

3.2 Physical Environment

3.2.1 Hydrology and Floodplains

This section describes the regulatory setting associated with hydrology and floodplains, the affected environment, the environmental consequences on hydrology and floodplains that would result from the project, and the minimization and/or mitigation measures that would reduce any potential impact.

3.2.1.1 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 FHWA requirements for compliance are outlined in 23 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 1 percent chance of being exceeded in any given year.” An encroachment is defined as “an action within the limits of the base floodplain.”

3.2.1.2 Affected Environment

This section is based upon the Location Hydraulic Study (LHS) (December 2010), the Preliminary Drainage Report (November 2011), and the Floodplain Evaluation Report (December 2010). These studies provide hydraulic information for Reach 1 of the Santa Ana River and the channels and drains identified in Table 3.2.1-1.

The study area includes the construction footprint, as described in Section 1.1, Introduction, and the FEMA-designated flood hazard areas located within the proposed project’s physical ground-disturbance footprint, as well as any areas where flood frequency, extent, and duration could be affected by the project. The proposed project traverses two hydrologic subareas (HSAs) (i.e., the

East Coastal Plain [HSA 801.11] and the Anaheim Split [HSA 845.61]), which are described in Section 3.2.2, Water Quality and Stormwater Runoff. In accordance with the FEMA Flood Insurance Rate Maps (FIRMs) (see Appendix Q), Reach 1 of the Santa Ana River, along with channels and drains within the proposed project limits, have been designated as flood hazard areas of varying degrees. These flood hazards are described below.

Table 3.2.1-1: Flood Hazard Areas within the I-405 Improvement Project Corridor

Channel Name	FEMA Flood Hazard Designation (Zone)¹
Delhi Storm Drain	A
Greenville-Banning Channel (D03)	A
Gisler Storm Channel	A
Santa Ana River	A
Fountain Valley Channel (D06)	A
Ocean View Channel (C06)	A
East Garden Grove-Wintersburg Channel (C05)	A
Newland Storm Channel	A
Edinger Storm Channel (C05S05)	A
Westminster Channel (C04)	A
Anaheim-Barber City Channel (C03)	A
Bolsa Chica Channel (C02)	A
Federal Storm Channel	D
Bixby Storm Channel (Orange County Flood Control District [OCFCD] Facility No. CO1P04)	A
Montecito Storm Channel (OCFCD Facility No. C01S03)	A
¹ FEMA definition of Zone A – “Areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.” FEMA definition of Zone D – “Areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. Flood insurance rates are commensurate with the uncertainty of the flood risk.”	

Source: <https://msc.fema.gov/>

Delhi Storm Drain

The 100-year flood boundary is shown on FEMA FIRM No. 06059C0267J, effective date December 3, 2009. The Delhi Storm Drain is located in HSA 801.11 and conveys offsite stormwater runoff across I-405 from the south to northeast of Bristol Street. The channel is designated as Zone A and, as indicated on the FIRM, the 100-year flood discharge is contained in the channel.

Greenville-Banning Channel (D03)

The Greenville-Banning Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0258J, effective date December 3, 2009. The Greenville-Banning Channel drains 8,310 acres at its mouth near Pacific Coast Highway and the Santa Ana River. The drainage area is located primarily within Costa Mesa and Santa Ana. The size of the existing facility is a triple 12-ft by 12-ft reinforced concrete box (RCB). The peak 100-year discharges for the Greenville-Banning Channel were calculated to be 3,450 cubic feet per second (cfs) crossing I-405 and 4,350 cfs crossing Victoria Street (Orange County Environmental Management Agency 1999). The channel is designated as Zone A and, according to the FIRM, the 100-year flood discharge is contained in the channel.

Gisler Storm Channel

The Gisler Storm Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0258J and C06059C0259J, effective date December 3, 2009. The Gisler Storm Drain (Facility No. D03S03), which is located on the north side of I-405, runs parallel to I-405 from east to west. It confluences with the Greenville-Banning Channel in the southwestern corner of the South Coast Drive and Harbor Boulevard intersection in Costa Mesa. The upstream end of the storm drain is a 72-inch reinforced concrete pipe (RCP) that crosses Bear Street south of I-405. It flows from east to west for approximately 2,700 ft, then changes direction and crosses I-405 going north where it transitions into an 84-inch RCP, to a 10-ft by 10-ft RCB, and then to a 16-ft by 10-ft RCB. The RCB transitions to a trapezoidal channel east of Fairview Road. A 10-ft by 9-ft RCB crosses Fairview Road, becoming an 18-ft-wide concrete trapezoidal channel west of Fairview Road. The channel transitions into an 18-ft by 10-ft RCB until it confluences with the Greenville-Banning Channel. The Gisler Storm Channel is designated as Zone A, and the 100-year flood discharge is contained in the channel.

