APPENDIX 2-I: ALTERNATIVES CONSIDERED DURING ALTERNATIVES SCREENING PROCESS

APPENDIX 2-I: ALTERNATIVES CONSIDERED DURING ALTERNATIVES SCREENING PROCESS

The project-level environmental review process for the San Jose to Merced Project Section commenced in 2009 with a notice of intent (NOI), a notice of preparation (NOP), and an agency and public scoping process.

The alternative development and consideration process was iterative from 2009 to 2017 as illustrated on Figure 1. The California High-Speed Rail Authority (Authority) solicited public and agency comments on the range of alternatives that should be studied in the environmental impact report/environmental impact study (EIR/EIS) multiple times, including the National Environmental Policy Act (NEPA)/California Environmental Quality Act (CEQA) scoping period, during alternative analysis document preparation in 2010 through 2013, and when the project analysis shifted focus to the San Jose to Central Valley Wye Project Extent in 2016 and 2017. Interagency coordination also informed the development of alternatives for consideration. After analysts identified the initial group of potential alternatives, they developed plans, concepts, and cross sections as necessary to support early consideration. Initial alternatives were developed and screened in coordination with the NEPA/404/408 Integration process.

NEPA/404/408 Integration Process

The MOU between the FRA, the Authority, USACE, and USEPA establishes a three-part "checkpoint" process for integrating NEPA and the requirements of Clean Water Act Section 404 and Rivers and Harbors Act Section 408:

- **Checkpoint A**—The USACE and USEPA review the FRA and Authority's identification of the project's purpose and need, and concur that it is fully described.
- **Checkpoint B**—The USACE and USEPA review the FRA and Authority's identification of alternatives for full evaluation in the EIR/EIS and concur that the range of alternatives is reasonable prior to release of the Draft EIR/EIS.
- **Checkpoint C**—The USACE and USEPA review the FRA and Authority's preferred alternative and provide concurrence that it represents the preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) and may be preliminarily recommended for Section 408 approval.

NEPA/404/408 Integration is a formal process by which the Federal Railroad Administration (FRA), Authority, U.S. Army Corps of Engineers (USACE), and U.S. Environmental Protection Agency (USEPA) coordinate on the identification, preliminary technical evaluation, and validation of detailed evaluation of alternatives in a NEPA document to ascertain that the requirements of Clean Water Act (CWA) Section 404 (concerning waters/wetlands) and Rivers and Harbors Act Section 408 (concerning federally authorized flood control projects) are fully and concurrently considered. The FRA, Authority, USACE, and USEPA signed a memorandum of understanding (MOU) that established a three-step "checkpoint" process to govern interagency coordination for the integration process (see sidebar).

The following summarizes the San Jose to Merced alternatives development and analysis process and results.

HSR Project-Level Alternatives Requirements

An EIR/EIS is required to analyze the potential effects of a range of reasonable alternatives (14 California Code of Regulations [Cal. Code Regs.] 15126.6; 40 Code of Federal Regulations (C.F.R.) Part 1502.14(a)). Under CEQA, the alternatives are to include a No Project Alternative and a range of potentially feasible alternatives that could (1) meet most of the project's basic objectives and (2) avoid or substantially lessen one or more of the project's significant adverse effects (14 Cal Code Regs. § 15126.6(c)). The lead agency must describe its reasons for excluding other potential alternatives when considering alternatives for evaluation in the environmental document. Under the "rule of reason," an EIR is required to study a sufficient range of alternatives in order to permit a reasoned choice (Cal. Code Regs. 14 § 15126.6(f)). CEQA does not require that all possible alternatives be studied.

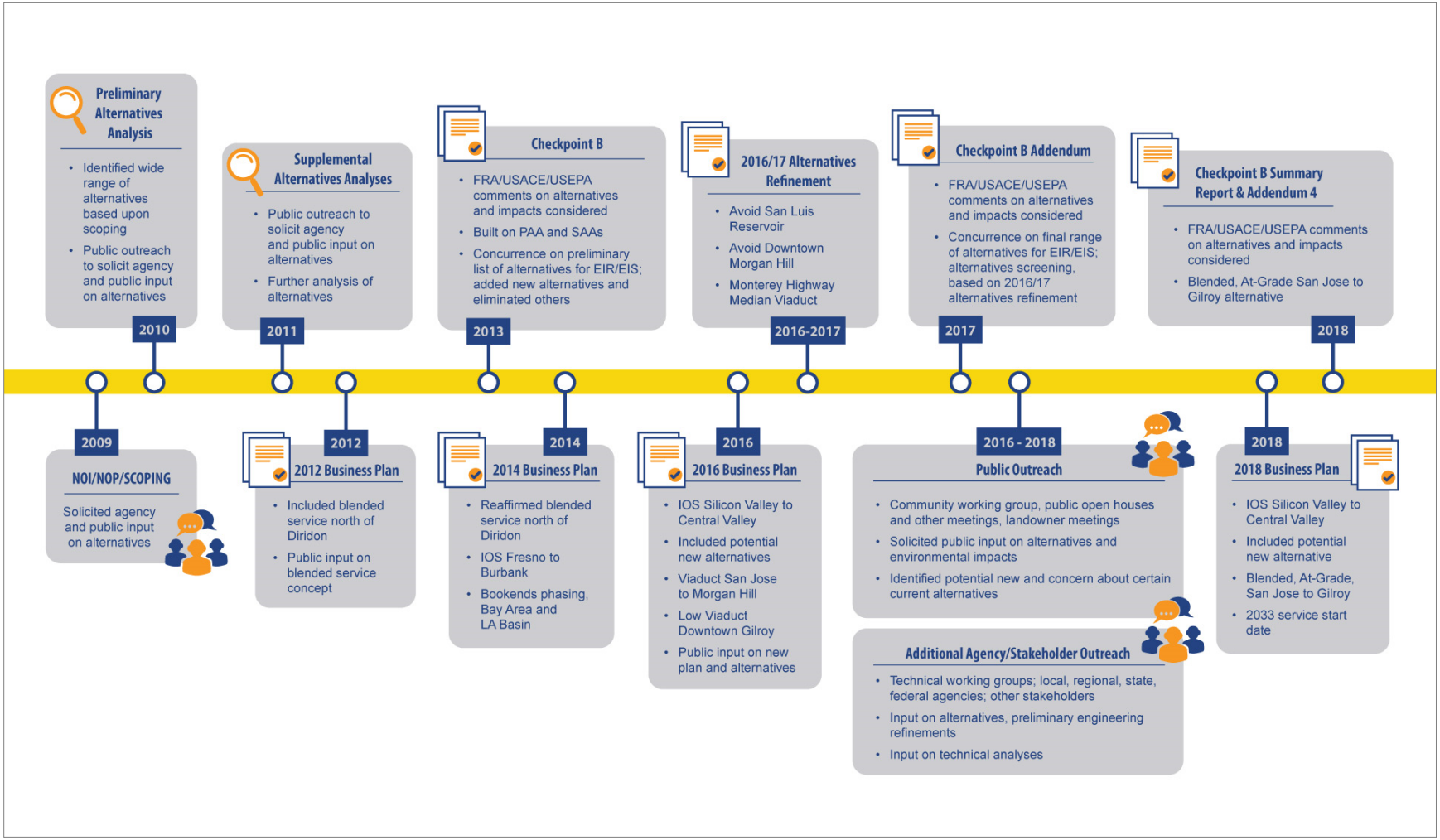

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Figure 1 Project Alternatives Development and Screening Process

Under NEPA, the alternatives analysis is "the heart of the environmental impact statement" (40 C.F.R. Part 1502.14). Under Council on Environmental Quality (CEQ) regulations, an EIS is required to examine "all reasonable alternatives" to the proposed action, as well as the no-action alternative. The CEQ guidance also allows, when the number of potentially reasonable alternatives is very large, the lead agency to examine "a reasonable number of examples, covering the full spectrum of alternatives" (CEQ, Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations [1981]). Pursuant to Section 10(b) of the FRA's *Procedures for Considering Environmental Impacts*, "It is entirely proper that the number of alternatives being considered should decrease as the environmental consideration process proceeds and as analysis reveals that certain alternatives would in fact be unreasonable" (64 Fed. Reg. 28546, 28550). The Authority and FRA considered the input of the public and interested resource agencies when developing the reasonable range of alternatives. Pursuant to CEQA and NEPA, the Authority and FRA held scoping meetings to invite public participation in defining the scope of the analysis, including the range of reasonable alternatives.

Alternatives Consideration Process and Chronology

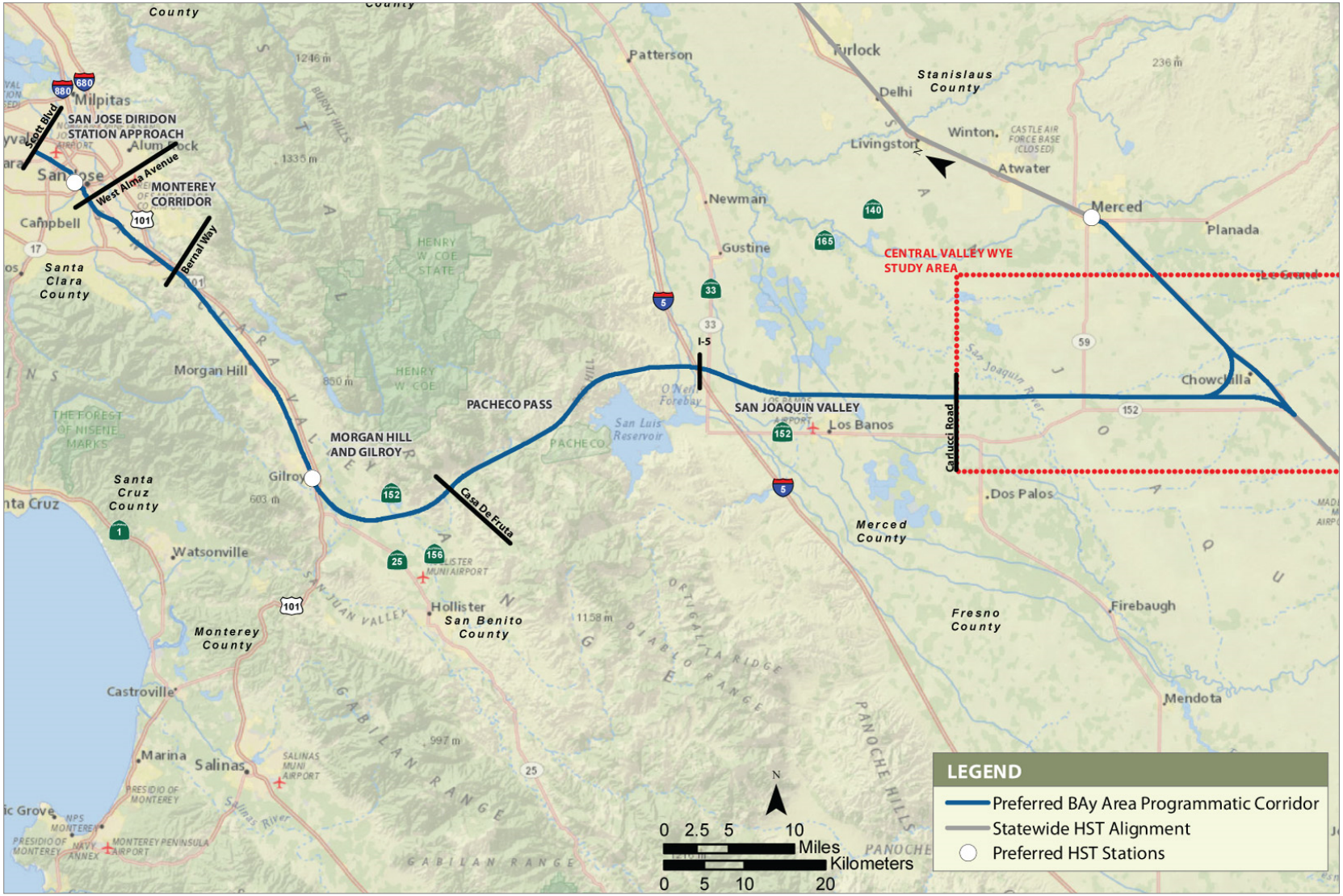
The following summarizes the milestones in alternatives development and consideration during this period.

NEPA/CEQA Scoping (2009)

On February 23, 2009, the Authority distributed an NOP announcing preparation of an EIR for the entire San Jose to Merced Project Section. The FRA published an NOI in the Federal Register on March 16, 2009, announcing the preparation of an EIS for the Project Section. Figure 2 from the Final Scoping Report illustrates the preferred corridor identified in the Statewide Program EIR/EIS (Authority and FRA 2009). The Authority held scoping meetings in Merced (March 18, 2009), San Jose (March 25, 2009), and Gilroy (March 26, 2009). More than 300 residents, property and business owners, agency representatives, elected officials, the media, and other interested parties participated in these meetings. The Authority and FRA solicited input concerning potential project-level alternatives and environmental effects.

Major issues raised during scoping included alignment options and alternatives for routes, stations, and maintenance facilities, design options for grade crossing and separations, considerations for alternative elevated, trenched or tunneled alignments, parking locations, and other facilities. Additional alignment alternatives suggested and shown on Figure 3 included:

- In San Jose, to avoid potential impacts on the greater Gardner neighborhood, several options for an underground tunnel or at-grade and alignment design options along State Route (SR) 87, south of I-280, between the Diridon and Tamien Caltrain stations
- In the south part of San Jose between the Tamien station to Coyote Valley, an option to follow SR 87 and SR 85, replacing the (Santa Clara) Valley Transportation Authority (VTA) light rail that runs along that corridor with high speed rail, and relocating the VTA light trail to Monterey Road.
- South of San Jose, an option to follow U.S. Highway (US) 101 to reach Gilroy, bypassing downtown Morgan Hill
- East of Gilroy on the west side of Pacheco Pass, an option to explore alignment options that would avoid bisecting the Frazier Lake Airpark
- On the east side of Pacheco Pass, options to avoid the Grassland Ecological Area and cross the San Joaquin Valley from Santa Nella to SR 99
- From Los Banos east, several options to follow SR 152 to reduce potential impacts on agricultural lands and Chowchilla
- Options south of SR 152 to reduce potential impacts on Chowchilla and make a connection to the Merced to Bakersfield Project Section



Source: Authority and FRA 2009

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Figure 2 Tier 1 Decision as Foundation for Range of Alternatives in Tier 2 EIR/EIS

This input helped to shape the initial alternative alignments that were considered for this section of the HSR system.

Preliminary and Supplemental Alternatives Analysis (2010–2011)

The development of initial project-level alternatives in 2009 followed the process described in *Alternatives Analysis Methods for Project EIR/EIS, Version 2* (Authority 2009). Figure 3 illustrates the initial range of alternatives identified through the scoping process. The assessment of potential alternatives involved both qualitative and quantitative analyses to address applicable policy and technical considerations. These methods included field inspections of corridors; project team input and review considering local issues that could affect alignments; qualitative assessment of constructability, accessibility, operations, maintenance, right-of-way, public infrastructure, railway infrastructure, and environmental effects; engineering assessment of project length, travel time, and configuration of key features of the alignment (such as the presence of existing infrastructure); and geographic information system (GIS) analysis of effects on farmland, water resources, wetlands, threatened and endangered species, cultural resources, current urban development, and infrastructure. Stakeholder input, concerns, and preferences were considered to provide local context.

Key Environmental Factors in the PAA and SAA Analysis

The PAA/SAA review considered all of the following factors:

- System factors: journey time, rail length, intermodal connections, costs
- Constructability: feasibility, disruption to existing railroads and utilities
- Endangered and Threatened Species: Effects on habitat for state- and federally listed plant and wildlife species
- Farmland: Effects on designated Important Farmland
- Flood Control: Effects on floodplains
- Cultural resources: Effects on archaeological sites and historic buildings and structures
- Geological constraints
- Land Use: Consistency with local planning
- Noise-sensitive receptors near alignment
- Parks and Open Space: Effects on publicly owned parks, recreational areas, and wildlife areas per Section 4(f) of the 1966 Department of Transportation Act
- Residential/Commercial: Potential displacement of residences and businesses
- Schools in close proximity
- Traffic effects and road closures
- Visual/scenic resources
- Waters/Wetlands: Effects on state and federal waters

Next, the Authority evaluated the narrowed range of alternatives against HSR system performance criteria. Figure 4 illustrates the alignment alternatives that were carried forward into detailed alternatives analysis. The screening process entailed use of environmental criteria to measure the potential effects of the proposed alternatives on the natural and human environment. For example, the land use criteria measured the extent to which a station alternative would support transit use; be consistent with existing adopted local, regional, and state plans; and be supported by existing and future growth areas. Constructability measured the feasibility of construction and the extent to which right-of-way would be constrained. Community effects measured the extent of disruption to neighborhoods and communities, such as the potential to minimize (1) right-of-way acquisitions, (2) the extent of division of an established community, and (3) conflicts with community resources. The analysis of biological resources and water quality evaluated the extent to which an alternative would minimize effects on natural resources. As a result of this screening process, some alignment alternatives were selected to proceed into the Draft EIR/EIS, as illustrated on Figure 5.

