# 4.11 HYDROLOGY AND FLOODPLAINS

This section presents a Tier 1/Program level assessment of potential hydrology and floodplain impacts associated with the Parkway. Additional information on hydrology and floodplains is provided in the Tier 1 Environmental Impact Statement/Environmental Impact Report (EIS/EIR) Hydrology and Floodplains Technical Memorandum (URS, 2007d), which is available at the locations identified in the Executive Summary, including the Placer County Transportation Planning Agency (PCTPA) website.

## 4.11.1 REGULATORY SETTING

Both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) require consideration of impacts to hydrology and floodplains. A general discussion of NEPA and CEQA requirements is provided in Chapter 1 of this Tier 1 EIS/EIR. In addition, other types of legislation influence hydrology and floodplains. Relevant laws and guidelines are described below.

### 4.11.1.1 Federal Regulations

The regulations that apply to hydrology and floodplains related to transportation projects include the following:

- Federal Executive Order 11988 Floodplain Management;
- Title 23, Code of Federal Regulations, Part 650, Subpart A (23 CFR 650A);
- 23 CFR 771; Environmental Impact and Related Procedures (Federal Highway Administration [FHWA]); and
- National Flood Insurance Act 1968.

The implementation of Executive Order 11988 in transportation projects is addressed by 23 CFR 650A. When transportation improvements encroach on a base floodplain (i.e., 100-year floodplain), the FHWA requires the agency responsible for the proposed project to perform a location hydraulic base floodplain elevation study and assess the risk involved. If the study indicates that there would be significant encroachment within the base floodplain, the FHWA must make a finding that the project is the "only practicable alternative."

The U.S. Army Corps of Engineers (USCOE) regulates the placement of fill or dredged materials that affect waters of the United States, which include stream courses and jurisdictional wetlands. The USCOE regulates these activities under the authority of Section 404 of the Clean Water Act. As part of any application for a 404 permit, coordination with U.S. Fish and Wildlife Service would be required. It is anticipated that the future construction of the Placer Parkway probably either will require an individual USCOE Permit or will be covered by a future permit obtained for the Placer County Habitat Conservation Plan (HCP). A Section 401 Certification also will be necessary to obtain a 404 permit for discharge into waters subject to USCOE jurisdiction. The certification is issued by the Regional Water Quality Control Board.

The USCOE has overall authority for the Sacramento River Flood Control Project—a series of engineering measures that are aimed at reducing the risk of flooding in the City of Sacramento. The Federal Emergency Management Agency (FEMA) is responsible for determining flood elevations based on USCOE studies. FEMA is also responsible for developing the Flood Insurance Rate Maps, which are used in the National Flood Insurance Program (NFIP). Participation in the NFIP provides an opportunity for property owners in the community to purchase flood insurance, provided that the community complies with FEMA requirements for maintaining flood protection and managing development in the floodplain. Within designated floodplains, the community must not permit any development, new construction, or

encroachment, which would cause an increase in the 100-year (base) flood elevation. FEMA defines a significant increase to mean a maximum rise of 1 foot in the base flood elevation (BFE).

#### 4.11.1.2 State Regulations

The State Board of Reclamation is responsible for maintenance of a major portion of the Sacramento River Flood Control Project, including the levee system that surrounds the Natomas Basin (see Section 4.1.1 of the Hydrology and Floodplain Technical Memorandum (URS, 2007d) for a detailed description of the Basin). The Board of Reclamation is also responsible for flood control in the State of California, and has guidelines and criteria for work in or near levees.

The California Department of Fish and Game (CDFG)'s Lake and Streambed Alteration Program (California Fish and Game Code Section 1600-1607) requires any person who proposes a project that will substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake or use materials from a streambed to notify the department before beginning the project. Notification is generally required for any project that will take place in or in the vicinity of a river, stream, lake, or their tributaries.

#### 4.11.1.3 General Plans and Policies

##### Sutter County

Sutter County is responsible for reviewing and approving development plans within the unincorporated areas of the county. The Sutter County General Plan (1996) contains specific goals and policies intended to minimize potential impacts associated with drainage and flood hazards. The General Plan requires that new development must adequately mitigate increases in stormwater flows and volume to avoid increase in downstream flows and must conform to the appropriate county requirements and standards governing drainage. The Hydrology and Floodplain Technical Memorandum for this Tier 1 EIS/EIR (URS, 2007d) lists the specific goals and policies.

Sutter County has developed Design Standards to regulate and guide the design and preparation of plans for construction of street and highway drainage facilities. In addition, Sutter County has a Flood Damage Prevention Ordinance that addresses floodplain management. The ordinance limits construction within the 100-year floodplain to prevent damage to structures and to limit the effect of development on BFEs.

##### Placer County

Placer County is responsible for reviewing and approving development plans within the unincorporated areas of the county. The Placer County General Plan (2005) contains specific goals and policies intended to minimize potential impacts associated with drainage and flood hazards. The Hydrology and Floodplains Technical Memorandum for this Tier 1 EIS/EIR (URS, 2007d) lists the specific goals and policies of this plan.

The Placer County Flood Control and Water Conservation District (PCFCWCD) formulates regional strategies for flood control management. The main objective of the PCFCWCD is to reduce the effects of flooding through Best Management Practices (BMPs). Stormwater management policies, guidelines, and specific development criteria are presented in the PCFCWCD Stormwater Management Manual. This manual requires that peak flows be reduced to approximately 90 percent of pre-project conditions for 2-year through 100-year storm events. The manual also requires that retention be provided for flow volumes exceeding pre-project flow volumes. The manual addresses elements that must be included in a stormwater management project. Additional information on the manual is available in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

Placer County Flood Damage Prevention Ordinance (Article 15.52) addresses floodplain management. The ordinance limits construction within the 100-year floodplain to prevent damage to structures and limit the effect of development on BFEs.

### Reclamation District No. 1000

Reclamation District No. 1000 (RD 1000) operates and maintains facilities that provide drainage and flood protection for lands within the Natomas Basin (see Section 4.1.1 of the Hydrology and Floodplain Technical Memorandum (URS, 2007d) for a detailed description of the Basin). RD 1000 requires the use of the Sacramento City and County Drainage Manual Volume 2: Hydrology Standards (City and County of Sacramento, 1996) as the basis for technical analyses. The Sacramento City North Natomas Drainage Design and Procedures Manual (City of Sacramento, 1998) also provides guidance on drainage design within the basin. RD 1000's policies for development within the Natomas Basin are listed in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

### Sacramento Area Flood Control Agency

The Sacramento Area Flood Control Agency (SAFCA) includes the City and County of Sacramento, Sutter County, the American River Flood Control District, and RD 1000. This agency coordinates flood control on a regional basis. One of SAFCA's primary focuses is on the levees that are part of the flood control system surrounding the Natomas Basin (see Natomas Basin, below). These include levees along the Cross Canal, Sacramento River, American River, the Pleasant Grove Creek Canal, and the Natomas East Main Drainage Canal (NEMDC).

### Pleasant Grove Creek/Curry Creek Watershed Management Groups

The Pleasant Grove/Curry Creek Ecosystem Restoration Plan (ERP) (Foothill Associates, 2005) addresses resource management and land use in the Pleasant Grove and Curry Creek watersheds and is intended to guide future planning, restoration, and land use management activities in the watersheds. Relevant policies include:

Objective 5.2 Protect, enhance, or recreate natural riparian processes, particularly hydrology and associated high water events, to promote the natural cycle of channel movement and sediment deposition that create a mosaic of riparian vegetation types.

Objective 6.3 Integrate meaningful ecosystem protection and restoration opportunities with the development review and approval process to encourage low impact development and transportation planning.

Objective 6.6 Ensure that flood control projects benefit habitat and wildlife while also meeting the needs of the watershed's agricultural and urban populations.

### Natomas Basin Habitat Conservation Plan

The purpose of the Natomas Basin Habitat Conservation Plan (NBHCP) (City of Sacramento et al., 2003) is to promote biological conservation in conjunction with economic and urban development within the basin. The goal of the NBHCP is to preserve, restore, and enhance habitat values while allowing urban development to proceed according to local land use plans. The NBHCP provides requirements regarding buffers between development and specific resource areas (e.g., garter snake habitat, wetlands, etc.), grading and construction activity restrictions, management of vegetation control along ditches and canals,

and application of herbicides and pesticides. These requirements ensure that runoff does not affect sensitive wildlife habitats.

### City of Roseville Reason Farms Retention Basin

The City of Roseville has developed a regional stormwater retention facility—Reason Farms Retention Basin—for the alleviation of potential downstream flooding that could be caused by entitled projects and future projects within the City of Roseville or within the area covered by a Memorandum of Understanding (MOU) between the City of Roseville and the County of Placer (County). The Reason Farms Retention Basin is located on Pleasant Grove Creek within the north-central portion of the Placer Parkway study area. To accommodate the estimated retention storage volume requirements for the City of Roseville plus the West Roseville Specific Plan and MOU areas, the retention basin was designed to provide 2,530 acre-feet of storage capacity. Construction of the Reason Farms facility is anticipated to begin in 2010, with a second phase of construction planned for 2017. This plan is currently undergoing revision in connection with the Reason Farms Environmental Preserve Master Plan.

