

BART TO LIVERMORE EXTENSION PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT

Volume 1 of 3
Summary through Section 3.H Hydrology and Water Quality

State Clearinghouse No. 2012082104



San Francisco Bay Area Rapid Transit District
July 2017



SAN FRANCISCO BAY AREA RAPID TRANSIT DISTRICT

July 31, 2017

Subject: Notice of Availability of Draft Environmental Impact Report for the BART to Livermore Extension Project (SCH 2012082104)

Dear Sir/Madam,

A copy of the Draft Environmental Impact Report (DEIR) for the proposed BART to Livermore Extension Project is enclosed. The enclosed CD-ROM contains the entire DEIR document and appendices. The Lead Agency for the project is the San Francisco Bay Area Rapid Transit (BART) District.

The Proposed Project, which would extend BART transit service into Livermore, is being developed in partnership with the City of Livermore and consists of a 5.5-mile BART extension along Interstate 580 from the Dublin/Pleasanton Station to a new station near the Isabel Avenue/I-580 interchange. The Proposed Project also includes new and modified bus services linking BART to the Altamont Corridor Express (ACE) stations and activity centers in Livermore, such as downtown Livermore, Las Positas College, and Lawrence Livermore National Laboratory (LLNL).

The Draft EIR evaluates several alternatives to the Proposed Project, including a No Project alternative, a Diesel Multiple Unit (DMU) alternative, an Express Bus/Bus Rapid Transit alternative, and an Enhanced Bus alternative. The Proposed Project as well as the DMU alternative include storage and maintenance facilities for effective operations.

Areas of potential impacts to the environment include transportation, land use and agricultural resources, population and housing, visual quality, cultural resources, geology and paleontological resources, hydrology and water quality, biological resources, noise and vibration, air quality, greenhouse gas emissions, energy, public health and safety, community services and utilities.

Comment Period. The public comment period for the DEIR begins on July 31, 2017. The deadline for receipt of comments is 5:00 pm, September 14, 2017.

How to Comment. Comments on the DEIR may be sent to the BART to Livermore Extension Project, 21st Floor, 300 Lakeside Drive, Oakland, CA 94612. You may also comment by email at barttolivermore@bart.gov or via the project website at www.bart.gov/livermore.

Public Meetings. Comments may also be made at two public hearings on the DEIR to be held in August:

- Tuesday, August 22, 2017, Robert Livermore Community Center, 4448 Loyola Way, Livermore, CA 94550. 6:00 pm Open House/7:00 pm Meeting
- Tuesday, August 29, 2017, Shannon Community Center, 11600 Shannon Avenue, Dublin, CA 94568. 6:00 pm Open House/7:00 pm Meeting

Additional Review Copies. The DEIR is also available via download from the BART website: www.bart.gov/about/projects/liv/environment. Additional copies of the CD-ROM may be obtained by emailing a request to the email address below or by calling the information request number below. The DEIR also is available at the Livermore, Dublin and Pleasanton Libraries. The DEIR and all related documents are available for public review at 300 Lakeside Drive, 21th Floor, Oakland, CA 94612. Email or call the information request number to arrange an appointment.

Information Line. For more information, please email barttolivermore@bart.gov or call the information request line at (888) 441-0434 or (510) 464-6401 and leave a message. However, comments cannot be accepted by phone.

Thank you for your participation in the environmental process.

Sincerely,



Andrew Tang
Project Manager

BART TO LIVERMORE EXTENSION PROJECT DRAFT ENVIRONMENTAL IMPACT REPORT

Volume 1 of 3

Summary through Section 3.H Hydrology and Water Quality

State Clearinghouse No. 2012082104

Prepared for:



San Francisco Bay Area Rapid Transit District

By:

URBAN
PLANNING
PARTNERS
INC.

Urban Planning Partners, Inc.
388 17th Street, Suite 230
Oakland, CA 94612

With:

Arup North America, Ltd.

ESA, Environmental Science Associates

Ramboll Environ

July 2017

VOLUME 1
Summary through Section 3.H Hydrology and Water Quality

TABLE OF CONTENTS

VOLUME 1

ACRONYM LIST	xxi
SUMMARY	1
A. EIR OVERVIEW	1
B. BACKGROUND	1
C. PROJECT OBJECTIVES.....	2
D. SUMMARY OF PROPOSED PROJECT AND ALTERNATIVES.....	3
E. PURPOSE OF THIS EIR.....	18
F. SUMMARY OF IMPACTS AND MITIGATION MEASURES.....	18
G. SUMMARY OF BENEFITS	19
H. AREAS OF CONTROVERSY.....	22
I. NEXT STEPS.....	23
CHAPTER 1 INTRODUCTION	43
A. EIR OVERVIEW	43
B. PURPOSE OF THE EIR.....	44
C. PROJECT BACKGROUND.....	46
D. REGIONAL CONTEXT	50
E. CEQA ENVIRONMENTAL REVIEW PROCESS.....	61
F. NATIONAL ENVIRONMENTAL POLICY ACT	69
G. ORGANIZATION OF THIS EIR	70
H. INTENDED USES OF THIS EIR	71
CHAPTER 2 PROJECT DESCRIPTION.....	77
A. INTRODUCTION.....	77
B. NO PROJECT ALTERNATIVE.....	87
C. PROPOSED PROJECT - CONVENTIONAL BART PROJECT.....	89

D.	DMU ALTERNATIVE/EMU OPTION	122
E.	EXPRESS BUS/BRT ALTERNATIVE	143
F.	ENHANCED BUS ALTERNATIVE	161
G.	CONSTRUCTION	168
H.	SUSTAINABILITY	187
I.	PROJECTED RIDERSHIP	188
J.	COSTS AND FUNDING	190
K.	ALTERNATIVES CONSIDERED BUT WITHDRAWN.....	194
CHAPTER 3 ENVIRONMENTAL ANALYSIS		213
A.	INTRODUCTION TO ENVIRONMENTAL ANALYSIS	213
1.	Organization of the Environmental Analysis	213
2.	Footprint, Study Areas, and Project Corridor	216
3.	Environmental Analysis Scenarios	219
4.	Cumulative Analysis	224
B.	TRANSPORTATION	233
1.	Introduction	233
2.	Existing Conditions	233
3.	Regulatory Framework	259
4.	Impacts and Mitigation Measures	265
C.	LAND USE AND AGRICULTURAL RESOURCES.....	461
1.	Introduction	461
2.	Existing Conditions	462
3.	Regulatory Framework	484
4.	Impacts and Mitigation Measures	496
D.	POPULATION AND HOUSING	523
1.	Introduction	523
2.	Existing Conditions	524
3.	Regulatory Framework	532
4.	Impacts and Mitigation Measures	533
E.	VISUAL QUALITY.....	553
1.	Introduction	553
2.	Existing Conditions	554
3.	Regulatory Framework	570
4.	Impacts and Mitigation Measures	579
F.	CULTURAL RESOURCES	633
1.	Introduction	633
2.	Existing Conditions	634
3.	Regulatory Framework	658
4.	Impacts and Mitigation Measures	662

