# Table of Contents

## Volume I: Draft SEIS/SEIR


**List of Tables** ..... **xii**

**List of Figures** ..... **xviii**

**Executive Summary** ..... **ES-1**

ES.1 Introduction ..... ES-1

ES.2 Overview ..... ES-2

ES.2.1 Project Alternatives ..... ES-2

ES.2.2 Changes Since the Release of the Draft SEIS/SEIR ..... ES-3

ES.3 Why Supplemental EIS and Subsequent EIR Document? ..... ES-4

ES.4 Public and Agency Involvement ..... ES-18

ES.4.1 Scoping ..... ES-18

ES.4.2 Areas of Controversy ..... ES-18

ES.5 Public Circulation of Draft SEIS/SEIR ..... ES-19

ES.6 Issues to be Resolved ..... ES-19

ES.7 Impacts and Mitigation Measures ..... ES-20

ES.7.1 NEPA ..... ES-20

ES.7.2 CEQA ..... ES-41

**Chapter 1 Purpose and Need** ..... **1-1**

1.1 Introduction ..... 1-1

1.1.1 Regional Transportation Network ..... 1-1

1.1.2 Overview of the BART Extension ..... 1-3

1.2 Purpose and Need for Transportation Improvements ..... 1-5

1.2.1 Purpose ..... 1-5

1.2.2 Need ..... 1-6

1.3 CEQA Objectives ..... 1-19

1.4 BART Extension Project History ..... 1-20

1.5 Organization of this Document ..... 1-24

**Chapter 2 Alternatives** ..... **2-1**

2.1 Introduction ..... 2-1

2.2 NEPA Alternatives ..... 2-7

2.2.1 NEPA No Build Alternative ..... 2-7

2.2.2 NEPA BART Extension Alternative ..... 2-14

2.3 CEQA Alternatives ..... 2-58

2.3.1 CEQA No Build Alternative ..... 2-58

2.3.2 CEQA BART Extension Alternative ..... 2-58

2.3.3 CEQA BART Extension with TOJD Alternative ..... 2-58

2.4 Alternatives Considered and Withdrawn ..... 2-64
2.4.1 Initial Planning and Alternatives Screening ..... 2-64
2.4.2 Consideration of Alignment Variations and Options ..... 2-65
2-A Recommended Project Description/Locally Preferred Alternatives ..... 2-109
2.A.1 VTA Staff Recommended Options ..... 2-109
2.A.2 NEPA Recommended Project – BART Extension Alternative ..... 2-111
2.A.3 CEQA Recommended Project – BART Extension with TOJD Alternative ..... 2-130
2.A.4 Timeline for Future Option Decisions ..... 2-134
2.5 Required Permits and Approvals ..... 2-135
2.B Project Costs ..... 2-139
2.6 Construction Schedule ..... 2-139
**Chapter 3 NEPA and CEQA Transportation Operation Analysis ..... 3-1**
3.1 Introduction ..... 3-1
3.2 Regulatory Setting ..... 3-2
3.2.1 Methods of Analysis ..... 3-3
3.2.2 Thresholds of Significance ..... 3-11
3.3 2015 Existing Conditions ..... 3-17
3.3.1 Transit Service ..... 3-17
3.3.2 Bicycle Facilities ..... 3-25
3.3.3 Pedestrian Facilities ..... 3-32
3.3.4 Vehicular Traffic ..... 3-34
3.4 2035 Forecast Year Transit System and Performance ..... 3-45
3.4.1 Transit Improvements ..... 3-45
3.4.2 No Build Alternative Transit Trips ..... 3-45
3.4.3 BART Extension Transit Trips ..... 3-48
3.4.4 Conclusion ..... 3-54
3.5 Freeway, Roadway, and Transportation System Performance ..... 3-55
3.5.1 2035 Forecast Year No Build Alternative ..... 3-55
3.5.2 BART Extension Alternative ..... 3-62
3.5.3 BART Extension with TOJD Alternative ..... 3-89
**Chapter 4 NEPA Alternatives Analysis of Operations ..... 4-1**
4.1 Introduction ..... 4-1
4.2 Air Quality ..... 4.2-1
4.2.1 Introduction ..... 4.2-1
4.2.2 Environmental and Regulatory Setting ..... 4.2-1
4.2.3 Methodology ..... 4.2-9
4.2.4 Environmental Consequences and Mitigation Measures ..... 4.2-11
4.2.5 NEPA Conclusion ..... 4.2-17
4.3 Biological Resources and Wetlands ..... 4.3-1

4.3.1 Introduction....4.3-1
4.3.2 Environmental and Regulatory Setting....4.3-1
4.3.3 Methodology....4.3-14
4.3.4 Environmental Consequences and Mitigation Measures....4.3-14
4.4 Community Facilities and Public Services....4.4-1
4.4.1 Introduction....4.4-1
4.4.2 Environmental and Regulatory Setting....4.4-1
4.4.3 Methodology....4.4-14
4.4.4 Environmental Consequences and Mitigation Measures....4.4-14
4.4.5 NEPA Conclusion....4.4-17
4.5 Cultural Resources....4.5-1
4.5.1 Introduction....4.5-1
4.5.2 Environmental and Regulatory Setting....4.5-1
4.5.3 Methodology....4.5-16
4.5.4 Environmental Consequences and Mitigation Measures....4.5-17
4.5.5 NEPA Conclusion....4.5-24
4.6 Electromagnetic Fields and Electromagnetic Interference....4.6-1
4.6.1 Introduction....4.6-1
4.6.2 Environmental and Regulatory Setting....4.6-1
4.6.3 Methodology....4.6-5
4.6.4 Environmental Consequences and Mitigation Measures....4.6-6
4.6.5 NEPA Conclusion....4.6-9
4.7 Energy....4.7-1
4.7.1 Introduction....4.7-1
4.7.2 Environmental and Regulatory Setting....4.7-1
4.7.3 Methodology....4.7-3
4.7.4 Environmental Consequences and Mitigation Measures....4.7-6
4.7.5 NEPA Conclusion....4.7-8
4.8 Geology, Soils, and Seismicity....4.8-1
4.8.1 Introduction....4.8-1
4.8.2 Environmental and Regulatory Setting....4.8-1
4.8.3 Methodology....4.8-3
4.8.4 Environmental Consequences and Mitigation Measures....4.8-4
4.8.5 NEPA Conclusion....4.8-6
4.9 Greenhouse Gas Emissions....4.9-1
4.9.1 Introduction....4.9-1
4.9.2 Environmental and Regulatory Setting....4.9-1
4.9.3 Methodology....4.9-4
4.9.4 Environmental Consequences and Mitigation Measures....4.9-5

4.9.5 NEPA Conclusion....4.9-7
4.10 Hazards and Hazardous Materials....4.10-1
4.10.1 Introduction....4.10-1
4.10.2 Existing Conditions and Regulatory Setting....4.10-1
4.10.3 Methodology....4.10-6
4.10.4 Environmental Consequences and Mitigation Measures....4.10-6
4.10.5 NEPA Conclusion....4.10-8
4.11 Land Use....4.11-1
4.11.1 Introduction....4.11-1
4.11.2 Environmental and Regulatory Setting....4.11-1
4.11.3 Methodology....4.11-22
4.11.4 Environmental Consequences and Mitigation Measures....4.11-23
4.11.5 NEPA Conclusion....4.11-32
4.12 Noise and Vibration....4.12-1
4.12.1 Introduction....4.12-1
4.12.2 Existing Conditions and Regulatory Setting....4.12-1
4.12.3 Methodology....4.12-22
4.12.4 Environmental Consequences....4.12-24
4.12.5 NEPA Conclusion....4.12-55
4.13 Security and System Safety....4.13-1
4.13.1 Introduction....4.13-1
4.13.2 Environmental and Regulatory Setting....4.13-1
4.13.3 Methodology....4.13-5
4.13.4 Environmental Consequences and Mitigation Measures....4.13-5
4.13.5 NEPA Conclusion....4.13-9
4.14 Socioeconomics....4.14-1
4.14.1 Introduction....4.14-1
4.14.2 Environmental and Regulatory Setting....4.14-1
4.14.3 Methodology....4.14-10
4.14.4 Environmental Consequences and Mitigation Measures....4.14-10
4.14.5 NEPA Conclusion....4.14-17
4.15 Utilities....4.15-1
4.15.1 Introduction....4.15-1
4.15.2 Environmental and Regulatory Setting....4.15-2
4.15.3 Methodology....4.15-6
4.15.4 Environmental Consequences and Mitigation Measures....4.15-7
4.15.5 NEPA Conclusion....4.15-13
4.16 Visual Quality and Aesthetics....4.16-1
4.16.1 Introduction....4.16-1