## 4.11.2 AFFECTED ENVIRONMENT

This section describes the existing conditions with respect to hydrology and floodplains. The hydrologic setting is based on existing available data, maps and reports. Floodplains within the study area are based on existing Flood Insurance Rate Maps prepared by FEMA. Additional information is provided in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

The study area is located within the Sacramento River Basin. The Sacramento River's major tributaries are the Pit and McCloud rivers, which join the Sacramento River from the north, and the Feather and American rivers, which are tributaries from the east.

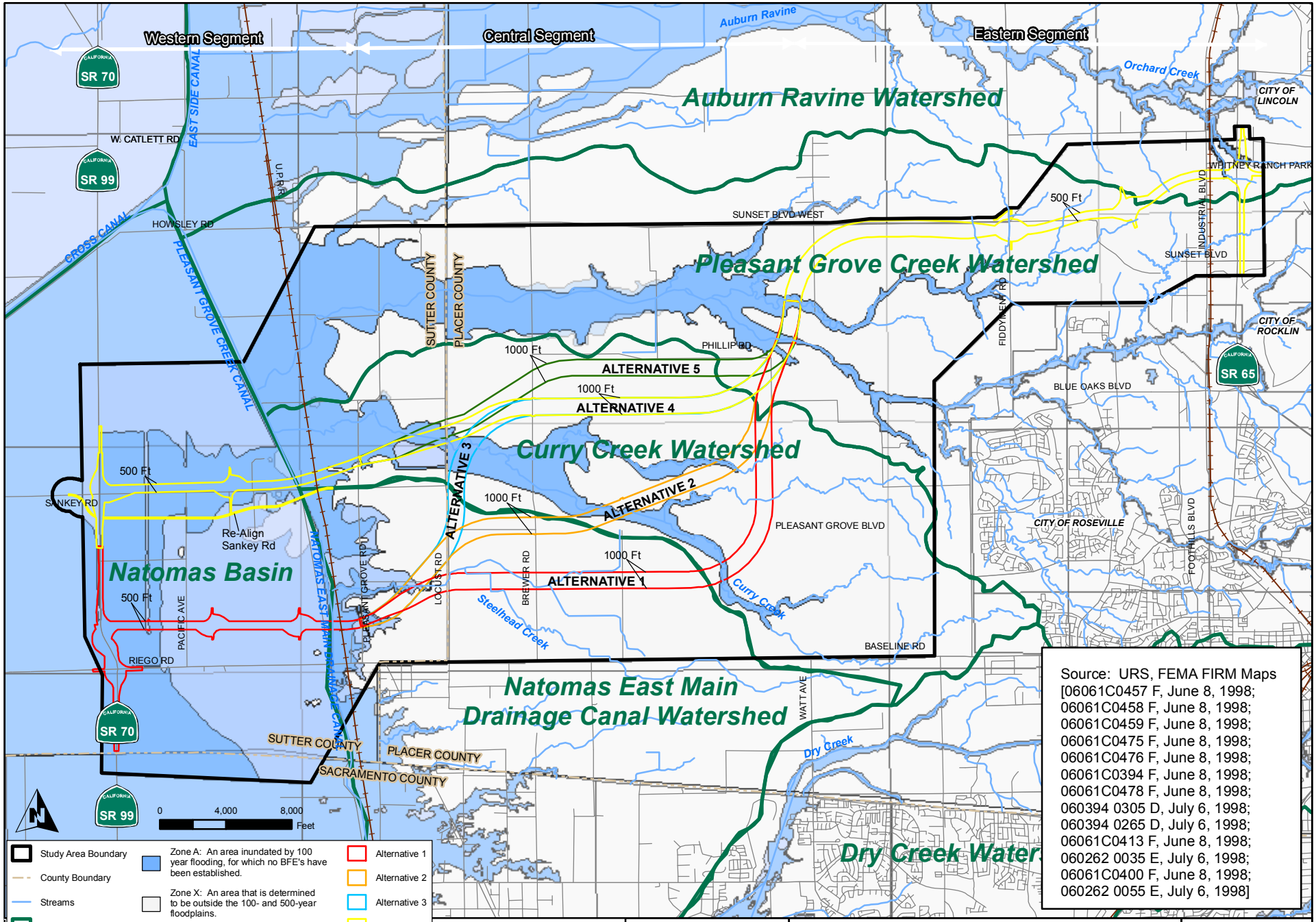
As shown on Figure 4.11-1, the majority of the study area is east of the Natomas Basin and is within the watersheds of Pleasant Grove Creek, Curry Creek, and the NEMDC (also known as Steelhead Creek). A small portion of the study area in the northeastern corner is within the Auburn Ravine watershed.

The existing topography of the study area is relatively flat. The area generally slopes from east to west, from an elevation of 165 feet above mean sea level (msl) in the northeastern corner to less than 10 feet above msl on the western edge within the Natomas Basin. In general, soils within the study area are categorized as hydrologic soil groups C and D, with C soils having zones of hardpan layers occurring less than 4 feet below ground surface (Quad Knopf, 2001). Localized areas with hydrologic soil groups A and B may be present, especially along Pleasant Grove Creek (see Section 4.13, Soils, Geology, and Seismicity, for additional details of soils and geology in the study area).

### 4.11.2.1 Watersheds

### Natomas Basin

The western portion of the study area (approximately 23 percent) is located within the Natomas Basin (see Figure 4.11-1). The Natomas Basin is defined as land in Sutter and Sacramento counties and includes 53,000 acres. The Natomas Basin is completely enclosed by levees that prevent natural drainage out of the basin. All storm runoff must be collected and pumped out. Sutter County, RD 1000, and the City and County of Sacramento have all established guidelines for drainage and flood control within the Natomas Basin.




Source: URS, FEMA FIRM Maps
[06061C0457 F, June 8, 1998;
06061C0458 F, June 8, 1998;
06061C0459 F, June 8, 1998;
06061C0475 F, June 8, 1998;
06061C0476 F, June 8, 1998;
06061C0394 F, June 8, 1998;
06061C0478 F, June 8, 1998;
060394 0305 D, July 6, 1998;
060394 0265 D, July 6, 1998;
06061C0413 F, June 8, 1998;
060262 0035 E, July 6, 1998;
06061C0400 F, June 8, 1998;
060262 0055 E, July 6, 1998]

PLACER PARKWAY CORRIDOR PRESERVATION

Tier 1 EIS/EIR

# Watershed Boundaries

***Figure 4.11-1***

***June 2007***

URS Corporation L:\Projects\PlacerParkway\2007_28066595\MXD\Current\Working Documents\EIS\Chapter_4-11_Hydrology_and_Floodplains\Fig_4_11-1_Watershed_Boundaries.mxd Date: 2/15/2007 6:06:49 PM Name: akkeele0

### Pleasant Grove Creek Watershed

Pleasant Grove Creek (Figure 4.11-1) discharges to the Pleasant Grove Creek Canal, which conveys flow north to the Cross Canal and ultimately to the Sacramento River near Verona (east of the study area). The Pleasant Grove Creek watershed has a total drainage area of approximately 47 square miles upstream of the Cross Canal (CH2M Hill, 1993). Approximately 30 percent of the study area is within the Pleasant Grove Creek watershed.

There are no long-term continuous streamflow measurements for Pleasant Grove Creek. Previous studies of this creek are described in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

### Curry Creek Watershed

Curry Creek (Figure 4.11-1) also discharges to the Pleasant Grove Creek Canal, which conveys flow north to the Cross Canal and ultimately to the Sacramento River. The total area of the Curry Creek watershed upstream of the Cross Canal is approximately 17 square miles (CH2M Hill, 1993). Approximately 29 percent of the study area is within the Curry Creek watershed.

There are no long-term continuous streamflow measurements for Curry Creek. A previous study evaluated potential increases in flooding due to development within these watersheds. Previous studies of this creek are described in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

### Auburn Ravine Watershed

A small portion of the study area, approximately 4 square miles in the northeastern corner, is within the Auburn Ravine watershed, which covers approximately 79 square miles. This portion of the study area drains to Orchard Creek, which is a tributary to Auburn Ravine.

There are no long-term continuous streamflow measurements for Auburn Ravine or Orchard Creek. The Hydrology and Floodplain Technical Memorandum (URS, 2007d) describes previous studies and includes previous streamflow data.

### Natomas East Main Drainage Canal Watershed

The NEMDC watershed is approximately 180 square miles, of which 55 percent is drained by Dry Creek, south of the study area (DWR, 2003). Approximately 14 percent of the study area is within the NEMDC watershed, specifically within the Steelhead Creek portion (Figure 4.11-1).

There are no long-term continuous streamflow measurements for Steelhead Creek. Previous measurements are included in the Hydrology and Floodplain Technical Memorandum (URS, 2007d).

## 4.11.2.2 Floodplains

The majority of the FEMA floodplain areas are located in the western portion of the study area. Other notable FEMA floodplain areas in the study area are associated with Pleasant Grove Creek and Curry Creek. The most recent FEMA Flood Insurance Rate Maps that cover the study area are dated June/July 1998. Both the 100-year and 500-year floodplains are shown on Figure 4.11-2.

The 100-year floodplains mapped by FEMA are designated as Zone A, for which no detailed studies were performed and no BFEs were determined. Although not currently mapped by FEMA, smaller streams and creeks or the upper reaches of streams and creeks may have floodplains associated with them, but detailed studies have not been performed to date.

During a 100-year storm event, the capacity of the Pleasant Grove Creek Canal would be exceeded and flow would enter the Natomas Basin at Sankey Road (see Figure 4.11-1). This area is referred to as the Sankey Gap. Due to the relatively flat topography west of the canal and lack of well-defined creek channels, the floodplain is shallow and wide. According to Sutter County officials, there are plans to remove the Sankey Gap from the 100-year floodplain (see Figure 4.11-2). The timing of these potential floodplain improvements to this area is not known.

