LINK21

CONNECT NORTHERN CALIFORNIA

ENVIRONMENTAL CONSTRAINTS AND OPPORTUNITIES REPORT

EXECUTIVE SUMMARY

September 2022

DRAFT - DELIBERATIVE

Prepared by:
Link21 Environmental Consultant Team

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ISSUE AND REVISION RECORD

REVISION	DATE	PREPARER(S)	PMC REVIEWER(S) / BART/CCJPA REVIEWER(S)	APPROVER / BART/CCJPA APPROVER	DESCRIPTION/ NOTES
0	06/29/2022	Rich Walter, ICF	Thomas Warrner and Rosanna McGuire, HNTB	Helene Kornblatt, HNTB	DRAFT submittal
	06/29/2022	Rich Walter, ICF	Donald Dean, BART	Donald Dean, BART	DRAFT submittal review
1	09/16/2022	Rich Walter, ICF	Thomas Warrner and Rosanna McGuire, HNTB	Helene Kornblatt, HNTB	DRAFT FINAL submittal
		---			*No review requirement*

SHAREPOINT PATH

Records Center/ENVI Record Center/WPA.02-ENVI-PH1-ECO_Report_Update-EXECUTIVE-SUMMARY-DRAFT_FINAL

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ACRONYMS AND ABBREVIATIONS

ACRONYM/ABBREVIATION	DEFINITION
BART	San Francisco Bay Area Rapid Transit
CCJPA	Capitol Corridor Joint Powers Authority
Bay Area	San Francisco Bay Area
Bay Bridge	San Francisco-Oakland Bay Bridge
BCDC	Bay Conservation and Development Commission
BNSF	BNSF Railway Company
CAHSRA	California High-Speed Rail Authority
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
COGs	councils of governments
CSLC	California State Lands Commission
CWA	Clean Water Act
Delta	Sacramento-San Joaquin Delta
E&O	Engagement and Outreach
ECO	Environmental Constraints and Opportunities
FEMA	Federal Emergency Management Agency
FESA	federal Endangered Species Act
GHG	greenhouse gas
GIS	geographic information system
HCPs	Habitat conservation plans
I-	Interstate
kV	kilovolt
Link21	Link21 Program
MBTA	Migratory Bird Treaty Act
Megaregion	Northern California Megaregion
MMPA	Marine Mammal Protection Act
MPOs	metropolitan planning organizations
MTC	Metropolitan Transportation Commission
MTPs	metropolitan transportation plans
NCCPs	natural community conservation plans

ACRONYM/ABBREVIATION	DEFINITION
NEPA	National Environmental Policy Act
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NPL	National Priorities List
NPS	National Park Service
NRHP	National Register of Historic Places
P&E	Planning and Engineering
PDF	portable document format
PMC	Program Management Consultants
PP	priority populations
RCIS	Regional Conservation Investment Strategy
ROW	right-of-way
RR	Regional Rail
RTPs	regional transportation plans
RWQCB	Regional Water Quality Control Board
SJJPA	San Joaquin Joint Powers Authority
SJRRC	San Joaquin Regional Rail Commission
SMART	Sonoma-Marin Area Rail Transit
SR	State Route
SWRCB	State Water Resources Control Board
TAMC	Transportation Agency for Monterey County
TOC	transit-oriented communities
TOD	transit-oriented development
U.S. EPA	United States Environmental Protection Agency
UCSF	University of California, San Francisco
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USDOT	United States Department of Transportation
USFWS	United States Fish and Wildlife Service

LINK21 PROGRAM TEAM NAMES

TEAM NAME	TEAM MEMBERS
PMC	The HNTB Team
Program Management Team (PMT)	BART/CCJPA + PMC
Consultants	Consultants supporting program identification/project selection
Link21 Team	PMT + Consultants
Environmental Team	Environmental Consultant Team
P&E Team	Planning and Engineering Consultant Team

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EXECUTIVE SUMMARY

ES.1 Introduction

The Link21 Program (Link21) Environmental Team developed this Environmental Constraints and Opportunities (ECO) Report to support Link21 by informing the initial design and development of program concepts and future project alternatives. The Link21 Team includes San Francisco Bay Area Rapid Transit (BART), Capitol Corridor Joint Powers Authority (CCJPA), Program Management Consultants (PMC), and Consultants supporting program identification and project selection. Identification of constraints and opportunities to support Link21's decision-making process is detailed below.

The purpose of identifying constraints at this phase of Link21 is as follows:

- To identify potential adverse effects that may occur due to rail infrastructure;
- To inform program concepts and future project alternatives by supporting an integrated planning and environmental process to consider options to avoid and/or minimize adverse effects;
- To allow evaluation of the environmental performance of different program concepts and future project alternatives; and
- To document the consideration of natural and social environmental resources in early planning to support later environmental review (National Environmental Policy Act [NEPA] and California Environmental Quality Act [CEQA]).

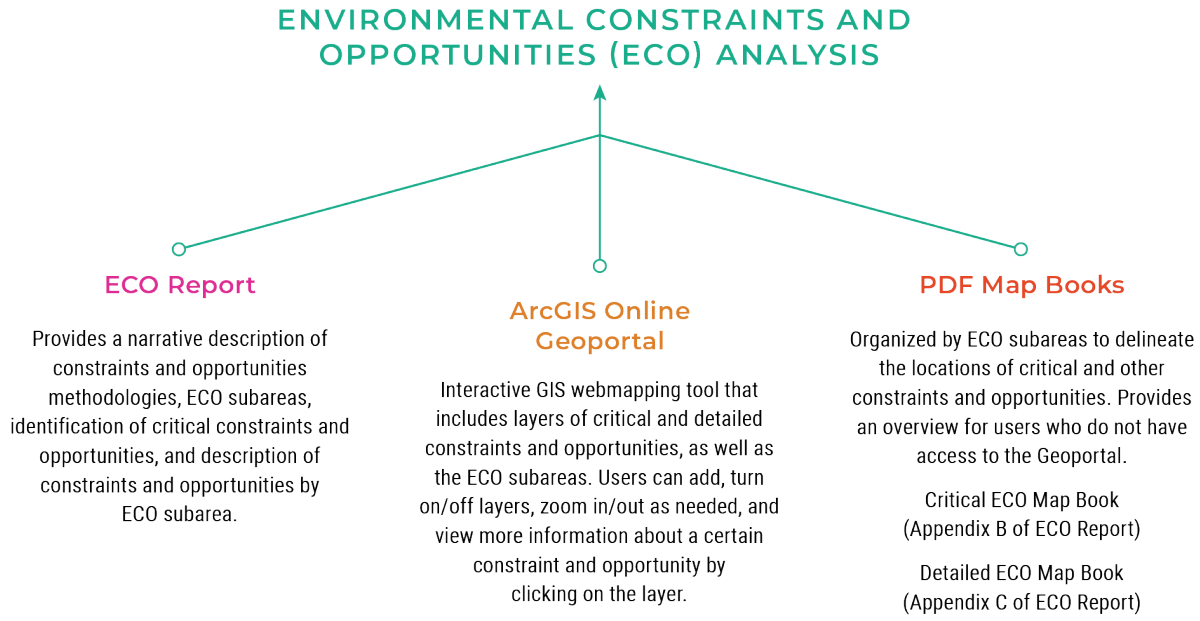
The purpose of identifying opportunities at this phase of Link21 is as follows:

- To identify potential opportunities to further transform the passenger experience, support economic opportunity and global competitiveness, promote equity and livability, and advance environmental stewardship and protection;
- To allow consideration of environmental opportunities along with transportation opportunities identified by the Planning and Engineering (P&E) Team and the Business Case and Market Analysis;
- To inform program concepts and future project alternatives as part of an integrated planning and environmental process to consider a range of opportunities; and
- To document the consideration of opportunities in early planning to support later environmental review (NEPA/CEQA).