4.16.2 Environmental and Regulatory Setting ..... 4.16-1
4.16.3 Methodology ..... 4.16-4
4.16.4 Environmental Consequences and Mitigation Measures ..... 4.16-5
4.16.5 NEPA Conclusion ..... 4.16-37
4.17 Water Resources, Water Quality, and Floodplains ..... 4.17-1
4.17.1 Introduction ..... 4.17-1
4.17.2 Existing Conditions and Regulatory Setting ..... 4.17-1
4.17.3 Methodology ..... 4.17-19
4.17.4 Environmental Consequences and Mitigation Measures ..... 4.17-19
4.17.5 NEPA Conclusion ..... 4.17-27
4.18 Environmental Justice ..... 4.18-1
4.18.1 Introduction ..... 4.18-1
4.18.2 Environmental and Regulatory Setting ..... 4.18-1
4.18.3 Methodology ..... 4.18-17
4.18.4 Environmental Consequences and Mitigation Measures ..... 4.18-18
4.18.5 NEPA Conclusion ..... 4.18-21
**Chapter 5 NEPA Alternatives Analysis of Construction ..... 5-1**
5.1 Introduction ..... 5-1
5.2 Preconstruction Activities ..... 5-1
5.2.1 ~~Final Design and~~ Engineering Phase ..... 5-1
5.2.2 Relocation Planning and ROW Acquisition ..... 5-5
5.2.3 ~~Utilities~~Utility Relocation ..... 5-5
5.2.4 Demolition ..... 5-5
5.3 Construction Activities ..... 5-27
5.3.1 Tunnel, Trackwork, and Ventilation Structures ..... 5-27
5.3.2 Aboveground Stations and Ancillary Facilities Construction ..... 5-74
5.3.3 Systems Installation ..... 5-75
5.3.4 Newhall Maintenance and Storage Facilities Construction ..... 5-79
5.3.5 Revenue Vehicle Procurement ..... 5-79
5.4 Testing and Commissioning ..... 5-79
5.4.1 Systems Integration Testing and Commissioning ..... 5-79
5.4.2 Revenue Service Phase ..... 5-80
5.5 Impacts from Construction of the BART Extension ..... 5-80
5.5.1 Construction Outreach ~~and~~ Management ~~Plan~~Program ..... 5-80
5.5.2 Transportation ..... 5-86
5.5.3 Air Quality ..... 5-113
5.5.4 Biological Resources and Wetlands ..... 5-120
5.5.5 Community Facilities and Public Services ..... 5-131
5.5.6 Cultural Resources ..... 5-132

5.5.7 Electromagnetic Fields and Electromagnetic Interference ..... 5-144
5.5.8 Energy ..... 5-145
5.5.9 Geology, Soils, and Seismicity ..... 5-145
5.5.10 Greenhouse Gas Emissions ..... 5-152
5.5.11 Hazards and Hazardous Materials ..... 5-153
5.5.12 Land Use ..... 5-156
5.5.13 Noise and Vibration ..... 5-157
5.5.14 Security and System Safety ..... 5-175
5.5.15 Socioeconomics ..... 5-176
5.5.16 Utilities ..... 5-179
5.5.17 Visual Quality and Aesthetics ..... 5-185
5.5.18 Water Resources, Water Quality, and Floodplains ..... 5-186
5.5.19 Environmental Justice ..... 5-190

**Chapter 6 CEQA Alternatives Analysis of Construction and Operation ..... 6.1-1**

6.1 Introduction ..... 6.1-1
6.1.1 Transit-Oriented Joint Development Construction Assumptions ..... 6.1-1
6.2 Transportation ..... 6.2-1
6.2.1 Introduction ..... 6.2-1
6.2.2 Environmental Consequences and Mitigation Measures ..... 6.2-1
6.3 Air Quality ..... 6.3-1
6.3.1 Introduction ..... 6.3-1
6.3.1 Regulatory Setting ..... 6.3-1
6.3.2 CEQA Methods of Analysis ..... 6.3-7
6.3.3 CEQA Thresholds of Significance ..... 6.3-12
6.3.4 Environmental Consequences and Mitigation Measures ..... 6.3-13
6.3.5 CEQA Conclusion ..... 6.3-32
6.4 Biological Resources and Wetlands ..... 6.4-1
6.4.1 Introduction ..... 6.4-1
6.4.2 Environmental Setting ..... 6.4-1
6.4.3 Regulatory Setting ..... 6.4-2
6.4.4 CEQA Methods of Analysis ..... 6.4-6
6.4.5 CEQA Thresholds of Significance ..... 6.4-6
6.4.6 Environmental Consequences and Mitigation Measures ..... 6.4-7
6.4.7 CEQA Conclusion ..... 6.4-17
6.5 Community Facilities and Public Services ..... 6.5-1
6.5.1 Introduction ..... 6.5-1
6.5.2 Regulatory Setting ..... 6.5-1
6.5.3 CEQA Methods of Analysis ..... 6.5-4
6.5.4 CEQA Thresholds of Significance ..... 6.5-4

6.5.5 Environmental Consequences and Mitigation Measures ..... 6.5-5
6.5.6 CEQA Conclusion ..... 6.5-12
6.6 Cultural Resources ..... 6.6-1
6.6.1 Introduction ..... 6.6-1
6.6.2 Regulatory Setting ..... 6.6-1
6.6.3 CEQA Methods of Analysis ..... 6.6-6
6.6.4 CEQA Thresholds of Significance ..... 6.6-7
6.6.5 Environmental Consequences and Mitigation Measures ..... 6.6-7
6.6.6 CEQA Conclusion ..... 6.6-14
6.7 Energy ..... 6.7-1
6.7.1 Introduction ..... 6.7-1
6.7.2 Regulatory Setting ..... 6.7-1
6.7.3 CEQA Methods of Analysis ..... 6.7-3
6.7.4 CEQA Thresholds of Significance ..... 6.7-4
6.7.5 Environmental Consequences ..... 6.7-5
6.7.6 CEQA Conclusion ..... 6.7-12
6.8 Geology, Soils, and Seismicity ..... 6.8-1
6.8.1 Introduction ..... 6.8-1
6.8.2 Regulatory Setting ..... 6.8-1
6.8.3 CEQA Methods of Analysis ..... 6.8-2
6.8.4 CEQA Thresholds of Significance ..... 6.8-3
6.8.5 Environmental Consequences and Mitigation Measures ..... 6.8-3
6.8.6 CEQA Conclusion ..... 6.8-11
6.9 Greenhouse Gas Emissions and Climate Change ..... 6.9-1
6.9.1 Introduction ..... 6.9-1
6.9.2 Existing Conditions and Regulatory Setting ..... 6.9-1
6.9.3 CEQA Methods of Analysis ..... 6.9-7
6.9.4 CEQA Thresholds of Significance ..... 6.9-8
6.9.5 Environmental Consequences and Mitigation Measures ..... 6.9-10
6.9.6 CEQA Conclusion ..... 6.9-23
6.10 Hazards and Hazardous Materials ..... 6.10-1
6.10.1 Introduction ..... 6.10-1
6.10.2 Existing and Regulatory Setting ..... 6.10-1
6.10.3 CEQA Methods of Analysis ..... 6.10-6
6.10.4 CEQA Thresholds of Significance ..... 6.10-6
6.10.5 Environmental Consequences and Mitigation Measures ..... 6.10-7
6.10.6 CEQA Conclusion ..... 6.10-21
6.11 Land Use ..... 6.11-1
6.11.1 Introduction ..... 6.11-1

