H. HYDROLOGY AND WATER QUALITY

1. Introduction

This section describes the hydrological resources and water quality setting as it relates to the BART to Livermore Extension Project, discusses the applicable regulations, and assesses the potential impacts to hydrological resources and water quality from construction and operation of the Proposed Project and Alternatives.

For the purpose of analyzing the hydrological and water quality impacts, the study area includes the collective footprint—i.e., the combined footprints of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative. In addition, the bus routes and bus infrastructure improvements for the Enhanced Bus Alternative—as well as for the feeder buses for the Proposed Project and other Build Alternatives, which are anticipated to extend along existing streets and within the street rights-of-way (ROWs)—are addressed programmatically in this analysis, as described in Chapter 2, Project Description. The study area also includes the channel reaches downstream of the collective footprint, as well as adjacent areas that could be inundated because of modification to surface water channels and stormflow conveyance facilities. The downstream channel reaches are part of the study area because pollutants can be transported downstream or downgradient to sensitive receiving waters farther away, such as Arroyo de la Laguna and Alameda Creek. The study area is primarily within the Lower Arroyo Mocho watershed, as well as portions of Lower Arroyo las Positas and South San Ramon Creek watershed; these areas are all part of the Arroyo de la Laguna watershed. Arroyo las Positas, a tributary to Arroyo Mocho traverses through the eastern part of the study area, is part of the Lower Arroyo Mocho watershed.

The Zone 7 Water Agency (Zone 7) is the primary entity responsible for overseeing water supply and flood control operations within the study area.

Sources of data and information used to prepare this section include but are not limited to the following resources:

- Zone 7 Stream Management Master Plan[1]
- Zone 7 Stream Management Master Plan Environmental Impact Report[2]

[1] Zone 7 Water Agency, 2006a. Zone 7 Stream Management Master Plan. August.
[2] Zone 7 Water Agency, 2006b. Zone 7 Stream Management Master Plan Environmental Impact Report. March.

- BART Livermore Extension, Water Quality and Hydromodification Study: Technical Memorandum[3]
- BART Livermore Extension, Hydraulic Analysis of Las Positas Creek[4]

Also referenced for this analysis were hazard maps from the Association of Bay Area Governments, soil surveys from the United States (U.S.) Department of Agriculture, publications of the California Department of Water Resources (DWR), and various scientific studies. In addition, standard reference materials were used, including U.S. Geological Survey (USGS) topographic maps and climate information.

No scoping comments pertaining to hydrology or water quality were received in response to the Notice of Preparation for this EIR or during the public scoping meeting held for the EIR.

2. Existing Conditions

This subsection describes the existing conditions for hydrology and water quality—including the regional context, surface water hydrology, flooding and flood hazards, dam inundation areas, groundwater hydrology, and water quality.

a. Regional Overview

The study area is located within the Arroyo de la Laguna watershed, which is part of the larger Alameda Creek watershed that covers approximately 630 square miles over three counties: (1) Alameda County (approximately 55 percent of the watershed); (2) Contra Costa County (10 percent); and (3) Santa Clara County (35 percent). Arroyo de la Laguna is the main tributary to Alameda Creek and comprises a watershed area of approximately 400 square miles, making up approximately 66 percent of the total Alameda Creek watershed. The watershed lies within the California Coast Ranges geographic unit, which is composed chiefly of a complex assemblage of marine sedimentary rocks and a series of northwest-trending ridges and valleys.[5]

Land uses in the Arroyo de la Laguna watershed include residential, commercial, light industrial, agricultural, ranch, and parklands. Land use in the project corridor is described in detail in Section 3.C, Land Use and Agricultural Resources. Five incorporated cities are completely or partially located within the Arroyo de la Laguna watershed: Livermore,

[3] Arup, 2016. BART Livermore Extension, Water Quality and Hydromodification Study: Technical Memorandum. April 5.
[4] Arup, 2017a. BART Livermore Extension, Hydraulic Analysis of Las Positas Creek, Draft 5. July 6.
[5] Rantz, S.E., 1972. Runoff Characteristics of California Streams. U.S. Geological Survey Water-Supply Paper 2009-A.

Pleasanton, Dublin, and the southeastern portions of San Ramon and Danville. The watershed is generally defined by the Altamont Pass (near Livermore) to the east; Mount Diablo to the north; the Coast Range hills to the south; and the watershed outlet to Alameda Creek on the west, from where it eventually flows into San Francisco Bay at Union City. The southern portion of the watershed—which is primarily the upland and headwater areas of the long, narrow Arroyo del Valle and Lower Arroyo Mocho watersheds—consists of higher elevations and more rugged topography and is relatively undeveloped. The northern portion of the watershed consists of the predominantly developed Livermore-Amador Valley[6] and includes the broader, less steep Alamo Creek, Tassajara Creek, and Arroyo las Positas watersheds. South San Ramon Creek, an Alamo Creek tributary, enters the Arroyo de la Laguna watershed at the Arroyo Mocho confluence on the western edge of the study area.

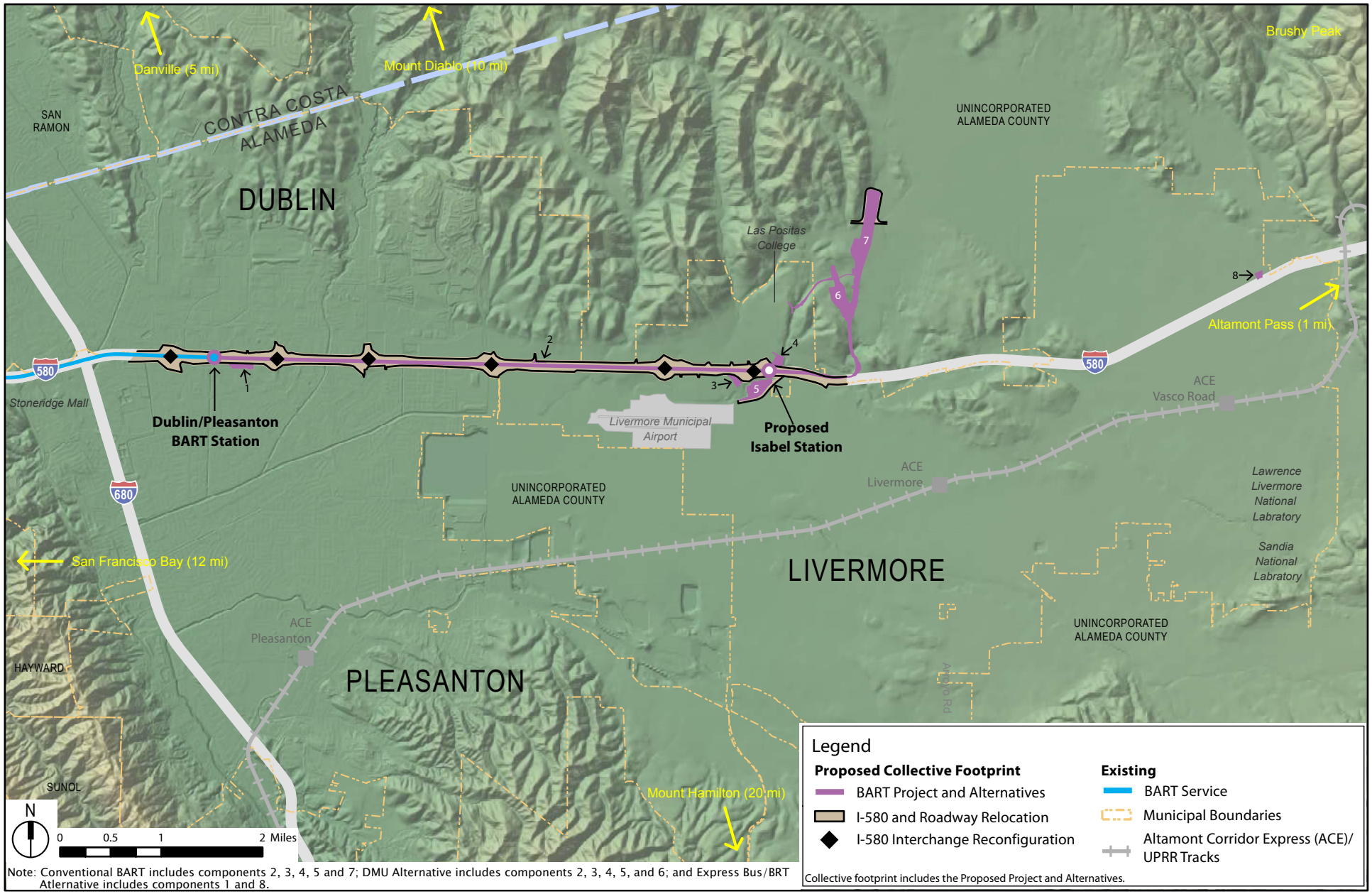
The study area is within the Livermore-Amador Valley and is relatively flat with elevations ranging from about 330 feet above mean sea level (msl) on the west to 600 feet above msl on the east.[7, 8] The Diablo Mountain Range runs through the project corridor, trending in a southeast-to-northwest direction and most of the hills and mountains north and south of the project corridor are part of this range. See Figure 3.H-1 for an overview of the topographic relief in Livermore-Amador Valley.

The regional climate in the study area is Mediterranean, with wet winters and dry summers. As shown in Table 3.H-1, the city of Livermore receives approximately 14.18 inches of rain annually, over 80 percent of which occurs during November to March, with little or no rainfall during summer months. Based on 107 years of rainfall data for Livermore, the 100-year storm is estimated to produce about 3.32 inches in a 24-hour period.[9]

b. Surface Water Hydrology

The Arroyo de la Laguna watershed, in the South Bay hydrologic unit in Alameda County, is a large and diverse landscape that supports a variety of land uses, habitats, and natural resources. Arroyo de la Laguna was historically the outlet of a permanent, marshy lagoon that occurred at a low point in what is now northwest Pleasanton.[10] Streams that currently

[6] The Livermore and Amador valleys are often referred to as the Livermore-Amador Valley when discussing the combined system.
[7] United States Geological Survey (USGS), 2012a. Dublin, California, United States, Topographic Map.
[8] United States Geological Survey (USGS), 2012b. Livermore, California, United States, Topographic Map.
[9] Zone 7 Water Agency, 2006b. Zone 7 Stream Management Master Plan Environmental Impact Report. March.
[10] Cardno ENTRIX, 2013. Draft Arroyo del Valle and Arroyo de la Laguna Steelhead Habitat Assessment. November.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Atlernative includes components 1 and 8.

Source: Arup, 2017b; NOAA, 2016.

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Figure 3.H-1
Hydrology and Water Quality
Topography

TABLE 3.H-1 PERIOD OF RECORD MONTHLY CLIMATE SUMMARY FOR LIVERMORE 1/1/1903 TO 12/31/2013

	Average Max. Temperature (ºF)	Average Min. Temperature (ºF)	Average Total Precipitation (inches)
January	56.8	36.7	2.97
February	61.2	39.4	2.47
March	65.2	41.3	2.15
April	70.5	43.6	1.00
May	76.4	47.6	0.44
June	83.1	51.7	0.11
July	89.0	54.2	0.02
August	88.2	54.0	0.04
September	86.0	52.5	0.22
October	77.7	47.7	0.67
November	66.3	41.1	1.54
December	57.5	37.0	2.56
Annual	**73.2**	**45.6**	**14.18**

Note: ºF = degrees Fahrenheit.
Source: Western Region Climate Center, 2013.

drain to Arroyo de la Laguna, such as Arroyo del Valle and Arroyo Mocho, likely terminated before the lagoon, percolating into the alluvium layer covering the Livermore-Amador Valley, although Arroyo del Valle may have occasionally connected with the lagoon depending on hydrologic conditions.[11] Three major tributaries—Alamo Creek, Arroyo del Valle, and Arroyo Mocho—contribute to Arroyo de la Laguna before it flows into Alameda Creek near the town of Sunol.[12] A few additional, relatively large watersheds also contribute to Arroyo de la Laguna by draining into the principal tributaries: South San Ramon Creek contributes flow to Alamo Creek/Canal, and Arroyo las Positas contributes to Arroyo Mocho. The South San Ramon Creek watershed includes areas in the hills west of Dublin and Pleasanton and south of Mount Diablo. South San Ramon Creek generally

[11] Ibid.
[12] Between I-580 and the confluence with Arroyo de la Laguna, Alamo Creek is referred to as Alamo Canal.

flows to the south, meeting its confluence with Alamo Creek to the east of Interstate Highway (I-) 680 and north of I-580. Arroyo Las Positas generally flows west along I-580; its tributaries include Arroyo Seco, Altamont, Cayetano, Collier Canyon, and Cottonwood Creeks. Along with runoff from more rural and undeveloped areas, the Arroyo de la Laguna watershed collects and drains runoff from the cities of Livermore, Pleasanton, and Dublin, and from urban areas of San Ramon and Danville.

The collective footprint crosses and is located adjacent to intermittent and perennial (year-round) creeks, arroyos, and flood control channels that traverse the alluvial Livermore-Amador Valley. The main streams in the vicinity of the study area are Alamo Creek/Canal, Arroyo de la Laguna, Arroyo del Valle, Tassajara Creek, Arroyo Mocho, Cottonwood Creek, and Arroyo las Positas. Arroyo Mocho and Arroyo del Valle converge on the floor of the Livermore-Amador Valley and drain into Arroyo de la Laguna at its confluence with Alamo Canal. Arroyo de la Laguna eventually drains into Alameda Creek, and Alameda Creek drains to the southern part of San Francisco Bay.

Annual runoff within the Arroyo de la Laguna watershed is highly variable. Many of the tributaries that supply flow to Arroyo de la Laguna are historically intermittent and can become isolated from the mainstem[13] beginning in early to mid-summer, particularly the natural and channelized streams draining the Livermore-Amador Valley.[14] The arroyos and creeks draining to the Livermore-Amador Valley exhibit highly variable daily flows and are rarely perennial in their lower reaches.[15] Some channels are also used as conduits to move water supplies from one area to another, and in certain cases the flow regime is artificially controlled.[16] Artificial lakes are located to the south of I-580, on the south side of Arroyo Mocho where it flows east to west. These lakes were formed by the conversion of abandoned gravel quarry pits to groundwater recharge basins and are called the Chain of Lakes. Additionally, though tributary inputs and total annual runoff volumes can be highly variable, discharges from quarries in the Pleasanton area generally result in year-round flow in the lower reach of Arroyo Mocho and downstream to Arroyo de la Laguna.[17]

[13] The mainstem of a river is the main drainage pathway, as opposed to tributaries that feed into the main drainage pathway.

[14] Gunther, A.J, J. Hagar, and P. Salop, 2000. An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed. Prepared for the Alameda Fisheries Restoration Workgroup. February 7.

[15] Zone 7 Water Agency, 2006c. Zone 7 Stream Management Master Plan Final Master Environmental Impact Report, Chapter 3. August-.

[16] Gunther, A.J, J. Hagar, and P. Salop, 2000. An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed. Prepared for the Alameda Fisheries Restoration Workgroup. February 7.

[17] Ibid.

(1) Water Features in the Study Area

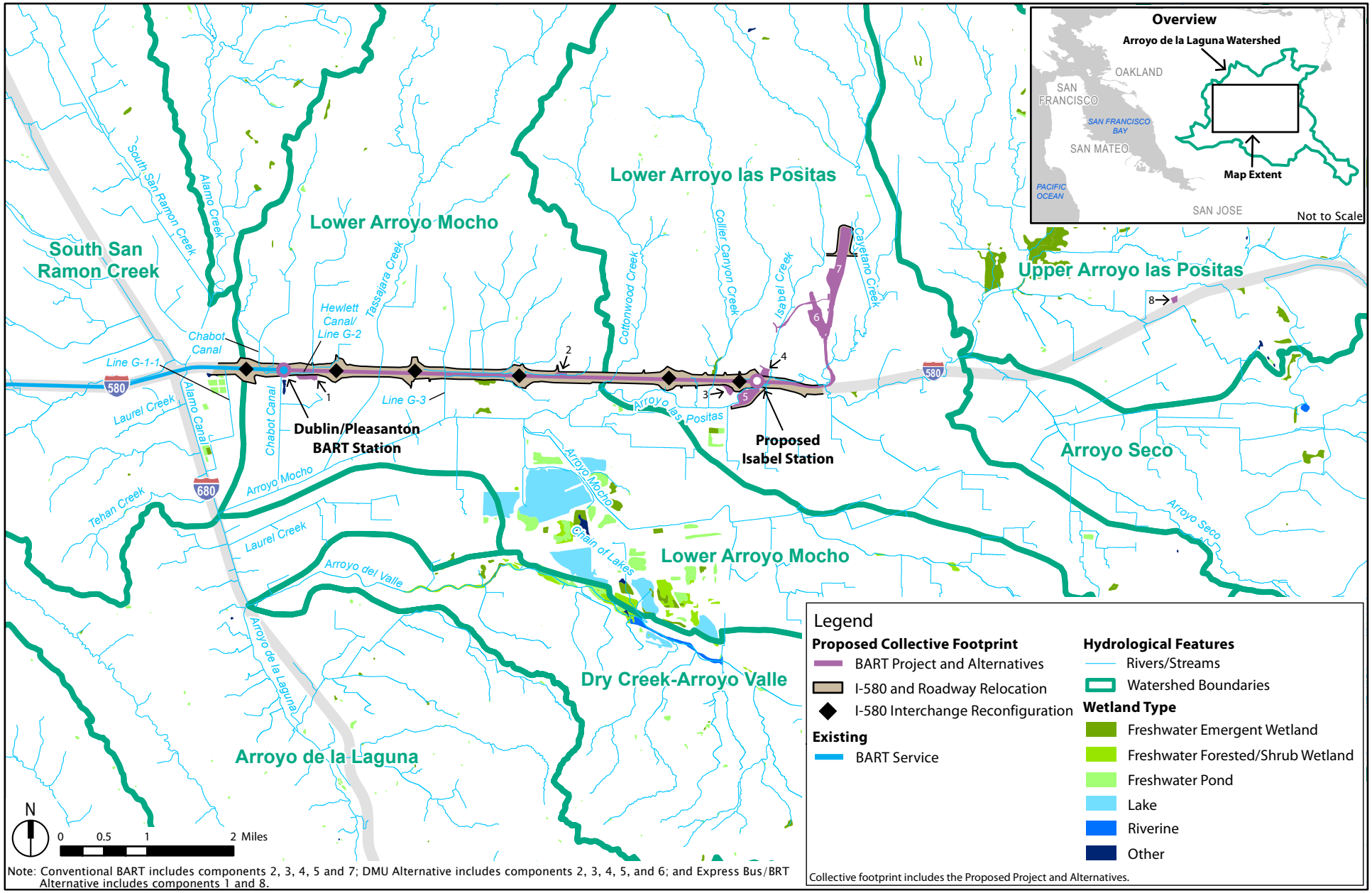
Streams and surface waters that extend through the collective footprint, from west to east, include the following: Line G-1-1; Chabot Canal and its tributary Line G-2 (also referred to as Hewlett Canal); Tassajara Creek; Line G-3; Arroyo las Positas; Cottonwood Creek; Collier Canyon Creek; Isabel Creek; Cayetano Creek; and other unnamed surface water features and drainages. [18, 19] These features are described in detail below. Other receiving surface water features, those downstream of waterways extending through the project corridor, include Arroyo Mocho, local wetlands, and unnamed local drainage features. Figure 3.H-2 shows the location of these water features as well as others within the area. These creeks and unnamed tributaries drain into Arroyo Mocho, which drains into Arroyo de la Laguna and ultimately into Alameda Creek downstream of the study area.

(a) Alamo Canal and Line G-1-1

Alamo Canal is a trapezoid flood-control channel that flows generally south through the study area, but does not extend through the collective footprint. The channel originates north of I-580 as Alamo Creek, which drains the Dougherty Valley. Alamo Creek flows south and becomes Alamo Canal on the upstream (north) side of I-580. Water drains to this channel from creeks to the west, including Dublin Creek, and from South San Ramon Creek to the north, which connects to Alamo Creek approximately 1 mile north of I-580. Upstream of the South San Ramon Creek confluence, Alamo Creek has a more natural form, which includes a more sinuous flow path and a narrow riparian corridor; downstream of this confluence, the channel is generally straight, trapezoidal, and lacking in any riparian vegetation. Alamo Canal flows into Arroyo de la Laguna near the southwest border of Pleasanton, at the point where Arroyo Mocho also flows into Arroyo de la Laguna. Zone 7 Stream Management Master Plan Reach 9 is located within the Alamo Canal drainage area.