The *San Jose to Merced Preliminary Alternatives Analysis Report* (PAA) (Authority and FRA 2010) and the two San Jose to Merced Supplemental Alternatives Analysis reports (SAA) (Authority and FRA 2011a, 2011b) present the alternatives analysis. The PAA and SAAs considered the entire Project Section from the San Jose HSR Station through the Central Valley Wye (the planned junction with the Merced to Fresno Project Section) and north to Merced. The alternatives analyses provide the reader with an understanding of how alternatives were developed, taking into account alignment and station development considerations. While the

alternatives analysis process considered multiple criteria (see sidebar), it emphasized the project objective to maximize the use of existing transportation corridors and available rights-of-way to the extent feasible as determined by the Authority" (California Streets and Highways Code, Division 4, Chapter 20, Section 2704 et seq.). Those alternatives that were not carried forward by the Authority and FRA had greater direct and indirect environmental effects, were impracticable, or failed to meet the project purpose. Figure 6 illustrates the alignment and station alternatives that resulted from this further development and screening process.

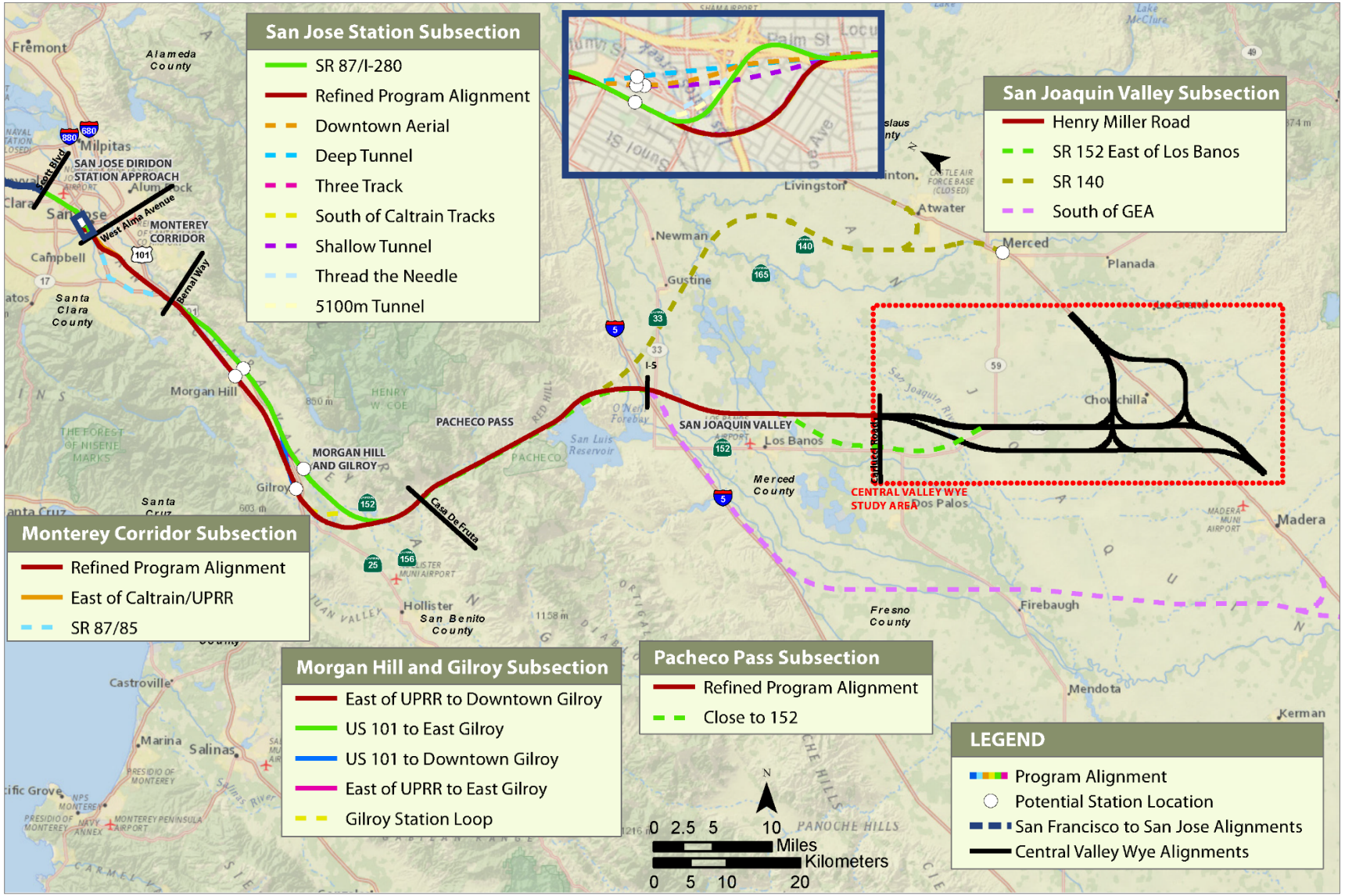
The three alternatives analysis reports referenced above (Authority and FRA 2010, 2011a, 2011b) evaluated alignment alternatives. These documents describe the procedure and rationale for selecting and rejecting alignment alternatives.

Public and agency comments were solicited by the Authority during preparation of the alternatives analysis reports. The PAA and SAAs describe the recommended alternatives to be carried forward for further analysis and alternatives to be withdrawn from further consideration.

2012 Business Plan (2012) and SB 1029

The 2012 Business Plan (Authority 2012) introduced the blended system concept for the San Francisco to San Jose Project Section of the HSR system. Under the blended system, Caltrain and HSR would share the Caltrain corridor and tracks in a mostly at-grade system from San Jose to San Francisco. Senate Bill (SB) 1029 made the blended system a legislative mandate. The San Jose to Merced Project Section includes the area north of the San Jose Diridon Station to Scott Boulevard. As further discussed in the description of Alternative 1, Caltrain and HSR would operate in a blended service from north of I-880 to Scott Boulevard.[1]

[1] Alternatives 2 and 3 would transition to at-grade operations at Scott Boulevard and therefore would not include a blended service component.



Source: Authority and FRA 2010

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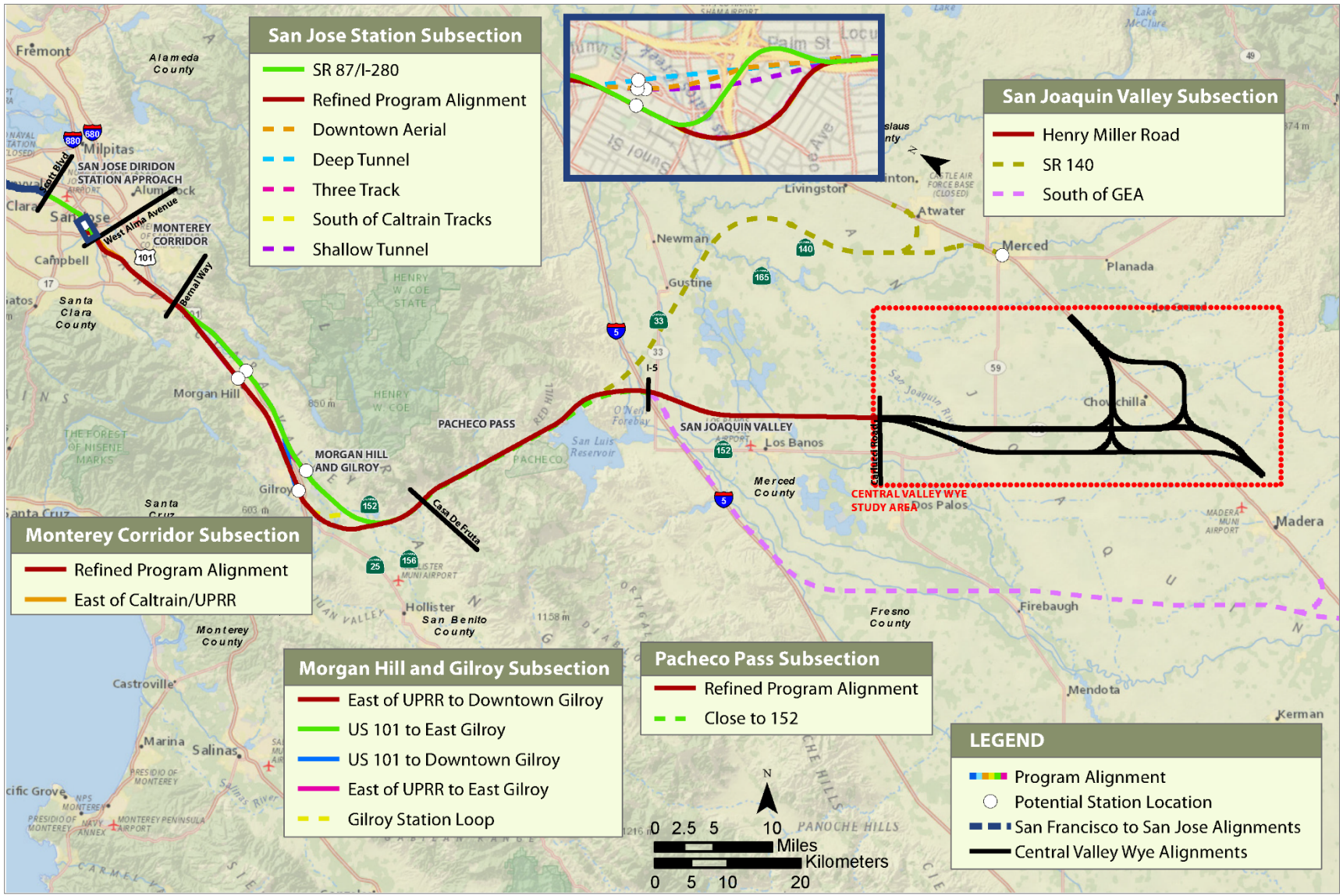
Figure 3 Alternatives Considered in the 2010 Preliminary Alternative Analysis Report as a Result of 2009 Scoping



Source: Authority and FRA 2010

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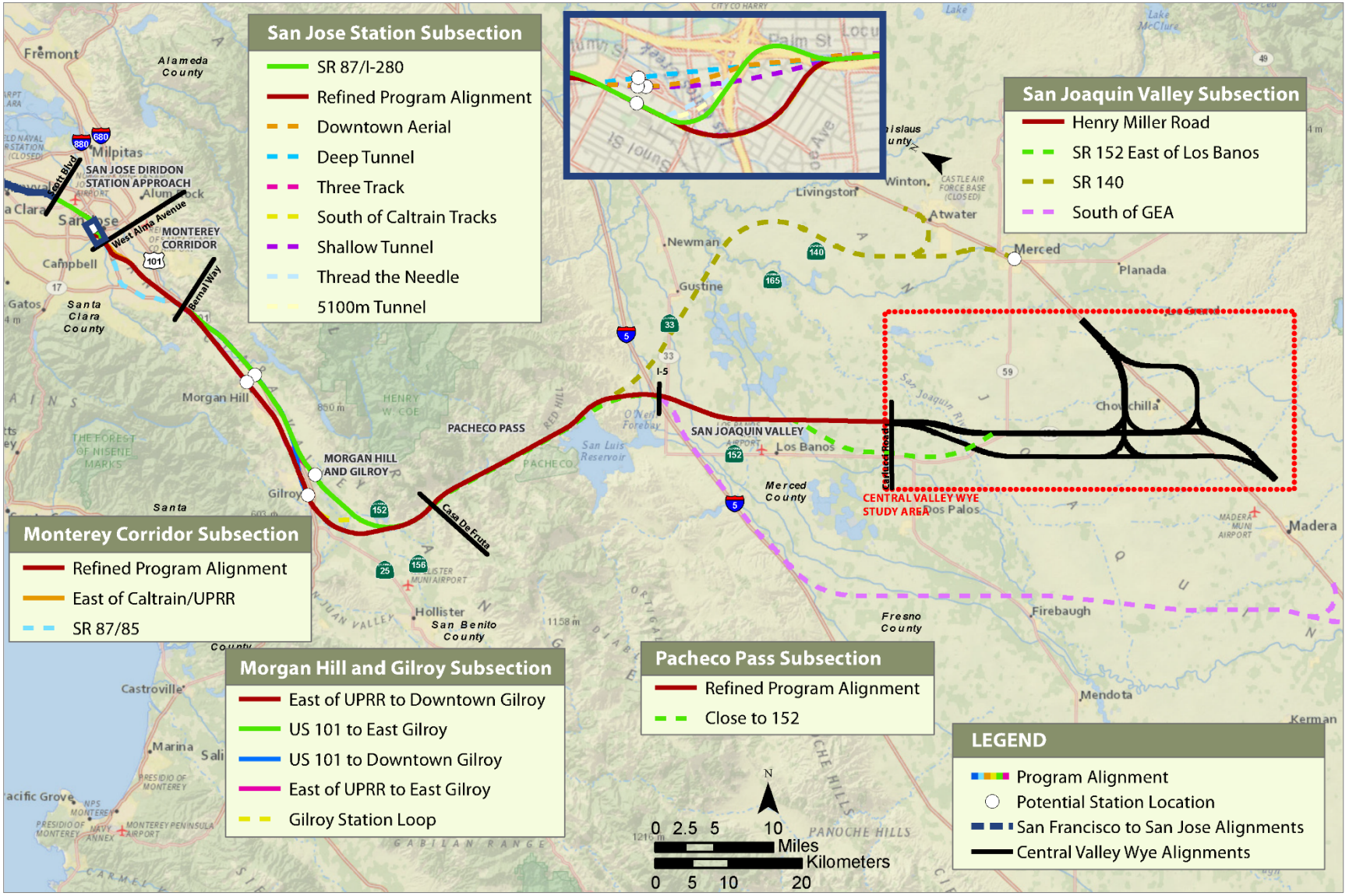
Figure 4 Alignment Alternatives Carried Forward into Detailed Alternatives Analysis in the 2010 Preliminary Alternatives Analysis Report



Source: Authority and FRA 2010

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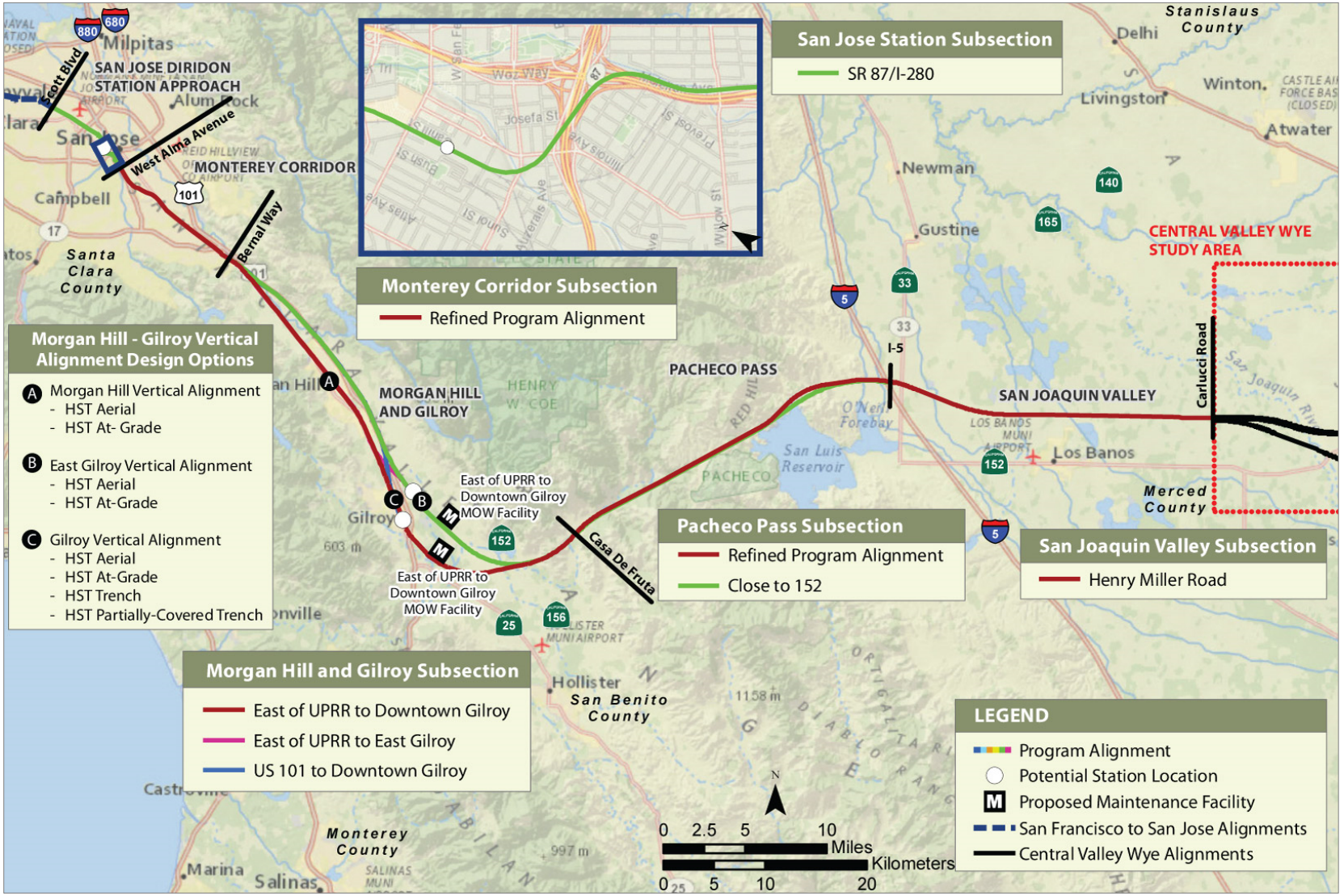
Figure 5 Alignment Alternatives Carried Forward into EIR/EIS as Identified in the Preliminary Alternatives Analysis Report



Source: Authority and FRA 2011

FEBRUARY 2018

Figure 6 Alignment and Station Alternatives to Be Carried Forward into the EIR/EIS as Identified in the 2011 Supplemental Alternatives Analysis Report

Checkpoint B Summary Report (2013)

Pursuant to the NEPA/404/408 Integration MOU, the FRA and the Authority are required to get concurrence from the USACE and USEPA regarding the range of alternatives to be analyzed in the Draft EIR/EIS. The integration process makes certain that the evaluation considers potential alternatives that can be feasibly permitted by the USACE under the requirements of CWA Section 404 and Rivers and Harbors Act Section 408.

