



PRELIMINARY ENGINEERING REPORT
LONGHORN DAM MULTIMODAL
IMPROVEMENTS

JULY 2020

FINAL



TABLE OF CONTENTS

1. INTRODUCTION	4
Background	4
Existing Conditions	4
Scope of Services.....	10
2. DESIGN CRITERIA	10
Bicycle and Pedestrian Geometric Design.....	10
Hydraulics Considerations	11
Utilities Considerations	11
Geotechnical Considerations.....	12
3. EVALUATION CRITERIA	12
Public Input.....	12
Existing Site Conditions/Geometrical Constraints.....	13
Safety & Accessibility	15
Convenient Connections.....	15
Hydraulic Impact	16
Environmental and Landscape.....	16
Construction Cost.....	18
4. ESTABLISHMENT OF ALTERNATIVES	19
Establishment of Alternatives.....	19
5. ALTERNATIVE DEVELOPMENT	23
Peninsula Alternative (Alt A)	24
Wishbone Alternative (Alt B)	28
Upstream Alternative (Alt C).....	31
Downstream Alternative (Alt D).....	35
Existing Bridge Widening Alternative (Alt E).....	38
6. OPINION OF PROBABLE CONSTRUCTION COST	42
Construction Cost Summary.....	42
7. EVALUATION OF ALTERNATIVES	43
Evaluation Summary.....	43
8. RECOMMENDATIONS	43
Recommendations	43



LIST OF FIGURES

Figure 1.1. Project Vicinity Map	5
Figure 1.2: Project Footprint	6
Figure 1.3: Typical Longhorn Dam and Bridge Section.....	7
Figure 1.4: Existing Utilities.....	8
Figure 1.5: Project Geology	9
Figure 2.1: Maintenance Boat	11
Figure 3.1: Constraints Map	17
Figure 3.2: Peninsula Tree Layout	18
Figure 4.1: Public Input-(a) What Needs Improvement? (b) What Do You Like?	20
Figure 4.2: Public Input- Desired Travel Paths.....	21
Figure 4.3: Public Input- Which Bridge Type Do You Prefer?	22
Figure 4.4: Alternative Responses	22
Figure 5.1: Peninsula Alternative (Alt A).....	25
Figure 5.2: Wishbone Alternative (Alt B)	28
Figure 5.3: Upstream Alternative (Alt C).....	32
Figure 5.4: Downstream Alternative (Alt D).....	35
Figure 5.5: Existing Bridge Widening Alternative (Alt E)	39

LIST OF TABLES

Table 5.1. Hydraulics Analysis Summary	24
Table 5.2. Peninsula Alternative (Alt A) Conflict Matrix.....	26
Table 5.3. Wishbone Alternative (Alt B) Conflict Matrix	30
Table 5.4. Upstream Alternative (Alt C) Conflict Matrix.....	33
Table 5.5. Downstream Alternative (Alt D) Conflict Matrix.....	37
Table 5.6. Existing Bridge Widening Alternative (Alt E) Conflict Matrix	40
Table 6.1. Estimated Construction Cost	42
Table 7.1. Evaluation Matrix.....	43

LIST OF APPENDICES

- Appendices A – Concept Drawings
- Appendices B – Cost Estimate
- Appendices C – Preliminary Geotechnical Bridge Foundation Recommendations Memo
- Appendices D – Public Meeting Input Summary
- Appendices D.1.1 – Materials Presented During First Public Meeting
- Appendices D.1.2 – Summary of First Public Meeting
- Appendices D.2.1 – Materials Presented During Second Public Meeting
- Appendices D.2.2 – Summary of Second Public Meeting
- Appendices D.3.1 – Materials Presented During Third Public Meeting
- Appendices D.3.2 – Summary of Third Public Meeting
- Appendices E – Preliminary Constraints and Permitting Analysis Report
- Appendices F – Hydraulic Memo
- Appendices G – Utility Layout
- Appendices H – Best Practice for Dam Owners



7/10/2020

Lee Friberg P.E.



1. INTRODUCTION

Background

HDR Engineering, Inc. (HDR) was contracted by the City of Austin (COA) to perform a preliminary engineering report evaluating the feasibility of new multi-use pedestrian bridge alternatives spanning the Colorado River near the Longhorn Dam and associated trail connectivity improvements. This report also illustrates improved connectivity to the Ann and Roy Butler Hike and Bike Trail, Guerrero Park and Trails, Country Club Creek Trail, Pleasant Valley Road, and protected bicycle lanes.

Multi-use pedestrian bridge alternatives include:

- Longhorn Shores to Lady Bird Lake Peninsula Crossing.
- Longhorn Shores to Holly Shores Crossing, Upstream of Longhorn Dam.
- Widening of the Existing Longhorn Dam Bridge.
- Longhorn Shores to Holly Shores Crossing, Downstream of Longhorn Dam.
- No build.

In addition to the connectivity provided by the multi-use pedestrian bridge, system connectivity improvements are as follows:

- Trail Upgrades at the intersection of Lakeshore Blvd. and Pleasant Valley Rd.
- Pleasant Valley Undercrossing Structure Replacement.
- Replacement of the bridge connecting Holly Shores to Lady Bird Lake Peninsula.

A no build alternative was included in the evaluation. True to the nature of a no build alternative, the facility will remain in its current condition as of the writing of this report. However, a no build alternative was not preferred as the public felt it was important to invest in safety and access improvements at the Longhorn Dam. For that reason, this report does not discuss the alternative option in detail.

Existing Conditions

The Ann and Roy Butler Hike and Bike Trail is located around portions of Lady Bird Lake near downtown Austin. The main trail is approximately 10 miles in length extending from Loop 1 to Longhorn Dam. The City of Austin has made various improvements to this trail over the years. Named for a former Austin mayor and his wife, this trail system receives more than 2.6 million visits per year and is one of Austin's most popular recreation areas.

In addition to a recreational path, this continuous loop around Lady Bird Lake serves as a high-comfort bicycle and pedestrian east-west transportation route with Lady Bird Lake crossings for Austin's urban core. In addition to the trail loop, there are several other connections to on and off-street bicycle and pedestrian facilities.

The project area focuses on the east end of the trail. It encompasses Lakeshore Blvd., Longhorn Shores, Longhorn Dam, Holly Shores, and the unnamed peninsula. See Figure 1.1 for the project vicinity map.



Figure 1.1: Project Vicinity Map

The project is located near Pleasant Valley Rd at the east end of the Ann and Roy Butler Hike and Bike Trail, between I-35 and US 183. The trail currently crosses the east end of Lady Bird Lake over the Longhorn Dam. The trail over Longhorn Dam is narrow and often difficult to navigate if other trail users or dam maintenance activity is present. The trail is separated from traffic by a concrete traffic barrier and chain link fence. It is separated from the lake by short railing. The combination of the narrow width, short exterior railing, height above the lake below and traffic noise result in discomfort and safety concerns for pedestrians and cyclists.

All non-residential roads within the project vicinity are known for significant congestion. Any trail/roadway crossing intersection improvements proposed as part of this project will be grade separated. Maintaining existing pedestrian and bicycle networks to adjacent trail systems within the project footprint is integral to the city’s trail system. See Figure 1.2 for the project footprint.



Figure 1.2: Project Footprint

Existing Roadway

The main vehicular roadway within the project footprint is Pleasant Valley Rd. It is a 4-lane undivided urban arterial serving as the only non-freeway crossing of the Lake/River between I-35 and US 183. It is approximately a 44.5' wide roadway composed of 2-11' lanes in either direction with minimal shoulders. Starting at Lakeshore Blvd., south of Longhorn Dam, the grade increases from 0.0% to 5.0% at the bridge approach. The grade levels off on Longhorn Dam and transitions to a -4.0% grade toward Cesar Chavez St., north of the dam.

Lidar survey, within the footprint of the project, was acquired for use during the development of this PER. While this data provided an appropriately accurate environment for a study phase project, site specific topography should be used for final design. This provides a degree of accuracy needed for designers to establish trail design and Americans with Disabilities Act (ADA) grade compliance.

Existing Bridge

The vehicular bridge is supported by, and integral to, the Longhorn Dam structure, as shown in Figure 1.3. The bridge structure is supported by a series of lift gate and bascule gate piers spaced at 56' or 58'. A 6 ¼" cast in place concrete deck is carried by 40" deep prestressed girders supported on multi-column bents. Construction of the dam and bridge structure was completed in the early 1960's. An approximately 6' wide sidewalk is cantilevered from the exterior girder, which includes a combination rail. Drainage is conveyed from the center crowned bridge deck to slot drains outside of the existing girder. As of April 2016, the sufficiency rating is 58.5.

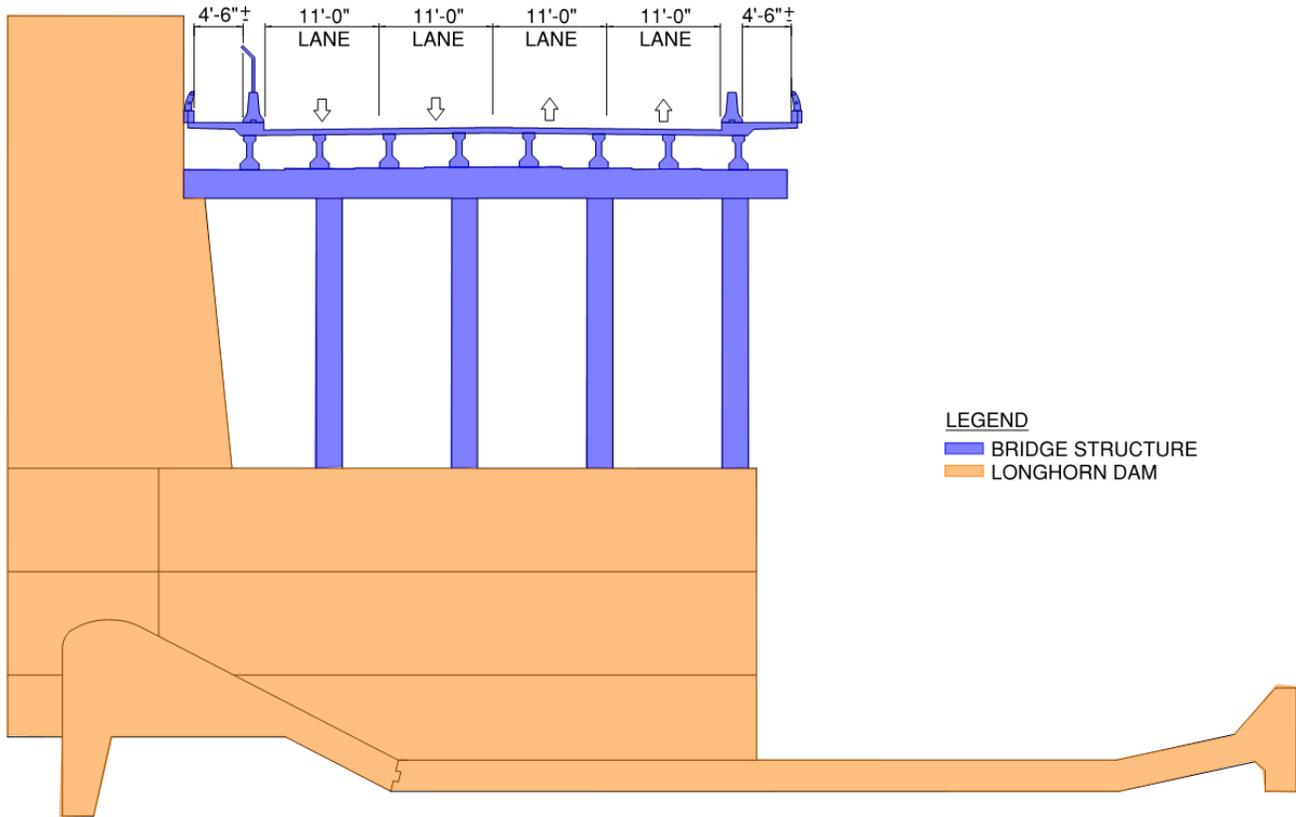


Figure 1.3: Typical Longhorn Dam and Bridge Section

Hydraulics

Lady Bird Lake was created in 1960 with the construction of Longhorn Dam for use as a cooling reservoir for the Holly Power Plant. The plant is now closed and Lady Bird Lake serves primarily as a recreational asset and amenity to the residents of the City of Austin. Lady Bird Lake is considered a pass-through lake since there is no available flood protection storage. Flows into Lady Bird Lake are routed through Longhorn Dam, continuing downstream along the Colorado River. Longhorn Dam spillway poses little influence to the hydraulic grade line of Lady Bird Lake/Colorado River for storm events greater than or equal to the 50-year event (2% annual exceedance probability). Longhorn Dam is currently operated and maintained by Austin Water.

The project site is located within Federal Emergency Management Agency (FEMA) special flood hazard area Zone AE and Zone X as of January 2016. Several structures and roadways are inundated by the effective floodplain upstream of Longhorn Dam. Per City code, project improvements cannot cause increased water surface elevations upstream of the project without obtaining a variance. Full details of the hydrologic and hydraulic analysis is detailed in an HDR technical memo dated June 29, 2020 addressed to Karl McArthur, City of Austin Watershed Protection Department. This memo is attached to this report in Appendix F.