6.11.2 Regulatory Setting ..... 6.11-1
6.11.3 CEQA Methods of Analysis ..... 6.11-33
6.11.4 CEQA Thresholds of Significance ..... 6.11-33
6.11.5 Environmental Consequences and Mitigation Measures ..... 6.11-33
6.11.6 CEQA Conclusion ..... 6.11-56
6.12 Noise and Vibration ..... 6.12-1
6.12.1 Introduction ..... 6.12-1
6.12.2 Regulatory Setting ..... 6.12-1
6.12.3 CEQA Methods of Analysis ..... 6.12-4
6.12.4 CEQA Thresholds of Significance ..... 6.12-9
6.12.5 Environmental Consequences ..... 6.12-10
6.12.6 CEQA Conclusion ..... 6.12-30
6.13 Utilities and Service Systems ..... 6.13-1
6.13.1 Introduction ..... 6.13-1
6.13.2 Regulatory Setting ..... 6.13-1
6.13.3 CEQA Methods of Analysis ..... 6.13-4
6.13.4 CEQA Thresholds of Significance ..... 6.13-4
6.13.5 Environmental Consequences ..... 6.13-5
6.13.6 CEQA Conclusion ..... 6.13-19
6.14 Visual Quality and Aesthetics ..... 6.14-1
6.14.1 Introduction ..... 6.14-1
6.14.2 CEQA Methods of Analysis ..... 6.14-10
6.14.3 CEQA Thresholds of Significance ..... 6.14-10
6.14.4 Environmental Consequences and Mitigation Measures ..... 6.14-10
6.14.5 CEQA Conclusion ..... 6.14-41
6.15 Water Resources, Water Quality, and Floodplains ..... 6.15-1
6.15.1 Introduction ..... 6.15-1
6.15.2 Regulatory Setting ..... 6.15-1
6.15.3 CEQA Methods of Analysis ..... 6.15-4
6.15.4 CEQA Thresholds of Significance ..... 6.15-4
6.15.5 Environmental Consequences ..... 6.15-5
6.15.6 CEQA Conclusion ..... 6.15-20
**Chapter 7 Other NEPA and CEQA Considerations ..... 7-1**
7.1 Cumulative Impacts under NEPA and CEQA ..... 7-1
7.1.1 Regulatory Setting ..... 7-1
7.1.2 Methodology ..... 7-1
7.1.3 Related Projects ..... 7-3
7.1.4 Cumulative Environmental Impacts ..... 7-15
7.2 Growth-Inducing Impacts under NEPA and CEQA ..... 7-48

7.2.1 Growth Inducement Analysis ..... 7-48
7.3 Irreversible and Irretrievable Commitments of Resources under NEPA and CEQA ..... 7-50
7.3.1 Changes in Land Use that Would Commit Future Generations ..... 7-50
7.3.2 Consumption of Nonrenewable Resources ..... 7-51
7.3.3 Irreversible Changes from Environmental Actions ..... 7-51
7.4 Relationship between Short-Term Uses and Long-Term Productivity under NEPA ..... 7-52
7.5 Significant Unavoidable Impacts ~~under CEQA~~ ..... 7-53
7.5.1 BART Extension Alternative (NEPA and CEQA) ..... 7-54
7.5.2 BART Extension with TOJD Alternative (CEQA Only) ..... 7-54
7.6 Environmentally Superior Alternative under CEQA ..... 7-55

**Chapter 8 Section 4(f) ..... 8-1**
8.1 Introduction ..... 8-1
8.2 Regulatory Setting ..... 8-1
8.3 Affected Environment ..... 8-2
8.3.1 Study Area ..... 8-2
8.4 Environmental Effects Analysis ..... 8-14
8.4.1 Criteria for Determining Section 4(f) Use ..... 8-14
8.4.2 Methods ..... 8-15
8.4.3 Effects on Section 4(f) Resources and Potential Use Assessment ..... 8-16
8.4.4 Section 6(f) Consideration ..... 8-21
8.4.5 Conclusion ..... 8-22

**Chapter 9 Financial Considerations ..... 9-1**
9.1 Introduction ..... 9-1
9.2 Capital Costs ..... 9-2
9.2.1 Assumptions Included in the Capital Cost Estimate ..... 9-2
9.2.2 Total Capital Costs in the Estimated Year of Expenditure ..... 9-3
9.3 Operating and Maintenance Costs ..... 9-4
9.3.1 VTA Operated and Assisted Transit Services without the BART Extension ..... 9-5
9.3.2 VTA O&M Costs for BART Extension Service ..... 9-6
9.3.3 Net Annual O&M Costs in the 2035 Forecast Year: All VTA Services ..... 9-8
9.4 Funding Sources of the NEPA Build Alternative ..... 9-9
9.4.1 Capital Cost Funding ..... 9-9
9.4.2 O&M Funding Sources ..... 9-12
9.4.3 Potential Additional Funding Sources ..... 9-13

**Chapter 10 Agency and Community Participation ..... 10-1**
10.1 Summary of Scoping ..... 10-2

10.1.1 Supplemental Environmental Impact Statement/Subsequent Environmental Impact Report ..... 10-2
10.2 Summary of Public Agency Coordination ..... 10-3
10.2.1 Agency Committees ..... 10-3
10.2.2 Coordination Plan Process ..... 10-5
10.3 Consultation Pursuant to Section 106 of the National Historic Preservation Act ..... 10-6
10.3.1 Agencies and Organizations Responsible for Historic Preservation ..... 10-6
10.3.2 Native American Consultation ..... 10-8
10.4 Summary of Public Outreach ..... 10-10
10.4.1 Community Working Groups ..... 10-10
10.4.2 Public Meetings and Workshops ..... 10-11
10.4.3 Newsletters, Fact Sheets, Brochures, and Notices ..... 10-12
10.4.4 Newspaper Distribution List ..... 10-12
10.4.5 Project Information Website ..... 10-13
10.5 Ongoing Public Outreach ..... 10-13
10.A Correspondence Received after the Close of Comment Period for the Draft SEIS/SEIR ..... 10-13
10.6 Chronology of Coordination ..... 10-15
~~10.6.1 Supplemental Environmental Impact Statement/Subsequent Environmental Impact Report~~

**Chapter 11 Distribution of SEIS/SEIR ..... 11-1**
11.1 Elected Officials ..... 11-2
11.1.1 Federal ..... 11-2
11.1.2 State ..... 11-2
11.1.3 County ..... 11-3
11.1.4 City ..... 11-5
11.2 Agencies ..... 11-6
11.2.1 Federal ..... 11-6
11.2.2 State ..... 11-7
11.2.3 West Sacramento, CA 95691 Regional ..... 11-8
11.2.4 County ..... 11-8
11.2.5 City ..... 11-9
11.3 Native Americans ..... 11-11
11.4 Libraries ..... 11-11

**Chapter 12 Definitions, Abbreviations, and Acronyms ..... 12-1**
12.1 Definitions ..... 12-1
12.2 Abbreviations and Acronyms ..... 12-13

**Chapter 13 References ..... 13-1**

**Chapter 14 List of Preparers ..... 14-1**

# Volume II: Response to Comments

**Chapter 1 Introduction....1-1**

1.1 Purpose of the Final Supplemental Environmental Impact Statement/Subsequent Environmental Impact Report ....1-1

1.2 SEIS/SEIR Certification and Project Selection Process ....1-3

1.3 Agency and Community Participation....1-4

1.4 Overview of the Final SEIS/SEIR ....1-4

1.4.1 Volume I....1-5

1.4.2 Volume II....1-5

1.4.3 Volume III....1-6

**Chapter 2 Responses to Comments....2-1**

2.1 Public Review of the Draft SEIS/SEIR ....2-1

2.2 Comments and Responses ....2-1

# Volume III: Appendices

**Appendix A: Notice of Preparation**

**Appendix B: Project Plans and Profiles**

Appendix B.1 – Twin-Bore Tunnel Plans and Profiles

Appendix B. 2 – Single-Bore Tunnel Plans and Profiles

**Appendix C: BART Station Site Plan Concepts**

**Appendix D: Cultural Resources ~~Area of Potential Effects Maps~~**

Appendix D.1 – Architectural/Built Resources Area of Potential Effects Map

Appendix D.2 – Archaeological Resources Area of Potential Effects Map

Appendix D.3 – Draft Programmatic Agreement

# Supporting Documentation

*(Supporting documentation is available on the enclosed CD and on VTA's web site at www.vta.org/bart.)*

**Scoping**

*Environmental Scoping Report*

**Technical Studies and Reports**

**Air Quality**

*Air Quality Study*

**Biological Resources**

*Special-Status Species Lists*

**Cultural Resources**

*Archaeological Resources Technical Report*[1]

*Supplemental Built Environment Survey Report*

*Preliminary Finding of Effects*

**Geology, Soils, and Seismicity**

*Geotechnical Memorandum*

**Hazardous Materials**

*Initial Site Assessment*

**Noise and Vibration**

*Noise and Vibration Technical Report*

**Section 4(f)/6(f)**

*Section 4(f)/6(f) Technical Report*

**Socioeconomics and Environmental Justice**

*Socioeconomics and Environmental Justice Technical Report*

**Transportation**

*Transportation Impact Analysis of the BART Extension*

*Transportation Impact Analysis of the BART Extension and VTA's Transit-Oriented Joint Development*

**Water Resources, Water Quality, and Floodplains**

*Hydrology and Water Quality Technical Report*

*Location Hydraulic Study*

[1] Available upon request to qualified professionals.