Santa Ana River

The Santa Ana River is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0258J, effective date December 3, 2009. The Santa Ana River begins almost 75 miles away in the San Bernardino Mountains, crossing central Orange County before emptying into the Pacific Ocean. The Orange County portion of the watershed includes portions of Anaheim, Brea, Huntington Beach, Orange, Placentia, Santa Ana, Villa Park, and Yorba Linda. Reach 1 of the Santa Ana River serves as the main tributary to HSA 801.11A. Reach 1 is a normally dry flood control facility and extends from 17th Street in Santa Ana to the tidal prism at the Pacific Ocean (Santa Ana RWQCB 1995). Within the proposed project limits, Reach 1 of the Santa Ana River is conveyed within a concrete-lined rectangular channel with a central low-flow channel under I-405. The channel is approximately 240 ft wide, with vertical walls approximately 23 ft in

height. The bridge over the Santa Ana River is supported by three pier walls on spread footings and concrete piles.

The 100-year discharge is 47,000 cfs and is contained in the channel.⁵ Reach 1 of the Santa Ana River is designated as Zone A, with lands adjacent to Reach 1 designated as Zone X. The FEMA FIRM shows levee systems on both sides of the channel.

According to the Santa Ana Regional Water Quality Control Board's (RWQCB) Basin Plan, the Santa Ana River is the only flood control facility within the project limits that has natural and beneficial floodplain values (Santa Ana RWQCB 1995). The beneficial uses that have been identified for Reach 1 of the Santa Ana River are as follows and have been defined in Section 3.2.2:

- Municipal and Domestic Supply⁶
- Body Contact Recreation⁷
- Non-Body Contact Recreation
- Warm Freshwater Habitat
- Wildlife Habitat

Fountain Valley Channel (D06)

The Fountain Valley Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0254J, effective date December 3, 2009. The Fountain Valley Channel is levied immediately upstream of I-405 and downstream, outside Caltrans ROW.

The size of the existing facility is a double 10-ft by 7-ft RCB. The Fountain Valley Channel conveys offsite stormwater runoff across I-405 from the north to the south in Fountain Valley. The Fountain Valley Channel drains to the Talbert Channel. The peak 100-year discharge for the Fountain Valley Channel is 172 cfs and is designated as Zone A.

Ocean View Channel (C06)

The Ocean View Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0253J and No. 06059C0254J, effective date December 3, 2009. The Ocean View

⁵ U.S. Army Corps of Engineers, Design Flood Peak Discharges, SAR, Future Conditions, *Santa Ana River Mainstem Phase II General Design*.

⁶ Exempted by RWQCB from the municipal use designation per State Board Resolution No. 88-63, Sources of Drinking Water Policy.

⁷ Access prohibited in all or part by Orange County Resources Development and Management Division (RDMD).

Channel is located primarily in Fountain Valley, with small portions in Huntington Beach, Santa Ana, and Westminster. The total drainage area for this facility is approximately 3,380 acres at its discharge point. The existing facility crossing I-405 is a double 12-ft by 9.25-ft RCB. Between Ross Lane and Bushard Street, the Ocean View Channel has been improved and consists of various sizes of vertical walls and double RCB channels.

The 100-year discharge crossing I-405 is calculated to be 1,930 cfs for a tributary drainage area of 2,360 acres (Orange County Environmental Management Agency 1989a). The floodplain comingles with the East Garden Grove-Wintersburg Channel (EGGWC).

The channel and adjacent lands are designated as Zone A north of I-405. The 100-year flows are contained in the channel downstream of I-405.

