

PHYSICAL ENVIRONMENT

2.8 Hydrology and Floodplains

2.8.1 Regulatory Setting

Executive Order (EO) 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 (FHWA) requirements for compliance are outlined in 23 Code of Federal Regulations (CFR) 650 Subpart A.

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.”

2.8.2 Affected Environment

This section is based on the *Location Hydraulic Study* (March 2023), *Drainage Report* (March 2023), and *Water Quality Assessment Report* (April 2023) prepared for the proposed Project.

2.8.2.1 Regional Hydrology

The Study Area is located within the watersheds listed in Table 2.8.1.

Drainage channels in the Study Area, from north to south, include Coyote Creek, Fullerton Creek, Carbon Creek, and Santiago Creek. All these channels eventually drain to the Pacific Ocean.

Table 2.8.1: Receiving Water Bodies

	Sub-Watershed	Watershed	Hydrologic Unit Code	Cal Water Watershed	Receiving Watershed
W-1	La Mirada Creek	Lower San Gabriel River	180701060502	405.15	Coyote Creek and San Gabriel River Estuary
W-2	Brea Creek-Coyote Creek	Lower San Gabriel River	180701060503	405.15	Coyote Creek and San Gabriel River Estuary
W-3	Fullerton Creek	Lower San Gabriel River	180701060504	845.61	Coyote Creek and San Gabriel River Estuary
W-4	Carbon Creek	Lower San Gabriel River	180701060505	801.11	Coyote Creek and San Gabriel River Estuary
W-5	Bolsa Chica Channel-Frontal Huntington Harbour	Bolsa Chica Channel-Frontal Huntington Harbour	180702010000	801.11	Bolsa Chica Channel
					Bolsa Chica Ecological Reserve
					Bolsa Bay Marsh
					Huntington Harbour
					Anaheim Bay
W-6	Walnut Canyon-Santa Ana River	Lower Santa Ana River	180702031002	801.11	Lower Santa Ana River
W-7	Lower Santiago Creek	Santiago Creek	180702030902	801.11	Lower Santa Ana River
W-8	Lower San Diego Creek	San Diego Creek	180702040103	801.11	San Diego Creek Reach 1, Newport Bay, Upper (Ecological Reserve), and Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings)
W-9	Peters Canyon Wash	San Diego Creek	180702040101	801.11	San Diego Creek Reach 1, Newport Bay, Upper (Ecological Reserve), and Newport Bay, Lower (entire lower bay, including Rhine Channel, Turning Basin and South Lido Channel to east end of H-J Moorings)

Cal Water = California Water Service

2.8.2.2 100-Year Floodplains

There are several 100-year floodplains within the Study Area. Coyote Creek, Fullerton Creek, Carbon Creek, Santa Ana River, and Santiago Creek are the five major flood control facilities that cross Interstate (I) 5 within the proposed Project limits. The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) are included in Appendix I (December 3, 2009). The floodplains are described in further detail below.

Coyote Creek Channel

The existing I-5 bridge over Coyote Creek (53-0279) is a reinforced concrete bridge with tee beam span design. The total length of the bridge is 90 feet, and the deck width is 11 feet. It is located on I-5 at Post Mile (PM) 0.34 in the city of La Mirada in Los Angeles County and bridges Coyote Creek (A01). The bridge was built in 1934 and reconstructed in 1959 and carries six lanes of traffic.

A review of the FEMA maps (FIRMs) for Los Angeles County indicates the I-5 bridge over Coyote Creek is within FEMA FIRM Panel 06059C0019J. The bridge area is identified as Zone X, areas of the 0.2 percent annual chance floodplain, based on the *Flood Insurance Study for the Orange County, California* (FIS; Volume 2 of 3, March 2019). There are no physical improvements proposed at this location; therefore, the Project will not result in any floodplain encroachments. The FIS data for Coyote Creek Channel at the location of the I-5 bridge are summarized in Table 2.8.2.

Table 2.8.2: FEMA Flood Insurance Study Flow Rate Summary Table—Coyote Creek Channel

Location	Tributary Area (sq mi)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q500 (cfs)
Approximately 2,400 feet downstream of Beach Boulevard	11.7	3,000	6,300	8,100	17,000

cfs = cubic feet per second
FEMA = Federal Emergency Management Agency
sq mi = square miles

Fullerton Creek Channel

The existing I-5 bridge over Fullerton Creek (55-0087) is a concrete slab that consists of three spans. The bridge length is 76.0 feet, and it is 95 feet wide. It is located on I-5 at PM 42.96 in the city of Buena Park in Orange County and bridges Fullerton Creek 2.7 miles upstream of its confluence with Coyote Creek. The bridge was built in 1957 and reconstructed in 2001. The bridge carries 12 mainline lanes and two off-ramp lanes.