Line G-1-1 is a tributary flood control channel that flows into Alamo Canal between West Las Positas Boulevard and Stoneridge Drive, approximately 0.5 mile upstream of Arroyo de la Laguna. In some areas, the channel bottom of Line G-1-1 is below the groundwater table, which tends to result in areas of slow, stagnant flow during low-flow periods.[20]

[18] Zone 7 commonly uses the term “line” to refer to unnamed sections of flood control channels (e.g., Line J-1, Line-G-3).
[19] Summarized from Zone 7 Water Agency, 2006c.
[20] Zone 7 Water Agency, 2006c. Zone 7 Stream Management Master Plan Final Master Environmental Impact Report, Chapter 3. August-.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Alternative includes components 1 and 8.

Source: Arup, 2017b; DWR, 2004; USFW (NWI), 2012; Zone 7, 2016.

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Figure 3.H-2
Hydrology and Water Quality
Surface Hydrology

(b) Chabot Canal and Line G-2

Chabot Canal is a long, uniform-depth, trapezoidal flood control channel that traverses commercial and industrial areas and flows south toward Arroyo Mocho. Line G-2, which is also referred to as Hewlett Canal, is a tributary to Chabot Canal and parallels the south side of the freeway adjacent to the Dublin/Pleasanton BART Station (Dublin/Pleasanton Station) before flowing into Chabot Canal and eventually Arroyo Mocho farther south. Line G-2 is characterized by perennial flows and shallow water with bottom substrates consisting of native clay materials, gravel, and silt.

(c) Tassajara Creek

Tassajara Creek consists of two distinct channel segments with an indeterminate connection. The upstream portion of Tassajara Creek is a primarily natural channel that drains areas south of Mount Diablo, crosses beneath I-580, and flows into Arroyo Mocho as a flood control channel in the city of Pleasanton. Tassajara Creek drains about 27 square miles of the northern hills to its confluence with Arroyo Mocho, near Dublin Boulevard. North of I-580, Tassajara Creek runs through a narrow riparian corridor and is generally considered a losing stream, meaning that water flows from the creek bed and bank and infiltrates the surrounding groundwater basin. South of I-580, Tassajara Creek is a trapezoidal flood control channel, generally considered a gaining stream, which is recharged with flow from the shallow groundwater aquifer.

(d) Line G-3

Line G-3 is an isolated trapezoidal urban flood control channel that receives high-volume flows from a large area north of I-580 and contributes surface runoff to Arroyo Mocho. This channel parallels I-580 to the north along Northside Drive before crossing under I-580 and flowing south. The base of the channel is about 8 to 12 feet wide as measured from the toe of slope. Line G-3 catches the underground flows through three underground channel tunnels that receive perennial flows from an expansive upland area north of I-580 and are approximately 10 to 12 feet wide.[12] The tunnels are part of an extensive underground storm drain system that receives urban runoff north of I-580. Upstream of Line G-3 is a natural unnamed drainage, referred to herein as the Fallon Road Drainage, which flows between Croak Road and Fallon Road just north of the Fallon Road/I-580 westbound off-ramp. The bottom substrate of the Fallon Road Drainage consists of concrete and riprap, with limited coverage by native clay.

(e) Arroyo Las Positas

Arroyo las Positas is a major drainage feature of the Livermore-Amador Valley in the northeast portion of the Alameda Creek watershed. It drains approximately 80 square miles prior to its confluence with Arroyo Mocho. Summer flows include a combination of

irrigation, urban flows, and agricultural runoff, all of which maintain Arroyo las Positas as a perennial creek. Arroyo las Positas begins in the Altamont Hills east of Livermore and flows westward to its confluence with Arroyo Mocho at El Charro Road. Arroyo las Positas flows primarily east-west through the city of Livermore, through the Las Positas Golf Course. The main-stem parallels I-580 through the city of Livermore and crosses under I-580 at several locations. Southeast of the Isabel Avenue/I-580 interchange, Arroyo las Positas runs through the Isabel South Area parallel to the north side of the proposed Isabel Station parking area. Inadequate channel capacity leads to associated periodic flooding in the lower, flat-gradient reach of Arroyo las Positas near its confluence with Arroyo Mocho.

The Arroyo las Positas watershed consists of a broad alluvial plain and gently sloped upland areas drained by several tributaries: Cottonwood Creek, Collier Canyon Creek, Isabel Creek, Cayetano Creek, Altamont Creek, and Arroyo Seco. The watershed is characterized by heavily incised channels through primarily commercial, agricultural, and ranch lands. All channels in this watershed are either flood control channels or natural channels traversing heavily grazed grasslands.[21] The predominant substrate size is fine silts with virtually no riparian vegetation. Base flows in these channels are generally low.

The tributaries to Arroyo las Positas within the collective footprint are described further below.

Cottonwood Creek

The Cottonwood Creek watershed is located north of I-580 between the cities of Dublin and Livermore. It flows north to south along Doolan Road through Doolan Canyon, which is bordered in the west, north, and east by the rolling foothills of Mount Diablo. Cottonwood Creek crosses under I-580 and into Arroyo las Positas near the Las Positas Golf Course. Stock ponds, natural springs, and seasonal wetlands are dispersed throughout Doolan Canyon.[22] Cottonwood Creek is a natural, seasonally dry ephemeral stream (only flowing immediately following rainfall events) that traverses grazing land and has a moderate slope. The stream channel is approximately 6 to 10 feet wide at the toe of slope near I-580. The bottom substrate in Cottonwood Creek consists of gravel and native soil.

[21] Gunther, A.J, J. Hagar, and P. Salop, 2000. An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed. Prepared for the Alameda Fisheries Restoration Workgroup. February 7.

[22] City of Livermore, 2013. City of Livermore Doolan and Springtown Preserve Mitigation Bank Request for Proposal. June.

Collier Canyon Creek

Collier Canyon Creek is a channelized perennial drainage located in an area that has recently constructed development, particularly around Las Positas College. Upstream of I-580, this creek is a natural narrow channel with moderate slope; downstream from I-580, it is a concrete-lined channel. Collier Canyon Creek crosses under I-580 and into Arroyo las Positas east of the Las Positas Golf Course.

Isabel Creek

Isabel Creek drains a relatively small watershed that is situated between the larger Collier Canyon Creek and Cayetano Creek watersheds. The watershed is located north of I-580 and drains mostly rural areas before flowing into the lower Arroyo las Positas on the north side of I-580. This channel is unnamed on USGS maps, but is referred to as Isabel Creek by Zone 7.

Cayetano Creek

The Cayetano Creek watershed is located north of I-580 in the city of Livermore. Cayetano Creek flows from north to south and drains into Arroyo las Positas north of I-580. The creek has been channelized along much of its length, though the lower quarter maintains a somewhat more natural, sinuous plan form. The watershed is heavily grazed by ranching land uses and riparian vegetation is generally limited. Wetlands and other aquatic features in the Cayetano Creek watershed are discussed in more detail in Section 3.I, Biological Resources.

Arroyo Mocho

Arroyo Mocho drains approximately 36,000 acres of mixed agricultural, urban, and undeveloped lands starting in Santa Clara County (south of Alameda County) and flows generally to the northwest. Prior to its confluence with Arroyo las Positas, just downstream of the Chain of Lakes area, Arroyo Mocho drains approximately 50 square miles of a long, narrow, northwest-trending valley with relatively steep upland areas in the eastern portion of the Alameda Creek watershed. Because of the regional Mediterranean climate, flow within Arroyo Mocho is variable. Summer flows are typically low, often depending on releases from Zone 7 to the Chain of Lakes system for groundwater recharge, and may sometimes run dry during the summer due to inadequate release volumes.

The lower reach of Arroyo Mocho, between Arroyo de la Laguna and Santa Rita Road, has been subject to considerable deposition, resulting in a reduced channel capacity. Originally, the channel section had a bottom width of about 60 feet; currently, the bottom width is approximately 16 feet with a small, incised channel approximately 2 to 3 feet

deep and 5 to 10 feet wide. The reach between Stoneridge Drive and the confluence of Arroyo las Positas (at El Charro Road) has been widened to 60 feet at the channel bottom and 160 feet from bank to bank.

The portion of Arroyo Mocho flowing through the Chain of Lakes area is naturally ephemeral. During the dry season, Arroyo Mocho is effectively two distinct segments separated by an approximately 200-yard dry length in the Pleasanton gravel quarry area. Arroyo Mocho is an important source of groundwater recharge for the Livermore-Amador Valley, particularly between Robertson Park in the city of Livermore and through the Chain of Lakes area. Flows in the upper watershed are supported by DWR releases from the California Aqueduct, which are intended to seep into the streambed and recharge groundwater in areas downstream. Flows below the quarries are supported by a National Pollution Discharge Elimination System (NPDES)-permitted discharge from quarry operators. Zone 7 manages the releases from DWR to maintain the dry length, ensuring that the water purchased from the State of California (State) is entering the groundwater basin.

Through the city of Livermore, Arroyo Mocho is an urban stream; however, some fairly natural segments contain gravel and cobble stream substrates. Sedimentation, gravel transport, and deposition periodically occur along Arroyo Mocho. Gravel deposition at Holmes Street and Stanley Boulevard bridges has resulted in capacity constraints at these two locations. Additionally, Arroyo Mocho tends to deposit gravel through the Chain of Lakes area, which decreases the channel capacity.

Aggradation (i.e., deposition of material by a river, stream, or current) is prevalent from the Chain of Lakes, downstream to its confluence with Arroyo de la Laguna, which periodically results in decreased channel capacity and an increased occurrence of flooding events in Arroyo Mocho. This section of Arroyo Mocho is not generally considered integral for water supply or aquifer recharge.

(f) Chain of Lakes

A complex of large, active and inactive gravel mining pits, collectively known as the Chain of Lakes, is located in the middle of the Livermore-Amador Valley, south of I-580 in unincorporated Alameda County, on the south side of Arroyo Mocho. As part of mitigation and the long-term plan for reclamation of the former gravel mines, most of the lakes will eventually be deeded to Zone 7 and used primarily for water surface water storage, stormwater retention, and/or groundwater recharge.[23] Three of the lakes are managed by Zone 7, and the rest are still actively mined. Zone 7 has developed a near-term delivery

[23] Zone 7 Water Agency, 2015. Annual Report for the Groundwater Management Program 2014 Water Year, Livermore Valley Groundwater Basin. July.

and groundwater recharge plan using these lakes.[24] As part of the Zone 7 plan, some of the lakes are proposed to be used primarily for groundwater recharge because the permeable soils along the lakes' sides allow for lateral seepage and efficient recharge of groundwater. Other lakes are proposed for conveyance and storage because recharge is not feasible as the silt in the bottom inhibits significant water infiltration into the groundwater table.

(g) Other Water Features

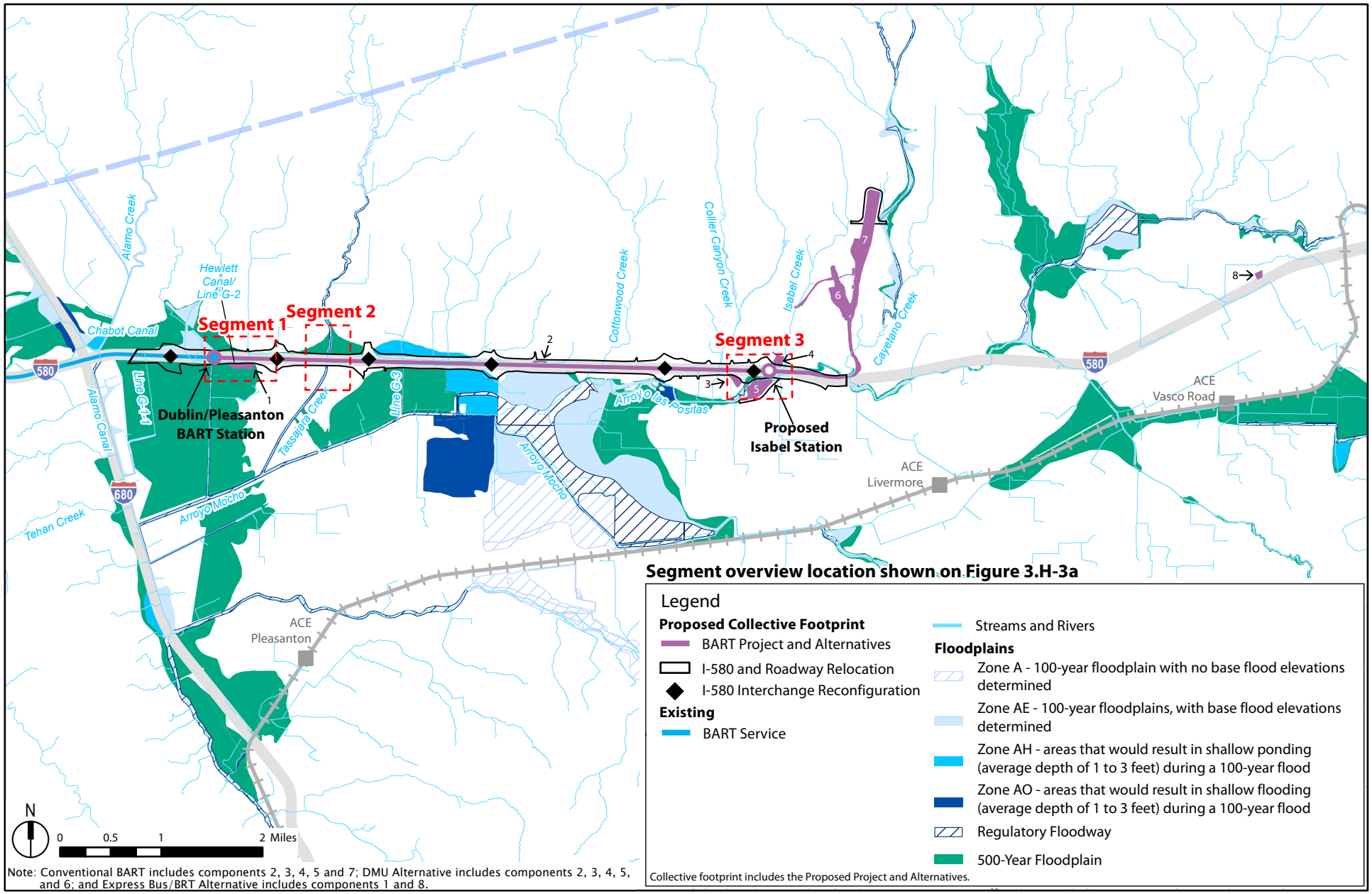
Additional unnamed drainages intersect the collective footprint, and several natural and man-made water features are also present in the study area. Man-made ponds are located within the Las Positas Golf Course (in the city of Livermore, adjacent to and south of I-580). Wetlands also occur within the study area and small, local aquatic features pass through the collective footprint, including a small pond in the Cayetano Creek area along Hartman Road. See Section 3.I, Biological Resources for additional discussion of wetlands.

c. Flooding and Flood Hazards

The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Rate Maps that identify areas subject to flooding (Special Flood Hazard Areas). Special Flood Hazard Areas are rated by FEMA by the risk of flooding and projected depth of flooding, and are generally defined by the 100-year flood zone (also known as the 1-percent-annual-chance flood, or base flood) and the 500-year flood zone (also known as the 0.2-percent-annual-chance flood). Some areas within 100-year flood zones are further designated as regulatory floodways and have more stringent limitations on encroachment of fill and structures. See the Regulatory Framework subsection below for further discussion of regulatory floodways. The Special Flood Hazard Areas for the 100-year and 500-year flood are shown in Figures 3.H-3a and 3.H-3b. Flood zones and designations within the study area are as follows:

- 100-year floodplain:
  - Zone A – 100-year floodplain with no base flood elevations determined.
  - Zone AE – 100-year floodplains, with base flood elevations determined.
  - Zone AH – areas that would result in shallow ponding (average depth of 1 to 3 feet) during a 100-year flood.
  - Zone AO – areas of shallow flow in a 100-year flood, which is usually sheet flow or, in sloping terrain, areas with water elevations of 1 to 3 feet.

[24] Zone 7 Water Agency, 2014. Preliminary Lake Use Evaluation for the Chain of Lakes. March.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Alternative includes components 1 and 8.

Source: Arup, 2017b; FEMA, 2009a.

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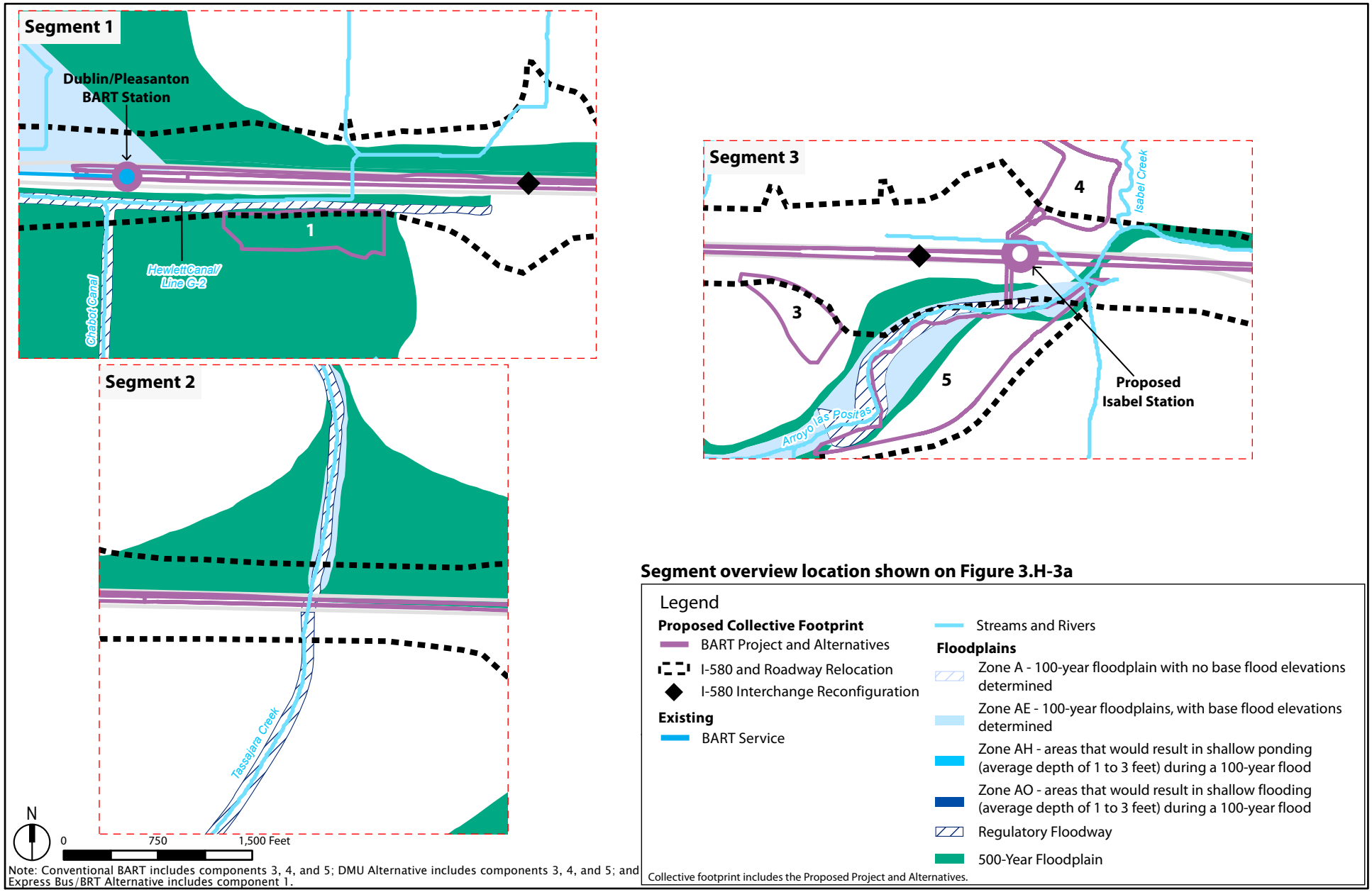
Figure 3.H-3a
Hydrology and Water Quality
Special Flood Hazard Areas – Overview



Note: Conventional BART includes components 3, 4, and 5; DMU Alternative includes components 3, 4, and 5; and Express Bus/BRT Alternative includes component 1.

