

6. Funding and Maintenance Strategy and Benefit-Cost Analysis

This chapter summarizes cost estimates and potential funding sources for construction, maintenance, and operations of the preferred options for a pedestrian and bicycle pathway along the EBMUD Aqueduct ROW. Cost estimates are planning level, and subject to change.

A benefit cost analysis follows the cost estimates. The analysis considers the return on the City's investment over the 30-year life of the proposed pathway, and is based on local data and utilizes conservative estimates of benefits.

The chapter concludes with a description of possible funding sources for construction and maintenance of the pathway. Funding for construction of the pathway will most likely come from grant sources, while funding for maintenance and operations will require local funding sources.

6.1 Construction Cost Estimates

Cost estimates shown in Table 6-1 are given in 2010 dollars, and are based on a planning-level review of the preferred options. Estimates include planning, design, permitting, administration, and contingency costs. The cost estimate developed for this Study are quite inclusive and include the cost of some elements which may be fully or partially funded and constructed by others (e.g. the traffic signals at the SR 24 off-ramp on Oak Hill Road and at the SR 24 on-ramp on First Street). See *Chapter 5: Options Evaluation and Preferred Options* for a description of the preferred options and detailed cost estimates. The cost of constructing the preferred options is \$6.0 to \$6.2 million for a Class I bikeway/ADA-accessible pathway. As presented in the Chapter 5 segment cost estimate tables, the construction cost estimates include a 25 percent markup to account for soft costs (e.g. survey design, permitting, and administrative costs) and a 25 percent contingency mark-up.

Table 6-1: Summary of Construction Cost Estimates for the Preferred Options

| Preferred Options | | Notes |
|--|----------------------------------|---------------------------------|
| <i>Segment 1</i> | | |
| Segment 1 Class I Bikeway/ ADA-Accessible Pathway [†] | \$372,100 | |
| Risa Road Crossing Improvements | \$144,400 - \$148,300 | |
| Private Drive Crossing Improvements | \$67,800 | |
| Dolores Drive Crossing Improvements | \$249,000 | |
| Happy Valley Road Pedestrian and Bicycle Bridge | \$1,238,100 | Bicycle-pedestrian overcrossing |
| <i>Segment 2</i> | | |
| Segment 2 Class I Bikeway/ ADA-Accessible Pathway | \$1,958,300 | Via SR 24 eastbound off-ramp |
| Oak Hill Road Crossing Improvements | \$721,200 | |
| <i>Segment 3</i> | | |
| Segment 3 Class I Bikeway/ ADA-Accessible Pathway | \$274,100 | |
| First Street Crossing Improvements | \$720,000 - \$937,900 | |
| <i>Segment 4</i> | | |
| Segment 4 Class I Bikeway/ ADA-Accessible Pathway | \$246,000 | |
| Total Cost of Preferred Option | \$5,991,000 - \$6,212,800 | |

[†]Class I bikeway/ADA-accessible pathway is a paved path with a 10 to 12-foot wide width, suitable for use by bicyclists and pedestrians. As designed, it meets ADA requirements.

The planning-level cost estimates are roughly consistent with actual construction costs for similar projects in the area. The St. Stephen's Trail in Orinda, for instance, is a mile-long paved Class I bikeway/ADA-accessible pathway that parallels SR 24 and cost approximately \$1.8 million to construct.²⁸ The St. Stephen's Trail is built along gradually climbing topography and follows a relatively straight alignment. The trail connects Davis Road and St. Stephen's Drive without additional roadway crossings. Treat Avenue Bicycle and Pedestrian Bridge on Iron Horse Trail cost \$13.4 million (2011 dollars), required a decade to plan and design, and receives approximately 1,300 users per day.²⁹ Alameda County Transportation Commission's draft costs for the Pedestrian and Bicycle Master Plan updates estimate \$1.2 million per mile for construction of Class I multi-use paths, based on a review of paths constructed in the Bay Area since 2006.

By comparison, the proposed Class I bikeway/ADA-accessible pathway along the EBMUD Aqueduct ROW would be approximately 1.5 linear miles, including switchbacks. Averaging costs between Pathway Segments, a pathway meeting a Class I bikeway/ADA-accessible pathway design standard and located along the EBMUD Aqueduct ROW would cost approximately \$4 million per mile.

²⁸ The St. Stephen's pedestrian and bicycle trail begins at Bates Boulevard and Davis Drive and runs along the east-bound lanes of SR 24 to St. Stephen's Drive. The approximately one-mile long, paved trail connects Orinda to the Lafayette Reservoir. St. Stephen's Trail was constructed in 1997. No structures were needed. Costs have been adjusted to year 2011 dollars, using the online tool at <http://data.bls.gov/cgi-bin/cpicalc.pl>.

²⁹ Cost estimate is based on fact sheet from Contra Costa Transportation Authority's 2008 Strategic Plan, escalated from 2008 dollars.

The higher cost of Class I bikeway/ADA-accessible pathway along the EBMUD Aqueduct ROW and Caltrans ROW is likely due to the inclusion of a pedestrian/bicycle overcrossing; retaining walls, earthwork, and switchbacks necessary to navigate the steep topography and maintain a maximum 8.3 percent slope along the pathway; and roadway crossing improvements at multiple roadways. Additionally, the pathway cost estimates include utility requirements associated with traffic signals and pathway lighting, and potentially special EBMUD design requirements. The pathway cost estimates likely include more extensive project development costs than the St. Stephen's Trail due to multi-agency (EBMUD and Caltrans) involvement. The Treat Avenue Bicycle and Pedestrian Bridge is perhaps the fairer comparison of the two as it is a more recent project and one that accommodated complex vehicle traffic and utility challenges.