The ECO analysis consists of three main components (see **Figure ES-1**): (1) this ECO Report; (2) a geographic information system (GIS) database with locations of environmental constraints and opportunities uploaded to the Link21 Geoportal; and (3) a

series of portable document format (PDF) map books that show the locations of environmental constraints and opportunities.

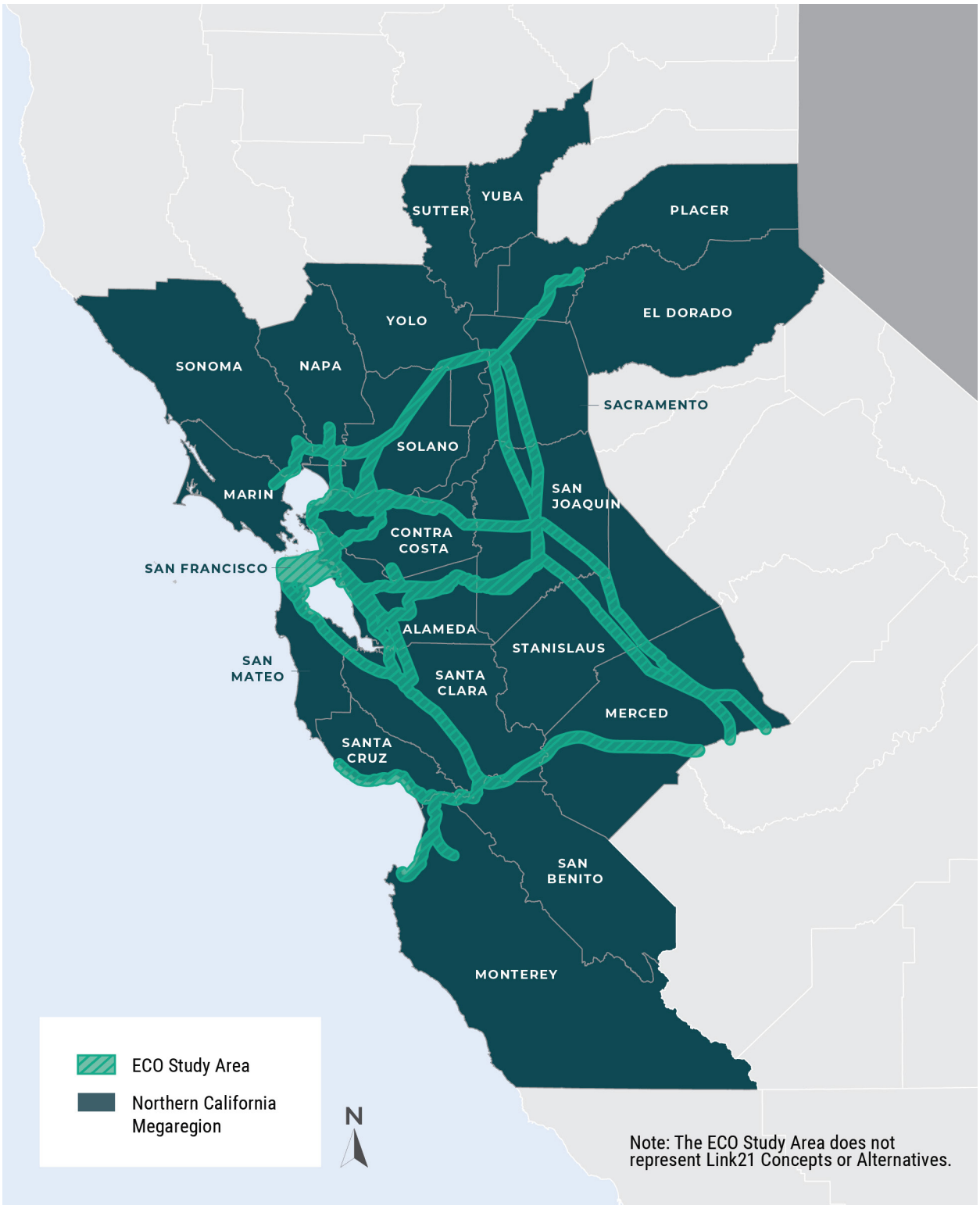
Figure ES-1. Components of the ECO Analysis



ES.2 ECO Study Area

The ECO study area (see **Figure ES-2**) is located within the 21-county Northern California Megaregion (Megaregion), which includes the greater San Francisco Bay Area (Bay Area), the Monterey Bay area, the Sacramento area, and the Northern San Joaquin Valley area. More specifically, the ECO study area includes existing and planned passenger rail networks and transportation hubs as well as other ECO subareas where future rail infrastructure and service improvements may be considered as part of Link21. *The ECO subareas presented in this report are solely for the presentation and discussion of environmental constraints and opportunities; these ECO subareas do not represent program concepts or future project alternatives that may be evaluated under Link21. The ECO subareas do not represent any predetermination of future Link21 corridors.*

Figure ES-2. Link21 ECO Study Area



To describe major constraints and opportunities across the Megaregion, the ECO study area is divided into distinct ECO subareas as follows (see further description in **Chapter 2**):

- In areas of potential new transportation infrastructure where none presently exist, ECO subareas are 0.5 mile wide.
- A more expansive area beyond the 0.5-mile swath was included for the transbay crossing (broad area of potential new rail crossing south of the San Francisco-Oakland Bay Bridge [Bay Bridge] and all of Alameda Island), southeastern San Francisco (including a roughly 1-mile swath from the upper Mission District south to Bernal Heights, and then turns southeast at Islais Creek to India Basin and Hunter's Point), western San Francisco (including the area between Geary to 19th Avenue and the University of California, San Francisco [UCSF]), and Richmond to Martinez (an expansive area from the State Route (SR) 4/Interstate (I-) 80 interchange east to the SR-4/I-680 interchange).
- In areas of existing rail transportation corridors, ECO subareas were defined as within a 1,000-foot swath (nominally 500 feet from the existing rail centerline).
- ECO subareas were identified within the Megaregion to allow discussion on a targeted geographic basis and were identified using logical geographic endpoints.