Source: Arup, 2017b; FEMA, 2009a.

Figure 3.H-3b
Hydrology and Water Quality
Special Flood Hazard Areas – Detail

- 100-year floodplain (regulatory floodway):
  - Zone AE Special Flood Hazard Areas that have also been designated as a regulatory floodway. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1 foot.[25]
- 500-year floodplain
- Areas with no floodplain designation

Special Flood Hazard Areas underlie portions of the collective footprint. For example, as shown in Figures 3.H-3a and 3.H-3b, portions of the study area are within a Zone AE 100-year floodplain. The largest 100-year floodplains within the study area include the following areas: Alamo Canal adjacent to the I-580/I-680 crossing; areas draining to Chabot Canal upstream of I-580; the north side of I-580 between Tassajara Road and Fallon Road; Arroyo Mocho and the Chain of Lakes area; and the Las Positas Golf Course area. In addition, regulatory floodways relevant to the collective footprint include those for Chabot Canal and Line G-2 near the Dublin/Pleasanton BART Station, Tassajara Creek at I-580, and Arroyo las Positas just upstream (east) of Isabel Avenue (adjacent to the proposed Isabel BART Station).

Ultimately, flood control management, policy promulgation, and enforcement are under the authority of FEMA. However, under the federal code, these responsibilities can also be delegated to a local floodplain manager, such as a city and/or municipality or a local agency. Flood control within the Livermore-Amador Valley is primarily under the jurisdiction of Zone 7 and individual municipalities, which are collectively responsible for most flood control structures and conveyances in the study area.[26] The City of Livermore, the City of Pleasanton, and the City of Dublin also provide local floodplain management and maintenance of unimproved drainage channels and storm drain systems within their jurisdictions. Zone 7 maintains a large network of improved flood control channels.

Over time, urban development has encroached on floodplain areas of the Livermore-Amador Valley. Some broad arroyos have been converted to trapezoidal channels, and construction of new roads and buildings has increased the total impervious surface area in the watershed and resulted in an overall reduction in infiltration area and an associated increase in peak runoff rates and volumes within the valley. As the Livermore-Amador Valley continues to change from rural to urban and suburban land

[25] Federal Emergency Management Agency (FEMA), 2009b. Flood Insurance Study, Alameda County, California, and Incorporated Areas, Volume 1 of 3. August 3.
[26] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.

uses, increases in both peak runoff and runoff volume are predicted for most of the principal creeks and arroyos in and around the study area.[27] Further, growth and development encroachment onto historic floodplains has exacerbated the risk of flood damage.[28] In the past, flooding has occurred within the Livermore-Amador Valley at several locations: Arroyo de la Laguna between Arroyo Mocho and Bernal Avenue; Arroyo Mocho between Alamo Canal and Santa Rita Road; Arroyo Mocho along Stanley Boulevard; and the confluence of Arroyo las Positas and Arroyo Mocho.

d. Dam Inundation Areas

Del Valle Dam at Lake Del Valle is approximately 7 miles south of the study area. The dam was constructed in 1969 and is under the jurisdiction of the DWR Division of Safety of Dams. The maximum capacity of the Del Valle Dam reservoir is 77,106 acre-feet, but its operating capacity is typically approximately 50 percent of the maximum capacity or less to maintain flood control storage capacity.[29, 30] The dam averages about 44,000 acre-feet of storage. As shown in Figure 3.H-4, the portion of the study area west of Airway Boulevard is within the Del Valle Dam failure inundation area, which means that in 5 to 40 minutes after a catastrophic dam failure, this area would be inundated with water from the reservoir.[31]

e. Groundwater Hydrology

The study area is within the Livermore-Amador Valley Groundwater Basin.[32] A groundwater basin is defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers. Groundwater basins, which do not necessarily coincide with surface drainage basins, are defined by surface features and/or geological features such as faults, impermeable layers, and natural or artificial divides in the water table surface. The elevation of groundwater varies with the amount of withdrawal and the amount of recharge to the groundwater basin. Groundwater basins may be recharged naturally as precipitation infiltrates and/or artificially with imported or reclaimed water.

[27] Zone 7 Water Agency, 2006c. Zone 7 Stream Management Master Plan Final Master Environmental Impact Report, Chapter 3. August-.

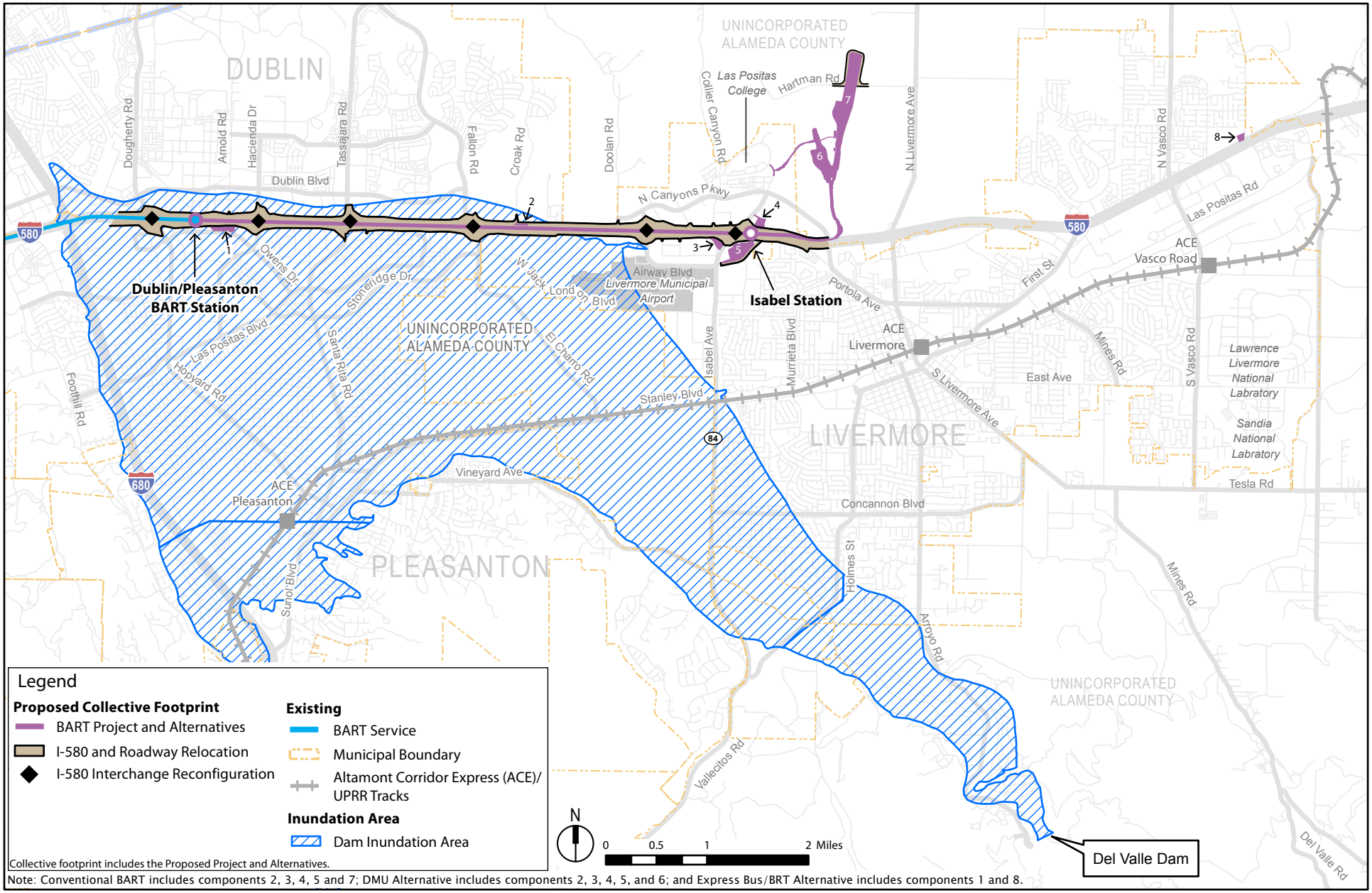
[28] Ibid.

[29] California Department of Water Resources (DWR), 2008. Bulletin 132-07: Management of the California State Water Project, Chapter 8 Water Supply.

[30] Lunn, David, 2008. Personal communication from David Lunn, Zone 7 Senior Water Engineer, with PBS&J. January 23.

[31] City of Livermore, 2004. City of Livermore General Plan 2003 – 2025, Public Safety Element, Figure 10-5 Dam Failure Inundation Areas Del Valle Dam.

[32] California Department of Water Resources (DWR), 2003. California Groundwater Bulletin 118; San Francisco Bay Hydrologic Region, Livermore Valley Groundwater Basin.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Alternative includes components 1 and 8.

Source: Arup, 2017b; OES, 2002.

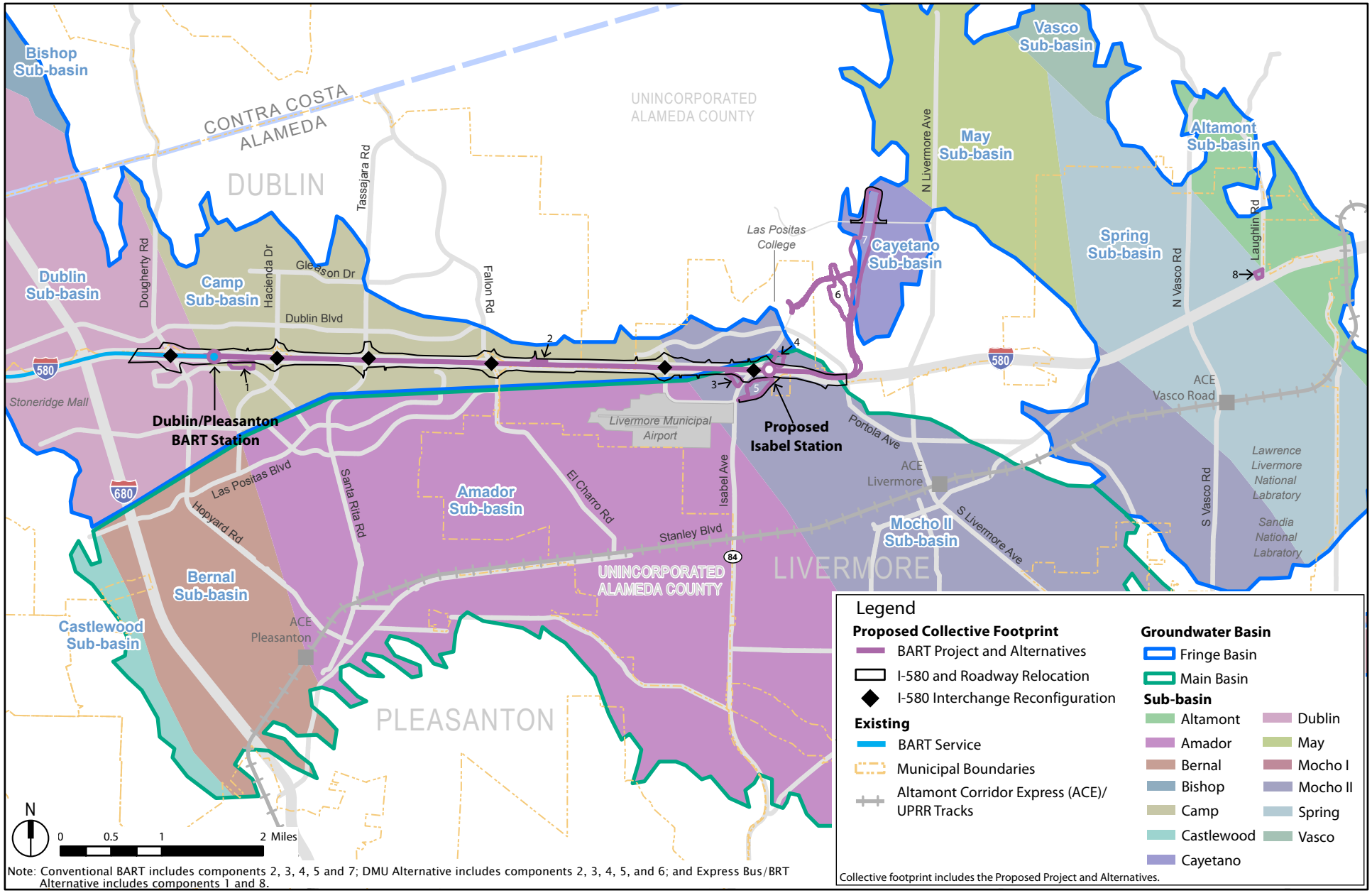
Figure 3.H-4
Hydrology and Water Quality
Dam Inundation Areas

Within the Livermore-Amador Valley Groundwater Basin, ground surface elevations range from about 600 feet above msl in the east, near the Altamont Hills, to about 280 feet above msl in the southwest, where Arroyo de la Laguna flows into the Sunol Groundwater Basin. The basin surface area is approximately 69,600 acres; it extends from the Altamont Hills and Greenville fault to the east to the Pleasanton Ridge and the Calaveras fault on the west, and from the Orinda Upland south to the Livermore Upland.[33] The floor of the Livermore-Amador Valley and portions of the upland areas of the valley overlie groundwater-bearing materials. The three major faults—Livermore Fault, Pleasanton Fault, and Parks Fault—prevent lateral groundwater movement. The general groundwater gradient is from east to west then south toward Arroyo de la Laguna.[34] Groundwater levels within the study area can range from less than 10 feet below ground surface in unconfined aquifers to more than 70 feet below ground surface.[35] Zone 7 administers oversight of the Livermore-Amador Valley Groundwater Basin through its Groundwater Management Program. The DWR has not identified the Livermore-Amador Valley Groundwater Basin as either in overdraft or expected to be in overdraft.

The Livermore-Amador Valley Groundwater Basin has been divided into two major basins based on importance for water supply: the Main Basin, which is the primary basin for groundwater storage and supply, and the Fringe Basin, which is a secondary basin surrounding the Main Basin that provides limited storage and supply. The Main Basin is composed of the Castlewood, Bernal, Amador, and Mocho II sub-basins, and represents the portion of the groundwater basin with the highest yield and highest quality of water within the Livermore-Amador Valley Groundwater Basin.[36] The Fringe Basin is considered to be less important for groundwater supply and management.[37] The collective footprint is primarily within the boundaries of the Fringe Basin, with a small portion of the area overlying the Main Basin at the Isabel North and South Areas, as shown in Figure 3.H-5.

The Main Basin covers over 17,000 acres and has an estimated storage capacity of 250,000 acre-feet, which is essentially equivalent to the estimated capacity of the entire Livermore-Amador Valley Groundwater Basin.[38] Though the overall extent of the area covered by the Fringe Basin is much greater (approximately 45,000 acres), it has much less capacity for groundwater storage. Currently, Zone 7 manages the Main Basin so that,

[33] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.
[34] California Department of Water Resources (DWR), 2003. California Groundwater Bulletin 118; San Francisco Bay Hydrologic Region, Livermore Valley Groundwater Basin.
[35] Zone 7 Water Agency, 2015. Annual Report for the Groundwater Management Program 2014 Water Year, Livermore Valley Groundwater Basin. July.
[36] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.
[37] Ibid.
[38] Ibid.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Alternative includes components 1 and 8.

Source: Arup, 2017b; Zone 7, 2013a.

Figure 3.H-5
Hydrology and Water Quality
Groundwater Basins

under non-emergency conditions, including several multi-year droughts, groundwater elevations do not drop below historic low levels through annual conjunctive use practices.[39] Groundwater recharge occurs through natural and artificial recharge from rainfall, releases from the South Bay Aqueduct of Lake del Valle, and gravel mining (water) recharge to Arroyo Mocho and Arroyo del Valle; however, the majority of recharge is through artificial recharge and recharge through stream channels. The annual average natural recharge into the groundwater basin is approximately 13,400 acre-feet per year.

Zone 7 artificially recharges the basin with additional surface water supplies by releasing water into Arroyo Mocho and Arroyo Valle. The existing artificial recharge capacity ranges from 12,300 to 20,000 acre-feet per year.[40]

Similar to surface streams in the study area, groundwater generally follows a westerly flow pattern along the axis of the valley.[41] The southeastern region of the Livermore-Amador Valley, farther southeast beyond the study area at the edge of the valley, is the most important groundwater recharge area, consisting mainly of sand and gravel deposited by the ancestral and present Arroyo del Valle and Arroyo Mocho.

f. Water Quality

(1) Surface Water Quality

While limited water quality data are available for the streams within the study area, water quality is expected to reflect the land uses in the watershed. The type and concentrations of pollutants in runoff water tend to be related to land cover, land uses, topography, and the amount of impervious cover, as well as to the intensity and frequency of rainfall and, in some cases, irrigation. Land uses surrounding the waterways draining the study area include open space, urban/industrial, and agriculture. Runoff in developed areas may contain oil, grease, and metals accumulated in streets, driveways, parking lots, and rooftops, as well as pesticides, herbicides, particulate matter, nutrients, animal waste, and other oxygen-demanding substances from landscaped areas. Agricultural land uses typically contribute sediment, pesticides, nutrients, and bacteria to runoff. Open space lands typically contribute bacteria, sediment from steep areas, and landscaping materials, if landscaped.

[39] Conjunctive use means the use of groundwater mixed with surface water to meet water demands and water quality requirements, and includes the use of surface water resources to artificially recharge groundwater.

[40] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.

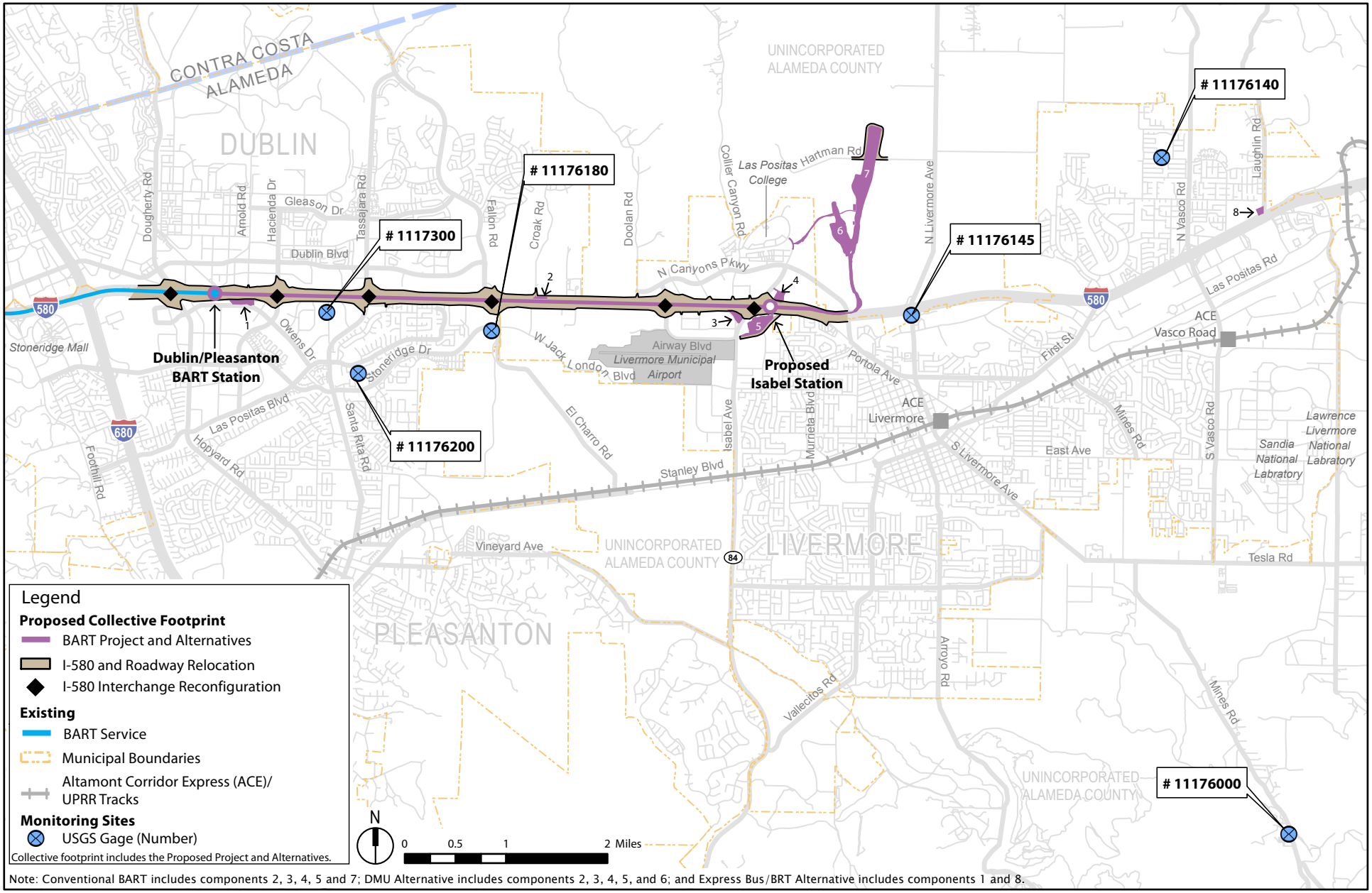
[41] Zone 7 Water Agency, 2016a. Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin. December.