G. GEOLOGY, SOILS, SEISMICITY, MINERAL AND PALEONTOLOGICAL RESOURCES 681

 1. Introduction 681

 2. Existing Conditions 682

 3. Regulatory Framework 708

 4. Impacts and Mitigation Measures 716

H. HYDROLOGY AND WATER QUALITY 743

 1. Introduction 743

 2. Existing Conditions 744

 3. Regulatory Framework 770

 4. Impacts and Mitigation Measures 782

VOLUME 2

I. BIOLOGICAL RESOURCES 817

 1. Introduction 817

 2. Existing Conditions 819

 3. Regulatory Framework 868

 4. Impacts and Mitigation Measures 876

J. NOISE AND VIBRATION 959

 1. Introduction 959

 2. Existing Conditions 960

 3. Regulatory Framework 971

 4. Impacts and Mitigation Measures 973

K. AIR QUALITY 1071

 1. Introduction 1071

 2. Existing Conditions 1072

 3. Regulatory Framework 1094

 4. Impacts and Mitigation Measures 1107

L. GREENHOUSE GAS EMISSIONS 1199

 1. Introduction 1199

 2. Existing Conditions 1200

 3. Regulatory Framework 1203

 4. Impacts and Mitigation Measures 1212

M. ENERGY 1257

 1. Introduction 1257

 2. Existing Conditions 1258

 3. Regulatory Framework 1267

 4. Impacts and Mitigation Measures 1271

N. PUBLIC HEALTH AND SAFETY 1317

 1. Introduction 1317

 2. Existing Conditions 1318

 3. Regulatory Framework 1336

 4. Impacts and Mitigation Measures 1354

O.	COMMUNITY SERVICES	1397
1.	Introduction	1397
2.	Existing Conditions	1398
3.	Regulatory Framework	1408
4.	Impacts and Mitigation Measures	1411
P.	UTILITIES	1431
1.	Introduction	1431
2.	Existing Conditions	1431
3.	Regulatory Framework	1438
4.	Impacts and Mitigation Measures	1439
CHAPTER 4 OTHER CEQA CONSIDERATIONS		1467
A.	INTRODUCTION	1467
B.	SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS	1467
C.	SIGNIFICANT CUMULATIVE IMPACTS	1467
D.	SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES	1468
E.	GROWTH-INDUCING IMPACTS	1474
F.	ENVIRONMENTALLY SUPERIOR ALTERNATIVE	1481
CHAPTER 5 PROJECT MERITS		1493
A.	INTRODUCTION	1493
B.	PROJECT BENEFITS	1494
C.	FUTURE SERVICE EXPANSION	1497
D.	BART AND METROPOLITAN TRANSPORTATION COMMISSION POLICIES	1499
E.	PLAN BAY AREA	1503
CHAPTER 6 LIST OF PREPARERS AND REFERENCES		1507
A.	LEAD AGENCY	1507
B.	CONSULTANTS	1507
C.	REFERENCES	1511

VOLUME 3

APPENDICES

- A. Notice of Preparation
- B. Footprint Mapbooks
 - B.1 Proposed Project
 - B.2 DMU Alternative
 - B.3 Express Bus/BRT Alternative
- C. Right-of-Way Information
 - C.1 Proposed Project
 - C.2 DMU Alternative
 - C.3 Express Bus/BRT Alternative
- D. BART's Parking Management Toolkit
- E. Cumulative Projects List
- F. Transportation Data
 - F.1 Transportation Data for EIR
 - F.2 Transit Ridership and Vehicle Miles Travelled Under Alternative Land Use Assumptions
- G. Noise Model Data
 - G.1 FTA Noise Calculations
 - G.2 Traffic Noise Input Assumptions and Modeling Output
 - G.3 Construction Noise Calculations
 - G.4 Construction Vibration Calculations
 - G.5 Noise Monitoring Summary Sheets
 - G.6 Sound Level Meter Certification
- H. Air Quality Technical Tables
- I. Energy and Greenhouse Gas Technical Tables
 - I.1 Energy Detail Tables
 - I.2 Energy and Greenhouse Gas Calculations

List of Figures

VOLUME 1

Figure S-1	Conventional BART – Overview	10
Figure S-2	DMU Alternative – Overview	11
Figure S-3	Express Bus/BRT Alternative – Overview.....	13
Figure S-4	Enhanced Bus Alternative – Overview.....	15
Figure 1-1	Regional BART System and Proposed BART to Livermore Extension Project.....	47
Figure 1-2	Regional Context	51
Figure 2-1	Conventional BART Project – Overview	90
Figure 2-2	Conventional BART Project – Detail	93
Figure 2-3	Conventional BART Project – Typical BART and BRT Vehicles	95
Figure 2-4	Conventional BART Project – Typical I-580 and Rail Cross-Section.....	97
Figure 2-5	Conventional BART Project – Isabel Station and Parking – Site Plan	99
Figure 2-6	Conventional BART Project – Isabel Station and Parking – Site Section	100
Figure 2-7	Conventional BART Project – Isabel Station Cross-Section	102
Figure 2-8	Conventional BART Project – Isabel Station Longitudinal Section and South Elevation	103
Figure 2-9	Conventional BART Project – Storage and Maintenance Facility	108
Figure 2-10	Conventional BART Project – Wayside Facilities – Typical Site Plans.....	111
Figure 2-11	Conventional BART Project – Wayside Facilities – Typical Elevations.....	112
Figure 2-12	Conventional BART Project – Typical Bus-Related Infrastructure	119
Figure 2-13	DMU Alternative – Overview.....	124
Figure 2-14	DMU Alternative – Detail	127
Figure 2-15	DMU Alternative – Typical DMU and EMU Vehicles	128
Figure 2-16	DMU Alternative – DMU Transfer Platform at Dublin/Pleasanton Station.....	131
Figure 2-17	DMU Alternative – DMU Transfer Platform Cross-Section.....	133
Figure 2-18	DMU Alternative – Storage and Maintenance Facility.....	137
Figure 2-19	Express Bus/BRT Alternative – Overview.....	145
Figure 2-20	Express Bus/BRT Alternative – Detail	147
Figure 2-21	Express Bus/BRT Alternative – Bus Ramps and Bus Transfer Platforms at Dublin/Pleasanton Station	149
Figure 2-22	Express Bus/BRT Alternative – Bus Ramps and Bus Transfer Platforms Cross-Section	150
Figure 2-23	Express Bus/BRT Alternative – Parking Facilities.....	152
Figure 2-24	Enhanced Bus Alternative – Overview.....	162
Figure 2-25	Construction Staging Areas	179

Figure 2-26 Locations Considered for the BART Storage Yard 201

Figure 2-27 Locations Considered for the DMU Storage and Maintenance
 Facility..... 207

