100-year flood stage and average flow velocities before and after implementation of the proposed project using HEC-2, or equivalent model.

Mitigation Measure 4.3-2c (A-3)

None required.

Implementation of Mitigation Measures 4.3-2a and 4.3-2b would reduce this impact (CCRMP, A-1a, A-1b, and A-2) to a less-than-significant level.

Impact 4.3-3
Channel Instability Within the CCRMP Planning Area Could Be Affected by Significant Changes in Upstream or Downstream Portions of the Watershed

The CCRMP planning area does not include the total watershed of Cache Creek. The watershed is a dynamic, complex, and integrated system. Changes in the hydraulics of the channel within one reach of the creek can result in responses throughout the watershed. Influences on channel stability within the CCRMP are related to changes in upstream reaches of the creek controlled by the Capay Dam. The dam provides gradient control and serves as a catchment basin for sediment transported to the upstream end of the planning area. Construction of dams in the upstream reaches of the creek could effectively reduce the amount of flow within the CCRMP during major flooding events. A significant reduction of flood flows within the CCRMP area would generally improve channel stability.

Flood hazards for the City of Woodland and the Town of Yolo have prompted extensive evaluations of potential flood management projects along the lower reaches of Cache Creek. Proposed flood protection projects could result in changes to the channel geometry of the creek that could affect upstream reaches within the CCRMP.

Draft CCRMP; and
Alternative 3: Channel Bank Widening (Implement Streamway Influence Boundary)

Under the CCRMP and Alternative 3, the CCRMP would be implemented. The CCRMP contains one Action pertaining to up- and downstream effects on the planning area:

Action 2.4-6: Work with other agencies having jurisdiction over Cache Creek including, but not limited to, the Yolo County Flood Control and Water Conservation District, the U.S. Army Corps of Engineers, the State Reclamation Board, and the Federal Emergency Management Agency in developing a coordinated solution for managing flood events throughout the watershed of Cache Creek.

As a part of this effort, the County should coordinate with the U.S. Army Corps to make appropriate sedimentation and channel stability assessments in conjunction with the development of flood control alternatives near the downstream end of the study area. This would ensure that both agencies are using the same sets of assumptions when making recommendations about the management of Cache Creek.

This action addresses an important consideration in designing and implementing channel improvement projects under the CCRMP. The hydraulics of the lower reaches of Cache Creek, downstream of the CCRMP planning area, could be influenced by the projects conducted by these agencies. The CCIP should be flexible and responsive to changes within the watershed. The potential impact of changes outside the CCRMP cannot be controlled by the CCRMP.

Alternative 1a: No Project (Existing Conditions);
Alternative 1b: No Project (Existing Permits and Regulatory Condition); and
Alternative 2: No Mining (Alternative Site)

Under Alternatives 1a, 1b, and 2, the County would not implement the CCRMP. It is expected that any information regarding any proposed projects within the Cache Creek watershed conducted by other jurisdictions would be made available to the County by those jurisdictions. However, adjustments in the hydraulic conditions within the CCRMP planning area related to any changes within the watershed would not be monitored by a program similar to the CCIP. The County would not likely maintain an updated hydraulic model of the Cache Creek channel. Therefore, the County would be dependent on the sponsors of the project or on outside consultants for evaluation of the potential impacts of proposed projects within the watershed.

Mitigation Measure 4.3-3a (CCRMP, A-3)

None required.

Mitigation Measure 4.3-3b (A-1a, A-1b, A-2)

The Yolo County Community Development Agency,in conjunction with the Yolo County Public Works Department, shall evaluate potential impacts of proposed projects within the Cache Creek watershed on hydraulic conditions of the Cache Creek channel within the CCRMP channel boundaries to ensure that adverse hydraulic conditions do not develop and appropriate restoration projects are implemented.

Implementation of Mitigation Measure 4.3-3b would reduce potential impacts associated with channel stability (A-1a, A-1b, and A-2) to a less-than-significant level.