3.2 Physical Environment

3.2.1 Hydrology and Floodplain

Regulatory Setting

Executive Order 11988 (Floodplain Management) directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only practicable alternative. The Federal Highway Administration requirements for compliance are outlined in 23 CFR 650 Subpart A.

In order to comply, the following must be analyzed:

- The practicability of alternatives to any longitudinal encroachments.
- Risks of the action.
- Impacts on natural and beneficial floodplain values.
- Support of incompatible floodplain development.
- Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values affected by the project.

The base floodplain is defined as "the area subject to flooding by the flood or tide having a one percent chance of being exceeded in any given year." An encroachment is defined as "an action within the limits of the base floodplain."

Affected Environment

The following text is based on the *I-80/I-680/SR-12 Interchange Project, Location Hydraulic Study & Summary Floodplain Encroachment Report* (LHS) and the *I-80/I-680/SR-12 Interchange Project, Stormwater Data Report* (SWDR) prepared in 2009.

The project area is comprised of relatively flat grazing plains and rural open space with gently sloping hills adjacent to the I-80/I-680/SR-12 interchange. The Vaca Mountains lie to the north of Suisun Valley and Fairfield. Along the reach of the project, nine named creeks convey runoff to Suisun Bay to the South: American Canyon Creek, Jameson Creek, Green Valley Creek, Dan Wilson Creek, Suisun Creek, Raines Drain, Alonzo Drain, Ledgewood Creek, and Pennsylvania Avenue Creek.

Solano County, a central region of California, is characterized by a Mediterranean climate. Summer is dominated by subtropical high pressure cells, with dry sinking air capping a surface marine layer of varying humidity, making rainfall impossible or unlikely but for the odd thunderstorm. During winter, the polar jet stream and associated periodic storms reach into the lower latitudes of the Mediterranean zones, bringing approximately 95% of the total precipitation for the region.

The San Francisco Bay Regional Water Quality Control Board (RWQCB) lists this region as Area 2 of its domain. The San Francisco Bay RWQCB further notes that its rainy season is from October 15 to April 15. The California Irrigation Management System (CIMIS) station collects meteorological data and is located in Suisun Valley (Station Number 123). Minimum, mean and maximum monthly precipitation values from August 1994 through February 2010 are included in Table 3.2.1-1. Note that the minimum precipitation values are only the minimum value recorded on a single day within that month. Thus each month since 1994 had a least one day where no precipitation was recorded.

Table 3.2.1-1. Minimum, Mean and Maximum Monthly Precipitation from August 1994 to February 2010 in Suisun Valley (Station No. 123)

Month	Minimum	Mean	Maximum
January	0	0.17	2.46
February	0	0.16	3.66
March	0	0.08	1.78
April	0	0.08	1.83
May	0	0.06	2.12
June	0	0.00	0
July	0	0.00	0
August	0	0.00	0.34
September	0	0.00	0.36
October	0	0.03	4.03
November	0	0.07	2.45
December	0	0.16	5.34

Source: http://wwwcimis.water.ca.gov/cimis/welcome.jsp. Accessed: 3/8/2010.

The land gradually slopes south toward Suisun Bay and all drainages within the project limits drain to Suisun Bay. The area is composed of relatively flat grazing plains and rural open space with gently sloping hills adjacent to the I-80/I-680 interchange. The Vaca Mountains lie to the north of Suisun Valley and Fairfield. Along the reach of the project area, two named creeks convey runoff to Suisun Bay to the south: Suisun Creek and Raines Drain. Historically, agriculture has affected runoff patterns in the areas adjacent to the proposed project. There is extensive urban development in areas to the west and east of the project but not in the immediate project area.

The Federal Emergency Management Agency (FEMA) delineates flood zones on Flood Insurance Rate Maps (FIRMs) and each FIRM depicts specific flood zones based primarily on topography and the areas likelihood of flooding. A 100-year flood has a 1% chance of being exceeded in any given year. Zone X flooding are areas determined to be outside the 0.2% annual chance floodplain. “Patterned” Zone X flooding are areas protected from by levees from the 1% annual chance flooding; or areas subject to 1% annual chance flooding with average depths less than 1-foot, or with drainage areas less than one square mile; or Areas of 0.2% annual chance flooding. Zone A is an area subject to 1% annual flooding that does not have flood elevations or depths defined. Zone AE is defined as areas subject to 1% annual flooding with base flood elevations determined. Figures 3.2.1-1 through 3.2.1-7 are each individual maps of the multiple flood zones along the project alignment.

American Canyon Creek

The American Canyon Creek drainage area is approximately 6.8 square miles at I-680, flowing east. The 100-year flow rate at the I-680 crossing is approximately 1,250 cubic feet per second (cfs). At I-680, American Canyon Creek passes under the freeway in a double box culvert; each cell is 12 feet wide. The 100-year flood is conveyed through the highway bridge without flooding the highway, as shown on the FEMA FIRMs. The most recent modifications to the FEMA-defined floodplain for American Canyon Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses I-680 was studied with approximate methods, and shows the 100-year floodplain as Zone A contained within the waterway upstream of the freeway and crossing under the freeway completely contained in the bridge crossing through the double 12-foot-wide reinforced concrete box (Figure 3.2.1-1).

Jameson Canyon Creek

The Jameson Canyon Creek drainage area is approximately 4.2 square miles at I-680, flowing east. The 100-year flow rate at the I-680 crossing is approximately 750 cfs. At I-680, Jameson Canyon Creek passes under the freeway in a double box culvert. The 100-year flood is conveyed through the highway bridge without flooding the highway, as shown on the FEMA FIRMs. The most recent modifications to the FEMA-defined floodplain for Jameson Canyon Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek between I-680 and I-80 was studied with approximate methods, and shows the 100-year floodplain as Zone A contained within the waterway and crossing under each freeway completely contained in the bridge crossings at I80 and I-680 (Figure 3.2.1-2). The culverts at I-80 and I-680 will be extended to accommodate the widened freeways.

Green Valley Creek

The Green Valley Creek drainage area is approximately 17.8 square miles at I-80, flowing south. The 100-year flow rate at I-80 crossing is 3300 cfs. Near I-80, Green Valley Creek passes under a series of bridges: the Green Valley Road crossing just north of I-80, four bridges that are part of the freeway crossing, and the Central Way Bridge immediately south of the freeway. The most recent modifications to the FEMA-defined floodplain for Green Valley Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses I-80 was studied with detailed methods, and shows the 100-year floodplain as Zone AE contained within the waterway upstream of the freeway and crossing under the freeway completely contained within the multiple multi-span bridge crossings (Figure 3.2.1-3). Farther downstream of I-80, the 100-year floodplain exceeds the channel banks. For this reach, including a portion of I-80, FEMA has also identified a “patterned” Zone X to indicate an area protected by levees from 1% annual chance flooding (Figure 3.2.1-3).