East Garden Grove-Wintersburg Channel (C05)

The EGGWC is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0251J, effective date December 3, 2009. The main watercourse was a historic overflow path of the Santa Ana River's main stream that flowed through downtown Anaheim prior to the 1918 diversion of the Santa Ana River into its present course, leaving the EGGWC system to serve as a local drainage facility. The EGGWC is levied downstream and upstream of I-405 and drains portions of Anaheim, Fountain Valley, Garden Grove, Huntington Beach, Orange, Santa Ana, and Westminster. The total watershed tributary area is approximately 28.1 square miles at its discharge point. The Bolsa Chica Wetlands, Haster Basin (C05S02) and West Street Basin (C05B01), near the headwaters of the C05S01 tributary, are two facilities of deficient capacity that provide some retarding effects downstream.

Upstream of Haster Basin, the EGGWC is a concrete-lined open channel with more than 1,000 ft of box culvert extending to Chapman Avenue; farther upstream, EGGWC continues as an underground facility. Downstream of C05B02, the EGGWC is predominantly a graded earthen channel with some reaches of concrete and riprap overlay lining. The size of the existing facility is a 77-inch by 121-ft elliptical RCP and a triple 10-ft by 10-ft RCB under I-405. Numerous onsite drainage laterals convey flow from I-405, along with major flood control facilities tributary to EGGWC, such as the Newland Storm Channel, the Edinger Storm Channel, and the Ocean View Channel.

The peak 100-year discharge is calculated as 5,910 cfs for a contributing drainage area of 9,264 acres. The EGGWC is designated as Zone A north of I-405, and nearly the entire length of the EGGWC is considered deficient. Furthermore, residential areas are shown to be inundated by the 100-year storm (Orange County Environmental Management Agency 1990).

The Orange County Flood Control District (OCFCD) is currently studying the EGGWC at a regional scale. Several proposed structures, such as retention basins and channel widenings, are being considered to protect the area from potential flooding. Because the EGGWC system is very complex at the I-405 crossing, a physical model was constructed to depict actual field conditions. The physical model was completed in September 2010. OCFCD will use this information to develop a hydraulic model for EGGWC and its tributaries. Coordination with OCFCD for future phases of design shall be maintained to analyze the addition of piers.

Newland Storm Channel

The Newland Storm Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0251J, effective date December 3, 2009. The Newland Storm Channel drainage area is approximately 914 acres and is located primarily in Westminster and in an unincorporated portion of Orange County. Approximately 9 acres, in the northeasternmost portion, is within Garden Grove, and approximately 1-acre, in the southernmost portion, is within Huntington Beach.

The Newland Storm Channel conveys offsite flows from north to south and generally runs parallel to Newland Street. The riprap-lined trapezoidal channel transitions to a 72-inch RCP prior to draining to the EGGWC upstream of I-405. A 77-inch by 121-inch elliptical RCP bypass pipe for the Newland Storm Channel crosses I-405.

The Newland Storm Channel was designed to convey a discharge of 550 cfs at the reach from Edinger Avenue to approximately 150 ft upstream of the EGGWC; however, the estimated 100-year discharge from this location is calculated as 1,080 cfs (Orange County Resources and Development Management Department 2005); therefore, OCFCD has designated the Newland Storm Channel as under capacity and is currently studying the channel and developing plans for future improvements.

Adjacent to I-405, the Newland Storm Channel is designated as Zone A.

Edinger Storm Channel (C05S05)

The Edinger Storm Channel is located in HSA 801.11 and is shown on FEMA FIRM No.06059C0251J, effective date December 3, 2009. The drainage area for the Edinger Storm Channel is approximately 316 acres located primarily in Westminster, with a small portion at the lower end of the drainage area in Huntington Beach.

The channel outlets at EGGWC immediately south of I-405. The freeway crossing is a 63-inch RCP located just west of Newland Street. The channel then becomes a concrete-lined trapezoidal

channel running parallel to the northbound side of I-405. It transitions to a 63-inch RCP at Edinger Avenue and continues upstream as a concrete-lined trapezoidal channel until it meets the Midway City Drain (C05P06) along Beach Boulevard. The 63-inch RCP underneath Edinger Avenue is under jurisdiction of the Cities of Huntington Beach and Westminster, and the 63-inch RCP under I-405 is under jurisdiction of Caltrans.

OCFCD recently undertook construction to improve the Edinger Storm Channel to provide additional hydraulic capacity. Improvements include a new rectangular channel parallel to I-405, a new 72-inch by 113-inch elliptical RCP under I-405, and a wider channel upstream.

The Edinger Storm Channel is designated as Zone A adjacent to I-405.