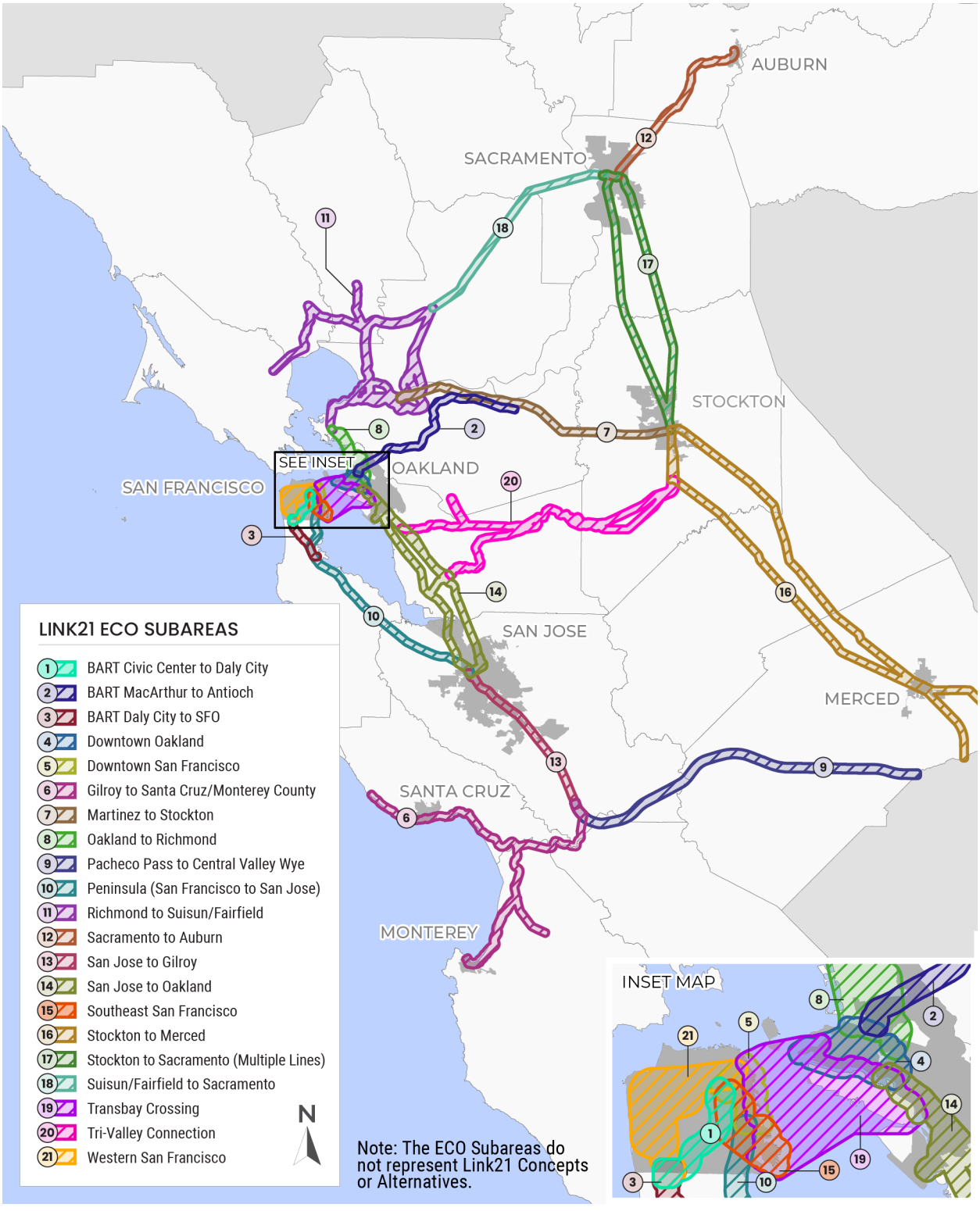
For the purposes of this ECO Report, the following ECO subareas were identified in the Megaregion (see **Figure ES-3**).

1. Transbay Crossing
2. Southeast San Francisco
3. Downtown Oakland
4. Downtown San Francisco
5. Western San Francisco
6. BART Civic Center to Daly City
7. Oakland to Richmond
8. Richmond to Suisun/Fairfield
9. Suisun/Fairfield to Sacramento
10. Sacramento to Auburn
11. Peninsula (San Francisco to San Jose)
12. BART Daly City to San Francisco International Airport (SFO)
13. San Jose to Oakland
14. Martinez to Stockton
15. BART MacArthur to Antioch

16. Tri-Valley Connection
17. Stockton to Sacramento
18. Stockton to Merced
19. San Jose to Gilroy
20. Gilroy to Santa Cruz/Monterey County
21. Pacheco Pass to Central Valley Wye

Certain ECO subareas were further subdivided into smaller portions for ease of reference.

Figure ES-3. Link21 ECO Subareas



ES.3 Methodology

An "environmental constraint" is defined as a physical or social condition that may impede the ability for Link21 to meet its vision, goals, and objectives; impede the ability of priority populations (PP)[1] to experience the benefits of Link21; result in substantial impacts on people or the environment due to infrastructure development; or substantially increase costs and time to implement Link21.

A "transportation opportunity" is defined as an opportunity that could further the Link21 vision, goals, and objectives and/or increase the ability of PP to experience the benefits of Link21.

An "environmental opportunity" is defined as an opportunity to improve the environmental performance of Link21 in terms of reducing impacts or promoting benefits and/or an opportunity that provides for collaboration between Link21 and other efforts that could advance other environmental priorities.

The methodology for developing constraints and opportunities focused on collecting and reviewing the following:

- Geospatial data from publicly available sources
- Draft Final Phase 0 Planning and Engineering Technical Summary Report (Link21 P&E Team 2022)
- Link21 Market Analysis
- Equity Team co-creation data
- Planning documents such as the metropolitan transportation plans (MTPs) or regional transportation plans (RTPs)
- Outreach to metropolitan planning organizations (MPOs) and councils of governments (COGs) to obtain land use data
- Environmental Consultant Team knowledge from experience working in the Megaregion

To support the constraints analysis, the Environmental Consultant Team collected geospatial data for the following subjects for the ECO subareas (see Figure ES-3 for a general mapping of the ECO subareas):

- Transportation, including existing rail lines

[1] Link21 defines PP as the census tracts where people are most affected by negative economic, mobility, community, health, and safety outcomes. Assessing how benefits and impacts from Link21 work could accrue to PP is a key part of the program's equity work. In support of Link21's equity goals, the ECO Report identifies environmental constraints and transportation opportunities for PP. The Link21 Team understands, however, that communities beyond PP have been marginalized. Additional tools and methods will be used to understand Link21's impact on these communities at appropriate points in the program timeline.

- PP developed by the Equity Team
- Community vulnerability/environmental burdens
- Recreation
- Community facilities
- Utilities (major facilities)
- Existing land use
- Important farmland
- Biological resources
- Cultural resources
- Hazardous waste and materials
- Hydrology and sea level rise (SLR)
- San Francisco Bay Conservation and Development Commission (BCDC) jurisdiction

To support the opportunities analysis, the Environmental Consultant Team relied on the Market Analysis, Draft Final Phase 0 Planning and Engineering Technical Summary Report, mapping of PP, and co-creation efforts completed by other Link21 teams. In addition, the Environmental Consultant Team identified opportunities related to collaboration with local and regional efforts for conservation of natural resources, and areas of housing and job growth based on land use plans.

Certain constraints and opportunities were designated as “critical” constraints or opportunities to highlight that these conditions may have substantial effects on feasibility, implementation, or cost. **Table ES-1** and **Table ES-2** define the reasoning behind defining conditions as constraints or opportunities, and designating them as critical.