# List of Tables


| Table | | Page |
|---|---|---|
| ES-1 | Summary of Adverse Effects and Proposed Mitigation Measures of the NEPA BART Extension Alternative – Construction | ES-22 |
| ES-2 | Summary of Adverse Effects and Proposed Mitigation Measures of the NEPA BART Extension Alternative – Operation | ES-36 |
| ES-3 | Comparison of Adverse Effects After Mitigation for Tunnel Construction Methodology Options (Twin-Bore and Single-Bore) for NEPA BART Extension Alternative | ES-38 |
| ES-4 | Summary of Significant Impacts and Proposed Mitigation Measures of the CEQA BART Extension Alternative – Construction | ES-42 |
| ES-5 | Summary of Significant Impacts and Proposed Mitigation Measures of the CEQA BART Extension Alternative – Operation | ES-54 |
| ES-6 | Summary of Significant Impacts and Proposed Mitigation Measures of CEQA BART Extension with TOJD Alternative – Construction | ES-57 |
| ES-7 | Summary of Significant Impacts and Proposed Mitigation Measures of CEQA BART Extension with TOJD Alternative – Operation | ES-70 |
| 1-1 | Population Growth, 2015 to 2035 | 1-8 |
| 1-2 | Jobs Growth, 2015 to 2035 | 1-9 |
| 1-3 | Activity Centers within the Vicinity of the BART Extension Alternative Stations | 1-14 |
| 2-1 | 2035 No Build Alternative Transit Improvements in BART Silicon Valley Area | 2-8 |
| 2-2 | 2035 No Build Alternative Fleet Size | 2-9 |
| 2-A | Proposed Parking to be Provided as Part of the BART Extension Alternative | 2-17 |
| 2-B | Changes Since Release of the Draft SEIS/SEIR | 2-18 |
| 2-3 | Summary of Proposed TOJD (Revised) | 2-62 |
| 2-C | BART's Access Policy Characteristics of an Urban Station and Diridon Station Characteristics | 2-88 |
| 2-D | NEPA and CEQA BART Alternative Options and VTA Staff Recommendations | 2-110 |
| 2-E | Parking to be Provided as Part of the BART Extension Alternative | 2-114 |
| 2-F | VTA Staff Recommended CEQA Project and Parking | 2-132 |
| 2-4 | Required Permits and Approvals (Revised) | 2-137 |
| 3-1 | Signalized Intersection Level of Service Definitions Based on Delay | 3-7 |
| 3-2 | Signalized Intersection Level of Service Standards | 3-8 |
| 3-3 | Unsignalized Intersection Level of Service Definitions Based on Control Delay | 3-9 |
| 3-4 | Freeway Segment Level of Service Definition Based on Density | 3-10 |
| 3-5 | 2015 Existing Average Weekday Boardings by Transit Operator | 3-24 |
| 3-6 | 2015 Existing Intersection Levels of Service Results Summary | 3-38 |
| 3-7 | Existing Freeway Levels of Service Results Summary by Station | 3-43 |

3-8 2015 Existing and 2035 Forecast Year No Build Conditions Total Weekday Transit Trips ..... 3-46
3-9 2015 Existing and 2035 Forecast Year No Build Alternative Average Weekday Boardings by Transit Operator ..... 3-47
3-10 2035 Forecast Year No Build Alternative Fleet Size ..... 3-48
3-11 2035 Forecast Year No Build and BART Extension Alternatives Average Weekday Boardings by Transit Operator ..... 3-49
3-12 2035 Forecast Year Average Weekday Ridership with the BART Extension Alternative ..... 3-50
3-13 2035 Forecast Year Average Weekday Ridership by Station with the BART Extension Alternative ..... 3-50
3-14 2035 Forecast Year Weekday Transit Trips and New Linked Transit Trips ..... 3-51
3-15 2035 Forecast Year Average Weekday Boardings and Alightings by BART Extension Station ..... 3-51
3-16 2035 Forecast Year Mode of Access by BART Extension Station ..... 3-52
3-17 2035 Forecast Year Weekday Transit Trips Crossing Santa Clara County-Alameda County Line ..... 3-52
3-18 2035 Forecast Year AM Peak Period Door-to-Door Travel Time (Minutes) for Selected Origin-Destination Pairs: No Build versus BART Extension ..... 3-53
3-19 2040 Bicycle/Pedestrian Facility Improvements ..... 3-56
3-20 2035 Forecast Year No Build Alternative Intersection Levels of Service ..... 3-57
3-21 2035 Forecast Year No Build Conditions Freeway Levels of Service ..... 3-60
3-22 2035 Forecast Year No Build Alternative Freeway Ramp Queuing Analysis ..... 3-61
3-23 2015 Existing Trip Generation and Parking Demand with BART Extension Alternative ..... 3-63
3-24 2015 Existing BART Extension Alternative Intersection Analysis Summary ..... 3-64
3-25 2015 Existing BART Extension Alternative Freeway Levels of Service ..... 3-67
3-26 2015 Existing BART Extension Alternative Freeway Ramp Queuing Analysis ..... 3-68
3-27 2035 Forecast Year Trip Generation and Parking Demand with the BART Extension Alternative ..... 3-69
3-A Proposed Parking to Be Provided as Part of the BART Extension Alternative (2040 projections) ..... 3-69
3-28 2035 Forecast Year BART Extension Alternative Intersection Analysis Summary ..... 3-70
3-29 2035 Forecast Year with BART Extension Alternative Freeway Levels of Service ..... 3-72
3-30 2035 Forecast Year BART Extension Alternative Freeway Ramp Queuing Analysis ..... 3-74
3-31 2035 Forecast Year BART Extension Alternative Park-and-Ride Demand ..... 3-82
3-B BART's Access Policy Characteristics of an Urban Station and Diridon Station Characteristics ..... 3-84
3-C Travel Demand Modeling, October 2015 ..... 3-85
3-32 Trip Generation Estimates for Mixed-Use Developments at the Alum Rock/28th Street and Santa Clara Station TOJD Sites (2015 Conditions) ..... 3-93