6.2 Maintenance and Operations Requirements and Costs

Maintaining pathways to a high standard is important for a variety of reasons: safety, liability, universal access, attracting and maintaining high use levels by all desired modes, and protecting the public investment. The City of Lafayette has a duty to protect the public welfare by maintaining facilities to a level that reduces potential safety hazards, including repairing damage on paths that may pose a hazard. Additionally, the City of Lafayette is required to follow maintenance responsibilities outlined in the Revocable Landscaping License between the City and EBMUD (2003) (see Section 4.2.3 for a description of this agreement), the details of which are summarized in this section. Allowing hazardous conditions to exist along a path or sidewalk exposes the City to potential lawsuits. The City of Lafayette is required by federal law to maintain public facilities so that they are accessible to people with disabilities. A well-maintained pathway, with smooth surfaces, well-kept vegetation, and up-to-date signage will attract and sustain use. Regular preventative maintenance on a pathway (e.g. periodic overlays) can extend the lifetime of the existing facility and delay the need for more expensive repairs.

Local residents and stakeholder agencies have likewise expressed a desire and specific legal requirements that any pedestrian and bicycle facility developed along the EBMUD Aqueduct ROW is maintained to a high standard.

At this time, hours of operation have not been identified for the pathway. If the project moves forward, the City will consider establishing hours of use that accommodate peak hour BART ridership.

6.2.1 Maintenance and Operations Requirements

The Revocable Landscaping License between the City of Lafayette and EBMUD outlines maintenance responsibilities for both the City and EBMUD. The agreement includes specific maintenance tasks and a proposed schedule. Table 6-2 lists these requirements. EBMUD is responsible for maintaining unlandscaped portions of the Aqueduct ROW to Fire Marshal standards, while the City of Lafayette is responsible for maintaining improvements to the ROW, including landscaping and pathway.

In the event that the ROW or improvements are disturbed during construction or repair of EBMUD facilities, EBMUD shall restore the ground surface to its pre-existing grade and make best efforts to limit damage to the landscaping, including bicycle and pedestrian trails.³⁰

³⁰ Section A-3 of the EBMUD Revocable Landscaping License Agreement defines EBMUD responsibilities in the event of damage, and the introduction to the Agreement defines "landscaping" to include trees, shrubs, lawn, decorative gravel, other nonpermanent landscaping material, public pedestrian and bicycle trails, and irrigation systems, including minor grading for drainage.

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The Agreement permits the City of Lafayette to restore and repair damage and collect reimbursement from EBMUD. Reimbursement costs for restoration and repair shall not exceed 50 cents per square foot for sprinkler replacement, 50 cents per square foot for grading and plant replacement, and \$2.50 per square foot for reconstruction of paved pathway or non-permanent hardscape. These reimbursement costs have not been updated since the agreement was drafted in 2003.

The maintenance requirements outlined in the EBMUD Revocable Landscaping License are comprehensive, and will require significant City resources to meet. If the City decides to pursue construction of the EBMUD Aqueduct Pathway, it is likely that the City and EBMUD will update the Revocable Landscaping License agreement to reflect more appropriate maintenance requirements. For example, construction of a pathway along the EBMUD Aqueduct ROW may require increasing the frequency of maintaining tree canopy from an as-needed basis to a higher level.

Ultimately, maintenance requirements and costs will be driven by the final design and operations of the pathway, and may increase or decrease from those presented in this Study. In some cases, maintenance requirements may impact the final design. For example, if switchbacks along the pathway limit the ability to disc vegetation near the switchbacks, it is recommended the City consider alternate means to disc or install landscaping at the impacted areas to meet Fire Marshal standards. If the City decides to pursue the pathway, the City should consider impacts to maintenance while preparing the final design.

Table 6-2: Maintenance Requirements Required by EBMUD Revocable Landscaping License Agreement

| Maintenance Requirements | Class I Pathway (Paved) | Recreational Trail (Unpaved) | Schedule |
|---|-------------------------|------------------------------|--|
| Pavement Repair and Sweeping Inspect/Sweep | • | | Weekly – April thru November Bi-Weekly – December thru March |
| Weed Abatement on ROW and Along/Around Fence Lines, Trails and Structures Mow or disc | • | • | Two Times (Minimum) – Yearly One Time – April and May One Time – July and August A third mow/disc cycle may be required in some areas to comply with fire marshal standards |
| Fences and Gates at Street Crossings and Drainages | • | • | One Time (Minimum) – Yearly Or as needed for public safety |
| Drainage Control and Maintenance of Culverts | • | • | One Time (Minimum) – September-October (prior to rainy season) One Time (Minimum) – April-June (to repair winter damage) |
| Patrolling and Policing Patrol entire length of trail in License limits Policing | • | • | Weekly (Minimum) – All Year As necessary to control vandalism, graffiti and homeless activities on the right-of-way |
| Litter/Debris Removal | • | • | Monthly (Minimum) – At least one sweep of the entire right-of-way As needed for dumping activities (as part of patrol duties) |
| Landscape Pruning and Dead Materials Removal | • | • | One Time (Minimum) – April-May One Time (Minimum) – September-October (before the rainy season) |
| Graffiti Removal – Trail Pavement, Fences and Signs | • | • | Monthly (Minimum) As it appears |
| Signage | • | • | As needed to assure public safety Within one week of reported damage |
| <p>**Note: Maintenance responsibility and requirements apply only to portions of the right-of-way where the City has made improvements according to plan(s) approved by EBMUD. To assist the City in maintaining the right-of-way, EBMUD will remove graffiti and repair vandalism to its facilities and respond to property owners and trail users and provide referral to City's maintenance department Source: Revocable Landscaping License between EBMUD and the City of Lafayette (2003)</p> | | | |

Other maintenance requirements not included in the EBMUD Revocable Landscaping License agreement are listed in Table 6-3.