Dan Wilson Creek

Dan Wilson Creek flows south with a drainage area at I-80 that is approximately 4.6 square miles. Upstream of I-80, flows in Dan Wilson Creek can be diverted to two detention basins located just west of the creek. These detention basins release back into the creek. Levees line the creek and approximately 190 meters of I-80 just to the west of the creek. The floodplain also receives overflows from Suisun Creek located east of Dan Wilson Creek. Dan Wilson Creek floods when the water surface elevation of the creek reaches an elevation of approximately 29.5 feet. The most recent modifications to the FEMA-defined floodplain for Dan Wilson Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses I-80 was

studied with detailed methods, and shows the 100-year floodplain as Zone AE (Figure 3.2.1-1). Both upstream and downstream of I-80, portions of the 100-year floodplain exceed the channel banks. At the freeway, the 100-year runoff is completely contained within the multiple multi-span bridge crossings. Since the most recent levee improvements were made along the west bank north of I-80, FEMA has revised the flooding maps to show the 100-year runoff in Dan Wilson as contained by the existing highway bridge with no flooding onto the highway traveled way. A small area north of I-80 and west of the creek is identified as patterned Zone X, an area protected by levees (Figure 3.2.1-4).

Suisun Creek and Raines Drain

Beginning at Lake Curry to the north, the Suisun Creek watershed area is approximately 48.8 square miles. During historic flooding, water from Suisun Creek has overflowed to Ledgewood Creek near the most northern crossing of Suisun Valley Road. One-hundred-year overtopping occurs near the most southern crossing with Suisun Valley Road and flows to Dan Wilson Creek to the west and Raines Drain to the east.

During a 100-year runoff event, Suisun Creek exceeds its bank capacity farther upstream from the highway. Overtopping flows go to Raines Drain to the east and to Dan Wilson Creek to the west. At the highway, the flow that still remains within the banks of Suisun Creek passes through the highway bridge without additional flooding. Flood flows do not encroach on the highway traveled way at Suisun Creek Bridge. However, those 100-year flows that leave Suisun Creek and flow to Raines Drain, combine with runoff from the Raines Drain Watershed and overtopping flows from the upper reaches of Ledgewood Creek, and overtop the I-80 Freeway. FEMA has designated this area as a “Patterned” Zone X, indicating there is flooding up to a depth of one foot during the 100-year event (Figure 3.2.1-5).

The Raines Drain watershed has a watershed size of 2.3 square miles at I-80. The watershed, located just east of Suisun Creek and south of Ledgewood Creek, collects runoff from local agricultural lands and from over-bank flows from Suisun Creek and Ledgewood Creek during extreme events.

Raines Drain refers to a trapezoidal, concrete-lined ditch that begins at Rockville Road and extends southward across the agricultural floodplain to I-80. At I-80 the ditch transitions to a 66-inch-diameter reinforced concrete pipe (RCP) and then to a 60-inch-diameter RCP under the freeway. In addition to the main culvert at I-80, there is a 42-inch culvert constructed in 1986, and two more 42-inch culverts installed in the 1960s. However, one of the 42-inch culverts is currently closed off on both ends. On the southern side of I-80, all the pipes transition back to a trapezoidal concrete-lined channel.

The 100-year flow in Suisun Creek passes under the I-80 bridge without flooding the highway. The 100-year flood elevation is 36 feet just upstream of the bridge and the low point roadway elevation is 39 feet. However, at several locations within two miles upstream of I-80, 100-year flows escape from the banks of Suisun Creek, flowing away from the creek toward Raines Drain. Some of these flood flows encounter the I-80 embankment at Raines Drain. The capacity of the Raines Drain cross culverts is not sufficient to carry the 100-year flood flows (including those escaping Suisun Creek) beneath the highway, causing flood flows to overtop the highway at Raines Drain, as defined on the FEMA FIRMs. The freeway low point elevation at Raines Drain

is 34.4 feet. The FEMA maps do not indicate a floodplain elevation at this location, but indicate that the flooding is less than one foot deep (Figure 3.2.1-5).

Alonzo Drain

The Alonzo Drain watershed upstream from I-80 and SR 12E is bounded by Raines Drain to the west and Ledgewood Creek to the north and east. The watershed collects runoff from local agricultural lands and from over-bank flows from Ledgewood Creek and Suisun Creek during extreme events.

The existing waterway crossing under I-80 consists of a single 48-inch RCP with collector ditches north of the highway leading to the culvert. South of the highway is a series of storm drains owned by the City of Fairfield that connects the 48-inch RCP to a large trapezoidal channel with a 100-year capacity. The trapezoidal channel was constructed in the 1980s to convey the 100-year flow in Alonzo Drain, including overflows from Ledgewood Creek. Approximately one mile farther downstream, the improved Alonzo Drain crosses SR 12E in a six-cell 60-foot-wide RCB and joins Ledgewood Creek just east of Beck Avenue. The City of Fairfield indicated that the trapezoidal channel was designed for a 100-year flow of 2500 cubic feet per second.

The existing 48-inch culvert under the I-80 does not have the hydraulic capacity to convey the 100-year runoff from the direct watershed and the overflows from Ledgewood Creek. FEMA identifies this area of 100-year flooding as Zone AO, with 1-foot-deep flooding (deeper flooding may exist in local low-lying areas) (Figure 3.2.1-6).

FEMA has not performed hydraulic calculations or prepared flood profiles for Alonzo Drain. West Yost & Associates has prepared a separate report for the Solano County Water Agency that includes hydrologic and hydraulic calculations for Alonzo Drain, identifying the manner and frequency of overtopping of I-80 (West Yost & Associates 1999).

I-80 flooding in the area of Alonzo Drain and Ledgewood Creek has occurred as recently as December 31, 2005, closing westbound I-80 traffic for several hours. This highway flooding is attributable to the deficiencies at the Alonzo Drain I-80 crossing and to overtopping of Ledgewood Creek upstream of I-80. The FEMA maps indicate flood flows overtopping the highway, but the presence of a 3-foot-high concrete median barrier inhibits overtopping flows, causing ponded upstream flows to seek relief toward the Ledgewood Creek Bridge to the east.