Westminster Channel (C04)

The Westminster Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 060J9C0232J, effective date December 3, 2009. The Westminster Channel drains approximately 6,960 acres of tributary area and is located in Garden Grove, Huntington Beach, Santa Ana, and Westminster. The Westminster Channel conveys offsite stormwater runoff across I-405 in a southwesterly direction. The size of the existing facility is a double 12-ft by 9.25-ft RCB that outlets into the vicinity of the Goldenwest Street/I-405 interchange in Westminster.

The 100-year peak flow rate upstream of the confluence with the Bolsa Chica Channel is calculated to be 9,520 cfs, for a contributing area of 6,960 acres. The peak 100-year discharge at I-405 is estimated to be 4,190 cfs, with a contributing drainage area of 5,360 acres (Orange County Public Facilities and Resources Department 2002).

The channel is designated as Zone A with some overtopping. The adjacent lands are designated as Zone X.

Anaheim-Barber City Channel (C03)

The Anaheim-Barber City Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0119J, effective date December 3, 2009. The Anaheim-Barber City Channel is located within Westminster, Garden Grove, and Stanton and drains approximately 9,560 acres to its outlet at the Bolsa Chica Channel. The Anaheim-Barber City Channel is concrete-lined throughout its entire length, except the portion between Edwards Street and Garden Grove Boulevard, which remains unlined. The size of the existing facility is a double 12-ft by 9.25-ft RCB, trapezoidal concrete channel downstream and a rectangular channel upstream from the I-405 crossing.

The 100-year peak discharge is estimated to be 6,250 cfs (Orange County Resources and Development Management Department 1986). The Anaheim-Barber City Channel is designated as Zone A, and the 100-year flood discharge is contained in the channel.

Bolsa Chica Channel (C02)

The Bolsa Chica Channel is located in HSA 801.11 and is shown on FEMA FIRM No. 06059C0118J, effective date December 3, 2009. The Bolsa Chica Channel drainage area consists of approximately 5,610 acres and includes portions of Anaheim, Cypress, Garden Grove, Los Alamitos, Stanton, and unincorporated portions of Orange County. The Bolsa Chica Channel is a trapezoidal earth-lined channel that varies in size from a 54-ft base width with 2 to 1 slopes at I-405 to a 4-ft base width with 1.5 to 1 side slopes at Cerritos Avenue. The existing crossing is a triple 12-ft by 10-ft RCB, and the Belgrave Channel (C02S05) and the Garden Grove Channel (C02S02) are the two tributary areas to the Bolsa Chica Channel. The estimated 100-year peak discharge is calculated as 4,150 cfs (Orange County Public Facilities and Resources Department 1997).

The Bolsa Chica Channel is designated as Zone A, and 100-year flows are contained in the channel. There is a gap downstream of I-405 that is designated Zone D, and the area east of the Bolsa Chica Channel and adjacent to I-405 is designated as Zone X.

Federal Storm Channel

The Federal Storm Channel is located in HSA 845.61 and is shown on FEMA FIRM No. 06059C0114J, effective date December 3, 2009. The contributing drainage area is 345 acres. The Federal Storm Channel conveys offsite stormwater runoff across I-405. The size of the existing crossing is a double 8-ft by 5-ft RCB that flows from north to south. Offsite stormwater runoff transitions to the channel that parallels the freeway along Perimeter Road.

The Old Ranch Golf Course Retarding Basin is located to the north of the Federal Storm Channel. This basin attenuates flow by reducing flow discharge from 960 cfs to 340 cfs. Flow from the basin is metered out by a culvert under I-405 and outlets into an open earthen channel. Per the *Hydrology Report for Los Alamitos Channel*, the estimated 100-year peak flow rate for the Federal Storm Channel is calculated as 340 cfs. The Federal Storm Channel is designated as Zone D, the Old Ranch Golf Course Retarding Basin is designated as Zone AE, and the earthen channel downstream is designated as Zone D.

Bixby Storm Channel (OCFCD Facility No. C01P04)

The Bixby Storm Channel is located in HSA 845.61 and is shown on FEMA FIRM No. 06059C0114J, effective date December 3, 2009. The channel runs parallel to the freeway and

confluences with the Montecito Storm Channel. At the confluence, this channel is a trapezoidal concrete-lined channel. Upstream of the confluence, the 100-year estimated peak discharge is calculated to be 203 cfs (Orange County Public Facilities and Resources Department 2002).