Available water quality data for the study area include water quality data gathered by the USGS during the early 1980s and more recent data collected by Zone 7. Available data suggest that the water quality of Arroyo Las Positas has remained relatively unchanged throughout the past 20 years, and that Zone 7 water quality objectives are being met for most constituents. [42] Total dissolved solids (TDS) thresholds, however, are exceeded regularly, and the water is generally high in chlorides. Alkaline soils in natural sections of the creek are a contributing factor to the elevated TDS levels. Ongoing erosion of stream bed and banks is also contributing sediment to the creek. Table 3.H-2 lists the range of historic water quality measurements in Tassajara Creek, Arroyo las Positas, Arroyo Mocho, and Altamont Creek. Figure 3.H-6 summarizes the locations of the water quality monitoring sites described in Table 3.H-2 relative to the study area and features. Historic measures of surface water quality indicate generally high salinity or hardness, nitrogen, and chloride, and moderately high pH. Table 3.H-3 lists measured water quality parameters in Arroyo Mocho and Arroyo las Positas for the 2014 water year (October 1, 2013 through September 30, 2014).

In accordance with State policy for water quality control, the San Francisco Bay Regional Water Quality Control Board (RWQCB) employs a range of beneficial use definitions for surface waters, groundwater, marshes, and mudflats that serve as the basis for establishing water quality objectives and discharge conditions and prohibitions. The San Francisco Bay RWQCB has identified existing and potential beneficial uses supported by the key surface water drainages throughout the Bay Area in the San Francisco Bay Basin Water Quality Control Plan (Basin Plan).[43] Many of the water bodies within the study area are tributaries to either Arroyo las Positas or Arroyo Mocho, and have been assigned the following existing and potential beneficial uses in the Basin Plan: groundwater recharge, cold freshwater habitat, warm freshwater habitat, fish migration, fish spawning, wildlife habitat, contact water recreation, and non-contact water recreation. Because the beneficial uses of any specifically identified water body generally apply to all its tributaries, the beneficial use of wildlife habitat applies to the tributaries of Arroyo las Positas and Arroyo Mocho. The beneficial uses designated in the Basin Plan for the creeks and arroyos in the proposed location of the Proposed Project and Build Alternatives are identified in Table 3.H-4.

[42] City of Livermore, 2016. El Charro Specific Plan Draft Environmental Impact Report. Available at: http://www.cityoflivermore.net/citygov/cedd/planning/charro.htm.

[43] Regional Water Quality Control Board, 2015. San Francisco Bay Basin Water Quality Control Plan. RWQCB San Francisco Bay Region. March.



Note: Conventional BART includes components 2, 3, 4, 5 and 7; DMU Alternative includes components 2, 3, 4, 5, and 6; and Express Bus/BRT Alternative includes components 1 and 8.

Source: Arup, 2017b; USGS, 2013a.

Figure 3.H-6
Hydrology and Water Quality
USGS Water Monitoring Sites

TABLE 3.H-2 HISTORIC SURFACE WATER QUALITY WITHIN THE STUDY AREA

	Location					
Constituent	**Tassajara Creek Near Pleasanton**	**Arroyo Mocho Near Pleasanton**	**Arroyo las Positas at El Charro Road Near Pleasanton**	**Arroyo las Positas at Livermore**	**Altamont Creek Near Livermore**	**Arroyo Mocho Near Livermore**
USGS Gage #	11176300	11176200	11176180	11176145	11176140	11176000
Date	1/80–6/83	11/70–6/83	12/79–6/83	3/81–6/83	1/80–3/80	10/79–8/83
Specific Conductivity (µS/cm)	345–1,300	500–1,610	340–2,500	1,050–3,250	670–4,440	270–1,300
pH	7.7–8.6	7.8–8.8	7.5–8.6	7.0–8.4	8.3	7.7–8.6
Nitrate + Nitrite as Nitrogen (mg/L)	0.04–2.60	0.15–4.40	0.58–6.20	0.02–7.40	2.10–5.00	0.010–1.70
Hardness as Calcium Carbonate (mg/L)	73–320	190–370	59–460	37–110	100–480	120–600
Sodium (mg/L)	41–160	45–110	49–420	3.3–8.7	140–770	12–63
Chloride (mg/L)	16–100	47–280	48–640	170–730	120–1,200	7.1–79
Residue Filtered, Sum of Constituents (Dissolved Solids) (mg/L)	243–730	260–671	203–1,450	501–2,050	478–2,510	159–734

Notes: µS/cm = microSiemens per centimeter; pH = potential of hydrogen (scale of acidity); mg/L = milligrams per liter
Source: U.S. Geological Survey (USGS), 2013b.

TABLE 3.H-3 RECENT SURFACE WATER QUALITY IN ARROYO MOCHO AND ARROYO LAS POSITAS

Location	Electrical Conductivity (µS/cm)	pH	TDS (mg/L)	Hardness (mg/L)	Nitrogen (mg/L)	Chloride (mg/L)
Arroyo Mocho						
Near Livermore	1,104–2,533	7.6–7.9	678–1,533	544–1,047	<0.44–0.97	54–394
Near Pleasanton	1,217	8.4	697	307	<0.44	197
Arroyo las Positas						
At Livermore	1,219	8.0	711	374	13.46	150
At El Charro Road	1,222	8.1	688	344	1.95	164

Note: µS/cm = microSiemens per centimeter; pH = potential of hydrogen (scale of acidity); mg/L = milligrams per liter; TDS = total dissolved solids.
Source: Zone 7 Water Agency, 2015.

TABLE 3.H-4 DESIGNATED BENEFICIAL USES

Waterbody	Cold Freshwater Habitat	Groundwater Recharge	Fish Migration	Water Contact Recreation	Non-contact Water Recreation	Fish Spawning	Warm Fish Habitat	Preservation of Rare Species	Wildlife Habitat
Arroyo Mocho	E	E	E	E	E	E	E		E
Tassajara Creek	P	E	E	E	E	E	E	E	E
Cottonwood Creek				E	E		E	E	E
Collier Canyon Creek				E	E		E	E	E
Cayetano Creek				E	E		E	E	E
Altamont Creek	E	E		E	E		E	E	E
Arroyo las Positas	E	E	E	E	E	E	E	E	E
Arroyo Seco (Alameda)	E	E	E	E	E	E	E	E	E

Notes: E = existing beneficial use; P = potential beneficial use.
Source: Regional Water Quality Control Board (RWQCB), 2015.

Some water bodies have been given special status under Section 303(d) of the federal Clean Water Act (CWA), which requires each state to identify "impaired" water bodies that will not achieve water quality standards after application of technology-based effluent limits, and to develop plans for water quality improvements. For each impairing pollutant, the states must determine the total maximum daily load (TMDL) that the water body can assimilate without violating that state's water quality standards. A TMDL is also a written plan that describes how an impaired water body will meet water quality standards.

Alameda Creek, Arroyo de la Laguna, Arroyo Mocho, and Arroyo las Positas are all listed as impaired by diazinon, an insecticide found in urban runoff and storm sewers.[44] The diazinon impairment is currently being addressed by a U.S. Environmental Protection Agency (EPA)-approved TMDL that was completed in 2006. In addition, Arroyo Mocho is listed as impaired by high water temperatures, and Arroyo las Positas is listed as impaired by nutrients and indicators of eutrophication, which is the process by which a body of water becomes enriched by dissolved nutrients that stimulate the growth of aquatic plant life, usually resulting in depletion of dissolved oxygen. The specific sources of nutrients are listed as unknown in both cases.[45]

These drainages ultimately discharge into the lower San Francisco Bay. The lower San Francisco Bay is listed as impaired by the following contaminants: chlordane, dichlorodiphenyltrichloroethane, dieldrin, and mercury from nonpoint sources; dioxin compounds, furan compounds, and mercury from atmospheric deposition; exotic species from ballast water; polychlorinated biphenyls (PCBs) and dioxin-like PCBs from unknown nonpoint sources; and trash from illegal dumping and urban runoff.[46] Industrial and municipal point sources, resource extraction, and natural sources are also considered to contribute to mercury degradation of the lower San Francisco Bay. The lower San Francisco Bay was previously categorized as "TMDL required." Proposed changes designate this water body as "now being addressed by EPA-approved TMDLs" (for PCBs and dioxin-like PCBs).[47]

(2) Groundwater Quality

Zone 7 actively monitors the quality of water at many of the key stream recharge areas to ensure water quality protection of both surface water and groundwater. Groundwater quality has been highly variable throughout the Main Basin. [48]

The Main Basin is characterized by relatively good quality groundwater that meets all State and federal drinking water standards with only minimal treatment (chloramination to preserve quality in the distribution system). The Main Basin serves large-capacity municipal production wells, and is also used to store and distribute high-quality imported water through Zone 7's recharge program. The primary groundwater water quality concerns in the Main Basin are TDS (or hardness), nitrate, boron, and organic

[44] Regional Water Quality Control Board, San Francisco Bay Region, 2012. Final 2012 Integrated Report (CWA Section 303(d) List / 305(b) Report).
[45] Ibid.
[46] Ibid.
[47] Regional Water Quality Control Board, San Francisco Bay Region, 2016. Proposed Changes to 303 (d) List. Accessed April 12, 2017.
[48] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.

compounds.[49] Groundwater in the Fringe sub-basins tends to be saltier than the Main Basin. Zone 7 has developed a salt management plan to identify and evaluate all significant salt loading to, and removed from, the groundwater basin.[50] Zone 7 has identified recharge of local streamflow and imported water, subsurface inflow, and irrigation returns as major contributors to increasing TDS concentrations. Localized elevated groundwater nitrate levels are associated with livestock operations and septic tank usage in the central and eastern portions of the Livermore-Amador Valley.

The northern portion of the Livermore-Amador Valley Groundwater Basin is dominated by sodium-rich water, while much of the western part of the basin near the city of Pleasanton has a magnesium-sodium characteristic (i.e., both magnesium and sodium are dominant cations).[51] The area along the eastern portion of the basin, beneath the Livermore area, has magnesium as the predominant cation. In the western portion of the Main Basin, groundwater is a calcium-magnesium-bicarbonate water type and has historically been hard. However, increased salinity in the western Main Basin is associated with several factors, but is primarily associated with saline shallow groundwater flowing from the Fringe sub-basins into the Main Basin or into streams that recharge the Main Basin. Increased salinity from irrigation in a semi-arid region is another major issue; salts are left behind as water evaporates or are used by plants and then washed down into groundwater during subsequent rain or irrigation events.

Trace amounts of boron are present in the eastern portion of the Fringe sub-basins (associated with natural marine geologic formations) and with shallow groundwater in the northern Fringe sub-basins. High boron levels and lower aquifer yields can limit the use of some Fringe sub-basins for agricultural irrigation.

Local impairments include some areas with boron concentrations exceeding 2 milligrams per liter (mg/L). Nitrates have also impaired portions of the Main Basin, especially in the east. Nitrate levels of 30 to 65 mg/L have been identified in a 670-acre area of unincorporated residential and agricultural land located south of Livermore.[52] Nitrates from in-basin wastewater disposal historically contributed to this problem prior to 1980.

Releases of fuel hydrocarbons from leaking underground storage tanks and spills of organic solvents at industrial sites have caused minor-to-significant groundwater impacts in specific parts of the region.[53] Chlorinated organic solvent releases to soil and

[49] Total dissolved solids is a measure of water salinity and hardness.
[50] Environmental Sciences Associates, 2004. Draft Zone 7 Water Agency Well Master Plan EIR, Chapter 3. Prepared for the Zone 7 Water Agency. April.
[51] A cation is a positively charged ion.
[52] Zone 7 Water Agency, 2005. Groundwater Management Plan for Livermore-Amador Valley Groundwater Basin. September-.
[53] Ibid.

groundwater are also an issue in the region, primarily in the Fringe sub-basins and in upper aquifers.

TDS in local surface water that serves to recharge the Livermore-Amador Valley Groundwater Basin varies significantly throughout the watershed, from approximately 350 mg/L to more than 1,000 mg/L.[54] The highest quality surface water recharging the basin occurs within Arroyo Mocho and Arroyo del Valle, where TDS is generally less than 500 mg/L. The poorest quality surface water recharging the basin has approximately 1,000 mg/L of TDS and occurs within Arroyo las Positas.

3. Regulatory Framework

This subsection describes the federal, State, and local environmental laws and policies relevant to water quality and hydrological resources.

a. Federal Regulations

(1) Clean Water Act

The purpose of the federal CWA (33 United States Code, Section 1251 et seq.) is restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters through prevention and elimination of pollution. The CWA applies to discharges of pollutants into waters of the U.S. The State Water Resources Control Board (SWRCB) is the California agency primarily responsible for implementing State and federal regulations relating to hydrology and water quality issues. Most regulatory requirements are implemented by the SWRCB through its nine RWQCBs. The CWA operates on the principle that any discharge of pollutants into the nation's waters is prohibited unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The following sections of the CWA are most relevant to this analysis.

(a) Clean Water Act Section 303 – Total Maximum Daily Load Program

California adopts water quality standards to protect beneficial uses of waters of the State as required by Section 303 of the CWA and the State's Porter-Cologne Water Quality Control Act of 1969. Section 303 establishes the TMDL process to guide the application of State water quality standards. To identify candidate water bodies for TMDL analysis, a list of water-quality-limited water bodies is generated. Water-quality-limited means that the water bodies are not meeting water quality standards because they are impaired by the presence of pollutants, including sediments.

[54] Ibid.

The TMDL is the maximum amount of pollution (both point and nonpoint sources) that a water body can assimilate without violating State water quality standards. Priorities for development of TMDLs are set by the State based on the severity of the pollution and the beneficial uses of the waters. The EPA TMDL program provides a process for determining pollution budgets for the nation's impaired waters. Pollutant loading limits are set and implemented by the SWRCB and the RWQCBs under the Porter-Cologne Water Quality Control Act, which provides the basis for water quality regulation within California.

(b) Clean Water Act Section 401 – Clean Water Quality Certification

Under Section 401 of the CWA, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the U.S. must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. All projects that have a federal component and may affect the quality of the states' waters (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401. In California, Section 401 certification or waiver thereof, is under the jurisdiction of the applicable RWQCB.

(c) Clean Water Act Section 402 – National Pollutant Discharge Elimination System Program

Section 402 of the CWA regulates discharges to surface waters through the NPDES program, administered by the EPA. In California, the SWRCB is authorized by the EPA to oversee the NPDES program through the RWQCBs. The NPDES program provides for both general permits (those that cover categories of activities) and individual permits.

The NPDES permit system was established in the CWA to regulate point source and certain types of diffuse source discharges. Point sources include a municipal or industrial discharge at a specific location or pipe. Urban stormwater runoff and construction site runoff are diffuse-sources of pollutants, similar to nonpoint sources, but regulated under the NPDES permit program because they are conveyed in a discrete conveyance system and discharged at a specific location.

For regulated diffuse source discharges, the NPDES program establishes a comprehensive stormwater quality program to manage urban stormwater and minimize pollution of the environment to the maximum extent practicable. To meet the goals of the NPDES permit, each local stormwater program and each permittee within a program establishes a Stormwater Management Plan. These plans provide specific local requirements targeted to meet the environmental needs of each watershed, as well as to reflect the political consensus of each community.

(d) Clean Water Act Section 404 – Permit for Fill Material in Waters and Wetlands

Section 404 of the CWA regulates the discharge of dredged and fill materials into waters of the U.S., which include oceans, bays, rivers, streams, lakes, ponds, and wetlands. The Section 404 permit is issued by the U.S. Army Corps of Engineers (USACE). Refer to Section 3.I, Biological Resources, for further discussion.

(2) Executive Orders 11988 and 13690 and the Federal Emergency Management Agency

Under Executive Order 11988, FEMA is responsible for managing floodplain areas. FEMA administers the National Flood Insurance Program to provide subsidized flood insurance to communities (e.g., the City of Livermore) that comply with FEMA regulations limiting development in floodplains. FEMA also issues Flood Insurance Rate Maps that identify land areas subject to flooding. These maps provide flood information and identify flood hazard zones in the community. The FEMA design standard establishes the minimum level of flood protection for new development at the 1-percent chance annual exceedance event (i.e., the 100-year flood event).

On January 30, 2015, President Obama issued Executive Order 13690 that revises Executive Order 11988 and proposes a new Federal Flood Risk Management Standard. Under Executive Order 13690, agencies are required to expand management beyond the base flood elevation for federal projects and, where possible, use natural systems, ecosystem processes, and nature-based approaches. However, regulations implementing some or all of Executive Order 13690 have not yet been issued within the study area or within Alameda County.

Encroachment within floodplains or regulatory floodways, such as structures and fill, generally reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic benefit of floodplain development against the resulting increase in flood hazard. Minimum federal standards limit such increases within the 100-year floodplain to 1 foot, cumulatively, during the 100-year flood event, provided that hazardous velocities are not produced. Within regulatory floodways, federal standards prohibit any increase in the 100-year flood elevation as a result of encroachment, unless a conditional floodway revision is applied for and ultimately approved by FEMA. Buildings, structures, and other development activities (such as fill) placed within a regulatory floodway are more likely to obstruct flood flows, causing the water to slow down and back up, resulting in higher flood elevations.

All projects in the regulatory floodway must undergo an encroachment review to determine their effect on flood flows and ensure that they do not cause unanticipated flooding.[55] Development projects in the flood fringe, by definition, do not increase flood heights above the allowable level; thus, encroachment reviews are not needed. Title 44 of the Code of Federal Regulations (CFR) 60.3(d)(3) states that communities must prohibit encroachments—including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway—unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the base flood discharge. Further, for any proposed alteration or relocation of a watercourse within a special flood hazard area, Title 44 of the CFR 60.3(b)(6) states that the community shall notify the National Flood Insurance Program State Coordinating Office and submit copies of such notifications to FEMA.

The floodways in the flood insurance study for Alameda County are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.[56]

b. State Regulations

(1) Porter-Cologne Water Quality Act

The San Francisco Bay RWQCB has regulatory authority over wetlands and waterways under both the federal CWA and the State of California's Porter-Cologne Water Quality Control Act (California Water Code, Division 7, Section 13000 et seq.). Under the CWA, the San Francisco Bay RWQCB has regulatory authority over actions in waters of the U.S. through the issuance of water quality certifications under Section 401; these certifications are issued in combination with permits by the USACE under Section 404 of the CWA. When the San Francisco Bay RWQCB issues Section 401 certifications, it simultaneously issues waste discharge requirements (WDRs) for projects under the Porter-Cologne Water Quality Control Act. Activities in areas outside the jurisdiction of the USACE (e.g., isolated wetlands, vernal pools, or stream banks above the ordinary high water mark) are regulated by the San Francisco Bay RWQCB under the authority of the Porter-Cologne Water Quality Control Act. Activities that lie outside USACE jurisdiction may require the issuance of either individual or general WDRs from the San Francisco Bay RWQCB.