3-33 2015 Existing Station Drive Access Trips and TOJD Trips....3-95
3-34 2015 Existing BART Extension with TOJD Alternative Intersection Analysis Summary....3-96
3-35 2015 Existing BART Extension with TOJD Freeway Levels of Service....3-99
3-36 2015 Existing with BART Extension with TOJD Freeway Ramp Queuing Analysis....3-101
3-37 2035 Forecast Year BART Extension with TOJD Alternative Intersection Analysis Summary....3-103
3-38 2035 Forecast Year BART Extension with TOJD Alternative Freeway Levels of Service....3-107
3-39 Average Daily VMT and VMT Per Capita for Santa Clara County-Based Trips....3-108
3-40 TOJD Parking....3-122
4.2-1 Federal and State Air Quality Standards and Attainment Status, San Francisco Bay Area....4
4.2-2 2010–2014 Ambient Air Quality Data in BART Extension Vicinity....5
4.2-3 Regional Vehicle Miles Traveled – BART Extension Alternative....16
4.2-4 Estimated Maximum Daily Operational Emissions – Bart Extension Alternative....16
4.4-1 Schools within the Study Area....4.4-9
4.4-2 Parks and Recreational Facilities within the Study Area....4.4-13
4.4-3 Civic, Cultural, and Religious Facilities within the Study Area....4.4-15
4.5-1 Properties Listed in or Previously Determined Eligible for the National Register of Historic Places and California Register of Historical Resources....4.5-12
4.5-2 Properties Determined Eligible for Listing in the National Register of Historic Places and California Register of Historical Resources as Part of the Phase II Extension Project....4.5-14
4.5-A Survey Population Properties that Are Assumed Eligible for Listing in the National Register of Historic Places and/or California Register of Historical Resources as Part of the Phase II Extension Project....4.5-14
4.5-3 Survey Population Properties that Are Historic Resources for CEQA but Are Determined Not Eligible for Listing in the National Register of Historic Places and/or California Register of Historical Resources as Part of the Phase II Extension Project....4.5-14
4.6-1 EMF Levels along BART Extension....4.6-2
4.6-2 ACGIH Guidelines for EMF Exposure....4.6-5
4.6-3 Vertical Field Peak Measurements above Existing, Operating BART Tracks at Hopyard Overpass, Pleasanton for Reference....4.6-6
4.6-4 Vertical Field Peak Measurements below Existing, Operating BART Pleasanton Line at Rodeo Park Underpass at BART/Interstate 580 for Reference....4.6-7
4.6-5 Vertical Field Peak and Range Measurements for Reference....4.6-7
4.6-6 Vertical Field Peak Measurements at Representative BART Stations....4.6-8
4.7-1 Santa Clara County Energy Usage in 2010....4.7-3

4.7-2 Annual Regional Vehicle Miles Traveled (million) for the BART Extension Alternative ..... 4.7-5
4.7-3 Direct and Total BTU Conversion Factors by Fuel Type ..... 4.7-5
4.7-4 Annual Direct and Total Energy Use for the Build Alternative (Million BTU) ..... 4.7-7
4.9-1 Estimated Carbon Dioxide Emissions – BART Extension Alternative ..... 4.9-6
4.12-1 Existing Ambient Noise Levels ..... 4.12-10
4.12-2 FTA Land Use Category and Noise Metric for Transit Impact Criteria ..... 4.12-15
4.12-3 Cumulative Increase Thresholds for Transit Noise Impact ..... 4.12-16
4.12-4 Indoor Groundborne Noise and Vibration Impact Criteria ..... 4.12-19
4.12-5 Interpretation of Vibration Criteria for Detailed Analysis ..... 4.12-20
4.12-6 Summary of Key Parameters for BART Train Wayside Noise Analysis ..... 4.12-22
4.12-7 First-Story, Wayside Noise Impacts from Train Operations ..... 4.12-26
4.12-8 Second-Story, Wayside Noise Impacts from Train Operations ..... 4.12-27
4.12-9 Ambient Noise in Santa Clara and 13th Street Neighborhood ..... 4.12-29
4.12-10 Airborne Train Noise from Santa Clara/13th Street Ventilation Structure ..... 4.12-30
4.12-11 Ambient Noise in Stockton Avenue Neighborhood ..... 4.12-31
4.12-12 Airborne Train Noise from Stockton Ventilation Shaft ..... 4.12-32
4.12-13 Predicted TPSS Noise Levels Near the Downtown San Jose West Station ..... 4.12-34
4.12-14 Predicted TPSS Noise Levels Near the Diridon Station South Option ..... 4.12-34
4.12-15 Predicted TPSS Noise Levels Near the Diridon Station North Option ..... 4.12-34
4.12-16 Groundborne Noise Mitigation -Twin-Bore Option Alignment ..... 4.12-36
4.12-17 Groundborne Noise Mitigation - Twin-Bore, Downtown San Jose Station East Option ..... 4.12-37
4.12-18 Groundborne Noise Mitigation - Twin-Bore, Downtown San Jose Station West Option ..... 4.12-37
4.12-19 Groundborne Noise Mitigation – Twin-Bore, Diridon Station South Option ..... 4.12-37
4.12-20 Groundborne Noise Mitigation – Twin-Bore, Diridon Station North Option ..... 4.12-38
4.12-21 Projected Levels of Groundborne Noise for Twin-Bore Option ..... 4.12-39
4.12-22 Projected Levels of Groundborne Noise for the Twin-Bore Option – Downtown San Jose Station East Option ..... 4.12-46
4.12-23 Projected Levels of Groundborne Noise for Twin-Bore Option – Downtown San Jose Station West Option ..... 4.12-47
4.12-24 Projected Levels of Groundborne Noise for Twin-Bore Option – Diridon Station South Option ..... 4.12-48
4.12-25 Projected Levels of Groundborne Noise for Twin-Bore Option – Diridon Station North Option ..... 4.12-51
4.12-26 Groundborne Noise Mitigation – Single-Bore Alignment ..... 4.12-54
4.12-27 Groundborne Noise Mitigation – Single-Bore, Diridon Station North Option ..... 4.12-55
4.12-28 Groundborne Noise Mitigation – Single-Bore, Diridon Station South Option ..... 4.12-55
4.14-1 Population Change 2010–2040 ..... 4.14-2

4.14-2 Average Household Size ..... 4.14-2
4.14-3 2010–2040 Household Growth ..... 4.14-3
4.14-4 Employment by Sector ..... 4.14-4
4.14-5 2010–2014 Employment Growth ..... 4.14-4
4.14-6 Employment/Unemployment Rates ..... 4.14-4
4.14-7 Median Household Income ..... 4.14-5
4.14-8 Per Capita Income ..... 4.14-5
4.14-9 San Jose General Plan Policies ..... 4.14-7
4.14-10 Santa Clara General Plan Policies ..... 4.14-9
4.14-11 BART Extension Alternative – Summary of Displacements ..... 4.14-12
4.17-1 Creek and River Crossings ..... 4.17-3
4.17-2 Floodplain Information ..... 4.17-5
4.17-3 Existing and Potential Beneficial Uses ..... 4.17-12
4.17-4 303(d)-Listed Water Bodies ..... 4.17-13
4.17-5 303(d)-Listed Water Body – South San Francisco Bay ..... 4.17-13
4.17-6 Summary of Baseline Floodplain Impacts ..... 4.17-26
4.18-1 Demographic Profile of the Study Area and Region ..... 4.18-3
4.18-2 Minority Percent ..... 4.18-3
4.18-3 Study Area Minority Percent Distribution ..... 4.18-5
4.18-4 Low-Income Population ..... 4.18-8
4.18-5 Study Area Low-Income Percent Distribution ..... 4.18-9
5-1 Haul Road Volumes and Number of Truck Trips for the BART Extension Alternative ..... 5-25
5-2 Downtown San Jose Station Twin-Bore Roadway Construction Impacts ..... 5-94
5-3 Construction Emissions Related to the BART Extension ~~Table~~ Alternative ..... 5-116
5-4 FTA Construction Noise Criteria ..... 5-157
5-5 Construction Hours by Jurisdiction ..... 5-158
5-6 Vibration Effects on Sensitive Receptors ..... 5-163
5-7 Demolition and Construction Vibration Activity ..... 5-165
5-8 Noise Emission Limits for Construction Equipment ..... 5-171
5-9 Major Utility Locations along the BART Extension Alignment (36-inch diameter and greater) ..... 5-180
6.3-1 Haul Road Volumes and Number of Truck Trips for the BART Extension Alternative ..... 6.3-8
6.3-2 BAAQMD Thresholds of Significance ..... 6.3-12
6.3-3 Construction Emissions Related to the BART Extension Alternative ..... 6.3-14
6.3-4 Construction Health Risk Assessment: BART Extension ..... 6.3-17
6.3-5 Construction Emissions Related to the Project Alternative: Unmitigated Emissions ..... 6.3-21
6.3-6 Construction Emissions Related to the Project: Mitigated Emissions ..... 6.3-23