Existing Utilities

Existing overhead and underground utilities within the project footprint are shown in Figure 1.4. A quality level D desktop survey has been completed resulting in the identification of the utility type, size, location, and ownership.

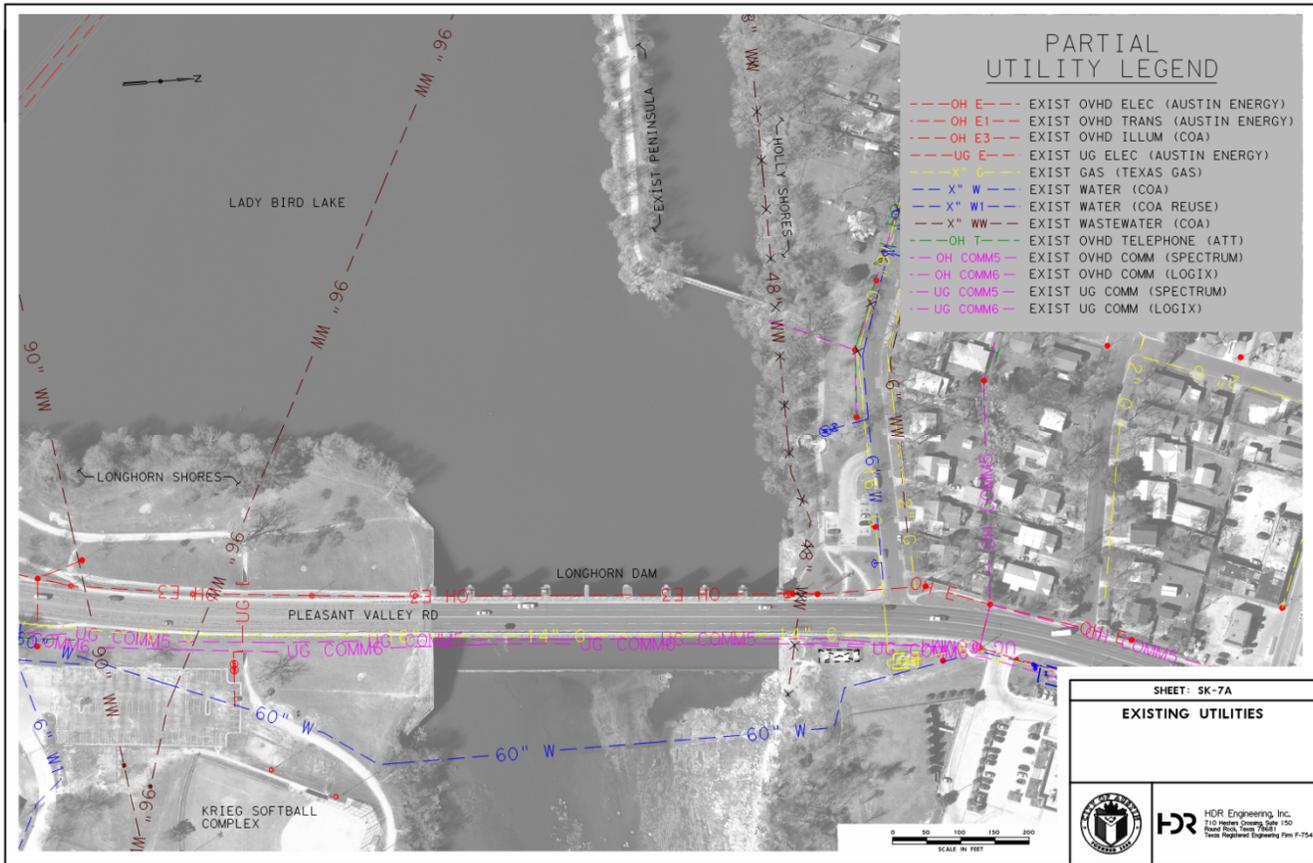


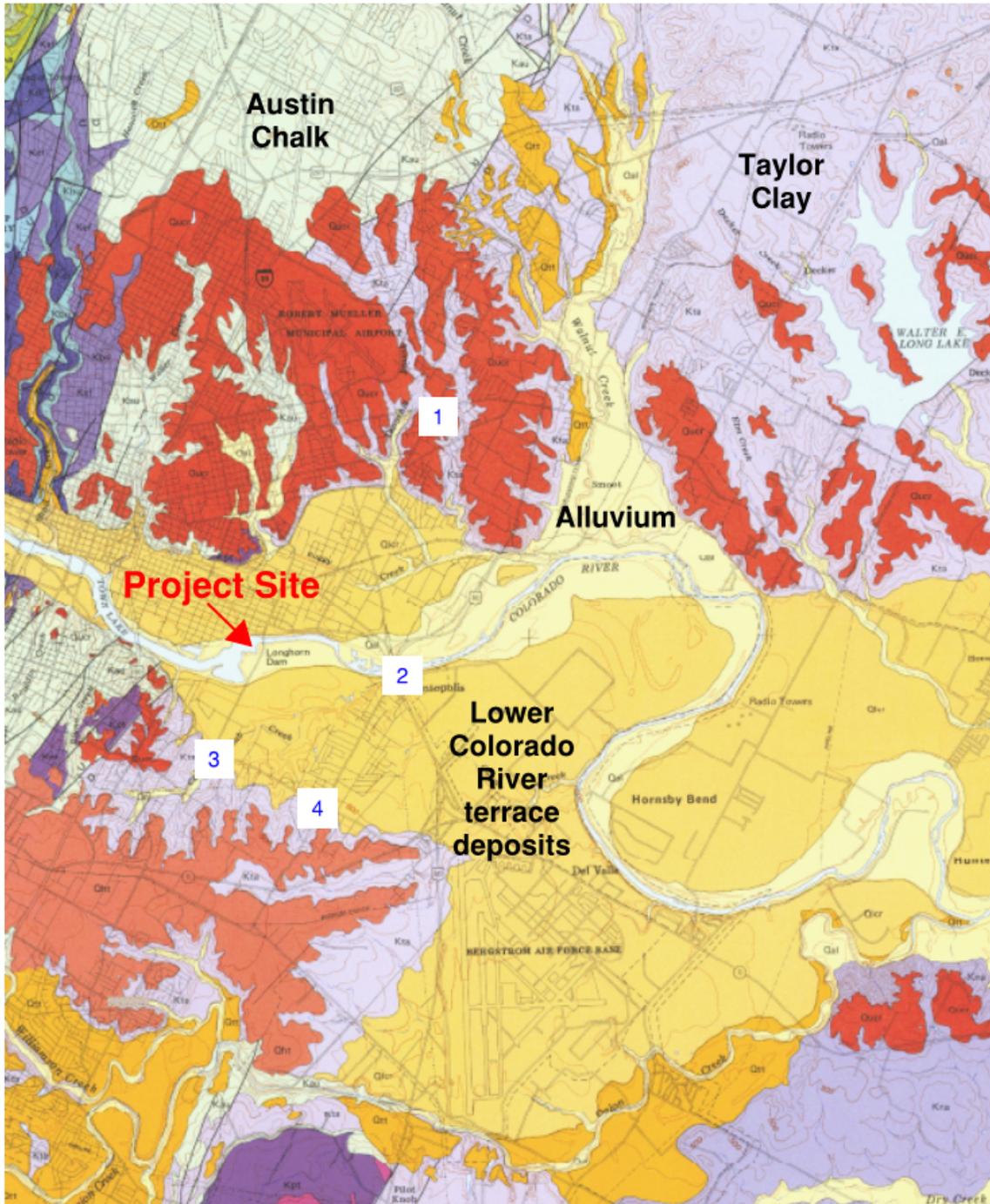
Figure 1.4: Existing Utilities

Major existing utility considerations include: the 60” Water line owned by COA downstream of Longhorn dam, the high pressure natural gas transmission pipeline attached to the underside of the dam owned by Austin Energy, and the 90” and 96” Wastewater tunnels crossing the lake upstream of the dam owned by COA.

Minor utilities in the area include illumination, small diameter gas service lines, and underground communication lines. An unknown utility was also discovered attached to the existing bridge while doing field utility investigations. Subsurface Utility Engineering (SUE) services are recommended in the next phase of design to identify function and ownership for the unknown utility, and to have more accurate utility location information. Refer to Appendix G for additional existing utility information.

Project Geology

A geologic map of the Austin area shows that the project site is underlain by alluvium and Lower Colorado River terrace deposits, which in turn are underlain by clay, clay shale, and shale of the Taylor Group. A portion of the geologic map showing the geology around Longhorn Dam is shown below in Figure 1.5. The original contract drawings for Longhorn Dam contain specific geotechnical information. These documents, along with investigations from adjacent projects and site geology maps are used to determine foundation feasibility, conceptual foundation recommendations, and corresponding order of magnitude construction costs.



Geologic Map and Past Projects

Geologic Map from the Bureau of Economic Geology, The University of Texas at Austin.

Exhibit 1

Figure 1.5: Project Geology



Scope of Services

The following tasks were performed during the conceptual development of this project:

- Lidar files, dated 2017, illustrating topographic contours, street outlines, and property boundaries were acquired.
- Bathymetry Data was acquired.
- Placed an 811 “One Call” to determine utility owners within the proposed project area.
- Developed an existing utility layout by collecting utility records and performing field walkthrough.
- Created a preliminary utility conflict matrix for each bridge design alternative.
- Pleasant Valley roadway and Longhorn Dam as-built plans were acquired.
- Effective FEMA hydraulic models were acquired and updated to reflect existing conditions.
- Pedestrian bridge and Longhorn dam bridge typical sections were developed.
- Alignment alternatives were developed.
- Bridge framing plans were developed.
- Hydraulic models were developed for each alternative to determine hydraulic impacts and potential scour.
- Coordinated with Austin Water and Watershed Departments.
- Provided a preliminary opinion of probable construction cost for each alternative.

2. DESIGN CRITERIA

Design criteria is defined as formal or industry standard guidelines that govern or guide analysis and design. The following trail design engineering criteria and/or agency guidance was considered during the preparation of this report:

Bicycle and Pedestrian Geometric Design

- Design Speed: 14 MPH
- Clear Width: 14'-24'
- Graded Shoulder Width: 2'-5'
- Maximum Gradient: 5%
- Minimum Gradient: 0.5%
- Maximum Cross Slope: 2.0%
- Minimum Curve Radius: 36'
- Vertical Clearance Minimum: 7'
- PROWAG Public Rights-of-Way Accessibility Guidelines
- Architectural Barriers Texas Accessibility Standards
- COA Transportation Criteria Manual
- COA Street Design Guide
- AASHTO Guide for the Development of Bicycle Facilities
- AASHTO Policy on Geometric Design of Highways and Streets
- AASHTO LRFD Bridge Design Specifications

Hydraulic Considerations

Both surface drainage and hydraulic models were assembled in order to properly design the opening underneath each proposed bridge alternative and its approaches. It was imperative that the bridge be designed to have little to no impact relative to the FEMA effective hydraulic models. The following criteria provided guidance for this effort:

- FEMA FIRM Panel 48453C0465J effective January 6, 2016 and FEMA FIRM Panel 48453C0605J effective January 6, 2016.
- Regulatory FEMA effective Colorado River hydraulic models currently posted on City FloodPro website.
- Approved development drainage studies within the study area.
- City Drainage Criteria Manual (DCM).
- Evaluated hydraulics for the 100-year storm event under fully developed conditions.

On August 18th, 2018, HDR met with COA Watershed Protection and Austin Water personnel to discuss design criteria for the proposed bridge location as to not affect Longhorn Dam functionality including hydraulic performance, maintenance, and future replacement. Proposed bridge considerations included:

- Pier spacing wide enough to allow three times the maintenance boat width and placed to shadow the Longhorn Dam piers.
- Low chord set to allow for vertical clearance for the maintenance boat at normal pool elevation or to provide 2 feet of freeboard during a flooding event or higher than the 100-year energy grade line (EGL).
- No impacts of the alternatives on the functionality of Longhorn Dam.
- Adverse flooding impact.

Austin Water provided the make and model of their maintenance boat, a ReconCraft RC18 Vessel with Overhead Fall Protection, which has a height of 8' -2" from waterline to top-most point on the fall protection. Based on this requirement, the minimum low chord elevation is equal to the normal water pool (428.25'), plus maintenance boat height (8.17') for a total of 436.42', however, this is lower than the duplicate effective 100-year EGL of 439.36'. Therefore, a minimum low chord elevation of 439.36' was used for all upstream alternatives. The duplicate effective 100-year EGL for downstream of Longhorn Dam is 441.48'



Figure 2.1: Maintenance Boat

Utility Considerations

Information regarding the utilities in the area of interest near the proposed bridge have been acquired and reviewed. Identified potential conflicts have been considered in the various conceptual designs and alternatives. All utilities should be verified with proper survey with a registered SUE firm.

Engineering judgment was used to avoid major utility lines within the project footprint. Alternatives that alter the existing bridge or dam structure could potentially risk impacting the utilities attached. A 14" Natural Gas high



pressure transmission line owned by Texas Gas attached to the existing bridge requires significant consideration. There are potential utility conflicts with the pedestrian tunnel south of the bridge. Considerations were made to maintain utility maintenance access for alternatives that modify the existing structure. Minor utility adjustments are expected with each alternative.