Table 6-3: Other Maintenance Requirements

| Maintenance Requirements | Class I Pathway (Paved) | Recreational Trail (Unpaved) | Schedule |
|--|-------------------------|------------------------------|----------------------|
| Slurry Seal | • | | Every 10 to 15 years |
| AC Overlay | • | | Every 15 years |
| Reconstruction | • | | Every 30 years |
| Regrading / Compaction | | • | |
| Lighting repair and maintenance | • | | Annually |
| Restriping | • | | 3 to 5 years |
| Site furnishings, replace damaged components | • | • | As needed |
| Signal maintenance | • | • | 3 to 5 years |
| In-pavement beacons maintenance | • | • | 3 to 5 years |
| Costs of providing electricity | • | | Ongoing |
| Costs of irrigating landscaping | • | | Ongoing |

6.2.2 Safety and Security

Properly designed and managed, the proposed EBMUD Aqueduct Pathway would provide a reasonable level of safety and security. In order to maximize safety and functionality for users, and to minimize liability exposure for the City of Lafayette and other property owners, the pathway design shall meet all mandatory and advisory standards as identified by Caltrans in the Highway Design Manual, CAMUTCD and the Americans with Disabilities Act (ADA) where feasible and appropriate. Where the need for design exceptions is identified and required, the detailed documentation required to obtain approval for the design exception must be translated into effective safety and security measures. For example, a design exception to standard grades to provide for a steeper than standard running slope should be accompanied by other pathway design features to mitigate high speeds and the design should not rely on warning signage alone to mitigate safety concerns. In addition, the EBMUD Revocable Landscaping License Agreement maintenance requirements include patrolling and policing as necessary to control vandalism, graffiti and homeless activities on the ROW. A Class I bikeway/ADA-accessible pathway would be accessible to bicycle patrol, if bicycle patrolling is initiated.

Creating a comfortable pathway environment goes beyond law enforcement officers and should involve the entire community. The most effective and most visible deterrent to illegal activity on any pathway is the presence of law-abiding pathway users.³¹ As a general pattern, introducing community-friendly, law abiding use on the pathway ROW will discourage undesired uses. Getting as many “eyes on the corridor” as possible is a key deterrent to illegal or undesirable activity on the pathway. There are several components to accomplishing effective community involvement in pathway safety, including providing access to the pathway, providing good visibility to the pathway from neighboring properties, and providing a high level of maintenance.

³¹ Rails-to-Trails Conservancy. “Trail- Trails and Safe Communities: The Experience on 372 Trails.” January 1998.

Homeland Security

The EBMUD Aqueduct's primary function is to provide uninterrupted water conveyance for EBMUD's East Bay customer base, thereby introducing additional safety and security concerns including Homeland Security issues. Federal law defines "critical infrastructure" as "systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters."³² The EBMUD Aqueduct is considered a Critical Infrastructure Key Resource, and as such Federal law requires it to be protected and secured from terrorist attacks. The EBMUD Manager of Security and Emergency Preparedness has indicated that the proposed EBMUD Aqueduct Pathway would not be a cause for concern related to Homeland Security issues.³³ He did have suggestions for improving general security along the proposed pathway. Specifically, he requested that any design enhance the visibility of the pathway to deter unwanted activities, and requested installation of a fence along Happy Valley Creek to deter people from walking across the exposed Aqueducts. He indicated that EBMUD has a precedent for working with communities to transform unused EBMUD ROW into formalized recreational amenities, and sees this formalization as beneficial to security.

6.2.3 Maintenance and Operations Costs

Costs for maintenance and operations vary significantly depending on the level of services provided. Maintenance of a recreational trail is less costly than for a paved pathway. Cost estimates provided here are conservative and intended to provide a maximum cost that the City could expect for maintenance of the pathway.

The City's Public Works Technician estimates annual maintenance cost of a 1.5-mile paved pathway to be \$38,000, based on the maintenance requirements outlined in the EBMUD Revocable Landscaping License Agreement. Including traffic signal maintenance, lighting, and irrigation, the annual maintenance cost would be \$50,925 in 2010 dollars. Note that these costs are conservative, and would likely be reduced pending renegotiation of the maintenance requirements in the EBMUD Revocable Landscaping License Agreement.³⁴ Therefore, it is likely the actual maintenance costs for a pathway along the EBMUD Aqueduct ROW will be less than those estimated in Table 6-4.

Over its 30-year lifetime the path would require an additional \$76,000 to \$111,000 for long-term maintenance (i.e., slurry-sealing and asphalt overlay). The City should maintain a reserve account for these long-term maintenance costs, either with a large one-time deposit in the first year of the project, or with smaller annual contributions over 20 or 30 years. If the City chooses to contribute annually to a reserve fund to pay for long-term maintenance, annual contributions would be between approximately \$4,700 and \$5,200 in 2010 dollars. Over the 30-year lifetime of the pathway, annual and long-term maintenance costs would be approximately \$898,000 to \$1.2 million, which includes annual contributions to a reserve fund to pay for long-term maintenance. Table 6-4 summarizes the maximum estimated maintenance costs.

³² 101 6(e) of the USA Patriot Act of 2001 (42 U.S.C. 5195c (e))

³³ Phone call with Steve Frew, Manager of Security and Emergency Preparedness, January 25, 2011.

³⁴ By comparison, EBRPD estimates maintenance and operations costs for a mile of trail at \$25,000 annually. This cost includes police patrol, vegetation management, litter pickup and a contribution to a reserve fund for eventual pathway replacement.

Table 6-4: Maximum Estimated Maintenance Costs

| Item | Cost (2011 Dollars) | Notes |
|---|--|--|
| Annual Maintenance Costs | | |
| Maintenance Required by EBMUD Revocable Licensing agreement | \$38,000 annually [†] | |
| Traffic signal maintenance and operations | \$2,525 annually [‡] | Traffic signal maintenance and operations costs are estimated at \$1,500 to \$2,525 annually, depending on the chosen First Street Option. |
| Lighting at pathway entrances and along bicycle/pedestrian bridge | \$9,400 annually [€] | Annual electrical costs of \$170/light fixture plus \$99 annual repair and maintenance per light. |
| Landscape irrigation | \$1,000 annually [£] | |
| Average Annual Maintenance Costs | \$50,925 | |
| Long-Term Maintenance Costs | | |
| Slurry seal | Year 10: \$42,000 [†] Year 25: \$42,000 [†] | |
| AC Overlay | Year 15: \$87,000 [†] | |
| Average Annual Long-Term Maintenance Costs | \$4,700 to \$5,200 | Assumes annual contribution to reserve fund. Cost range reflects discount rates of 5% and 2.5%. |
| Reconstruction of Pathway | | |
| Reconstruction | Year 30: \$3,150,000 | Total cost of replacement. |
| Average Annual Reconstruction Costs | \$86,800 to \$95,400 | Assumes annual contribution to reserve fund. Cost range reflects discount rates of 5% and 2.5%. Estimates are conservative. |
| Total Cost Over Lifetime of Pathway | | |
| 5% discount rate | \$42,700 \$86,800 \$898,100 \$2,300,000 | Annual Costs for Annual and Long-Term Maintenance Annual Costs for Reconstruction of Pathway Total Cost Over 30-Year Lifetime (No Reconstruction) Total Cost Over 30-Year Lifetime (Reconstruction) |
| 2.5% discount rate | \$43,200 \$95,400 \$1,203,300 \$3,249,000 | Annual Costs for Annual and Long-Term Maintenance Annual Costs for Reconstruction of Pathway Total Cost Over 30-Year Lifetime (No Reconstruction) Total Cost Over 30-Year Lifetime (Reconstruction) |