Figure 3.A-1 Project Corridor and Geographic Subareas..... 218

Figure 3.A-2 Isabel Neighborhood Plan 228

Figure 3.B-1 Study Area 234

Figure 3.B-2 Freeway Study Area..... 237

Figure 3.B-3 Study Area Intersections 239

Figure 3.B-4 Bicycle Facilities – Existing and Planned 253

Figure 3.B-5 Bicycle Level of Traffic Stress – Existing 255

Figure 3.B-6 Pedestrian Facilities and Gaps – Existing 257

Figure 3.B-7 BART Station Access Hierarchy 262

Figure 3.B-8 BART Station Access Types 263

Figure 3.B-9 Traffic Pattern Changes, AM Peak Period..... 321

Figure 3.B-10 Intersection LOS and Change in AM Delay – 2025 Conventional
 BART Project..... 348

Figure 3.B-11 Intersection LOS and Change in PM Delay – 2025 Conventional
 BART Project..... 349

Figure 3.B-12 Intersection LOS and Change in AM Delay – 2025 DMU Alternative..... 350

Figure 3.B-13 Intersection LOS and Change in PM Delay – 2025 DMU Alternative 351

Figure 3.B-14 Intersection LOS and Change in AM Delay – 2025 Express Bus/BRT
 Alternative 352

Figure 3.B-15 Intersection LOS and Change in PM Delay – 2025 Express Bus/BRT
 Alternative 353

Figure 3.B-16 Intersection LOS and Change in AM Delay – 2025 Enhanced Bus
 Alternative 354

Figure 3.B-17 Intersection LOS and Change in PM Delay – 2025 Enhanced Bus
 Alternative 355

Figure 3.B-18 Intersection LOS and Change in AM Delay – 2040 Conventional
 BART Project..... 365

Figure 3.B-19 Intersection LOS and Change in PM Delay – 2040 Conventional
 BART Project..... 366

Figure 3.B-20 Intersection LOS and Change in AM Delay – 2040 DMU Alternative..... 367

Figure 3.B-21 Intersection LOS and Change in PM Delay – 2040 DMU Alternative 368

Figure 3.B-22 Intersection LOS and Change in AM Delay – 2040 Express Bus/BRT
 Alternative 369

Figure 3.B-23 Intersection LOS and Change in PM Delay – 2040 Express Bus/BRT
 Alternative 370

Figure 3.B-24 Intersection LOS and Change in AM Delay – 2040 Enhanced Bus
 Alternative 371

Figure 3.B-25 Intersection LOS and Change in PM Delay – 2040 Enhanced Bus
 Alternative 372

Figure 3.B-26	Bicycle Level of Traffic Stress – 2025 and 2040 Conventional BART Project.....	385
Figure 3.B-27	Intersection LOS and Change in AM Delay – 2025 Cumulative Conditions, Conventional BART Project	419
Figure 3.B-28	Intersection LOS and Change in PM Delay – 2025 Cumulative Conditions, Conventional BART Project	420
Figure 3.B-29	Intersection LOS and Change in AM Delay – 2025 Cumulative Conditions, DMU Alternative.....	421
Figure 3.B-30	Intersection LOS and Change in PM Delay – 2025 Cumulative Conditions, DMU Alternative.....	422
Figure 3.B-31	Intersection LOS and Change in AM Delay – 2025 Cumulative Conditions, Express Bus/BRT Alternative	423
Figure 3.B-32	Intersection LOS and Change in PM Delay – 2025 Cumulative Conditions, Express Bus/BRT Alternative	424
Figure 3.B-33	Intersection LOS and Change in AM Delay – 2025 Cumulative Conditions, Enhanced Bus Alternative	425
Figure 3.B-34	Intersection LOS and Change in PM Delay – 2025 Cumulative Conditions, Enhanced Bus Alternative	426
Figure 3.B-35	Intersection LOS and Change in AM Delay – 2040 Cumulative Conditions, Conventional BART Project	437
Figure 3.B-36	Intersection LOS and Change in PM Delay – 2040 Cumulative Conditions, Conventional BART Project	438
Figure 3.B-37	Intersection LOS and Change in AM Delay – 2040 Cumulative Conditions, DMU Alternative.....	439
Figure 3.B-38	Intersection LOS and Change in PM Delay – 2040 Cumulative Conditions, DMU Alternative.....	440
Figure 3.B-39	Intersection LOS and Change in AM Delay – 2040 Cumulative Conditions, Express Bus/BRT Alternative	441
Figure 3.B-40	Intersection LOS and Change in PM Delay – 2040 Cumulative Conditions, Express Bus/BRT Alternative	442
Figure 3.B-41	Intersection LOS and Change in AM Delay – 2040 Cumulative Conditions, Enhanced Bus Alternative	443
Figure 3.B-42	Intersection LOS and Change in PM Delay – 2040 Cumulative Conditions, Enhanced Bus Alternative	444
Figure 3.B-43	Bicycle Level of Traffic Stress – 2025 and 2040 Cumulative Conditions, Conventional BART Project and DMU Alternative.....	458
Figure 3.C-1a	Existing Land Uses.....	463
Figure 3.C-1b	Existing Land Uses.....	464
Figure 3.C-2	Dublin/Pleasanton Station Area Photos	465
Figure 3.C-3	I-580 Corridor Area and Isabel North Area Photos	467
Figure 3.C-4	Isabel South Area Photos	470
Figure 3.C-5	Cayetano Creek Area Photos.....	472

Figure 3.C-6 Laughlin Road Area Photos 473

Figure 3.C-7 General Plan Designations in the Study Area 476

Figure 3.C-8 Zoning Designations in the Study Area..... 479

Figure 3.C-9 Agricultural Resources 483

Figure 3.C-10 Regulatory Boundaries and Special Planning Areas 485

Chart 3.D-1 Journey to Work Data for the Study Area 527

Figure 3.E-1 Viewpoint Locations 557

Figure 3.E-2 Dublin/Pleasanton Station Area and I-580 Corridor Area Photos 559

Figure 3.E-3 Isabel North Area and Isabel South Area Photos 564

Figure 3.E-4 Cayetano Creek Area Photos..... 566

Figure 3.E-5 Laughlin Road Area Photos 568

Figure 3.E-6a Caltrans Landscaped Freeway Segments 572

Figure 3.E-6b Caltrans Landscaped Freeway Segments 573

Figure 3.E-7 Designated Scenic Vistas and Routes in Livermore..... 577

Figure 3.E-8 Conventional BART Project – El Charro Road Overpass 589

Figure 3.E-9 Conventional BART Project – I-580 Between Isabel Avenue & Portola Avenue 590

Figure 3.E-10 Conventional BART Project – Isabel Avenue North of I-580 591

Figure 3.E-11 Conventional BART Project – East Airway Boulevard 592

Figure 3.E-12 Conventional BART Project – Isabel Avenue and Kitty Hawk Road 593

Figure 3.E-13 Conventional BART Project – I-580 East of Portola Avenue 594

Figure 3.E-14 Conventional BART Project – North Livermore Avenue and Hartman Road 595