Geotechnical Considerations

Based on a review of the geologic map and available subsurface investigation, it is recommended that deep foundations (drilled shafts) be used to support proposed bridge structures. These deep foundations have the added advantage of providing additional resistance to scour relative to shallow foundations.

Preliminary drilled shaft capacities were calculated using two different methods which are described in detail in Appendix C, Conceptual/Preliminary Geotechnical Bridge Foundation Recommendations Memo. These two different methods are the Texas Department of Transportation (TxDOT) and Federal Highway Administration (FHWA) approach to determining foundation capacity. Both methods would be appropriate for this location.

3. EVALUATION CRITERIA

During the initial development phase of this project, community members and stakeholders provided input on facility upgrade priorities. This list was used, along with project specific engineering guidance, as the guiding principles to define and evaluate this project.

Public Input

The City of Austin Team began the public engagement process in fall of 2018. This project has generated significant public interest and the opinions of local residents have been instrumental in the evaluation process. The history of the area along with the existing crossing conditions were presented at the first public meeting. The public was asked to provide input on the trail alignment and bridge type as well as attributes to be improved and favorable site attributes. This provided an understanding of the project need as well as existing site constraints. During this meeting valuable insight on community priorities as well as conceptual level alignments was collected.

Bridge types were identified that were conducive to aspects of the project site such as geology, available span lengths, span length capacity, and similarity to local construction. A graphic was presented to the public illustrating that more custom or exotic bridge types would result in a higher overall cost. It was also communicated that with increase in project cost, the time to implement increased. The most popular bridge type was a prestressed beam type superstructure with upgraded superstructure components. These upgraded superstructure components were expected to be benches, lighting, planters, curved geometry, textured and colored concrete, and handrails.

Through the public engagement process, it was documented that the area attributes that the public liked were the views, trail connections, and water features. These should be exploited and or preserved in future design refinements.

Through a project survey ballot itemizing potential attributes, the following items received the most support votes from local residents:

Safety	Pedestrian Accommodations	Maintenance
Bridge Width	Trail Connections	Amenities
Bicycle Accommodations	Sidewalks	Tunnel
Connectivity	Lighting	Signage

Five build alternative alignments were identified along with one no-build alternative. Based on the response from the community, a no build alternative was not preferred as the public felt it was important to invest in safety and access improvements at the Longhorn Dam. For that reason, this report does not discuss the alternative option in detail. These alignments were refined based on environmental factors, site topography, horizontal/vertical curve limitations, hydraulic requirements, capacity of structural components, utility locations, and proximity and impact on existing dam.

Following the refinements a second public meeting was held. The public was asked to choose their preferred alignment and provide any other refinement input. A summary of public input for the second public meeting has been included in Appendix D. This summary shows a graphic depiction of public support for various options.

The community priorities have been summarized and are included herein as a portion of the evaluation criteria. This evaluation criteria was used to determine the project that is recommended for advancement to final design and construction.

A summary of public input for each of the public meetings can be found in Appendix D.

Existing Site Conditions/Geometrical Constraints

The improvements discussed herein were evaluated based on how well the proposed geometry meshes with existing conditions. Existing conditions include hydraulics, topography, geology, avoidance of existing utilities, dam functionality, and dam maintenance requirements.

Hydraulics

All of the proposed alternatives either cross Lady Bird Lake or the Colorado River depending on whether the crossing is upstream or downstream of Longhorn Dam. A hydraulic analysis has been performed for each of the alternatives in order to determine the magnitude of hydraulic impact on upstream water surface elevations. Any increase in water surface elevation would require the approval of a floodplain variance by the City Council, a notification letter to all properties impacted by the rise, a Conditional Letter of Map Revision (CLOMR), and a Letter of Map Revision (LOMR) with requirements of FEMA acknowledgement of a complete LOMR application prior to final acceptance by City. Changes in the effective water surface elevation during a design event was influenced by the number and placement of bridge columns and abutments. The conclusion of the hydraulic analysis effort determined the low bridge chord elevation. The girder height and deck thickness was added to determine the profile grade. All alternatives provide the necessary hydraulic clearance. See Section 5 for a summary of hydraulic analysis.

Existing Topography

At this particular location many factors influence the way a proposed trail will cross Lady Bird Lake. For example, the existing topography and need to elevate the bridge structure above the water surface elevation for the 100yr flood determines the average trail grades.

The proposed trail alignment connects Longhorn Shores with Holly Shores. Based on a nominal horizontal and vertical distance between the two shores, the resulting 1.8% slope is a representative minimum. $(457'-434') / (2600' - 1300') = 1.8\%$. All proposed alignments contain a relatively flat section of the bridge that promotes comfort of crossing. This space is easily traversable and results in an area where users can congregate without standing on a slope. Provision of the relatively flat section would result in short end sections that are above the minimum 1.8% slope.

Due to the low elevation of the existing trail along the unnamed peninsula in Lady Bird Lake, alternatives that propose tying into this trail would bring sections of the bridge into the floodplain during a 50-year storm event, causing a reduction in available flood conveyance area balanced by the removal of the existing pedestrian bridge section.



Alternatives with relatively flat grades, minimizing the degree and length of steep slopes while being compliant with the hydraulic and topographic requirement were evaluated favorably.

Geotechnical Investigation

Geotechnical investigation was not performed during this study. Geological information as well as sub surface information was gathered from projects within close proximity of the area of interest for the proposed pedestrian bridge. It should be noted that the specific location of shifts between geological layers can vary, but the overall geologic information can provide enough information to draft a conceptual level of the analysis necessary for a design of this level.

Based on preliminary analysis after reviewing the information provided about the area of interest for the proposed bridge, the following should be considered when designing the length and diameter of the drilled shafts for the bridge:

- Use a minimum disregard depth of 10 feet, increased for scour
- Disregard all embankment fills and any other fill material;
- Disregard all alluvial soils.
- Drilled shafts should penetrate the clay shale, shale and/or limestone at least 20 feet; and
- Drilled shafts should have a minimum diameter of 3 feet.

Specific geotechnical design recommendations are included in Appendix C. These recommendations provide relatively favorable capacities for drill shaft foundations. The conclusion that can be made from the geotechnical investigation efforts to date is that foundation capacity is not expected to be a limiting factor for the bridge layout design.

In support of final design, the geotechnical study for the proposed bridge should include, at a minimum, one boring at each abutment and two new water borings. Other recommendations include drilling a boring at each of the abutment and bent locations.

Existing Utilities

A “One-Call” locating ticket was placed with Texas 811 to identify a list of utility companies with facilities in the project area. Utility owners were contacted to provide record documents for their facilities within the project footprint. Record documents were collected, analyzed and plotted on the existing Utility Layout in their approximate locations. While gathering utility information and speaking with utility owners, it was noted that maintenance access is a concern for utility owners if the existing bridge is modified. Additional information regarding owners and utilities can be found in Appendix G.

A field walkthrough was made to verify that existing utilities were shown on the existing utility layout. At the site visit, an unknown utility was found attached to the existing bridge for which no records were received. Moving forward, SUE services are recommended to obtain more accurate utility data on the unknown line and on other main utility infrastructure.

A preliminary Utility Conflict Matrix was prepared for each of the proposed alternatives, except the no-build alternative. The matrix allows the bridge design team to see all of the available information about the existing utilities including: size, function, owner, and what it is potentially in conflict with from the proposed bridge structure/other project improvements. The conflicts are listed as potential on the matrix until designs progress and conflicts can be confirmed or cleared. Similar potential conflicts were noted across the alternatives. The gas transmission line owned by Austin Energy is in potential conflict with the proposed tunnel on the south side of the lake.



Dam Maintenance

Maintenance of the existing Longhorn Dam requires gate access from both the upstream side and from the roadway above. Particular activities require boat access from the upstream side. The physical dimensions of this maintenance boat is shown in Section 2.0. Proposed alternatives provide vertical clearance from the normal pool elevation.

Gate maintenance requires crane access from the roadway above in order to lift portions of bascule and lift gates. The ideal placement for this crane is in the west lanes of the bridge. Proposed alignment alternatives (or other components) that inhibit crane mobility would be problematic.

Safety, Accessibility, Sustainability

Safety is one of the main drivers for this project. Safety concerns for both pedestrians and cyclists were prioritized and influenced the design decisions throughout the design process.

This section is broken down into three parts. First, there are factors that influence both the degree of safety and accessibility that can be addressed from a trail location and/or alignment perspective. Second, there are safety and accessibility factors that can be addressed by the facility detailing. Lastly, there are sustainability factors that can be addressed through materials used and designed service life of the proposed feature.

Attributes of trail location and/or alignment contribute to a wide open facility devoid of sharp turns, hiding places, and dead end alignments were evaluated favorably. Alignments that minimize grade changes and maximum ADA allowed grades are also favorable. Positive overall alignment attributes are those that exhibit a logical extension to the existing system.

Many of the details that affect safety such as appropriate handrail height, kickplates, appropriately spaced handrail openings, joint cover plates, facility lighting, and surface texture and coloring, are design details that could be applied to any option.

The main materials proposed for use in construction of this facility are time tested, robust materials that are intended for the harsh outdoor environment. The bridge alternatives evaluated are expected to provide a service life in the range of 75 years.

Convenient Connections

The Austin park system is a diverse and complex series of spaces interconnected to some degree. Within the project footprint, Lady Bird Lake provides a natural barrier between the Holly and Longhorn Shores neighborhoods. As a result, the existing communities connect by utilizing the bridge over Longhorn Dam, which is a narrow and dangerous trail user experience. Additionally, this section places trail users adjacent to vehicles. The close proximity of trail users to vehicles is undesirable; the noise, smell and heat of car exhaust in combination with the dangers associated with potential vehicle/pedestrian conflicts.

Trail

One of the goals of this project is to increase mobility along the existing local and regional trail network in a safe and inviting way. The trail upgrade should be responsive to the needs of commuters as well as exercise enthusiasts desiring an uninterrupted path around Lady Bird Lake.

Alignment alternatives that provided a convenient and safe connection to the Country Club Creek Trail, and completed the Ann and Roy Butler Hike and Bike Trail loop were rated favorable. Alignment alternatives that provided more direct connections for the north-south commuter as well as the recreational user were rated higher.



Street

While providing for trail connectivity, separation should be provided between trail users and vehicles on Pleasant Valley Rd. In addition to increased pedestrian and cyclist safety, separating pedestrian and cyclists from vehicles increases the roadway's level of service.

Alternatives that provided separated but unimpeded trail and vehicular, while providing connections to significant trail and street networks, were considered favorable.

Hydraulic Impact

The City of Austin Land Development Code states developments will not result in additional adverse flooding impact on other property. Small adverse impacts to upstream water surface elevations are anticipated (if not mitigated) with the proposed placement of bridge piers and abutments in the 100-year floodplain. Any rise in water surface elevations upstream of the project area would require a City Council variance, a notification letter to all properties impacted by the rise, a CLOMR, LOMR with requirements of FEMA acknowledgement of a complete LOMR application prior to final acceptance by City. Refer to Appendix F for additional details.

If the project moves forward into final design then procedures as outlined in FHWA Hydraulic Engineering Circular (HEC) Nos. 18, 20, and 23 should be followed to determine scour envelope and hydraulic loads. Best practices to implement from HEC-18 to reduce the risk of bridge failure from scour include defining the scour envelop for the recommended design frequencies, considering potential storm debris, designing appropriate abutment slopes, armoring abutments, streamlining piers, understanding flow patterns, and drilling piers to appropriate depths.

Environmental and Landscape

Each alignment alternative will be constructed in or within close proximity of Lady Bird Lake. Assessing potential environmental impacts may be critical in deciding which bridge alternative may be chosen and how that specific alternative will impact the environment in which it is constructed.

The existing project area exhibits a densely vegetated area with some topographic relief. The combination of these two attributes provide ample opportunity for the proposed bridge structure and trail system to mesh with its surroundings to continue to exhibit a park-like atmosphere.

Environmental constraints were identified and conflicts were avoided through alignment adjustments. These constraints consisted of potential: historic sites, industrial hazardous waste, conservation and recovery act locations, Texas water development board well, springs, wetlands, oil and gas pipelines, biological resource, erosion hazard zone, and critical water quality zone.

These environmental constraints were identified using environmental and regulatory research databases, historical and aerial photographs, and limited field work. The full Preliminary Constraints and Permitting Analysis Report is located in Appendix E.

The specific constraints documented in the Preliminary Constraints and Permitting Analysis Report are:

- Oil and Gas Pipeline
- COA Erosion Hazard Zone (EHZ)
- Critical Water Quality Zone
- Critical Environmental Features (CEF)
 - Lady Bird Lake south shore wetland
 - Holly Power Plant wetland
 - Longhorn Dam downstream wetland
 - Lady Bird Lake north shore wetland

- North shore, southwest of peninsula wetland
- Longhorn Dam downstream seep
- COA Parkland
- FEMA 100-year Floodplain
- Underground Storage Tank (UST)

The location of these constraints relative to the project area is shown in Figure 3.1, from the Preliminary Constraints and Permitting Analysis Report in Appendix E.