[†] Costs provided by David Turhune, City's Public Works Technician, Feb 11, 2011.

[‡] Traffic Signal Maintenance and Design Survey, DKS Associates, estimates operations and maintenance costs per incandescent signal at \$2,670 in 1997 dollars. Cost adjusted for inflation, and modified to account for 75% lower maintenance and operations costs of LED lights.

[€] Costs provided by Donna Fehan, City of Lafayette, July 25, 2010.

[£] Irrigation needs assume approximately 2,000 sf of landscaping, water consumption of approximately 194,700 gallons per year and the EBMUD water rate of \$3.11 per 100 cubic feet of water. Water consumption based on A. Vickers, *Handbook of Water Use and Conservation* (2002) water consumption rate for turf.

The anticipated lifespan of the pathway is 30 years, at which time the pathway may require replacement. Eventual pathway replacement in year 30 is estimated to cost between \$1.4 million and \$2.0 million in 2010 dollars, assuming the City chooses to contribute annually to a reserve fund to pay for eventual reconstruction of the pathway. Annual contributions would be between \$86,900 and \$95,300 in 2010 dollars. Replacement of the pathway includes the cost of replacement of all features of the pathway (i.e., retaining walls, signals, the pathway itself, etc.). Given the long-term maintenance that is recommended (e.g. slurry sealing and AC overlay), it is likely that the pathway features will not require replacement, and may just require repair. As such, this is a conservative estimate of the needs for replacement.

Annual cost estimates are higher than actual costs incurred by other agencies in the Bay Area, and reflect the higher maintenance requirements required by EBMUD. An update to the EBMUD Revocable Landscaping License Agreement may reduce maintenance costs. Additionally, though it is a best practice, not all agencies contribute to a reserve fund to pay for long-term maintenance and eventual replacement of pathways. Contribution to the reserve fund triples the annual cost estimates.

EBRPD estimates maintenance and operations costs for a mile of trail at \$25,000 annually.³⁵ This cost includes police patrol, vegetation management, litter pickup and a contribution to a reserve fund for eventual pathway replacement.

City of San Jose estimates \$12,500 per mile per year for operations and maintenance of a paved pathway and \$6,025 per mile per year for operations and maintenance of an unpaved recreational trail, and \$12,050 per acre for maintaining landscaping adjacent to trails.³⁶ Trail rangers are \$2,000 per mile per year.

The City of South Lake Tahoe and the Ski Run Business Improvement District maintain a two-mile landscaped and lighted path. Maintenance requirements are close to those for the proposed EBMUD Aqueduct Pathway, and costs for maintenance are closer. Maintenance includes maintaining 48 pedestrian lighting heads, electric bills for the lighting, water bills, mowing and fertilizing landscaping, and maintaining the multi-use path. It costs \$29,700 to \$30,700 annually to maintain the landscaping and path.³⁷

6.3 Benefit-Cost Analysis

A benefit-cost analysis is a valuable tool for analyzing the merits of this project to the City of Lafayette and the overall San Francisco Bay Area transportation network. Over the years that a pathway has been considered for the EBMUD Aqueduct ROW, many stakeholders in this project have requested a benefit-cost analysis; these parties include the general public, City of Lafayette elected and appointed officials, as well as Technical Advisory Group and Citizen Advisory Committee members for this project. The most relevant benefit-cost analysis tool applicable to this project is the National Academy of Sciences Transportation Research Board, *National Cooperative Highway Research Program Report 552: Guidelines for Analysis of Investments in Bicycle Facilities* (NCHRP Report 552) (2006).

³⁵ Email correspondence with Jim Townsend, Manager, Trails Development Program, EBRPD, January 13, 2011.

³⁶ Email correspondence with Yves Zsutty, Acting Division Manager, Department of Parks, Recreation & Neighborhood Services, City of San Jose, January 18, 2011.

³⁷ Phone call with Gary Moore, Director, Parks and Recreation Department, South Lake Tahoe, July 27, 2009. Costs have been adjusted for inflation.

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This tool was recently applied by the East Bay Regional Park District in an analysis of the projects included in their TIGER II grant application to FHWA for which the agency was awarded approximately \$10 Million and is the standard benefit-cost analysis methodology for bicycle facilities. To account for extrapolating data, the analysis includes low, medium and high usage scenarios. Significant research went into developing the methodology used and while it may not be perfect, it is the best available.

The following categories of benefits are considered:

- Mobility benefits
- Health benefits
- Recreation benefits; and,
- Reduced auto use benefits.

Note that this benefit-cost analysis does not include other benefits that have been linked to pathways, including increased patronage at nearby businesses and increased property values. These benefits are difficult to estimate, but studies have shown that home prices near pathways tend to be higher than home prices farther from pathways^{38, 39, 40} and bicycle and pedestrian facilities can lead to increased spending by consumers.⁴¹

6.3.1 Methodology

The benefit-cost analysis presented in the NCHRP report first estimates the number of new bicyclists that will result from constructing the EBMUD Aqueduct pathway, and then applies benefit values to those new users to estimate a monetary benefit resulting from new users.