The most recent modifications to the FEMA defined floodplain for Alonzo Drain are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses SR 12 was studied with approximate methods, and shows the 100-year floodplain as Zone AO (depth one foot) flowing across the location of SR 12E (Figure 3.2.1-6). This analysis of the Alonzo floodplain was performed before this reach of SR 12E was improved to current conditions and before the Alonzo Drain was improved between I-80 on the upstream end to downstream of SR 12E and Beck Avenue to the confluence with Ledgewood Creek. It is understood by Solano County and the Solano County Water District that the current improvements to Alonzo Drain between I-80 and SR 12E and downstream of SR12E are sufficient to convey the peak 100-year flow.

Ledgewood Creek

The Ledgewood Creek drainage area at I-80 is approximately 16.8 square miles (Figure 3.2.1-6). At SR 12, the Ledgewood Creek drainage area is about 0.5 square miles greater. Far upstream of I-80, Ledgewood Creek receives overflows from Suisun Creek during a 100-year runoff event. South of where overflows are received from Suisun Creek (and still upstream from I-80), overflows escape from Ledgewood Creek, flowing to the west and south to join with the Alonzo Drain and Raines Drain at the highway crossing.

At I-80, the flow that still remains within the banks of Ledgewood Creek passes through the highway bridge without additional flooding. Flood flows do not encroach on the I-80 traveled way at Ledgewood Creek Bridge. While there has been flooding of the highway in the area of Ledgewood Creek as recently as December 31, 2005, this flooding is attributable to the deficiencies at the Alonzo Drain highway crossing and the fact that Ledgewood Creek overtopped upstream of I-80. At SR 12E, Ledgewood Creek crosses the highway in a five-cell 75-foot-wide RCB.

The most recent modifications to the FEMA-defined floodplain for Ledgewood Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses SR 12E was studied with detailed methods, and shows the 100-year floodplain as Zone AE contained within the waterway upstream of the freeway and crossing under the freeway completely contained within the existing bridge crossings (Figure 3.2.1-1). Farther downstream of SR 12E, the 100-year floodplain is shown within the stream banks. However, the FEMA maps show a Zone AO (depth one foot) flooding beyond the Ledgewood stream banks beginning just upstream of SR 12E and extending far downstream of the highway. The *Summary Floodplain Encroachment Report* does not state if this flood depth is from overflows or mixing of Alonzo Drain, Ledgewood Creek, and/or Pennsylvania Avenue Creek. Flooding of Ledgewood Creek has occurred as recently as December 31, 2005 at I-80 and reaches both upstream and downstream of I-80, but no flooding was observed at the SR 12E crossing of Ledgewood Creek.

Pennsylvania Avenue Creek

The Pennsylvania Creek watershed area at SR 12E is approximately 3.2 square miles. Pennsylvania Avenue Creek crosses under SR 12E in a triple cell box culvert. The FEMA FIRMs indicate that the 100-year flow is contained in the culverts located in Pennsylvania Avenue upstream of SR-12, however the same flood maps indicate that the 100-year flooding inundates SR 12E.

The most recent modifications to the FEMA-defined floodplain for Pennsylvania Avenue Creek are shown on FEMA mapping dated May 4, 2009. The reach of the creek that crosses I-80 was studied with detailed methods, and shows the 100-year floodplain as Zone AE to a point just upstream of SR 12E (Figure 3.2.1-7). At this point, the 100-year flood is completely contained in the existing culvert upstream of the highway. However, downstream of SR 12E and immediately upstream, the FEMA maps show a Zone AO (1-foot depth) flooding to the west of Pennsylvania Avenue Creek and Zone AE (elevation ten feet) to the east of the creek. It is not known if these flood depths and elevations are from overflows or mixing of Alonzo Drain, Ledgewood Creek, and/or Pennsylvania Avenue Creek.

Finally, The FEMA profile gives a roadway elevation of 10.1 feet. Current topographic mapping (using the same datum) indicates the roadway is just below elevation 13.0 feet. The current understanding is that the existing triple box culvert is sufficient to carry the 100-year flow. The existing box culvert will be extended as appropriate for the project improvements.

Environmental Consequences

The project alternatives would not involve construction of housing in the local 100-year floodplain. The truck scale facility structures would be elevated above the floodplain. The project alternatives would not result in a significant encroachment on the floodplains, except in the vicinity of Raines Drain (discussed below). The project alternatives are not downstream of any dams or large bodies of water (as it is located approximately 15 miles north of Suisun Bay) and would not pose any risk of flooding hazards as a result of dam failure. Although levees line some of the creeks that cross under the highway, the risk of a levee failure significantly affecting people or structures would be low. The project area is located in an area of relatively flat topography that is not near any large bodies of water. The potential for a seiche, tsunami, or mudflow is low.

The LHS concluded that the project alternatives would not affect the hydraulic capacity or floodplain of American Canyon Creek and Jameson Creek, the existing culvert waterway crossings are intended to be extended in-kind, not replaced. Therefore, these creeks are not discussed further. Table 3.2.1-2 summarizes floodplain impacts by creek.

Table 3.2.1-2. Floodplain Summary Table

Waterway	Within Alternative Limits	Affected by the Project
American Canyon Creek	All	
Jameson Canyon Creek	All	
Green Valley Creek	All	✓
Dan Wilson Creek	B, C, B1	✓
Suisun Creek	B, C	✓
Raines Drain	B, C	✓
Alonzo Drain	All	✓
Ledgewood Creek	All	✓
Pennsylvania Avenue Creek	B, C	✓

Coordination on the existing conditions and the potential project impacts on the existing waterways and floodplains of Suisun Creek and Raines Drain has included specific discussions with Caltrans District 4 Hydraulics office, the County of Solano, the Solano County Water District and the Solano Irrigation District.

Hydraulic Capacity and Floodplain of Green Valley Creek

With the use of levees, the 100-year flow is currently contained within Green Valley Creek. Major reconstruction of this waterway crossing would occur under both alternatives. However, as discussed below, the reconstruction would improve flow characteristics in such a manner that there would be no adverse effect to the 50-year or 100-year hydraulic conditions:

- The five existing waterway bridges would be removed, including the numerous columns and pier walls in the active waterway.

- The new low-elevation bridges (four under Alternative B and three under Alternative C) would be longer than the existing bridges, and would clear-span the waterway above the 100-year water surface elevation.
- The four high-elevation bridges proposed in Alternative B would be constructed with no columns in the active waterway.
- The side slopes and bottom of the existing Green Valley Creek would be restored to a more natural condition than that of the existing waterway.
- There are no planned longitudinal encroachments to the Green Valley Creek floodplain.
- Currently, the 100-year flow is contained within Green Valley Creek and the proposed project would not change these conditions.
- The project will not increase the base floodplain elevation.