Figure 3.E-15 DMU Alternative – Dougherty Road Overpass 604

Figure 3.E-16 DMU Alternative – I-580 East of Dublin/Pleasanton Station 605

Figure 3.E-17 DMU Alternative – El Charro Road Overpass..... 606

Figure 3.E-18 DMU Alternative – North Livermore Avenue 607

Figure 3.E-19 EMU Option – El Charro Road Overpass 612

Figure 3.E-20 Express Bus/BRT Alternative – Dougherty Road Overpass 614

Figure 3.E-21 Express Bus/BRT Alternative – I-580 East of Dublin/Pleasanton Station..... 615

Figure 3.F-1 Archaeological Sensitivity 656

Figure 3.G-1 Regional Topography and Faults 683

Figure 3.G-2 Geologic Units 685

Figure 3.G-3 Liquefaction Susceptibility 698

Figure 3.G-4 Landslide Susceptibility..... 700

Figure 3.G-5 Soil Types in the Study Area 702

Figure 3.H-1 Topography 746

Figure 3.H-2 Surface Hydrology..... 750

Figure 3.H-3a Special Flood Hazard Areas – Overview 756

Figure 3.H-3b Special Flood Hazard Areas – Detail..... 757

Figure 3.H-4 Dam Inundation Areas..... 760

Figure 3.H-5 Groundwater Basins 762
 Figure 3.H-6 USGS Water Quality Monitoring Stations 765

VOLUME 2

Figure 3.I-1a Vegetation Communities in the Study Area – Western Project
 Corridor 823
 Figure 3.I-1b Vegetation Communities in the Study Area – Eastern Project
 Corridor 824
 Figure 3.I-2a Waters of the U.S. and State in the Study Area – Western Project
 Corridor 830
 Figure 3.I-2b Waters of the U.S. and State in the Study Area – Eastern Project
 Corridor 831
 Figure 3.I-3 Sensitive Species Occurrences 835
 Figure 3.I-4a Potential Habitat for CTS, CRLF, BUOW, and SJKF in the Study Area
 – Western Project Corridor 853
 Figure 3.I-4b Potential Habitat for CTS, CRLF, BUOW, and SJKF in the Study Area
 – Eastern Project Corridor 854
 Figure 3.I-5 Summary of Zone 7 Water Agency CRLF Survey Findings 857
 Figure 3.J-1 Examples of Typical Noise and Vibration Levels 963
 Figure 3.J-2 Noise Measurement Locations in Study Area 968
 Figure 3.J-3 FTA Noise Impact Criteria for Transit Projects 972
 Figure 3.K-1 Stationary Air Pollutant Sources 1092
 Figure 3.M-1 Energy Sources and Use in California..... 1259
 Figure 3.M-2 Electricity Generation by Source in California 1263
 Figure 3.N-1 Environmental Database Sites Within the Study Area 1325
 Figure 3.N-2 Livermore Municipal Airport Zones 1329
 Figure 3.N-3 Wildfire Hazard Potential..... 1331
 Figure 3.N-4 Electromagnetic Fields 1334
 Figure 3.N-5 ICNIRP Reference Levels 1351
 Figure 3.O-1 Police and Fire Stations 1399
 Figure 3.P-1 Major Utility Lines in the Collective Footprint 1437

List of Tables

VOLUME 1

Table S-1	Key Components of the Proposed Project and Build Alternatives.....	4
Table S-2	Estimated Capital Costs for the Proposed Project and Build Alternatives	16
Table S-3	Operating and Maintenance Costs for the Proposed Project and Build Alternatives	17
Table S-4	Summary of Quantitative Beneficial Effects in 2040	20
Table S-5	Summary of Significant Impacts	27
Table 1-1	Public Agencies with Possible Future Permit and/or Approval Authority.....	72
Table 2-1	Key Components of the Proposed Project and Build Alternatives.....	80
Table 2-2	Conventional BART Project – Alignment, Facilities, and Structures	96
Table 2-3	Conventional BART Project – I-580 and Roadway Modifications	113
Table 2-4	Conventional BART Project – New/Modified Bus Service	117
Table 2-5	DMU Alternative – Alignment, Facilities, and Structures	130
Table 2-6	DMU Alternative – I-580 and Roadway Modifications	140
Table 2-7	Express Bus/BRT Alternative – Alignment, Facilities, and Structures	148
Table 2-8	Express Bus/BRT Alternative – I-580 and Roadway Modifications	154
Table 2-9	Express Bus/BRT Alternative – New/Modified Bus Service	157
Table 2-10	Enhanced Bus Alternative – New/Modified Bus Service	165
Table 2-11	Construction Segments and Duration	169
Table 2-12	Approximate Depths of Excavation for Construction of the Proposed Project and Build Alternatives	182
Table 2-13	Construction Quantities and Truckloads for Conventional BART Project.....	183
Table 2-14	Construction Quantities and Truckloads for DMU Alternative	184
Table 2-15	Construction Quantities and Truckloads for Express Bus/BRT Alternative	185
Table 2-16	Existing and Future BART Systemwide Daily Ridership (Weekday)	188
Table 2-17	Existing and Future Tri-Valley Area Daily Boardings (Weekday).....	189
Table 2-18	Estimated Capital Costs for the Proposed Project and Build Alternatives	191
Table 2-19	Operating and Maintenance Costs for the Proposed Project and Build Alternatives	193
Table 2-20	Variants to the Conventional BART Project – Considered but Withdrawn	195
Table 2-21	Variants to the DMU Alternative – Considered but Withdrawn	205

Table 2-22	Variants to the Express Bus/BRT Alternative – Considered but Withdrawn	210
Table 3.A-1	Growth Projections for the Project Corridor through 2040.....	222
Table 3.A-2	Projected Growth in the INP Area through 2040.....	229
Table 3.B-1	I-580 General-Purpose Freeway Level of Service, Existing (2014).....	236
Table 3.B-2	Intersection Level of Service, Existing (2013).....	241
Table 3.B-3	BART Systemwide Average Peak-Hour Load at Maximum Load Points, Existing	248
Table 3.B-4	Arriving Train Peak-Hour Load, Dublin/Pleasanton-Daly City Line at Selected Stations, AM Peak Direction (Westbound), Existing	248
Table 3.B-5	Surrounding Transit Services, Existing	249
Table 3.B-6	Weekday Ridership, Existing.....	251
Table 3.B-7	Pedestrian Delay For Study Intersections, Existing (2013).....	259
Table 3.B-8	Level of Service Criteria – Freeway Segments	271
Table 3.B-9	Level of Service Criteria – Signalized Intersections	271
Table 3.B-10	Level of Service Criteria – Unsignalized Intersections.....	272
Table 3.B-11	Level of Traffic Stress Criteria – Bicycle Segments	273
Table 3.B-12	Pedestrian Delay Thresholds for Signalized Intersections.....	274
Table 3.B-13	I-580 Lane Configuration in 2014 and 2025/2040, No Project Conditions	275
Table 3.B-14	I-580 Performance in AM, 2025 No Project Conditions.....	276
Table 3.B-15	I-580 Performance in PM, 2025 No Project Conditions	277
Table 3.B-16	I-580 Performance in AM, 2040 No Project Conditions.....	279
Table 3.B-17	I-580 Performance in PM, 2040 No Project Conditions	280
Table 3.B-18	Local Roadway Improvements, 2025 and 2040 No Project Conditions	281
Table 3.B-19	Local Roadway Intersection Performance, 2025 and 2040 No Project Conditions	283
Table 3.B-20	Surrounding Transit Services Ridership (Weekday Boardings), Existing and 2025/2040 No Project Conditions	289
Table 3.B-21	BART Systemwide Daily Ridership (Weekday), Existing and 2025/2040.....	291
Table 3.B-22	Tri-Valley BART Boardings (Weekday), Existing and 2025/2040	292
Table 3.B-23	Dublin/Pleasanton Station Access Modes and Daily Boardings (Weekday), 2040 Conditions	294
Table 3.B-24	Proposed Isabel Station Access Mode and Daily Boardings (Weekday), 2040 Conditions	296
Table 3.B-25	BART Systemwide Average Peak-Hour Load at Maximum Load Points (Passengers per Car), 2040 Conditions	297
Table 3.B-26	Peak-Hour Train Loads at Selected Stations, Dublin/Pleasanton-Daly City Line (Passengers per car), Existing and 2040	298