Estimating Use

The NCHRP report presents a sketch planning model that can be used to estimate bicycling demand in local areas. The sketch plan is derived from an analysis of bicycle demand research and high-quality, nationally consistent data (e.g. U.S. Census, National Household Travel Survey). Based on this research, the sketch plan uses bicycle commuting as a leading indicator for other types of bicycling in a community. The model estimates the number of bicyclists by:

1. Using U.S. Census or local data to establish the number of residents within 1600 meters, 800 meters and 400 meters of the proposed facility
2. Using U.S. Census data to calculate the number of adults and number of commuters within each buffer

³⁸ Karadeniz, D. (2008). The Impact of the Little Miami Scenic Trail on Single Family Residential Property Values. Unpublished master's thesis, University of Cincinnati. Retrieved November 4, 2011 from <http://atfiles.org/files/pdf/LittleMiamiPropValue.pdf>

³⁹ Lindsey, G., J. Man, S. Payton, & K. Dickson. (2004). Property Values, Recreation Values, and Urban Greenways. *Journal of Park and Recreation Administration*, 22(3), 69-90.

⁴⁰ Los Angeles County Metropolitan Transportation Authority. (2007). *Bicycle Paths: Safety Concerns and Property Values*. Retrieved November 4, 2011, from: http://www.greenway.org/pdf/la_bikepath_safety.pdf

⁴¹ Center for International Public Management, Inc. for the Florida Dept. of Environmental Protection, Office of Greenways and Trails. (1998). *Thinking Green: A Guide to the Benefits and Costs of Greenways and Trails*. Retrieved November 4, 2011, from: <http://www.dep.state.fl.us/gwt/community/refguide/pdf/thinkgreen.pdf>

3. Using the U.S. Census bicycle commute mode share to calculate the number of adult commuter bicyclists
4. Applying low, medium, and high ratios between commuter bicyclists and all adult bicyclists to estimate the existing number of adult bicyclists on a given day. Ratios are derived from the aforementioned analysis of research.
5. Applying multipliers, based on proximity to the proposed facility, to calculate the number of bicyclists who would be induced to ride if a facility was built. Multipliers are derived from the aforementioned analysis of research.

Regarding pedestrian usage, the pathway will create a more direct pedestrian connection between BART and several of the densest residential clusters in Lafayette, decreasing walk time and increasing convenience and safety, all of which are important factors in a person's decision to walk to transit. In addition, the NCRHP method is based on several standard growth rate factors that take time to materialize; while these rates may not reflect current conditions, over time Lafayette may well increase its Downtown residential density more than the standard rates assume.

Calculating Benefits

The benefit-cost analysis presented in this study relies on local data whenever available, and conservatively estimates the number of bicyclists and pedestrians that would use the proposed pathway. Estimated numbers of existing and new bicyclists are based on local Lafayette data drawn from the 2008 American Community Survey and GIS mapping. The methodology used by the NCHRP Report 552 considers only the benefits for bicycle commuters and adult cyclists. The benefits for pedestrians are also substantial and are likely a sizeable fraction of the benefits calculated for cyclists. The BART Station Profile data for the Lafayette BART Station (2008) show that while only 2 percent of BART passengers access this station by bicycle, 12 percent access this station by walking.⁴² To include the benefits for pedestrians in this benefit-cost analysis, it is conservatively estimated that twice as many pedestrians will use the proposed pathway as bicyclists.

The NCHRP report relies on a review and analysis of relevant literature to estimate the benefits of proposed facilities. The total annual benefits are determined by summing the mobility, health, recreation, and reduced auto use benefits anticipated to result from implementation of the pathway. The benefit category monetary values are determined based on research review as identified by NCHRP Report 552 and summarized here:

- The mobility benefit quantitatively evaluates individual preferences for different cycling environments. Mobility benefits are based on analysis of stated preference research. The mobility benefit for each existing and new cyclist of riding on an off-street bicycle trail, compared to riding on a street with parked cars is \$4.08/trip, with 2 trips per day 5 days per week 50 weeks per year.
- The annual health benefits is derived from multiplying \$128, the annual per capita cost savings from physical activity, by the number of new cyclists. Benefits are based on a literature review of the cost savings of increased physical activity, and represent the median value of benefits presented in ten studies.

⁴² 2008 BART Station Profile Study, BART Marketing and Research Department. Downloaded from http://www.bart.gov/docs/StationProfileStudy/2008StationProfileReport_web.pdf

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- The annual recreation benefit for new adult cyclists, excluding new bicycle commuters, is calculated at \$10/day times 365 days. Benefits are based on a literature review of numerous studies, which found that the typical monetary value of an hour of outdoor recreational activity is \$10.
- The reduced auto use benefit is based on an average 6-mile roundtrip commute distance and \$0.13/per mile, the NCHRP Report 552 value for urban areas. Benefits are based on the review of several reports that discuss benefits of reduced auto use associated with increased bicycling. Benefits include the value of reduced congestion, reduced air pollution, and user cost savings.

In calculating the benefit-cost ratio of a project in which benefits and costs are expected to be distributed over several years, it is important to consider the change in value of money over time. This is commonly done by calculating the net present value (NPV) of a project over the lifetime of that project. If the NPV is positive, then a project will produce benefits over its lifetime. If the NPV is negative, then a project will cost more than the benefits it produces over its lifetime.

The NPV is calculated as the sum of the present values (PVs) of the benefits and costs for each year of the project. To calculate the PV for a given year, one sums the benefits and costs for that year and discounts it back to the first year of the project using a discount rate. The discount rate can be defined a variety of ways. For this benefit-cost analysis, it is defined as the opportunity cost of the initial investment, or the interest rate that the capital needed for the project could return if invested in an alternative venture.⁴³ This benefit-cost analysis also uses a low and a high discount rate to account for the uncertainty in the actual discount rate. A lower discount rate makes it more likely that a project will see a positive net benefit.

The benefit-cost ratio weighs the anticipated annual benefits of the pathway against the estimated construction and maintenance costs for the pathway. The estimated construction cost for the preferred options is \$6.0 to \$6.2 million, as identified in **Table 6-1**. For benefit-cost analyses, construction costs incurred from 2012 to 2017 and annual maintenance and operating costs over 30 years are adjusted to net present value (NPV). The benefit-cost analysis includes the cost of total pathway reconstruction in addition to maintenance expenses. Annual benefits (2010 dollars) were calculated based on high estimates, best estimates and low estimates for the number of bicycle commuters that would use the EBMUD Aqueduct Pathway, following the NCHRP Report 552 methodology for both 5 percent and 2.5 percent discount rates.