In 2013, the Authority and FRA developed a *Checkpoint B Summary Report*, largely drawn from the work completed for the PAA and SAAs between June 2010 and July 2011, for review by the USACE and USEPA. The USACE and USEPA concurred in August and September 2014, respectively, with the alternatives recommended for inclusion in the Draft EIR/EIS.

Following the completion of the Checkpoint B analysis in 2013, work on the San Jose to Merced Project Section as a whole was suspended, and the Authority initiated a more limited study focused on the Central Valley Wye. The Central Valley Wye study was advanced as a supplemental EIR/EIS for the Merced to Fresno Project Section. The *Merced to Fresno Section: Central Valley Wye Draft Supplemental EIR/EIS* (Authority 2019) was published May 2, 2019.

Key Environmental Factors in the Checkpoint B Analysis

The Checkpoint B alternatives review considered all the following factors:

- Waters/Wetlands: Effects on waters of the U.S. (including wetlands) per CWA Section 404 as well as state-regulated wetlands and riparian areas
- Flood Control: Effects on federally authorized flood control projects under Rivers and Harbors Act Section 408 and on floodplains
- Cultural Resources: Effects on archaeological sites and historic buildings and structures
- Endangered and Threatened Species: Effects on habitat for state- and federally listed plant and wildlife species
- Environmental Justice: Extent of low-income and minority populations near the alignment
- Farmland: Effects on designated Important Farmland
- Parks and Open Space: Effects on publicly owned parks, recreational areas, and wildlife areas per Section 4(f) of the 1966 Department of Transportation Act
- Residential and Commercial: Potential displacement of residences and businesses

In late 2015, the Authority reinitiated work on the San Jose to Central Valley Wye Project Extent – that is, the portion of the San Jose to Merced Project Section that is located to the west of the Central Valley Wye. The additional analysis of the Project Extent began with, and built upon, the range of alternatives that had been documented in the *2014 Checkpoint B Summary Report* for the San Jose to Merced Project Section.

2016 Business Plan (2016)

The 2016 Business Plan (Authority 2016) described the Authority's decision to shift its early focus from the project sections in Southern California to those in Northern California with a goal of initiating Central Valley to Silicon Valley (Valley-to-Valley) service in 2025. In light of updated ridership forecasts and operational planning undertaken since the 2012 Business Plan, the Authority identified certain new alternatives (such as a viaduct alternative between San Jose and Gilroy and blended operation north of Diridon Station) and also reconsidered the formerly dismissed at-grade alignment for the San Jose Diridon Station Approach Subsection as part of the 2016 Business Plan.

Further Outreach, Consultation, and Alternatives Refinement (2016–2017)

After reinitiating work on the San Jose to Central Valley Wye Project Extent in 2015 and after adoption of the Business Plan in 2016, the Authority and FRA conducted additional community outreach and engineering along the corridor. With project reinitiation, the Authority and FRA reached out to the public, stakeholders, and agencies to solicit their input and concerns about project alternatives and to consider refinements of the prior alternatives or the addition of new alternatives responsive to those concerns. The reconsideration of alternatives in 2016 and 2017 used a two-phase screening process to evaluate the direct and relative performance of conceptual alternatives. The initial phase considered financial feasibility, constructability, and operations. If the alternative met these initial criteria, then it was also reviewed for community and environmental impacts (Table 1).

Table 1 Evaluation Criteria, 2016–2017 Alternatives Refinement for San Jose to Central Valley Wye Project Extent

Evaluation Criteria	Considerations
First Phase	
Financial feasibility	▪ Be financially feasible within the Authority's capital expenditure program
Constructability	▪ Provide constructible, 100-year lifecycle infrastructure ▪ Be reasonably constructed within the project schedule timeframe without unacceptable risks
Operations/Maintenance	▪ Support safe, reliable, and resilient operations ▪ Train speed meets the Prop 1A service travel time ▪ Peak hour average representative travel time ▪ Blended operations north of Diridon Station and dedicated operations south of Diridon Station ▪ Station configuration to accommodate passing trains ▪ Adhere to federal and state laws governing transportation projects
Second Phase	
Community impact	▪ Would the alternative result in unacceptable community impacts?
Environmental impact	▪ Would the alternative avoid or minimize impacts on aquatic resources protected under Section 404 of the CWA such that it could be considered the least environmentally damaging practicable alternative (LEDPA)? ▪ Would the alternative avoid or minimize impacts on public recreational facilities, wildlife refuges, and listed historic resources protected under Section 4(f) of the U.S. Department of Transportation Act of 1966? ▪ Would the alternative comply with other federal and state regulations protecting environmental resources including the National Historic Preservation Act, the Civil Rights Act, and federal and state Endangered Species Acts?

Source: Compiled by Authority and ICF 2019

During 2016 and 2017, the Authority refined and modified the range of alternatives to be considered in this Draft EIR/EIS in response to changed community conditions, a more detailed understanding of environmental and community concerns, and cost and constructability issues. This section summarizes the outreach processes used in 2016 and 2017 and the input provided by various parties. The actual consideration and fate of 2016 and 2017 alternatives considered are presented in Section 2.4.3, Range of Potential Design Options Considered and Findings by Subsections.

The Authority and FRA conducted public outreach meetings, consulted with environmental regulatory agencies; consulted with cities and counties; met with federal, state, and private landowners; and met with other stakeholders during this process. The Authority presented the alternatives currently under consideration for the Draft EIR/EIS in a wide-ranging series of public, agency, and stakeholder meetings and received input regarding concerns about alternatives and suggestions for additional alternatives. This additional outreach led to the development of new design options in the Monterey Corridor, Morgan Hill and Gilroy, and Pacheco Pass Subsections and reconsideration of some alternatives previously dismissed in earlier alternative evaluations. Figure 7 illustrates the alignments and design options that were presented in April 2016 community and technical working group meetings. Table 2 shows the key outreach venues, concerns expressed, and alternatives considered as a result of this outreach. Summaries of individual public and agency meetings are shown in Table 9-1 in Chapter 9, Public and Agency Involvement, of the Draft EIR/EIS.

Table 2 Summary of Key Outreach Venues and Alternatives Concerns, 2016–2017

Type	Dates	Concerns Expressed
Open House/Community meetings (Los Banos, Gilroy, Morgan Hill, San Jose, neighborhood groups)	2016: May, June, September, November, December 2017: February, March, April, May, July	▪ San Joaquin Valley: Community expressed concerns about impacts on farmlands, dairies, wildlife, and Henry Miller Road. Requests to reconsider options south and north of Henry Miller Road dismissed in prior PAA/SAA/Checkpoint B processes. ▪ Pacheco Pass: Community expressed concerns about impact on individual properties and the Romero Ranch Conservation Easement. ▪ Gilroy: Citizens expressed concerns about community disruption, aesthetics, right-of-way acquisition, agricultural impacts, and cultural resources for both downtown and east Gilroy options. Alternatives considered include East Gilroy, Downtown Gilroy, and US 101 options. ▪ San Martin: Residents advocated for reconsideration of US 101 alignments to avoid impacts on downtown San Martin. ▪ Morgan Hill: Community expressed concerns about impact of alignments through downtown and bypassing downtown due to displacement. Environmental group concerns about the impact on wildlife movement in the Coyote Valley. ▪ Monterey Corridor: Residents expressed concerns about traffic, noise, and aesthetic impacts on Monterey Corridor. Requests for reconsideration of US 101 alignments and for tunnel option. ▪ Downtown San Jose: Some parties expressed continued interest in tunnel and at-grade options due to concern about aesthetics and business displacements of downtown aerial option. Other parties expressed concern about impact of at-grade options on communities and other rail operators (e.g., Caltrain). ▪ North of downtown San Jose: Community expressed concerns about aesthetic impact of viaduct to Scott Blvd. option and favor shorter viaduct (to I-880).
CWGs (Los Banos, Gilroy-Morgan Hill, San Jose)	2016: April, August 2017: January, May, July, August, September, October	
TWGs (Los Banos–Gilroy, Gilroy, San Jose to Morgan Hill, San Jose)	2016: March, April, June, July, August, September 2017: January, June, July	

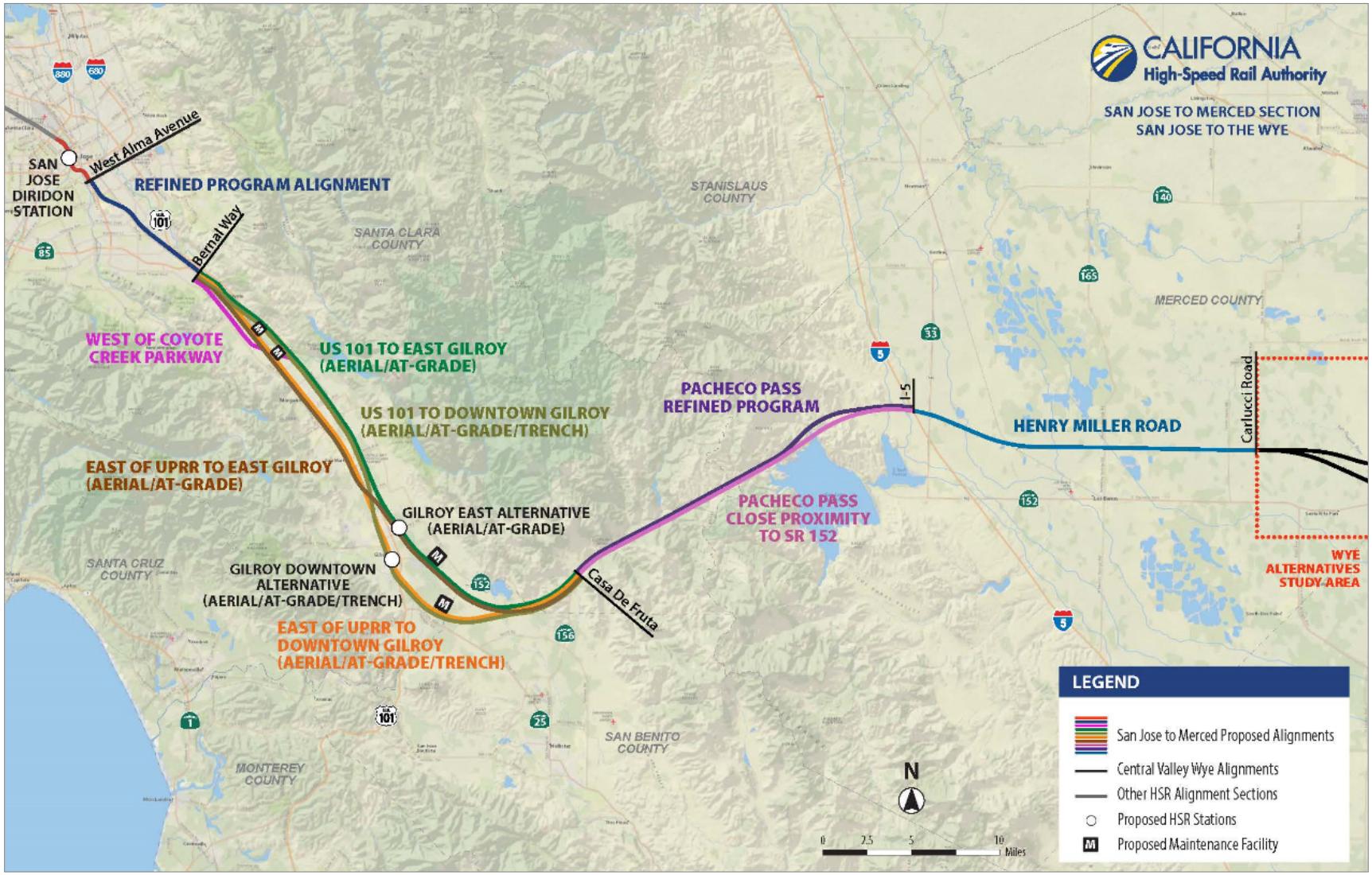
Type	Dates	Concerns Expressed
City/County Meetings Gilroy, Morgan Hill, San Jose, Santa Clara County, Merced County	2016: May, June, July, August, September, October, November, December 2017: January, February, March, April, May, June, July, August	▪ Consultation with Gilroy resulted in selection of two vertical options for downtown Gilroy including low viaduct and embankment (eliminating trench and high viaduct options) and consideration of a US 101 alignment within Gilroy. ▪ Consultation with Morgan Hill resulted in creation of a Morgan Hill bypass option to reduce impacts on downtown Morgan Hill. ▪ Consultation with City of San Jose resulted in development of a median viaduct option as well as consideration of a tunnel option for Monterey Corridor. The city also requested a reconsideration of a prior tunnel and at-grade options for downtown San Jose and conducted independent analyses of these options.
Agency meetings Federal: GSA, USBR, USFWS, NMFS State: CDFW, CALTRANS, RWQCB Local: SCVWD, VTA, Water Authorities, Reclamation Districts, Irrigation Districts, Caltrain, BART, School Districts. Pajaro River Watershed Flood Prevention Authority	2016: March, June, July, August, October, November, December 2017: January, February, March, April, May, June, July, August	▪ USBR concerns regarding encroachment into San Luis Reservoir resulted in a shift of the Pacheco Pass option to the North Pacheco Pass tunnel option to avoid the reservoir. ▪ Resource agencies' registered concerns over impacts on sensitive species and habitat, aquatic resources, and wildlife movement corridors. Detailed analysis, in cooperation with agencies, through the checkpoint process led to design modifications of increase wildlife permeability. ▪ Water infrastructure agency concerns addressed through project design modifications and mitigation. ▪ Soap Lake designs were coordinated with flood districts and resource agencies to address floodplain capacity and wildlife movement concerns with more permeable structures . ▪ Coordination with interagency working group on Diridon Station options to consider City of San Jose, Caltrain, BART, SCVWD, and other agency concerns.

Source: Compiled by ICF 2017
CWG = community working group
TWG = technical working group
PAA = preliminary alternatives analysis
SAA = supplemental alternatives analysis
US = U.S. Highway
I- = Interstate
GSA = General Services Administration
USBR = U.S. Bureau of Reclamation
USFWS = U.S. Fish and Wildlife Service
CDFW = California Department of Fish and Wildlife
CALTRANS = California Department of Transportation
RWQCB = Regional Water Quality Control Board
SCVWD = Santa Clara Valley Water District
VTA = (Santa Clara) Valley Transportation Authority
BART = Bay Area Rapid Transit

Checkpoint B Summary Report Addendum 3 (2017)

The Authority and FRA reviewed prior design options and new design options developed during 2016 and 2017. The results of the evaluation of new design options and reconsideration of prior design options are presented in Section 2.4.3, Range of Potential Design Options Considered and Findings by Subsection.