Chapter 3 describes the methodology used in this report in further detail.

Table ES-1. Overview of Constraints and Critical Constraints Methodology

CONSTRAINT TYPE	WHY IS THIS A CONSTRAINT?	WHAT ASPECTS OF THIS CONSTRAINT ARE CRITICAL?	WHAT DESIGN INTERVENTIONS CAN AVOID THESE CONSTRAINTS?	WHAT OTHER DESIGN AND COLLABORATIVE STRATEGIES CAN AVOID OR LESSEN THESE CONSTRAINTS?
Biological Resources	▫ Typically requires a permit from a regulatory agency or agencies. In-water marine work typically requires permits from USACE, USCG, RWQCBs, and in certain circumstances from CSLC. Stream crossings require some of those same permits, plus a permit from CDFW. NMFS and USFWS require consultation on threatened and endangered species; CDFW requires permits for impacts on state species. Projects within the San Francisco Bay or its immediate shoreline require permits from BCDC. ▫ Biological resources constraints highlighted in this report are for species, habitats, or resource types for which permitting is complex and challenging, require time in agency consultations, may require refinements to design, and/or require expensive mitigation. ▫ Various local and regional environmental groups are interested in preservation of these resources.	Navigable waters, critical habitats, rare resources, protected areas including conservations easements, and mitigation banks.	Horizontal or vertical shifts often can avoid or lessen these impacts. Planning for wildlife movement as an essential element of design in critical movement areas.	Partnering with nonprofits, local municipalities, or other public agencies early can help identify aspects of the design that could cause public controversy so that they can be avoided or minimized prior to the release of the environmental document. Local groups also have location-specific knowledge which can help identify and address constraints. Partnerships would also increase the benefits of the program, such as to maximize wetland restoration, riparian enhancement, flood protection, and habitat restoration and enhancement efforts would be an opportunity to complete mitigation, share funds, and support underfunded areas. Optimizing the biological benefits of the program could help reduce public controversy over the program.
Cultural Resources	▫ Requires compliance with procedures outlined in various laws such as Section 106 of the NHPA; state and local controls protecting cultural resources, including consultation and coordination with Native American representatives, local preservation groups, and NPS for NHLs. Lengthy consultation and costly mitigation required. ▫ Cultural resources include sites/objects, buildings, and districts. ▫ Properties listed or eligible for listing in the NRHP are afforded the highest protection by federal law. ▫ Encroachment on sacred lands requires consultation with Native American representatives under state and federal regulations. ▫ Active local preservation and community groups are interested in preservation of these resources and public controversy.	Built resources (buildings, structures, objects, and districts) listed in and eligible for listing in historic registers, including NHLs. Archaeological and tribal resources including Native American village locations, burial sites, and sacred lands.	For surface sites, horizontal or vertical shifts often can avoid or lessen impacts. For buried archaeological sites, horizontal alignment shifts can avoid or lessen impacts. Design within historical districts or near historic structures requires case-by-case evaluation based on features of the resources to identify design approaches that would avoid and minimize effects on character-defining features. Project designs that are developed to comply with the Secretary of the Interior's Standards and other applicable preservation standards would reduce the likelihood of impacts on significant cultural resources.	There are opportunities to streamline the Section 106 process by using programmatic approaches in order to save time and evaluation efforts. Archaeological and geoarchaeological sensitivity assessments can streamline time-consuming identification of buried archaeological sites.

CONSTRAINT TYPE	WHY IS THIS A CONSTRAINT?	WHAT ASPECTS OF THIS CONSTRAINT ARE CRITICAL?	WHAT DESIGN INTERVENTIONS CAN AVOID THESE CONSTRAINTS?	WHAT OTHER DESIGN AND COLLABORATIVE STRATEGIES CAN AVOID OR LESSEN THESE CONSTRAINTS?
Section 4(f) Resources	▫ By statute, requires consideration of publicly owned park and recreation lands (including public trails, recreational area parts of public schools open to the public, publicly owned golf courses, and sometimes civic plazas), publicly owned wildlife and waterfowl refuges, and publicly or privately owned historic sites listed on or eligible for listing on the NRHP during transportation project development. ▫ When there is use (impact) of Section 4(f) properties, the federal lead agency must determine no feasible and prudent alternative can avoid these Section 4(f) properties and that the project includes all possible planning to minimize harm to the Section 4(f) properties. ▫ Requires consultation with agencies that own/operate these resources. ▫ Section 4(f) issues are sometimes litigated.	All Section 4(f) resources are critical.	For surface resources, horizontal or vertical shifts often can avoid or lessen impacts. For below-ground sites, horizontal alignment shifts can avoid or lessen impacts. Requires case-by-case evaluation based on impacts on the resources.	Identify Section 4f resources early and avoid use of these resources. Wherever avoidance is not feasible or prudent, minimize harm so that the use would quality for *de minimis* determinations.
Land Use	▫ Dense urban areas can present physical constraints for new rail infrastructure due to limited available ROW; presence of buildings with deep foundations and large underground facilities; proximity of sensitive receptors; and effects on circulation, community and business activities, utilities, and visual quality. ▫ Acquisition of commercial, residential, and cultural facilities, especially in urban areas with high density, can lead to further issues, such as displacement and community disruption. ▫ Land ownership, especially on federal and Native American-owned lands, can require lengthy coordination. ▫ Urban growth boundaries by local agencies can restrict growth outside the boundaries.	Federal and Native American lands and lands outside urban growth boundaries.	Vertical shifts (typically undergrounding) can avoid or lessen impacts.	Plan rail investments in urban areas that are targeted growth areas, which are typically served by existing or planned high-quality transit corridors and encompass transit-supportive land uses, areas of substantial growth, and locations that could support connectivity in the Megaregion. Early coordination with municipalities where stations are proposed outside of their identified growth areas.
Agricultural Lands	▫ Federal and state laws protect Prime Farmland and Farmland of Statewide Importance. Design needs to consider minimization of impacts on these categories of farmlands. Can require costly mitigation and design changes such as construction of grade separated access roads for farmlands.	Not critical for this analysis.	Horizontal or vertical shifts can avoid or lessen impacts.	Identify opportunities to partner with agricultural land trusts and opportunities for conservation easements.