Fullerton Creek was modified in 1998 to create a stable subcritical flow throughout the channel. The modified channel at the location of the I-5 bridge (Bridge # 55-0087) is a rectangular channel with a capacity of 6,576 cubic feet per second (cfs), a bottom width of 37.5 feet, and a longitudinal slope of 0.00641. Water Surface

Elevation (WSE) at the location of this bridge is at 76.0 feet on the upstream side and 74.5 feet on the downstream side.

In the segment of Fullerton Creek Channel within the city of Buena Park, the Santa Ana Freeway-Union Pacific Railroad (UPRR) crossing is a severe obstruction of flow causing a backwater situation that results in local shallow flooding.

The I-5 bridge over Fullerton Creek is within FEMA FIRM Panel 06059C0126J. The Project limits within the tributary area to Fullerton Creek are identified as Zone X, except for a portion upstream of the bridge, which are identified as Zone AH. The areas of 1 percent annual chance flood with flood depths of 1 to 3 feet with base flood elevation of 82 feet (NAVD 88) are shown on said FIRM map. The proposed improvements over the above waterway consist of restriping of the freeway to add managed lanes (MLs) without any bridge widenings; therefore, the Project will not result in any floodplain encroachments. The FIS data for Fullerton Creek Channel at the location of the I-5 bridge are summarized in Table 2.8.3.

**Table 2.8.3: FEMA Flood Insurance Study Flow Rate Summary Table—
Fullerton Creek Channel**

Location	Tributary Area (sq mi)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q500 (cfs)
At Dale Avenue	16.8	1,300	3,300	5,300	11,800
At confluence of Houston Channel	14.8	1,250	3,250	5,750	10,150

cfs = cubic feet per second
FEMA = Federal Emergency Management Agency
sq mi = square miles

Carbon Creek Channel

The existing I-5 bridge over Carbon Creek (55-0910) is a reinforced concrete box culvert with two main spans at 16 feet each. The width of the bridge along the creek is approximately 200 feet. It is located under I-5 at PM 40.20 in the city of Anaheim in Orange County and bridges Carbon Creek (B01) 7.4 miles upstream of its confluence with Coyote Creek (A01). The bridge was built in 2002 and carries 12 lanes of traffic.

Upstream and downstream of the I-5 bridge, the creek is an earthen trapezoidal channel with a base width of 23 feet and a height of 8 feet and is owned by the Orange County Flood Control District (OCFCD). Initially, the culvert was designed

as a series of 15–48" reinforced concrete pipe culverts, and in 1997, it was redesigned as a double 16' x 12'-6" reinforced concrete box culvert.

A review of the FEMA FIRM maps for Orange County indicates that the I-5 bridge over Carbon Creek is within FEMA FIRM Panel 06059C0129J. The bridge area is identified as Zone A on the downstream side of the creek and Zone AH with an elevation of 88 feet on the upstream side. The 100-year floodplain extends to the southwestern corner of the bridge covering the Crescent Retarding Basin (B01B02), which is owned by OCFCD. The proposed improvements over the above waterway consist of re-striping of the freeway to add MLs without any bridge widenings; therefore, the Project will not result in any floodplain encroachments. The FIS data for Carbon Creek Channel at the location of the I-5 bridge are summarized in Table 2.8.4.

**Table 2.8.4: FEMA Flood Insurance Study Flow Rate Summary Table—
Carbon Creek Channel**

Location	Tributary Area (sq mi)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q500 (cfs)
At Southern Pacific Railroad	15.1	1,600	2,400	4,200	15,000
At Knott Avenue	13.8	1,400	2,100	3,800	14,000

cfs = cubic feet per second

sq mi = square miles

FEMA = Federal Emergency Management Agency

Santa Ana River

The existing I-5 bridge over the Santa Ana River (55-0811) is a reinforced concrete bridge with a stringer/multi-beam span with five main spans, a deck width of 270 feet, and bridge length of 502 feet. It is located on I-5 at PM 34.47 in the city of Santa Ana in Orange County and bridges the Santa Ana River 12 miles upstream of its outfall to the Pacific Ocean. The bridge was built in 1999 and carries 14 lanes of traffic.