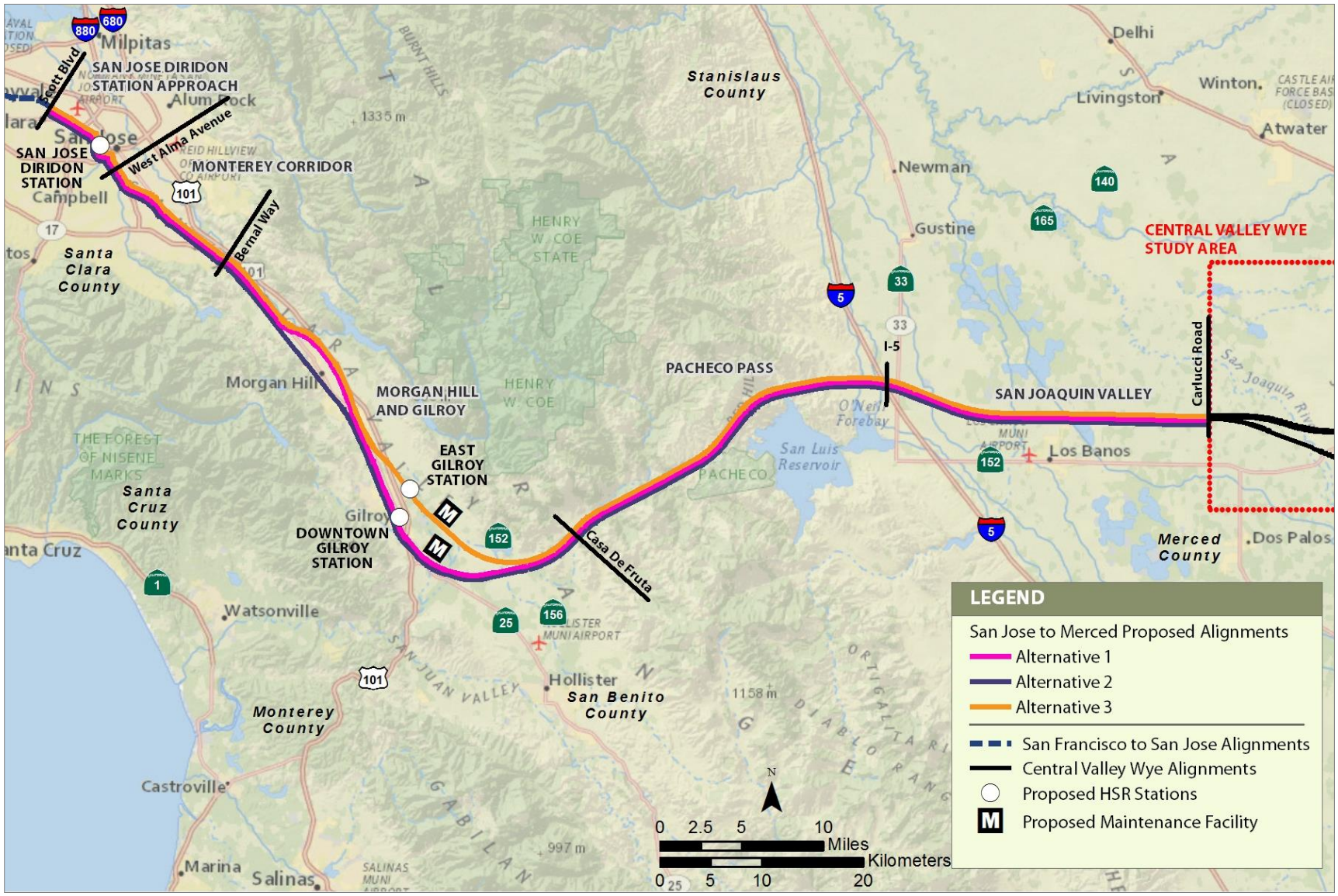
The Authority and FRA developed a Checkpoint B Summary Report Addendum 3 to narrow the range of alternatives to three of the end-to-end alternatives evaluated in this Draft EIR/EIS. Figure 8 illustrates the alignments and design options that were recommended to carry forward in the Draft EIR/EIS as a result of the evaluation. The USACE and USEPA concurred with the range of alternatives in the Checkpoint B Summary Report Addendum 3 (Authority and FRA 2017) on October 20, 2017.



Source: Authority and FRA 2017

DECEMBER 2017

Figure 7 Alternatives Refinements Resulting from April 2016 Community Working Group and Technical Working Group Meetings



Source: Authority and FRA 2017

DECEMBER 2017

Figure 8 Alternatives Refinements Resulting from Outreach during 2017 Checkpoint B Addendum Development

2018 Business Plan (2018)

The 2018 Business Plan (Authority 2018) confirmed the Authority's decision to focus on the project sections in Northern California with a goal of initiating Central Valley to Silicon Valley (Valley-to-Valley) service in 2033. In light of operational planning undertaken since the 2016 Business Plan, the Authority reconsidered the formerly dismissed at-grade alignment for the San Jose Diridon Station Approach Subsection and extending blended service proposed for the San Francisco to San Jose Project Section from San Jose to Gilroy as part of the 2018 Business Plan. The blended infrastructure and service between San Jose Diridon Station and Downtown Gilroy Station would occur largely at grade and predominantly within the existing Caltrain and UPRR rights-of-way. The concept of extending blended electrified passenger rail infrastructure and operations from San Jose to Gilroy is currently under discussion between the California State Transportation Agency, the Authority, and UPRR. The parties have advanced the concept sufficiently that the Authority has determined that this alternative merits study as at least potentially feasible at this time. Figure 9 illustrates the phasing plan from the 2018 Business Plan.

Checkpoint B Summary Report Addendum 4 (2018)

The Authority and FRA reviewed a Blended, At-Grade design option developed during 2017 and 2018 that would implement the 2018 Business Plan concept. The blended alternative would represent a least-cost option for initiating early service between San Jose and downtown Gilroy and could reduce certain impacts relative to the other alternatives previously advanced for study.

The Authority and FRA developed a *Checkpoint B Summary Report Addendum 4* to review the preliminary effects of this alternative and assess whether to evaluate a new alternative in this Draft EIR/EIS. The USACE and USEPA concurred with the range of alternatives in the *Checkpoint B Summary Report Addendum 4* (Authority and FRA 2018) on January 22 and February 1, 2019 (respectively).

Range of Potential Design Options Considered and Findings by Subsection

This section discusses the range of potential route design options and corresponding locations of stations and maintenance facilities that were considered by the Authority and FRA during the alternatives development process (the PAA, the two SAAs, the 2013 Checkpoint B Report, the 2017 Checkpoint B Summary Report Addendum 3, and the 2018 Checkpoint B Summary Report Addendum 4). The following analysis discusses design options by subsection. After the Authority and the FRA screened design options for each subsection to determine which would be advanced to EIR/EIS evaluation, the Authority linked the design options to define three end-to-end project alternatives; a fourth alternative was identified to provide blended, at-grade service from San Jose to Gilroy.

The new design options developed during 2016 and 2017 and some of the prior design options previously reviewed were reviewed by the Authority and FRA using the five-step process previously described. The results of the evaluation of new design options and reconsideration of prior design options are presented in Section 2.4.3, Range of Potential Design Options Considered and Findings by Subsection.

San Jose Diridon Approach Subsection Design Options Considered

The Authority and FRA considered a range of horizontal and vertical alignments to connect the HSR system to downtown San Jose for the San Jose Diridon Approach Subsection, as illustrated on Figure 10.

Note: Implementation phasing is described in Appendix 2-L
Source: Authority 2018

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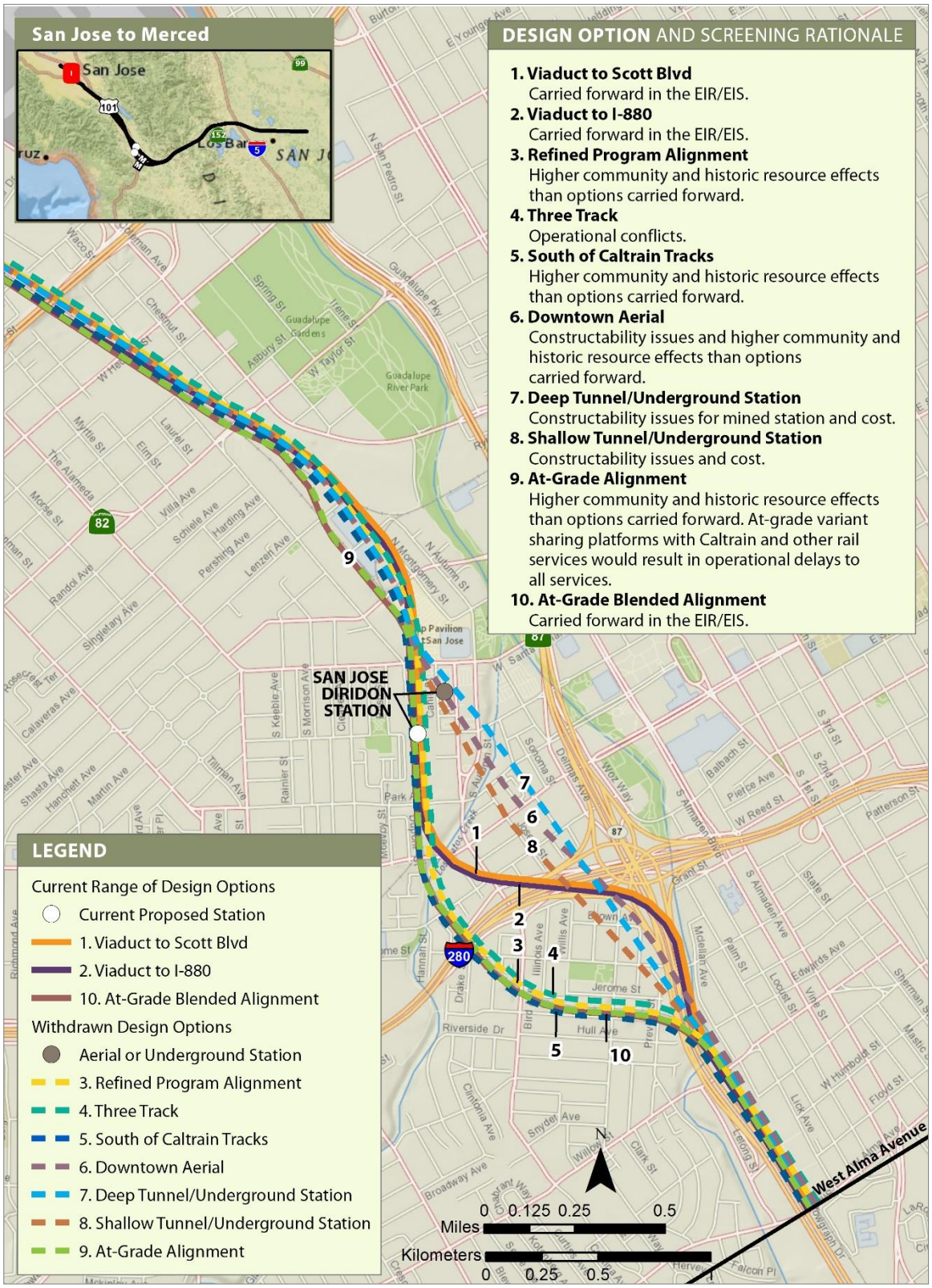
Figure 9 Phasing Plan from the 2018 Business Plan



Source: Authority and FRA 2013, Authority 2016

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Figure 10 Design Options Considered in the San Jose Diridon Approach Subsection

Two broad themes characterize design options in this subsection: (1) whether HSR will remain within the Caltrain Corridor and (2) whether the HSR vertical profile will be at grade, aerial, or tunnel. Several design options generally follow the Caltrain Corridor alignment: Refined Program Alignment (RPA), Three Track, South of Caltrain Tracks, and At-Grade Alignment options, but they also include areas outside (and parallel to) Caltrain. The Blended, At-Grade option is entirely within the Caltrain and UPRR right-of-way. Other design options do not follow the Caltrain Corridor south of Diridon Station (such as the SR 87/I-280 aerial, Downtown Aerial, and Downtown Tunnel options). The second theme is vertical profile. Many of the design options along the Caltrain Corridor use extensive at-grade profile rather than aerial and tunnel options. Three design options considered by the Authority and FRA (Viaduct to Scott Boulevard, Viaduct to I-880, and Downtown Aerial) entail aerial structures through downtown. The Blended, At-Grade option is entirely at grade through downtown. The Authority and FRA considered and evaluated several tunnel design options.

The Authority and FRA evaluated design options for this subsection in the PAA, SAAs, the 2013 Checkpoint B Summary Report, the 2017 Checkpoint B Summary Report Addendum 3, and the 2018 Checkpoint B Summary Report Addendum 4. Additional modified tunnel options were evaluated leading into the Checkpoint B Summary Report Addendum 3 process per community interest. An additional Blended, At-Grade option was evaluated in the 2018 Checkpoint B Summary Report Addendum 4.

In the 2013 Checkpoint B Summary Report, all the design options, except the SR 87/I-280 aerial option, were withdrawn from further consideration by the Authority and FRA due to a variety of practicability, feasibility, and environmental effect reasons. Table 3 shows the rationale, and greater detail is provided in the PAA, SAAs, 2013 Checkpoint B Summary Report, 2017 Checkpoint B Summary Report Addendum 3, and 2018 Checkpoint B Summary Report Addendum 4. The downtown tunnel options considered in the Checkpoint B process (Deep Tunnel and Shallow Tunnel) were withdrawn due to constructability constraints of a mined underground station and the substantially higher cost than an aerial option.

Three modified tunnel options considered subsequent to the Checkpoint B process were withdrawn, primarily for constructability constraints. The “Thread the Needle” tunnel option would have increased travel time compared to the Deep Tunnel and would face constructability issues because of limited portal space in the SR 87/I-280 interchange. The “5100m Tunnel” option would face constructability issues associated with building a station beneath active rail lines and stations, as well as increased travel time compared to the Deep Tunnel. The “Modified Tunnel” option—a medium-depth tunnel—was withdrawn due to constructability issues associated with a mined station, concerns about interaction with the future Bay Area Rapid Transit (BART) station, and constraints on future development.

An at-grade, dedicated alignment and HSR operations for the San Jose Diridon Approach Subsection were reconsidered after the Authority Board of Directors adopted the 2016 Business Plan. Staff evaluated combined use of the existing Diridon Station platforms and tracks for stopping and through-station operations with other passenger railroads. Staff determined that combined use would result in substantial delays to all passenger rail services (and conflict with freight rail operations) because of insufficient capacity at Diridon Station and approaching track. Resolving capacity constraints would require relocation of the Caltrain Centralized Equipment Maintenance and Operations Facility (CEMOF) to allow the combination of dedicated HSR and continued and planned passenger rail services (Authority 2016). The Authority and FRA also reaffirmed that an at-grade, dedicated alignment would have substantial community effects on the North Gardner neighborhood, as originally identified in the PAA, SAAs, and 2013 Checkpoint B Summary Report.

in 2016 and 2017, public input continued to advocate for consideration of HSR within the existing railroad rights-of-way to minimize impacts on existing communities and planned development along the alignment between San Jose and Gilroy. During this period, the concept of extending blended electrified passenger rail infrastructure and operations from San Jose to Gilroy was discussed by the California State Transportation Agency, the Authority, and UPRR. The parties

had advanced the concept sufficiently that the Authority determined that the approach was potentially feasible and merited further evaluation. A blended, at-grade alternative was added after the Authority Board of Directors adopted the 2018 Business Plan. The new alternative was evaluated in the Checkpoint B Summary Report Addendum 4 after development and consideration in 2017 and 2018.

Variations of the at-grade alignment, with exclusive HSR platforms east or west of the existing Diridon Station and platforms, were evaluated by the Authority in response to public concerns raised in 2016 and 2017 about the aesthetic and land displacement effects of an aerial design option on downtown San Jose. An HSR station east of the existing station tracks would require moving the existing historic Diridon station, using extensive portions of City parking lots around the SAP Center for tracks, and necessitating other displacements in downtown, in addition to the aforementioned community effects on the North Gardner neighborhood. An HSR station west of the existing station tracks would eliminate access to CEMOF, require relocation of the VTA light rail station, necessitate the demolition of multistory residential units west of the existing station, and lead to the aforementioned impacts on the North Gardner neighborhood. In consideration of these factors, the Authority and FRA dismissed all permutations of an at-grade design option for this subsection, confirming the prior 2013 Checkpoint B Summary Report determination.

In 2016 and 2017, local community residents expressed concern about visual and noise effects of an aerial section north of I-880 next to the College Park neighborhood. In response to these comments, the Authority developed a variant of the aerial design option that would entail an at-grade profile near I-880 instead of continuing on aerial structure all the way to Scott Boulevard. In response to the Authority's 2018 Business Plan and input received from the public about developing an at-grade station at San Jose Diridon and staying within the existing railroad right-of way, the Authority developed and considered a Blended, At-Grade option that would use a blended alignment from the San Jose Diridon Station to Downtown Gilroy Station. This option was subsequently evaluated in the Checkpoint B Summary Report Addendum 4.

Table 3 shows the design options considered for this subsection and the rationale for inclusion or withdrawal from further consideration in this Draft EIR/EIS. With elimination of the other design options, three design options for the San Jose Diridon Approach Subsection are evaluated in this Draft EIR/EIS: Viaduct to Scott Boulevard, Viaduct to I-880 as demonstrated here, and Blended, At-Grade as a result of the 2018 Business Plan. These design options are described in greater detail in Section 2.5.

Monterey Corridor Subsection Design Options Considered

The Authority and FRA considered a range of horizontal and vertical alignments for the Monterey Corridor Subsection (Figure 11). The themes defining the design options considered in this subsection are choice of transportation corridor (i.e., UPRR, Monterey Road, US 101, or SR 87/SR 85) and vertical profile (i.e., at grade, aerial, or tunnel).

The Bay Area to Central Valley Program EIR/EIS originally considered shared use of the UPRR corridor (as distinct from the UPRR right-of-way) for an at-grade alignment between San Jose and Gilroy. When UPRR subsequently decided not to provide HSR with use of the UPRR corridor, the Authority and FRA withdrew shared use and longitudinal encroachments within the UPRR right-of-way as design options. The Tier 1 EIR/EIS proposed an HSR at-grade alignment adjacent to the UPRR right-of-way, using surplus right-of-way resulting from the reduction of lanes on Monterey Road as proposed in the San Jose general plan. Subsequently, an addendum to Checkpoint B proposed the addition of a fourth alternative (Alternative 4) to the San Jose to Central Valley Wye project, augmenting the three alternatives that were defined in the 2017 Checkpoint B Summary Report Addendum 3. Alternative 4 would implement blended electrified passenger rail infrastructure and operations between San Jose and Gilroy. Under Alternative 4, blended infrastructure and service would extend past the current endpoint for blended operations at San Jose Diridon Station to the Downtown Gilroy Station. This service would occur largely at grade and within the existing Caltrain and UPRR rights-of-way, as described in the 2018 Business Plan (Authority 2018).