The Bixby Storm Channel is designated as Zone A, and the FIRM shows that the 100-year flood discharge is contained in the trapezoidal concrete channel. The adjacent lands are designated as Zone X, and levees protect these lands from the 1 percent annual chance flood. Although there are no base flood elevations (BFEs) shown on the FIRM, a recent hydrology study (AECOM 2009) indicates that the 100-year flow overtops the existing channel. No floodplain delineations were modeled.

The study recommends widening the Bixby Storm Channel to accommodate the approximately 15.8 acres of drainage area that would be redirected to the Bixby Storm Channel due to the freeway widening in the area. This increase in drainage area equates to an additional flow of 18 cfs to the existing Bixby Storm Channel. This additional flow would cause severe back-water flooding near the surrounding areas of the confluence due to the governing hydraulic condition at the Montecito Storm Channel confluence. In addition, the Bixby Storm Channel would not meet the OCFCD minimum freeboard requirement.

To mitigate the flooding and freeboard issues, construction of a bypass (i.e., Bixby bypass) parallel to the existing Montecito box culvert under the freeway is proposed (AECOM 2009). The Bixby bypass channel would begin approximately 240 ft upstream of the existing confluence with the Montecito Storm Channel. A triple 72-inch RCP is proposed to cross under I-405. The alignment of the Bixby bypass channel would parallel that of the existing Montecito Storm Channel alignment and then confluence with the Montecito Storm Channel approximately 1,080 ft downstream. This bypass channel would capture the 100-year discharge and alleviate additional flow on the Montecito Storm Channel.

The Montecito Storm Channel would also be widened. Approximately 1,050 ft of the Montecito Storm Channel, beginning from 157 ft upstream of the Los Alamitos Channel confluence to the new Bixby bypass confluence, would need to be improved to achieve a lower downstream water surface control.

The design phase for the I-405 improvement should include these improvements.

Montecito Storm Channel (OCFCD Facility No. C01S03)

The Montecito Storm Channel is located in HSA 845.61 and is shown on FEMA FIRM No. 06059C0114J, effective date December 3, 2009. The Montecito Storm Channel connects to the Los Alamitos Channel downstream of I-405. The Los Alamitos Channel ultimately drains to the Los Alamitos Retarding Basin where flows are metered out. The Montecito Storm Channel confluences with the Bixby Storm Channel in the vicinity of the I-405/SR-22 West interchange.

The size of the existing crossing facility is a double 8-ft by 8-ft RCB where stormwater runoff flows from east to west. The 100-year estimated peak discharge for the Montecito Storm Channel is calculated to be 230 cfs upstream of the confluence with the Bixby Storm Channel, and 410 cfs downstream of the confluence with the Bixby Storm Channel, per the *Montecito Hydrology Report No C01-3*.

The Montecito Storm Channel and the Bixby Storm Channel are proposed to be improved to accommodate the additional flows generated from the SR-22 WCC Project, Phase 2 (I-405/I-605 HOV Connector Project) and the I-405 Improvement Project.

The Montecito Storm Channel is designated as Zone A, and the FIRM indicates that the 100-year flood discharge is contained in the channel.

3.2.1.3 Environmental Consequences

Permanent Impacts

No Build Alternative

The implementation of the No Build Alternative would not result in any floodplain encroachment.

Build Alternatives

The build alternatives would all have similar consequences; therefore, they are combined here for analysis related to hydrology and floodplains.

The proposed project would impact several channels and drains and their floodplain at varying degrees; however, review of the National Flood Insurance Program (NFIP) maps, the field investigation, topographic mapping, and tributary drainage indicates that the proposed freeway widening would have very small to no significant impact upon:

- Life and property,
- Interruption or termination of a transportation facility, or

- Natural and beneficial floodplain values.

The following sections discuss potential consequences in the context of 23 CFR 600.