Under the No-Build Alternative, no changes would be made to Green Valley Creek or the bridges that cross it, and therefore there would be no change in the hydraulic capacity and floodplain of Green Valley Creek

Hydraulic Capacity and Floodplain of Dan Wilson Creek

Reconstruction of the Dan Wilson Creek waterway crossing would occur under Alternative B, Alternative C, and Alternative B, Phase 1. However, as discussed below, the planned improvements would improve flow characteristics in such a manner that there would be no adverse effect to the 50-year or 100-year hydraulic conditions:

- The existing waterway bridge would be removed, including the numerous columns and pier walls in the active waterway.
- The new bridge would clear-span the waterway, be longer than the existing bridge, and be placed above the 100-year water surface elevation.
- The side slopes and bottom of the existing Dan Wilson Creek would be restored to a more natural condition than the existing waterway.
- There are no planned longitudinal encroachments to the Dan Wilson Creek floodplain.
- The project will not increase the base floodplain elevation.

There would be no changes to the Dan Wilson Creek Crossing under Alternative C, Phase 1 and under the No-Build Alternative and therefore there would be no potential to change the hydraulic capacity or floodplain.

Hydraulic Capacity and Floodplain of Suisun Creek

The 50-year design flood and the 100-year base flood are both contained within Suisun Creek. Reconstruction of the Suisun Creek waterway crossing would occur under both alternatives. However, as discussed below, the planned improvements would improve flow characteristics in such a manner that there would be no adverse effect to the 50-year or 100-year hydraulic conditions:

- The existing highway bridge is three spans wide and 72 feet long (in the direction of traffic). The new Suisun Creek bridge would be significantly longer at 110 feet and would clear-span the creek.
- Additionally, both alternatives include an adjacent bridge that would carry the westbound truck scales on-ramp to I-80.
- The Suisun Creek side slopes and bottom would not be affected by the new Suisun Creek bridges, and there are no planned modifications to Suisun Creek.
- Soffit elevations for all bridges would be placed above the existing FEMA 100-year flow elevation.
- There are no planned longitudinal encroachments to the floodplain.
- The project will not increase the base floodplain elevation.

No changes to Suisun Creek or the creek crossing are proposed under the fundable first phase of either alternative or the No-Build Alternative, and therefore there would be no change in the hydraulic capacity at that location.

Hydraulic Capacity and Floodplain of Raines Drain

The location where Raines Drain crosses the highway is a low point in the highway's vertical profile. Originally constructed for irrigation purposes, Raines Drain also serves as a storm drain. The waterway crossing consists of four culverts ranging in size from 18 inches to 66 inches in diameter. One of the 42-inch culverts is blocked at both the upstream and downstream ends per agreement between the Department and the Solano Irrigation District. At I-80, the lined ditch enters a 66-inch diameter reinforced concrete pipe from the north highway right-of-way, connecting to a 60-inch diameter reinforced concrete pipe that crosses under the freeway mainline. In addition to the main culvert at I-80, there is also a 42-inch culvert constructed in 1986 (more recently blocked to flow), and two additional 42-inch culverts installed in the 1960s. On the southern side of I-80, all the pipes transition back to a trapezoidal concrete-lined channel.

This section of the I-80 has been evaluated for a 50-year event consistent with correspondence from FHWA (see Appendix H). WRECO has prepared a separate report for the Department, District 4, which includes detailed hydrologic and hydraulic calculations for Raines Drain, identifying the manner and frequency of highway overtopping under existing conditions (WRECO 2003). According to the LHS, water would encroach on the traveled way beginning at elevation 33.5 feet, and begin to overtop the highway at the low-point elevation of approximately 34.4 feet. According to the WRECO report, for the 50-year event depths of flow on the roadway were estimated to be a maximum of 1.5 feet in the westbound lanes and about 0.5 foot in the eastbound lanes. The capacity of the existing Raines Drain culverts is 355 cfs with surcharge elevation to the edge of existing pavement, and 470 cfs with surcharge elevation to the overtopping elevation; compared to the 50-year peak flow of 925 cfs. In other words, existing conditions can barely convey half of the 50-year peak flow of 925 cfs. This stated 50-year flood event for Raines Drain includes flood overflows from Suisun Creek in addition to the direct Raines Drain watershed. Even more flows (not identified here) could contribute from the upper Ledgewood Creek.

Under both alternatives, two features of the proposed project could result in impacts on the existing floodplain:

1. The centerline elevation of the reconstructed mainline roadway would be approximately three feet higher than the existing condition. If the freeway elevation were raised without increasing the capacity of the culverts or other mitigation, flood waters would rise to a higher elevation (up to three feet higher) upstream of the freeway before overtopping the roadway resulting in increased ponding elevation upstream. However, if additional culvert capacity were constructed without peak flow mitigation, more frequent and severe flooding might occur downstream because the reduction in peak flow attenuation from the existing upstream ponding.
2. The construction of the relocated westbound truck scales and associated on- and off-ramps will reduce the attenuation potential of the existing upstream condition by filling an area subject to shallow flooding, or ponding upstream of the freeway. Without the existing attenuation potential, peak runoff events may increase downstream of the freeway.

As part of the project, an upstream inlet and underground stable cavities (for stormwater storage) would be constructed beneath the new westbound truck scale facility. This would minimize changes in condition of floodplain of Suisun Creek and Raines Drain as a result of project operation. If possible, construction would occur during the dry season to minimize the effects to water quality and would be completed prior to operation of the proposed project. These structures would allow flooding up to the existing elevation of overtopping without increasing the flow passing under the freeway. Flows in excess of the overtopping event would be captured in a separate inlet structure upstream of the freeway. That inlet structure would mimic the manner and capacity of flows that overtop the existing freeway. These captured excess flows would be conveyed under the freeway and released on the downstream side of the freeway via a lateral structure to redistribute the flows across the existing floodplain. In addition, stable cavities would be created beneath the truck scale that would mitigate the reduction of floodplain storage from the placement of fill material in the floodplain.

Stable cavities are meant to be spaces, vaults or other below ground storage devices for storm runoff intended to mitigate for lost floodplain storage. The cavities will not impact the groundwater because they are intended to be placed at or above the existing ground elevation within the new fill for the westbound truck sales.

Additionally, over-excavation in open areas within the project limits would also create additional storage to offset the additional fill material, ultimately increasing the size of the floodplain and minimizing the effect of the proposed project on the floodplain.