The concept of extending blended electrified passenger rail infrastructure and operations from San Jose to Gilroy is currently under discussion between the California State Transportation Agency, the Authority, and UPRR. The parties have advanced the concept sufficiently that the Authority has determined that this alternative merits study as at least potentially feasible at this time and would reduce certain impacts relative to the other alternatives previously advanced for study.

The Bay Area to Central Valley Program EIR/EIS identified the Monterey Road corridor as the preferred program route on the basis of feasibility and community effect issues associated with the US 101 and SR 87/SR 85 corridors. The SR 87/SR 85 design option was further reviewed prior to completion of the PAA and was withdrawn because of cost and logistical impracticability, including the need to relocate the VTA's light rail line from SR 87 to the Monterey Road corridor, overhead clearance issues, and community effects. The Authority and FRA considered three US 101 design options: US 101/I-280, US101 to Monterey Road via SR 85, and US 101 to Monterey Road via Blossom Hill Road, in response to public outreach comments in 2016 and 2017. The Authority determined that the freeway and roadways curves are too sharp to accommodate HSR design requirements (nominally 125–130 mph) for this subsection. Where the HSR alignment would depart from the roadway right-of-way, comparatively more residential and commercial displacements would be required than those associated with the Monterey Road design options carried forward. A US 101 alignment from South San Jose to Gilroy would also result in substantially greater effects on Section 4(f) public recreational resources and sensitive biological resources compared to the Monterey Road design options carried forward.

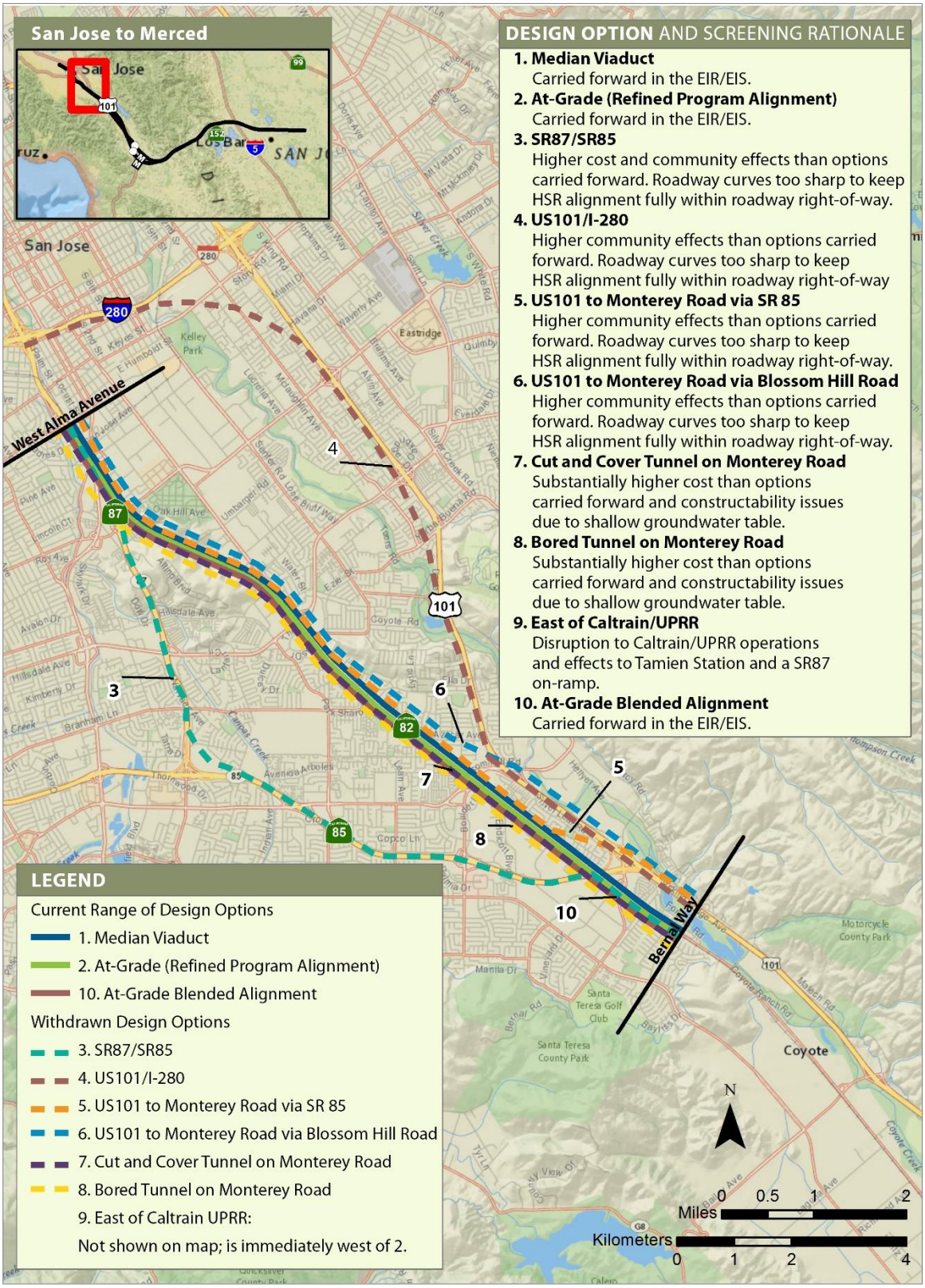
Analogous to consideration of horizontal alignment options within the vicinity of the Tier 1 corridor, the Authority and FRA have evaluated vertical at-grade, aerial, trench, and tunnel profile design options as part of the Tier 2 project analysis. An at-grade alignment along Monterey Road (previously referred to as the RPA) was the initial proposal. During design development, the cost and feasibility of providing an at-grade alignment within the UPRR corridor was considered. A viaduct option (the 2016 Business Plan based the program capital cost estimate on a viaduct alongside Monterey Road) was introduced to address the preference for use of existing transportation corridors, while also acknowledging that a viaduct could offer enhanced separation from UPRR and to consider cost differential. When the aerial viaduct alongside Monterey Road was explored, it became clear that the ground impacts and visual intrusion of running the line along one side of Monterey Road would present substantial effects that could be addressed by moving the aerial viaduct into the median of Monterey Road. The original viaduct alignment adjacent to the UPRR right-of-way on the west side of Monterey Road was shifted to the roadway median after consultation with City of San Jose staff to allow more room for the roadway. The At-Grade (RPA) and the Median Viaduct along Monterey Road were both determined to be practicable and are included as part of the alternatives evaluated in detail in this Draft EIR/EIS.

Table 3 San Jose Diridon Station Approach Subsection: Design Options Considered

Design Option	Description	Determination	Rationale
Design options to be evaluated in detail in the Draft EIR/EIS			
Viaduct to Scott Blvd.	Viaduct from south of Tamien Station to SR 87/I-280, Diridon Station arrival and departure, and then north to Scott Blvd	To be evaluated in detail in EIR/EIS	This option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; minimizes effects by staying predominantly within existing transportation corridor rights-of-way; and does not have the logistical, feasibility, and cost issues associated with the alignment options being withdrawn.
Viaduct to I-880	Viaduct from south of Tamien Station to SR 87/I-280, Diridon Station arrival and departure, and then north to I-880 and at-grade to Scott Blvd	To be evaluated in detail in EIR/EIS	This option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; minimizes effects by staying predominantly within existing transportation corridor rights-of-way; and does not have the logistical, feasibility, and cost issues associated with the alignment options being withdrawn. This option would entail a shorter viaduct than the Viaduct to Scott Blvd option, which would reduce visual effects but would require other changes in construction.
Blended, At-Grade	Blended, at-grade from south of Tamien Station to Scott Blvd	To be evaluated in detail in EIR/EIS	This option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; minimizes effects by staying predominantly within existing railroad rights-of-way; and does not have the logistical, feasibility, and cost issues associated with the alignment options being withdrawn. This option would entail blended at-grade operation, which would be a least-cost option.
Design options withdrawn from further consideration			
Refined Program Alignment (RPA)	Aerial structure from Diridon Station to south of West Virginia St, then at-grade alignment along Caltrain Corridor with two additional tracks for HSR, then to an elevated structure crossing SR 87, continuing south within the SR 87 and Caltrain ROW	Withdrawn in the PAA and the 2013 Checkpoint B document.	Withdrawn from further analysis because of greater effects on historic properties than the design options being carried forward, and could also affect additional residential properties. In addition, comparatively greater significant community effects could result from substantial noise, visual, vibration, traffic congestion and circulation, property value, and construction disruption impacts.

Design Option	Description	Determination	Rationale
Three Track	Same as the RPA option with the exception that Caltrain and UPRR would share one track through the Greater Gardner neighborhood south of Diridon Station	Withdrawn in the PAA and the 2013 Checkpoint B document	Withdrawn from further analysis because it would be impracticable due to operational conflicts with existing rail and transit and would not meet the project's purpose and need.
South of Caltrain Tracks	Same as the RPA except the HSR tracks would be south of the existing Caltrain/UPRR tracks through the Greater Gardner neighborhood	Withdrawn in the PAA and the 2013 Checkpoint B document	Withdrawn from further analysis because of substantial effects on aesthetic/visual resources, residential displacements, and more severe effects on historic properties than the options being carried forward.
Downtown Aerial	Aerial through downtown San Jose bypassing Diridon Station	Withdrawn in the PAA and the 2013 Checkpoint B document	Withdrawn from further analysis because it was found to be impracticable due to major constructability issues, the comparatively high number of residential displacements, potential inconsistency with existing plans and policies, aesthetic/visual effects, and more severe effects on historic properties than the options being carried forward.
Deep Tunnel/ Underground Station	Tunnel through downtown San Jose and underground San Jose HSR station	Withdrawn in the PAA and the 2013 Checkpoint B document	Withdrawn from further analysis because it was found to be impracticable as a result of geologic conditions (constructability and operational challenges of a mined underground station in an area of high groundwater); this design option would also have a capital cost approximately four times that of the option being carried forward.
Shallow Tunnel/ Underground Station	Tunnel through downtown	Withdrawn in the PAA and the 2013 Checkpoint B document	Withdrawn from further analysis because it was determined to be impracticable due to constructability logistics and a capital cost nearly three times that of the alignment option being carried forward; further, the shallow tunnel design could result in additional cost effects and disruption to both existing and future heavy and commuter rail service caused by possible settlement from tunnel construction where tunnels would cross under those facilities. This design option would result in substantial biological effects resulting from cut-and-cover activities under Los Gatos Creek.
At-Grade Alignment	Follows Caltrain corridor with additional dedicated tracks for HSR with three station variants: shared platforms with Caltrain and other services, HSR station west of Diridon platforms, HSR station east of Diridon platforms	Evaluated in 2017 and withdrawn	Withdrawn from further analysis due to substantial community disruption to neighborhoods south of downtown from at-grade alignment through North Gardner neighborhood. Sharing of platform option with Caltrain and other rail services would create substantial operational delays to all services. An HSR station east of the existing station tracks would require moving the existing historic Diridon Station structure, using extensive portions of City parking lots around the SAP Center for tracks, and require other displacements in downtown. An HSR station west of the existing station tracks would eliminate access to Caltrain's CEMOF, require relocation of the VTA station, and require the demolition of multistory residential units west of the existing rail station.

Source: Compiled by ICF 2019



Source: Authority and FRA 2013, Authority 2016

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Figure 11 Design Options Considered in the Monterey Corridor Subsection

The Authority also considered a trench option, but eliminated it from further consideration due to substantially higher construction costs than the at-grade or aerial options. Pursuant to comments from outreach in 2016 and 2017 concerning the effects of the at-grade alignment and the median viaduct on Monterey Road, the Authority evaluated two tunnel design options along Monterey Road: a cut-and-cover tunnel and a bored tunnel. Both tunnel options would extend from the Communications Hill area to south of Bailey Road (approximately 10 miles), because there is not adequate space area along Monterey Road in San Jose to accommodate a short tunnel portal. The Authority dismissed these tunnel designs from further consideration because of prohibitive cost compared to other design options, as well as concern about the effects of lengthy tunnels in an area constrained by the hydraulics of shallow groundwater. The cut-and-cover tunnel would be approximately 2 times and the bored tunnel approximately 2.5 times more costly than the median viaduct.

The Authority previously considered a variation on the at-grade option—East of Caltrain/UPRR—located in the Caltrain right-of-way from Tamien to Curtner Avenue then transitioning to east of UPRR by CP Lick and to a similar alignment as the At-Grade option (RPA). This option was withdrawn from further consideration due to conflicts with Caltrain and UPRR operations and effects on the Tamien Station and a SR 87 northbound on-ramp. The Blended, At-Grade option was identified in response to the Authority's 2018 Business Plan and input received from the public about staying within the existing railroad right-of-way. The option provides an alternative that would travel within the UPRR railroad right-of-way from San Jose Diridon Station to downtown Gilroy.

Table 4 shows the design options considered for this subsection and the rationale for inclusion or withdrawal from further consideration in this Draft EIR/EIS. Three designs for the Monterey Corridor Subsection are included in the alternatives being considered in this Draft EIR/EIS: (1) Median Viaduct, (2) At-Grade within the Caltrain corridor, and (3) Blended, At-Grade sharing the Caltrain/UPRR right-of-way. These design options are described in greater detail in Section 2.5.

Table 4 Monterey Corridor Subsection: Design Options Considered

Design Option	Description	Determination	Rationale
Design options to be evaluated in detail in the Draft EIR/EIS			
1. Median Viaduct	Viaduct along median of Monterey Rd	To be evaluated in detail in EIR/EIS	This option was added because it reduces environmental and community effects relative to the East of UPRR option in this subsection (also known as the At-Grade option); also reduces interaction with UPRR facilities, which reduces the need for intrusion barriers; reduces effects on Swainson's hawk and tricolored blackbird habitat and on grazing land. The reduced footprint of the viaduct also displaces fewer residential units, both in number and square footage, than the At-Grade option.
2. At Grade (RPA)	East of UPRR on west side of Monterey Rd (outside UPRR ROW)	To be evaluated in detail in EIR/EIS	The option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; while there are engineering challenges, it would allow for more efficient operation than would the East of Caltrain/UPRR option.
3. Blended, At-Grade	Within the UPRR ROW	To be evaluated in detail in EIR/EIS	This option was added because it reduces the disturbance area and thereby environmental and community effects relative to the other options in this subsection by remaining predominantly within the Caltrain/UPRR railroad right-of-way.
Design options withdrawn from further consideration			
4. SR 87/SR 85	Follows SR 87 and SR 85 from downtown San Jose to south San Jose; relocates VTA light rail along Monterey Rd and South First St	Withdrawn prior to the 2011 PAA	Determined impracticable due to cost and logistics; it would not meet HSR criteria for curve radii; would require construction of an aerial alignment over the freeways, through a residential neighborhood, and across from a high school; and would require relocation of VTA's operating LRT line. The clearance beneath existing overpasses along SR 87 and SR 85 is too low to meet HSR design standards. Relocation of the VTA's LRT would require unidentified funding and study, as it would eliminate light rail service from an existing 10-mile corridor and replace it along a new corridor at considerable cost and impact. This option would also cause more rail and displacement effects than the options carried forward.
5. US 101/I-280	Follows US 101 and I-280 from downtown San Jose to south San Jose	Considered due to public interest; withdrawn in 2017	Determined impracticable due to cost and logistics; it would not meet HSR criteria for curve radii for design speeds. Because the curves required for HSR would have to be located outside the road right-of-way, this option would result in more commercial and residential displacements along the route, compared to options carried forward.
6. US 101 to Monterey Rd via SR 85	Uses SR 85 to connect from Monterey Rd to a US 101 alignment south	Considered due to public interest; withdrawn in 2017	The SR 85 highway corridor curve between US 101 and Monterey Rd is too sharp for proposed HSR design speeds; constructing a 125–130 mph curve would require substantially more displacement of residential/commercial and open space than options carried forward.
7. US 101 to Monterey Rd via Blossom Hill Rd	Uses Blossom Hill Rd to connect from Monterey Rd to a US 101 alignment south	Considered due to public interest; withdrawn in 2017	The Blossom Hill corridor curve between US 101 and Monterey Rd is too sharp for proposed HSR design speeds; constructing a 125–130 mph curve would require substantially more displacement of residential/commercial and open space than options carried forward.

Design Option	Description	Determination	Rationale
8. Cut and Cover Tunnel on Monterey Rd	Cut and cover tunnel on Monterey Rd from Communication Hill to south of Bailey Rd (~10 miles)	Considered due to public interest; withdrawn in 2017	Withdrawn due to prohibitive cost of $2.7 billion, which far exceeds costs for At-Grade or Viaduct options (Viaduct cost for 10 miles is approx. $1.3 billion assuming comprehensive unit cost of $125 million/mile). Tunnel could have substantial effects on groundwater hydrology and supply due to shallow water table. Construction would require closing half of Monterey Rd, resulting in disruption of the transportation corridor.
9. Bored Tunnel on Monterey Rd	Bored tunnel from Communications Hill to south of Bailey Rd (~10 miles).	Considered due to public interest; withdrawn in 2017	Withdrawn due to prohibitive cost of $3.2 billion, which far exceeds costs for At-Grade or Viaduct options (Viaduct cost for 10 miles is approx. $1.3 billion assuming comprehensive unit cost of $125 million/mile). Tunnel could have substantial effects on groundwater hydrology and supply due to shallow water table.
10. East of Caltrain/ UPRR	Within Caltrain ROW from Tamien Station to Curtner Ave, then transitioning to east of UPRR on west side of Monterey Rd (outside UPRR ROW)	Withdrawn in the PAA and 2013 Checkpoint B	Withdrawn from further analysis due to constructability and implementation issues. This option would disrupt Caltrain and UPRR operations and affect the Caltrain Tamien Station and the SR 87 northbound on-ramp.