6.3-7 Regional Vehicle Miles Traveled: BART Extension with TOJD Alternative .....6.3-25
6.3-8 Net Annual Operational Emissions for the Project Alternative .....6.3-26
6.3-9 Net Daily Operational Emissions for the BART Extension with TOJD Alternative .....6.3-28
6.3-10 Construction Health Risk Assessment: Project Alternative .....6.3-31
6.7-1 Annual Regional Vehicle Miles Traveled (million) for the BART Extension .....6.7-4
6.7-2 Annual Direct and Total Energy Use for the Project Alternative (Million BTU) .....6.7-10
6.7-3 TOJD Per-Service Population Energy Consumption Compared with Santa Clara County Average .....6.7-11
6.9-1 Estimated Carbon Dioxide Emissions: BART Extension Alternative .....6.9-12
6.9-2 Carbon Dioxide Equivalent Emissions: BART Extension and TOJD .....6.9-17
6.9-3 Carbon Dioxide Equivalent Emissions: TOJD .....6.9-18
6.10-1 Schools within One-Quarter Mile of the BART Extension .....6.10-2
6.11-1 Consistency with Applicable Land Use Goals and Policies .....6.11-40
6.11-2 General Plan Land Use and Zoning Designations for the BART Extension with TOJD Alternative .....6.11-54
6.12-1 FTA Construction Noise Criteria .....6.12-3
6.12-2 FTA Construction Vibration Criteria .....6.12-4
6.12-3 Construction Equipment and Noise Emission Levels .....6.12-7
6.12-4 Typical Vibration Levels for Construction Equipment .....6.12-8
6.12-5 Ambient Noise in Santa Clara and 13th Street Neighborhood .....6.12-14
6.12-6 Airborne Train Noise from Santa Clara/13th Street Ventilation Facility .....6.12-15
6.12-7 Ambient Noise in Stockton Avenue Neighborhood .....6.12-16
6.12-8 Airborne Train Noise from Stockton Ventilation Shaft .....6.12-17
6.12-9 Predicted TPSS Noise Levels Near the Downtown San Jose Station West Option .....6.12-18
6.12-10 Predicted TPSS Noise Levels Near the Diridon Station South Option .....6.12-19
6.12-11 Predicted TPSS Noise Levels Near the Diridon Station North Option .....6.12-19
6.12-12 Estimated Noise Levels at Noise-Sensitive Receptors near Newhall Maintenance Facility .....6.12-20
6.12-13 Demolition and Construction Vibration .....6.12-22
6.15-1 Added Impervious Area by Watershed .....6.15-9
6.15-2 Estimated Biotreatment Area .....6.15-9
6.15-3 Added Impervious Area by Watershed .....6.15-16
6.15-4 Estimated Biotreatment Area .....6.15-17
7-1 Summary of Cumulative Impact Methodology .....7-2
7-2 List of Related Projects .....7-4
7-A Summary of Proposed TOJD .....7-15
7-3 Traffic Noise Impacts from the BART Extension with TOJD Alternative .....7-38
7-4 Comparison of Environmental Impacts of Alternatives to the Project Alternative .....7-56
8-1 Potential Section 4(f) Properties (Parks and Recreational Areas) .....8-3

8-2 Historic Properties Determined Eligible for Listing in the NRHP ..... 8-11
9-1 Annual O&M Costs and Operating Revenues for VTA-Operated and Assisted Services under the No Build Alternative—2035 Forecast Year Operating Plans ..... 9-5
9-2 Annual O&M Costs, Capital Reserve Contribution, and Operating Revenues for the BART Extension—2035 Forecast Year Operating Plans ..... 9-7
9-3 Net Annual O&M Costs in the 2035 Forecast Year ..... 9-8
9-4 Capital Cost and Sources of Capital Funding for the Phase II BART Extension Alternative ..... 9-9

# List of Figures


| Figure | | Page |
|---|---|---|
| ES-1 | Regional Location (Revised) | ES-6 |
| ES-2 | BART Extension Alternative (Revised) | ES-8 |
| ES-A | Alum Rock/28th Street Station Plan (Twin-Bore and Single-Bore) | ES-9 |
| ES-B | Downtown San Jose Station East Option Plan (Twin-Bore and Single-Bore) | ES-10 |
| ES-C | Downtown San Jose Station West Option Plan (Twin-Bore and Single-Bore) | ES-11 |
| ES-D | Diridon Station South Option Plan (Twin-Bore and Single-Bore) | ES-12 |
| ES-E | Diridon Station North Option Plan (Twin-Bore and Single-Bore) | ES-13 |
| ES-F | Santa Clara Station (Twin-Bore and Single-Bore) | ES-14 |
| ES-3 | BART Extension (with Station options) and Transit-Oriented Joint Development Alternative (Revised) | ES-16 |
| 1-1 | Regional Transportation Network | 1-2 |
| 1-2 | BART System Map | 1-3 |
| 1-3 | BART Extension | 1-4 |
| 1-4 | Freeway Congestion, A.M. Peak Period (3 Hours), 2012 | 1-7 |
| 1-5 | Deteriorating Bus Transit Travel Times | 1-7 |
| 1-6 | 2010 Population Density | 1-10 |
| 1-7 | 2010 Employment Density | 1-11 |
| 1-8 | Growing Downtown Populations | 1-12 |
| 1-9 | Growing Downtown Jobs | 1-12 |
| 1-10 | Households with Limited Mobility, 2010 | 1-13 |
| 1-11 | Activity Centers within the Vicinity of the BART Extension Alternative Stations (Revised) | 1-17 |
| 1-12 | Travel Time With and Without the BART Extension Alternative | 1-18 |
| 2-1 | Regional Location (Revised) | 2-4 |
| 2-2 | Project Location (with Options) (Revised) | 2-6 |
| 2-3 | LRT Service Map | 2-10 |
| 2-4 | Tunnel Options (Revised) | 2-16 |
| 2-5 | Alum Rock/28th Street Station Plan (Twin-Bore ~~and Single-Bore~~) (Revised) | 2-25 |
| 2-A | Alum Rock/28th Street Station Plan (Single-Bore) | 2-26 |
| 2-6 | Downtown San Jose Station East Option ~~Station~~ Plan (Twin-Bore ~~and Single-Bore~~) (Revised) | 2-29 |
| 2-B | Downtown San Jose Station East Option Plan (Single-Bore) | 2-30 |
| 2-7 | Downtown San Jose Station West Option Plan (Twin-Bore ~~and Single-Bore~~) (Revised) | 2-34 |
| 2-C | Downtown San Jose Station West Option Plan (Single-Bore) | 2-35 |
| 2-8 | Diridon Station South Option Plan (Twin-Bore ~~and Single-Bore~~) | 2-39 |

2-D Diridon Station South Option Plan (Single-Bore) ..... 2-40
2-9 Diridon Station North Option Plan (Twin-Bore) (Revised) ..... 2-42
2-10 Diridon Station North Option Plan (Single-Bore) (Revised) ..... 2-44
2-11 Newhall Maintenance Facility ..... 2-48
2-12 Santa Clara Station (Twin-Bore and Single-Bore) (Revised) ..... 2-52
2-13 BART Extension (with Station options) and Transit-Oriented Joint Development (Revised) ..... 2-60
2-E Alternatives Considered and Withdrawn ..... 2-66
2-F BART Extension in a Bridge Over U.S. 101 Alignment Alternative Conceptual Design ..... 2-71
2-G BART Extension in a Bridge Over U.S. 101 with Station at 23rd Street Alignment Alternative Conceptual Design ..... 2-75
2-H BART Extension Under and Adjacent to U.S. 101 Alignment Alternative Conceptual Design ..... 2-78
2-I BART Extension Under U.S. 101 and Anne Darling School Alignment Alternative Conceptual Design ..... 2-80
2-J BART Extension Under U.S. 101 North of McKee Road Alignment Alternative Conceptual Design ..... 2-83
2-K1 Santa Clara Station – Parking Structure North Option ..... 2-92
2-K2 Santa Clara Station – Parking Structure South Option ..... 2-93
2-L Santa Clara Station – Without Parking Structure Option at Diridon Station ..... 2-95
2-M Santa Clara Station Conceptual Site Plan – SVRTP Alternative Only ..... 2-96
2-N Santa Clara Station Conceptual Site Plan – 2015 ..... 2-99
2-O Santa Clara Station Conceptual Site Plan – 2016 ..... 2-100
2-P Santa Clara Station South Option ..... 2-104
2-Q VTA Staff Recommended BART Extension Alternative ..... 2-114
2-R Alum Rock/28th Street Station (Twin-Bore) ..... 2-118
2-S Alum Rock/28th Street Station (Single-Bore) ..... 2-119
2-T Downtown San Jose Station (Twin-Bore) ..... 2-120
2-U Downtown San Jose Station (Single-Bore) ..... 2-121
2-V Diridon Station (Twin-Bore) ..... 2-123
2-W Diridon Station (Single-Bore) ..... 2-124
2-X Newhall Maintenance Facility ..... 2-127
2-Y Santa Clara Station ..... 2-130
2-Z VTA Staff Recommended BART Extension and Transit-Oriented Joint Development ..... 2-132
2-AA Construction Schedule ..... 2-142
3-1 Existing Transit Services – Alum Rock/28th Street Station Area ..... 3-19
3-2 Existing Transit Services – Diridon and Downtown Stations ..... 3-20
3-3 Existing Transit Services – Santa Clara Station Area ..... 3-21