⁴³ To give an example of discounting, given a discount rate of 7 percent, \$5,000 in benefits received ten years from now has the same value as \$2,542 in benefits received now. In other words, if one was to invest \$2,542 now with interest rates at 7 percent, in ten years, that money would be worth \$5,000.

Projected Existing and New Bicyclists and Pedestrians

Table 6-5 shows the estimated number of commuting and adult cyclists under existing conditions and Table 6-6 shows the estimated number of new cyclists resulting from the pathway. These estimates are based on local Census and BART ridership data, and are conservative. Under existing conditions, the “best estimate” projection of bicycle commuters and daily adult cyclists using the corridor is 109 cyclists. The “best estimate” for the number of new bicycle commuters and daily adult cyclists attributed to the pathway is 144 cyclists, which would double the estimated existing daily ridership along the corridor to 285. Using the methodology identified above, a conservative “best estimate” of the number of new pedestrians attributed to the pathway is 288 pedestrians (two times the number of anticipated new bicyclists). Comparison of these usage estimates to those produced by other pathway demand models, for example the National Bicycle and Pedestrian Documentation Project demand model, confirms that they are conservative.

Table 6-5: Daily Bicycle Commuters and Daily Adult Cyclists Under Existing Conditions

| Category | Assumption | | |
|--|---------------|---------------|--------------|
| Population within approximately one mile (1,600 meters) of the pathway alignment [†] | 15,650 | | |
| Percentage of Commuters | 47.37% | | |
| Percentage of Adults | 76.09% | | |
| Category | High Estimate | Best Estimate | Low Estimate |
| Bicycle Commuters [‡] | 40 | 32 | 25 |
| Daily Adult Cycling Percentages [€] | 2.24% | 0.91% | 0.33% |
| Daily Adult Cyclists [£] | 266 | 109 | 39 |
| [†] Population based on the 2008 American Community Survey and GIS mapping. [‡] Calculated as the product of population and the commuting cyclist's percentage of population. [€] Calculated using the NCHRP Report 552 equations on Page 38: <ul style="list-style-type: none"> • High estimate is 0.6% plus 3 times the high estimate bicycle commute percentage. • Best estimate is 0.4% plus 1.2 times the best estimate bicycle commute percentage. • Low Estimate is the low estimate bicycle commute rate. [£] Daily Adult Cyclists are calculated as the product of the population, percentage of adults and daily adult cycling percentages. | | | |

Table 6-6: New Daily Bicycle Commuters, Daily Adult Cyclists, and Daily Pedestrians Attributed to the Pathway

| Category | High Estimate | Best Estimate | Low Estimate |
|--|---------------|---------------|--------------|
| New Bicycle Commuters [‡] | 30 | 23 | 18 |
| New Daily Adult Cyclists [‡] | 514 | 121 | 15 |
| Pedestrians [†] | 1,088 | 288 | 66 |
| [‡] Per the NCHRP Report 522, Page 39, the numbers of new bicycle commuters and new daily adult cyclists are estimated to be 1.93, 1.11 and 0.39 times the current values for distances of 400 meters, 800 meters, and 1,600 meters from the pathway, respectively. The sum is presented here. These values are in addition to the existing bicycle commuters. [†] Assumes twice as many pedestrians will use the proposed pathway as bicyclists. | | | |

6.3.2 Findings

The last row in Table 6-7 shows Total Annual Benefits for both bicyclists and pedestrians. The “best estimate” annual benefits are more than \$1.7 million. This estimate represents the sum of the estimated mobility, health, recreational, and reduced auto use benefits.

Table 6-7: Benefit-Cost Analysis; Total Annual Benefits for Pedestrian and Bicyclists

| Category | High Estimate | Best Estimate | Low Estimate |
|--|---------------|---------------|--------------|
| Mobility Benefits: Bicycle Only | \$145,174 | \$113,956 | \$88,196 |
| Health Benefits: Bicycle Only | \$70,406 | \$18,677 | \$24,389 |
| Recreation Benefits: Bicycle Only | \$1,897,178 | \$445,855 | \$56,803 |
| Reduced Auto Use Benefits: Bicycle Only | \$5,903 | \$4,634 | \$3,586 |
| Total Annual Benefit: Bicycle Only | \$2,118,661 | \$583,123 | \$172,974 |
| Total Annual Benefits: Bicycle and Pedestrian <i>Assumes twice as many pedestrians use path as bicyclists.</i> | \$6,355,984 | \$1,749,368 | \$518,922 |

Table 6-8 shows the NPV benefit-cost results over the 30-year lifetime of the pathway. The benefit-cost ratio is determined by dividing the estimated benefits of the pathway in dollars by the estimated costs in dollars. A benefit-cost ratio higher than one means the project has more benefits than costs over its lifetime. A benefit-cost ratio of one means benefits and costs are equal. A benefit-cost ratio less than one means the project costs outweigh the benefits.

For the 5 percent and 2.5 percent real discount rates, the best estimate benefit-cost ratios are 2.66 and 3.28, respectively. Thus, the environmental, economic, public health, and social benefits the community would experience as a result of the pathway exceed the cost of the pathway by three times. The “low” estimates are extremely conservative and greatly underestimate the actual benefits. In this case the benefit-cost ratios for the 5 percent and 2.5 percent discount rates are 0.79 and 0.97, respectively. Under this scenario, the cost of constructing and maintaining the pathway would be very close to or more than the benefits. Using the “high” estimates, the benefit-cost ratios for the 5 percent and 2.5 percent discount rates are 9.67 and 11.93, respectively.