Table 3.B-27 Projected BART Fleet Requirements 299

Table 3.B-28 BART Parking Facilities, Existing 300

Table 3.B-29 Parking Demand at Existing and Proposed BART Parking Facilities,
 2025 and 2040 301

Table 3.B-30 VMT Reductions Summary (Average Weekday)..... 302

Table 3.B-31 Summary of Transportation Impacts 304

Table 3.B-32 AM Westbound General-Purpose Freeway Level of Service, 2025
 Project Conditions 317

Table 3.B-33 PM Westbound General-Purpose Freeway Level of Service, 2025
 Project Conditions 318

Table 3.B-34 AM Eastbound General-Purpose Freeway Level of Service, 2025
 Project Conditions 319

Table 3.B-35 PM Eastbound General-Purpose Freeway Level of Service, 2025
 Project Conditions 320

Table 3.B-36 AM Westbound General-Purpose Freeway Level of Service, 2040
 Project Conditions 326

Table 3.B-37 PM Westbound General-Purpose Freeway Level of Service, 2040
 Project Conditions 327

Table 3.B-38 AM Eastbound General-Purpose Freeway Level of Service, 2040
 Project Conditions 328

Table 3.B-39 PM Eastbound General-Purpose Freeway Level of Service, 2040
 Project Conditions 329

Table 3.B-40 AM Westbound HOV/Express Lane Freeway Level of Service, 2025
 Project Conditions 333

Table 3.B-41 PM Westbound HOV/Express Lane Freeway Level of Service, 2025
 Project Conditions 334

Table 3.B-42 AM Eastbound HOV/Express Lane Freeway Level of Service, 2025
 Project Conditions 335

Table 3.B-43 PM Eastbound HOV/Express Lane Freeway Level of Service, 2025
 Project Conditions 336

Table 3.B-44 AM Westbound I-580 HOV/Express Lane Level of Service, 2040
 Project Conditions 339

Table 3.B-45 PM Westbound I-580 HOV/Express Lane Level of Service, 2040
 Project Conditions 340

Table 3.B-46 AM Eastbound I-580 HOV/Express Lane Level of Service, 2040
 Project Conditions 341

Table 3.B-47 PM Eastbound I-580 HOV/Express Lane Level of Service, 2040
 Project Conditions 342

Table 3.B-48 Intersection Delay and Level of Service, 2025 Project Conditions 343

Table 3.B-49 Intersection Delay and Level of Service, 2040 Project Conditions 361

Table 3.B-50 Surrounding Transit Services Ridership (Weekday Boardings), 2025
 Project Conditions 380

Table 3.B-51	Surrounding Transit Services Ridership (Weekday Boardings), 2040 Project Conditions	381
Table 3.B-52	AM Westbound I-580 General-Purpose Freeway Level of Service, 2025 Cumulative Conditions	393
Table 3.B-53	PM Westbound I-580 General-Purpose Freeway Level of Service, 2025 Cumulative Conditions	394
Table 3.B-54	AM Eastbound I-580 General-Purpose Freeway Level of Service, 2025 Cumulative Conditions	395
Table 3.B-55	PM Eastbound I-580 General-Purpose Freeway Level of Service, 2025 Cumulative Conditions	396
Table 3.B-56	AM Westbound I-580 General-Purpose Freeway Level of Service, 2040 Cumulative Conditions	398
Table 3.B-57	PM Westbound I-580 General-Purpose Freeway Level of Service, 2040 Cumulative Conditions	399
Table 3.B-58	AM Eastbound I-580 General-Purpose Freeway Level of Service, 2040 Cumulative Conditions	400
Table 3.B-59	PM Eastbound I-580 General-Purpose Freeway Level of Service, 2040 Cumulative Conditions	401
Table 3.B-60	AM Westbound I-580 HOV/Express Lane Freeway Level of Service, 2025 Cumulative Conditions	405
Table 3.B-61	PM Westbound I-580 HOV/Express Lane Freeway Level of Service, 2025 Cumulative Conditions	406
Table 3.B-62	AM Eastbound I-580 HOV/Express Lane Freeway Level of Service, 2025 Cumulative Conditions	407
Table 3.B-63	PM Eastbound I-580 HOV/Express Lane Freeway Level of Service, 2025 Cumulative Conditions	408
Table 3.B-64	AM Westbound I-580 HOV/Express Lane Freeway Level of Service, 2040 Cumulative Conditions	411
Table 3.B-65	PM Westbound I-580 HOV/Express Lane Freeway Level of Service, 2040 Cumulative Conditions	412
Table 3.B-66	AM Eastbound I-580 HOV/Express Lane Freeway Level of Service, 2040 Cumulative Conditions	413
Table 3.B-67	PM Eastbound I-580 HOV/Express Lane Freeway Level of Service, 2040 Cumulative Conditions	414
Table 3.B-68	Intersection Level of Service and Change in Delay, 2025 Cumulative Conditions	415
Table 3.B-69	Intersection Level of Service and Change in Delay, 2040 Cumulative Conditions	433
Table 3.B-70	Surrounding Transit Services Ridership (Weekday), 2025 Cumulative Conditions	454
Table 3.B-71	Surrounding Transit Services Ridership Systemwide Boardings (Weekday), 2040 Cumulative Conditions	455