3-4 Existing Bicycle Facilities – Alum Rock/28th Street Station Area....3-29
3-5 Existing Bicycle Facilities – Downtown San Jose Station and Diridon Station Areas....3-30
3-6 Existing Bicycle Facilities – Santa Clara Station Area....3-31
3-7 Study Intersections – Alum Rock/28th Street Station....3-39
3-8 Study Intersections – Diridon Station....3-40
3-9 Study Intersections – Santa Clara Station....3-41
3-10 Proposed Mitigation for Coleman Avenue and Brokaw Road....3-113
3-11 Conceptual Striping Plan – Lafayette Street and Lewis Street....3-114
3-12 Proposed Mitigation for Coleman Avenue and I-880 Southbound Off-Ramp....3-115
4.3-1 CNDDB Plants within 2 Miles....4.3-3
4.3-2 CNDDB Wildlife within 2 Miles....4.3-4
4.3-3 Land Cover Types and Special-Status Wildlife Surveys....4.3-11
4.4-1 Police and Fire Services (Revised)....4.4-4
4.4-2 School and Park Facilities (Revised)....4.4-10
4.4-3 Civic, Religious, ~~Entertainment,~~ and Cultural Facilities (Revised)....4.4-16
4.10-1 Hazardous Materials Locations....4.10-2
4.11-1 San Jose General Plan Land Use Designations – Alum Rock/28th Street Station (Single and Twin Bore) (Revised)....4.11-4
4.11-2 San Jose General Plan Land Use Designations – Downtown San Jose Station East Option (Twin Bore) (Revised)....4.11-6
4.11-A San Jose General Plan Land Use Designations – Downtown San Jose Station East Option (Single Bore)....4.11-7
4.11-3 San Jose General Plan Land Use Designations – Downtown San Jose Station West Option (Twin Bore) (Revised)....4.11-9
4.11-B San Jose General Plan Land Use Designations – Downtown San Jose Station West Option (Single Bore)....4.11-10
4.11-4 San Jose General Plan Land Use Designations – Diridon Station South Option (Single and Twin Bore) (Revised)....4.11-12
4.11-5 San Jose General Plan Land Use Designations – Diridon Station North Option, (Single Bore) (Revised)~~Option~~....4.11-14
4.11-6 San Jose General Plan Land Use Designations – Diridon Station North Option, (Twin Bore) (Revised) ~~Option~~....4.11-16
4.11-7 Santa Clara General Plan Land Use Designations – Santa Clara Station (Single and Twin Bore) (Revised)....4.11-18
4.12-1 Comparison of Various Noise Levels....4.12-3
4.12-2 Examples of Typical Outdoor Noise Exposure....4.12-4
4.12-3 Propagation of Groundborne Vibration into Buildings....4.12-6
4.12-4 Typical Groundborne Vibration Levels and Criteria....4.12-7
4.12-5 Long-term Noise Measurement Locations for Wayside Train Noise....4.12-11
4.12-6 Long-term Noise Measurement Locations at 13th Street Ventilation Structure....4.12-12

4.12-7 Long-term Noise Measurement Locations at Stockton ~~Street~~ Avenue Ventilation Structure ..... 4.12-13
4.12-8 Increase in Noise Levels Allowed by Criteria (Land Use Categories 1 and 2) ..... 4.12-17
4.12-9 Increase in Noise Levels Allowed by Criteria (Land Use Category 3) ..... 4.12-17
4.12-10 Criteria for Detailed Vibration Analysis ..... 4.12-21
4.16-1 Viewpoints Map for Visual Simulations (Revised) ..... 4.16-7
4.16-2 Key Viewpoint 1: Alum Rock/28th Street Station – Santa Clara Street/~~ and~~ North 28th Street (Twin Bore) ..... 4.16-10
4.16-A Key Viewpoint A: Alum Rock/28th Street Station – Santa Clara Street/North 28th Street (Single Bore) ..... 4.16-11
4.16-3 Key Viewpoint 2: 13th Street Ventilation Structure (Single and Twin Bore) ..... 4.16-14
4.16-4 Key Viewpoint 3: Downtown San Jose ~~East~~ Station East Option – City Hall Looking East (Twin Bore) ..... 4.16-15
4.16-5 Key Viewpoint 4: Downtown San Jose ~~East~~ Station East Option – Santa Clara Street/~~ and~~ 4th Street~~s~~ (Twin Bore) ..... 4.16-16
4.16-6 Key Viewpoint 5: Downtown San Jose ~~East~~ Station East Option – Santa Clara Street/~~ and~~ 3rd Street~~s~~ (Single and Twin Bore) ..... 4.16-17
4.16-7 Key Viewpoint 6: Downtown San Jose ~~West~~ Station West Option – Santa Clara Street/Lightson Alley (Twin Bore) ..... 4.16-20
4.16-8 Key Viewpoint 7: Downtown San Jose ~~West~~ Station West Option – 2nd Street/Fountain Alley (Twin Bore) ..... 4.16-21
4.16-B Key Viewpoint B: Downtown San Jose Station West Option – Santa Clara Street/2nd Street (Single Bore) ..... 4.16-22
4.16-C Key Viewpoint C: Downtown San Jose Station West Option – Santa Clara Street/Market Street (Single Bore) ..... 4.16-23
4.16-D Key Viewpoint D: Downtown San Jose Station West Option – Santa Clara Street/Lightson Alley (Single Bore) ..... 4.16-24
4.16-9a Key Viewpoint 8: Diridon Station South Option – Cahill Street Looking Northwest (Twin Bore) ..... 4.16-27
4.16-E Key Viewpoint E: Diridon Station South Option – Cahill Street Looking Northwest (Single Bore) ..... 4.16-28
4.16-9b Key Viewpoint 9: Diridon Station North Option – Santa Clara Street/White Street ~~Looking Northeast~~ (Single and Twin Bore) ~~)~~ ..... 4.16-29
4.16-F Key Viewpoint ~~X~~F: PG&E Substation Connection ..... 4.16-32
4.16-10 Key Viewpoint 10: Santa Clara Station – Benton Street/~~ and~~ El Camino Real (Single and Twin Bore) ..... 4.16-35
4.16-11 Key Viewpoint 11: Santa Clara Station Platform (Single and Twin Bore) ..... 4.16-36
4.17-1 Waterways Crossing the Study Area ..... 4.17-2
4.17-2 Floodplains, Part 1 of 4 ..... 4.17-6
4.17-3 Floodplains, Part 2 of 4 ..... 4.17-7
4.17-4 Floodplains, Part 3 of 4 ..... 4.17-8