Construction of upstream inlet structures, new highway cross culverts, an outlet structure, and stable cavities would ensure that this effect would not be adverse. Both alternatives would not increase the 50-year floodplain elevation.

No changes to Raines Drain are proposed under the fundable first phase of either alternative or the No-Build Alternative, and therefore, there would be no change in the hydraulic capacity at that location.

Hydraulic Capacity and Floodplain of Alonzo Drain and Ledgewood Creek

The LHS concluded that the project alternatives would not affect the Alonzo Drain or Ledgewood Creek floodplain for the following reasons:

- The improvements across SR 12E include minor widening.
- The multi-cell box culvert at Beck Avenue would be replaced with a significantly elevated clear span structure, improving the hydraulics at that crossing.
- The existing floodplain is completely contained in the existing RCB under SR 12E.
- The existing RCB at Alonzo Drain would be lengthened 30 feet in both the upstream and downstream directions under Alternative B, Alternative B, Phase 1, and Alternative C. Under Alternative C, Phase 1, the RCB would be lengthened 30 feet in the downstream direction only.
- Between the SR 12E crossing and the Beck Avenue Crossing there would be a slight encroachment to the left channel bank with the construction of the Beck Avenue off ramp. This is a man-made reach of Alonzo Drain that is sized to allow the existing earth-side slope to be modified to a vertical embankment or retaining wall. This would be an insignificant impact on the very wide trapezoidal channel.
- As with the removal of the RCB at Beck Avenue, the existing waterway would be returned to a more natural state.
- Improvements to the Ledgewood Creek crossing on SR 12E include minor widening on both the upstream and downstream ends for Alternative B, Alternative B, Phase 1, and Alternative C; and only downstream widening for Alternative C, Phase 1.
- The existing RCB on Ledgewood Creek would be lengthened 15 feet in both the upstream and downstream directions under Alternative B and 45 feet in both directions under Alternative C.
- Over Ledgewood Creek, Alternative B has two additional bridges for collector roads, one immediately upstream and one immediately downstream of the widened mainline. The upstream bridge would be a three-span bridge 244 feet long, significantly longer than the existing 85-foot bridge. The downstream bridge would be two-span bridge 164 feet long, also significantly longer than the existing 85-foot bridge.
- There are no planned modifications to Ledgewood Creek except for the RCB extension.
- The project will not increase the base floodplain elevation to either Alonzo or Ledgewood creeks.

No changes to Alonzo Drain and Ledgewood Creek are proposed under the No-Build Alternative, and therefore, there would be no change in the hydraulic capacity and floodplain at that location.

Hydraulic Capacity and Floodplain of Pennsylvania Avenue Creek

The LHS concluded that the project alternatives would not affect the Pennsylvania Avenue Creek hydraulic capacity and floodplain under either Alternative B or Alternative C for the following reasons:

- The 100-year floodplain AE Zone is completely contained in the existing triple cell box culverts located in Pennsylvania Avenue just upstream of SR 12E. The 100-year elevation at the upstream side of SR 12 is 11 feet, and ten feet at downstream side. Though the FEMA maps indicate overtopping flooding of the culverts crossing SR-12, it is understood that the current condition of this crossing is that the existing triple box culvert is sufficient to convey the 100-year flood under the freeway.
- Immediately east of the Pennsylvania Avenue Creek crossing of SR-12 are ten small diameter culverts that drain a small isolated area across the freeway. These several culverts will be extended to match the highway improvements.
- For Alternative B, the cross culvert under SR 12E would be extended. A new culvert would be added under the proposed Meyer Way Extension.
- For Alternative C, the cross culvert under SR 12E would be extended upstream (with a possible gap within the loop ramp), connecting to the existing culvert in Pennsylvania Avenue, and extended downstream to clear the mainline widening. A new culvert would be added under the proposed connector street.
- There are no planned modifications to the natural portions of Pennsylvania Avenue Creek except for the new and extended culvert.
- There are no planned longitudinal encroachments to the floodplain.
- The project will not increase the base floodplain elevation.

No construction is proposed in this area under the fundable first phase of either alternative or under the No-Build Alternative and therefore, there would be no change in the hydraulic capacity at this location.

Avoidance, Minimization, and/or Mitigation Measures

The project will not result in adverse effects to hydrology or floodplain and therefore, no avoidance, minimization, or mitigation measures are necessary.