The Practicability of Alternatives to any Longitudinal Encroachments

Table 3.2.1-2 identifies anticipated encroachments to floodplain areas. With the exception of the floodplain encroachment at Federal Storm Channel, all of the other floodplain encroachments associated with this project fall within FEMA Flood Zone A. Zone A is described as areas with a 1 percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage. The floodplain encroachment at Federal Storm Channel is within Flood Zone D. Flood Zone D is described as areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted in Flood Zone D locations. The transverse encroachment at Reach 1 of the Santa Ana River involves extending the I-405 bridge pier walls and constructing a new Ellis Avenue on-ramp bridge to southbound I-405 over the river (Parsons 2011h). Although Alternative 3 would raise the 100-year water surface by a maximum 2.34 ft between the I-405 and Euclid Street southbound I-405 on-ramp from Ellis Avenue bridge, the LHS indicated that there is still sufficient freeboard and channel capacity. Specifically, the water surface elevation returns to existing levels shortly downstream of the proposed Euclid Street southbound I-405 on-ramp from Ellis Avenue bridge (Parsons 2011f).

Of the 12 floodplain locations associated with the proposed project, only 2 result in longitudinal encroachments. The 2 longitudinal encroachments are located at the Edinger Storm Channel and the Bixby Storm Channel.

Overall, these longitudinal encroachments would mostly involve improvements within the existing freeway ROW in an area already mostly occupied by an active freeway facility. Furthermore, the proposed channel improvements would remove areas outside of the channel from the floodplain, and the longitudinal encroachments would not be an issue. Table 3.2.1-2 identifies anticipated encroachments to floodplain areas.

For the following facilities, the proposed project improvements are not anticipated to impact the floodplain: Delhi Storm Drain; Greenville-Banning Channel D03 (Alternatives 1 and 2 only); Gisler Storm Channel (Alternatives 1 and 2 only); Newland Storm Channel; Edinger Storm Channel; Westminster Channel C04; Anaheim-Barber City Channel C03; Bolsa Chica Channel; and the Federal Storm Channel.

Table 3.2.1-2: Potential Floodplain Encroachment Summary

Affected Floodplain/ Location	FIRM Zone	Type of Encroachment	Proposed Work and Proposed Improvements
Gisler Storm Channel	A	Transverse	For Alternative 3, protect in place. No impacts are anticipated for Alternatives 1 and 2.
Greenville-Banning Channel (D03)	A	Transverse	For Alternative 3, extend triple 12-ft by 12-ft RCB at upstream; reconstruct headwall and wingwall and conduct channel work.
Santa Ana River	A	Transverse	Bridge widening, pier wall extension, new in-river columns for new on-ramp bridge.
Fountain Valley Channel (D06)	A	Transverse	Lengthen culvert, modify inlet and outlet headwalls.
Ocean View Channel (C06)	A	Transverse	Lengthen culvert upstream.
East Garden Grove-Wintersburg Channel (C05)	A	Transverse	Construct a center pier upstream and construct a pier wall in line with the existing RCB walls downstream.
Newland Storm Channel	A	Transverse	Protect in place.
Edinger Storm Channel (C05S05)	A	Longitudinal	New rectangular channel parallel to I-405 and a new RCP under the freeway. Improvements will be coordinated with OCFCD.
Westminster Channel (C04)	A	Transverse	Protect in place.
Federal Storm Channel	D	To be provided	Protect in place.
Bixby Storm Channel	A	Longitudinal	Construct a new bypass channel to capture the 100-year discharge and alleviate flow on the Montecito Storm Channel, per WCC Drainage Report.
Montecito Storm Channel	A	Transverse	Extend RCB. Modify headwall and confluence structure.

Source: Parsons 2011f and 2011g.

Risks of the Action

Table 3.2.1-3 summarizes the risks associated with implementation of the proposed project. Based on the LHS (Parsons 2011f), implementation of the proposed project would not create a high-risk condition. Risks of the action are either not applicable (i.e., no floodplain impacts are associated with the alternative) or there are no risks associated with any of the alternatives (Parsons 2011h). Although a moderate risk was identified for the encroachment in the Santa Ana River, the LHS indicated that there is still sufficient freeboard and channel capacity.

Furthermore, the water surface elevation returns to existing levels shortly downstream of the proposed Euclid Street southbound I-405 on-ramp from Ellis Avenue bridge.