4.17-5 Floodplains, Part 4 of 4 (Revised) ..... 4.17-10
4.18-1 Study Area ..... 4.18-2
4.18-2 Minority Percent Distribution ..... 4.18-4
4.18-3 Median Household Income ..... 4.18-7
4.18-4 Percent Below Poverty ..... 4.18-11
4.18-5 Environmental Justice Communities ..... 4.18-13
5-1 Construction Schedule (Revised) ..... 5-4
5-2 Proposed Mabury Road and U.S. 101 Construction Staging Areas (Revised) ..... 5-8
5-3 Proposed Alum Rock Construction Staging Areas (Revised) ..... 5-10
5-4 Proposed 13th Street Mid-Tunnel Ventilation Structure Construction Staging Area (Revised) ..... 5-12
5-5 Proposed Downtown San Jose Station East Option Construction Staging Areas (Revised) ..... 5-14
5-6 Proposed Downtown San Jose Station West Option Construction Staging Areas (Revised) ..... 5-16
5-7 Proposed Diridon Station North Construction Staging Area (Revised) ..... 5-18
5-8 Proposed Diridon Station South Option Construction Staging Area ..... 5-19
5-9 Proposed Stockton Avenue Mid-Tunnel Ventilation Structure Construction Staging Areas ..... 5-20
5-10 Proposed Santa Clara Station Construction Staging Area ..... 5-21
5-11 Proposed Newhall Maintenance Facility Construction Staging Area (Revised) ..... 5-23
5-12 Truck Haul Routes ..... 5-26
5-13 Examples of Tunnel Boring Machines ..... 5-28
5-14 General Arrangement of an Earth Pressure Balanced Tunnel Boring Machine ..... 5-29
5-A General Arrangement of a Slurry Tunnel Boring Machine ..... 5-32
5-B Main Components of a Typical Batch Plant for Slurry TBM ..... 5-33
5-15 Example of Segmental Concrete Lining Units and Rings ..... 5-34
5-16 Conveyor System ..... 5-35
5-17 Diameter and Spacing of Tunnel Bores (TRD) ..... 5-37
5-18 Twin Tunnel Bores ..... 5-38
5-19 Single-Bore Tunnel – Typical Station Cross Section (Revised) ..... 5-42
5-20 ~~Example of~~ (A) Single-Bore Tunnel ~~Transit System~~ – Typical Stacked Guideways Cross Section; (B) Single-Bore Tunnel – Typical Side-by-Side Guideways Cross Section (Revised) ..... 5-44
5-21 Example of Single-Bore Tunnel Station (Revised) ..... 5-48
5-22 Emergency Egress (Cross ~~-~~Passage ~~Connecting the~~) between Twin ~~-~~Bore Tunnels ..... 5-51
5-C Emergency Egress within Transitions for Single Bore Tunnels ..... 5-52
5-23 At-Grade Guideway ..... 5-53
5-24 Retained Cut U-~~Wall~~Section ..... 5-54
5-25 Steel Sheet Piles ..... 5-56

5-26 Lateral Bracing Members ..... 5-57
5-27 Soldier Piles and Lagging ..... 5-58
5-28 ~~Solid~~Soil Nail Wall ..... 5-59
5-29 Temporary Deck Installation ..... 5-62
5-30 Ongoing Excavation After Temporary Deck Installation ..... 5-63
5-31 Temporary Utility Support in an Excavation ..... 5-64
5-32 Basic Components of a Tieback Anchor ..... 5-65
5-33 Deep Soil Mix and Auger Rig Installation ..... 5-68
5-34 Deep Soil Mix and Steel Soldier Piles ..... 5-69
5-35 Trench Remixing and Deep-Wall Method (TRD) ..... 5-70
5-36 Construction of a ~~Diaphragm Slurry~~ Slurry Diaphragm Wall ..... 5-71
5-D Construction of a Secant Pile Wall ..... 5-72
5-E Example of Sequential Excavation Method (SEM) ..... 5-76
5-F Example of Box Jacking ..... 5-77
5-G Example of Pipe Arch ..... 5-78
5-H Diridon Station Area On-Street Parking Supply Within a Half-Mile Radius ..... 5-104
5-I Diridon Station Area On-Street Parking Supply Within a Third-Mile Radius ..... 5-105
5-J Diridon Station Area Off-Street Parking Supply Within a Half-Mile Radius ..... 5-106
5-K Diridon Station Area Off-Street Parking Supply Within a Third-Mile Radius ..... 5-107
6.11-1 San Jose General Plan Land Use Designations – Alum Rock/28th Street Station (Single and Twin Bore) (Revised) ..... 6.11-3
6.11-2 San Jose General Plan Land Use Designations – 13th Street Ventilation Facility (Revised) ..... 6.11-5
6.11-3 San Jose General Plan Land Use Designations – Downtown San Jose Station East Option (Twin Bore) (Revised) ..... 6.11-7
6.11-A San Jose General Plan Land Use Designations – Downtown San Jose Station East Option (Single Bore) ..... 6.11-8
6.11-4 San Jose General Plan Land Use Designations – Downtown San Jose Station West Option (Twin Bore) (Revised) ..... 6.11-10
6.11-B San Jose General Plan Land Use Designations – Downtown San Jose Station West Option (Single Bore) ..... 6.11-11
6.11-5 San Jose General Plan Land Use Designations – Diridon Station South Option (Single and Twin Bore) (Revised) ..... 6.11-13
6.11-6 San Jose General Plan Land Use Designations – Diridon Station North Option (Single Bore) (Revised) ..... 6.11-15
6.11-7 San Jose General Plan Land Use Designations – Diridon Station North Option~~,~~ (Twin ~~-~~Bore) (Revised) ..... 6.11-17
6.11-8 San Jose General Plan Land Use Designations – Stockton Avenue Ventilation Facility (Revised) ..... 6.11-19
6.11-9 Santa Clara General Plan Land Use Designations – Santa Clara Station (Single and Twin Bore) (Revised) ..... 6.11-21

6.14-1 ~~Key~~ Viewpoints Map for Visual Simulations (Revised) ..... 6.14-12
6.14-2 Key Viewpoint 1: Alum Rock/28th Street Station – Santa Clara Street/ ~~and~~ North 28th Street (Twin Bore) ..... 6.14-13
6.14-A Key Viewpoint A: Alum Rock/28th Street Station TOJD – Santa Clara Street/North 28th Street (Single Bore) ..... 6.14-14
6.14-3 Key Viewpoint 2: Alum Rock/28th Street Station TOJD – North 28th Street ~~and~~/Five Wounds Lane (Twin Bore) ..... 6.14-15
6.14-4 Key Viewpoint 3: Downtown San Jose ~~East~~ Station East Option – TOJD & Station Entrance ~~at~~ – Santa Clara ~~and~~ Street/~~6th~~5th Streets (Twin Bore) ..... 6.14-16
6.14-B Key Viewpoint B: Downtown San Jose Station East Option TOJD & Station Entrance – Santa Clara Street/5th Street (Single Bore) ..... 6.14-17
6.14-5 Key Viewpoint 4: Downtown San Jose ~~East~~ Station East Option – TOJD & Station Entrance ~~at~~ – Santa Clara ~~and~~ Street/4th Streets (Twin Bore) ..... 6.14-18
6.14-C Key Viewpoint C: Downtown San Jose Station East Option TOJD & Station Entrance – Santa Clara Street/4th Street (Single Bore) ..... 6.14-19
6.14-6 Key Viewpoint 5: Downtown San Jose ~~East~~ Station East Option – TOJD ~~at~~ – Santa Clara ~~and~~ Street/3rd Streets (Twin Bore) ..... 6.14-20
6.14-7 Key Viewpoint 6: Downtown San Jose ~~West~~ Station West Option – TOJD & Station Entrance ~~at~~ – Santa Clara ~~and~~ Street/3rd Streets (Twin Bore) ..... 6.14-21
6.14-8 Key Viewpoint 7: Diridon Station North and South Options TOJD ~~along~~ – Santa Clara Street/Autumn Street (Twin Bore) ..... 6.14-22
6.14-9a Key Viewpoint 8: Diridon Station North Option TOJD ~~on~~ – Cahill Street Looking Northwest (Twin Bore) ..... 6.14-23
6.14-D Key Viewpoint D: Diridon Station South Option TOJD & Station Entrance – Cahill Street Looking Northwest (Single Bore) ..... 6.14-24
6.14-9b Key Viewpoint 8: Diridon Station South Option TOJD & Station Entrance ~~on~~ – Cahill Street Looking Northwest (Twin Bore) ..... 6.14-25
6.14-10 Key Viewpoint 9: Stockton Avenue TOJD – From Villa Avenue (Single and Twin Bore) ..... 6.14-26
6.14-11 Key Viewpoint 10: Santa Clara Station TOJD – From ~~the~~ Existing Station Platform (Single and Twin Bore) ..... 6.14-27
6.14-12 Key Viewpoint 11: Santa Clara Station TOJD – From El Camino Real (Single and Twin Bore) ..... 6.14-28
7-1 Cumulative Projects ..... 7-5
8-1 Park and Recreational Facilities within 1,000 feet of BART Extension Alternative ..... 8-8