CONSTRAINT TYPE	WHY IS THIS A CONSTRAINT?	WHAT ASPECTS OF THIS CONSTRAINT ARE CRITICAL?	WHAT DESIGN INTERVENTIONS CAN AVOID THESE CONSTRAINTS?	WHAT OTHER DESIGN AND COLLABORATIVE STRATEGIES CAN AVOID OR LESSEN THESE CONSTRAINTS?
Community Resources	▫ Level of impact and significance/prominence of the resource matters. For example, a major hospital is hard to relocate, whereas a sliver take of hospital parking is not a major constraint. ▫ The local community that uses the resource may have a deep interest in changes to these facilities. ▫ Community resources are difficult and controversial to relocate unless enhancements are considered.	Public schools, colleges, hospitals, and universities.	Horizontal or vertical shifts can avoid or lessen impacts.	Enhancing linkages to community resources is an opportunity for community benefit. Use of co-creation workshops is an effective tool to identify community benefits. Plan rail investments to serve major community resources (e.g., regional medical facilities, higher education institutions, public facilities) to enhance accessibility.
Hazardous Materials Sites	▫ Hazardous materials sites present constraints because testing and remediation involve cost and time, involve liabilities for the project, and require coordination with regulatory agencies. ▫ Contamination can be in the soil, in buildings and structures, and in the groundwater. ▫ U.S. EPA-designated NPL sites present the highest level of contamination.	While a concern for construction compliance, most hazardous materials sites are not a critical constraint. NPL sites have extensive contamination and substantial liabilities and are a critical constraint.	Horizontal or vertical shifts (aerial) can avoid or lessen impacts.	Brownfield sites present opportunities for siting railyards and maintenance facilities as well as other transportation infrastructure. Depending on the level of contamination or subsequent cleanup, these also can be sites for stations and TOD.
Utilities	▫ Utilities exist underground (e.g., sewer, water, electric), at-grade (e.g., aqueducts, water storage tanks, landfills, wastewater treatment plants), and aboveground (e.g., electric). They are both linear as well as points (e.g., water treatment plant electric substation). Relocation of major utilities is costly, can have secondary environmental impacts, and requires lengthy coordination with various utility providers.	Major transmission lines over 230 kV (as well as submarine cables like the Transbay Cable), pipelines aqueducts, wastewater treatment plants, and power plants.	Coordination with utility service providers for relocation of utilities, including payment for relocation, or horizontal and vertical design shifts can avoid impacts.	Early collection of utility data from other projects and utility providers in the region should be prioritized to identify and locate critical facilities.
Transportation	▫ Existing highways, rail infrastructure, airports, and maritime facilities would require avoidance or costly relocation. ▫ Modifications to or encroachment on major transportation infrastructure could involve costly, time-consuming negotiations with owners and operators. ▫ Demolition of or encroachment on transportation infrastructure constructed using taxpayer dollars is an area of public controversy.	All major transportation infrastructure.	Horizontal or vertical shifts can avoid or lessen impacts.	Connection to projects by others have benefits of creating an RR[2] and transit network. Linkages to other modes like ferries, bikeways, and trails offer regional transportation benefits.
Hydrology and SLR	▫ Areas in the Megaregion that are tidally influenced, especially areas around the Bay, have the potential for inundation in future years from SLR. Areas within 100-year floodplains also have risk of inundation. ▫ Future inundation of land due to SLR and rising groundwater requires consideration in location and design techniques.	SLR (2090 medium-high risk aversion level with 100-year storm, due to permitting requirements and state guidance) and 100-year floodplains.	Specialized design considerations (e.g., berms, raised foundations, and walls) may be needed for construction in areas at risk of inundation.	Early local and regional coordination with municipalities and flood control districts to identify potential design elements and secondary environmental effects. Community outreach can identify areas that are already flooding that may not be captured in existing flood mapping. Community outreach can also identify secondary effects of proposed design elements.

[2] In Link21, Regional Rail (RR) refers to commuter (e.g., Caltrain, Altamont Corridor Express, and Sonoma-Marin Area Rail Transit), intercity (e.g., Capitol Corridor, San Joaquin), and high-speed rail (e.g., California High-Speed Rail) service and operators.

CONSTRAINT TYPE	WHY IS THIS A CONSTRAINT?	WHAT ASPECTS OF THIS CONSTRAINT ARE CRITICAL?	WHAT DESIGN INTERVENTIONS CAN AVOID THESE CONSTRAINTS?	WHAT OTHER DESIGN AND COLLABORATIVE STRATEGIES CAN AVOID OR LESSEN THESE CONSTRAINTS?
PP	▫ PP by themselves are not a constraint but preserving community resources and existing transportation accessibility for these PP needs to be considered during planning and design. ▫ Do not disproportionately burden PP with project impacts (e.g., dividing existing communities, removing bus stops, affecting parks and schools).	Construction within PP communities should be designed to avoid and minimize adverse effects of construction and operation.	PP require consideration in early planning to avoid disproportionately high and adverse effects on these populations.	Providing additional linkages and improving accessibility to transit and rail for PP areas is a goal of Link21, and also allows opportunities to address historical transportation inequities.

CDFW = California Department of Fish and Wildlife

CSLC = California State Lands Commission

kV = kilovolt

NHL = National Historic Landmark

NHPA = National Historic Preservation Act

NMFS = National Marine Fisheries Service

NPL = National Priorities List

NPS = National Park Service

NRHP = National Register of Historic Places

ROW = right-of-way

RR = Regional Rail

RWQCB = Regional Water Quality Control Board

TOD = transit-oriented development

USACE = United States Army Corps of Engineers

USCG = United States Coast Guard

U.S. EPA = United States Environmental Protection Agency

USFWS = United States Fish and Wildlife Service

Table ES-2. Overview of Opportunities and Critical Opportunities Methodology

OPPORTUNITY TYPE	WHY IS THIS AN OPPORTUNITY?	WHAT ASPECTS OF THIS OPPORTUNITY ARE CRITICAL?	HOW CAN DESIGN AND EARLY PLANNING UTILIZE THIS OPPORTUNITY?	WHAT OTHER COLLABORATIVE STRATEGIES CAN HELP UTILIZE THESE OPPORTUNITIES?
Transportation	Transportation opportunities increase ridership, provide mobility, and promote economic welfare by: ▫ Expanding or improving service to areas of equity-weighted unmet transbay rail potential ▫ Increasing system capacity ▫ Building infill stations to meet demand ▫ Enhancing transit opportunities along transit priority corridors	Existing passenger rail lines and stations, and transit priority corridors.	Plan linkages to areas with high transbay equity-weighted unmet rail potential.	Linkages to existing transit and passenger rail lines and stations are opportunities for Link21 to bolster existing infrastructure use.
Land Use	▫ MPOs have identified targeted growth areas and local cities and counties have identified areas where they anticipate housing and job growth appropriate for stations and transit-oriented uses. These growth and development areas would have high concentrations of potential Link21 riders. Providing TOCs with improved transit supports regional reductions in GHG emissions. ▫ Vacant lands are opportunities for siting new rail infrastructure. ▫ Rail investments can encourage and support TOCs and TOD.	Targeted growth areas and vacant lands.	Plan stations and service expansion in targeted growth areas.	Work with local MPOs and cities to identify potential station locations that could support TOCs, offer sufficient density of riders to support Link21, and minimize displacement. Coordinate with cities and counties to identify vacant lands, former industrial, or brownfield areas that would be suitable for rail maintenance facilities.
SLR	A program like Link21 could participate in regional solutions to and investments in SLR resiliency by considering improvements that protect both rail infrastructure and local communities.	Increasing climate change resilience is a priority for Link21.	Where feasible, providing rail infrastructure on a berm along the coast also may provide added flood protection/flood barrier for the local community.	Opportunity to join Link21 designs with other local and regional SLR initiatives around planning and adaptation to find win-win solutions for both Link21 and local communities. Opportunity to partner with bayfront communities, restoration projects, and other transportation facilities that could need fill for berms or raising ground levels since Link21 could produce large volumes of excavated soil.
Biological Resources	The scale of Link21 allows consideration of regional mitigation strategies for conservation of critical species and habitats.	Not a critical opportunity.	Consider opportunities to grade-separate existing barriers (i.e., barriers created by existing rail infrastructure) to enhance wildlife connectivity and avoid habitat fragmentation.	Partnering with nonprofits, local municipalities, or other public agencies to optimize wetland restoration, riparian enhancement, flood protection, habitat restoration and enhancement efforts, and wildlife connectivity is an opportunity to complete mitigation, share funds, and support underfunded areas.
Recreation Resources	Large recreation resources are trip generators and attractors and access to them may be enhanced by transit improvements.	Regional recreational facilities like Golden Gate Park and various stadia and events centers in the Megaregion are critical opportunities as major trip generators/attractors.	Siting stations or providing linkages with pedestrian and bikeways to these destinations would provide an integrated transportation system.	Partnering with regional agencies on regional trail projects is an opportunity to enhance multimodal linkages.