Table 3.C-1	Affected Land Uses within the Collective Footprint (non-BART owned parcels).....	474
Table 3.C-2	General Plan Land Use Designations.....	477
Table 3.C-3	FMMP Farmland Classifications.....	481
Table 3.C-4	Summary of Land Use Impacts.....	498
Table 3.D-1	Existing Demographic Profile for the Study Area.....	525
Table 3.D-2	Existing and Projected Population and Households, by Jurisdiction.....	529
Table 3.D-3	Existing and Projected Housing Units, by Jurisdiction.....	530
Table 3.D-4	Existing and Projected Housing Units in Livermore and its Priority Development Areas.....	531
Table 3.D-5	Existing and Projected Jobs, by Jurisdiction.....	532
Table 3.D-6	Summary of Population and Housing Impacts.....	534
Table 3.D-7	Residential Parcels Affected by the Conventional BART Project and DMU Alternative.....	540
Table 3.E-1	Summary of Visual Quality Impacts.....	581
Table 3.F-1	Prior Cultural Resource Studies within or adjacent to the Collective Footprint.....	640
Table 3.F-2	Cultural Resources Previously Identified within the Study Area.....	641
Table 3.F-3	Summary of Cultural Resources Impacts.....	664
Table 3.F-4	Damage Threshold to Historic Buildings from Construction Equipment.....	667
Table 3.G-1	Modified Mercalli Intensity Scale.....	690
Table 3.G-2	Active and Potentially Active Faults within the Study Area.....	692
Table 3.G-3	Categories of Liquefaction and Lateral Spreading Susceptibility.....	697
Table 3.G-4	Summary of Geology, Soils, Seismicity, Mineral, and Paleontological Resources Impacts.....	718
Table 3.H-1	Period of Record Monthly Climate Summary for Livermore 1/1/1903 to 12/31/2013.....	747
Table 3.H-2	Historic Surface Water Quality within the Study Area.....	766
Table 3.H-3	Recent Surface Water Quality in Arroyo Mocho and Arroyo las Positas.....	767
Table 3.H-4	Designated Beneficial Uses.....	767
Table 3.H-5	Summary of Hydrology and Water Quality Impacts.....	784
Table 3.H-6	Existing and Proposed Impervious Surface within the Proposed Project and Build Alternatives Footprints.....	791

VOLUME 2

Table 3.I-1	Completed and Pending Surveys for the Proposed Project and Build Alternatives.....	821
Table 3.I-2	Vegetation Communities in the Study Area.....	822
Table 3.I-3	Drainages and Aquatic Features in the Study Area.....	829

Table 3.I-4	Special-status Wildlife and Plant Species With Potential to Occur in the Study Area.....	837
Table 3.I-5	Special-Status Wildlife and Plant Species with Potential to Occur - Summary by Geographic Subarea.....	846
Table 3.I-6	Wildlife Corridors in the Study Area	867
Table 3.I-7	Native Trees in the City of Livermore.....	875
Table 3.I-8	Summary of Biological Resources Impacts	879
Table 3.I-9	Potential Direct Impacts to CTS and CRLF Habitat	892
Table 3.I-10	Potential Direct Impacts to BUOW Upland Habitat	904
Table 3.I-11	Potential Direct Impacts to SJKF Upland Habitat	918
Table 3.I-12	Potential Direct Impacts to Jurisdictional Wetlands, Other Waters of the U.S. and Waters of the State.....	922
Table 3.I-13	List of Cumulative Projects Considered in the Biological Resources Cumulative Analysis	940
Table 3.J-1	Summary of Ambient Noise Measurements in the Study Area.....	965
Table 3.J-2	Representative Sensitive Receptors within Study Area	970
Table 3.J-3	Groundborne Vibration and Noise Impact Criteria.....	973
Table 3.J-4	Construction Noise Impact Criteria	975
Table 3.J-5	Construction Vibration Impact Criteria for Building Damage	976
Table 3.J-6	Screening Distances for Operational Noise Assessment	977
Table 3.J-7	Operational Noise Impact Criteria	978
Table 3.J-8	Summary of Key Parameters for Operational Noise Analysis of BART and DMU Trains	980
Table 3.J-9	Traffic Noise Impact Criteria	982
Table 3.J-10	Screening Distances for Operational Vibration Assessment	983
Table 3.J-11	Summary of Noise and Vibration Impacts	985
Table 3.J-12	Conventional BART Project - Predicted Construction Noise Levels At Representative Sensitive Receptors	990
Table 3.J-13	Conventional BART - Predicted Construction Vibration Levels At Representative Sensitive Receptors	993
Table 3.J-14	DMU Alternative - Predicted Construction Noise Levels At Representative Sensitive Receptors	996
Table 3.J-15	DMU Alternative - Predicted Construction Vibration Levels At Representative Sensitive Receptors	998
Table 3.J-16	Express Bus/BRT Alternative - Predicted Construction Noise Level At Representative Sensitive Receptors	1001
Table 3.J-17	Express Bus/BRT Alternative - Predicted Construction Vibration Level At Representative Sensitive Receptors	1002
Table 3.J-18	Conventional BART Project - Location of Switches	1009
Table 3.J-19	Conventional BART Project - Predicted Day-Night Noise Levels from BART Trains in 2025.....	1010
Table 3.J-20	DMU Alternative - Location of Switches.....	1014

Table 3.J-21 DMU Alternative – Predicted Day-Night Noise Levels from DMU Trains in 2025..... 1015

Table 3.J-22 Express Bus/BRT Alternative – Predicted Day-Night Noise Levels from Buses in 2025 1019

Table 3.J-23 Modeled I-580 Noise Levels in 2025 1026

Table 3.J-24 Modeled Noise Levels on Local Roadways in 2025 1028

Table 3.J-25 Modeled I-580 Noise Levels in 2040 1034

Table 3.J-26 Modeled Peak Hour Noise Levels on Local Roadways in 2040..... 1035

Table 3.J-27 Conventional BART Project – Predicted Vibration Levels from At-Grade Rail Operations..... 1041

Table 3.J-28 DMU Alternative – Predicted Vibration Levels from At-Grade Rail Operations..... 1041

Table 3.J-29 Modeled I-580 Noise Levels under 2025 Cumulative Conditions 1052

Table 3.J-30 Modeled Noise Levels on Local Roadways under 2025 Cumulative Conditions 1055

Table 3.J-31 Modeled I-580 Noise Levels under 2040 Cumulative Conditions 1059

Table 3.J-32 Modeled Noise Levels on Local Roadways under 2040 Cumulative Conditions 1061

Table 3.K-1 National and California Ambient Air Quality Standards, Effects, and Sources..... 1076

Table 3.K-2 Ambient Air Quality in Alameda County 1080

Table 3.K-3 2015 Estimated Criteria Pollutant Emissions Inventories by Source (County and Air Basin)..... 1085

Table 3.K-4 Annual Average Ambient Concentrations of Volatile Organic Compound Carcinogenic TACs in Livermore..... 1088

Table 3.K-5 Sensitive Receptors for Health Risk Assessment..... 1093

Table 3.K-6 Change in Annual Net Passenger VMT..... 1113

Table 3.K-7 Summary of Air Quality Impacts 1127

Table 3.K-8 Average Daily Construction-Related Emissions 1135

Table 3.K-9 Average Daily Construction-Related Emissions after mitigation- Conventional BART Project and DMU Alternative 1136

Table 3.K-10 Maximum Excess Construction Cancer Risk at Off-Site Receptors 1139

Table 3.K-11 Maximum Annual Average Construction PM_{2.5} Concentrations at Off-Site Receptors 1139

Table 3.K-12 Mitigated Average Daily Construction-Related Emissions (Express Bus/BRT Alternative)..... 1142

Table 3.K-13 Maximum Excess Construction Cancer Risk at Off-Site Receptors after mitigation 1143