Though the benefit-cost estimates are less than one for the low estimate, this analysis is very conservative and does not include documented benefits of pathways such as higher property values adjacent to a pathway, increased economic activity generated by pathway users, and increased quality of life. Additionally, the benefit-cost analysis includes the cost of total pathway reconstruction in addition to maintenance expenses; however, given the recommended long-term maintenance, it is likely that many of these features may just require repair and not replacement. As such, the benefit-cost analysis is very conservative. If pathway reconstruction were not included in the estimated costs, the analysis would likely indicate a more favorable ratio of benefits to costs. It is likely that the actual benefits received from the pathway will exceed the costs over its lifetime. Given very conservative maintenance costs and benefits, as well as the intangible benefits that have not been captured by the benefit analysis, this Study recommends the City pursue construction of the EMBUD Aqueduct Pathway.

Table 6-8: Net Present Value Benefit-Cost Results

| Benefit-Cost Analysis | Net Present Value of Benefits | Net Present Value of Construction and Maintenance Costs | Benefit-Cost Ratio | Do Benefits Outweigh Costs? |
|---|--------------------------------------|--|---------------------------|------------------------------------|
| <i>Benefits with 5% discount rate</i> | | | | |
| High Estimate | \$71,402,610 | \$7,385,529 | 9.67 | Y |
| Best Estimate | \$19,652,259 | \$7,385,529 | 2.66 | Y |
| Low Estimate | \$5,829,529 | \$7,385,529 | 0.79 | N |
| <i>Benefits with 2.5% discount rate</i> | | | | |
| High Estimate | \$105,726,547 | \$8,862,655 | 11.93 | Y |
| Best Estimate | \$29,099,294 | \$8,862,655 | 3.28 | Y |
| Low Estimate | \$8,631,842 | \$8,862,655 | 0.97 | Probably |

The project costs shown in Table 6-8 include the NPV of annual maintenance and operating costs, as required for benefit-cost analysis. Total project costs are higher for the 2.5 percent discount rate case than for the 5 percent discount case because the lower discount rate results in less discounting of construction costs and annual maintenance costs in later years.

The above benefit-cost results are based on conservative, lower-bound data inputs and assumptions and there are additional categories of benefits which have not been considered in the above analysis because of the difficulty in quantifying them. Additional benefits include increased economic vitality of communities, increased property values, improved quality of life, and more social equity. The actual benefit-cost ratios are likely substantially higher than those shown above in Table 6-8 because:

- The Census data on bicycle commuters probably substantially underestimate the actual percentages of bicycle commuters. In Contra Costa County a substantial number of bicycle commuters commute to BART or Amtrak commuter rail stations. These bicycle commuters are probably counted under “transit” rather than “bicycle.” BART data indicate that 53 bicyclists access the Lafayette BART station on an average weekday (two percent of BART riders from home origins).⁴⁴
- Because of Lafayette’s dry temperate climate, with relatively few rainy days, cycling is a 12-month per year activity and the percentages of adult cyclists are likely underestimated by the NCHRP’s national estimates, which include many areas with severe winters and/or many more rainy days.
- The proposed trail projects fill “gaps” in the City of Lafayette bicycle and pedestrian network, creating direct links to a major transit stop as well as local and regional shopping destinations. Filling the gaps will likely have a multiplier effect with much greater usage of the new trail segments than would be the case if the new trails were isolated trails.

⁴⁴ 2008 BART Station Profile Study

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- The Lafayette Priority Development Area (PDA) and future housing developments near BART will likely increase the population near the pathway, and, thereby, the number of pathway users.
- Annual maintenance costs for the pathway may be reduced through renegotiation of the EBMUD Revocable Landscaping License Agreement.

6.4 Funding Sources

6.4.1 Funding Sources for Construction

If the City of Lafayette decides to pursue the proposed pedestrian and bicycle pathway, the City will most likely rely on grants for construction. Maximum grant awards for bicycle and pedestrian projects tend to be low—ranging from \$250,000 to approximately \$1,000,000—so pathway construction would need to be phased and potentially multiple grant sources used to fund a segment.

Several factors will affect the availability of grant funds to construct the proposed pathway segments. Eligibility requirements vary by grant source, but typically pathways must show a commute benefit to be eligible. While a recreational trail is less expensive to construct than an ADA-compliant pathway or Class I multi-use path, funding sources for recreational pathways are limited. Administrative costs also vary by grant source, with some grants permitting a portion of the award to be used for administration. **Appendix D** outlines potential sources for grant funding for construction of the proposed EBMUD Aqueduct pathway.

In addition to grant sources, there are two possible local sources for construction funding, the Lamorinda Transportation Development Fee and conditioning pathway construction to new development.

Lamorinda Transportation Development Fee

In 1998, the City of Lafayette entered into a Joint Powers Agreement with the cities of Orinda and Moraga to establish a transportation development fee that funds design and construction of transportation projects that mitigate traffic impacts generated by new development. Projects that can be funded by the fee are listed on an Expenditure Plan and must be shown to a) have a reasonable relationship (nexus) to the traffic generated by the new development and b) have regional benefits. If a study shows that there is a nexus between the proposed EBMUD Aqueduct Pathway and new development, the City of Lafayette may wish to add the pathway to the Expenditure Plan. Since the proposed pathway provides access to BART, it is likely that it could be shown to have a nexus, and provide regional benefits.

Conditioning Pathway Construction to New Development

There is precedent for the City to require developers to construct or fund frontage improvements as a condition of development. If there is a nexus between a proposed development and the EBMUD Aqueduct pathway, the City may wish to consider requiring construction of the pathway as a condition of development.

6.4.2 Local Tax Revenue Sources for Maintenance and Operations

The proposed pathway will create significant infrastructure and to add to the City's maintenance inventory and safety and security operations. Funding for these programs should be secured before the City decides to proceed with the proposed pathway. As grant funding is generally not available for on-going costs of maintenance and safety and security operations, the City of Lafayette will need to identify local revenues to fund these activities.

Existing local revenue sources are currently over-subscribed, and it is unlikely that additional maintenance and operations costs could be funded with existing revenue streams. There are several options that the City may wish to consider to raise funding for maintenance and operations of the proposed EBMUD Aqueduct Pathway.⁴⁵

Option 1. Modify the Core Area Landscape and Lighting District

The City of Lafayette established the Core Area Landscape and Lighting District in 1979 to fund ongoing maintenance of landscaping and lighting amenities within the downtown area. Eligible amenities include median and parkway landscaping, street lighting and decorative lighting in some areas, ornamental and hardscape amenities, trees and a park site within the district. The services associated with these improvements include labor, materials, equipment, utilities, related incidental expenses and reserve funds to provide for the proper maintenance of these improvements. Funds may only be spent on amenities identified by the District.