OPPORTUNITY TYPE	WHY IS THIS AN OPPORTUNITY?	WHAT ASPECTS OF THIS OPPORTUNITY ARE CRITICAL?	HOW CAN DESIGN AND EARLY PLANNING UTILIZE THIS OPPORTUNITY?	WHAT OTHER COLLABORATIVE STRATEGIES CAN HELP UTILIZE THESE OPPORTUNITIES?
Community Resources	Community resources like universities and hospitals are trip generators and attractors.	Universities and hospitals in the Megaregion are critical opportunities.	Siting stations or providing linkages with pedestrian and bikeways to these destinations would provide an integrated transportation system.	Partnering with local cities and counties is an opportunity to provide greater pedestrian, bike, bus, and shuttle linkages as a way to enhance multimodal linkages.
PP	Providing greater rail and transit accessibility in PP areas could create linkages between affordable housing and job markets and health and educational facilities. This is also an opportunity to address historical inequities and reduce environmental burdens in these communities (e.g., air pollution).	Link21 prioritizes providing better service to PP.	Evaluate station locations in PP communities.	Partnering with cities and counties is an opportunity to provide multimodal linkages and integrated solutions using bikeways and pedestrian facilities and buses in PP areas.

GHG = greenhouse gas

TOC = transit-oriented communities

ES.4 Summary of Major Constraints and Opportunities

Chapter 4 discusses environmental constraints and opportunities that the Link21 Team may consider while designing and developing the program concepts and future project alternatives. For ease of reference, critical constraints and opportunities are called out in tables by ECO subareas. **Appendix A** lists the map book and Geoportal data layers used in the ECO analysis. Additionally, **Appendix B** maps critical constraints and opportunities together. **Appendix C** shows constraints and opportunities in greater detail. Appendix C contains a map series of each topic area shown by ECO subarea.

ES.4.1 Major Regional Constraints

The following subsections summarize major regional constraints by topic. Chapter 4 presents all constraints identified.

ES.4.1.1 Land Use

The areas where highest transit demand occurs are also the most densely populated and urbanized. Such dense urban areas often present physical constraints on areas where new rail infrastructure may be developed. Constraints can include existing residential, commercial, industrial, institutional, community, and urban park and open space uses. The major nodes of San Francisco, Oakland, and Sacramento present dense downtown environments where building underground junctions and surface infrastructure could be difficult.

ES.4.1.2 Transportation

Many of the existing passenger rail services share tracks (and have limited trackage rights) with private parties such as the Union Pacific Railroad (UPRR) and BNSF Railway Company (BNSF). In these cases, the private parties own the track ROWs and often have priority passage for freight traffic. Expansion of passenger rail service must be negotiated with these private parties.

ES.4.1.3 Need to Minimize New Adverse Effects on Priority Populations

Given that PP have often experienced disproportionate adverse burdens of transportation infrastructure construction and operations, there is a need to avoid and minimize further adverse effects of new infrastructure. Consequently, avoiding and minimizing effects on PP can be a constraint to construction site and new infrastructure locations.

ES.4.1.4 Presence of Regulated/Protected Lands and Resources

Protected lands and resources, such as biological resources (including state and federal waters and habitats for protected fish and wildlife species), cultural resources, agricultural lands, and Section 4(f) lands (e.g., publicly owned parks, open space, refuges), are regulated by various laws and regulations. Regulatory limitations, agency prerogatives in protecting these resources, and the mitigation costs of addressing impacts on such resources would constrain development of rail infrastructure in areas containing these resources.

Regulated Waters and Species

The Megaregion is home to a diverse natural environment from the San Francisco Bay, Suisun Marsh, and Sacramento-San Joaquin Delta (Delta) wetlands to inland grasslands and estuarine and shoreline habitats. Federal and state agencies manage and permit activities that affect natural resources. USACE regulates federal waters. USFWS regulates federally listed wildlife species and certain fish species that utilize waters and wetlands. NMFS regulates other federally listed fish species. BCDC regulates fill and uses within San Francisco Bay and its shoreline. The State Water Resources Control Board (SWRCB) and the RWQCBs regulate state waters. CDFW regulates streams, lakes, state-listed species, and fish and game. Link21 likely would require permits from all of these regulatory agencies.

The federal Endangered Species Act (FESA), California Endangered Species Act (CESA), Coastal Zone Management Act, Clean Water Act (CWA), Marine Mammal Protection Act (MMPA), Migratory Bird Treaty Act (MBTA), McAteer-Petris Act, Porter-Cologne Water Quality Control Act, and California Fish and Game Code, among other regulations, protect a variety of special-status species and designated critical habitat present across the ECO study area. Rail development within highly sensitive areas, such as the Suisun Marsh, may be severely limited or prohibited by regulatory agencies. Mitigation for impacts on special-status species is also regionally constrained because state and federal agencies prefer that mitigation sites be in the same county or ecological region as project impacts — resulting in limited availability of suitable banking credits in the region. Additionally, existing banks could be closed by the time Link21 advances to permitting, although there is also a possibility that new banks could open. In combination with regional limitations, lack of suitable mitigation opportunities due to rarity or land availability, or the availability of mitigation banking credits in certain geographic areas, would influence mitigation planning.

Cultural Resources

The Megaregion is home to many significant built-environment and archaeological cultural resources. Cultural resources may include individually significant buildings and structures, historic districts, cultural landscapes, archaeological sites, and areas of sensitivity for Native American tribes (e.g., shell mounds, village locations, burial sites).

Alteration of these cultural resources would require impacts analysis and mitigation as part of CEQA and NEPA/Section 106 of the NHPA review processes, consultation with Native American representatives, consultation with the Office of Historic Preservation, and coordination with local heritage groups.

Agricultural Lands

Much of the agricultural land in the Megaregion is considered Prime Farmland or Farmland of Statewide Importance. In recognition of the role agriculture plays in the state and national economy, federal and state laws have been enacted to avoid the loss of farmlands, including the California Farmland Conservancy Program that provides conservation easements and local, federal, and private contributions and the Williamson Act that takes development pressure off farmlands through reducing property taxes in exchange for 10-year contracts with farmers (California Department of Food and Agriculture 2009). As a result, farmlands could be considered a constraint for any future development project, including large-scale infrastructure programs like Link21.