## 4.11.3 IMPACT ANALYSIS

### 4.11.3.1 Methodology for Impact Evaluation

Potential impacts to hydrology and floodplains were evaluated through a quantitative comparison of the potential impact of each of the corridor alignment alternatives to relevant parameters affecting surface water hydrology and floodplains.

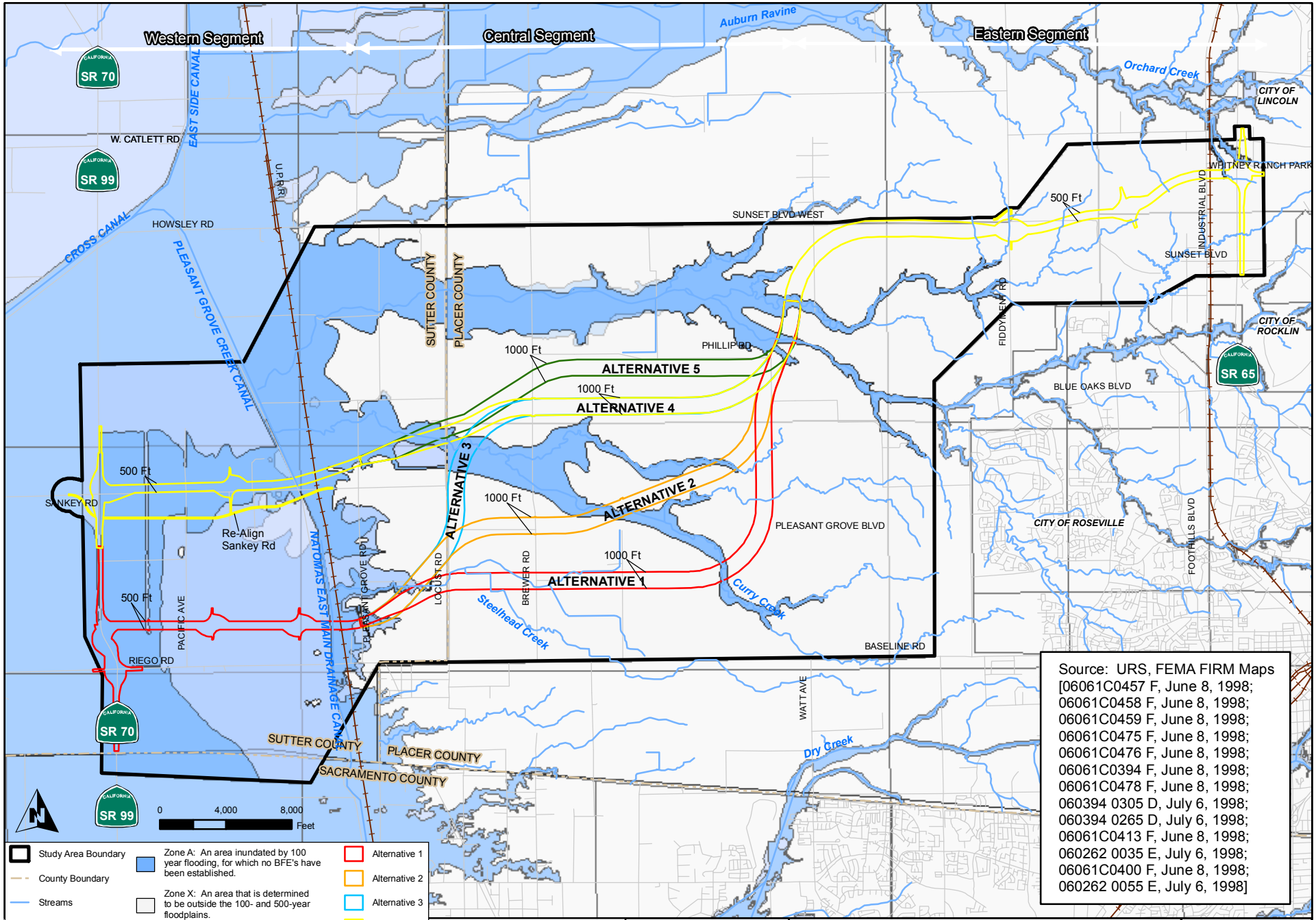
The criteria used in this analysis were developed to allow comparison of potential impacts to hydrology and floodplains associated with each of the corridor alignment alternatives. The focus of this Tier 1 analysis was to identify potential impacts that differentiate between proposed alternatives. For example, the measurement of linear feet of floodplain crossed by an alternative quantifies the magnitude of that resource in the watersheds that potentially would be impacted. Floodplain crossings that are less than the typical bridge span length would not encroach into the floodplain, while longer crossings would require columns that potentially could impact floodplain elevations and widths. Comparison of the magnitude of floodplain crossing length potentially affected by each alternative is a quantitative approach to comparing the relative potential impact of the various alternatives.

### 4.11.3.2 Evaluation Criteria

For the project, potential impacts to hydrology and floodplains have been evaluated on a preliminary basis using the evaluation criteria listed below, which typically are used by FHWA and the California Department of Transportation (Caltrans) in the assessment of hydrology and flood plain impacts.

**Amount of Impervious Area.** The construction of Placer Parkway would result in the construction of paved surface areas in the study area. This would increase the total amount of impervious surface, thereby increasing stormwater runoff. The amount of impervious area includes the road, shoulder, and interchanges. Increased runoff could contribute to downstream flooding and could exceed the hydraulic capacity of existing drainage facilities, resulting in localized flooding. As a consequence of vegetation removal during construction activities, stormwater runoff may be increased temporarily. Also, soil excavation and grading during construction could increase the risk of erosion and sedimentation of nearby water bodies. The amount of impervious area is indicative of the amount of soil that may be disturbed and require erosion controls and stabilization during and after construction and provides an order of magnitude indication of the potential increase in runoff. Given the high existing potential for flooding in and downstream of the study area, any increase in runoff associated with the Parkway could contribute to localized and regional flooding.

**Stream and Canal Crossings.** Stream and canal crossings may constrict or block natural streamflows, which may affect the hydraulics of the stream or canal. Special considerations must be addressed when construction is performed in or near creeks and canals, such as limiting fill placed in creeks/canals and minimizing alteration of streams.




PLACER PARKWAY CORRIDOR PRESERVATION

Tier 1 EIS/EIR

# FEMA Floodplains

***Figure 4.11-2***

***June 2007***

**Table 4.11-1**
**Summary of Criteria Used for Evaluation of Alternatives:**
**Hydrology and Floodplains**

| Evaluation Criteria | Regulatory Concerns (Potential Impacts) | Quantitative Evaluation Approach | Justification |
|---|---|---|---|
| Amount of Impervious Area | • Hydrologic integrity<br>• Increased peak flows and runoff volumes cause flooding downstream | Magnitude of area affected; lower value better | Potential increase in impervious area and resultant increase in runoff may impact downstream areas; objective is to minimize increase of impervious area |
| | • BMPs required to offset increases in runoff | Magnitude of area potentially available for BMPs; higher value better | Opportunities to site BMPs (e.g., ability to located detention basins/swales within the right-of-way to attenuate peak runoff) |
| Stream Crossings | • Hydrologic integrity<br>• Constriction or blockage of natural streamflow<br>• Constriction or blockage of natural streambed migration<br>• Modification of downstream natural flooding regime<br>• Reduction in downstream transport of sediment and nutrients<br>• Streambed alteration | Number of streams crossed by each alternative; lower number better | Alternative crossing may affect hydrology of downstream segments; objective is to minimize the number of streams potentially affected<br>Streambed alteration requires permit from CDFG |
| Canal Crossings | • Hydrologic integrity<br>• Constriction or blockage of canal flow | Number of canals crossed by each alternative; lower number better | Alternative crossing may affect hydrology of canal; objective is to minimize the number canals potentially affected |
| Length of Floodplain Crossed | • Hydrologic integrity<br>• Maintenance of beneficial floodplain values<br>• Constriction or blockage of flow | Total length of alternative that crosses 100-year and 500-year floodplain; lower value better | Potential impact to beneficial floodplain values; objective is to minimize the crossing length potentially affecting the floodplain |
| Angle of Floodplain Crossing | • Minimization of effects on hydraulic and floodplain functions | Average angle of alternative crossing of stream or floodplain (range 0° to 90°); higher value better | Indicator of degree of longitudinal impact to floodplain areas; objective is to minimize the angle of potential effect |
| Total Floodplain Area Crossed | • Hydrologic integrity<br>• Maintenance of beneficial floodplain values<br>• Constriction or blockage of flow that could increase flood elevation, extend floodplain boundary and reduce storage<br>• Encroachment could raise BFE and reduce flood storage benefits | Magnitude of area affected; lower value better | Potential impact to beneficial floodplain values; objective is to minimize the area potentially affected |

**Length of Floodplain Crossed.** The ability of a bridge to cross a floodplain without encroachment depends on the length of the crossing. Since there are no design details for the floodplain crossings, typical Caltrans crossings have been assumed for the Tier 1 analysis (see Figure 2-2, Typical Cross-Section (Conceptual)). If the width of the floodplain at the planned crossing exceeds the typical span length for a bridge (assumed to be 150 feet), columns or piers would be required to support the bridge.