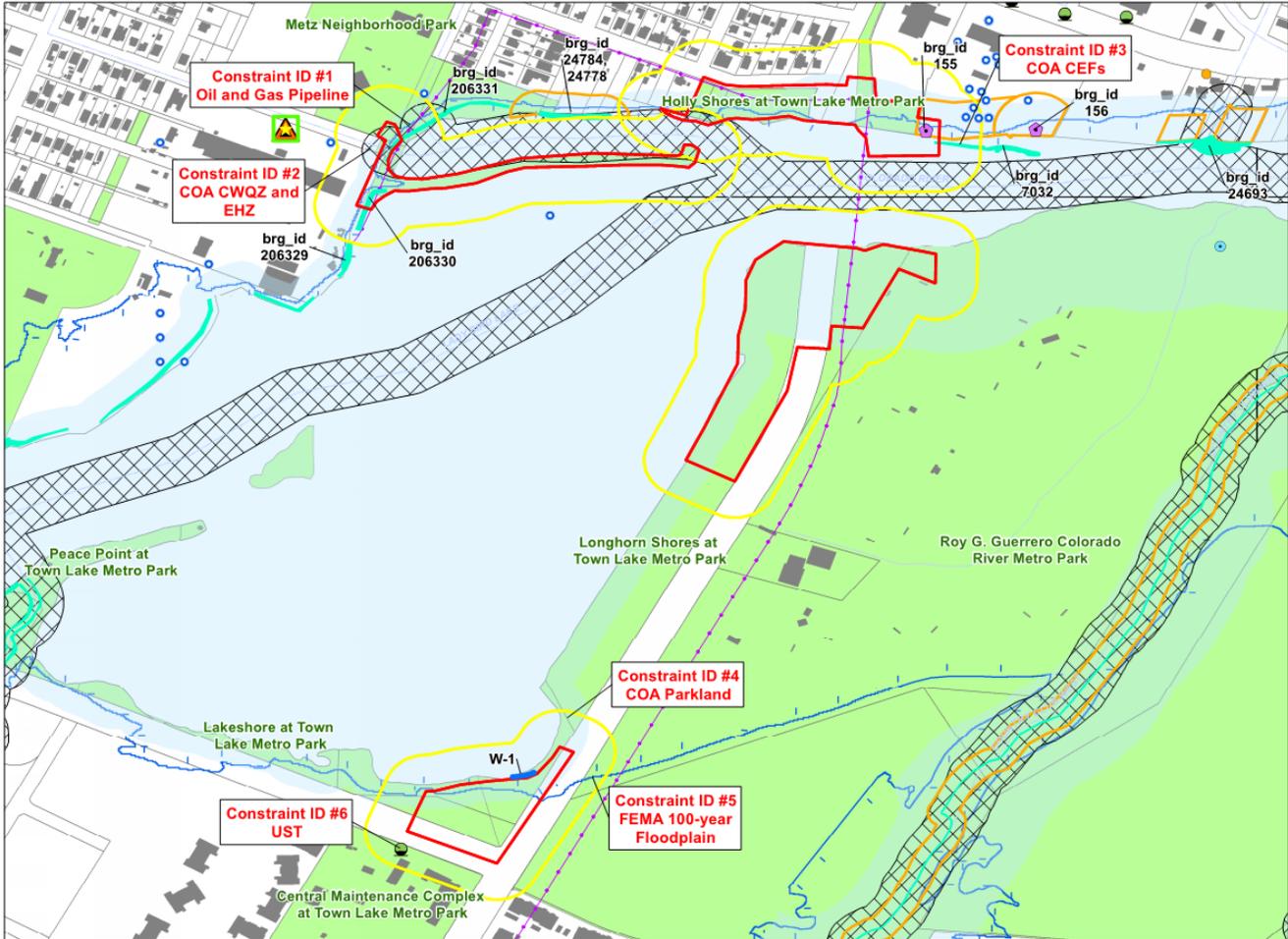


Figure 3.1: Constraints Map

During the project development process it was determined that there were several protected and heritage trees located within the project footprint. Specific tree species, if greater than 19” in diameter at 4.5’ above natural grade are protected. Specific tree species, if greater than 24” in diameter at 4.5’ above natural grade are considered heritage trees. Two Bald Cypress heritage trees, one Bald Cypress protected tree, and one Sycamore protected tree have been identified within the project footprint. All are located on the unnamed peninsula, shown in Figure 3.2.

Aesthetics and cost were deemed important to the community during the public engagement process. It was further communicated that the overall nonlinear form of the structure could provide positive aesthetic attributes while using historically economical components. Given this direction the design team developed horizontally curved

structures that fit within the project site, supported by conventional construction materials and shapes. Each alignment offers a level congregation area near the center of the Lady Bird Lake crossing to enjoy views – downtown skyline, lake, etc. The sense of space created by the culmination of these attributes was in response to public direction.

Alternatives that provided the smallest environmental footprint while giving landscape opportunities and taking advantage of aesthetic appeal and provided an aesthetically pleasing structure that fits the landscape were evaluated favorably.



Figure 3.2: Peninsula Tree Layout

Construction Cost

An estimate of initial construction cost was estimated in an effort to determine the most economical alternative. Historic data was used to evaluate the relative costs of each alternative. Estimated costs were based on TxDOT published average unit bid prices and modified in accordance with the nature of difficulty/risk for this particular project. Where published costs were not available, other project costs of similar nature were modified based on volume, location, and inherent market conditions.

Neither long term nor life cycle costs were included in this evaluation. Due to the preliminary nature of this document, only project components expected to make significant contributions to the overall construction costs were quantified and assigned a unit cost. Additional items were taken into account for conceptual level of detail in the form of contingencies and allowances.



In an attempt to produce a construction cost estimate that can be used for future program planning, several factors were applied to the base construction cost. These included engineering, construction inspection, City of Austin Management, inflation, and a contingency.

Comparing the compiled construction cost estimate for each alternative aided in determining the economic efficiency of each individual alternative. Alternatives with lower construction costs scored more favorably.

4. ESTABLISHMENT OF ALTERNATIVES

Establishment of Alternatives

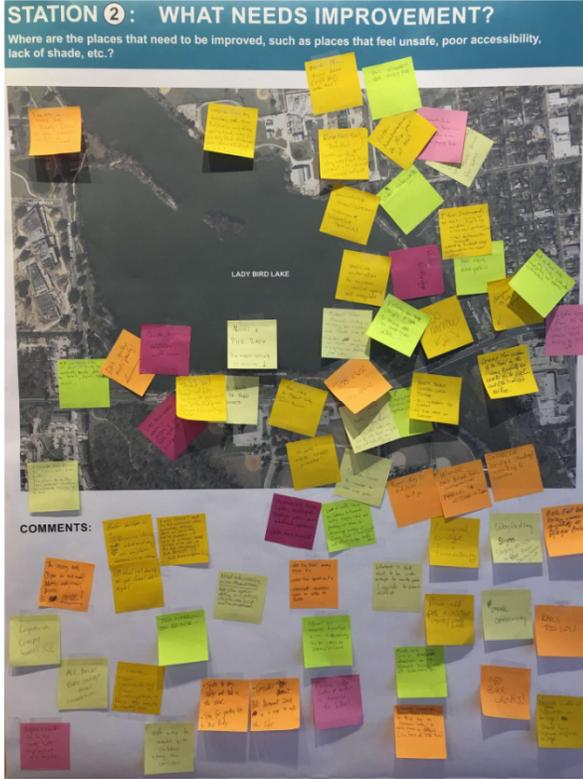
Through a series of three public meetings, the project team identified, evaluated, and refined alternative concepts for an improved crossing of Lady Bird Lake near Longhorn Dam.

Public Meeting #1, took place November 13, 2018 at Fiesta Gardens in Austin, TX. Concurrently, an online survey was released to collect additional feedback. This meeting focused on defining the issues with the current crossing and identifying desirable attributes for any system improvements, as shown in Figure 4.1. The meeting also solicited input on specific routes as shown in Figure 4.2 and general bridge style as shown in Figure 4.3. Figure 4.3 was intended to graphically depict varying bridge types as well as corresponding construction cost and time required for implementation. It showed that as the cost increases, the time required for implementation also increases. The material presented and public input received during the first comment period is summarized in Appendix D.1.1 and D.1.2.

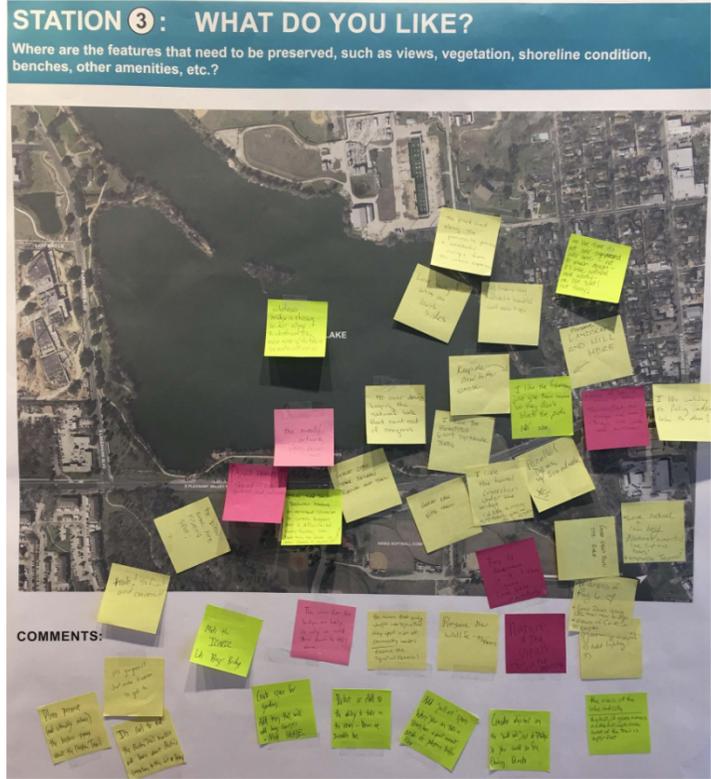
In addition to fulfilling the agenda, the first public meeting helped establish several general trail alignments. This is graphically shown in excerpts from the public meeting #1 summary included as Figure 4.4. At public meeting #1 all alignments were explicitly presented, except for the wishbone alternative. The wishbone alternative was stakeholder generated, originating from thirteen write-in responses.

Public Meeting #2, took place June 10, 2019 at Fiesta Gardens in Austin, TX. This meeting focused on presenting refined concepts for the five alternatives including tradeoffs for each concept and gathering feedback from the community. Each alternative was architecturally rendered on full size poster boards. Estimated construction cost information as well as features and tradeoffs for each alignment were shown. Each alternative as well as potential interim improvements on the existing bridge were solicited and requested feedback during this meeting and via the project website online survey. The material presented and public input received during the second comment period is summarized in Appendix D.2.1 and D.2.2.

Public Meeting #3 took place December 10, 2019 at Oswaldo A.B. Cantu/ Pan American Recreation Center in Austin Texas. This meeting presented the recommended bridge alternative based on public feedback, future project objectives and interim improvements. The material presented and public input received during the first comment period is summarized in Appendix D.3.1 and D.3.2. The third public meeting results are summarized in Section 8.



(a)



(b)

Figure 4.1: Public Input-(a) What Needs Improvement? (b) What Do You Like?

STATION ①: DESIRED TRAVEL PATHS

Where would you be going to and coming from when you would be using a new pedestrian and bicycle bridge?

Draw Your Path(s) →



COMMENTS:

DONT ENFORCE AN EXISTING LOOK OUT POINT
LAKES - SO
THE HEIGHTS
POINTS ARE NOT
RESTRICTED

Figure 4.2: Public Input- Desired Travel Paths

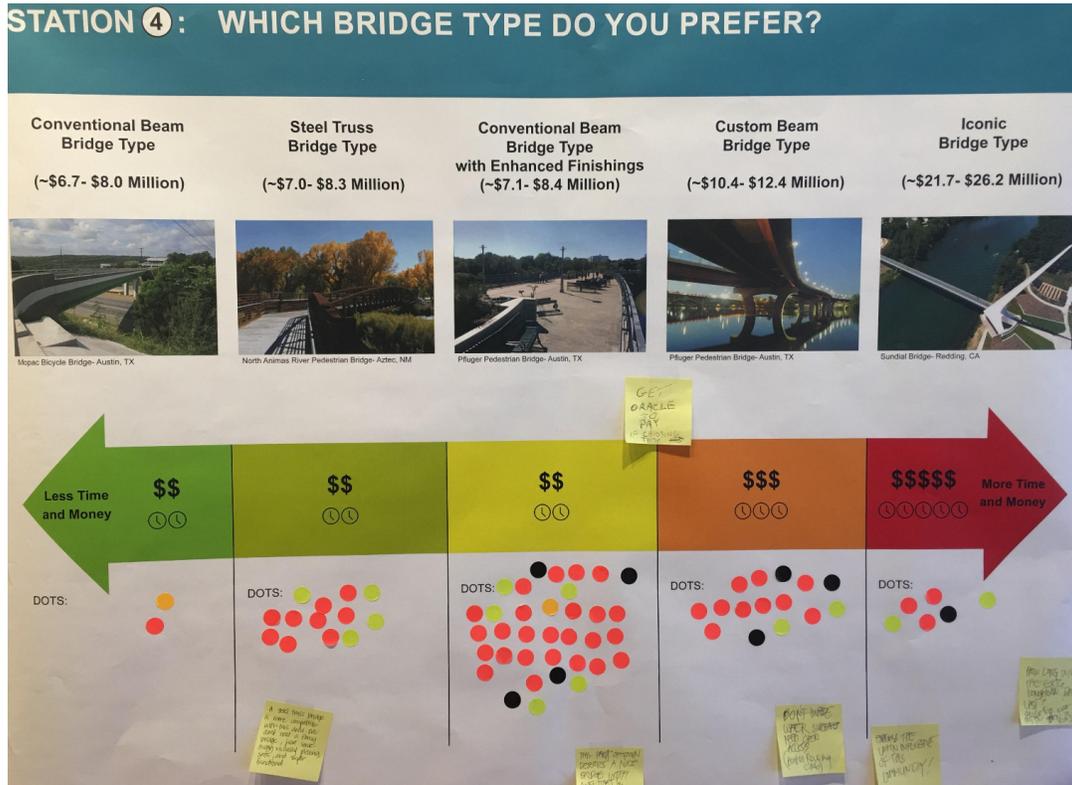


Figure 4.3: Public Input- Which Bridge Type Do You Prefer?