Table 3.K-14 Maximum Annual Average Construction PM_{2.5} at Off-Site Receptors after mitigation 1143

Table 3.K-15 Average Net New Daily Operational Emissions in 2025 1154

Table 3.K-16 Net New Annual Operational Emissions in 2025..... 1155

Table 3.K-17	Average Net New Daily Operational Emissions in 2040	1157
Table 3.K-18	Net New Annual Operational Emissions in 2040.....	1158
Table 3.K-19	Maximum Operational Project Cancer Risk at Off-Site Receptors in 2025	1161
Table 3.K-20	Maximum Annual Average Operational Project PM _{2.5} Concentrations at Off-Site Receptors in 2025	1162
Table 3.K-21	Maximum Operational Project Cancer Risk at Off-Site Receptors in 2040	1166
Table 3.K-22	Maximum Annual Average Operational Project PM _{2.5} Concentrations at Off-Site Receptors in 2040	1167
Table 3.K-23	Peak Hourly Intersection Traffic Counts in 2025	1172
Table 3.K-24	Peak Hourly Intersection Traffic Counts in 2040	1174
Table 3.K-25	Maximum Operational Cancer Risk at Off-Site Receptors, 2025 Cumulative Conditions	1183
Table 3.K-26	Maximum Annual Average Operational PM _{2.5} Concentrations at Off- Site Receptors, 2025 Cumulative Conditions	1184
Table 3.K-27	Maximum Operational Cancer Risk at Off-Site Receptors, under 2040 Cumulative Conditions	1190
Table 3.K-28	Maximum Annual Average Operational PM _{2.5} Concentrations at Off- Site Receptors, under 2040 Cumulative Conditions	1191
Table 3.L-1	Global Warming Potentials of Principal Greenhouse Gases.....	1201
Table 3.L-2	Net Change in BART Car Miles, DMU/EMU Miles, and Bus Miles for 2025 and 2040 Project and Cumulative Conditions	1218
Table 3.L-3	Net Change in Passenger Vehicle Miles Traveled	1221
Table 3.L-4	Summary of Greenhouse Gas Emissions Impacts	1222
Table 3.L-5	GHG Emissions from Construction of Proposed Project and Build Alternatives	1225
Table 3.L-6	Time to Offset Construction GHG Emissions due to Operational Emission Reductions.....	1227
Table 3.L-7	Change in Annual GHG Emissions under 2025 Project Conditions	1230
Table 3.L-8	Change in Annual GHG Emissions under 2040 Project Conditions	1239
Table 3.L-9	Change in Annual GHG Emissions under 2025 Cumulative Conditions	1247
Table 3.L-10	Change in Annual GHG Emissions under 2040 Cumulative Conditions	1252
Table 3.M-1	Origin of California Energy Supply	1260
Table 3.M-2	Natural Gas Use in California by Sector	1261
Table 3.M-3	Petroleum Use in California by End Use Fuel Type	1261
Table 3.M-4	Electricity End Use in California by Sector	1264
Table 3.M-5	Net Change in BART Car Miles, DMU/EMU Miles, and Bus Miles for 2025 and 2040 Project and Cumulative Conditions	1276
Table 3.M-6	Net Change in Passenger Vehicle Miles Traveled	1279

Table 3.M-7 Summary of Energy Impacts 1280

Table 3.M-8 Energy Use During Construction 1282

Table 3.M-9 Change in Annual Energy Use under 2025 Project Conditions 1287

Table 3.M-10 Change in Annual Energy Use under 2040 Project Conditions 1296

Table 3.M-11 Change in Annual Energy Use under 2025 Cumulative Conditions..... 1306

Table 3.M-12 Change in Annual Energy Use under 2040 Cumulative Conditions..... 1312

Table 3.N-1 Environmental Database Sites Within the Study Area 1321

Table 3.N-2 Environmental Database Sites Within The collective Footprint 1324

Table 3.N-3 Schools within 0.25-Mile of the Collective Footprint 1327

Table 3.N-4 Example Magnetic Field Strengths 1333

Table 3.N-5 ICNIRP Electric and Magnetic Field Thresholds for General Public Exposure..... 1357

Table 3.N-6 ACGIH Electric and Magnetic Field Thresholds for Workers Wearing Medical Devices..... 1358

Table 3.N-7 BART Train Measurement Locations 1358

Table 3.N-8 EMU Train Measurement Locations 1359

Table 3.N-9 Summary of Public Health and Safety Impacts 1360

Table 3.N-10 Measured EMF for BART Trains and Thresholds..... 1386

Table 3.N-11 Measured EMF for EMU Trains and Thresholds 1387

Table 3.O-1 BART Police Department Calls and Crimes – Fourth Quarter Fiscal Year 2016 1404

Table 3.O-2 Livermore-Pleasanton Fire Department Calls for Service History 1407

Table 3.O-3 Summary of Community Services Impacts..... 1412

Table 3.P-1 Major Utility Lines in the Collective Footprint 1438

Table 3.P-2 Summary of Utilities Impacts 1441

Table 3.P-3 Water Consumption – Conventional BART and Build Alternatives 1450

Table 3.P-4 Wastewater Generation – Conventional BART and Build Alternatives 1450

Table 3.P-5 Solid Waste Generation – Conventional BART and Build Alternatives 1459

Table 4-1 Summary of Significant Impacts 1484

Table 4-2 Summary of Beneficial Impacts..... 1490

Table 5-1 Summary of Quantitative Beneficial Effects under 2040 Project and Cumulative Conditions 1495

Table 5-2 Comparison of Metropolitan Transportation Commission Resolution #3434 – Thresholds with Existing and Planned Housing Units in 2040 1503

Table 5-3 Plan Bay Area Goals and Performance Targets 1504

Acronym List

AB	Assembly Bill
ABAG	Association of Bay Area Governments
AC	alternating current
ACDEH	Alameda County Department of Environmental Health
ACE	Altamont Corridor Express
ACGIH	American Conference of Governmental Industrial Hygienists
ACWD	Alameda County Water District
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
af	acre-feet
afy	acre-feet per year
AIA	Airport Influence Area
ALUC	Airport Land Use Commissions
ALUCP	Airport Land Use Compatibility Plan
APA	Airport Protection Area
APCO	Air Pollution Control Officer
APN	Assessor's Parcel Number
APSA	Aboveground Petroleum Storage Act
ASR	Archeological Survey Report
ASTM	American Society for Testing and Materials
ATCM	Airborne Toxic Control Measure
B	beneficial impact
BAAQMD	Bay Area Air Quality Management District
BART	San Francisco Bay Area Rapid Transit District
BART Police	BART Police Department
Basin Plan	San Francisco Bay Basin Water Quality Control Plan
Bay Area	San Francisco Bay Area
bgs	below ground surface
BMP	best management practice
BRT	bus rapid transit
BTU	British thermal units
BTU/gal	British thermal units per gallon
BUOW	burrowing owl
CAA	Clean Air Act (federal)
CAAQS	California Ambient Air Quality Standards
CAFE	Corporate Average Fuel Economy (standards)
CAL FIRE	California Department of Forestry and Fire Protection