Section 4(f) Resources

Section 4(f) refers to the original section within the United States Department of Transportation (USDOT) Act of 1966, which provides for consideration of public park and recreation lands, wildlife and waterfowl refuges, and historic sites during transportation project development. A project must include all possible planning to minimize harm to the Section 4(f) properties. Therefore, it is important to consider potential impacts on Section 4(f) resources in early planning as they may preclude development of rail infrastructure within Section 4(f) properties where there is a feasible and prudent avoidance alternative to such encroachment.

ES.4.1.5 Community Resources, Hazardous Materials Sites, and Major Utilities

In addition to a rich natural environment, the Megaregion has world-class universities and research facilities; hospitals; regional and state parks; community centers and local community-supporting facilities; and existing infrastructure (e.g., roads, bridges, power plants, wastewater plants, gas pipelines, electricity lines, aqueducts, canals). All of these community resources and major utilities present physical constraints or could require costly relocation. In addition, the hazardous materials sites related to prior military uses, industrial uses, and port infrastructure could require costly remediation before construction and development.

ES.4.1.6 Hydrology and Sea Level Rise

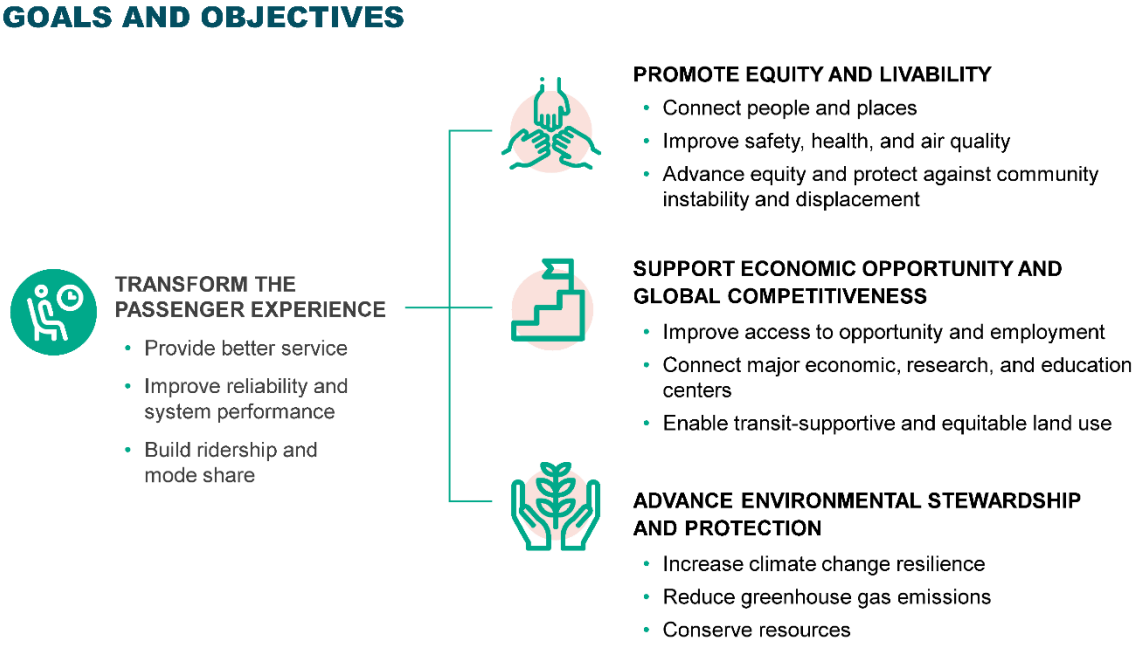
Many areas around the San Francisco Bay and throughout the Megaregion are designated as floodplains, floodways, tsunami hazard areas, and at risk of SLR inundation. Extensive infrastructure could be required to make Link21 resilient to SLR

within coastal areas. In addition, accelerating SLR may affect areas of potential markets, such as Alameda Island, which may be a future constraint. Consultation and compliance with BCDC policies along jurisdictional shorelines is required, and potentially consultation with the Federal Emergency Management Agency (FEMA) would occur for extensive floodplain impacts.

ES.4.2 Major Opportunities

The opportunities for Link21 directly relate to Link21 goals and objectives (see **Figure ES-4**). The following subsections summarize these opportunities.

Figure ES-4. Link21 Program Goals and Objectives



Note: Goals are in **BOLD CAPS,** objectives are in the bullets below.

ES.4.2.1 Transform Passenger Experience

Build Ridership, Serve New Markets with Equity-Weighted Unmet Transbay Rail Potential

The Megaregion has equity-weighted unmet transbay rail potential throughout its geography. This potential is especially concentrated at the core of the Megaregion (i.e., in San Francisco and Alameda counties). As a result, several high-potential transbay markets in the Megaregion would benefit from a transbay rail service. While some of these markets have no existing access to a rail service, several have access to rail

services that are poor due to, for example, limited capacity, overcrowding, or infrequent and slow service, resulting in an unmet rail potential. Several markets in the Megaregion (e.g., Santa Clara County) have a low unmet transbay rail potential but a high number of non-transbay users that could benefit from rail improvements that would give them access to the East and West Bay.

Additionally, certain markets with modest equity-weighted unmet transbay rail potential (e.g., Sacramento) have a relatively medium transbay miles- and equity-weighted unmet rail potential due to the longer trip distances involved. This higher passenger miles potential could translate into larger mileage-related benefits from a new transbay passenger rail crossing and other infrastructure at the core of the Megaregion (e.g., travel time savings, GHG emissions reductions). Overall, the consistent presence of equity-weighted unmet transbay rail potential across the Megaregion signals abundant opportunity to enhance transbay access and mobility using transit to access job markets and improve connectivity.

Integrate Multiple Modes and Mode Share

Link21 provides an opportunity to use existing ROWs, including public rail and some highway ROWs and private ROWs with UPRR and BNSF, in addition to linking to other modes of transportation (e.g., buses, airports, the ferry system). In addition, connection to active transportation networks, specifically trail and bicycle networks, improves multimodal connectivity. Several efforts are underway for transit fare integration and allowing easier transfers across the various systems run by different operators. With potential expanded BART and RR service through Link21, increasing transit integration would expand the reach of the overall transit system and would increase ridership, not only for BART and CCJPA but also for other transit systems due to increased overall travel efficiency.

Connect to Rail/Transit Projects by Others

In addition to current BART and CCJPA projects (specifically the BART Communications-Based Train Control, BART Silicon Valley Extension Phase II, CCJPA South Bay Connect and CCJPA Sacramento to Roseville Third Main Track projects), several other transit agencies in the Megaregion have approved, will approve shortly, or are planning the below rail and transit projects. This list is not intended to be comprehensive and may change as other rail and transit projects are planned, proposed, and approved in the Megaregion.

- Transbay Joint Powers Authority — Downtown Rail Extension (DTX)
- Peninsula Corridor Joint Powers Board — Peninsula Corridor Electrification Project
- San Francisco Municipal Transit Agency — Central Subway Project

- San Joaquin Regional Rail Commission (SJRRC) — Altamont Corridor Express (ACE) extensions to Ceres, Merced, and Butte County, Valley Rail improvements between Sacramento and Stockton, and East Bay Rail Hub at Union City
- San Joaquin Joint Powers Authority (SJJPA) — Plans for increasing San Joaquin service, including possible extension to downtown Merced
- Tri-Valley San Joaquin Valley Regional Rail Authority — Valley Link between Lathrop and Dublin/Pleasanton
- Transportation Agency for Monterey County (TAMC) — Monterey County Rail Extension
- Sonoma-Marin Area Rail Transit (SMART) — Extensions to Cloverdale and Solano
- California High-Speed Rail Authority (CAHSRA) — San Francisco to San Jose, San Jose to Merced, and Merced to Fresno project sections

There is an opportunity for BART and CCJPA to connect to these projects, thereby providing expanded transit and rail connections.