[55] Federal Emergency Management Agency (FEMA), 2013. National Flood Insurance Program Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials. Available at: www.fema.gov/media-library-data/20130726-1539-20490-9157/nfip_sg_full.pdf.

[56] Federal Emergency Management Agency (FEMA), 2009. Flood Insurance Study, Alameda County, California, and Incorporated Areas, Volume 1 of 3. August 3.

Under the authority of the Porter-Cologne Water Quality Act, the San Francisco Bay RWQCB has developed and implements the Basin Plan, which defines the beneficial uses of waters of the State within the San Francisco Bay Region. Beneficial uses designated for the Livermore-Amador Valley Groundwater Basin include municipal and domestic supply, industrial process supply, industrial service supply, and agricultural supply. Arroyo Mocho, Arroyo las Positas, Tassajara Creek, Arroyo Seco, and Arroyo de la Laguna have designated beneficial uses of groundwater recharge, fish migration, fish spawning, wildlife habitat, cold and warm freshwater habitat, and recreation (both water-contact and non-water-contact). Any permit action taken by the San Francisco Bay RWQCB must be consistent with maintaining beneficial uses of waters of the State.

(2) Sustainable Groundwater Management Act of 2014

The Sustainable Groundwater Management Act (SGMA), signed into law by the California Legislature in 2014, under California Water Code Section 10723, provides a framework for sustainable management of groundwater resources. In groundwater basins designated by DWR as medium and high priority, local public agencies and groundwater sustainability agencies are required to develop and implement groundwater sustainability plans (or alternative). Each groundwater sustainability plan or alternative must include measurable objectives and interim milestones for achieving sustainability goals for the given groundwater basin. Plans must also include a physical description of the basin—including information on groundwater levels, groundwater quality, subsidence and groundwater-surface water interaction, historical and projected water demand and supply data, monitoring and management provisions, and a description of how the plan will affect other plans. The Livermore Valley, managed by Zone 7, has been designated as a medium- or high-priority groundwater basin within the context of the SGMA. Zone 7 has produced an alternative groundwater sustainability plan; while Zone 7 recognizes that the management criteria concepts set forth by the SGMA have not yet been incorporated into its policies and actions, Zone 7's current groundwater management practices are functionally equivalent to the SGMA process.[57]

(3) NPDES Program

Discussed below are the permit programs implemented under the CWA and administered by the SWRCB and RWQCBs that are most relevant to this analysis.

[57] Zone 7 Water Agency, 2016a. Alternative Groundwater Sustainability Plan for the Livermore Valley Groundwater Basin. December.

(a) NPDES Construction General Permit

The SWRCB permits all regulated construction activities under Order No. 2009-0009-DWQ (effective July 1, 2010), which requires, prior to beginning any construction activities, that the permit applicant obtain coverage under the Construction General Permit (CGP) by preparing and submitting a Notice of Intent to the SWRCB, and preparing and implementing a Stormwater Pollution Prevention Plan (SWPPP) in accordance with the CGP requirements for all construction activities disturbing 1 or more acres of land surface. In addition, 2003 revisions to the original CGP clarify that all construction activity, including at small construction sites that are part of a larger common plan, must obtain coverage under this CGP.

(b) Dewatering Activities

Small and/or temporary construction-related dewatering activities (e.g., excavations during construction) are covered under the CGP or a general WDR permit for low-threat discharges to land.[58] Large amounts of dewatering, particularly over lengthy periods of time, or dewatering discharges to surface waters, may necessitate individual WDRs. Project-related dewatering is likely to be limited in nature and scope and covered under the CGP or a general WDR permit.

(c) Caltrans Statewide Permit

The California Department of Transportation (Caltrans) is responsible for the design, construction, management, and maintenance of the State highway system, including freeways, bridges, tunnels, Caltrans' facilities, and related properties. Caltrans' discharges consist of stormwater and non-stormwater discharges from State-owned ROWs. Stormwater discharges from Caltrans' stormwater systems are regulated under a statewide permit for all stormwater discharges from Caltrans-owned Municipal Separate Storm Sewer Systems, maintenance facilities, and construction activities (NPDES Statewide Stormwater Permit Waste Discharge Requirements for State of California Department of Transportation [Order No. 2012-0011-DWQ]).[59] This permit applies to projects within Caltrans ROWs, regardless of the level of Caltrans involvement. Thus, construction and operation of the Proposed Project and Build Alternatives within Caltrans ROWs would be subject to the Caltrans statewide permit. All treatment measures designed to comply with the provisions of the Caltrans statewide permit—e.g., site design, source control best

[58] California State Water Resources Control Board Water Quality Order No. 2003-0003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality.

[59] California State Water Resources Control Board Order 2012-0011-DWQ, as amended by Order WQ 2014-0006-EXEC, Order WQ 2014-0077-DWQ, and Order WQ 2015-0036-EXEC, National Pollutant Discharge Elimination System (No. CAS000003) Statewide Storm Water Permit, Waste Discharge Requirements for State of California Department of Transportation.

management practices (BMPs)—would be submitted to Caltrans' engineering staff for review. BART would evaluate any subsequent comments and any proposed revisions for potential incorporation into the project design, as appropriate.

(d) Caltrans Stormwater Management Plan

Caltrans' Stormwater Management Plan (SWMP) describes the procedures and practices used to reduce or eliminate the discharge of pollutants to storm drainage systems and receiving waters.

The stormwater conveyance structures that are part of the Caltrans statewide system of transportation corridors, facilities, and related appurtenances are considered a Municipal Separate Storm Sewer System. The SWMP applies to discharges consisting of stormwater and non-stormwater resulting from the following:

- Maintenance and operation of State-owned highways, freeways, and roads
- Maintenance facilities
- Other facilities with activities that have the potential for discharging pollutants
- Permanent discharges from subsurface dewatering
- Temporary dewatering
- Construction activities

This SWMP describes Caltrans' program and addresses stormwater pollution control related to Caltrans activities, including planning, design, construction, maintenance, and operation of roadways and facilities. The SWMP is designed to include an iterative process of use, evaluation, and modification of BMPs to provide continuing progress toward achieving compliance with stormwater quality requirements. Projects constructed by other agencies on Caltrans property require a Caltrans encroachment permit. The sponsor must file the Notice of Intent and seek coverage under the SWRCB's CGP before Caltrans will issue an encroachment permit for any construction activity within the Caltrans ROW.

(e) Municipal Regional Stormwater NPDES Permit

Municipal stormwater runoff from the Alameda, Contra Costa, San Mateo, Santa Clara, Fairfield-Suisun, and Vallejo permittees' areas are subject to the NPDES municipal stormwater program under the Municipal Regional Stormwater NPDES Permit (MRP) (Permit No. CAS612008, Order No. R2-2015-0049).[60] The MRP is an extensive regulatory mechanism with provisions aimed specifically at substantially limiting the potential hydrological impacts of new development. One of the primary objectives of the regulations for pollutant dischargers is the reduction of pollutants in urban stormwater by

[60] San Francisco Bay Regional Water Quality Control Board, 2015. Municipal Regional Stormwater NPDES Permit (Permit No. CAS612008, Order No. R2-2015-0049). November 19.

using BMPs. The study area lies within the cities of Dublin, Pleasanton, Livermore, and unincorporated areas of Alameda County, all of which are subject to the provisions the MRP.

New development projects that create 10,000 square feet or more of impervious surface (collectively over the entire project site) are considered regulated projects under the MRP, which requires such projects to implement low-impact development (LID) source control BMPs, site design BMPs, and stormwater treatment BMPs, either on site or at a joint stormwater treatment facility, unless the MRP Provision C.3.e alternate compliance applies. The MRP requires regulated projects to treat 100 percent of project site runoff with LID measures, including harvesting and use, infiltration, evapotranspiration, and biotreatment. The bus infrastructure improvements under the Enhanced Bus Alternative, as well as the feeder bus improvements for the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would be regulated projects if they create or replace 10,000 square feet or more of impervious surfaces. Regulated projects must provide permanent post-construction treatment controls for stormwater according to specific calculations (Provision C.3.d.).

For projects where increased flow or volume is likely to cause increased erosion of creek beds and banks, silt pollutant generation, or other impacts to beneficial uses, MRP Provision C.3.g requires additional stormwater management controls for compliance with the Hydromodification Management Standard.[61] Stormwater discharges from hydromodification projects shall not cause an increase in the erosion potential of the receiving stream over the pre-project (existing) conditions. A hydromodification project is a regulated project that creates and/or replaces 1 acre or more of impervious surface and is not specifically excluded in the MRP. Thus, the Proposed Project and Build Alternatives would be located within an area subject to the Hydromodification Management Standard. [62]

A Hydrograph Modification Management Plan was prepared by the Alameda Countywide Clean Water Program in partial fulfillment of requirements in its third 5-year municipal stormwater discharge permit. [63] Additionally, a C.3 Stormwater Technical Guidance handbook was prepared to help developers and project applicants implement the C.3 provisions.[64]

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[61] Ibid.

[62] Changes in the timing and volume of runoff from a site are known as hydrograph modification or hydromodification.

[63] Alameda County Public Works Agency, 2005. Alameda Countywide Clean Water Program, Hydrograph Modification Management Plan, Part A: General Provisions for Hydromodification Management. May 15.

[64] Alameda County Public Works Agency, 2016. Alameda Countywide Clean Water Program, C.3 Stormwater Technical Guidance – A handbook for developers, builders and project applicants. Version 5.0, April 11.

(f) Stormwater Discharges from Small Municipal Separate Storm Sewer Systems Permit

Phase II of the Municipal Separate Storm Sewer Systems (MS4) Permit—referred to as the Small MS4 Permit (SWRCB Order Number 2013-0001-DWQ, NPDES General Permit Number S000004)—contains specific actions necessary to reduce discharge of pollutants into stormwater to the maximum extent practicable, in a manner designed to achieve compliance with specific water quality standards and objectives under the CWA and the California Water Code. Phase II differs from Phase I in that it applies to special districts and other non-traditional entities, such as parks departments, universities, and the military. Many of the stormwater treatment BMPs and source control measures outlined in the MRP section are comparable to the actions described in the Phase II MS4 Permit. BART is a non-traditional permittee under the Small MS4 Permit; thus, the Proposed Project, DMU Alternative, and potentially the Express Bus/BRT Alternative would be considered regulated projects. Regulated projects must implement both construction and post-construction stormwater management measures, including but not limited to source control measures, LID design standards, hydromodification measures, and BMP condition assessments. Provisions in the order are enforceable and contain reporting requirements.

The RWQCBs are responsible for overseeing compliance with this order. Oversight may include but is not limited to reviewing reports, requiring modification to stormwater program components and various submissions, imposing region-specific monitoring requirements, conducting inspections and program evaluations (audits), and taking enforcement actions against violators of the order. Permittees shall modify and implement their stormwater management programs and monitoring as required by the RWQCB Executive Officer.

(g) Waste Discharge Requirements or Individual NPDES Permit

No general permit is in effect for construction or operational groundwater dewatering in Region 2, unless groundwater dewatering is permanent, requires treatment, and exceeds 10,000 gallons per day. If a project involves substantial construction or operational dewatering, an individual WDR permit could be required. If the discharge is directly to a surface water resource, a completed federal NPDES permit application form must be filed with the RWQCB. For other types of discharges, such as those affecting groundwater or in a diffused manner (e.g., erosion from soil disturbance or waste discharges to land), a Report of Waste Discharge must be filed with the RWQCB to obtain WDRs. Discharge of small amounts of water from construction dewatering is permitted under the CGP.

(h) Permanent Treated Groundwater Dewatering Waste Discharge Requirements

If a project requires substantial (more than 10,000 gallons per day) permanent groundwater dewatering and the groundwater must be treated prior to discharge, the

discharge requires coverage under the General Waste Discharge Requirements for Discharge or Reuse of Extracted Brackish Groundwater and Reverse Osmosis Concentrate Resulting from Treatment of Groundwater by Reverse Osmosis and Discharge or Reuse of Extracted and Treated Groundwater Resulting from Structural Dewatering (Order No. R2-2007-0033, NPDES No. CAG912004).[65] In accordance with discharge prohibitions, discharges shall not cause pollution, contamination, or nuisance as defined by Section 13050 of the California Water Code, and shall not occur at a volume or velocity that causes erosion or scouring to the banks or bottoms of receiving waters. Effluent limitations include limitations on residual chlorine (less than 0.08 mg/L), pH (6.5 to 8.5), and toxicity (rainbow trout survival in 96-hour static renewal bioassays). This NPDES permit includes reclamation and land discharge specifications, receiving water limitations, groundwater limitations, and monitoring and reporting requirements. To obtain coverage under this CGP, the discharger must submit a Notice of Intent application package documenting the proposed treatment system and associated operation, maintenance, and monitoring plans. The Notice of Intent must include analytical results for influent as identified in the CGP and documentation supporting selection of proposed treatment system(s) effectiveness at meeting effluent and receiving water limitations.

(4) California Department of Fish and Wildlife Streambed Alteration Agreements

Under Sections 1601–1603 of the Fish and Game Code, agencies are required to notify the California Department of Fish and Wildlife prior to implementing any project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake. The Fish and Game Code gives the California Department of Fish and Wildlife jurisdiction over any activity in a creek or river that contains a fish or wildlife resource (or from which such a resource derives benefit). Projects affecting or potentially affecting such resources must obtain an agreement from California Department of Fish and Wildlife, which usually imposes conditions to protect the environment. Refer to Section 3.I, Biological Resources, for further discussion.

(5) Caltrans Location Hydraulic Study and Flood Plain Study

A policy of the Federal Highway Administration (FHWA)[66] serves as a basis for the Caltrans requirements regarding encroachment on floodplains. The provisions of this policy apply

[65] San Francisco Bay Regional Water Quality Control Board, 2012. General Waste Discharge Requirements for Discharge or Reuse of Extracted Brackish Groundwater and Reverse Osmosis Concentrate Resulting from Treatment of Groundwater by Reverse Osmosis and Discharge or Reuse of Extracted and Treated Groundwater Resulting from Structural Dewatering (Order No. R2-2012-0060, NPDES No. CAG912004). Effective from August 8, 2012 through August 9, 2017.

[66] 23 CFR 650, Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains.

to all encroachments and to all actions that affect base floodplains, except for repairs made with emergency funds (23 CFR 668) during or immediately following a disaster.[67]

As part of the work plan for a project, Caltrans guidance requires the preparation of a location hydraulic study (which includes structures hydraulics) and a flood plain study.[68] These studies are usually combined into one document as they largely address the same issues. The location hydraulic study is a specific FHWA requirement when a project will encroach on a flood plain. The flood plain study may consider a broader range of topics than required for the location hydraulic study and is usually part of the information required to deal with the USACE 404 permit process. Any analyses completed for proposed encroachment within a regulatory floodway (above) would likely satisfy the requirements of the Caltrans flood plain study.

(6) Division of Safety of Dams

Existing dams under DWR Division of Safety of Dams jurisdiction are periodically inspected to ensure adequate maintenance and correction of any noted deficiencies by the dam owner. To comply with the California Water Code and the California Code of Regulations, the DWR is required to retain a consulting board to review (1) the adequacy of the design of any dam or reservoir DWR proposes to construct; and (2) the safety of the completed construction, including the terms and conditions for the Certificate of Approval. These provisions require the DWR to retain a board of three consultants to meet at least once every 5 years to review the operational performance of DWR owned dams, and more frequently when reviewing newly constructed dams. The board of consultants independently reviews and assesses safety conditions of State Water Project dams. Regular inspections and required maintenance of the dams substantially reduce the potential for catastrophic failure.

c. Local Regulations

(1) Flood Control Facilities Encroachment Permit

Development or encroachment within floodplains and floodways is subject to FEMA requirements for maintenance of flood flow conveyance and/or floodplain storage. The Alameda County Flood Control and Water Conservation District consists of 10 zones; Zone 7 covers the eastern portion of Alameda County, and includes the cities of Dublin, Pleasanton, and Livermore. Zone 7 manages stormwater conveyances and flood channels within the region and requires that activities within these channels, including discharges

[67] Federal Emergency Management Agency (FEMA), 2013. National Flood Insurance Program Floodplain Management Requirements: A Study Guide and Desk Reference for Local Officials. Available at: www.fema.gov/media-library-data/20130726-1539-20490-9157/nfip_sg_full.pdf.

[68] California Department of Transportation, 2014. Workplan Standards Guide, Release 11.0.

of stormwater, obtain an encroachment permit. In some cases, Zone 7 may defer authority for floodplain and floodway encroachment review to the cities (e.g., the City of Livermore). In general, an encroachment permit is required for reviewing and inspecting proposed work of any nature that has the potential to impact any existing Zone 7 flood control or water supply facilities. An encroachment permit must be obtained before any non-Zone 7 work is conducted on or within a facility or ROW that is owned or maintained by Zone 7.

As described above, Zone 7 Water is the primary entity responsible for overseeing the various water supply and flood control operations within the study area. Zone 7 was established in 1957 by the voters of the Livermore-Amador Valley to place water management, including flood control, under local control through a locally elected Board of Directors.[69] Since the 1960s, Zone 7 has imported water from the State Water Project to artificially recharge the local groundwater basin.[70] Zone 7 provides potable water to the municipalities of Dublin, Pleasanton, and Livermore, among others, and is also responsible for sustainably managing the groundwater basin of the Livermore-Amador Valley. Within the Livermore-Amador Valley, there is no direct diversion of untreated surface water for municipal potable supply. Surface water recharge into the groundwater aquifer (described in more detail below) provides a major source of municipal and private potable supply. Zone 7 also provides for the management of flood and stormwaters to protect life, property, and habitat within a 430-square-mile area that includes the cities of Dublin, Pleasanton, and Livermore.[71]

Zone 7 developed the 2006 Stream Management Master Plan to target and manage improvements within the drainage system for flood control, as well as for other beneficial properties. As the Master Plan and other flood control projects are implemented, conveyance capacity of the local drainage system would be improved.

(2) Alameda Countywide Clean Water Program

The Alameda Countywide Clean Water Program was initiated with the intention of forming consistent, effective countywide strategies to control sources of stormwater pollution; it complies with the RWQCB's Basin Plan and requirements of the federal CWA and other federal regulatory programs discussed above. The Alameda Countywide Clean Water Program is a consortium of the following local agencies in Alameda County: Alameda County (unincorporated area); Alameda County Flood Control and Water Conservation District; Zone 7; and the cities of Alameda, Albany, Berkeley, Dublin, Emeryville, Fremont, Hayward, Livermore, Newark, Oakland, Piedmont, Pleasanton, Union City, and San Leandro. The Alameda County Flood Control and Water Conservation District is

[69] Zone 7 Water Agency, 2016b. Flood Protection Program 2015 Annual Report. April.
[70] Ibid.
[71] Ibid.

responsible for administering the overall program. Its participants worked jointly to prepare the Stormwater Quality Management Plan.[72] The goal of the Alameda Countywide Clean Water Program, as outlined in the SWMP, is to help local residents, businesses, and municipalities meet the stormwater quality goals of the CWA.

(3) Alameda County Watercourse Protection Ordinance

For unincorporated areas within Alameda County, the Watercourse Protection Ordinance restricts the discharge of pollutants to watercourses and the encroachment of new development into watercourses without first obtaining a permit from the County. In addition to prohibiting discharges into watercourses, the ordinance establishes a 20-foot building setback from the top of the bank to contain flows from the 100-year flood event. Implementation of this ordinance serves to protect surface water and groundwater recharge areas from erosion, sedimentation, and sources of pollution. The Proposed Project and Build Alternatives would be required to comply with the requirements of this ordinance.

(4) Zone 7 Encroachment Permits

As discussed previously, Zone 7 requires an encroachment permit prior to activities or construction that will be conducted within the agency's property, easements, or ROWs. These permits help protect the region's water supply and flood control facilities, ensure the safety of nearby residents and passers-by, and ensure that Zone 7's facilities are restored to their original condition. Zone 7's encroachment permit is separate from other city or public agency permits.[73]

4. Impacts and Mitigation Measures

This subsection lists the standards of significance used to determine impacts, discusses the methodology used in the analysis, summarizes the impacts, and then provides an in-depth analysis of the impacts with mitigation measures identified as appropriate.

a. Standards of Significance

For the purposes of this EIR, impacts on hydrology and water quality are considered significant if the Proposed Project or one of the Alternatives would result in any of the following:

[72] Alameda Countywide Clean Water Program, 2003. Storm Water Quality Management Plan, July 2001 –June 2008. July.