The proposed pathway along the EBMUD Aqueduct ROW falls within the assessment district and, in the event of any future increases or modifications to this assessment, could receive funding for maintenance and operations.

Property owners (both business and residential) are assessed between \$120 to \$5,280 annually, with an average assessment of \$348. Total annual income from the assessment district is \$158,489. Assessments are calculated annually, based on the anticipated costs for services, and are proportionately spread to the parcels based on the benefits received by each parcel using a formula that calculates each parcel's land use, acreage, residential units, and frontage on Mt. Diablo Boulevard. The assessment is not indexed to inflation.

Currently, the revenue generated by the assessment district does not pay for existing services, and the City has made the difference up from the general fund.⁴⁶ The assessment has not been increased since 1994, when State Proposition 218 passed, requiring a vote of affected property owners, rather than council action, to approve any new or increased assessment before it could be levied. The City's last effort to modify the assessment district (in 2007) did not receive sufficient votes by affected property owners to pass.

Option 2: Establish a Business Improvement District

The City of Lafayette does not currently have a business improvement district (BID), but supports the formation of one, if there is support from local businesses. With recent cuts in City funding to downtown beautification efforts and events, the Chamber of Commerce and City are discussing ways of raising funds, including the formation of a BID.⁴⁷ Maintenance of the proposed EBMUD Aqueduct pathway could be funded through a BID, provided the pathway provides benefits to the business owners and downtown area. The Chamber of Commerce has historically not supported the formation of a BID, and so this option may not be likely.

⁴⁵ Phone interview; Tracy Robinson, Administrative Services Director, City of Lafayette, January 12, 2011.

⁴⁶ The City currently pays about \$100,000 annually to maintain existing levels of service in the assessment district, and the costs are increasing. (Phone call with Tracy Robinson, Administrative Services Director, City of Lafayette, January 12, 2011.)

⁴⁷ In December 2010, Lafayette City Council approved \$500,000 in budget cuts, \$80,000 of which affected downtown beautification and events such as the Christmas twinkle lights, banners, and Art and Wine Festival. (Phone call with Tracy Robinson, Administrative Services Director, City of Lafayette, January 12, 2011.)

Option 3: Establish a Business License Requirement

Lafayette does not currently require businesses to apply for a business license. If the City were to establish a business license program, funds would most likely be directed to the General Fund, and a portion could be allocated to maintenance of the proposed EBMUD Aqueduct pathway. The costs of administering a business license program may not warrant establishing this tax. The Chamber of Commerce has historically not supported the formation of a business license tax, and so this option may not be likely.

Option 4: Adjacent Property Owner Maintenance Requirements

In many cities, property owners are required to pay for maintenance of sidewalks and other public infrastructure fronting their property. The City may wish to consider requiring adjacent property owners to maintain the pathway and associated landscaping. This is most easily achieved where the pathway is immediately adjacent to the existing or proposed buildings and provides direct benefit to users of those buildings. Under the existing EBMUD Landscaping Licensing Agreement, if the City issues a sub-license to an adjacent property owner, the City is ultimately responsible for maintenance if the property owner fails to comply.

Option 5: Private Foundation Funding

Local private foundations may be willing to support ongoing pathway maintenance and operations by endowing a fund for that purpose. Annual maintenance costs are estimated at between maintenance costs would average approximately \$72,700 to \$103,100 annually, in 2010 dollars. Assuming a 3 percent inflation rate, reinvestment to equal inflation, and an annual rate of return of 5 percent, an endowment of \$2,000,000 would provide for approximately \$40,000 annually for maintenance.⁴⁸

Option 6: Business Sponsorship

Businesses could provide for some maintenance funding as part of a formal adopt-a-pathway program, or as part of a less formal sponsorship program. In return for sponsorship, businesses would be recognized on pathway signage, maps, and City correspondence with the public about the pathway. Sponsorship programs may not bring in enough revenue to support administration of the program, so careful analysis should be conducted before the City decides to pursue such a program.

Option 7: Shared Maintenance Agreement with EBMUD or EBRPD

EBMUD currently maintains the EBMUD Aqueduct right-of-way. While EBMUD cannot make improvements or perform maintenance for the benefit of other local governments, if a pathway were constructed, potential areas of overlap should be identified to improve efficiency. If found to be workable, then the City and EBMUD may wish to develop a shared maintenance approach, the details of which would be specified in a new Revocable Landscaping Licensing Agreement. Similarly, since the pathway provides connections to the regional trail system maintained by East Bay Regional Parks District, the City should discuss maintenance-sharing possibilities with EBRPD. Given that both agencies have clearly indicated that they will not provide maintenance services for an improved pathway along the EBMUD Aqueduct, it is likely that this option is not viable.

⁴⁸ Calculations and assumptions based on Ford Foundation's Endowment Calculator: http://survey.grantcraft.org/catalog/guides/endowments/endow_worksheet2.html

6.4.3 Non-Revenue Sources for Maintenance and Operations

Volunteer Pathway Patrol and Maintenance

Volunteer pathway patrols are used by several agencies, including the East Bay Regional Park District. These patrols remind users of rules and regulations and serve as a “presence” on the pathways and are limited to litter pick up and vegetation management. Professional maintenance staff is required for crack sealing, repaving, and graffiti removal and disposing of trash and plant matter. The City could combine a volunteer trail patrol with a hotline number for volunteers to report pathway maintenance issues, thereby improving City response time. This project is not a likely candidate to develop a strong volunteer core in the short-term given existing Park and Recreation Committee interest in and commitment to maintaining existing park and open space facilities.

Commercial/Residential Neighborhood Block Watch

A commercial or neighborhood block watch can effectively address safety and security concerns along the proposed pathway. The City of Lafayette’s has an established Neighborhood Watch Program, in which neighbors partner with each other and the police to address issues of concern.

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