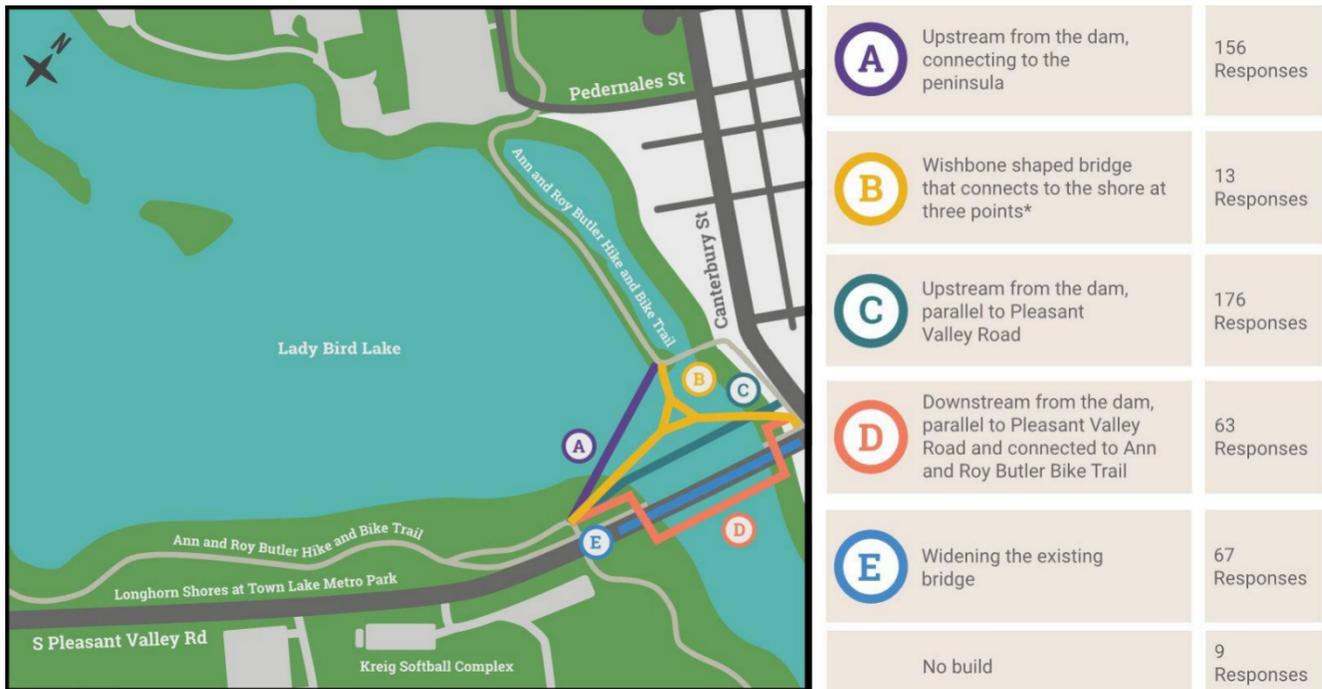


Figure 4.4: Alternative Responses

5. ALTERNATIVE EVALUATION

Each identified alternative has been developed in detail and evaluated against the design criteria defined within this document. Each alternative was assigned a score based on its performance relative to each criteria.

The following build alternatives provide varying degrees of performance relative to the project goals. The alternatives evaluated within this document are as follows:

- Peninsula Alternative (Alt A)
- Wishbone Alternative (Alt B)
- Upstream Alternative (Alt C)
- Downstream Alternative (Alt D)
- Existing Bridge Widening Alternative (Alt E)

The no build alternative was not evaluated in this section due to the public support for this project demonstrated during public meetings.

The horizontal alignment concepts for each of these options were developed based on input provided by the public as constrained by Design Criteria. A public input summary showing conceptual alignments and corresponding support was discussed in Section 4. Once the horizontal alignment and deck width variances were established for each alternative, the vertical profiles were developed. This profile and bridge structure depth were set just above the controlling water surface elevation based on hydraulic analysis. ADA compliant grades were a controlling factor in profile development for all alternatives, which also provided comfort and ease of access. All profiles feature an approximately flat area near the center of the bridge that can be used to congregate and enjoy the views. The point where the profile met the existing ground line determined the total bridge length. This bridge length was only lengthened in circumstances where the bridge length would constrict flows during a hydraulic design event.

The individual legs of the bridge, either upstream/downstream/or over to the unnamed peninsula, were approximately 500 feet. Tx Girders were chosen for the proposed bridge based on public input, cost, and appropriateness for the site. The maximum span length for a 62" deep girder is approximately 130'. The substructures are expected to be composed of minimal sized columns (4' to 5' dia.) for the transportation industry. It is not anticipated that these column sizes would need to be upsized to support 130' span lengths. The 130' maximum span length could then be used as a maximum typical span for all alternatives with the exception of the bridge widening. The superstructure for the bridge widening was based on existing span lengths and similar girders.

Hydraulic Impact

A hydraulic analysis of the Colorado River was performed for each of the five build alternatives. The FEMA effective Colorado River hydraulic models were obtained from the City of Austin Watershed Protection Department and consist of two separate models for two distinct reaches; the 'Tom Miller Reach' model extending from Tom Miller Dam to Longhorn Dam, and the 'Bastrop Reach' extending from Longhorn Dam to the Bastrop USGS Gauge 08159200. The hydraulic models were developed as part of the Lower Colorado River Flood Damage Evaluation Project for Lower Colorado River Authority (LCRA) and Fort Worth District U.S. Army Corps of Engineers in 2002.

The primary objectives of this analysis effort were to:

- Define existing flood risk and no adverse impact criteria.
- Analyze the impacts of the pedestrian bridge alternatives on the functionality of Longhorn Dam.
- Determine the minimum low chord elevation.
- Analyze proposed hydraulic impacts upstream and potential mitigation measures.
- Develop countermeasure recommendations for scour and hydraulic loads.



The existing flood risk was updated by including The Boardwalk and the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula to City effective hydraulic models. Both are located within the model extent used to determine the hydraulic impact of the proposed alternatives.

The Peninsula, Wishbone, Upstream, and Downstream alternatives each create varying degrees of hydraulic impact with up to a one inch rise in water surface elevations calculated upstream (see Table 5.1). The Bridge Widening alternative resulted in no hydraulic impact. Potential methods on how to mitigate hydraulic impact are defined in the HDR technical memo in Appendix F. Examples of minimizing hydraulic impact considered include removal of the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula; reducing the number of piers; recessing pier caps within the bridge deck; and beginning abutments outside of the effective flow area.

All of the proposed alternatives were determined to have no impact on the operation and maintenance of Longhorn Dam through discussion with Austin Water in a September 2019 progress meeting.

A summary of low chord elevations and upstream hydraulic impacts are shown in Table 5.1.

LONGHORN DAM MULTIMODAL IMPROVEMENTS PER					
Hydraulic Analysis Summary					
Alternative	Low Chord Based on 100 yr EGL (ft)	Low Chord Based on Maintenance Boat Access (ft)	Controlling Low Chord Elevation (ft)	Design/Modeled Low Chord Elevation (ft)	Increase in 100yr WSE (ft)
Peninsula Alternative (Alt A)	439.36	436.42	439.36	439.50	0.03
Wishbone Alternative (Alt B)	439.36	436.42	439.36	439.82	0.05
Upstream Alternative (Alt C)	439.36	436.42	439.36	439.90	0.10
Downstream Alternative (Alt D)	441.48	N/A	441.48	443.15	0.05
Bridge Widening Alternative (Alt E)	439.36	N/A	N/A	N/A	0.00

Table 5.1: Hydraulic Analysis Summary

Peninsula Alternative (Alt A)

This alignment alternative connects to the existing Ann and Roy Butler Hike and Bike Trail prior to the existing Pleasant Valley Pedestrian underpass. As can be seen in Figure 5.1 this alignment gives users the option of crossing under a new Pleasant Valley Pedestrian underpass or crossing Lady Bird Lake between Longhorn Shores and Holly Shores. It provides a link to the Country Club Creek Trail and continuation of the Ann and Roy Butler Hike and Bike Trail via the unnamed peninsula as well as a direct route to Cesar Chavez Street. The bridge portion of this alignment alternative connects Longhorn Shores directly to the unnamed peninsula, then directly to Holly Shores. Under this scenario, the existing bridge connection between Holly Shores and the unnamed peninsula would be replaced.



Figure 5.1: Peninsula Alternative (Alt A)

Public Input

This alternative was presented at three public meetings. The initial recognition and concept modification occurred during Public Meeting #1, with further refinement taking place at Public Meeting #2, and the recommendation was presented at Public Meeting #3. This alternative tied with Alt D for second highest score with 19% of respondents selecting this option as their #1 choice. The score summary is included in Appendix D.

Existing Site Conditions/Geometric Constraints

Roadway

The total length of improvements considered during the preparation of this report is 2197'. Out of the total length, 1058' is supported by bridge deck. The at-grade trail width is typically 16' wide. With the exception of the intersection of the Longhorn Shores/Holly Shores alignment and the unnamed peninsula alignment, the bridge deck varies in width from 16'to 32'. An approximately 100' diameter deck area is located at the alignment intersection. A total of nine, single column and one, four column trestle style substructure units are required for this alternative.

Starting at the connection with the Country Club Creek Trail, the trail slopes up at a 2% grade as it passes under Pleasant Valley Rd. and heads towards the Lady Bird Lake crossing. The profile continues towards Holly Shores at a flat (0%) grade for over 600 feet before climbing up to Holly Shores at 4.2%. As the trail passes by the unnamed peninsula, a third leg lands on the unnamed peninsula at an incline of 4.4% to match existing grade. A summary of horizontal and vertical profiles can be found in Appendix A.



Geotech

According to available bathymetry, the shoreline slopes down from approximately 435’ to a flat bottom at approximately 410’. This is true regardless of alignment. The geotechnical memo, developed using project data collected from nearby projects, estimates foundation capacities for this site. Based on the consistent bathymetry and capacity data, regardless of alignment, there is no geotechnical advantage for a particular alignment.

Maintenance

Maintenance of the dam is not anticipated to be affected by this alternative. The vertical profile provides adequate maintenance boat clearance. This horizontal alignment provides a minimum/maximum clearance offset of 328’/391’ from the face of the dam, refer to Appendix F. This offset was deemed acceptable from the facility owner.

This alternative would allow for the pedestrian traffic to be removed from the west side of the bridge over Longhorn Dam and strictly dedicate this area of the dam site for secure operations and maintenance of the dam by Austin Water. In addition, on the North West end of the dam, as shown in Figure 5.1, a dedicated space would be incorporated to facilitate management of the dam. Recommended best practices for dam owners is included in Appendix H.

Utilities

The preliminary utility conflict matrix in Table 5.2 identifies the potential utility conflicts that can be expected for this alternative. The matrix includes the approximate location and linear footage information. The risk level is assigned a number from 1 to 5 based on factors including relative safety concerns and the cost and timeframe likely needed for utility adjustments or relocations.