[73] Zone 7 Water Agency, 2013. Encroachment Permit Guidelines. Available at http://www.zone7water.com/images/pdf_docs/permits/encroachment-permit-guide.pdf, accessed October 4, 2013.

- Violate any water quality standards or WDRs
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted)
- Substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on or off site
- Substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on or off site
- Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff
- Substantially degrade water quality
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam
- Allow for inundation by seiche, tsunami, or mudflow

b. Impact Methodology

The methodology used to evaluate the significance of hydrological and water quality impacts is described below under each respective impact analysis. The EMU Option would result in the same impacts as the DMU Alternative; therefore, the analysis and conclusions for the DMU Alternative also apply to the EMU Option.

The analysis of the Enhanced Bus Alternative, which addresses the potential impacts of construction of the bus infrastructure improvements and operation of the bus routes at a programmatic level, would also apply to the bus improvements and feeder bus service under the Proposed Project and other Build Alternatives. Therefore, the analyses and conclusions for the Enhanced Bus Alternative also apply to the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative, and are not repeated in the analysis of the Proposed Project and other Build Alternatives.

c. Summary of Impacts

Table 3.H-5 summarizes the impacts of the Proposed Project and Alternatives described in the analysis below.

TABLE 3.H-5 SUMMARY OF HYDROLOGY AND WATER QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project[b]**	**DMU Alternative (with EMU Option)[b]**	**Express Bus/BRT Alternative[b]**	**Enhanced Bus Alternative**
Construction					
Project Analysis					
Impact HYD-1: Violate water quality standards, discharge requirements, or alter drainage during construction	NI	LS	LS	LS	LS
Cumulative Analysis					
Impact HYD-2(CU): Violate water quality standards, discharge requirements, or alter drainage during construction Cumulative Conditions	NI	LS	LS	LS	LS
Operational					
Project Analysis					
Impact HYD-3: Violate water quality standards or waste discharge requirements	NI	LS	LS	LS	LS
Impact HYD-4: Substantially deplete groundwater	NI	LS	LS	LS	NI
Impact HYD-5: Substantially alter drainage patterns – erosion, sedimentation, flooding	NI	LSM	LSM	LSM	NI
Impact HYD-6: Exceed the capacity of stormwater drainage systems or provide substantial additional sources of polluted runoff	NI	NI	NI	NI	NI
Impact HYD-7: Substantially degrade water quality	NI	NI	NI	NI	NI
Impact HYD-8: Place housing within a 100-year flood hazard	NI	NI	NI	NI	NI

TABLE 3.H-5 SUMMARY OF HYDROLOGY AND WATER QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project[b]**	**DMU Alternative (with EMU Option)[b]**	**Express Bus/BRT Alternative[b]**	**Enhanced Bus Alternative**
Impact HYD-9: Impede or redirect flood flows within a 100-year flood hazard area	NI	LSM	LSM	LSM	NI
Impact HYD-10: Create flooding and inundation risk as a result of the failure of a levee or dam	NI	LS	LS	LS	LS
Impact HYD-11: Allow for inundation by seiche, tsunami, or mudflow	NI	NI	NI	NI	NI
Cumulative Analysis					
Impact HYD-12(CU): Violate water quality standards, discharge requirements, or substantially alter drainage patterns under Cumulative Conditions	NI	LS	LS	LS	LS
Impact HYD-13(CU): Substantially deplete groundwater under Cumulative Conditions	NI	LS	LS	LS	NI
Impact HYD-14(CU): Impede or redirect flood flows within a 100-year flood hazard area under Cumulative Conditions	NI	LS	LS	LS	NI
Impact HYD-15(CU): Create flooding and inundation risk as a result of the failure of a levee or dam under Cumulative Conditions	NI	LS	LS	LS	LS

Notes: NI=No impact; LS=Less-than-Significant impact, no mitigation required; LSM=Less-than-Significant impact with mitigation; DMU = diesel multiple unit; EMU = electrical multiple unit; BRT = bus rapid transit.
[a] All significance determinations listed in the table assume incorporation of applicable mitigation measures.
[b] The analysis of the Enhanced Bus Alternative also applies to the feeder bus service and bus improvements under the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative, as described in the Impact Methodology subsection above.

d. Environmental Analysis

Impacts pertaining to project construction are described below, followed by operations-related impacts.

(1) Construction Impacts

Potential impacts related to project construction are described below, followed by cumulative construction impacts.

Based on project characteristics and existing conditions, and due to the temporary nature of construction activities, the analysis of construction impacts is limited to evaluating the potential to violate water quality standards or WDRs. Construction activities represent the period of the greatest disturbance of site soils from removal of vegetation, structures, and asphaltic and/or concrete surfaces. Once constructed, these previously exposed soils would either be covered by new pervious or impervious surfaces, or revegetated.

(a) Construction – Project Analysis

Impact HYD-1: Violate any water quality standards or waste discharge requirements, including through the alteration of an existing drainage pattern or the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on or off site during construction.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with construction of the Proposed Project or any of the Build Alternatives. However, planned and programmed transportation improvements for segments of I-580, local roadways and intersections, and core transit service improvements for BART, Altamont Corridor Express, and the Livermore Amador Valley Transit Authority would be constructed. In addition, population and employment increases throughout Alameda County would result in continued land use development, including both residential and commercial. Construction of these improvements and development projects could violate water quality standards or WDRs. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to result in substantial erosion or sedimentation during construction. **(NI)**

Conventional BART Project, DMU Alternative, and Express Bus/BRT Alternative. Construction of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would involve localized ground disturbance activities (e.g., grading, excavation, drilling, and erection of structures) associated with the construction of buildings and project infrastructure. These activities could result in soil erosion and downslope or downstream sediment delivery by stormwater runoff if not managed appropriately. Aside from the proposed tail tracks and storage and maintenance facility in the Cayetano Creek Area, the majority of the project facilities would be constructed in relatively flat areas with little topographic relief. The gentle topographic relief would minimize the potential for soil erosion during construction.

Further, as discussed in Chapter 2, Project Description, the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would each disturb more than 1 acre of ground surface. Projects that result in construction disturbance of more than 1 acre are required to comply with the CGP. This requirement was developed to ensure that stormwater is managed and erosion is controlled on construction sites. The CGP requires preparation and implementation of a SWPPP, which mandates BMPs to control run-on and runoff from construction work sites. The BMPs include, but are not limited to, physical barriers to prevent erosion and sedimentation, construction of sedimentation basins, limitations on work periods during storm events, use of bioinfiltration swales, protection of stockpiled materials, and a variety of other measures that would substantially reduce or prevent erosion from occurring during construction. BART would also be subject to the Construction Site Stormwater Runoff Control Program of the Small MS4 Permit. The Small MS4 Permit requires BART to develop, implement, and enforce a program to prevent construction site discharges of pollutants and impacts on beneficial uses of receiving waters. Further, as required by the Small MS4 Permit program, BART has developed contract language ensuring that its construction contractors comply with the CGP.

Project construction could require temporary dewatering depending on the depth to groundwater at the time of construction. Dewatering could introduce pollutants into nearby receiving waters. Further, pollutants associated with construction equipment and vehicles, such as fuels and oils, could be entrained in storm runoff and delivered to a local surface channel or creek. Dewatering activities are covered under the CGP or general WDR permit for low-threat discharges to land.[74] Project-related dewatering is likely to be limited based on the proposed activities, which generally entail excavation up to 4 feet below grade, as described in Chapter 2, Project Description, and thus would not involve substantive below-ground improvements. These activities would be covered under the CGP or a general WDR permit.

[74] California State Water Resources Control Board Water Quality Order No. 2003-0003-DWQ, Statewide General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality.

Temporary dewatering may be required for the I-580 relocation at creek crossings where new bridge piers would be installed. In addition, temporary dewatering may be required for the few areas with substantive below-ground excavation, ranging from 10 to 25 feet below grade—for the DMU transfer platform or the bus transfer platforms (for the DMU Alternative and Express Bus/BRT Alternative, respectively), as well as the Isabel Station and the underpass under westbound I-580 (for both the Proposed Project and DMU Alternative). Additionally, for the Proposed Project and DMU Alternative, construction activities in the Cayetano Creek Area—for the tail tracks and storage and maintenance facility—would require excavation ranging up to 70 feet for the hillside tunnel. However, based on Zone 7's delineation of the groundwater management zones, the Cayetano Creek Area is an upland area and large volumes of groundwater are unlikely to be encountered during construction in this area. Dewatering activities (if necessary) at these locations (above) would likely still be covered under the CGP or general WDR permit for low threat discharges to land, depending on the volume of dewatering required. If large amounts of dewatering are necessary for these construction activities, appropriate individual WDRs would be obtained as described below.

Any large amounts of dewatering, particularly over lengthy periods of time, or dewatering discharges to surface waters, would necessitate obtaining individual WDRs from the San Francisco Bay RWQCB. If substantial (more than 10,000 gallons per day) groundwater dewatering is required and the groundwater must be treated prior to discharge, the discharges would require coverage under the General Waste Discharge Requirements for Discharge or Reuse of Extracted Brackish Groundwater and Reverse Osmosis Concentrate Resulting from Treatment of Groundwater by Reverse Osmosis and Discharge or Reuse of Extracted and Treated Groundwater Resulting from Structural Dewatering (RWQCB Order No. R2-2007-0033, NPDES No. CAG912004). However, as stated above, project-related dewatering is likely to be limited and covered under the CGP or a general WDR permit.

As described above, construction of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would be subject to existing regulations and requirements concerning construction activities (erosion and runoff and dewatering) and the protection of water quality; required permits would include the CGP, the Small MS4 Permit, and the Treated Groundwater Dewatering General Waste Discharge Requirements. These permits require implementation of water quality BMPs and discharge volume and rate controls. Therefore, construction-related impacts to water quality under the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would be less than significant, and no mitigation measures are required. **(LS)**

Enhanced Bus Alternative. The bus infrastructure improvements that would be constructed under the Enhanced Bus Alternative would be located along existing street ROWs. If implementation of the Enhanced Bus Alternative would collectively disturb more than 1 acre of ground surface, it would need to comply with the CGP. Otherwise,

construction of this alternative would entail very limited ground disturbance in an already urbanized environment. Construction of the Enhanced Bus Alternative would result in less-than-significant impacts to water quality, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant construction-related water quality impacts during construction, and no mitigation measures are required.

(b) Construction – Cumulative Analysis

The geographic study area for cumulative impacts during construction is the Arroyo de la Laguna watershed.

Impact HYD-2(CU): Violate any water quality standards or waste discharge requirements, including through the alteration of an existing drainage pattern or the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on or off site during construction, under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact HYD-1** above, the No Project Alternative would have no impacts resulting in violation of water quality standards, WDRs, or substantial erosion or sedimentation during construction. Therefore, the No Project Alternative would not contribute to cumulative impacts during construction. **(NI)**

Conventional BART Project and Build Alternatives. Several of the cumulative projects construction areas and timing could overlap with areas and timing of construction associated with the Proposed Project and Build, resulting in combined erosion effects. For example, cumulative projects that would have relatively large construction footprints include the Dublin Crossing Specific Plan and the Isabel Neighborhood Plan (INP). As described in **Impact HYD-1** above, construction activities associated with the Proposed Project and Build Alternatives have the potential to cause soil erosion.

However, the State CGP would require the preparation and implementation of a SWPPP for each of these cumulative projects. The SWPPPs would include BMPs to control runoff and prevent erosion. The CGP has been developed to address cumulative conditions arising from construction throughout California, and is intended to maintain cumulative effects of projects below levels that would be considered significant. For example, under the CGP, two adjacent construction sites would both be required to implement BMPs to reduce and control the release of sediment and/or other pollutants in any runoff leaving each respective site. The runoff water from both sites would be required to achieve the same

action levels, measured as a maximum amount of sediment or pollutant allowed per unit volume of runoff. Thus, even if the waters were to combine after leaving the sites, the sediments and/or pollutants in the combined runoff would still be at concentrations (amount of sediment or pollutants per volume of runoff water) below action levels.

Therefore, cumulative impacts on water quality from the Proposed Project and Build Alternatives, in combination with past, present, or probable future projects, would be less than significant, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts to water quality during construction, and no mitigation measures are required.

(2) Operational Impacts

Potential impacts related to project operations are described below, followed by cumulative operations impacts.

(a) Operations – Project Analysis

Impact HYD-3: Violate any water quality standards or waste discharge requirements, including through the alteration of an existing drainage pattern or the course of a stream or river, or in a manner that would result in substantial erosion or sedimentation on or off site.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The Proposed Project and Build Alternatives include the installation and operation of facilities that, in some cases, would result in modification of existing stream channel crossings, realignment, and/or modification of existing channels, and an increase in the amount of impervious surfaces within the Proposed Project and Build Alternatives footprints. Table 3.H-6 presents estimates of existing and proposed impervious surface areas for the Proposed Project and Build Alternatives. This table shows the total acreages of the Proposed Project and Build Alternatives footprints, the amount of impervious surfaces under existing conditions, and the change in impervious surface acreages that would occur with the Proposed Project and Build Alternatives.

TABLE 3.H-6 EXISTING AND PROPOSED IMPERVIOUS SURFACE WITHIN THE PROPOSED PROJECT AND BUILD ALTERNATIVES FOOTPRINTS

	Total Permanent Footprint (Acres)	Existing Impervious Area (Acres)	Proposed Additional Impervious Area (Acres)	Added Impervious Area As Percent of Total Footprint (Percent)
Conventional BART Project	411	206	32	8%
DMU Alternative	405	235	38	9%
Express Bus/BRT Alternative	77	62	6	8%

Notes: Temporary construction staging areas are not included in this table, as they would be returned to prior condition following construction. The bus routes and bus infrastructure improvements for the Enhanced Bus Alternative, as well as for the Proposed Project and other Build Alternatives, are anticipated to be constructed within existing street ROWs and would not change the amount of existing impervious surfaces.
Source: Arup, 2017b.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. However, operation of the planned and programmed transportation improvements and continued land use development, including residential and commercial uses under the No Project Alternative, could violate water quality standards or WDRs. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to violation of water quality standards. **(NI)**

Conventional BART Project. As described in the Surface Water Quality subsection above, several of the water bodies that drain the study area are listed as impaired. Incremental increases in certain pollutants to these water bodies, as a result of operation of the Proposed Project and Build Alternatives, could result in impacts to water quality conditions and violation of water quality standards as these water bodies essentially have no capacity to assimilate any increase in pollutant delivery (i.e., the water bodies are impaired for a particular pollutant(s) and cannot take on any additional loading). It should be noted that sediment is considered a pollutant.[75] An increase in stormwater runoff, from the proposed increase in impervious surface area, could increase pollutant entrainment and delivery (to receiving waters) as well as induce erosion and sediment production within surface

[75] Regional Water Quality Control Board, 2015. San Francisco Bay Basin Water Quality Control Plan. RWQCB San Francisco Bay Region. March.

channels, thereby potentially violating water quality standards or inducing localized flooding. New or increased pollutants in surface runoff could also eventually infiltrate and affect water quality within the groundwater aquifer(s).

As shown in Table 3.H-6, implementation of the Proposed Project could result in an increase in impervious surfaces by approximately 32 acres. New impervious areas could result in violations of water quality standards. However, as summarized in the Regulatory Framework subsection above, the NPDES Program and related regulations would require implementation of stormwater treatment and runoff volume control measures into the designs of the Proposed Project. For areas outside of an existing or proposed Caltrans ROW, such as the storage and maintenance facility, the Proposed Project would be regulated under the Small MS4 Permit (SWRCB Order Number 2013-0001-DWQ), and all provisions therein would apply, including stormwater design requirements.

The Small MS4 Permit implements a number of provisions aimed at protecting water quality. BART would be required to develop and implement SWPPPs for pollutant hotspots at high priority sites.[76] The SWPPP would identify a set of stormwater BMPs to be installed, implemented, and maintained to minimize the discharge of pollutants in stormwater. Further, the Small MS4 Permit requires proper management of stormwater quality through implementation of site design measures and LID design standards, as well as planning for operation and maintenance for post-construction stormwater management. As part of stormwater management, BART would be required to develop a map or diagram dividing the developed portions of the Proposed Project site into discrete drainage management areas. After implementation of site design measures, runoff from remaining impervious drainage management areas must be directed to one or more facilities designed to infiltrate, evapotranspire, and/or biotreat stormwater runoff as specified in the Small MS4 Permit. BART would also be required to develop an operations and maintenance verification program, one element of which would require BART to ensure that systems and hydromodification controls installed are properly operated and maintained for the life of the Proposed Project. BART would be required to document compliance with the Small MS4 Permit through required periodic reports to the SWRCB.

For areas within an existing or proposed Caltrans ROW, such as within the I-580 freeway, the Proposed Project would be regulated under the Caltrans statewide stormwater permit (SWRCB Order No. 2012-0011-DWQ) and all the provisions therein would apply. The Caltrans statewide permit regulates stormwater and non-stormwater discharges from Caltrans' properties and facilities (including all ROWs owned by Caltrans), and discharges associated with operation and maintenance of the State of California highway system.

[76] If a permittee has an existing or equivalent document, such as a Hazardous Materials Business Plan or Spill Prevention Plan, that contains the required information, development of a SWPPP is not required.

Both of these orders have been issued pursuant to Section 402(p) of the CWA (as amended by the Water Quality Act of 1987). CWA section 402(p) establishes performance standards and mandates that municipal permits "shall require controls to reduce the discharge of pollutants to the maximum extent practicable, including management practices, control techniques and system, design and engineering methods, and such other provisions as the Administrator or the State determines appropriate for the control of such pollutants." These orders prohibit stormwater discharges that do not comply with the maximum extent practicable standard. Further, stormwater runoff regulated under these orders would have no subsequent potential impact upon groundwater quality.

A preliminary water quality and hydromodification analysis has been completed for the Proposed Project and Build Alternatives.[77] The analysis presents preliminary design recommendations, applicable to all relevant areas of the Proposed Project (i.e., outside and inside of existing and proposed Caltrans ROWs), for the required treatment areas and storage volumes. The analysis summarized the sizing requirements and generalized locations of water quality and hydromodification BMPs (or treatment measures) needed to meet or exceed the requirements of the Small MS4 Permit. At each specific treatment site, natural at-grade treatment facilities would be utilized wherever available.[78] The preliminary analysis indicates that meeting the Small MS4 Permit site design and stormwater treatment requirements would be feasible for the Proposed Project. The specific design for each treatment measure and location would require further detailed analysis based on available space, land type, and treatment measures design hierarchy.

The San Francisco Bay RWQCB is responsible for overseeing compliance with the Small MS4 Permit, Caltrans permit, and Section 402(p) of the CWA (and for requiring amendments or revisions, as necessary). Oversight may include, but is not limited to, reviewing reports, requiring modification to stormwater program components and various submissions, imposing region-specific monitoring requirements, conducting inspections and program evaluations (audits), and taking enforcement actions. BART's obligations as a permittee under the Small MS4 Permit and under the Caltrans permit would be adequate to ensure that operations-related impacts under the Proposed Project related to violation of water quality standards, including those as a result of erosion or sedimentation, would be less than significant and no mitigation measures are required. **(LS)**

DMU Alternative. The DMU Alternative would generally have a similar footprint to the Proposed Project, with the addition of improvements in the Dublin/Pleasanton Station Area, and a different footprint for the storage and maintenance facility in the Cayetano Creek Area. As shown in Table 3.H-6, the DMU Alternative would result in approximately

[77] Arup, 2016. BART Livermore Extension, Water Quality and Hydromodification Study: Technical Memorandum. April 5.
[78] Ibid.