CalARP	California Accidental Release Prevention Program
CalEEMod®	California Emission Estimator Model, version 2013.2.2
CalEPA	California Environmental Protection Agency
Cal/OSHA	California Division of Occupational Safety and Health
California CAA	State of California Clean Air Act
California Register	California Register of Historical Resources
Caltrans	California Department of Transportation
CalWater	California Water Service Company
CARB	California Air Resources Board
CARE	Community Air Risk Evaluation
CBC	California Building Code
CBIA	California Building Industry Association
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CGP	Construction General Permit
CGS	California Geological Survey
CHMIRS	California Hazardous Material Incident Reporting System
CHRIS	California Historical Resources Information System
CaHSR	California High Speed Rail
CIA	Community Impact Assessment
CNDDB	California Natural Diversity Database
CNEL	community noise equivalent level
CNPS	California Native Plant Society
CO	carbon monoxide
CO ₂	carbon dioxide
CO ₂ e	carbon dioxide equivalent
CPUC	California Public Utilities Commission
CRLF	California red-legged frog
CRPR	California Rare Plant Rank
CSS	Caltrans' Context Sensitive Solutions
CTS	California tiger salamander
CUPA	Certified Unified Program Agency

CWA	Clean Water Act
dB	decibel
dBA	A-weight decibel
DC	direct current
DHS	California Department of Health Services
DMU	diesel multiple unit
DPM	diesel particulate matter
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EACCS	East Alameda County Conservation Strategy
eBART	East Contra Costa County BART Extension
EDR	Environmental Data Resources, Inc.
EIR	environmental impact report
EMF	electromagnetic field
EMR	electromagnetic radiation
EMU	electrical multiple unit
EPA	United States Environmental Protection Agency
ERNS	Emergency Response Notification System
ESA	environmental site assessment
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FHWA	Federal Highway Administration
FMMP	Farmland Mapping and Monitoring Program
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
g	gravity
g/hp-hr	gram per horsepower-hour
GHG	greenhouse gas
GO	General Order
gpd	gallons per day
gpy	gallons per year
GSP	groundwater sustainability plan
HAP	hazardous air pollutant
HCP	habitat conservation plan
HMBP	hazardous materials business plan
HMIRS	Hazardous Materials Incident Reporting System
HP	horsepower
HPSR	historic properties survey report

HRA	health risk assessment
HRER	historical resources evaluation report
HSC	California Health and Safety Code
Hz	Hertz
I-	Interstate Highway
IARC	International Agency for Research on Cancer
ICNIRP	International Commission on Non-Ionizing Radiation Protection
in/sec	inch(es) per second
INP	Isabel Neighborhood Plan
ISA	initial site assessment
kV	kilovolts
kW	kilowatt
kWh	kilowatt-hour
LAVTA	Livermore-Amador Valley Transportation Authority
LAVWMA	Livermore-Amador Valley Water Management Agency
lbs/day	pounds per day
L_{dn}	day-night average noise level
L_{eq}	equivalent A-weighted noise level
$L_{eq}(h)$	equivalent A-weighted noise level over 1 hour
LHFS	longhorn fairy shrimp
LID	low-impact development
LLNL	Lawrence Livermore National Laboratory
L_{max}	maximum sound level
LQG	large-quantity generators
LS	less-than-significant impact
LSM	less-than-significant impact with mitigation
LUST	leaking underground storage tank
m	milli (1 thousandth)
MACT	maximum achievable control technology
MAP-21	Moving Ahead for Progress in the 21st Century Act
MAX	Modesto Area Express
MBTA	Migratory Bird Treaty Act
MEISR	maximally exposed individual sensitive receptor
mG	milliGauss
mgd	million gallons per day
mg/L	milligrams per liter
mph	miles per hour
MM	Modified Mercalli
MMRP	mitigation monitoring and reporting program
MRP	Municipal Regional Stormwater NPDES Permit

MRZ	Mineral Resource Zone
MSAT	mobile source air toxics
MS4	Municipal Separate Storm Sewer Systems
msl	mean sea level
MTC	Metropolitan Transportation Commission
MW	megawatt
M_w	Moment Magnitude scale
NAAQS	National Ambient Air Quality Standards
NAHC	Native American Heritage Commission
National Register	National Register of Historic Places
NCCP	natural community conservation plan
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act
NI	no impact
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOI	notice of intent
NOP	notice of preparation
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List (Superfund sites)
NSPS	New Source Performance Standards
NSR	New Source Review
NWIC	Northwest Information Center
O&M	operations and maintenance
OEHHA	California's Office of Environmental Health Hazard Assessment
OHP	California Office of Historic Preservation
PCB	polychlorinated biphenyl
PDA	Priority Development Area
PEIR	Program EIR
PG&E	Pacific Gas and Electric Company
PGA	peak ground acceleration
PM	particulate matter
$PM_{2.5}$	fine particulate matter, less than 2.5 microns in diameter
PM_{10}	respirable particulate matter, less than 10 microns in diameter
ppm	parts per million
PPV	peak particle velocity
PRC	Public Resources Code
PV	photovoltaic

PWS	planning watershed
RCRA	Resource Conservation and Recovery Act
RDP	ridership development plan
ROG	reactive organic gas
ROW	right-of-way
RTA	rail transit agency
RTD	(San Joaquin) Regional Transit District
RTP	regional transportation plan
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SEMS	Superfund Enterprise Management System
SEP	BART System Expansion Policy
SFBAAB	San Francisco Bay Area Air Basin
SGMA	Sustainable Groundwater Management Act
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJRRC	San Joaquin Regional Rail Commission
SJKF	San Joaquin kit fox
SLIC	spills, leaks, investigations and cleanup
SNL	Sandia National Laboratory
SO ₂	sulfur dioxide
SO _x	oxides of sulfur
SPCC	Spill Prevention, Control, and Countermeasure
SQG	small-quantity generators
SSPP	BART System Safety Program Plan
State	State of California
SU	significant and unavoidable impact
SVP	Society of Vertebrate Paleontology
SWMP	Stormwater Management Plan
SWP	State Water Project
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	toxic air contaminant
T-BACT	best available control technology
TDS	total dissolved solids
TIP	transportation improvement program
TLV	Threshold Limit Value
TMDL	total maximum daily load
TOD	transit-oriented development
tpd	ton(s) per day

tpy	ton(s) per year
TPSS	traction power substation
UGB	urban growth boundary
ULSD	ultra-low-sulfur diesel
U.S.	United States
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UST	underground storage tank
UXO	Unexploded Ordinance
V	volts
VdB	vibration decibel
V/m	volts per meter
VMT	vehicle miles traveled
VOC	volatile organic compound
VPFS	vernal pool fairy shrimp
WDR	waste discharge requirements
WPT	western pond turtle
WUIC	Wildland-Urban Interface Code
Zone 7	Zone 7 Water Agency of the Alameda County Flood Control and Water Conservation District
°F	degrees Fahrenheit
μ	micro (1 millionth)
μS/cm	microSiemens per centimeter
μT	microtesla