Preliminary Utility Conflict List S Pleasant Valley Road Pedestrian Bridge										
Conflict #	Alternative	Utility Type	Utility Owner	Start Station	End Station	Conflict Type	Utility Orientation (crossing, longitudinal, point)	Comments	Utility Conflict Summary	
									Risk Level (1-5)	Conflict
									0	YES
									8	Potential
									0	NO
									8	Total Conflicts
1	Peninsula (Alt A)	UG Comm	Logix	11+95	23+00	Conceptual weir construction, Tunnel	Longitudinal	attached to east side of existing dam	2	Potential
2	Peninsula (Alt A)	UG Comm	Spectrum	11+95	23+00	Conceptual weir construction, Tunnel	Longitudinal	attached to east side of existing dam	2	Potential
3	Peninsula (Alt A)	16" Gas	Texas Gas	11+95	23+00	Conceptual weir construction, Tunnel	Longitudinal	attached to east side of existing dam, high pressure transmission line	5	Potential
4	Peninsula (Alt A)	Water Appurtenance	Austin Water	24+70	24+70	Sidewalk construction	Point	water valve to match final grade of sidewalk	1	Potential
5	Peninsula (Alt A)	UG Comm	Spectrum	23+25	23+25	Sidewalk construction	Point	verify location of UG comm line, appears to be a service to no where	2	Potential
6	Peninsula (Alt A)	UG Comm	Spectrum	22+40	22+45	Bridge bent	Point	verify location of UG comm line, appears to be a service to no where	2	Potential
7	Peninsula (Alt A)	48" WW	Austin Water	22+40	22+45	Bridge bent	Point	abandoned 48" WW	3	Potential
8	Peninsula (Alt A)	Unknown	Unknown	11+95	23+00	Conceptual weir construction, Tunnel	Longitudinal	attached to existing bridge	3	Potential

Table 5.2: Peninsula Alternative (Alt A) Conflict Matrix

Safety, Accessibility, Sustainability

All proposed alignments exhibit a significantly wider crossing than the existing. This particular alignment has a very large round deck space at the intersection of the Longhorn Shores, unnamed peninsula, and Holly Shores legs. This wider deck space offers additional safety by providing separation room between users at this point of intersection.

This alignment has no sharp turns or dead end spaces.



Its longer alignment allows for maximum grades of 4.2% and 4.4% for corresponding lengths of approximately 276' and 292', respectively.

This alignment requires new infrastructure that would be expected to return a 75 year design life with routine maintenance.

Convenient Connections

This alignment, like all proposed options makes the following trail network connections: Ann and Roy Butler Hike and Bike Trail and Country Club Creek Trail system. Similar in all proposed alignments, this alignment is intended to serve both commuters as well as recreational users. It replaces the current deficient section of the Ann and Roy Butler Trail System. The primary commuter path is north - south. This alignment uses grade separations at all vehicle/pedestrian intersections. This alternative is the fourth longest composite alignment along Pleasant Valley and Ann and Roy Butler Hike and Bike Trail, see Appendix A.

Hydraulic Impact

This alignment proposes a low chord above the 100-year Energy Grade Line but includes obstructions in the floodplain, including the right bank abutment, the unnamed peninsula abutment, and 12 piers. As a result, this alternative produces a maximum hydraulic impact of 0.03' just upstream of the project area and propagates upstream to Tom Miller Dam where the hydraulic impact is 0.01'. The alignment was refined to minimize hydraulic impacts by minimizing the number of piers placed into the floodway, recessing pier caps within the bridge deck, and removing the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula.

Potential scour is thought to be minimal for structures placed upstream of Longhorn Dam, as velocities at that elevation are low compared to the velocities at the surface.

Environmental and Landscape

This alignment was refined to avoid the environmental constraints and critical environmental features as defined by the Preliminary Constraints and Permitting Analysis Report, Appendix E. Environmental constraints relative to this alignment are a series of three heritage and one protected tree located along the unnamed peninsula. The alignment was modified to avoid all but one heritage tree. Although this alignment requires the removal of this tree, fortunately, the City of Austin arborist has determined that the tree is in poor health. The remaining trees appear to be in adequate health without any indications that they won't live to maturity.

This alignment does follow the overall, nonlinear form theme received at public meetings.

The overall area of disturbance expected from this alignment is approximately 1.13 acres, which is the third largest footprint of the alternatives.

Construction Cost

In an effort to evaluate the various alignments and corresponding bridge configurations, preliminary analysis was performed on structural components. Quantities for all improvements were calculated based on this preliminary analysis and the trail alignments. A cost estimate for each alternative was then developed.

Estimated, initial construction cost was developed using in-place quantities for major components. Due to the preliminary nature of the current state of design, a contingency line item was included. This contingency has been included to account for the preliminary nature of current design as well as minor components. Costs considered include quantified, unquantified, related project, and inflation. In total the peninsula alternative was estimated to be the third most cost effective option. A cost summary has been included in Section 6.0. A detailed breakdown of items considered to make up a significant amount of construction cost can be found in Appendix B.

Wishbone Alternative (Alt B)

This alternative is referred to as the “wishbone” due to the 3-way intersecting bridge directly connecting Longhorn Shores, Holly Shores, and the unnamed peninsula over Lady Bird Lake. The main alignment connects the Ann and Roy Butler Hike and Bike Trail between Longhorn Shores and the unnamed peninsula. A secondary alignment provides a route from Longhorn Shores to Trail to Holly Shores. This alternative proposes a new Pleasant Valley Pedestrian underpass north of the existing underpass, which would continue to connect the Country Club Creek Trail and the Ann and Roy Butler Hike and Bike Trail. This scenario would remove the existing bridge connection between Holly Shores and the unnamed peninsula.

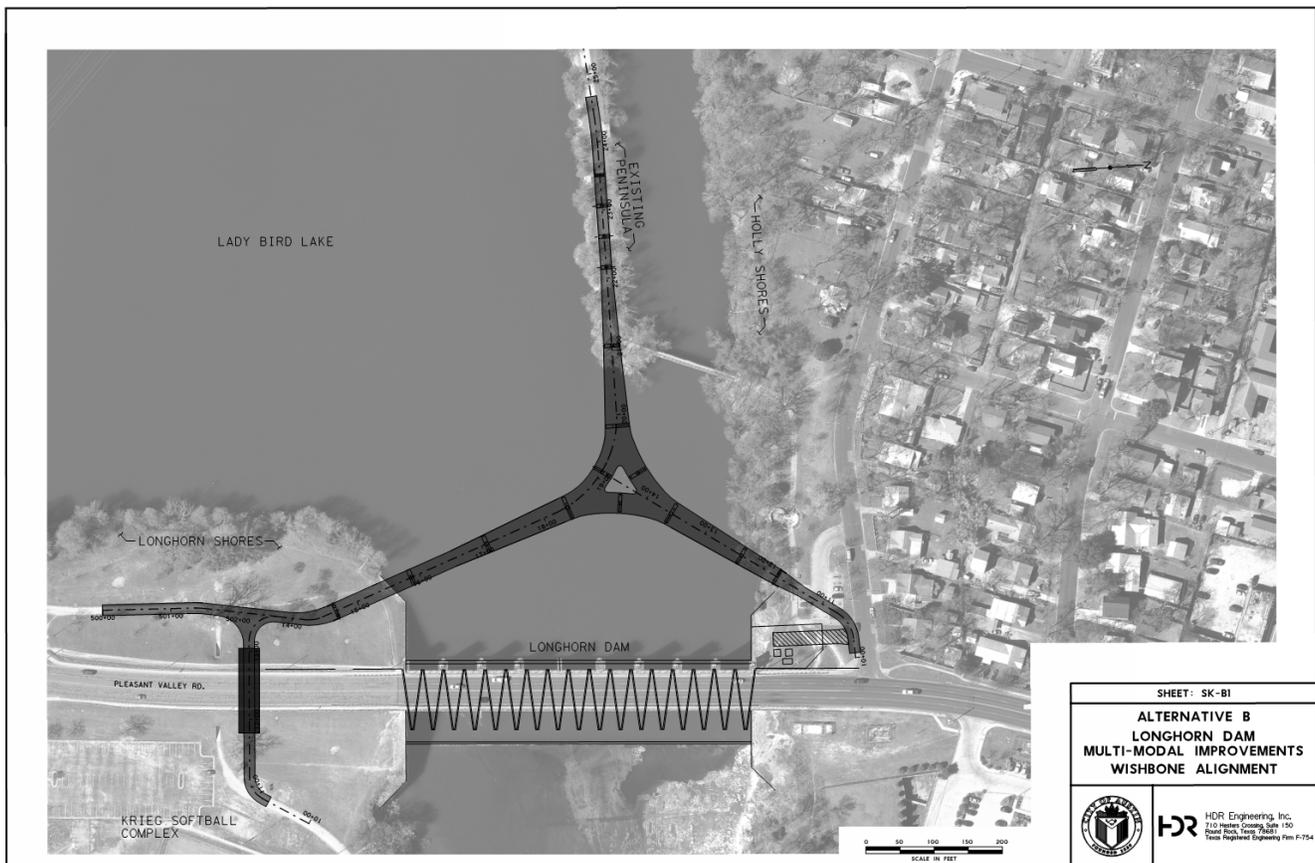


Figure 5.2: Wishbone Alternative (Alt B)

Public Input

This alternative was presented at three public meetings. The initial recognition and concept modification occurred during Public Meeting #1 by multiple stakeholders, with further refinement taking place at Public Meeting #2 for stakeholder feedback, and the recommendation was presented at Public Meeting #3. This alternative scored highest with 42% of respondents selecting this option as their #1 choice. Refer to Appendix D for the score summary.



Existing Site Conditions/Geometric Constraints

Roadway

The overall length of improvements proposed by this alternative is approximately 2315', with 1375' of the length being supported by bridge deck. At-grade trail width is typically 16' wide and tapers up towards the abutments. The "wishbone" alternative consists of three legs of bridge deck extending from Longhorn Shores, unnamed peninsula, and Holly Shores to a triangular intersection. The bridge deck extending from Longhorn shores is 372' long and ranges in width from 24' to 36' (abutment to wishbone intersection) The bridge deck from the unnamed peninsula is 368' long and ranges in width from 16' to 36' (abutment to wishbone intersection). The bridge deck from Holly Shores extends 181' long and ranges in width from 24' to 37' (abutment to wishbone intersection). The wishbone feature connects the 3 bridge decks together with a triangular void at the intersection allowing for users to pivot around to any of the 3 pathways. The typical width at this location is approximately 30'. A total of 13, single column substructure units are required.

Two alignments exist for this alternative. The first alignment starts at the connection with the Country Club Creek Trail and ascends at a 2.0% grade as it passes under Pleasant Valley Rd. towards the Lady Bird Lake crossing for over 455'. The profile then descends -0.4% approximately 523' and changes to -5.0% downgrade roughly 281' past the abutment located on the unnamed peninsula. The second alignment begins at a higher elevation where the slope descends from Holly Shores at -0.7% for about 76', to a down slope of -4.8% for 237', and reduces to a downgrade of -0.3% for about 212' up to the intersection of the first alignment defined. A summary of horizontal and vertical profiles can be found in Appendix A.

Geotech

Regardless of alignment, the shoreline slopes down from an elevation of approximately 435' to a flat bottom at elevation of approximately 410'. The geotechnical memo was developed using project data collected from nearby projects, estimates foundation capacities for this site, Appendix C. Based on the consistent bathymetry and capacity data, regardless of alignment, there is no geotechnical advantage for a particular alignment.

Maintenance

This alternative is not anticipated to affect the process to perform maintenance of the dam. The vertical profile provides sufficient maintenance boat clearance. The minimum and maximum horizontal offset distance the bridge is from the face of the dam is 105' and 213', refer to Appendix F. The facility owner considered the offsets acceptable.

This alternative would allow for the pedestrian traffic to be removed from the west side of the bridge over Longhorn Dam and strictly dedicate this area of the dam site for secure operations and maintenance of the dam by Austin Water. In addition, on the North West end of the dam, as shown in Figure 5.2, a dedicated space would be incorporated to facilitate management of the dam. Recommended best practices for dam owners is included in Appendix H.

Utilities

As shown in Table 5.3, this alternative has potential utility conflicts. The high pressure gas line will need coordination for a Texas Gas representative to be on site when tunnel excavation is happening in the vicinity of their line. They may also need a representative present or special precautions taken when work is happening to construct the conceptual weir or perform dam maintenance.

The reconfiguration of the parking area and sidewalk along Canterbury St in this alternative creates a potential conflict with the existing overhead illumination and communication lines. The pole locations are only approximate at this time and are not based on survey information.