38 acres of new impervious surface area; this would be a slightly greater amount of new impervious surface area than under the Proposed Project (approximately 6 acres more). New impervious areas could result in violations of water quality standards. Impacts related to water quality under the DMU Alternative would not be substantially different from those under the Proposed Project. However, the same regulatory requirements, programs, and standards would apply with respect to stormwater treatment and hydromodification measures for project operation. Therefore, impacts under the DMU Alternative related to violation of water quality standards, including those as a result of erosion or sedimentation, would be less than significant, and no mitigation measures are required. **(LS)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative would entail improvements at the Dublin/Pleasanton Station Area, a portion of the I-580 Corridor Area, and the Laughlin Road Area. As shown in Table 3.H-6, the Express Bus/BRT Alternative would result in approximately 6 acres of new impervious surface area. New impervious areas could result in violations of water quality standards. In addition, this alternative would involve modification (fill and relocation) of Line G-2, a tributary to Chabot Canal, which extends immediately south of I-580 in the vicinity of the Dublin/Pleasanton Station. Specifically, the relocation of the I-580 median to accommodate the bus transfer platform would require the relocation of approximately 1,400 feet of Line G-2; the channel would be relocated approximately 50 to 70 feet to the south of its existing location. See Section 3.I, Biological Resources**, Impact BIO-11** and **Impact BIO-12,** for discussion of jurisdictional waters and riparian habitat impacts**.**

Although the Express Bus/BRT Alternative would result in considerably less new impervious area than the Proposed Project, the nature of potential impacts related to water quality under the Express Bus/BRT Alternative would be similar to those under the Proposed Project. The same regulatory requirements, programs, and standards (e.g., the MRP) would apply with respect to stormwater treatment and hydromodification measures for project operation under this alternative.

Therefore, impacts under the Express Bus/BRT Alternative related to violation of water quality standards, including those as a result of erosion or sedimentation, would be less than significant, and no mitigation measures are required. **(LS)**

Enhanced Bus Alternative. The bus infrastructure improvements that would be constructed under the Enhanced Bus Alternative would be located along existing street ROWs east of the Dublin/Pleasanton Station. Stormwater runoff from these areas is currently regulated under either the Caltrans permit or the MRP. The bus infrastructure improvements must be consistent with the requirements of one or both of these permits, which include performance standards and requirements for complying with water quality standards and controlling erosion or sedimentation. Therefore, impacts under the

Enhanced Bus Alternative related to violation of water quality standards, including those as a result of erosion or sedimentation, would be less than significant, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to violation of water quality standards, and no mitigation measures are required.

Impact HYD-4: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: NI)

As noted in the Existing Conditions subsection above, the Main Basin (the primary groundwater supply and storage basin) encompasses an area of approximately 17,000 acres and recharge is primarily from stream recharge via Arroyo Mocho and Arroyo del Valle, as well as recharge from the Chain of Lakes. Normal year groundwater recharge of the Main Basin by direct precipitation is only about 3,700 acre-feet per year, or about 18.7 percent of total recharge. Though the overall extent of the Fringe Basin is much greater (approximately 45,000 acres), it is far less important with respect to its capacity for groundwater storage. Inflows from the Fringe sub-basins are only about 1,000 acre-feet per year (5 percent). An increase in the amount of impervious surface area with implementation of the Proposed Project and Build Alternatives could reduce the recharge potential within the Livermore-Amador Valley Groundwater Basin, and consequently reduce groundwater supplies. The potential for reductions in groundwater recharge during operation primarily depends on the amount of new impervious surface area created.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. However, operation of the planned and programmed transportation improvements and continued land use development, including residential and commercial uses under the No Project Alternative, could substantially deplete groundwater supplies or interfere substantially with groundwater recharge. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of

Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to aquifer volume or a lowering of the local groundwater table level. **(NI)**

Conventional BART Project. The net increase in impervious surfaces under the Proposed Project would be approximately 32 acres, which would represent approximately 8 percent of the total footprint of the Proposed Project, as shown in Table 3.H-6. Overall, the total footprint area (pervious and impervious areas) is much less than 1 percent of the combined area of both the Main and Fringe basins. Thus, even under worst-case assumptions (i.e., assuming that all precipitation on the Proposed Project footprint is impeded from infiltration), the potential recharge impedance by the Proposed Project would be extremely limited. Further, most of the Proposed Project footprint would overlie the Fringe Basin, as shown in Figure 3.H-5, which is not as important for groundwater storage as the Main Basin.

As noted in **Impact HYD-3**, the Proposed Project would be required to include treatment measures and design approaches consistent with LID, which provide flow magnitude and duration control and hydromodification measures that typically include features to encourage on-site infiltration of stormwater runoff such as vegetated swales, pervious paving, and landscaping. Precipitation that falls on new impervious areas created by the Proposed Project (approximately 32 acres),[79] even with implementation of LID and stormwater management features, would still include runoff that would ultimately be discharged to local streams and creeks (e.g., Arroyo las Positas). However, the net increase in impervious surfaces in relation to the basin area is relatively small. Therefore, impacts under the Proposed Project related to groundwater supplies or interfering substantially with groundwater recharge would be less than significant, and no mitigation measures are required. **(LS)**

DMU Alternative. As described above in **Impact HYD-3**, the DMU Alternative would result in approximately 38 acres of new impervious surface area; this would be slightly greater new impervious surface area than the Proposed Project (approximately 6 acres more). As shown in Table 3.H-6, this would represent approximately 9 percent of the total footprint of the DMU Alternative. However, similar to the Proposed Project, the net new impervious surfaces under the DMU Alternative represents much less than 1 percent of the Main Basin and Fringe Basin areas. Therefore, the DMU Alternative's impact to groundwater supplies or recharge would be less than significant, similar to the Proposed Project, and no mitigation measures are required. **(LS)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative would result in approximately 6 acres of new impervious surfaces, which would represent approximately

[79] Ibid.

8 percent of the total Express Bus/BRT footprint area. This increase in impervious surfaces represents an even smaller percentage of the Main Basin and Fringe Basin surface areas combined when compared to the Proposed Project. Therefore, impacts related to groundwater supplies or interfering substantially with groundwater recharge under the Express Bus/BRT Alternative would be similar to, though less than, the Proposed Project and would be less than significant; no mitigation measures are required. **(LS)**

Enhanced Bus Alternative. The bus infrastructure improvements that would be constructed under the Enhanced Bus Alternative would be along existing street ROWs. These improvements would not be anticipated to create new impervious areas that would affect groundwater recharge. Therefore, there would be no impacts related to groundwater supplies or interfering substantially with groundwater recharge under the Enhanced Bus Alternative, and no mitigation measures are required**. (NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to groundwater supplies and recharge, and no mitigation measures are required.

Impact HYD-5: Substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on or off site or result in flooding on or off site.

(No Project Alternative: NI; Conventional BART Project: LSM; DMU Alternative: LSM; Express Bus/BRT Alternative: LSM; Enhanced Bus Alternative: NI)

As described in Chapter 2, Project Description, or discussed above (**Impact HYD-3**), implementation of the Proposed Project and Build Alternatives would create new impervious surfaces (except in the case of the Enhanced Bus Alternative) as well as result in new or modified structures that span channels in the study area (Figure 3.H-2), and would cross or encroach into floodplains and floodways. The potential water quality impacts of increased impervious surfaces arise from the potential increase in runoff rates or volumes induced by such surfaces; thus, the potential for flooding impacts from impervious surface creation is concurrently addressed above (**Impact HYD-3**) via water quality. With respect to spanning structures, installation or modification of such structures could alter the hydraulic capacity of and/or velocities within channels, which could result in increased erosion and scour and/or localized flooding, as described below. See **Impact HYD-9** for potential impacts related specifically to the FEMA 100-year flood zones and/or regulatory floodways.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives.

However, the planned and programmed transportation improvements and continued land use development under the No Project Alternative could substantially alter the existing drainage pattern of a site or area. The effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to erosion, sedimentation, or flooding. **(NI)**

Conventional BART Project. The Proposed Project would construct new or modified structures along water features in the study area, requiring new or modified channel crossings at the following locations:

- **Tassajara Creek.** The existing I-580 overcrossing would be widened (extended upstream and downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the upstream and downstream side of the existing span. The existing channel undercrossing and support structures are within a Regulatory Floodway.
- **Cottonwood Creek.** The existing I-580 overcrossing would be widened (extended upstream and downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, concrete embankments) would be constructed on the upstream and downstream side of the existing span.
- **Arroyo las Positas (at the proposed Isabel Station).** A new bridge (and supporting structures) for the tail tracks would be constructed across Arroyo las Positas. This location is within a FEMA special flood hazard area (the 0.2 percent chance, or 500-year, floodplain).
- **Arroyo las Positas (just north of the proposed Isabel Station).** The existing I-580 overcrossing would be widened (extended upstream and downstream) and, concurrently, new sections of the existing undercrossing and support structures (e.g., piers) would be constructed on the upstream and downstream side of the existing span.
- **Arroyo las Positas (east of Portola Avenue).** A new bridge (and supporting structures) for the tail tracks would be constructed across Arroyo las Positas.
- **Cayetano Creek.** A new bridge (and supporting structures) for the tail tracks would be constructed across Cayetano Creek.
- **Isabel Creek.** A new access road (leading to the proposed storage and maintenance facility) would be constructed across Isabel Creek.

A hydraulics study was completed by Arup at the request of BART to assess the potential impacts of the Proposed Project on Arroyo las Positas (including the locations just north of

the proposed Isabel Station and east of Portola Avenue) and Cayetano Creek with respect to localized flooding.[80] The study used the USACE Hydraulic Engineering Center-River Analysis System (HEC-RAS) model to analyze potential flooding impacts in these areas due to implementation of the Proposed Project. Based on recent, existing information, a contemporary estimate of the 100-year, 24-hour flow was used as the basis for analysis in the model. The existing conditions assessment showed out-of-bank flooding at a number of locations during the modeled event, including over I-580 and in areas of developed land around Isabel Avenue and East Airway Boulevard.

Zone 7 bases flood analysis and planning within their jurisdictional area on a revised, planning-level HEC-RAS hydraulic model, which is similar to, although slightly different from, the model used in the Arup hydraulics study. The Zone 7 revised model predicts a different extent of the existing 100-year flood than does the Arup model, particularly with respect to Arroyo las Positas at the I-580 bridge (westernmost crossing, adjacent to the Isabel North Area). The differing results may be accounted for by small differences in the resolution of the topographic survey used for the two models, in addition to modifications made in the Arup hydraulics study model to the existing I-580 highway bridge over Arroyo las Positas.[81] As a result of these differences, the Arup model predicts greater flooding under existing conditions than does the Zone 7 model.

Nevertheless, the Arup hydraulics study showed that implementation of the Proposed Project would result in minor increases in the spatial extent of flooding, mainly on the upstream and downstream side of the I-580 bridge at the Arroyo las Positas crossing between Isabel Avenue and Portola Avenue. The minor impacts in the spatial extent of flooding are a result of a reduction in flood flows over I-580 due to the inclusion of a retaining wall around the entrance to the proposed tail track tunnel, modifications associated with the surface parking lots at the proposed Isabel Station, and proposed earthwork at the Isabel Avenue/I-580 intersection.[82] Further, the Arup hydraulics study showed that there would be no impacts to Cayetano Creek with respect to the extent of flooding. However, due to the discrepancy between the Zone 7 model and the Arup model, further refining of the hydraulics study is considered necessary. Coordination with Zone 7 is ongoing to resolve differences in model predictions of the 100-year flood extent, particularly in the vicinity of Arroyo las Positas.[83] Thus, project-induced flooding on Arroyo las Positas upstream of I-580 is considered a potentially significant impact.

In general, the new or extended channel sections and associated structures (e.g., abutments, piers) would be aligned with the existing structures; thus, there would likely

[80] Arup, 2017a. BART Livermore Extension, Hydraulic Analysis of Las Positas Creek, Draft 5. July 6.
[81] Ibid.
[82] Ibid.
[83] Ibid.

be little-to-no effect on hydraulic capacity or flow velocities. However, the exact design and layout of the proposed structures and/or modifications at these locations may change slightly and, ultimately, could alter or reduce the hydraulic capacity of and/or velocities within the channels, thereby causing increased erosion and scour and/or localized flooding in cases where no special flood hazard area is currently defined. This would be a potentially significant impact (for the channel sections listed above other than Cayetano Creek). See **Impact HYD-9** for a discussion of potential impacts within flood hazard areas and floodways.

The impacts described above would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-5**, which includes provisions for maintaining the existing hydraulic capacity and velocities for storm flows at channel crossing locations. Despite the ongoing consultation with Zone 7 and efforts to refine the hydraulic model described above, the performance standard of maintaining the existing hydraulic capacity required by **Mitigation Measure HYD-5** addresses the existing uncertainty and can feasibly reduce this potential impact to less than significant. **(LSM)**

DMU Alternative. The DMU Alternative would require two channel crossings in the Dublin/Pleasanton Station Area, in addition to the channel crossings described above for the Proposed Project. The DMU Alternative would construct new or modified structures at the additional water features below:

- **Line G-1-1.** The existing I-580 and frontage road (Johnson Drive) overcrossing would be widened (extended downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the downstream side of the existing span.
- **Chabot Canal.** The existing I-580 and frontage road (Scarlett Court) overcrossing would be widened (extended upstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, culvert walls) would be constructed on the upstream side of the existing span.

Thus, the DMU Alternative's potential impact to erosion, sedimentation, and/or flooding, through alteration of the existing drainage pattern of the project site, would be similar to that of the Proposed Project, although it would entail additional channel crossings. The hydraulics study of Arroyo las Positas and Cayetano Creek for the Proposed Project (described above) is also applicable to the DMU Alternative; thus, project-induced flooding on Arroyo las Positas upstream of I-580 is considered a potentially significant impact. Installation or modification of structures associated with the crossings could alter the hydraulic capacity of and/or velocities within the channels, thereby causing increased erosion and scour and/or localized flooding, which could result in a potentially significant impact. These impacts would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-5**, which includes provisions for maintaining

the existing hydraulic capacity and velocities for storm flows at channel crossing locations. **(LSM)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative would entail relatively minor improvements at the Dublin/Pleasanton Station Area, as well as at the Laughlin Road Area**.** The Express Bus/BRT Alternative would construct new or modified structures, requiring new or modified channel crossings, at the following water features in the study area:

- **Line G-1-1.** The existing I-580 and frontage road (Johnson Drive) overcrossing would be widened (extended downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the downstream side of the existing span.
- **Chabot Canal.** The existing I-580 and frontage road (Scarlett Court) overcrossing would be widened (extended upstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, culvert walls) would be constructed on the upstream side of the existing span.
- **Tassajara Creek.** The existing I-580 overcrossing would be widened (extended upstream and downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the upstream and downstream side of the existing span. The existing channel undercrossing and support structures are within a Regulatory Floodway.

Thus, the Express Bus/BRT Alternative's potential impact to erosion, sedimentation, and/or flooding, through alteration of the existing drainage pattern of the project site, would be similar to, though somewhat less than, that of the Proposed Project. This impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-5**, which includes provisions for maintaining the existing hydraulic capacity and velocities for storm flows at channel crossing locations. **(LSM)**

Enhanced Bus Alternative. The bus infrastructure improvements that would be constructed under the Enhanced Bus Alternative would be located along existing street ROWs. Therefore, there would be no impacts related to altering existing drainage patterns and no mitigation measures are required. **(NI)**

Mitigation Measures. As described above, the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would have potentially significant impacts to erosion, sedimentation, and/or flooding, through alteration of existing drainage patterns. However, with implementation of **Mitigation Measure HYD-5**, which would require hydraulic capacity at all channel crossings to be maintained at no less than the existing capacity and average velocities be maintained at no more than existing conditions, potential impacts would be reduced to a less-than-significant level.

Mitigation Measure HYD-5: Hydraulic Capacity for Non-Flood Hazard Area Crossings. (Conventional BART Project, DMU Alternative/EMU Option, and Express Bus/BRT Alternative)

At all channel crossings, the hydraulic capacity and average channel velocities for storm flows shall be maintained at no less than and no more than, respectively, the existing condition. For the annual flood (or the flow associated with ordinary high water, whichever is greater) and the 100-year flood, BART shall, as part of the project design process, calculate the pre- and post-project hydraulic capacity and average channel velocity following standard engineering practices and methodology. Prior to completion of final design, these calculations shall be submitted to Zone 7 and the RWQCB for review and approval in compliance with floodplain management obligations as well as water quality certification requirements under CWA Section 401.

Impact HYD-6: Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

(No Project Alternative: NI; Conventional BART Project: NI; DMU Alternative: NI; Express Bus/BRT Alternative: NI; Enhanced Bus Alternative: NI)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. The planned and programmed transportation improvements and continued land use development under the No Project Alternative could create runoff water. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to runoff water. **(NI)**

Conventional BART Project and Build Alternatives. All potential impacts concerning excess runoff, polluted runoff, and/or degradation of water quality are discussed and addressed under other significance criteria (see **Impact HYD-3** and **Impact HYD-5**). No additional potential impacts from runoff water, other than those addressed under other significance criteria, would occur as a result of the Proposed Project and Build Alternatives. Therefore, the Proposed Project and Build Alternatives would have no impact related to runoff water. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not have significant impacts related to runoff water; therefore, no mitigation measures are required.

Impact HYD-7: Substantially degrade water quality.

(No Project Alternative: NI; Conventional BART Project: NI; DMU Alternative: NI; Express Bus/BRT Alternative: NI; Enhanced Bus Alternative: NI)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. The planned and programmed transportation improvements and continued land use development under the No Project Alternative could substantially degrade water quality. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to water quality. **(NI)**

Conventional BART Project and Build Alternatives. All potential impacts concerning degradation of water quality are discussed and addressed under other significance criteria (see **Impact HYD-3** and **Impact HYD-5**). Further, potential impacts related to hazardous materials (e.g., accidental release of fuels or oils) are addressed in Section 3.N, Public Health and Safety. No additional potential impacts, other than those addressed under the other significance criteria, would occur as a result of the Proposed Project and Build Alternatives. Therefore, the Proposed Project and Build Alternatives would have no impact associated with the substantial degradation of water quality. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not have significant impacts related to degradation of water quality; therefore, no mitigation measures are required.

Impact HYD-8: Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map.

(No Project Alternative: NI; Conventional BART Project: NI; DMU Alternative: NI; Express Bus/BRT Alternative: NI; Enhanced Bus Alternative: NI)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. The planned and programmed transportation improvements and continued land use development under the No Project Alternative could place housing within a 100-year flood hazard area. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for

those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to housing within a 100-year flood hazard area. **(NI)**

Conventional BART Project and Build Alternatives. Although portions of the Proposed Project and Build Alternatives footprints would be located in a 100-year floodplain (see Figures 3.H-3a and 3.H-3b), the BART to Livermore Extension Project would not entail the construction of housing and would not place housing within a 100-year floodplain. Therefore, the Proposed Project or Alternatives would have no impacts associated with placing housing within a 100-year floodplain. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not have significant impacts associated with placing housing within a 100-year floodplain; therefore, no mitigation measures are required.

Impact HYD-9: Place within a 100-year flood hazard area structures that would impede or redirect flood flows.

(No Project Alternative: NI; Conventional BART Project: LSM; DMU Alternative: LSM; Express Bus/BRT Alternative: LSM; Enhanced Bus Alternative: NI)

Within the study area, FEMA is the primary agency responsible for floodplain management within flood hazard areas. Local agencies and entities, such as Zone 7 and the Cities of Livermore and Pleasanton, are also responsible for floodplain management and review of projects that encroach into the floodplain. For areas that are particularly important with respect to flood conveyance, FEMA in some cases divides the 100-year flood hazard area into a Regulatory Floodway (floodway) and a floodway fringe. The floodway is the channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment from anything that might impede flows so that the 100-year flood can be carried without substantial increases in flood heights. The flood fringe is the area beyond the floodway but still within the 100-year flood hazard area (e.g., flood depths within the floodway fringe are expected to be relatively shallow).

Encroachment on floodplains by structures and fill can reduce flood-carrying capacity, increase flood heights and velocities, and increase flood hazards in areas beyond the encroachment itself. According to 44 CFR 60.3(d)(3), floodway encroachments—including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway—are prohibited, unless it has been demonstrated through hydrologic and hydraulic analyses that they would not result in an increase in existing flood levels. All projects in the floodway must undergo an encroachment review to determine their effect on flood flows and ensure that they do not limit the capacity of the floodway to ameliorate flooding. However, projects in the flood fringe are not required to

undergo encroachment reviews as they would not increase flood heights above the allowable level.