**Angle of Crossing of Floodplain.** Longitudinal encroachment of the floodplain is a primary impact consideration for FHWA and Caltrans in evaluating the environmental impact of a proposed stream crossing by a roadway facility. The degree of longitudinal impact of the alternative crossings on the existing floodplain is defined by the angle at which the roadway crosses the floodplain area. This angle (in the range of zero degrees to 90 degrees) defines the magnitude of potential impact to the floodplain area. A perpendicular crossing (at 90 degrees) represents the scenario with the least potential impact. As the angle of crossing approaches zero degrees, the crossing becomes more longitudinal and increases the potential for encroachment into the floodplain. The evaluation seeks to minimize the potential impact, so a higher value for the angle of the potential floodplain crossing is considered better (i.e., the angle is more perpendicular than longitudinal).

**Total Area of Floodplain Crossed.** Roads, bridges and culverts that cross a designated floodplain may encroach into the floodplain and affect the hydraulics of the creek and its associated floodplain. While a detailed analysis would be required to evaluate the effects of the potential encroachment, the estimated amount of floodplain that may be affected by the proposed project provides an indication of the potential magnitude of the encroachment for comparing the alternatives. In addition, because there are restrictions on construction activities and types of development that can be implemented in a floodplain, the amount of floodplain within a proposed corridor provides an indication of land use limitations. Floodplains in relation to the alternatives and segments are shown on Figure 4.11-2.

Portions of Placer Parkway would be constructed within designated floodplains. At some major creek crossings, sections of the Parkway would be elevated on a bridge (see Figure 2-2). Bridges would be designed such that the base of any new bridges within floodplains would be above the 100-year water surface elevation. Encroachment at these crossings from or column installation within the floodplain could compromise creek capacity for conveyance of the 100-year flow and result in an increase in the BFE and corresponding floodplain width upstream of the proposed crossing. The encroachment in the floodplain would be limited to the bridge columns. The columns would be placed to minimize potential impacts. In addition, increased flows due to increased impervious surfaces also could affect the floodplain.

Comparative data were collected and evaluated for each alternative and its segments (i.e., Western, Central and Eastern) using Geographical Information System technology. Table 4.11-2 summarizes the detailed information for each alternative and segment.

### 4.11.3.3 Direct Impacts

### No-Build Alternative

Under the No-Build Alternative (see Section 2.3-1), land for the construction of Placer Parkway would not be acquired and Placer Parkway would not be constructed. No impacts to floodplains or other hydrological resources would occur as a result of the No-Build Alternative.

**Table 4.11-2**
**Summary of Alternatives: Hydrology and Floodplains**

| Alternative | Segment | Length (feet) | Impervious Area (acres) | FEMA 100-Year Floodplain Crossing (feet) | Minimum Angle of Floodplain Crossing (degrees) | FEMA 100-Year Floodplain (acres) | FEMA 500-Year Floodplain (acres) | Interchanges (#) | Stream Crossings (#) | Canal Crossings (#) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Western | 15,300 | 322 | Total = 4,100<br>NB: 3,500<br>SC: 600 | NA | 211.4 | 172.2 | 3 | 0 | 1 |
| | Central | 40,600 | 103 | Total = 2,800<br>SC: 1,000<br>CC: 500<br>PGC: 200 + 300 | 0 | 46.6 | 14.0 | 0 | 9 | 0 |
| | Eastern | 29,600 | 321 | PGC: 800 | 90 | 10.7 | 2.8 | 3 | 6 | 0 |
| | Total | 85,500 | 745 | 6900 | | 268.7 | 189.0 | 6 | 15 | 1 |
| 2 | Western | 15,300 | 322 | Total = 4,100<br>NB: 3,500<br>SC: 600 | NA | 211.4 | 172.2 | 3 | 0 | 1 |
| | Central | 36,400 | 94 | Total = 2,500<br>SC: 1,000<br>CC: 1,000 + 200<br>PGC: 500 | 45 | 79.5 | 25.9 | 0 | 5 | 0 |
| | Eastern | 29,600 | 321 | PGC: 800 | 90 | 10.7 | 2.8 | 3 | 6 | 0 |
| | Total | 81,300 | 737 | 7600 | | 301.6 | 200.9 | 6 | 11 | 1 |
| 3 | Western | 15,300 | 322 | Total = 4,100<br>NB: 3,500<br>SC: 600 | NA | 211.4 | 172.2 | 3 | 0 | 1 |
| | Central | 37,500 | 97 | Total = 3800<br>SC: 1,000 CC: 2,500<br>PGC: 500 | 45 | 94.4 | 25.9 | 0 | 4 | 0 |
| | Eastern | 29,600 | 321 | PGC: 800 | 90 | 10.7 | 2.8 | 3 | 6 | 0 |
| | Total | 82,400 | 740 | 8,900 | | 316.2 | 200.9 | 6 | 10 | 1 |

**Table 4.11-2**
**Summary of Alternatives: Hydrology and Floodplains (Continued)**

| Alternative | Segment | Length (feet) | Impervious Area (acres) | FEMA 100-Year Floodplain Crossing (feet) | Minimum Angle of Floodplain Crossing (degrees) | FEMA 100-Year Floodplain (acres) | FEMA 500-Year Floodplain (acres) | Interchanges (#) | Stream Crossings (#) | Canal Crossings (#) |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Western | 15,300 | 223 | Total = 15,300<br>NB: 11,300<br>CC: 4,000 | NA | 254.8 | 55.9 | 2 | 0 | 1 |
| | Central | 30,600 | 80 | Total = 6,300<br>CC: 5,000<br>PGC: 500 | 45 | 104.8 | 37.2 | 0 | 3 | 0 |
| | Eastern | 29,600 | 321 | PGC: 800 | 90 | 10.7 | 2.8 | 3 | 6 | 0 |
| | Total | 75,500 | 624 | 21,600 | | 370.3 | 95.9 | 5 | 9 | 1 |
| 5 | Western | 15,300 | 223 | Total = 15,300<br>NB: 11,300<br>CC: 4,000 | NA | 254.8 | 55.9 | 2 | 0 | 1 |
| | Central | 30,100 | 78 | Total = 6,300<br>CC: 5,000<br>PGC: 500 | 45 | 106.8 | 27.8 | 0 | 3 | 0 |
| | Eastern | 29,600 | 321 | PGC: 800 | 90 | 10.7 | 2.8 | 3 | 6 | 0 |
| | Total | 75,000 | 622 | 21,600 | | 372.3 | 86.5 | 5 | 9 | 1 |

Notes:

1. Alternatives and segments are shown on Figures 2-1 and 4.11-1.
2. Impervious area includes paved road surface, paved shoulders and interchanges. Road surface assumes 6 lanes (three in each direction). NA = not applicable. NB= Natomas Basin. CC = Curry Creek. PGC = Pleasant Grove Creek. SC= Steelhead Creek.

Western Segment impacts for Alternatives 1, 2, and 3 are the same and for Alternatives 4 & 5 are the same

Eastern Segment impacts are the same for all alts

## Alternative 1 – the Red Alternative

### Western Segment

**Amount of Impervious Area**. Most of the estimated amount of impervious area associated with this segment is in the Natomas Basin watershed (316 acres), with the remaining 6 acres in the NEMDC watershed. Impacts associated with impervious surface creation include increase in runoff, erosion, downstream flooding, and sedimentation.

**Stream and Canal Crossings.** There are no stream crossings. There is a canal crossing at the NEMDC/Steelhead Creek. The width of this canal at this crossing and its associated wetlands is estimated to be greater than a standard bridge span of 150 feet and would therefore need to be supported by columns. Impacts associated with stream and canal crossings include flow constriction and impacts on water quality during construction.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by this segment is approximately 4,100 feet, most of which (approximately 3,500 feet) is in the western portion within the Natomas Basin/Steelhead Creek. The remaining 600 feet of the segment crosses the 100-year floodplain east of the NEMDC. Impacts associated with floodplain encroachment include impairment of floodplain, flood control, and water storage function.

**Total Area of Designated Floodplain Crossed.** As shown on Figure 4.11-2, the western portion and the easternmost portion of the Western Segment would be within the 100-year floodplain. Roughly half of the corridor associated with this segment would be within the 100-year floodplain. The remainder of this segment is within Zone X500, which is designated as an area inundated by the 500-year flood event. The estimated footprint within the 100-year floodplain is approximately 211 acres. Approximately 172 acres is within the 500-year floodplain. Impacts associated with total area floodplain include adverse effects on floodplain function and values, such as loss of water storage capacity.

### Central Segment

**Amount of Impervious Area.** The estimated amount of total impervious area associated with this segment is 103 acres. Approximately 51, 33, and 19 acres are within the NEMDC/Steelhead Creek, Curry Creek, and Pleasant Grove Creek watersheds, respectively.

**Stream and Canal Crossings.** There are nine stream crossings within this segment: four on NEMDC/ Steelhead Creek, three on Curry Creek, and two on Pleasant Grove Creek. This segment crosses approximately 7,000 feet of Steelhead Creek longitudinally. Depending on the alignment of the road within the corridor, realignment of this section of NEMDC/Steelhead Creek may be required. Culverts may be used at smaller creek crossings. Where creek crossings coincide with floodplain crossings, the road would be elevated on a bridge. (Stream crossings for all alternatives are shown on Figure 4.11-3.)

This segment does not cross any existing canals. Therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by this segment is approximately 2,800 feet. At the western edge, the Central Segment would start in the eastern edge of the 100-year floodplain associated with the NEMDC/Steelhead Creek and extend for approximately 1,000 feet. Impacts would be the same as discussed for the Western Segment.