Preliminary Utility Conflict List
S Pleasant Valley Road Pedestrian
Bridge

Utility Conflict Summary	
0	YES
14	Potential
0	NO
14	Total Conflicts

Conflict #	Alternative	Utility Type	Utility Owner	Start Station	End Station	Conflict Type	Utility Orientation (crossing, longitudinal, point)	Comments	Risk Level (1-5)	Conflict
1	Wishbone (Alt B)	16" Gas	Texas Gas	12+15	12+15	Proposed tunnel	Crossing	high pressure transmission line crosses proposed tunnel, gas line is longitudinal to Pleasant Valley	5	Potential
2	Wishbone (Alt B)	UG Comm	Spectrum	12+05	12+05	Proposed tunnel	Crossing	crosses proposed tunnel, comm line is longitudinal to Pleasant valley	2	Potential
3	Wishbone (Alt B)	UG Comm	Logix	11+90	11+90	Proposed tunnel	Crossing	crosses proposed tunnel, comm line is longitudinal to Pleasant valley	2	Potential
4	Wishbone (Alt B)	16" Gas	Texas Gas	15+50	12+00	Conceptual weir construction	Longitudinal	attached to east side of existing dam, high pressure transmission line	5	Potential
5	Wishbone (Alt B)	UG Comm	Spectrum	15+50	12+00	Conceptual weir construction	Longitudinal	attached to east side of existing dam	2	Potential
6	Wishbone (Alt B)	UG Comm	Logix	15+50	12+00	Conceptual weir construction	Longitudinal	attached to east side of existing dam	2	Potential
7	Wishbone (Alt B)	16" Gas	Texas Gas	10+00	22+00	Pavement expansion	Longitudinal	high pressure, along north edge of Canterbury under proposed pavement for parking, becomes abandoned at 20+00	5	Potential
8	Wishbone (Alt B)	6" Water	Austin Water	10+00	22+00	Pavement expansion	Longitudinal	longitudinal to north edge of Canterbury, valves to match grade	2	Potential
9	Wishbone (Alt B)	OH Illumination	Austin Energy	11+00	21+50	Pavement expansion	Longitudinal	OH comms attached to poles - Spectrum and AT&T	3	Potential
9A	Wishbone (Alt B)	OH Comm	Spectrum	11+00	21+50	Pavement expansion	Longitudinal	OH comms attached to poles - Spectrum and AT&T	2	Potential
9B	Wishbone (Alt B)	OH Comm	AT&T	11+00	21+50	Pavement expansion	Longitudinal	OH comms attached to poles - Spectrum and AT&T	2	Potential
10	Wishbone (Alt B)	48" WW	Austin Water	11+80	11+80	Bridge bent	Crossing	abandoned 48" WW	2	Potential
11	Wishbone (Alt B)	UG Comm	Spectrum	20+00	20+50	Pavement expansion	Point	verify location of UG comm line, appears to be a service to no where - riser pole in proposed sidewalk	2	Potential
12	Wishbone (Alt B)	Unknown	Unknown	11+90	12+00	Conceptual weir construction	Longitudinal	attached to underside of existing bridge	3	Potential

Table 5.3: Wishbone Alternative (Alt B) Conflict Matrix

Safety, Accessibility, Sustainability

The wishbone alternative minimizes grade and elevation changes, and also maximizes widths. This alternative allows for pedestrians and cyclists to pivot to either Holly Shores, Longhorn shores, or the unnamed peninsula. The varying alignment allows for maximum grades of 4.8% and 5% for corresponding lengths of approximately 281' and 237', respectively.

This alternative requires new infrastructure that would be expected to return a 75 year design life with routine maintenance.

Convenient Connections

The Wishbone alternative provides the most direct route for both commuters and recreational users traveling along Pleasant Valley and connects the Ann and Roy Butler Hike and Bike Trail and Country Club Creek Trail systems. The wishbone alternative replaces the current deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam; removes the existing bridge connecting the unnamed peninsula and Holly shores; and replaces the existing underpass under Pleasant Valley Rd with an underpass south of Longhorn Dam. This alternative is the third longest composite alignment along Pleasant Valley and Ann and Roy Butler Hike and Bike Trail, see Appendix A.



Hydraulic Impact

This alignment proposes a low chord above the 100-year Energy Grade Line but includes obstructions in the floodplain, including the unnamed abutment and 13 piers. As a result, this alternative produces a maximum hydraulic impact of 0.05' just upstream of the project area and propagates upstream to Tom Miller Dam where the hydraulic impact is 0.01'. The alignment was refined to minimize hydraulic impacts by minimizing the number of piers placed into the floodway, recessing pier caps within the bridge deck, beginning abutments outside of the effective flow area, and removing the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula.

Potential scour is thought to be minimal for structures placed upstream of Longhorn Dam as velocities at the thalweg are low compared to the velocities at the surface.

Environmental and Landscape

The wishbone alternative was modified to maximize space while accounting for environmental constraints defined by the Preliminary Constraints and Permitting Analysis Report, Appendix E. Environmental constraints relative to this alignment are a series of three heritage and one protected tree located along the unnamed peninsula. The alignment was modified to avoid all but one heritage tree. Although this alignment requires the removal of this tree, fortunately, the City of Austin arborist has determined that the tree is in poor health. The remaining trees appear to be in adequate health without any indications that they won't live to maturity.

The overall area of disturbance expected from this alignment is approximately 1.15 acres, which is the second largest footprint proposed.

Construction Cost

A preliminary analysis was performed to evaluate the various alignments and bridge configurations. A cost estimate was developed to quantify improvements proposed by each alternative. The initial construction cost was developed using in-place quantities for major components. A contingency line item was included to consider the preliminary design. Costs considered include quantified, unquantified, related project, and inflation. In total the wishbone alternative was estimated to be the second most cost effective option. Section 6.0 provides a cost summary for each alternative. A detailed breakdown of items considered to make up a significant amount of construction cost can be found in Appendix B.

Upstream Alternative (Alt C)

This alternative consists of two bridges to connect Longhorn Shores, Holly Shores, and the unnamed peninsula upstream (west) of Longhorn Dam, and would continue to connect the Ann and Roy Butler Hike and Bike Trail. The first bridge would begin at Longhorn Shores north of a new Pleasant Valley Pedestrian underpass and end east of Tejano Music Monument on Holly Shores. To meet the 100 year flood event requirements, the second bridge will replace the existing bridge and continue to provide a connection between Holly Shores and the unnamed peninsula. The new underpass would be located just north of the existing underpass and would continue to connect the Country Club Creek Trail and Ann and Roy Butler Hike and Bike Trail.

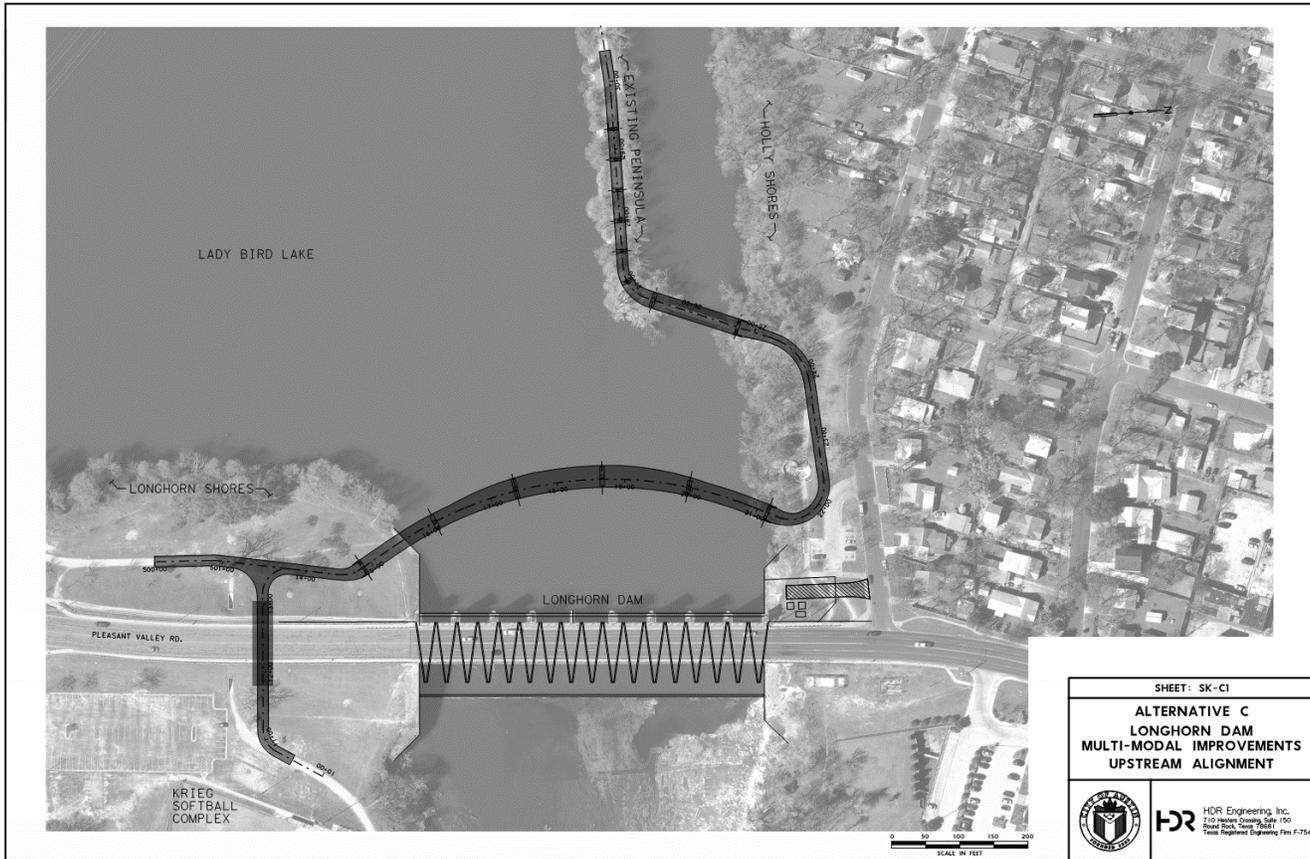


Figure 5.3: Upstream Alternative (Alt C)

Public Input

This alternative was presented at three public meetings. The initial recognition and concept modification occurred during Public Meeting #1, with further refinement taking place at Public Meeting #2, and the recommendation was presented at Public Meeting #3. This alternative scored second lowest with 14% of respondents selecting this option as their #1 choice. Refer to Appendix D for the score summary.

Existing Site Conditions/Geometric Constraints

Roadway

The overall length of improvements proposed by this alternative is approximately 2195', with 629' of the length being supported by the upstream bridge deck and 404' of length being supported by the replacement bridge connecting the unnamed peninsula and Holly Shores. Near the upstream bridge the 16' wide trail tapers up to 24' at the abutments. The bridge horizontal alignment is concave to Longhorn Dam, with the widest portion of the bridge deck, 32', at the vertex. The replacement bridge deck connecting the unnamed peninsula to Holly Shores, varies in width from 24' (at Holly Shores) to 16' (on the unnamed peninsula). A total of 10, single column substructure units are required.

The alignment starts at the connection with the Country Club Creek Trail and ascends at a 1.5% grade as it passes under Pleasant Valley Rd. towards the Lady Bird Lake crossing for over 441'. The profile then flattens to 0.5% over a distance of 443' along the upstream bridge and changes to 4.9% upgrade for about 179' to Holly Shores. From Holly Shores the vertical alignment remains on a downward slope past the bridge abutment on the unnamed peninsula.



Grades along this path include -3.7% for over 300', -3.0% for over 211', and -5.0% for over 254'. A summary of horizontal and vertical profiles can be found in Appendix A.

Geotech

The geotechnical memo, found in Appendix C, is comprised of project data collected from nearby projects, estimates, and foundation capacities for this site. The document states, regardless of alignment, the shoreline slopes down from an elevation of approximately 435' to a flat bottom at elevation of approximately 410'. In addition, there is no geotechnical advantage for a particular alignment based on the consistent bathymetry and capacity data.

Maintenance

Regardless of alternative, maintenance of the dam is not anticipated to be affected. The upstream bridge vertical profile provides sufficient maintenance boat clearance. The minimum and maximum horizontal offset distance the bridge is from the face of the dam is 107' and 176', see to Appendix F. The facility owner considered the offsets acceptable.

This alternative would allow for the pedestrian traffic to be removed from the west side of the bridge over Longhorn Dam and strictly dedicate this area of the dam site for secure operations and maintenance of the dam by Austin Water. In addition, on the North West end of the dam, as shown in Figure 5.3, a dedicated space would be incorporated to facilitate management of the dam. Recommended best practices for dam owners is included in Appendix H.

Utilities

As shown in Table 5.4, the upstream bridge alternative avoids potential conflict with an abandoned 48" wastewater line that other alternatives have. This alternative does alter the existing parking area near the high pressure gas line though. More investigations should be done on the gas transmission line to determine depth and location before new pavement is added along Canterbury St.

Preliminary Utility Conflict List										Utility Conflict Summary	
S Pleasant Valley Road Pedestrian Bridge										0	YES
										8	Potential
										0	NO
										8	Total Conflicts
Conflict #	Alternative	Utility Type	Utility Owner	Start Station	End Station	Conflict Type	Utility Orientation (crossing, longitudinal, point)	Comments	Risk Level (1-5)	Conflict	
1	Upstream (Alt C)	16" Gas	Texas Gas	12+15	21+30	Conceptual weir construction, proposed tunnel	Longitudinal	high pressure transmission line crosses proposed tunnel, gas line is longitudinal to Pleasant Valley and attached to existing bridge	5	Potential	
2	Upstream (Alt C)	UG Comm	Spectrum	12+05	21+30	Conceptual weir construction, proposed tunnel	Longitudinal	attached to existing bridge	2	Potential	
3	Upstream (Alt C)	UG Comm	Logix	11+95	21+30	Conceptual weir construction, proposed tunnel	Longitudinal	attached to existing bridge	2	Potential	
4	Upstream (Alt C)	16" Gas	Texas Gas	21+50	23+30	Pavement expansion	Longitudinal	along north edge of Canterbury under proosed parking spaces, high pressure	5	Potential	
5	Upstream (Alt C)	6" Water	Austin Water	21+50	23+30	Pavement expansion	Longitudinal	along north edge of Canterbury under proosed parking spaces, valves to match grade	2	Potential	
6	Upstream (Alt C)	Water Appurtenance	Austin Water	22+75	22+75	Shared use path	Point	valve to match grade	2	Potential	
7	Upstream (Alt C)	UG Comm	Spectrum	24+15	24+15	Shared use path	Point	verify service, appears to go no where	2	Potential	
8	Upstream (Alt C)	Unknown	Unknown	12+00	21+25	Conceptual weir construction	Longitudinal	attached to existing bridge	3	Potential	

Table 5.4: Upstream Alternative (Alt C) Conflict Matrix



Safety, Accessibility, Sustainability

The upstream alignment allows for pedestrians and cyclists to cross Lady Bird Lake over a new bridge, which removes the current deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam. The new infrastructure proposed would be expected to return a 75 year design life with routine maintenance. Typically this alternative minimizes grade and elevation changes, and also maximizes widths and maintainability. However, significant grades and elevation changes occur for Ann and Roy Butler Hike and Bike Trail users between Longhorn shores and Holly Shores. The varying alignment allows for maximum grades of 4.9% and 5.0% for corresponding lengths of 179' and 254'.