ES.4.2.2 Support Economic Opportunity and Global Competitiveness

Capitalize on the Megaregion's Targeted Growth Areas

The Megaregion encompasses a diverse mix of land uses, from highly urbanized downtowns to large expanses of residential subdivisions, farmland and natural resource areas, and employment concentrations and industrial complexes. Its 164 cities and 21 counties account for approximately 12.7 million people, or nearly one-third of the state's population. If the Megaregion were a country, it would be the 16th largest economy worldwide. Future growth forecasts indicate a continued trend of population and employment expansion. How and where this growth is accommodated represents a major opportunity for communities to shape and transform the land use pattern — both locally and regionally, to support economic vitality, promote a range of housing options, reduce traffic congestion, improve air quality, preserve open space, and promote social equity. This is an opportunity for the program to shape and encourage TOCs in these areas of housing and employment expansion.

The six COGs/MPOs that compose the Megaregion have identified areas within their respective regions where future growth is expected to occur. Identification of these targeted growth areas is the result of ongoing discussions with each of the local jurisdictions in their regions about how best to shape the local and regional land uses to attain the opportunities stated above.

Directing development and infrastructure to support the targeted growth areas would be beneficial to the Megaregion to sustain its value as an economic powerhouse, maintain its productive and scenic natural resources, foster improved environmental

sustainability, and create equitable opportunities for its communities to prosper and enjoy these benefits.

ES.4.2.3 Promote Equity and Livability

Better Serve Priority Populations and Reduce Environmental Burdens

PP face significant constraints in using rail and transit based on access, reliability, and affordability. Link21's co-creation efforts with communities across the ECO study area are focused on PP. These efforts have identified several impediments in the current system, such as schedules not matching ridership needs, lack of stations within certain PP areas, inadequate linkages to rail (including issues of safety and convenience), mismatch in service locations, and cost.

Consequently, one of the greatest opportunities for Link21 lies in increasing access to high-quality rail and transit for PP. This would create linkages between affordable housing and jobs.

The Market Analysis conducted during Phase 0 identified unmet rail potential associated with a transbay crossing between Oakland and San Francisco throughout the Megaregion. The analysis identified unmet rail potential in two ways: (1) for the population in general; and (2) equity weighted by doubling the unmet potential in areas with PP.[3]

In 2017, the California State Legislature passed Assembly Bill (AB) 617 to improve air quality for communities disproportionately affected by air pollution. Four of the 15 such communities in California are located in the Link21 Megaregion. These communities include west Oakland, Richmond-San Pablo, South Sacramento-Florin, and Stockton. Link21 has an opportunity to reduce air pollution in these communities by creating an opportunity for mode shift from personal automobiles to transit and rail. Also, many of these PP have experienced historical inequities with respect to access to rail and transit; Link21 provides an opportunity to engage with these PP and prioritize benefits to them.

ES.4.2.4 Advance Environmental Stewardship and Protection

Increase Climate Change Resilience

Where Link21 infrastructure requires protection from coastal flooding and SLR, there may be an opportunity to join Link21 designs with other local and regional SLR initiatives to find win-win solutions for both RR and local communities. There may also

[3] Market Analysis conducted during Phase 0 used a preliminary version of the updated PP referenced in this ECO Report.

be opportunities to employ nature-based solutions to help attenuate flooding risks. A resilient railway system (including a second transbay crossing) could provide adaptive capacity by providing alternative means of access to flood-prone areas.

Conserve Resources

The Megaregion encompasses waterways, wetlands, tidal resources, and sensitive biological habitats. As a result, it presents opportunities to work with many local agencies, municipalities, and communities in order to achieve shared or parallel goals. Partnering with nonprofits, local municipalities, or other public agencies to maximize wetland restoration, riparian enhancement, flood protection, and habitat restoration and enhancement efforts is an opportunity to complete regional mitigation efforts, share funds, and support underfunded areas. In addition, providing funding for habitat restoration and enhancement opportunities to potential landowners or teaming partners may be a way to establish easements in otherwise inaccessible areas.

Habitat conservation plans (HCPs) and natural community conservation plans (NCCPs) include in-depth development of mitigation strategies for potential impacts. These strategies are regionally focused, based on the specific needs and characteristics of the plans. Background information collected during the creation of HCPs and NCCPs (e.g., identification of suitable mitigation properties) could be used to streamline biological resource compliance for Link21. The Regional Conservation Investment Strategy (RCIS) Program identifies high-value conservation and habitat enhancement opportunities on a regional basis to help declining and vulnerable species by protecting, creating, restoring, and reconnecting habitat in order to contribute to species recovery and adaptation to climate change and resiliency. The information and analyses in the RCIS Program can assist in infrastructure and other land use planning. In addition, the Metropolitan Transportation Commission (MTC) and the California Coastal Conservancy have a Regional Advance Mitigation Planning Program that may also provide opportunities for Link21.

ES.5 Major Constraints and Opportunities by ECO Subarea

Chapter 4 describes critical constraints and opportunities by ECO subarea, including a detailed explanation of constraints and opportunities. Most, but not all, of the constraints and opportunities identified by ECO subarea fit within the topics noted in **Section ES.4**. The specific constraints and opportunities are too numerous to list in this summary but are described in Chapter 4 along with the associated mapping in Appendix B and Appendix C.

ES.6 Limitations

Chapter 3 describes the study limitations. Although the report focuses on major constraints and opportunities across the Megaregion, there are constraints and opportunities on a more local level that have not been articulated. The maps in Appendix C show detailed locations of constraints, only some of which are described in Chapter 4. The ECO subarea widths are likely much larger than an ultimate BART or RR footprint would ever be (no rail system is 0.5 mile or even 1,000 feet wide, except for maintenance yards, stations, and terminals). Consequently, some of the constraints identified for such a large ECO subarea will not apply to ultimate rail infrastructure that may be advanced through Link21 planning. As a desktop-level analysis, this ECO Report identifies only general physical and social conditions that may affect Link21 planning and relies on data collected by others at a certain point in time. Constraints and opportunities related to program concepts and future project alternatives will need to be further refined to identify the specific consequences for Link21. Chapter 3 describes general limitations and specific limitations by subject area.

ES.7 Next Steps

The information in this report and available through Geoportal will be used by the P&E Team during the development of program concepts and future project alternatives as part of the program's integrated planning and environmental process. In addition, the Engagement and Outreach (E&O) Team will share information on constraints and opportunities with the public during Phase 1 outreach. This ECO Report will be posted to the program's website and referenced during outreach activities to solicit public and stakeholder input on environmental constraints and opportunities. This input will be incorporated into the development of program concepts and future project alternatives to further support the program's integrated planning and environmental process.