This segment crosses the 100-year floodplain associated with Curry Creek in one location. The width of the floodplain at this crossing is approximately 500 feet. The eastern portion of this segment crosses the

100-year floodplain associated with Pleasant Grove Creek. There are two crossings. The widths of the floodplain at these crossings are approximately 200 and 300 feet. Impacts would be the same as discussed for the Western Segment.

**Angle of Crossing of Floodplain.** This segment crosses the NEMDC/Steelhead Creek longitudinally; i.e., the angle of the crossing is essentially zero. The floodplain for the NEMDC/Steelhead Creek has not been fully delineated; however, it may extend farther upstream than is designated on the current FEMA flood insurance rate map (FIRM). Detailed studies would need to confirm the 100-year water levels for this water body in the vicinity of the creek crossings. This segment is almost entirely within the floodplain, which is broad and shallow; therefore, the angle of crossing is not applicable to this segment. Impacts associated with the angle of floodplain crossing include adverse effects on hydraulic and floodplain functions.

The Curry Creek floodplain crossing and both of the Pleasant Grove Creek floodplain crossings are at approximately 90-degree angles.

**Total Area of Designated Floodplain Crossed.** As described above, this corridor crosses through several floodplains. The total amount of 100-year floodplain area crossed by this segment is approximately 46 acres. In addition, this segment crosses the 500-year floodplain associated with the NEMDC/Steelhead Creek; approximately 14 acres are within this 500-year floodplain. Impacts would be the same as discussed for the Western Segment.

**Eastern Segment**

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 321 acres, of which approximately 218 acres are within Pleasant Grove Creek watershed and the remaining 102 acres are within Auburn Ravine watershed. Impacts would be the same as discussed for the Western Segment.

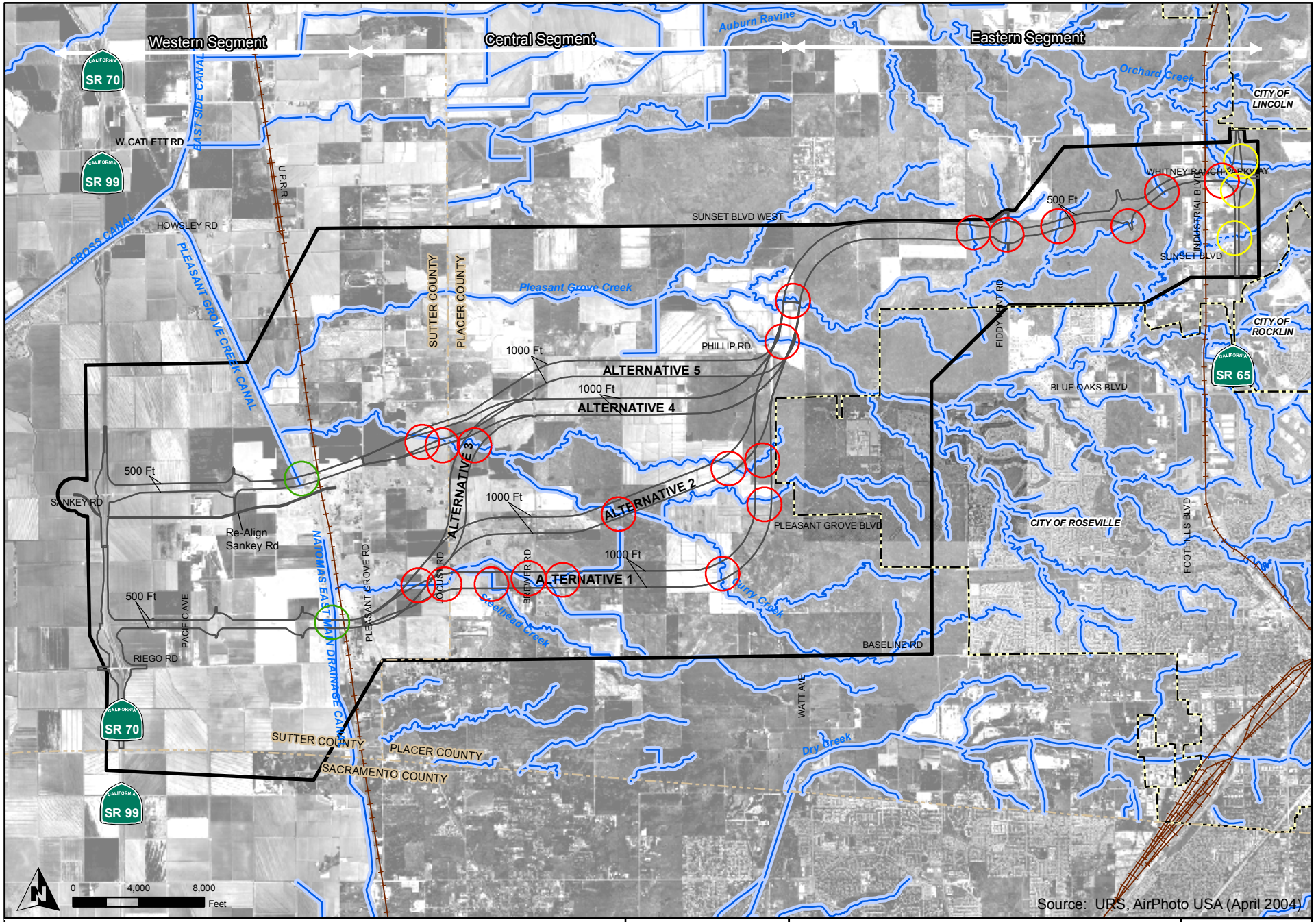
**Stream and Canal Crossings.** Six new stream crossings are within this segment: four on tributaries of Pleasant Grove Creek and two on tributaries of Orchard Creek. All of these crossings are in the headwaters of the creeks; therefore, culverts would be used at these crossings. In addition, this segment includes three existing stream crossings along State Route 65. These crossings would require modifications, such as extension of existing culverts, as part of adding the auxiliary lanes. Impacts would be the same as discussed for the Western Segment.

This segment does not cross any existing canals; therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** This segment crosses the 100-year floodplain associated with a tributary to Pleasant Grove Creek. The floodplain width at this crossing is approximately 800 feet.

**Angle of Crossing of Floodplain.** This segment crosses the floodplain associated with a tributary of Pleasant Grove Creek at approximately a 90-degree angle. Impacts would be the same as discussed for the Central Segment.

**Total Area of Designated Floodplain Crossed.** The total amount of 100-year floodplain area crossed by this segment is approximately 11 acres. In addition, this segment crosses approximately 3 acres within the 500-year floodplain. Impacts would be the same as discussed for the Western Segment.

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## Alternative 2 – the Orange Alternative

### Western Segment

The Western Segment of Alternative 2 is the same as that for Alternative 1; therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

### Central Segment

The Central Segment for Alternative 2 is located in Sutter and Placer counties. It traverses three watersheds: the NEMDC/Steelhead Creek, Curry Creek, and Pleasant Grove Creek. The total length of this segment is approximately 36,400 feet along the centerline of the corridor. There are no interchanges along this segment.

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 94 acres. Approximately 41, 35, and 19 acres are within the NEMDC/Steelhead Creek, Curry Creek, and Pleasant Grove Creek watersheds, respectively. Impacts would be the same as discussed for Alternative 1.

**Stream and Canal Crossings.** Five stream crossings are within this segment: one on the NEMDC/ Steelhead Creek, two on Curry Creek, and two on Pleasant Grove Creek. Culverts may be used at smaller creek crossings. Where creek crossings coincide with floodplain crossings, the road would be elevated on a bridge. Impacts would be the same as discussed for Alternative 1.

This segment does not cross any existing canals; therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by this segment is approximately 3,500 feet. The western edge of the Central Segment would start in the eastern portion of the 100-year floodplain associated with the NEMDC/Steelhead Creek and extend for approximately 1,000 feet. Impacts would be the same as discussed for Alternative 1.

This segment crosses the 100-year floodplain associated with Curry Creek in two locations. The approximate widths of the floodplains are on the order of 1,000 feet at the first crossing and approximately 200 feet at the second crossing. Impacts would be the same as discussed for Alternative 1.

In addition, the eastern portion of this segment crosses the 100-year floodplain associated with Pleasant Grove Creek. The two crossings are the same as those described for the Central Segment of Alternative 1. Impacts would be the same as discussed for Alternative 1.

**Angle of Crossing of Floodplain.** This segment crosses the floodplain associated with Steelhead Creek at approximately a 45-degree angle. The Curry Creek floodplain crossings are at approximately 45- and 90-degree angles. Both of the Pleasant Grove Creek floodplain crossings are at approximately 90-degree angles. Impacts would be the same as discussed for Alternative 1.

**Total Area of Designated Floodplain Crossed.** As described above, this corridor crosses several floodplains. The total amount of 100-year floodplain area crossed by this segment is approximately 80 acres. In addition, this segment crosses the 500-year floodplain associated with the NEMDC; approximately 26 acres are within this 500-year floodplain. Impacts would be the same as discussed for Alternative 1.