Morgan Hill and Gilroy Subsection Design Options Considered

In the Morgan Hill and Gilroy Subsection, the Authority and FRA considered a range of horizontal and vertical alignments, as illustrated on Figure 12 through Figure 14.

The defining themes of design options in this subsection are transportation corridor selection (i.e., Monterey Road, US 101, UPRR, or neither); Gilroy station location; vertical profile (i.e., at grade, embankment, aerial, trench, and tunnel); and horizontal alignment. Various maintenance facility locations were also considered.

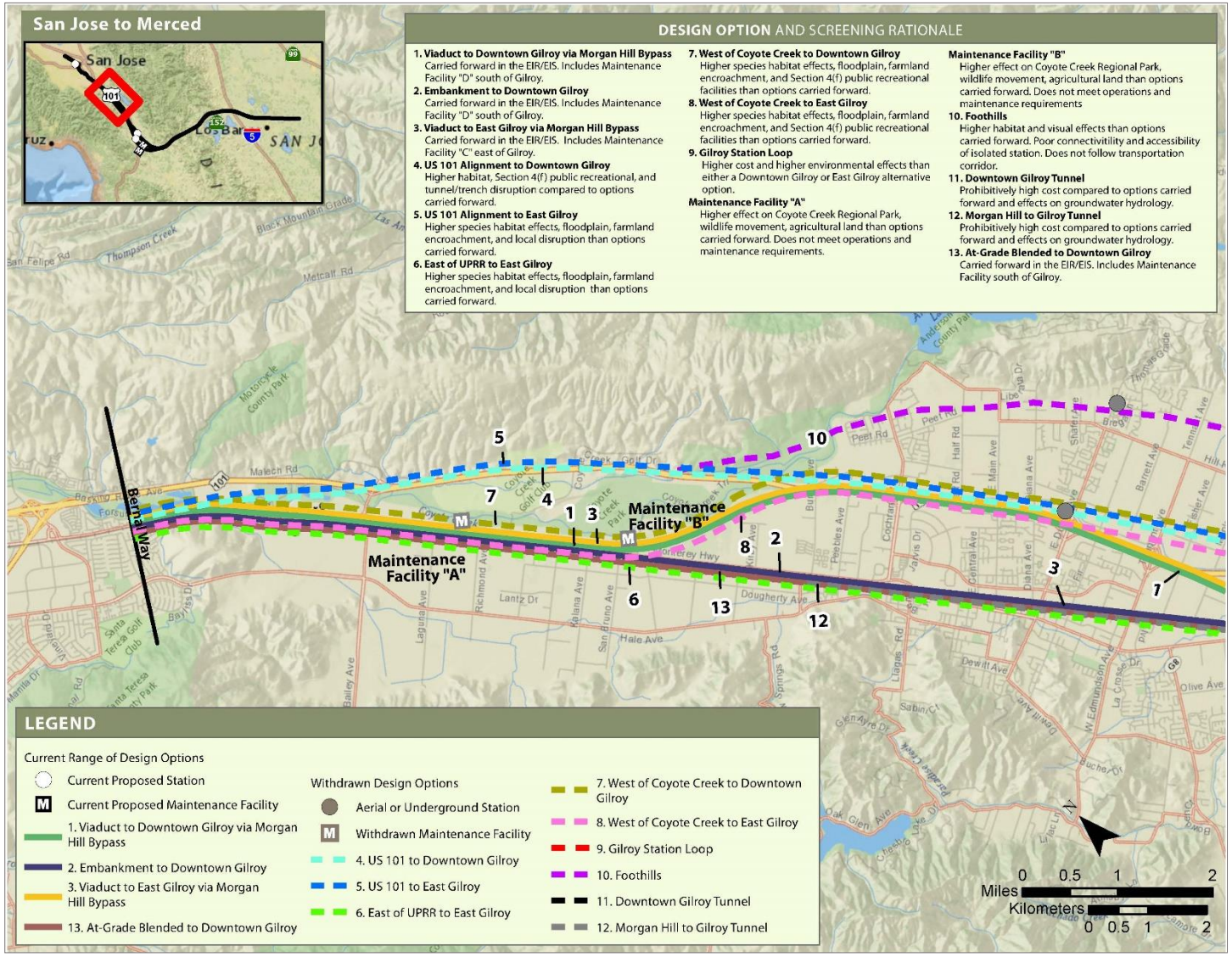
In the Statewide Program EIR/EIS, the Authority considered several alignments outside existing transportation corridors. The Foothills alignment along the base of the Diablo Range foothills on the east side of Santa Clara Valley included a station east of Morgan Hill. The East of 101 alignment crossed open space, farmland, and rural residential land east of US 101. The Authority withdrew both options from further consideration because they did not follow existing transportation corridors and would have poor station connectivity and accessibility. The Foothills alignment would also have had substantially greater effects on sensitive biological resources than design options carried forward. As discussed below, several options using alignments partially east of US 101 were considered during the project-level alternatives analysis.

The Bay Area to Central Valley Program EIR/EIS (and the Revised Program EIR/EIS and Partially Revised EIR/EIS) focused on the Monterey Road corridor. The Authority subsequently developed additional alignments along the Monterey Road and US 101 corridors for further evaluation, evaluating a total of seven alignment options and four maintenance facility options in the PAA, SAAs, and 2013 Checkpoint B report. All the initial alignment options (except the Gilroy Station Loop) and the four maintenance facility options were originally recommended for inclusion in the Draft EIR/EIS.

The Gilroy Station Loop, which included a mainline track through east Gilroy and a spur track to a two-track Downtown Gilroy Station, was withdrawn from further consideration due to the combined cost and effects, particularly aesthetic and visual quality effects, of building both an east Gilroy and a downtown Gilroy alignment.

The 2016 Business Plan also introduced a viaduct to downtown Gilroy, and the Authority conducted further outreach, agency consultation, and evaluations of potential design options in 2016 and 2017. Based on this input, the Authority identified new designs for consideration and reconsidered the inclusion of prior alignment and maintenance facility options in the Draft EIR/EIS. The 2018 Business Plan introduced a Blended, At-Grade option with an associated maintenance facility location that was subsequently evaluated in the 2018 Checkpoint B Summary Report Addendum 4. Table 5 shows the evaluation process.

Four design options were carried forward for evaluation in this Draft EIR/EIS. Two new designs (Viaduct to Downtown Gilroy via Morgan Hill Bypass and Viaduct to East Gilroy via Morgan Hill Bypass) were determined to be practicable and to have fewer effects on Section 4(f) public recreational and sensitive biological resources than other design options. The Embankment to Downtown Gilroy option (formerly the East of UPRR to Downtown Gilroy option) considered in the PAA, SAAs, 2013 Checkpoint B Summary Report, and 2017 Checkpoint B Summary Report Addendum 3 was also determined to be practicable and to result in performance and effects contrasting with those of the two viaduct design options as a consequence of a different route through Morgan Hill and a different vertical profile through Gilroy. The Blended, At-Grade option was determined to be practicable and to minimize disruption and noise impacts on existing local communities, benefit rail operations, and avoid the visual and spatial disruption associated with constructing a dedicated guideway on embankment or viaduct, as determined in the 2018 Checkpoint B Summary Report Addendum 4.



Source: Authority and FRA 2013, Authority 2016

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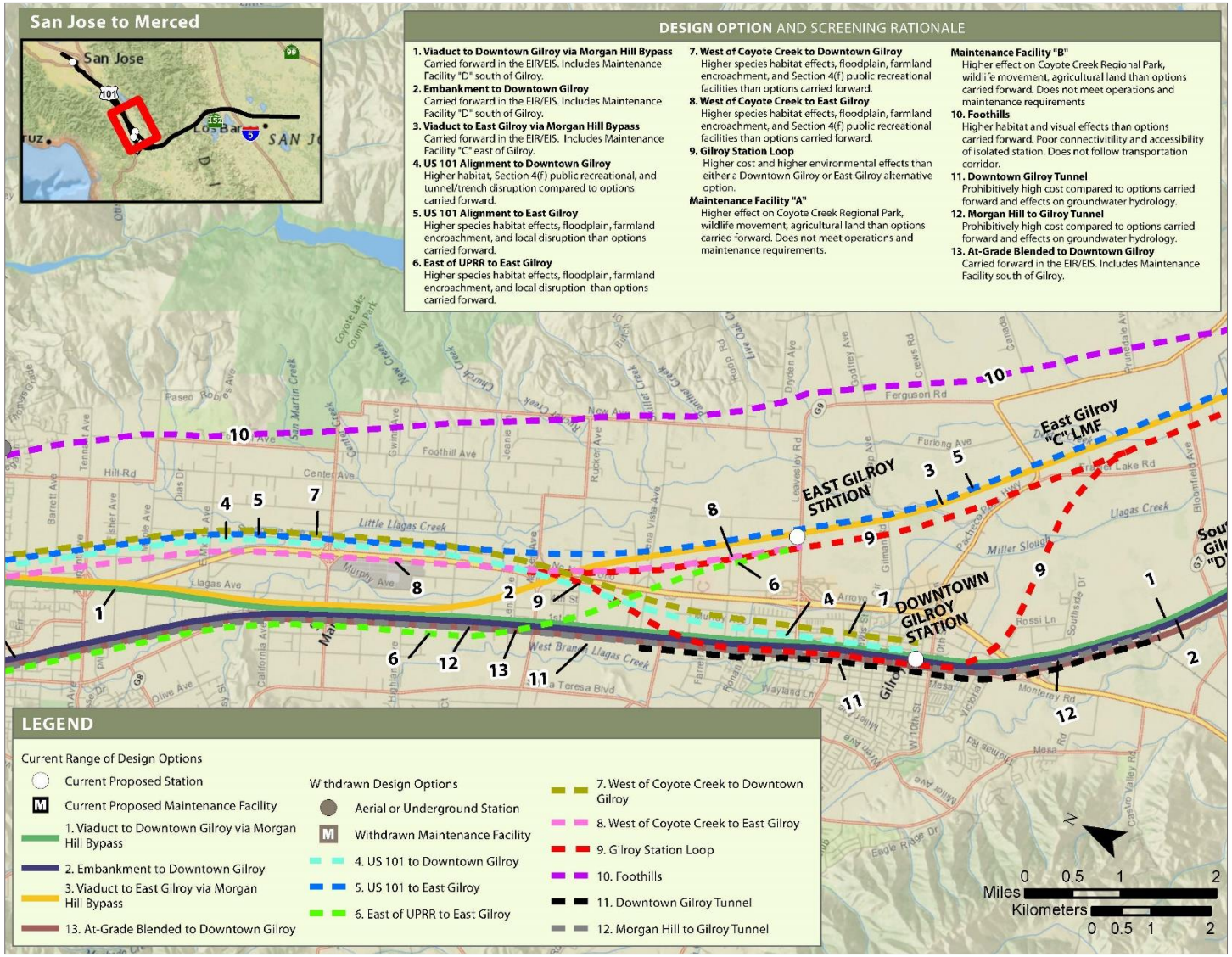
Figure 12 Design Options Considered in the Morgan Hill and Gilroy Subsection



Source: Authority and FRA 2013, Authority 2016

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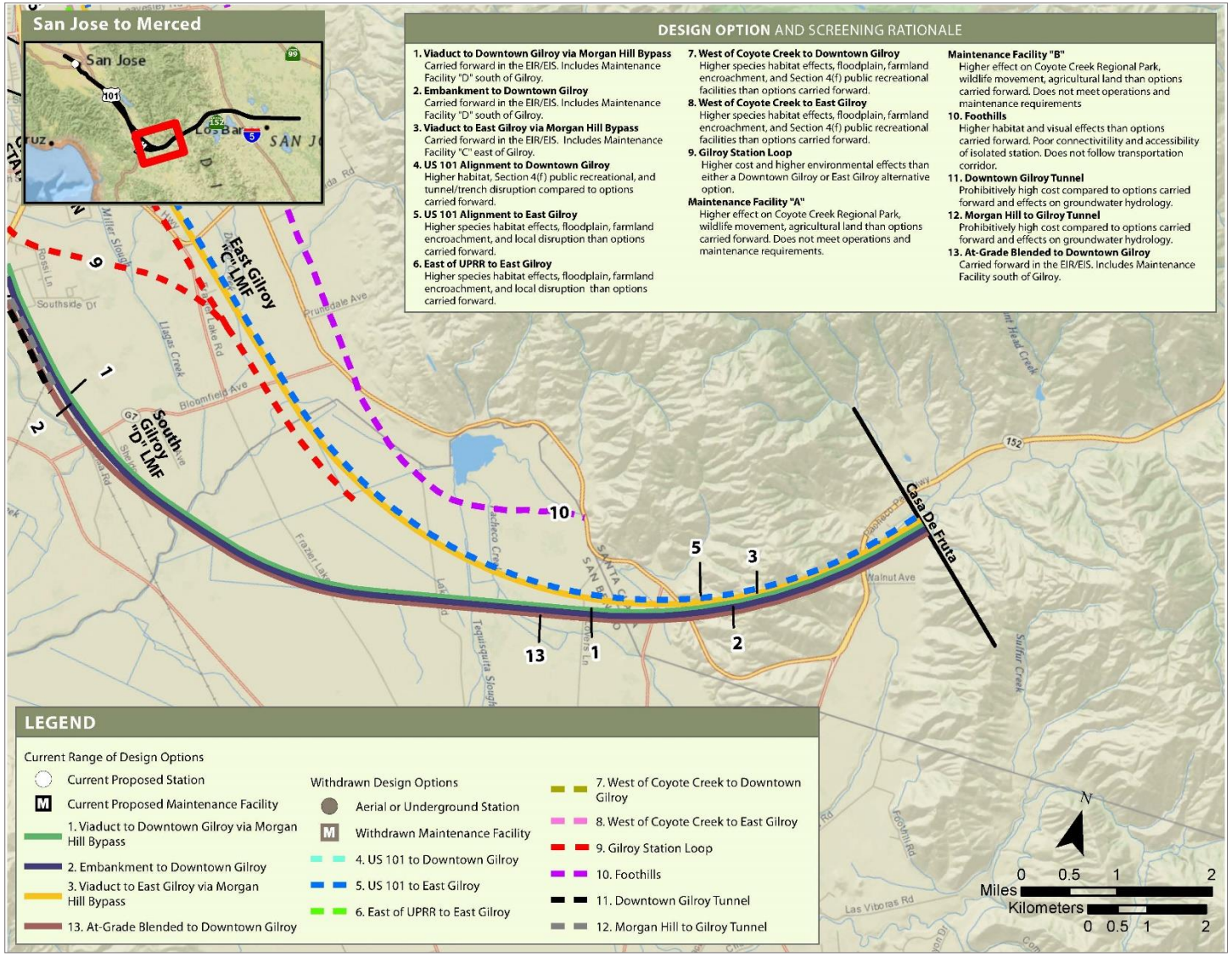
Figure 13 Design Options Considered in the Morgan Hill and Gilroy Subsection



Source: Authority and FRA 2013, Authority 2016

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Figure 14 Design Options Considered in the Morgan Hill and Gilroy Subsection

The Authority determined the US 101 design options (i.e., US 101 Alignment to Downtown Gilroy, US 101 Alignment to East Gilroy) and the West of Coyote design options (i.e., West of Coyote Creek to Downtown Gilroy, West of Coyote Creek Parkway to East Gilroy), although avoiding the Coyote Creek Parkway, would result in substantially greater effects on Section 4(f) recreational resources, aquatic resources, special-status species habitat, and Important Farmland than other design options carried forward. All except the US 101 to East Gilroy design would also disturb a larger area of floodplains than design options carried forward. The trench and tunnel portions of the alignments near the San Martin Airport would result in greater disruption during construction and increased cost.

The Authority determined that the East of UPRR to East Gilroy design option would have greater effects on special-status species habitat, built historic resources, floodplains, Important Farmland, and residences than design options carried forward. The crossover from east of the UPRR right-of-way to east of US 101 north of Gilroy would also disrupt local infrastructure and land uses to a greater degree than design options carried forward.

Three vertical profile options were considered for the downtown Gilroy alignment: a trench, a high viaduct, and a low viaduct. The trench option would require changing the grade of the existing UPRR tracks and trenching the new grade for the HSR tracks, entailing extensive grade-separation work throughout downtown Gilroy. A high viaduct (nominally 60 feet above ground level) would result in greater visual effects in downtown than the low viaduct option (nominally 30–40 feet high) specified in the Viaduct to Downtown Gilroy option. Because of the greater disruption and visual effects than the options being carried forward, the trench and high viaduct options were withdrawn from further consideration.