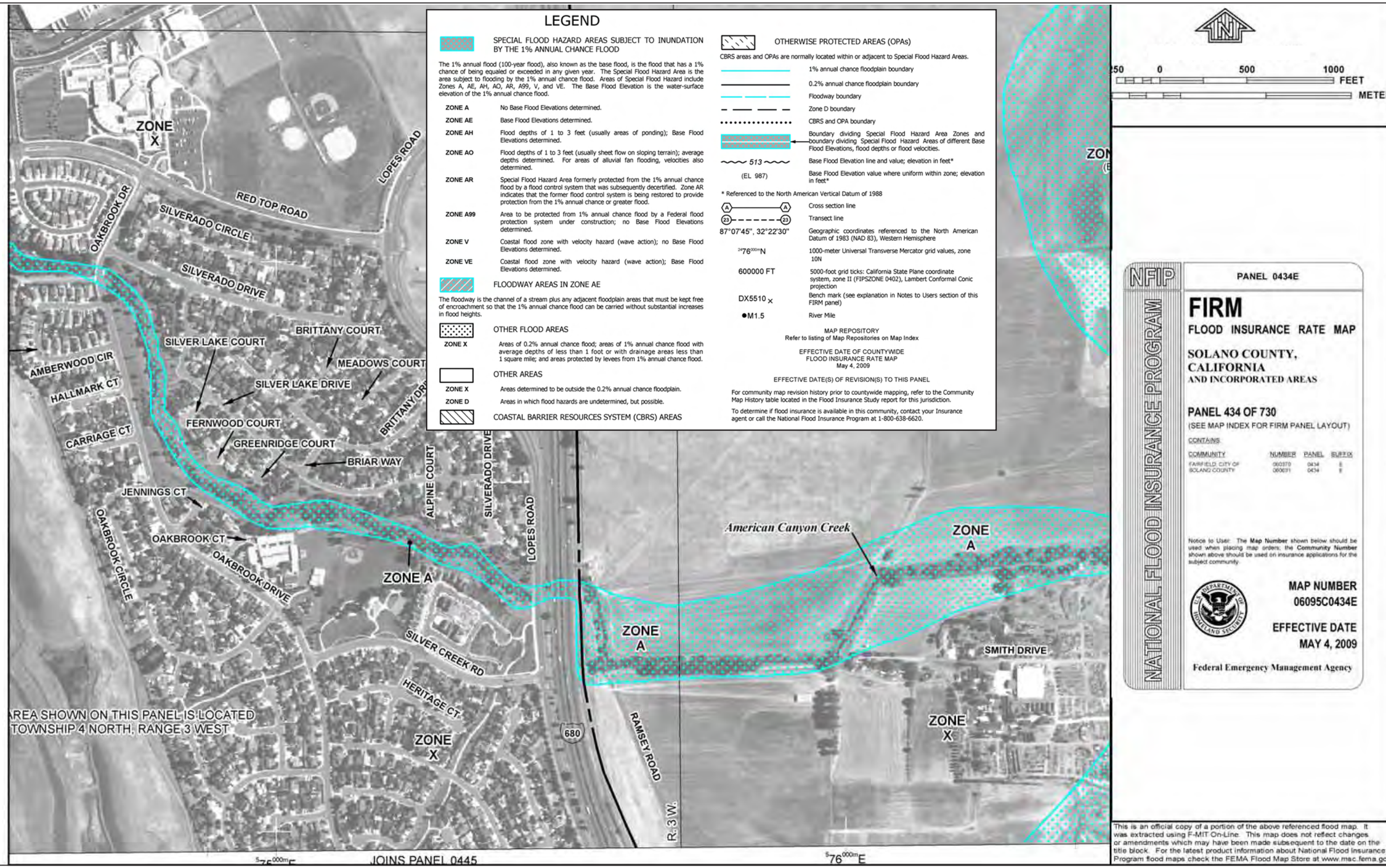

Figure 3.2.1-1
100-Year Floodplains

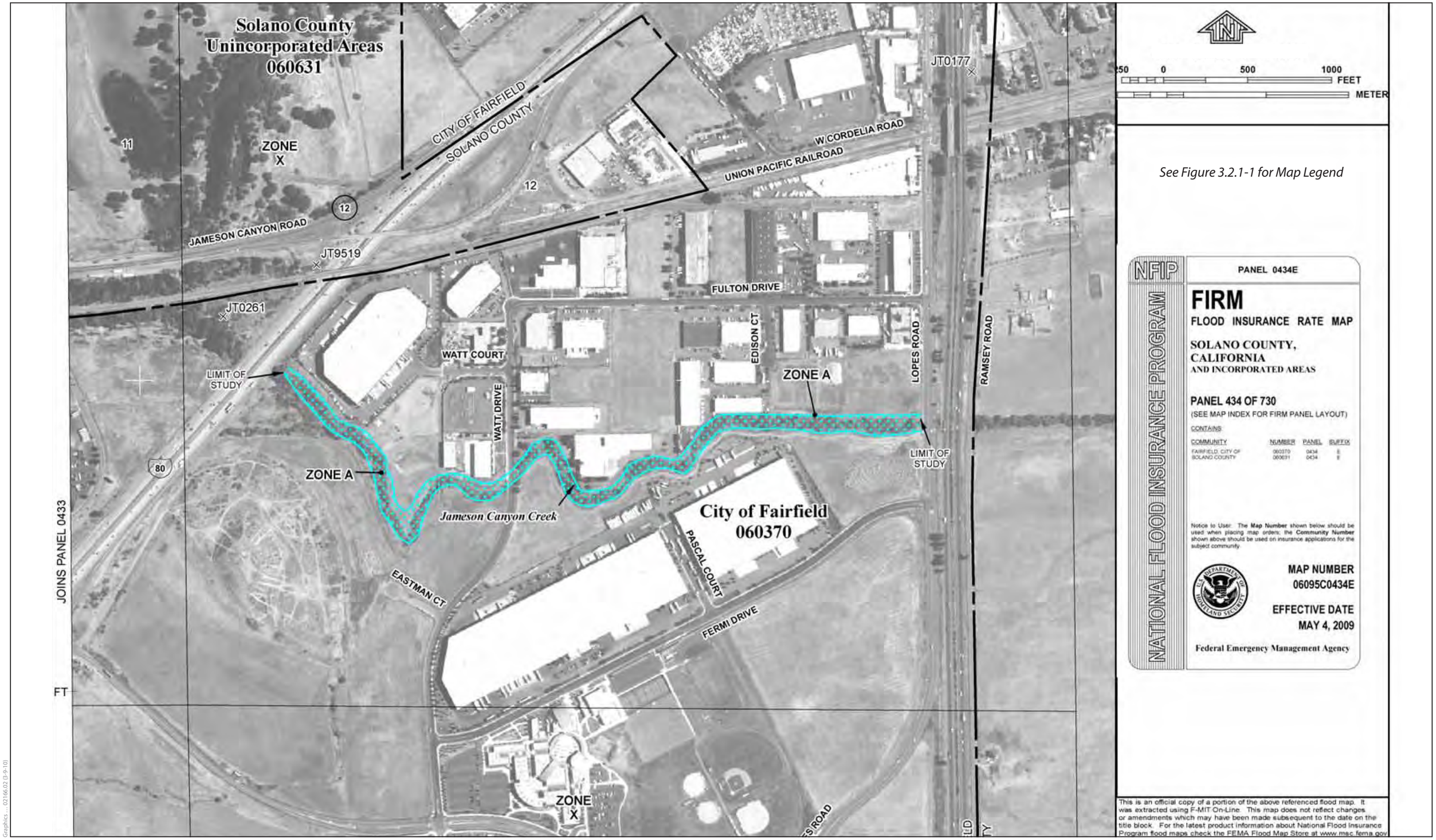

Figure 3.2.1-2
100-Year Floodplains