**Eastern Segment**

The Eastern Segment of Alternative 2 is the same as that for Alternative 1; therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

### Alternative 3 – the Blue Alternative

**Western Segment**

The Western Segment of Alternative 3 is the same as that for Alternative 1; therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

**Central Segment**

The Central Segment for Alternative 3 is located in Sutter and Placer counties. It traverses three watersheds: NEMDC/Steelhead Creek, Curry Creek, and Pleasant Grove Creek. The total length of this segment is approximately 38,000 feet along the centerline of the corridor. No interchanges are planned along this segment.

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 97 acres. Approximately 23, 58, and 16 acres are within the NEMDC/Steelhead Creek, Curry Creek, and Pleasant Grove Creek watersheds, respectively. Impacts would be the same as discussed for Alternative 1.

**Stream Crossings.** Four stream crossings are within this segment: one on Steelhead Creek, one on Curry Creek, and two on Pleasant Grove Creek. Culverts or a bridge could be used at the Steelhead Creek crossing. The Curry Creek and Pleasant Grove Creek crossings coincide with floodplain crossings; therefore, the road would be elevated on a bridge. Impacts would be the same as discussed for Alternative 1.

**Canal Crossings.** This segment does not cross any existing canals. Therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by this segment is approximately 4,800 feet. Impacts would be the same as discussed for Alternative 1.

At the western edge, the Central Segment would start in the eastern edge of the 100-year floodplain associated with the NEMDC/Steelhead Creek and extend for approximately 1,000 feet. This segment crosses the 100-year floodplain associated with Curry Creek. Depending on the alignment of the crossing within the proposed corridor, the floodplain width is on the order of 2,500 feet. In addition, the eastern portion of this segment crosses the 100-year floodplain associated with Pleasant Grove Creek. These two crossings are the same as those described for the Central Segment of Alternative 1. Impacts would be the same as discussed for Alternative 1.

**Angle of Crossing of Floodplain.** This segment crosses the floodplain associated with Steelhead Creek at approximately a 45-degree angle. The Curry Creek floodplain crossing is at approximately a 90-degree angle. Both of the Pleasant Grove Creek floodplain crossings are at approximately 90-degree angles. Impacts would be the same as discussed for Alternative 1.

**Total Area of Designated Floodplain Crossed.** As described above, this corridor crosses several floodplains. The total amount of 100-year floodplain area crossed by this segment is approximately 94 acres. In addition, this segment crosses the 500-year floodplain associated with the NEMDC;

approximately 26 acres are within this 500-year floodplain. Impacts would be the same as discussed for Alternative 1.

**Eastern Segment**

The Eastern Segment of Alternative 3 is the same as that for Alternative 1. Therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

### Alternative 4 – the Yellow Alternative

**Western Segment**

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 223 acres. In addition, this segment includes the realignment of Sankey Road. The estimated amount of impervious area for the Sankey Road realignment is approximately 46 acres; however, since the realigned roadway would be slightly longer than the existing roadway, the additional amount of impervious area would be minimal.

**Stream and Canal Crossings.** There are no stream crossings within this segment.

This segment would cross the Pleasant Grove Creek Canal. The canal is within the 100-year floodplain, and as such, this portion of the road would be elevated on a bridge. The columns to support the bridge would be placed outside the ordinary high water elevation of the canal. The approximate width of the canal at this crossing is on the order of 150 to 200 feet. Impacts would be the same as discussed for Alternative 1.

**Length of Floodplain Crossed.** Since the entire segment is essentially within the 100-year floodplain, the entire length of this corridor traverses the floodplain. The total length is approximately 15,300 feet. When the Sankey Gap is removed from the 100-year floodplain some time in the future, the length of floodplain crossed by this segment would be reduced. Impacts would be the same as discussed for Alternative 1.

**Angle of Crossing of Floodplain.** This segment is almost entirely within the floodplain, which is broad and shallow; therefore, the angle of crossing is not applicable to this segment.

**Total Area of Designated Floodplain Crossed.** As shown on Figure 4.11-2, essentially all of the Western Segment associated with Alternative 4 would be within the 100-year floodplain. The estimated footprint within the 100-year floodplain is 255 acres. In addition, approximately 56 acres of the proposed corridor would be within the 500-year floodplain. When the Sankey Gap is removed from the 100-year floodplain some time in the future, the amount of floodplain crossed by this segment would be reduced. Impacts would be the same as discussed for Alternative 1.

**Central Segment**

The Central Segment for Alternative 4 is located in Sutter and Placer counties. It traverses two watersheds: Curry Creek and Pleasant Grove Creek. The total length of this segment is approximately 30,600 feet along the centerline of the corridor. There are no interchanges along this segment.

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 80 acres. Approximately 64 and 16 acres are within the Curry Creek and Pleasant Grove Creek watersheds, respectively. Impacts would be the same as discussed for Alternative 1.

**Stream and Canal Crossings.** Three stream crossings are within this segment: one on Curry Creek and two on Pleasant Grove Creek. The Curry Creek and Pleasant Grove Creek crossings coincide with floodplain crossings; therefore, the road would be elevated on a bridge. Impacts would be the same as discussed for Alternative 1.

This segment does not cross any existing canals. Therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by the Central Segment is approximately 6,300 feet. This segment crosses the 100-year floodplain associated with Curry Creek, which is essentially an extension of the floodplain associated with the Western Segment of Alternative 4.

In addition, the eastern portion of this segment crosses the 100-year floodplain associated with Pleasant Grove Creek. These two crossings are the same as those described for the Central Segment of Alternative 1.

**Angle of Crossing of Floodplain.** This segment crosses the Curry Creek floodplain at approximately a 45-degree angle. Both of the Pleasant Grove Creek floodplain crossings are at approximately 90-degree angles. Impacts would be the same as discussed for Alternative 1.

**Total Area of Designated Floodplain Crossed.** As described above, this corridor crosses several floodplains. The total amount of 100-year floodplain area crossed by this segment is approximately 105 acres. In addition, this segment crosses approximately 37 acres within the 500-year floodplain.

**Eastern Segment**

The Eastern Segment of Alternative 4 is the same as that for Alternative 1. Therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

### Alternative 5 – the Green Alternative

**Western Segment**

The Western Segment of Alternative 5 is the same as that for Alternative 4; therefore, the potential impacts for this segment are the same as discussed for Alternative 4.

**Central Segment**

**Amount of Impervious Area.** The estimated amount of impervious area associated with this segment is 78 acres. Approximately 60 and 19 acres are within the Curry Creek and Pleasant Grove Creek watersheds, respectively. Impacts would be the same as discussed for Alternative 1.

**Stream and Canal Crossings.** Three stream crossings are within this segment: one on Curry Creek and two on Pleasant Grove Creek. The Curry Creek and Pleasant Grove Creek crossings coincide with floodplain crossings; therefore, the road would be elevated on a bridge. Impacts would be the same as discussed for Alternative 1.

This segment does not cross any existing canals; therefore, there would be no potential impacts to canals.

**Length of Floodplain Crossed.** The total length of 100-year floodplain crossed by this segment is approximately 6,300 feet.

Similar to the Central Segment for Alternative 5, this segment crosses the 100-year floodplain associated with Curry Creek, which is essentially an extension of the floodplain associated with the Western Segment of Alternative 4. Therefore, the elevated road would continue approximately 4,000 feet into the Central Segment. Impacts would be the same as discussed for Alternative 1.

In addition, the eastern portion of this segment crosses the 100-year floodplain associated with Pleasant Grove Creek. These two crossings are the same as those described for the Central Segment of Alternative 1. Impacts would be the same as discussed for Alternative 1.

**Angle of Crossing of Floodplain.** This segment crosses the Curry Creek floodplain at an approximately 45-degree angle. Both of the Pleasant Grove Creek floodplain crossings are at approximately 90-degree angles. Impacts would be the same as discussed for Alternative 1.

**Total Area of Designated Floodplain Crossed.** As described above, this corridor crosses through several floodplains. The total amount of 100-year floodplain area crossed by this segment is approximately 107 acres. In addition, this segment crosses approximately 28 acres within the 500-year floodplain. Impacts would be the same as discussed for Alternative 1.

**Eastern Segment**

The Eastern Segment of Alternative 5 is the same as that for Alternative 1. Therefore, the potential impacts for this segment are the same as discussed for Alternative 1.

## Comparison of Alternatives

The five build alternatives are summarized and ranked in Table 4.11-3. The No-Build Alternative is not shown in Table 4.11-3 because no impacts would be associated with this alternative. A ranking of 1 correlates to the least number of impacts in any particular input category.

**Amount of Impervious Area.** With respect to the amount of impervious area, Alternative 1 would have the largest increase in impervious area because it is the longest corridor and has the greatest number of interchanges, while Alternative 5 would have the least (i.e., shorter corridor length and fewer interchanges). However, the difference between these two alternatives is only 123 acres. Approximately 66 (Alternatives 4 and 5) to 76 percent (Alternatives 1, 2, and 3) of the total impervious area associated with the proposed project would be created by the proposed interchanges.

As summarized in Table 4.11-4, Alternatives 1 and 2 would create less impervious area in Curry Creek than Alternatives 3, 4, and 5 because these alternatives would have shorter roadway lengths through the Curry Creek watershed. The amount of impervious area that would be created by the proposed project for these alternatives would range from approximately 0.4 to 0.6 percent of the total Curry Creek drainage area.

All of the alternatives would create approximately the same amount of impervious area (approximately 0.4 square mile) within the Pleasant Grove Creek watershed, because the corridor alignments for all alternatives are similar and they all would include two interchanges. This amount would be approximately 0.8 percent of the total Pleasant Grove Creek watershed area.