At the location of the bridge, the creek is an earthen trapezoidal channel with a base width of 260 feet and a height of 12.5 feet and is owned by OCFCD.

A review of the FEMA maps (FIRMs) for Orange County indicates that the I-5 Bridge over the Santa Ana River is within FEMA FIRM Panel 06059C0142J. The bridge area is identified as Zone A. The area is protected from the 1-percent annual chance or greater flood hazard by a levee system. The proposed improvements over the above waterway consist of restriping of the freeway to add MLs without any bridge widenings. Therefore, the Project will not result in any floodplain

encroachments. The FIS data for Santa Ana River at the location of the I-5 bridge are summarized in Table 2.8.5.

**Table 2.8.5: FEMA Flood Insurance Study Flow Rate Summary Table—
Santa Ana River**

Location	Tributary Area (sq mi)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q500 (cfs)
At Katella Avenue in Orange	2,346	-	-	50,000	-
At Imperial Highway in Anaheim	2,306	-	-	50,000	-

cfs = cubic feet per second

sq mi = square miles

FEMA = Federal Emergency Management Agency

Santiago Creek Channel

The existing I-5 bridge over Santiago Creek (55-1046) is a pre-stressed concrete bridge with a box beam span with four main spans at 82 feet each, a deck width of 300 feet (130 feet for I-5 northbound and 170 feet for I-5 southbound), and a total length of 165 feet. It is located on I-5 at PM 33.39 in the city of Santa Ana in Orange County and bridges Santiago Creek 1.5 miles upstream of its confluence with the Santa Ana River. The bridge was built in 1996 and carries 18 lanes of traffic.

At the location of the bridge, the creek is an earthen trapezoidal channel with a base width of 32 feet and a height of 12 feet and is owned by OCFCD.

A review of the FEMA maps (FIRMs) for Orange County indicates that the I-5 bridge over Santa Ana River is within FEMA FIRM Panel 06059C0163J. The bridge area is identified as Zone AE with a 100-year base flood of 144 feet. The proposed improvements over the above waterway consist of restriping of the freeway to add MLs without any bridge widenings. Therefore, the Project will not result in any floodplain encroachments. The FIS data for Santiago Creek Channel at the location of the I-5 bridge are summarized in Table 2.8.6.

**Table 2.8.6: FEMA Flood Insurance Study Flow Rate Summary Table—
Santiago Creek Channel**

Location	Tributary Area (sq mi)	Q10 (cfs)	Q50 (cfs)	Q100 (cfs)	Q500 (cfs)
At Santa Ana River	102	1,500	4,000	12,000	27,000
At Atchison Topeka and Santa Fe Railway	96	1,500	4,000	12,000	27,000

cfs = cubic feet per second

sq mi = square miles

FEMA = Federal Emergency Management Agency

2.8.2.3 Natural and Beneficial Floodplain Values

Floodplains in their natural or relatively undisturbed state provide natural and beneficial floodplain values including, but not limited to, fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge. The values fall into three main categories: water resource values (e.g., natural moderation of floods, water quality maintenance, and groundwater recharge), living resource values (e.g., fish, wildlife, and plant species), and cultural resource values (e.g., open space, archaeological, historical natural beauty, scientific study, outdoor education, and recreation).

Beneficial uses of surface waters are identified in the *Water Quality Control Plan for the Santa Ana River Basin* (Santa Ana RWQCB 1995) as various ways that water can be used for the benefit of people and/or wildlife. The designated beneficial uses for direct receiving water resources within the Project Area are presented in Table 2.8.7, below.

Table 2.8.7: Beneficial Uses for Direct Receiving Waters

Inland Surface Stream	MUN	GWR	IND	PROC	AGR	REC1	REC2	WARM	RARE	WILD
Coyote Creek (Above La Canada Verde Creek)	•*		•	•				•	•	•
Carbon Creek	•	•				•	•	•	•	•
Fullerton Creek	No designated beneficial uses per Santa Ana Region Basin Plan updated February 2016									
Santa Ana River, Reach 1	+					•	•**			
Santa Ana River, Reach 2	+	•			•	•	•	•	•	•
Santiago Creek, Reach 1	•	•				•	•			•

• = Existing or Potential Beneficial Use

| = Intermittent Beneficial Use

+ = Excepted from Municipal and Domestic Supply

* = Designated under SB 88-63 and RB 89-03. May be considered for exemption at a later date.