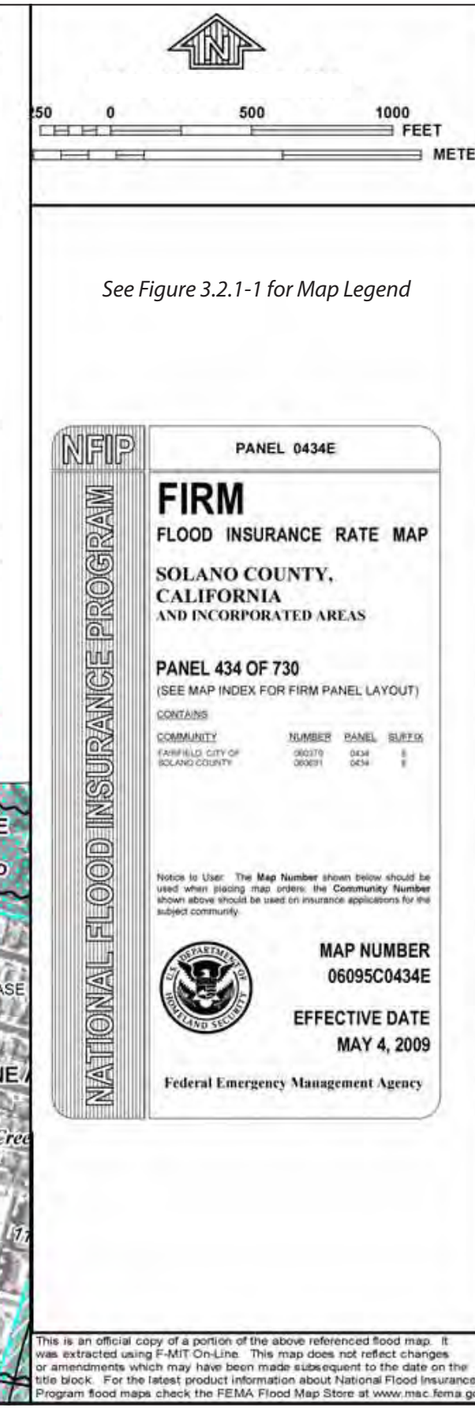

Figure 3.2.1-3
100-Year Floodplains

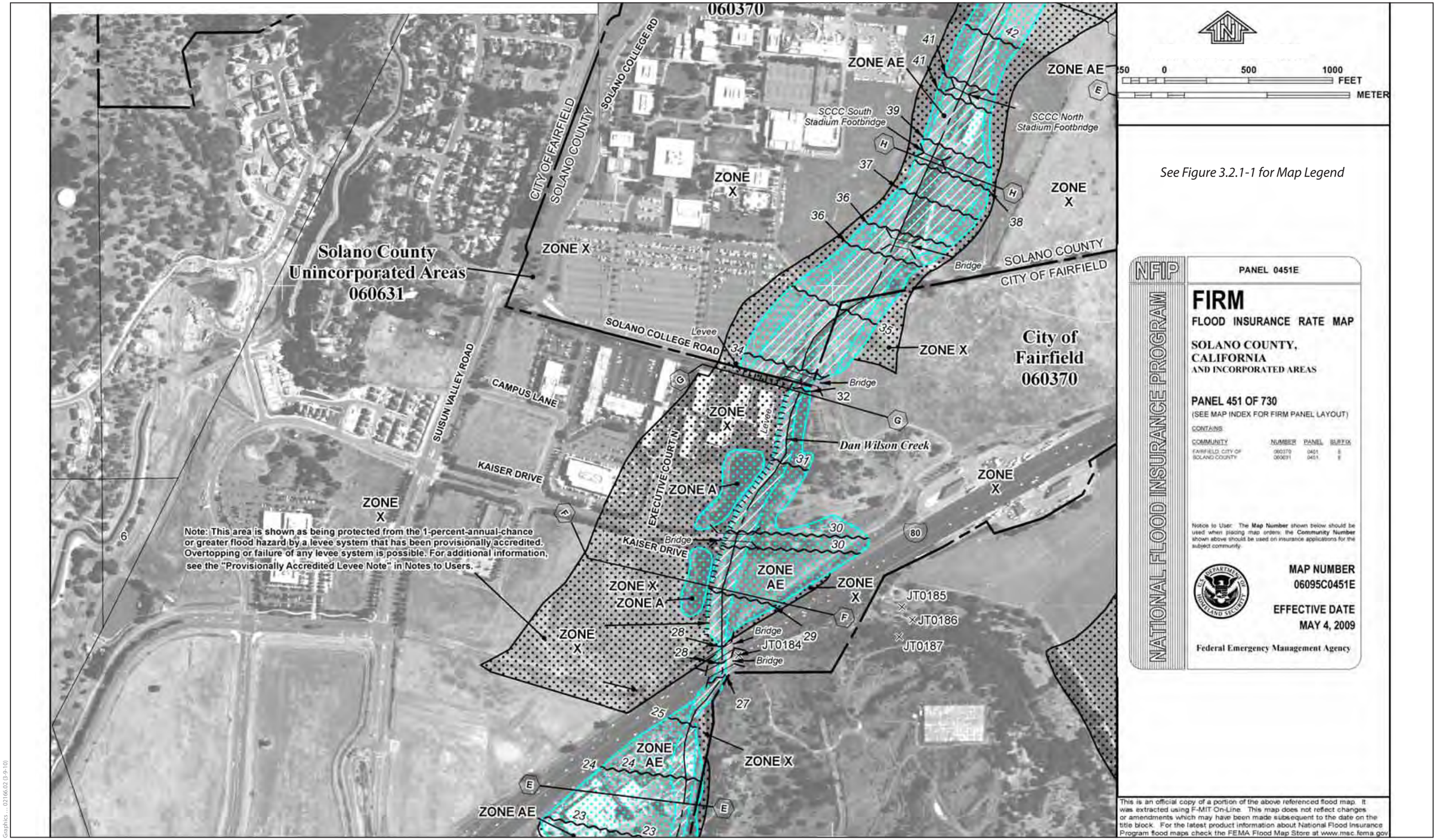

Figure 3.2.1-4
100-Year Floodplains

Figure 3.2.1-5