Alternatives 4 and 5 would create less impervious area (approximately 0.3 square mile) in the Natomas Basin than Alternatives 1, 2, and 3 (approximately 0.5 square mile). The difference is primarily because Alternatives 4 and 5 would include two interchanges and Alternatives 1, 2, and 3 would include three interchanges within the watershed. The amount of impervious area that would be created by the proposed project would range from approximately 0.4 to 0.6 percent of the total Natomas Basin drainage area.

**Table 4.11-3**
**Summary of Alternatives Ranking: Hydrology and Floodplains**

| Alternative | Total Length | | Impervious Area | | Stream Crossings | | Canal Crossings | | Watersheds | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Feet | Rank | Acres | Rank | Number | Rank | Number | Rank | Number | Rank |
| 1 | 85,500 | 5 | 745 | 5 | 15 | 4 | 1 | 0 | 5 | 2 |
| 2 | 81,300 | 3 | 737 | 3 | 11 | 3 | 1 | 0 | 5 | 2 |
| 3 | 82,400 | 4 | 740 | 4 | 10 | 2 | 1 | 0 | 5 | 2 |
| 4 | 75,500 | 2 | 624 | 2 | 9 | 1 | 1 | 0 | 4 | 1 |
| 5 | 75,000 | 1 | 622 | 1 | 9 | 1 | 1 | 0 | 4 | 1 |

| Alternative | 100-Year Floodplain Crossing | | 500-Year Floodplain Crossing | | 100-Year Floodplain Crossed | | Minimum Angle of Crossing | |
|---|---|---|---|---|---|---|---|---|
| | Acres | Rank | Acres | Rank | Feet | Rank | Degrees | Rank |
| 1 | 269 | 1 | 189 | 3 | 6,900 | 1 | 0 | 2 |
| 2 | 302 | 2 | 201 | 4 | 7,600 | 2 | 45 | 1 |
| 3 | 317 | 3 | 201 | 4 | 8,900 | 3 | 45 | 1 |
| 4 | 370 | 4 | 96 | 2 | 21,600 | 4 | 45 | 1 |
| 5 | 372 | 5 | 87 | 1 | 21,600 | 4 | 45 | 1 |
| 1 = least number of impacts. | | | | | | | | |

**Table 4.11-4**
**Amount of Parkway Impervious Area in Watersheds**

| Alternative | Total Watershed Area (sq. mi.)[1] | Area in Corridor (sq. mi.)[2] | Parkway Impervious Area (sq. mi.)[3] | Parkway Impervious Area as Percentage of Watershed |
|---|---|---|---|---|
| Natomas Watershed | | | | |
| 1 | 83 | 0.6 | 0.5 | 0.6% |
| 2 | 83 | 0.6 | 0.5 | 0.6% |
| 3 | 83 | 0.6 | 0.5 | 0.6% |
| 4 | 83 | 0.5 | 0.3 | 0.4% |
| 5 | 83 | 0.5 | 0.3 | 0.4% |
| Steelhead Creek (NEMDC) Watershed[4] | | | | |
| 1 | 9 | 0.8 | 0.09 | 1% |
| 2 | 9 | 0.6 | 0.07 | 0.8% |
| 3 | 9 | 0.4 | 0.05 | 0.6% |
| 4 | 9 | 0 | 0 | 0 |
| 5 | 9 | 0 | 0 | 0 |
| Curry Creek Watershed | | | | |
| 1 | 17 | 0.4 | 0.05 | 0.3% |
| 2 | 17 | 0.5 | 0.05 | 0.3% |
| 3 | 17 | 0.7 | 0.08 | 0.5% |
| 4 | 17 | 0.9 | 0.11 | 0.6% |
| 5 | 17 | 0.9 | 0.11 | 0.6% |
| Pleasant Grove Creek Watershed | | | | |
| 1 | 47 | 1.0 | 0.4 | 0.8% |
| 2 | 47 | 1.0 | 0.4 | 0.8% |
| 3 | 47 | 1.0 | 0.4 | 0.8% |
| 4 | 47 | 1.0 | 0.4 | 0.8% |
| 5 | 47 | 1.0 | 0.4 | 0.8% |
| Auburn Ravine Watershed | | | | |
| 1 through 5 | 79 | 0.2 | 0.16 | 0.2% |

Notes:

1. Total watershed areas based on information from CH2M Hill (1993).
2. Area in corridor is based on length and width of corridor, plus interchanges and Sankey Road realignment.
3. Parkway impervious area includes road surface (six lanes at 12 feet), shoulders (four lanes at 10 feet), interchanges and Sankey Road realignment.
4. While the Parkway corridor and roadway would not traverse the NEMDC/Steelhead Creek watershed for Alternatives 4 and 5, there would be a small amount of impervious area (approximately less than 5 acres) created by the re-alignment of Sankey Road.

Alternatives 1, 2, and 3 would contribute less than 0.1 square mile of impervious area in the NEMDC watershed, which would be less than 1 percent of the total NEMDC/Steelhead Creek watershed area. Alternatives 4 and 5 do not traverse this watershed and therefore the proposed Parkway would not contribute any impervious area in this area; however, the proposed Sankey Road re-alignment would create less than 5 acres of impervious area within the NEMDC/Steelhead Creek watershed.

Because the proposed corridor alignment and one interchange would be the same for all alternatives, all of the alternatives would create the same amount of impervious area within the Auburn Ravine watershed, approximately 0.2 square mile. This would be about 1 percent of the total drainage area of Orchard Creek and only about 0.2 percent of the total Auburn Ravine watershed.

All of the alternatives would create the same amount of impervious area within the Pleasant Grove Creek and Auburn Ravine watersheds. Alternatives 1, 2, and 3 would create slightly more impervious area in the Natomas watershed, while Alternatives 4 and 5 would create slightly more impervious area in the Curry Creek watershed. With the exception of the small amount of impervious area associated with the Sankey Road re-alignment, Alternatives 4 and 5 would not create any new impervious area within the NEMDC watershed.

**Stream and Canal Crossings.** Alternatives 4 and 5 have the fewest stream crossings (12 crossings), while Alternative 1 has the most (18 crossings). Alternatives 4 and 5 cross Curry Creek, Pleasant Grove Creek and tributaries to Orchard Creek. Alternatives 1, 2, and 3 cross these same creeks in different locations, but also cross Steelhead Creek.

Alternatives 1, 2, and 3 would cross the NEMDC/Steelhead Creek, and Alternatives 4 and 5 would cross the Pleasant Grove Creek Canal. Each of the proposed canal crossings probably would require the placement of fill material (either an embankment or piers) within wetlands or waters associated with the canal crossings. The wetlands and open water of the canal at the southern crossing (Alternatives 1, 2, and 3) (NEMDC/Steelhead Creek) appear to be more than 150 feet wide and would also need to span a railroad ROW. The northern crossing (Pleasant Grove Creek Canal) (Alternatives 4 and 5) appears similar (about 150 to 200 feet) but the distance between the railroad ROW and the canal is greater. Because the estimated canal widths are approximately the same as or wider than a typical bridge span, it is very likely that columns or an embankment would be required at one or both locations.

**Length of Floodplain Crossed.** Alternative 1 crosses the 100-year floodplain the least (approximately 6,900 feet), while Alternatives 4 and 5 cross the most (21,600 feet). This suggests that Alternatives 4 and 5 would require more columns to be placed within the floodplains, and therefore the potential for significant encroachment would be greater for these alternatives.

When the Sankey Gap is removed from the 100-year floodplain sometime in the future, the amount of floodplain crossed by Alternatives 4 and 5 would be reduced on the order of approximately 8,000 feet. Even with removal of the Sankey Gap, Alternatives 4 and 5 would still cross considerably more floodplain than Alternatives 1, 2, and 3.

**Angle of Crossing of Floodplain.** Alternative 1 crosses Steelhead Creek longitudinally for approximately 7,000 feet; this may require relocation of the creek. Alternative 1 is the only alternative with a longitudinal crossing. The minimum angle of crossing for the other alternatives is 45 degrees in the Central Segment.

**Total Area of Designated Floodplain Crossed.** Alternative 1 would cross the least amount of 100-year floodplain (269 acres) and Alternative 5 would cross the most (372 acres). This difference is primarily due to the amount of 100-year floodplain designated within the Natomas Basin. In the future, when

Sankey Gap is eliminated from the 100-year floodplain, there will be very little difference in the total amount of floodplain crossed by the alternatives.

While there is not much difference between the total amounts of floodplain crossed by the various alternatives (103 acres), the alternatives cross the Curry Creek floodplain in different places. As summarized in Table 4.11-5, Alternatives 1 and 2 cross the Curry Creek floodplain farther upstream within the watershed than do Alternatives 3, 4, and 5. Potential impacts would be greater for floodplain crossings that are lower in the watershed. For example, floodplains are wider and therefore crossings would be longer. Any encroachment or fill placed in the floodplain would have the potential to affect upstream areas; therefore, crossings higher in the watershed (Alternatives 1 and 2) would have fewer impacts to floodplains.

Until the Sankey Gap is addressed and removed from the 100-year floodplain, the Western Segment associated with Alternatives 3, 4, and 5 is almost entirely within the 100-year floodplain. This limits the opportunities to site BMPs within the corridor for attenuation of peak flows and retention of runoff volumes.