Two additional tunnel design options were considered pursuant to outreach conducted in Gilroy and Morgan Hill during 2016 and 2017. A Downtown Gilroy Tunnel design was considered to avoid some of the community effects of the downtown embankment and low viaduct options. Using the tunnel cost estimates developed for the Monterey Corridor Subsection, a 4-mile tunnel was estimated to cost $1.1–1.3 billion compared to a rough cost of $500 million for viaduct of a similar length (excluding the cost of a Gilroy station).[2] A Morgan Hill to Gilroy Tunnel design was considered to avoid effects of an embankment or viaduct design through Morgan Hill, San Martin, and Gilroy. Using the same general unit cost factors, a 15-mile tunnel was estimated to cost $4.0–4.7 billion compared to an estimated cost of $2.0 billion for a viaduct of similar length (excluding the cost of a Gilroy station). Because the substantially higher costs associated with these options, the Authority withdrew them from further consideration.

In 2017, the City of Gilroy requested the Authority consider an alignment along US 101 through Gilroy. The Authority evaluated three Gilroy US 101 Alignment variants along US 101, all of which would transition from Monterey Road north of Buena Vista Avenue to US 101 and then split into either an east of US 101, US 101 median, or west of US 101 alignment. South of downtown Gilroy, the alignments would cross over US 101 and then cross the Soap Lake floodplain to Tunnel 1. The Authority evaluated these alignment variants against the downtown and east Gilroy alignment options using the following criteria: intermodal connectivity, pedestrian and vehicular accessibility, TOD implementation, economic benefit, construction impacts, and parking requirements (Richard 2017).[3] Relative to the downtown alignments, the US 101 alignment and its variants were ranked lower for intermodal connectivity, pedestrian activity, TOD implementation, economic benefit, construction impacts, and parking requirements. Vehicular accessibility was similar. Accordingly, the Authority concluded that a US 101 alignment through Gilroy did not provide any substantial benefit over the downtown alignments included for evaluation in the Draft EIR/EIS and thus did not warrant further consideration.

The Authority initially developed and evaluated four maintenance facility options in the PAA, SAAs, and 2013 Checkpoint B report. The maintenance requirements of HSR operations and

[2] The cost estimates for the Monterey Corridor Subsection were developed for cut-and-cover and bored tunnel sections.

[3] The criteria used in evaluating the Gilroy US 101 Alignment variants were refined from the initial list of screening criteria reflecting specific concerns in this corridor.

blended service envisioned in the 2016 Business Plan included the need for equipment and infrastructure maintenance facilities located near Gilroy. The Authority also determined that Maintenance Facility Option “A” (Coyote Creek) and Maintenance Facility “B” (Coyote Creek) would have greater effects on Coyote Creek Regional Park, Important Farmland, and wildlife movement in Coyote Valley than the design options carried forward. Due to operational requirements and greater environmental effects, these design options were withdrawn from further consideration. Maintenance Facility Option “C” (east Gilroy) and Maintenance Facility Option “D” (south of Gilroy), were determined practicable and compatible with the alignments carried forward into the Draft EIR/EIS and were accordingly identified to carry forward into the Draft EIR/EIS as the East Gilroy LMF/MOIF and South Gilroy LMF/MOIF, respectively. Subsequently, the 2018 Business Plan identified Brisbane as the LMF for San Francisco to San Jose Project Section and changing the East Gilroy and South Gilroy facilities to an MOWF. In addition, the consideration and evaluation of a Blended, At-Grade design between San Jose Diridon Station and Downtown Gilroy Station identified a second south of Gilroy MOWF site. The East Gilroy MOWF, South Gilroy MOWF, and South Gilroy MOWF for Alternative 4 were thus carried forward into the Draft EIR/EIS.

Table 5 shows the design options considered for this subsection and the rationale for inclusion or withdrawal from further consideration in this Draft EIR/EIS. With elimination of the other design options, four designs for the Morgan Hill and Gilroy Subsection were included in the alternatives being considered in this Draft EIR/EIS: (1) Viaduct to Downtown Gilroy via Morgan Hill Bypass (including the South Gilroy MOWF); (2) Embankment to Downtown Gilroy (including the South Gilroy MOWF); (3) Viaduct to East Gilroy via Morgan Hill Bypass (including the East Gilroy MOWF); and (4) Blended, At-Grade to Downtown Gilroy (including the South Gilroy MOWF. These design options are described in greater detail in Section 2.5).

Table 5 Morgan Hill and Gilroy Subsection: Design Options Considered

Design Option	Description	Determination	Rationale
Design options to be evaluated in detail in the Draft EIR/EIS			
1. Viaduct to Downtown Gilroy via Morgan Hill Bypass	Viaduct along Monterey Rd median from San Jose, then crossing Coyote Valley east to west side of US 101 around Morgan Hill, then west to Monterey Rd through San Martin, then low viaduct through downtown Gilroy. Includes Maintenance Facility Site D, south of Gilroy	To be evaluated in detail in EIR/EIS	This option was added in response to input from Morgan Hill and Gilroy and to reduce environmental effects in the vicinity of Coyote Creek Regional Park. A viaduct rather than an at-grade embankment would increase permeability for wildlife movement in the Coyote Valley, an important area for migration of various species including elk. The viaduct alignment west of US 101 would avoid residential and commercial displacements in downtown Morgan Hill and displacement of the Morgan Hill Aquatic Center and adjacent soccer fields, and would reduce the structural complexity and expense of crossing over US 101. This option would avoid effects on undeveloped land by siting the HSR station in downtown Gilroy, rather than using an East Gilroy Station option. This option would include a maintenance facility that meets operations and maintenance requirements, and avoids impacts upon parkland, wildlife movement, and agricultural land in Coyote Valley. This option would also reduce environmental effects for most resources, relative to the options that are withdrawn.
2. Embankment to Downtown Gilroy	Embankment east of UPRR along Monterey Rd and through Downtown Gilroy. Includes Maintenance Facility Site D, south of Gilroy	To be evaluated in detail in EIR/EIS	This option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; it does not have the logistical, feasibility, and high cost issues of some of the withdrawn options; and it would avoid or minimize effects on Section 4(f) recreational resources including Coyote Creek Regional Park. This option would avoid the visual effects of an aerial option, but would have greater construction effects and disruption than an aerial option. This option would include a maintenance facility that meets operations and maintenance requirements, and avoids impacts upon parkland, wildlife movement, and agricultural land in Coyote Valley.
3. Viaduct to East Gilroy via Morgan Hill Bypass	Viaduct along Monterey Rd median from San Jose, then crossing Coyote Valley eastward to west side of US 101 around Morgan Hill, then westward to Monterey Rd through San Martin, then eastward across US 101 to east Gilroy station site. Includes Maintenance Facility Site C, east of Gilroy	To be evaluated in detail in EIR/EIS	This option was added in response to input from Morgan Hill and to reduce environmental effects in the vicinity of Coyote Creek Regional Park. A viaduct rather than an at-grade embankment would increase permeability for wildlife movement in the Coyote Valley, an important area for migration of various species including elk. The viaduct alignment west of US 101 would avoid residential and commercial displacements in downtown Morgan Hill and displacement of the Morgan Hill Aquatic Center and adjacent soccer fields, and would reduce the structural complexity and expense of crossing over US 101. This option would reduce conversion of raw land relative to options that follow a longer stretch of US 101. This option would avoid the land displacements of a guideway and station in downtown Gilroy and avoid acquisition of land owned by the UPRR for a downtown station site; it would reduce environmental effects on many resources relative to the options that are withdrawn. This option would include a maintenance facility that meets operations and maintenance requirements, and avoids impacts upon parkland, wildlife movement, and agricultural land in Coyote Valley.

Design Option	Description	Determination	Rationale
4. Blended, At-Grade to Downtown Gilroy	Blended, At-Grade within the UPRR railroad right-of-way and through downtown Gilroy. Includes Maintenance Facility south of Gilroy	To be evaluated in detail in EIR/EIS	This option is potentially practicable and is carried forward for further analysis because it meets the project's purpose and need; it does not have the logistical, feasibility, and high cost issues of some of the withdrawn options; and it would avoid or minimize disruption and noise impacts on existing local communities, benefit rail operations, and avoid the visual and spatial disruption associated with constructing a dedicated guideway on embankment or viaduct. This option would include a maintenance facility that meets operational and maintenance requirements and would avoids impact on parkland, wildlife movement, and agricultural land in Coyote Valley.
Design options withdrawn from further consideration			
5. US 101 Alignment to Downtown Gilroy	Follows US 101 to south of San Martin Airport, crosses over to Monterey Rd to a station in downtown Gilroy and maintenance facility south of Gilroy	Dismissed from further evaluation	Withdrawn because this alignment has greater environmental effects than options carried forward on the following resources: aquatic features, California red-legged frog, California tiger salamander, least Bell's vireo, tricolored blackbird, steelhead, San Joaquin kit fox, Bay checkerspot butterfly, and Metcalf Canyon jewelflower. It would require conversion of a greater extent of 100-year floodplains, parks, and agricultural land than the options carried forward. It would displace portions of the Morgan Hill Aquatic Center and associated soccer fields in Morgan Hill and would require a tunnel and trench to cross US 101 with associated disruption of local land use and infrastructure.
6. US 101 Alignment to East Gilroy	Follows US 101 to a station and maintenance facility in East Gilroy	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because this alignment has greater environmental effects than the options carried forward on the following resources: aquatic features, California red-legged frog, California tiger salamander, least Bell's vireo, tricolored blackbird, steelhead, Bay checkerspot butterfly, San Joaquin kit fox, Metcalf Canyon jewelflower, and Santa Clara Valley dudleya. The US 101 to East Gilroy option would also convert a greater extent of important agricultural land than the options carried forward and would displace portions of the Morgan Hill Aquatics Center and associated soccer fields and portions of Coyote Creek Regional Park.
7. East of UPRR to East Gilroy	Embankment east of UPRR along Monterey Rd to San Martin, then east across US 101 to East Gilroy	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because this alignment has greater environmental effects than the options carried forward on the following resources: California red-legged frog, least Bell's vireo, Swainson's hawk, tricolored blackbird, steelhead, Bay checkerspot butterfly, San Joaquin kit fox, Metcalf Canyon jewelflower, Santa Clara Valley dudleya, and built environment resources. The footprint for this option would require more conversion of 100-year floodplain, important agricultural land, and residential housing than the options carried forward. The East of UPRR to East Gilroy option would also affect a greater extent of land in conservation easements. These effects are associated with a relatively larger at-grade footprint. This option would also create substantial disruption to local infrastructure use and land uses as it crosses over from east of the UPRR right-of-way to east of US 101 north of Gilroy.

Design Option	Description	Determination	Rationale
8. West of Coyote Creek to Downtown Gilroy	From Monterey Rd, transitions to a US 101 alignment south of Coyote Creek Pkwy, then transitions back to Monterey Rd south of San Martin Airport	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because this alignment has greater environmental effects than the options carried forward on the following resources: aquatic features, California red-legged frog, California tiger salamander, least Bell's vireo, Swainson's hawk, tricolored blackbird, steelhead, Bay checkerspot butterfly, San Joaquin kit fox, Metcalf Canyon jewelflower, Santa Clara Valley dudleya, and built environment cultural resources. This option would convert a greater amount of 100-year floodplain and important agricultural land than the options carried forward. This option would require demolition of more residences (in number and square footage) than the options carried forward. This option would also displace portions of the Morgan Hill Aquatics Center and associated soccer fields and portions of Coyote Creek Regional Park. It would require a combination of tunnel and trench to cross under US 101, with substantial disruption to local land uses and cost.
9. West of Coyote Creek to East Gilroy	From Monterey Rd, transitions to a US 101 alignment south of Coyote Creek Pkwy then to east Gilroy station	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because this alignment has greater environmental effects than the options carried forward on the following resources: aquatic features, California red-legged frog, least Bell's vireo, tricolored blackbird, steelhead, Bay checkerspot butterfly, San Joaquin kit fox, Metcalf Canyon jewelflower, and Santa Clara Valley dudleya. The at-grade and embankment crossover between the Monterey corridor and US 101 would obstruct wildlife movement in the Coyote Valley. This option would also convert more important agricultural land, 100-year floodplain, conservation easements, and parks (both number and acreage) than the options carried forward, and would displace portions of the Morgan Hill Aquatics Center and associated soccer fields
10. Gilroy Station Loop	Mainline track along east Gilroy alignment with spur track to downtown Gilroy; two-track downtown Gilroy station and grade-separated flyovers where mainline and spur meet north and south of Gilroy	Withdrawn in the PAA and Checkpoint B 2013	Withdrawn from further analysis due to prohibitive cost and visual effects, this option would result in the combined cost and effects of building both an east Gilroy alignment and a downtown Gilroy alignment. This alignment option would have the greatest aesthetic/visual effects of all alignment options in this subsection due to the double alignment.
11. Foothills	Alignment along the east side of Santa Clara Valley in the Morgan Hill and Gilroy area	Withdrawn in 2005 Statewide Program EIR/EIS	Withdrawn from further investigation in the 2005 Statewide Program EIR/EIS because it would have potentially substantial effects on sensitive habitat through the foothills and would have high visual effects. The Morgan Hill (Foothills) and the Morgan Hill (east of US 101) station sites were eliminated from further investigation in the 2005 Statewide Program EIR/EIS because they would have poor connectivity and accessibility and would not meet the basic program objectives. No new information has been identified by the Authority subsequent to the Program EIR/EIS that would change the prior conclusion.

Design Option	Description	Determination	Rationale
12. Downtown Gilroy Tunnel	Tunnel in downtown Gilroy (~4 miles)	Originally considered in 2013; reconsidered due to public outreach in 2017; withdrawn	Withdrawn from further analysis due to prohibitive cost; assuming cut-and-cover cost of $270 million per mile and bored tunnel cost of $310 million per mile, cost could be $1.1–1.3 billion, not including cost of underground Gilroy station. Costs for tunnel options far exceed embankment and viaduct options carried forward (estimated cost of viaduct for 4 miles would be $500 million assuming $125 million per mile). Tunnel could have substantial effects on groundwater hydrology and supply due to shallow water table, as well as substantial disruption to downtown Gilroy during construction of cut-and-cover tunnel.
13. Morgan Hill to Gilroy Tunnel	Tunnel from north of Morgan Hill to south of Gilroy (15 miles)	Considered due to public outreach in 2017; withdrawn	Withdrawn from further analysis due to prohibitive cost; assuming cut-and-cover cost of $270 million per mile and bored tunnel cost of $310 million per mile, cost could be $4.0–4.7 billion, not including cost of underground Gilroy station. Costs for tunnel options far exceed embankment and viaduct options carried forward (estimated cost for viaduct for 16 miles, including Morgan Hill Bypass, would be $2.0 billion, excluding Gilroy station, assuming $125 million per mile). Tunnel could have substantial effects on groundwater hydrology and supply due to shallow water table, as well as substantial disruption to downtown Gilroy during construction of cut-and-cover tunnel.
14. Gilroy US 101 Alignment	From Buena Vista Avenue, transition to US 101, then along the east side, median, or west side of US 101 to south of downtown	Considered due to public outreach in 2017; withdrawn	A US 101 alignment through Gilroy does not meet the Authority's and CPUC's station area policy on TOD. Only the two existing downtown Gilroy alignments meet TOD requirements. Through a qualitative analysis, potential variant alignments along US 101 do not offer any benefits over the existing downtown alignments. Although the downtown Gilroy alignments may be disruptive during construction, the long-term economic, pedestrian, vehicular, and intermodal connectivity benefits are quite substantial. Among the US 101 variants, the west of US 101 alignment has the least amount of impacts. However, it is still a still highly disruptive alignment that involves many straddle-bent structures, disruption to a PG&E high-voltage power line, impacts on several residential and industrial properties, and impacts on a public park. In light of these infrastructure impacts, the US 101 Gilroy alignment would not be consistent with the City's desire to minimize impacts on residences and businesses. Additionally, the Authority does not consider any of the US 101 Gilroy alignment variants analyzed as likely to be considered the Least Environmentally Damaging Practicable Alternative.
▪ Maintenance Facility "A"	Adjacent to Monterey Rd on the east side between Morgan Hill and San Jose; would work with west of Coyote Creek alignments only	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because the location does not meet operations and maintenance requirements, would encroach on Coyote Creek Regional Park land and agricultural land, and would obstruct wildlife movement in the constrained corridor of Coyote Valley.
▪ Maintenance Facility "B"	Adjacent to Monterey Rd on the east side between Morgan Hill and San Jose; would work with Monterey Rd alignments only	Withdrawn in Checkpoint B Addendum 2017	Withdrawn because the location does not meet operations and maintenance requirements, would encroach on Coyote Creek Regional Park land and agricultural land, and would obstruct wildlife movement in the constrained corridor of Coyote Valley.