** = Access prohibited in all or part per agency with jurisdiction

Beneficial Use Definitions: MUN (Municipal and Domestic Supply); AGR (Agricultural Supply); GWR (Groundwater Recharge); IND (Industrial Service Supply); PROC (Industrial Process Supply); RARE (Rare, Threatened or Endangered Species); REC1 (Water Contact Recreation); REC2 (Non-Contact Water Recreation); WARM (Warm Freshwater Habitat); WILD (Wildlife Habitat).

2.8.3 Environmental Consequences

A discussion of the temporary and permanent impacts associated with Alternative 2, Alternative 3, Alternative 4, and the No Build Alternative is included below.

2.8.3.1 Temporary Impacts

Build Alternatives

Alternative 2

Alternative 2 only consists of sign replacement and pavement delineation that will also be implemented to meet the latest California Manual on Uniform Traffic Control Devices (CA MUTCD) standards.

Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 2 and would be constructed within the existing freeway right-of-way (ROW) (refer to the *Park and Ride Study* [2023] prepared for this Project). Construction activities would include clearing and grubbing, grading, and excavation. During construction, soil would be exposed, and there would be a potential for soil erosion compared to existing conditions. Additionally, during a storm event, soil erosion could occur at an accelerated rate. During pavement delineation, there is a potential for construction-related pollutants to be spilled or leaked or to be transported via storm runoff into drainages adjacent to the Project Area and into downstream receiving waters. However, construction activities for Alternative 2 would disturb a total of 2.60 acres of surface area; therefore, under the Construction General Permit, this Build Alternative would be required to prepare a Stormwater Pollution Prevention Plan (SWPPP) and implement construction Best Management Practices (BMPs) aimed at reducing pollutants of concern in stormwater runoff. The construction BMPs would include Erosion Control, Sediment Control, and Good Housekeeping BMPs designed to minimize erosion, retain sediment on site, and prevent spills.

There are no construction activities in the channels crossing the Project, therefore there is no impact to the beneficial floodplain values.

Alternative 3

Alternative 3 would convert the existing high-occupancy vehicle (HOV) lane to an Express Lane (EL) in each direction between Red Hill Avenue and State Route (SR) 55; convert two existing HOV lanes to ELs in each direction between SR-55 and SR-57; and convert the existing HOV lane to an EL in each direction from SR-57 to the Orange/Los Angeles County line. This Build Alternative would shift some

existing ramps to accommodate outside widening. Alternative 3 would impact one existing retaining wall to accommodate widening the mainline to avoid ROW acquisition. The affected retaining wall structure is located along southbound I-5, north of E. 17th Street. Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 3 and would be constructed within the existing freeway ROW. Sign replacement and pavement delineation would also be implemented to meet the latest CA MUTCD standards.

Alternative 3 would result in similar impacts to water quality as those discussed above for Alternative 2 because both Build Alternatives include similar construction activities, such as clearing and grubbing, grading, excavation, paving, and sealing. The extension of the soundwall under Alternative 3 may include driving sheet piles for foundation support and shoring operations. During construction of the soundwall extension, without proper control and use of equipment, materials, and waste products from pile driving operations, there is a potential for the discharge of pollutants to the storm drain system and receiving waters. However, Alternative 3 would disturb a total area of 9.03 acres; therefore, under the Construction General Permit, Alternative 3 would also be required to prepare a SWPPP aimed at reducing pollutants of concern in stormwater runoff. The processing of developing and implementing a SWPPP for the proposed Project is discussed in greater detail within Section 2.9 – Water Quality..

There are no proposed construction activities in the drainage channels under Alternative 3; therefore, there will be no temporary construction impacts related to grading activities, road-widening improvements, realignments of on-/off-ramps, and construction of retaining walls that could result in the introduction of pollutants of concern to floodplain areas within the Study Area.

Alternative 4

Alternative 4 would convert the existing HOV lane to an EL in each direction between Red Hill Avenue and SR-55; convert two existing HOV lanes to ELs in each direction between SR-55 and SR-57; convert the existing HOV lane to an EL in each direction from SR-57 to the Orange/Los Angeles County line; and construct an additional EL in each direction between SR-57 and SR-91. This alternative would shift some existing ramps to accommodate outside widening. Alternative 4 would impact existing retaining walls and one existing soundwall and would create a new retaining wall. Retaining walls would be provided, where required, to minimize and avoid ROW acquisition. Additionally, two proposed park-and-ride facilities are being evaluated as part of Alternative 4 and would be constructed within the existing

freeway ROW. Sign replacement and pavement delineation would also be implemented to meet the latest CA MUTCD standards.