**Table 4.11-5**
**Distribution of Curry Creek Floodplain Crossed by Alternative**

| Alternative | Total Floodplain Area (sq. mi.) | Floodplain Downstream of Crossing (sq. mi.) | Floodplain in Corridor (sq. mi.) | Floodplain Upstream of Crossing (sq. mi.) | Percent of Floodplain Upstream of Crossing | Floodplain Crossing Length (feet) |
|---|---|---|---|---|---|---|
| 1 | 3 | 2.7 | 0.1 | 0.2 | 6 | 5,009 |
| 2 | 3 | 2.3 | 0.1 | 0.6 | 20 | 7,400 |
| 3 | 3 | 1.3 | 0.1 | 1.6 | 53 | 7,900 |
| 4 | 3 | 0.8 | 0.2 | 2 | 67 | 21,600 |
| 5 | 3 | 0.8 | 0.2 | 2 | 67 | 21,600 |

### 4.11.3.4 Secondary and Indirect Impacts

#### No-Build Alternative

Under the No-Build Alternative land would not acquired and the Parkway would not be constructed. There would not be any secondary or indirect impacts on hydrology and floodplains.

#### Build Alternatives

Construction and operation of the Parkway could result in secondary and indirect impacts on hydrology and floodplains. Secondary and indirect impacts associated with anticipated growth are discussed in Section 6.1, Growth.

Although it is not possible to predict with any certainty where new impervious surfaces may be created, it is reasonable to assume that impacts associated with reduction in pervious land cover and increased run-off, either directly associated with the construction of the Parkway or as a result of growth induced by the Parkway, could adversely affect floodplains and hydrology. This could occur in a number of ways:

- Contamination of surface water and groundwater through increased runoff of pollutants;
- Increased peak flows and runoff volumes cause flooding downstream;

- Declining levels of developable land could place additional pressure for continued floodplain encroachment, with its associated adverse effect on wildlife and increased risk of flooding;
- Impacts on aquatic wildlife as a result of increased sedimentation from runoff; or
- Impacts on aquatic wildlife as a result of constriction or blockage of natural stream flow associated with stream crossings.

### 4.11.3.5 Cumulative Impacts

#### No-Build Alternative

Under the No-Build Alternative, land would not be acquired and the Parkway would not be constructed. The No-Build Alternative would not contribute to cumulative impacts on existing hydrology and floodplains within the study area.

#### Alternatives 1 Through 5

The combined effects of floodplain encroachment associated with multiple projects could exacerbate adverse impacts associated with individual projects, through cumulative loss of pervious surfaces and a corresponding increase in the volume and rate of runoff due to reduced percolation of surface water. This also could lead to increased flooding risk as land throughout the area covered under the cumulative impact scenario is converted from pervious surface to development, and overall peak flow rates and runoff volumes are increased. Cumulative impacts can also be caused by acceleration of runoff caused by improved conveyance of stormwater through streets, gutters, and storm sewer facilities. The potential adverse impacts on hydrology and floodplains associated with this development could result in cumulative impacts.

The amount of impervious area associated with Placer Parkway would be roughly one square mile (ranging from approximately 0.98 square mile for Alternative 5 to approximately 1.2 square miles for Alternative 1). While this is a very small amount compared to the total area of the watersheds and the project's contribution to peak flows and volumes in the creeks would be expected to be small, when combined with potential upstream flow increases, the cumulative impacts could still be substantial.

Mitigation strategies have been identified to reduce these impacts. These include strategies to avoid impacts by design (i.e., strategies to limit impacts from construction activities and site planning and design features to avoid impacts), implementation of BMPs, and participation in the City of Roseville's planned regional stormwater retention facility (Reason Farms). This facility has been specifically planned to alleviate potential downstream flooding.

In addition, Sutter County and Placer County General Plan policies and programs are intended to offset the potential direct and cumulative flooding and water quality problems that may arise from development. New developments are required to detain onsite drainage such that the rate of runoff is maintained at pre-development levels. Because peak runoff rates from new development would be maintained at pre-development levels, there would be no increases in peak flows. Both Sutter and Placer counties have ordinances that limit construction in floodplains. Given this regulatory environment, the relatively minor amount of impervious surface associated with Placer Parkway in comparison to the overall cumulative development scenario, and with development of the mitigation strategies identified in this report into enforceable mitigation measures, Placer Parkway's incremental contribution to cumulative impacts related to peak flows and floodplains would not be cumulatively considerable.

## 4.11.4 AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

### 4.11.4.1 Tier 1 – Avoidance/Minimization Strategies

- During the development of alternatives, in order to reduce environmental impacts, avoidance alternatives were considered (see Section 2.5.4). These alternatives did not meet the project Purpose and Need and were therefore eliminated from further consideration.

- During development of the Tier 1 conceptual design of the Parkway, efforts were made which directly or indirectly help to avoid impacts on hydrology and floodplains. These efforts included:

  – The use of bridges to span floodplains. Culverts would be used at smaller creek crossings as appropriate, depending on local conditions and permit requirements. The Pleasant Grove Creek floodplain would be crossed by bridges (one in each direction) supported by abutments located approximately 800 feet on either side of the creek to avoid the riparian habitat associated with the creek.

  – Roadway elevation within the 100-year floodplain such that the bottom of any new bridges would be above the 100-year water surface elevation. The roadway support structures and bridges would be designed to minimize environmental impact and not impede stream and flood flows.

  – The restriction of access between Pleasant Grove Road and Fiddyment Road. This would help to minimize floodplain and hydrological impacts.

  – The location of the Parkway within a no-development buffer zone (see Section 2.5) that would preserve open space and agricultural uses adjacent to the Parkway and limit future development in the buffer zone. This would help to minimize floodplain and hydrological impacts

### 4.11.4.2 Tier 2 – Consultation

- PCTPA will continue to coordinate with local jurisdictions in Tier 2 to reduce the likelihood of impacts on hydrology and floodplains. Coordination will include development of specific project design details described below to minimize impacts and consultation regarding the design and location of other planned and proposed development in the study area.

### 4.11.4.3 Tier 2 – Mitigation Commitments

- Tier 2 design will include the following strategies to reduce potential hydrological and floodplain impacts:

  – Limitation of temporary disturbance to minimum areas necessary for construction and restoration of disturbed areas to pre-project conditions.

  – Avoidance and/or minimization of construction activities in or near creeks and floodplains, including limiting amount of fill placed in creeks.

  – Use of the least intrusive construction methods reasonably available.

- Design of project features (e.g., culverts, drainage systems, and bridges) to avoid increasing flow velocities that may cause or contribute to downstream erosion and flooding and minimize potential for debris clogging that could cause flooding. Bridges and columns will be designed such that increase in the BFE will be less than one foot as specified by FEMA (see Section 3.1 Placer Parkway Hydrology and Floodplains Technical Report (URS, 2007d).

- Use of structural runoff controls, such as vegetated swales.

- Incorporation of appropriate BMPs (e.g., provided appropriate detention and use vegetation to reduce flow velocities and peak discharges).

- Maximization of the angle of stream crossing to as close to 90° as possible.

- Implementation of Caltrans/Sutter County/Placer County BMPs as described in the Caltrans Statewide Stormwater Management Plan.

- Compliance with standard conditions in the form of regulatory requirements of federal, state and local agencies including Sutter County, PCFCWCD, and RD 1000 requirements for siting and design of facilities and hydrologic modification and floodplain encroachment guidance and siting/design guidance from FHWA, USCOE, Caltrans, and CDFG.

#### 4.11.4.4 Tier 2 – Mitigation Considerations

- Tier 2 design would consider, where possible, implementation of the following strategies to reduce potential impacts on hydrology and floodplains:

  - Avoidance or minimization of stream crossings.

  - Alignment of the roadway within the corridor to decrease impervious cover by reducing the area of pavement or number of road miles.

  - Provision of sufficient setback distances in accordance with Caltrans and county requirements between the highway right-of-way and wetlands or riparian areas.

  - Location of the Parkway and bridges away from sensitive areas and establish buffer zones.

  - Mimic natural patterns as much as possible, including considering Low Impact Development whenever appropriate.

- PCTPA will evaluate the potential use of an expansion of this retention basin as part of mitigation for the Parkway. Such an expansion would require City of Roseville approval and additional environmental review.

- PCTPA will identify and address, as needed, Pleasant Grove Creek/Curry Creek Watershed Management Groups' requirements.

- Objectives from the Pleasant Grove/Curry Creek ERP may be relevant and should be considered during planning, design, and construction of Placer Parkway.

### 4.11.5 TIER 1 AND TIER 2 STUDIES

- Analyses that will begin in Tier 2
  - Preparation of a Drainage Report consistent with Caltrans Highway Design Manual 800 (Caltrans, 2001b) and Caltrans Design Directive D-6 requirements (Caltrans, 2001a) (Note: guidance provided by Caltrans Environmental Handbook, Volume 1, Chapter 9 will also be followed once it becomes available).
  - Preparation of a Location Hydraulic Study consistent with Caltrans Environmental Handbook, Volume 1, Chapter 17 requirements (Caltrans, 2005). The Location Hydraulic Study is performed to evaluate the base flood (100-year) and potential impacts from the proposed action on the base floodplain and is based on FEMA's Flood Insurance Study data and the FIRMs. This is performed to demonstrate that the proposed design would not significantly encroach on or impact floodplains.
  - Preparation of a Summary Floodplain Encroachment Report consistent with Caltrans Environmental Handbook, Volume 1, Chapter 17 requirements (Caltrans, 2005). This is performed to document the findings of the Location Hydraulic Study; that the Parkway design would not significantly encroach on or impact floodplains.