Proposed encroachments within 100-year flood hazard areas that are also within a Caltrans ROW must comply with Caltrans-specific requirements, which are based on those of the FHWA.[84] Typically, a singular study that provides an assessment of project hydraulics and the associated flood plain is used to satisfy both federal and State requirements and procedures. [85]

As shown in Figures 3.H-3a and 3.H-3b, implementation of the Proposed Project and Build Alternatives would result in new or modified structures within a FEMA 100-year flood hazard area and, in some cases, within a floodway. Installation or modification of such structures could alter the hydraulic capacity of and/or velocities within a channel at a particular location, which could result in increased erosion, scouring, and/or flooding, similar to the potential impacts discussed in **Impact HYD-5** above related to hydraulic capacity and velocities in non-flood hazard areas. This impact analysis focuses on modifications that would be the located within a Regulatory Floodway as designated on a FEMA Flood Insurance Rate Map.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. However, the planned and programmed transportation improvements and continued land use development, including under the No Project Alternative, could place structures within a floodway or floodplain area. The effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to the impediment or redirection of flood flows. **(NI)**

Conventional BART Project. The Proposed Project would result in new or modified structures and/or fill that would be within a 100-year (non-floodway or floodway fringe) flood hazard area such as the Arroyo Mocho 100-year flood hazard area that extends to the north between Tassajara Road and El Charro Road. The main features of the Proposed Project (e.g., railway alignment and I-580 relocation) would be consistent with existing grades and would not impede or redirect flows within a 100-year (non-floodway or floodway fringe) flood hazard area. However, the Proposed Project would result in new or

[84] 23 CFR 650, Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains.
[85] California Department of Transportation, 2014. Workplan Standards Guide, Release 11.0.

modified structures and/or fill that could encroach on designated floodways at the following locations:

- **Tassajara Creek.** The existing I-580 overcrossing would be widened (extended upstream and downstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the upstream and downstream side of the existing span. The existing channel undercrossing and support structures are within a Regulatory Floodway.
- **Arroyo las Positas (at the proposed Isabel Station).** The footprint and fill for the Isabel Station surface parking would encroach within the Regulatory Floodway for Arroyo las Positas in the Isabel South Area. Also, a new pedestrian overcrossings and supporting structures (e.g., piers) would be constructed across Arroyo las Positas. The new pedestrian overcrossing would span across a Regulatory Floodway, though no structural components of the walkway are proposed to encroach, or be located within, the floodway.

The modifications at Isabel Station (surface parking lot) and for the highway widening at Tassajara Creek would have a potentially significant impact on flood conveyance capacity and water surface elevations within the floodways. However, this impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-9**, which includes provisions for maintaining existing conveyance capacities through implementation of and adherence to existing floodplain management guidelines and requirements. **(LSM)**

DMU Alternative. As described above in **Impact HYD-3**, the DMU Alternative would generally have a similar footprint to the Proposed Project, with the addition of improvements in the Dublin/Pleasanton Station Area and a different footprint for the storage and maintenance facility in the Cayetano Creek Area. Some components of the DMU Alternative would be within the 100-year (non-floodway or floodway fringe) flood hazard area to the north of the Dublin/Pleasanton Station. However, the main features of the DMU Alternative in this area (e.g., railway alignment, I-580 relocation, Dublin/Pleasanton Station Area improvements) would be consistent with existing grades or otherwise would not impede or redirect flows within a 100-year (non-floodway or floodway fringe) flood hazard area. The DMU Alternative would also result in new or modified structures and/or fill that could encroach on designated floodways at the same locations described for the Proposed Project above (Tassajara Creek and Arroyo las Positas at the proposed Isabel Station).

Thus, the DMU Alternative would have potentially significant impacts associated with the impedance or redirection of flood flows. However, this impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-9**, which includes provisions for maintaining existing conveyance capacities through

implementation of and adherence to existing floodplain management guidelines and requirements. **(LSM)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative would entail improvements at the Dublin/Pleasanton Station Area as well as at the Laughlin Road Area. Similar to the Proposed Project, components of the Express Bus/BRT Alternative would be within the 100-year (non-floodway or floodway fringe) flood hazard area that extends north of the Dublin/Pleasanton Station, although the respective components of the Express/Bus Alternative would either be consistent with existing grades or would otherwise not impede or redirect flows within a 100-year (non-floodway or floodway fringe) flood hazard area. The Laughlin Road Area is not within a 100-year flood hazard area, and thus would have no potential impacts associated with this location. New or modified structures and/or fill that could encroach on designated floodways at the following locations:

- **Line G-2.** The relocation of the I-580 median to accommodate the bus transfer platform would require the relocation of approximately 1,400 feet of the existing Line G-2 (a tributary to Chabot Canal) that extends along the southern edge of I-580 in the vicinity of Dublin/Pleasanton Station. The channel would be relocated approximately 50 to 70 feet to the south to accommodate the relocation of the freeway lanes. This section of Line G-2 is a Regulatory Floodway.
- **Tassajara Creek.** The existing I-580 overcrossing would be widened (extended upstream) and, concurrently, new sections of the existing channel undercrossing and support structures (e.g., abutments, piers) would be constructed on the upstream side of the existing span. The existing channel undercrossing and support structures are within a Regulatory Floodway.

Therefore, under the Express Bus/BRT Alternative, impacts related to the impedance or redirection of flood flows would be potentially significant. However, this impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure HYD-9**, which includes provisions for maintaining existing conveyance capacities through implementation of and adherence to existing floodplain management guidelines and requirements. **(LSM)**

Enhanced Bus Alternative. The bus infrastructure improvements that would be constructed under the Enhanced Bus Alternative would be along existing street ROWs. Therefore, there would be no impacts related to impeding or redirecting flood flows under the Enhanced Bus Alternative. **(NI)**

Mitigation Measures. As described above, the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would have potentially significant impacts related to placing structures within a 100-year flood hazard area. However, with implementation of

Mitigation Measure HYD-9, which requires existing conveyance capacities to be maintained through implementation of and adherence to existing floodplain management guidelines and requirements, potential impacts would be reduced to a less-than-significant level.

As described above, the Enhanced Bus Alternative would not result in significant impacts related to placing structures within a 100-year flood hazard area, and no mitigation measures are required for this alternative.

Mitigation Measure HYD-9: Floodway Hydraulic Analysis (Conventional BART Project, DMU Alternative/EMU Option, and Express Bus/BRT Alternative).

As part of the design process, for all proposed locations of potential regulatory floodway modification and/or encroachment (Line G-2 at the Dublin/Pleasanton Station, Tassajara Creek along the I-580 Corridor Area, and Arroyo las Positas at the Isabel South Area), BART shall demonstrate through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed modification and/or encroachment would not result in an increase in flood levels during the occurrence of the base flood discharge. Further, for the relocation of Line G-2, and per Title 44 of the CFR 60.3(b)(6), BART would notify the adjacent communities (cities of Dublin and Pleasanton) of the planned relocation, and copies of the notification would be provided to FEMA.

For locations that are also within a Caltrans ROW, the analysis shall concurrently satisfy the requirements of a location hydraulic and floodplain study report, consistent with the current version of the Caltrans Workplan Standards Guide. For all locations, BART shall submit a copy of the floodway hydraulics report to Zone 7 and, as applicable, to Caltrans.

For the Line G-2 relocation under the Express Bus/BRT Alternative, in addition to implementing the measures summarized above, and per Title 44 of the CFR 60.3(b)(6), BART will notify the adjacent communities (cities of Dublin and Pleasanton) of the planned relocation, and copies of the notification will be provided to FEMA. Further, BART (in cooperation with the cities of Dublin and Pleasanton) shall submit a letter of map revision to FEMA documenting the changes in location and extent of the regulatory floodway and, as applicable, the 100-year and 500-year flood hazard areas.

Impact HYD-10: Expose people or structures to a significant risk of loss, injury, or death in the event of flooding, including flooding as a result of the failure of a levee or dam.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. However, planned and programmed transportation improvements and continued land use development under the No Project Alternative could expose people or structures to flooding. The effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to the exposure of people or structures to flooding. **(NI)**

Conventional BART Project and Build Alternatives. As shown in Figure 3.H-4, the Dublin/Pleasanton Station Area and the portion of I-580 Corridor Area through Airway Boulevard are located within the estimated inundation area from a catastrophic failure of the Del Valle Dam at Lake Del Valle. The dam is approximately 7 miles south of the study area. In 1974, the California Division of Safety of Dams conducted a failure inundation study to assess the safety of the Del Valle Dam. The study assessed the worst-case failure scenario, a situation in which the dam failed from top to bottom when the reservoir was at full capacity. For Lake Del Valle, full capacity is projected to occur only during a 500-year storm event. The Del Valle Dam is a relatively newly constructed dam, has never been spilled from exceedance of storage capacity, and is routinely inspected and monitored by the Division of Safety of Dams for structural integrity, which includes the ability to withstand a substantial earthquake. Additionally, Del Valle was designed with a wider than average base for a dam of its size as a conservative measure to improve structural integrity.[86] For these reasons, the likelihood of total failure is considered extremely remote.

Also to the south of the Proposed Project and Build Alternatives footprints, there are levees along the Arroyo Mocho and Arroyo las Positas.[87] However, these levees are not recognized by FEMA as providing protection from the 100-year flood, and the probability of failure for these levees has not been assessed.[88, 89] However, the Proposed Project and Build Alternatives would not affect these levees in any manner. All other relevant potential impacts with respect to flooding are discussed above (see **Impact HYD-5** and **Impact HYD-9**). Therefore, potential impacts under the Proposed Project and Build Alternatives

[86] Jon H. Wright, Area 2 Engineer, Division of Safety of Dams, 2008. Personal Communication with PBS&J, January 23.
[87] Federal Emergency Management Agency (FEMA), 2016. National Flood Hazard Layer. Available at: https://hazards.fema.gov/femaportal/kmz/FEMA_NFHL_v3.0.1.kmz.
[88] Ibid.
[89] Federal Emergency Management Agency (FEMA), 2009b. Flood Insurance Study, Alameda County, California, and Incorporated Areas, Volume 1 of 3. August 3.

related to dam and levee failure would be less than significant, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not have significant impacts related to flooding involving dam failure, and no mitigation measures are required.

Impact HYD-11: Allow for inundation by seiche, tsunami, or mudflow.

(No Project Alternative: NI; Conventional BART Project: NI; DMU Alternative: NI; Express Bus/BRT Alternative: NI; Enhanced Bus Alternative: NI)

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. Any effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to inundation by seiche, tsunami, or mudflow. **(NI)**

Conventional BART Project and Build Alternatives. The study area is not located in areas that are subject to inundation by seiche, tsunami, or mudflow. In addition, the Proposed Project or Build Alternatives would not result in changes related to inundation by seiche, tsunami, or mudflow. Therefore, the Proposed Project and Build Alternatives would have no impacts related to inundation by seiche, tsunami, or mudflow. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not have significant impacts related to seiches, tsunamis, or mudflows; therefore, no mitigation measures are required.

(b) Operations – Cumulative Analysis

The geographic study area for cumulative water quality and hydrology impacts related to surface water is the Arroyo de la Laguna Watershed, which is the watershed downstream of the study area, and for groundwater it is the Livermore-Amador Valley Groundwater Basin.

As described in **Impacts HYD-6**, **HYD-7**, **HYD-8**, and **HYD-11** above, the Proposed Project and Build Alternatives would have no impacts related to runoff water, water quality, placement of housing within a 100-year flood hazard area, and seiche, tsunami, or

mudflow. Therefore, the Proposed Project and Build Alternatives would not contribute to these cumulative impacts during operations.

Impact HYD-12(CU): Violate any water quality standards or waste discharge requirements, including through the alteration of an existing drainage pattern or the course of a stream or river, in a manner that would result in substantial erosion or sedimentation on or off site, or substantially alter the existing drainage pattern of a site or area, including through the alteration of the course of a stream or river, in a manner that would result in flooding on or off site under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact HYD-3** and **Impact HYD-5** above, the No Project Alternative would have no physical impacts associated with the violation of water quality and discharge standards. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. The cumulative projects—as described in Section 3.A, Introduction to Environmental Analysis and Appendix E (which includes the INP)—would be developed within the Arroyo de la Laguna watershed and would alter the existing land cover by increasing the extent of impervious surfaces; consequently, the rate and volume of runoff produced during storm events could increase. For example, implementation of the INP would create approximately 103 acres of new impervious surface.[90] These activities could represent potential sources of additional pollutants, erosion, sediment transport to and siltation of surface waters, and/or increased potential for on- or off-site flooding. As noted in the Existing Conditions subsection above, surface waters within the Arroyo de la Laguna watershed have been identified as having impaired water quality.

All existing and future cumulative development projects within the Arroyo de la Laguna watershed would require adherence to existing regulatory requirements implemented by the RWQCB or the SWRCB. These orders and regulations require the implementation of stormwater treatment and runoff volume control measures. The regulations typically require minimizing the introduction of new impervious surfaces and encouraging on-site infiltration. These features include LID stormwater measures such as vegetated swales, pervious paving, and detention basins, which have proven effective in controlling stormwater pollutants and minimizing increases in runoff volumes.

[90] Dyett & Bhatia, 2017. Communication with Urban Planning Partners, Inc. regarding INP impervious surface estimate.

Similar to the Small MS4 Permit requirements described for the Proposed Project in **Impact HYD-3** above, cumulative projects would be a regulated project under the MRP (RWQCB Order No. R2-2015-0049) and all the provisions therein would apply. Therefore, cumulative water quality and increased runoff impacts from the Proposed Project or Alternatives, in combination with past, present, or probable future projects, would be less than significant, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts relative related to water quality standards or increased storm runoff, and no mitigation measures are required.

Impact HYD-13(CU): Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of preexisting nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted) under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: NI)

No Project Alternative. As described in **Impact HYD-4** above, the No Project Alternative would have no physical impacts associated with aquifer volume or a lowering of the local groundwater table level. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project, DMU Alternative, and Express Bus/BRT Alternative. The potential for reductions in groundwater recharge during project operation is primarily related to the creation of new impervious surfaces. An increase in the amount of impervious surface area with implementation of the Proposed Project or one of the Build Alternatives, in combination with other cumulative projects, could reduce the recharge potential within the Livermore-Amador Valley Groundwater Basin, and consequently reduce groundwater supplies. Cumulative projects that would have comparatively large impervious footprints include the Dublin Crossing Specific Plan and the INP, which would primarily overlie the Main Basin.

However, similar to the Proposed Project and Build Alternatives, the cumulative projects would be subject to the applicable urban water management plan for water supplies, and major developments would require a water supply assessment to ensure that adequate water supplies are available without depleting water resources. These mechanisms, in addition to Zone 7's management of the groundwater basin resources, to keep groundwater elevations at or above historic low levels through annual conjunctive use

practices would ensure that groundwater supplies are not substantially depleted and that the local groundwater table is not substantially lowered. Additionally, the recently adopted SGMA provides a framework for sustainable management of groundwater resources and created a new regulatory mechanism for avoiding substantial depletion of groundwater resources.

Further, all the cumulative projects would be required to comply with the MRP (RWQCB Order No. R2-2015-0049), the requirements of which help to promote groundwater recharge. Among other things, the MRP requires regulated projects to treat 100 percent of project site runoff with LID measures. LID treatment measures are harvesting and use, infiltration, evapotranspiration, and biotreatment. Thus, precipitation and stormwater would likely be used on site or infiltrated, or otherwise treated prior to being released to existing stream channels where most of the natural recharge with the Livermore-Amador Valley occurs.

Therefore, as described above, cumulative impacts on groundwater recharge, groundwater supplies, and a lowering of the groundwater table from the Proposed Project and Build Alternatives, in combination with past, present, or probable future projects, would be less than significant, and no mitigation measures are required. **(LS)**

Enhanced Bus Alternative. As described in **Impact HYD-4** above, the Enhanced Bus Alternative would have no impact related to physical impacts associated with aquifer volume or a lowering of the local groundwater table level. Therefore, the Enhanced Bus Alternative would not contribute to cumulative impacts. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to groundwater, and no mitigation measures are required.

Impact HYD-14(CU): Impede or redirect flood flows within a 100-year flood hazard area under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: NI)

No Project Alternative. As described in **Impact HYD-9** above, the No Project Alternative would have no physical impacts associated with the impediment or redirection of flood flows within a 100-year flood hazard area. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project, DMU Alternative, and Express Bus/BRT Alternative. As stated above in **Impact HYD-9**, the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would result in new or modified structures and/or fill that would be

within a 100-year flood hazard areas. The main features of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative (e.g., railway alignment and I-580 widening) would generally be consistent with existing grades and would not impede or redirect flows within a 100-year flood hazard area (non-floodway). However, some project components would result in new or modified structures and/or fill that could encroach on the designated floodways of Line G-2, Tassajara Creek, and Arroyo las Positas. The addition of cumulative development projects in these areas could increase the risk of flood conveyance capacity loss in conjunction with the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative.

All floodplain and floodway development within the Arroyo de la Laguna watershed is regulated by FEMA and local cities with requirements for maintenance of flood flow conveyance and floodplain storage. According to 44 CFR 60.3(d)(3), floodway encroachments—including fill, new construction, substantial improvements, and other development within the adopted regulatory floodway—are prohibited, unless it has been demonstrated through hydrologic and hydraulic analyses that they would not result in an increase in existing flood levels. All cumulative projects in a floodway would undergo an encroachment review to determine their effect on flood flows and ensure that they do not limit the capacity of the floodway to ameliorate flooding.

Also, proposed encroachments within 100-year flood hazard areas that are also within a Caltrans ROW must comply with Caltrans-specific requirements, which are based on those of the FHWA.[91] Typically, a singular study that provides an assessment of project hydraulics and the associated flood plain is used to satisfy both federal and State requirements and procedures. [92]

Further, Zone 7 manages and maintains most of the major stormwater and flood conveyance channels in the study area. The Zone 7 Stream Management Master Plan has been developed to target and manage improvements within the drainage system for flood control, as well as for other beneficial properties. As the Stream Management Master Plan and other flood control projects are implemented, conveyance capacity of the local drainage system would be improved.

In addition to the Zone 7 Stream Management Master Plan improvements and FEMA regulatory requirements, **Mitigation Measure HYD-9**, which would require floodway hydraulic analysis, would help reduce the impacts of flood flows to less-than-significant levels. Therefore, as described above, cumulative impacts on the impediment or redirection of flood flows from the Proposed Project, DMU Alternative, and Express

[91] 23 CFR 650, Subpart A – Location and Hydraulic Design of Encroachments on Flood Plains.
[92] California Department of Transportation, 2014. Workplan Standards Guide, Release 11.0.

Bus/BRT Alternative, in combination with past, present, or probable future projects, would be less than significant, and no mitigation measures are required. **(LS)**

Enhanced Bus Alternative. As described in **Impact HYD-9** above, the Enhanced Bus Alternative would have no physical impacts associated with the impediment or redirection of flood flows within a 100-year flood hazard area. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to impeding or redirecting flood flows within a 100-year flood hazard area, and no mitigation measures beyond those identified for the project are required.

Impact HYD-15(CU): Expose people or structures to a significant risk of loss, injury, or death in the event of flooding, including flooding as a result of the failure of a levee or dam, under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact HYD-10** above, the No Project Alternative would have no new physical impacts associated with exposing people or structures to flooding. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. Based on project characteristics and existing conditions, exposure to flood hazards and dam inundation typically occurs due to a project's location within a flood hazard zone or dam inundation zone; therefore, such impact is generally site specific, limited to the immediate vicinity of the site, and independent of cumulative project activities. Because operation of the Proposed Project and Build Alternatives would be localized, the past, current, and reasonably foreseeable future projects would not combine with those of the Proposed Project or Build Alternatives to cause or contribute to potential cumulative impacts associated with flood inundation or dam inundation. Therefore, the Proposed Project and Build Alternatives, in combination with past, present, or probable future projects, would have less-than-significant impacts related to flooding as a result of failure of a levee or dam, and no mitigation measures are required. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts relative related to flooding as a result of failure of a levee or dam, and no mitigation measures are required.