Alternative 4 would result in similar impacts to water quality as those discussed above for Alternative 3. However, during construction, Alternative 4 would disturb a total of 24.61 acres of surface area; therefore, under the Construction General Permit, Alternative 4 would also be required to prepare a SWPPP aimed at reducing pollutants of concern in stormwater runoff. The processing of developing and implementing a SWPPP for the proposed Project is discussed in greater detail within Section 2.9 – Water Quality..

There are no proposed construction activities in the drainage channels under Alternative 4; therefore, there will be no temporary construction impacts related to grading activities, road-widening improvements, realignments of on-/off-ramps and construction of retaining walls that could result in the introduction of pollutants of concern to floodplain areas within the Study Area.

No Build Alternative (Alternative 1)

The No Build Alternative would not include the construction of any of the proposed Project improvements. Therefore, the No Build Alternative would not result in temporary impacts to hydrology and floodplains in the Study Area.

2.8.3.2 Permanent Impacts

Build Alternatives (Alternatives 2, 3, and 4)

Hydraulic Analysis

The proposed improvements over the waterways along the Project limits do not include any widening; therefore, the Project will not result in any hydraulic impacts or change in water surface elevations for any of the three Build Alternatives. The Project would not create an adverse effect on channel hydraulics, and no mitigation would be needed to reduce effects.

100-Year Floodplain Encroachment

Potential Risk from Longitudinal Encroachment

Encroachments, as defined by FEMA, are activities or construction within the floodway, including fill, new construction, substantial improvements, and other development. A longitudinal encroachment is an encroachment that is oriented parallel to the direction of flow. A transverse encroachment is an encroachment that is perpendicular or skewed to the direction of flow. The bridges do not

traverse over the channels parallel to the flow; therefore, there are no longitudinal encroachments.

Potential Risk to Life and Property

The Build Alternatives do not propose any improvements that would change channel hydraulics or increase risk of flooding and inundation to residences, businesses, or other buildings. Water surface elevation would not change, and waters would remain within their respective channels. Additionally, the Build Alternatives would not alter existing flood sources and would not result in traffic disruptions during flood conditions. Therefore, there would be no potential risk to life and property created by the Build Alternatives.

Potential Risk to Natural and Beneficial Floodplain Values

Channel conveyance is unchanged for all channels within the Project boundaries; therefore, any downstream beneficial uses or floodplain values, including groundwater recharge and wildlife, will still be served with implementation of the Build Alternatives.

During operation of the Build Alternatives, a substantial increase in pollutant load is not expected to occur, and BMPs would be included in the Project to capture and treat stormwater runoff before it reaches drainages. Therefore, no operational impacts to channel areas are expected.

Potential Risk for Support of Incompatible Floodplain Development

The areas surrounding the Build Alternatives are fully developed. Because the Build Alternatives would not result in additional development in floodplain areas or extend development into new floodplains, the Build Alternatives would not support incompatible floodplain development.

Significant Encroachment

“Significant encroachment,” as defined at 23 CFR 650.105, is a highway encroachment that would result in:

- A significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community’s only evacuation route
- A significant risk (to life or property)
- A significant adverse impact on natural and beneficial floodplain values

The Build Alternatives do not require the extension of existing bridge structures within the 100-year floodplains. The Build Alternatives would not result in a change in the 100-year floodplain elevations. The 100-year flood flows would continue to be carried within these channels. The proposed improvements would not result in any adverse impacts on the natural and beneficial floodplain values, would not result in a change in flood risks or damage, and do not have potential for interruption or termination of emergency services or emergency routes. Therefore, the Build Alternatives do not constitute a significant floodplain encroachment as defined in 23 CFR 650.105(q).

Overall Assessment of Risk

As described above, the Build Alternatives would not pose any appreciable risk related to traffic disruption, loss of life and property, or natural or beneficial floodplain values. There are no proposed modifications to floodplain crossings. Additionally, effects on riparian and wetland areas would be minor. In summary, the combined assessed level of risk associated with risks to life and property, risks to natural and beneficial floodplain values, and risks of probable incompatible floodplain development is minimal as defined in 23 CFR 650 Subpart A.

No Build Alternative (Alternative 1)

The No Build Alternative would not result in the construction and operation of the improvements under the Build Alternatives and, therefore, would not result in adverse permanent impacts to hydrology and floodplains in the Study Area.

2.8.4 Avoidance, Minimization, and/or Mitigation Measures

There are no avoidance, minimization, and/or mitigation measures or Standard Project Features associated with Hydrology that are anticipated to be included as part of the proposed Project.