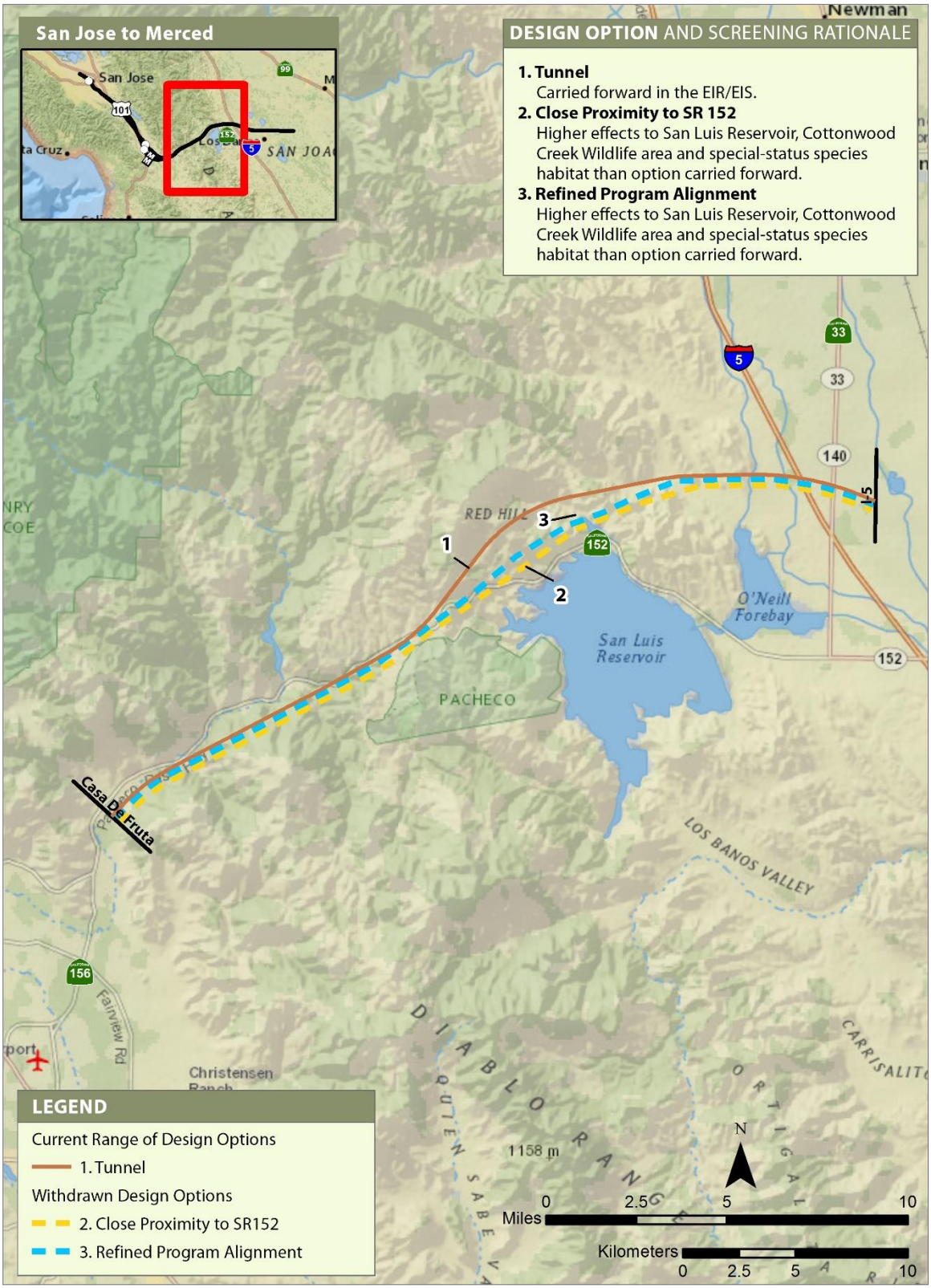
Pacheco Pass Subsection Design Options Considered

The Authority and FRA considered three design options for the Pacheco Pass Subsection, as illustrated on Figure 15.

The Bay Area to Central Valley EIR/EIS (and the Revised EIR and Partially Revised EIR) identified the SR 152 corridor over Pacheco Pass as the preferred route for connecting the Bay Area and Central Valley portions of the HSR system. In the PAA, SAAs, and 2013 Checkpoint B Summary Report, the Authority identified two potential design options for the route. The Close Proximity to SR 152 design would entail a combination of embankment, viaduct, and tunnels along SR 152. The RPA is the same as the Close Proximity to SR 152 option where it crosses over SR 152, but diverges to the north at San Luis Reservoir to cross at the narrower part of the Cottonwood Creek arm of the reservoir. Both design options were recommended to be carried forward in the 2013 Checkpoint B Summary Report.

After reinitiating design and environmental work on the Project Section in late 2015, the Authority continued to consult with the Bureau of Reclamation, which (along with the California Department of Water Resources) urged complete avoidance of the San Luis Reservoir, and the California Department of Fish and Wildlife, which urged minimization of any surficial encroachment within the Cottonwood Creek Wildlife Area. The Authority subsequently developed a new option, the Tunnel, which would include a 13.5-mile tunnel and avoid any encroachment into the San Luis Reservoir or surficial encroachment into the Cottonwood Creek Wildlife Area. Once the Tunnel design was determined to be practicable, the other two designs were withdrawn from further consideration because they would have substantially greater effects on aquatic resources, special-status species habitat, and 4(f) resources than the new tunnel option. The analysis of the two withdrawn options and the new tunnel option are documented in the 2017 Checkpoint B Summary Report Addendum 3 (Authority 2017). In 2017, the Authority continued to consult with stakeholders and refine the design to reduce impacts on known resources including Romero Creek and the operations of Romero Ranch. The alignment included three crossings of Romero Creek and a traversal of Romero Ranch. The Authority subsequently adjusted the alignment northward (half in tunnel and half at the eastern end of the subsection) to provide one crossing of Romero Creek and to reduce encroachments on highly sensitive Romero Creek species and sensitive habitat as well as on ranch calving pastures and headquarters. Once the Romero Ranch realignment was determined to be practicable, the other alignment was withdrawn from further consideration because it would have substantially greater effects on creek species and sensitive habitat than the new alignment.

Table 6 shows the design options considered for this subsection and the rationale for inclusion or withdrawal from further consideration in this Draft EIR/EIS. With elimination of the other design options, one design for the Pacheco Pass Subsection is included in the alternatives being considered in this Draft EIR/EIS: Tunnel. This design option is described in greater detail in Section 2.5.



Source: Authority and FRA 2013, 2017c.

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Figure 15 Design Options Considered in the Pacheco Pass Subsection

Table 6 Pacheco Pass Subsection: Design Options Considered

Design Option	Description	Determination	Rationale
Design option to be evaluated in detail in the Draft EIR/EIS			
1. Tunnel	Predominantly a 13.5-mile tunnel north of SR 152	To be evaluated in detail in EIR/EIS	This option was added because it would avoid crossing the San Luis Reservoir and associated potential effects on water storage capacity and recreational uses, and would avoid surficial use of the Cottonwood Creek Wildlife Area (a Section 4(f) property). Subsequent refinements reduced the crossing of Romero Creek from three to one and provided for the continued operation of Romero Ranch and the movement of wildlife. The two options the Authority proposes to withdraw would affect the reservoir, requiring major steps to maintain the ongoing safety of the reservoir and to avoid decreases in water storage capacity, and would alter the ground surface within the Cottonwood Creek Wildlife Area, a use that would affect recreation and wildlife resource values. The Tunnel option would use more tunneling compared to at-grade or viaduct guideway, with an associated reduction of effects on the surface landscape.
Design options withdrawn from further consideration			
2. Close proximity to SR 152	Combination of embankment, viaduct, and tunnels along SR 152	Withdrawn in 2017 Checkpoint B Addendum	Withdrawn because it would encroach upon the San Luis Reservoir with associated effects on water storage capacity. This option has greater environmental effects than the Tunnel option on aquatic resources, California red-legged frog, California tiger salamander, least Bell's vireo, Swainson's hawk, tricolored blackbird, steelhead, San Joaquin kit fox, blunt-nosed leopard lizard, and giant garter snake. The option would have more extensive effects on 100-year floodplains, important agricultural land, lands under conservation easement, parks (both in number and acreage), the Cottonwood Creek Wildlife Area, and the San Luis Reservoir State Recreation Area.
3. Refined Program Alignment (RPA)	Combination of embankment, viaduct, and tunnels farther from SR 152.	Withdrawn in 2017 Checkpoint B Addendum	Withdrawn because it would encroach upon the San Luis Reservoir with associated effects on water storage capacity and recreational uses. The RPA has greater effects on aquatic resources, California red-legged frog, California tiger salamander, least Bell's vireo, Swainson's hawk, tricolored blackbird, steelhead, San Joaquin kit fox, and blunt-nosed leopard lizard. This option would convert more 100-year floodplain and important agricultural land and would affect more parks (number and acreage) and more acreage of the Cottonwood Creek Wildlife Area and the San Luis Reservoir State Recreation Area (which is avoided by the Tunnel option).

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San Joaquin Valley Subsection Design Options Considered

The Authority and FRA considered three design options for the San Joaquin Valley Subsection, as illustrated on Figure 16.

In the PAA, SAAs, and 2013 Checkpoint B Summary Report, the Authority and FRA analyzed design options for the complete San Jose to Merced Project Section. Subsequently, the Authority and FRA decided to analyze the Central Valley Wye alternatives separately in a Supplemental EIR/EIS to the Merced to Fresno EIR/EIS and to focus on the alignments west of the Central Valley Wye in this Draft EIR/EIS.

During the PAA, SAA, and 2013 Checkpoint B Summary Report analyses, three primary routes were considered east of the Pacheco Pass subsection: a central route predominantly along Henry Miller Road to Carlucci Road and then various Central Valley Wye options; a northern route using SR 140; and a southern route through Firebaugh.

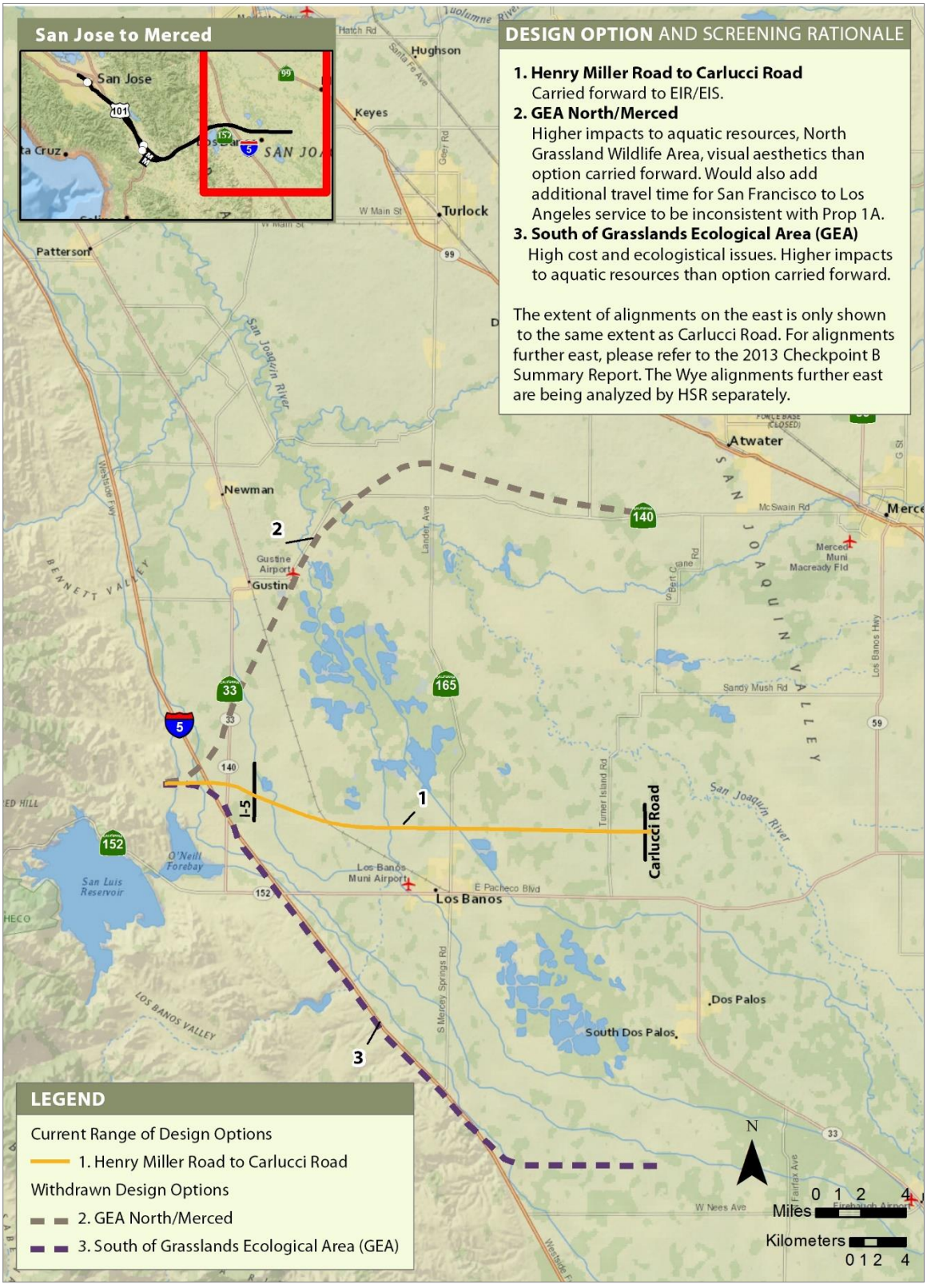
The northern route, GEA North/Merced, would proceed northeast from near I-5 across SR 33 and then along SR 140 east toward Merced. The Authority determined that this option would result in substantially greater effects on aquatic resources than the alignment along Henry Miller Road; would be the only option to affect the North Grasslands Wildlife Area; would have high visual intrusiveness associated with a river crossing within a state park; and would add 4 minutes of travel time between San Francisco and Los Angeles, likely making it inconsistent with the travel time objective under Proposition 1A of 2 hours 40 minutes between the Transbay Terminal in San Francisco and Los Angeles Union Station.

The southern route, South of GEA, would proceed south along I-5 to past SR 165, then east through Firebaugh to meet the north-south route between Madera and Fresno. The Authority determined that this option would have the greatest effect on aquatic resources of all options considered in this subsection and would have high cost and logistical issues due to its extensive environmental effects and additional miles of alignment compared to other options considered.

Public meetings, Community Working Group meetings, Technical Working Group meetings, and stakeholder and agency meetings were conducted in 2016 and 2017, during which the public expressed concern about the potential environmental effects of the Henry Miller Road to Carlucci Road option. Impacts on farmlands, properties, dairies, wetlands, wildlife, and water infrastructure were of particular concern. As part of the Program EIR/EIS Tier 1 environmental process, the Authority committed to 3 miles of an elevated profile adjacent to the GEA and to the purchase of 10,000 acres of conservation easements to avoid and reduce impacts to wildlife species. The Authority also consulted in 2016 and 2017 with irrigation districts, the San Luis and Delta-Mendota Water Authority and USBR on design refinements to be included in the project to minimize infrastructure conflicts and land use displacement/disruptions. Although the Henry Miller alignment would affect farmlands and dairies, as noted above, the alternatives that avoided Henry Miller Road would have had substantially higher impacts on aquatic resources, which would make them difficult, if not impossible to permit by the U.S. Army Corps of Engineers.

The Authority concluded that the issues raised by public concerns were previously considered in the 2013 Checkpoint B Summary Report, prior Tier 1 commitments and additional design refinements were responsive to concerns raised earlier and in 2016 and 2017 and that the prior conclusions regarding the design options to be carried forward or withdrawn from further consideration remained valid.

Table 7 shows the design options considered in this subsection and the rationale for inclusion or withdrawal from further consideration in this Draft EIR/EIS. The central route (Henry Miller Road to Carlucci Road) was determined to be practicable and to result in less effects on aquatic resources than the other two options and was carried forward for analysis in this EIR/EIS. This design option is described in greater detail in Section 2.5.



Source: Authority and FRA 2013, Authority 2016

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Figure 16 Design Options Considered in the San Joaquin Valley Subsection

Table 7 San Joaquin Valley Subsection: Design Options Considered

Design Option	Description	Determination	Rationale
Design option to be evaluated in detail in Draft EIR/EIS			
1. Predominantly Henry Miller Rd to Carlucci Rd	Mostly at-grade alignment with some viaduct or embankment	To be evaluated in detail in EIR/EIS	Lesser effects on wetlands than northern and southern alignments.
Design options withdrawn from further consideration			
2. Grasslands Ecological Area (GEA) North/ Merced	Across SR 33 to SR 140 to Merced	Withdrawn in the PAA and 2013 Checkpoint B Report	Withdrawn from further analysis because the potential effects on aquatic resources would be substantially greater than those of the alignment along Henry Miller Rd, and it would be the only option to affect the North GEA. This option would result in high visual intrusiveness by adding an HSR river crossing within a state park. Further, this option would add 4 minutes of travel time between San Francisco and Los Angeles, likely making it inconsistent with the travel time objective of Proposition 1A (2 hours 40 minutes between Los Angeles Union Station and San Francisco). Because it is inconsistent with Proposition 1A, this option does not meet the project's purpose and need.
3. South of GEA	South along I-5 past SR 165, then east through Firebaugh to SR 99 corridor between Madera and Fresno	Not included in program-level corridors, but analyzed and withdrawn in the PAA and 2013 Checkpoint B Report	The South of GEA option was not included in one of the program-level corridors. This option was withdrawn from further analysis because it would have the greatest effect on aquatic resources of options considered and would have high cost and logistical issues due to its extensive environmental effects and additional miles of alignment compared to the design option carried forward.

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