Table 3.2.1-3: Risks of the Action

Affected Floodplain/Location	High Risk		
	Alternative 1	Alternative 2	Alternative 3
Gisler Storm Channel	N/A ¹	N/A ¹	No
Greenville-Banning Channel (D03)	N/A ¹	N/A ¹	No
Santa Ana River	Moderate		
Fountain Valley Channel (D06)	No	No	No
Ocean View Channel (C06)	No	No	No
East Garden Grove-Wintersburg Channel (C05)	No	No	No
Newland Storm Channel	No	No	No
Edinger Storm Channel (C05S05)	No	No	No
Westminster Channel (C04)	No	No	No
Federal Storm Channel	No	No	No
Bixby Storm Channel	No	No	No
Montecito Storm Channel	No	No	No

¹N/A – No floodplain impacts associated with alternative.

Source: Parsons 2011g.

Impacts on Natural and Beneficial Floodplain Values

According to the Santa Ana RWQCB’s Basin Plan, the Santa Ana River is the only flood control facility that has natural and beneficial floodplain values (Santa Ana RWQCB 1995). Beneficial uses for Reaches 1 and 2 of the Santa Ana River are as follows and have been defined in Section 3.2.2:

- Municipal and Domestic Supply⁸
- Body Contact Recreation⁹
- Non-Body Contact Recreation
- Warm Freshwater Habitat
- Wildlife Habitat

The Santa Ana River has moderate wildlife habitat values. The bridges constructed across the Santa Ana River would not substantially alter the habitat and impede the use of the floodplain as

⁸ Exempted by the RWQCB from the municipal use designation per State Board Resolution No. 88-63, Sources of Drinking Water Policy.

⁹ Access prohibited in all or part by Orange County RDMD.

a movement corridor for wildlife; therefore, implementation of the proposed project would have no material effect on natural and beneficial floodplain values.

Support of Incompatible Floodplain Development

The I-405 Improvement Project does not involve new highways that would foster incompatible developments within floodplains. Furthermore, it was determined that floodplain encroachments would not adversely affect the BFEs (Parsons 2011h). Because the 100-year flood would still be contained within the existing floodplain boundaries at each location, there would be no increased risk to life or property associated with the proposed improvements. No additional roadways would flood upstream of the proposed project improvements; therefore, no transportation routes would be interrupted or terminated beyond existing conditions. According to the Bridge Hydraulic Report for the Santa Ana River and Euclid Street On-Ramp (Parsons 2011i), the new Ellis Avenue on-ramp bridge pier in the Santa Ana River would only slightly increase the BFE. The water surface would reach normal depth immediately downstream of the proposed Euclid Street southbound I-405 on-ramp from Ellis Avenue bridge.

Temporary Impacts

No Build Alternative

The No Build Alternative would not change the existing physical environment; therefore, the No Build Alternative would result in no temporary impacts to hydrology and floodplains.

Build Alternatives

During construction for any of the build alternatives, temporary impacts to hydrology and floodplains are not anticipated with inclusion of the measures described below.

3.2.1.4 Avoidance, Minimization, and/or Mitigation Measures

No Build Alternative

The No Build Alternative would not change the existing physical environment; therefore, no avoidance, minimization, and/or mitigation measures are necessary under the No Build Alternative.

Build Alternatives

The proposed project has been designed to minimize impacts, where possible, by taking reduced amounts of ROW and limiting the grading footprint to minimize impacts to existing structures while still meeting project objectives. The I-405 Improvement Project would discharge to both lined and unlined channels. All transitions between culvert outlets, headwalls, wingwalls, and channels would be smoothed to reduce turbulence and scour. Where appropriate, energy

dissipation devices would be utilized. Offsite runoff would be handled by allowing flows to pass under or around the proposed facility. Offsite flows would be managed using the existing drainage network and not inundate the roadway surface or overburden the existing drainage system. Minimization measures for floodplain impacts include:

- HYD-1:** Project design elements will include bridge pier alignment paralleling the direction of flow to minimize flow obstruction;
- HYD-2:** Bridges will be designed with sufficient freeboard above the 100-year water surface elevation to prevent the bridge deck from impacting flood flows;
- HYD-3:** Positive drainage will be provided during construction and refrain from diverting flows;
- HYD-4:** Recommended BMPs will be implemented;
- HYD-5:** In-river construction and post construction shall include erosion control and water quality protection;
- HYD-6:** A contingency plan shall be developed for unforeseen discovery of underground contaminants;
- HYD-7:** Construction activities between October and May shall be limited to those actions that can adequately withstand high flows and entrainment of construction materials; and
- HYD-8:** Adequate conveyance capacity will be provided at bridge crossings to ensure no net increase in velocity.

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