100-Year Floodplains

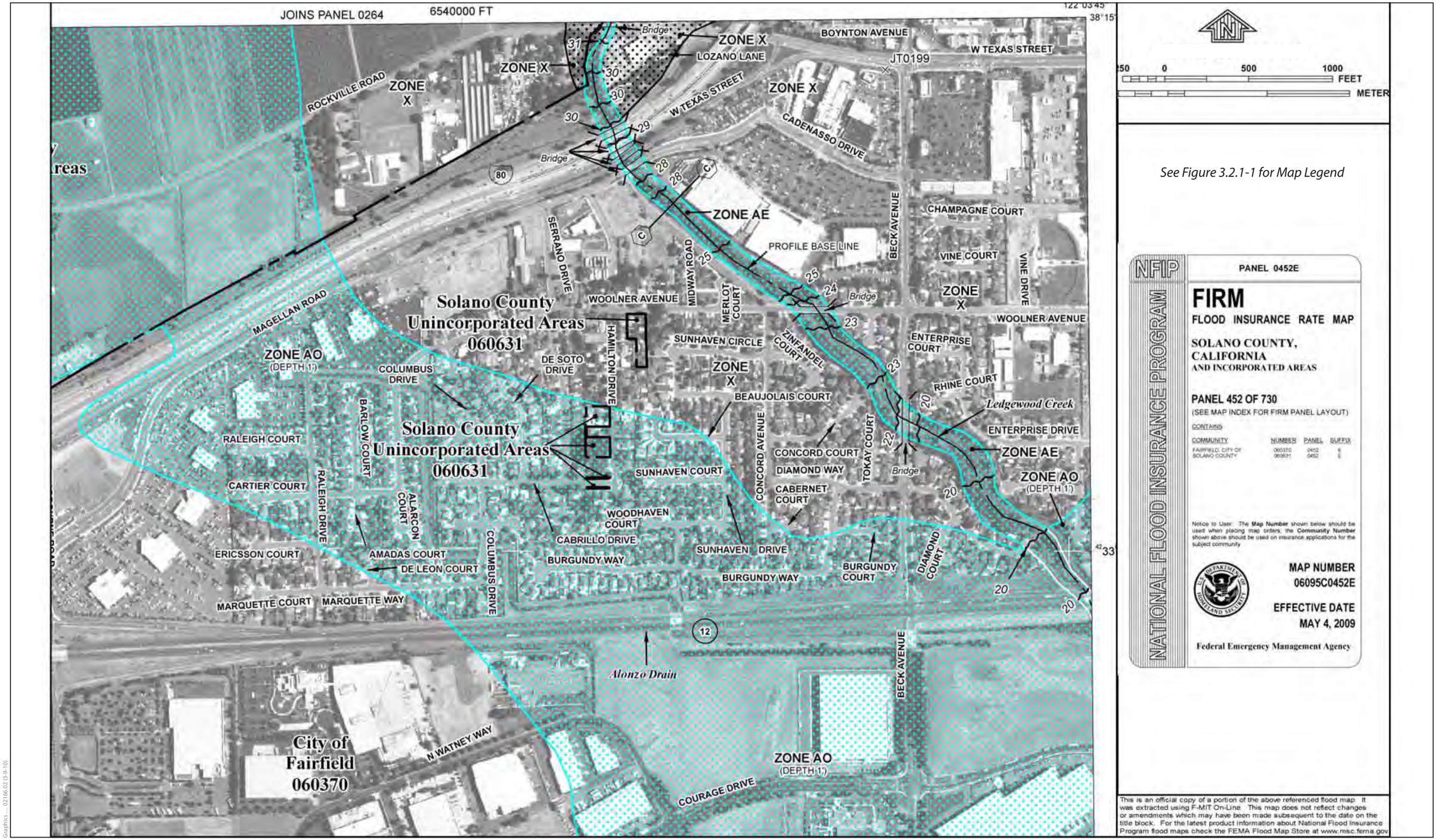

Figure 3.2.1-6
100-Year Floodplains

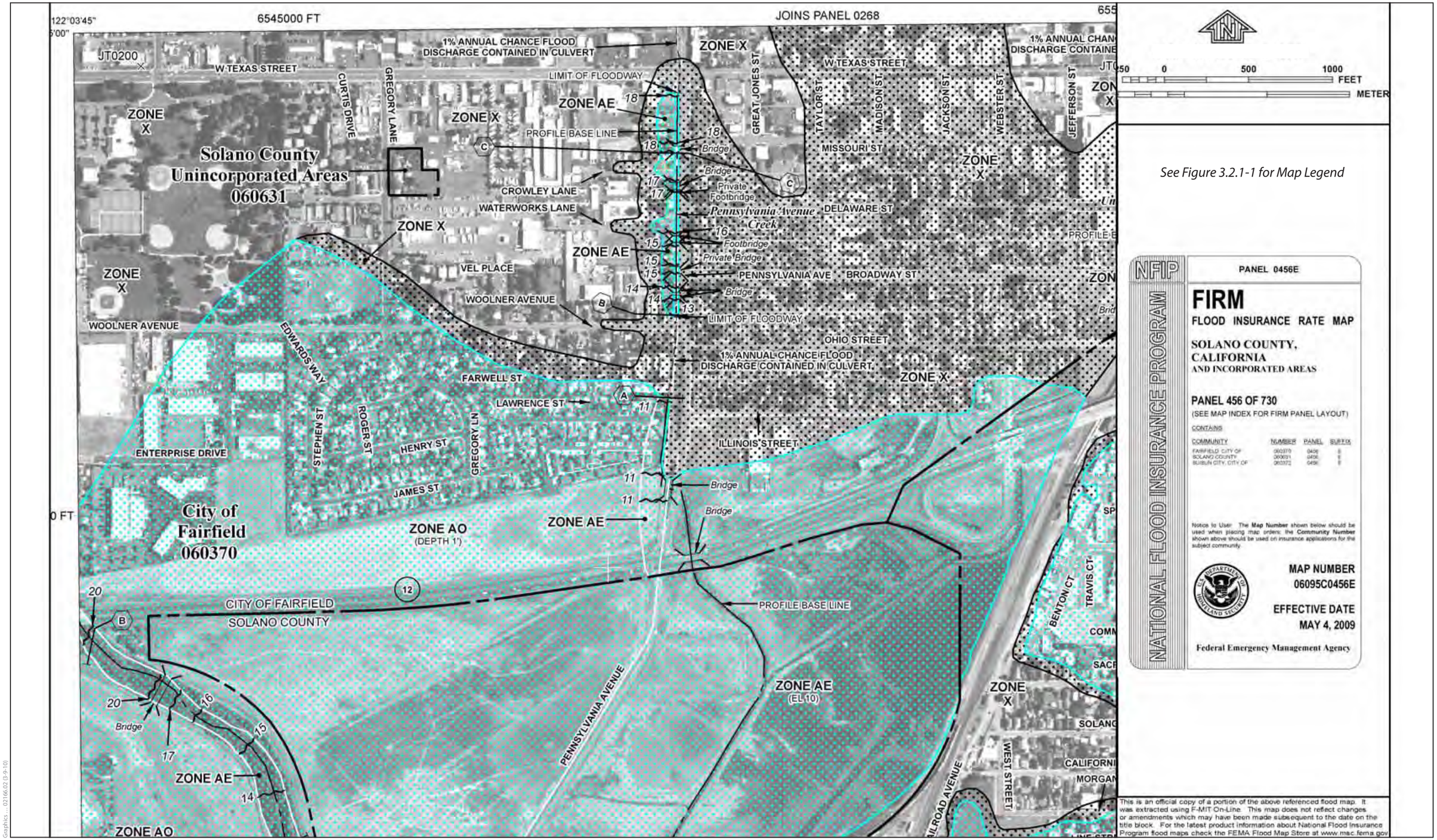

Figure 3.2.1-7
100-Year Floodplains