Convenient Connections

The upstream alignment alternative maintains a connection between Ann and Roy Butler Hike and Bike Trail and Country Club Creek Trail system. This alternative provides service to both commuters as well as recreational users. The upstream alternative removes the current deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam; replaces existing bridge connecting the unnamed peninsula and Holly shores; and replaces the existing underpass under Pleasant Valley Rd with an underpass south of Longhorn Dam. This alternative is the shortest composite alignment along Pleasant Valley and Ann and Roy Butler Hike and Bike Trail, see Appendix A

Hydraulic Impact

This alignment proposes a low chord above the 100-year Energy Grade Line but includes obstructions in the floodplain, including the right bank abutment, four piers, and replacement of the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula. As a result, this alternative produces a maximum hydraulic impact of 0.10' just upstream of the project area and propagates upstream to Tom Miller Dam where the hydraulic impact is 0.03'. The alignment was refined to minimize the number of piers placed into the floodway.

Potential scour is thought to be minimal for structures placed upstream of Longhorn Dam as velocities at the thalweg are low compared to the velocities at the surface.

Environmental and Landscape

The upstream alternative was modified to maximize space while accounting for constraints defined by the Preliminary Constraints and Permitting Analysis Report, Appendix E. Environmental constraints relative to this alignment are a series of three heritage and one protected tree located along the unnamed peninsula. The alignment was modified to avoid impacts to all trees.

The overall area of disturbance expected from this alignment is roughly 1.02 acres, which is the smallest footprint proposed out of the alternatives.

Construction Cost

Quantities for all improvements were calculated based on a preliminary analysis that evaluated various alignments and corresponding bridge configurations. An initial construction cost estimate for each alternative was then developed using in-place quantities for major components, which included a contingency line item. This contingency accounts for the preliminary nature of current design as well as minor components. Components of costs considered include quantified, unquantified, related project, and inflation. In total the upstream alternative was estimated to be the most cost effective. A cost summary has been included in Section 6.0. A detailed breakdown of items considered to make up a significant amount of construction cost can be found in Appendix B.

Downstream Alternative (Alt D)

This alternative consists of two bridges, one downstream (east) of Longhorn Dam and the other to replace the existing bridge between Holly shores and the unnamed peninsula. The bridge downstream (east) of Longhorn Dam starts north of a new Pleasant Valley Pedestrian underpass and ends northeast of Longhorn Dam. Two new Pleasant Valley Pedestrian underpasses are proposed to connect the Ann and Roy Butler Hike and Bike Trail. The first new underpass would be located just north of the existing underpass south of Longhorn Dam. The second underpass would be north of Longhorn Dam and south of Canterbury Street.

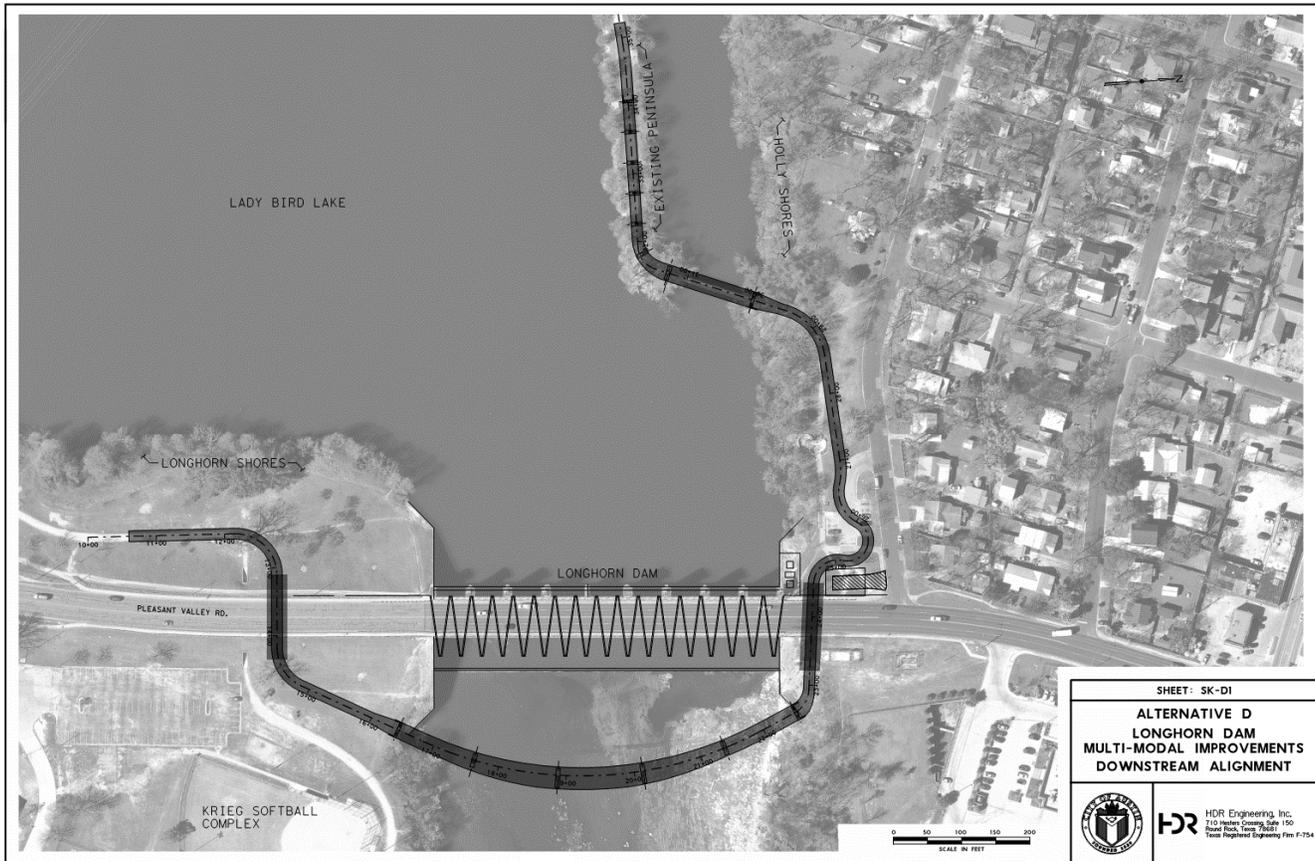


Figure5.4: Downstream Alternative (Alt D)

Public Input

This alternative was presented at three public meetings. The initial recognition and concept modification occurred during Public Meeting #1, with further refinement taking place at Public Meeting #2, and the recommendation was presented at Public Meeting #3. This alternative tied with Alt A for second highest score with 19% of respondents selecting this option as their #1 choice. Refer to Appendix D for the score summary.

Existing Site Conditions/Geometric Constraints

Roadway

The overall length of improvements proposed by this alternative is approximately 2462', with 610' of the length being supported by the downstream bridge deck and 407' of length being supported by the replacement bridge connecting the unnamed peninsula and Holly Shores. Near the downstream bridge a 16' wide trail tapers up to 24' at



Abutment 1 and Abutment 6. The bridge horizontal alignment is concave with respect to Longhorn Dam, with the widest portion of the bridge deck, 32', at the vertex of the curve. The replacement bridge deck connecting the unnamed peninsula to Holly Shores, varies in width from 24' (at Holly Shores) to 16' (on the unnamed peninsula). A total of 10, single column substructure units are required.

The alignment starts at Longhorn Shores on a flat grade just before the newly proposed underpass on the south end of Longhorn Dam under Pleasant Valley Rd., for about 50'. The profile then increases at a 2.0% grade over a distance of 636' up to the Bent 2 of the downstream bridge option. The profile then flattens to a 0% grade for 653' up to the second proposed underpass north of Longhorn Dam. The grade will increase 4.9% from the second underpass for 224' in length on Holly shores. From Holly Shores the vertical alignment remains on a downward slope of -4.0% just before the Bent 7 location, which is roughly 325' long. For 213' after the seventh bent, the slope changes to a -1.1% slope. For the remainder of the bridge past Bent 9 the slope changes to -5.0% for over 244'. Past the abutment located on the unnamed peninsula, the slope flattens to a -0.5% grade as the alignment extends for 131'. A summary of horizontal and vertical profiles can be found in Appendix A.

Geotech

Data from nearby projects, estimates, and foundation capacities for the project footprint were used to develop the geotechnical memo, found in Appendix C. The document states that there is no geotechnical advantage for a particular alignment based on the consistent bathymetry and capacity data. Regardless of alignment, the shoreline slopes down from an elevation of approximately 435' to a flat bottom at elevation of approximately 410'.

Maintenance

The downstream bridge vertical profile provides sufficient clearance for a maintenance boat. However, the existing dam limits access by boat due to an apron on the down station end. In addition, a boat may be limited due to the water level at a given period if flow is restricted by the Dam. The horizontal offset distance the bridge is from the face of the dam is 59' and 140', minimum and maximum. See to Appendix F for locations of offsets.

This alternative would allow for the pedestrian traffic to be removed from the west side of the bridge over Longhorn Dam and strictly dedicate this area of the dam site for secure operations and maintenance of the dam by Austin Water. In addition, on the North West end of the dam, as shown in Figure 5.4, a dedicated space would be incorporated to facilitate management of the dam. Recommended best practices for dam owners is included in Appendix H.

Utilities

As shown in Table 5.5, the downstream alternative proposes bridge bents very close to the existing 60" water line. Additional SUE services are recommended in this alternative to more accurately identify the exact location of the 60" water line to be sure that adequate clearance is maintained from the proposed bridge bents. In this and in other alternatives, water valves should match final grade.



Preliminary Utility Conflict List
S Pleasant Valley Road Pedestrian
Bridge

Utility Conflict Summary	
0	YES
10	Potential
0	NO
10	Total Conflicts

Conflict #	Alternative	Utility Type	Utility Owner	Start Station	End Station	Conflict Type	Utility Orientation (crossing, longitudinal, point)	Comments	Risk Level (1-5)	Conflict
1	Downstream (Alt D)	16" Gas	Texas Gas	14+00	23+75	Conceptual weir construction	Longitudinal	attached to east side of existing dam, high pressure transmission line	5	Potential
2	Downstream (Alt D)	UG Comm	Spectrum	14+00	23+50	Conceptual weir and sidewalk construction	Longitudinal	attached to east side of existing dam	2	Potential
3	Downstream (Alt D)	UG Comm	Logix	14+00	23+75	Conceptual weir and sidewalk construction	Longitudinal	attached to east side of existing dam	2	Potential
4	Downstream (Alt D)	UG Comm	Fiberlight	23+50	23+75	Sidewalk construction	Longitudinal	along east side of Pleasant Valley north of dam	2	Potential
5	Downstream (Alt D)	60" Water	Austin Water	17+15	17+20	Bridge bent	Point	water line in close proximity to bridge bent, verify water line location	5	Potential
6	Downstream (Alt D)	60" Water	Austin Water	21+30	21+35	Bridge bent	Point	water line in close proximity to bridge bent, verify water line location	5	Potential
7	Downstream (Alt D)	6" Gas	Texas Gas	23+50	23+75	Sidewalk construction	Longitudinal	along east side of Pleasant Valley north of dam	3	Potential
8	Downstream (Alt D)	UG Comm	Spectrum	28+50	28+50	Sidewalk construction	Point	verify location of UG comm line, appears to be a service to no where	2	Potential
9	Downstream (Alt D)	Water Appurtenance	Austin Water	27+15	27+15	Sidewalk construction	Point	water valve to match final grade of sidewalk	1	Potential
10	Downstream (Alt D)	Unknown	Unknown	14+00	23+50	Conceptual weir construction	Longitudinal	attached to existing bridge	3	Potential

Table 5.5: Downstream Alternative (Alt D) Conflict Matrix

Safety, Accessibility, Sustainability

This alignment proposes new infrastructure downstream of the Longhorn Dam, removing the existing deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam. The bridge is expected to return a 75 year design life with routine maintenance. Typically the downstream alternative minimizes grades and elevation changes, and also maximizes widths and maintainability. However, elevation changes are more apparent with varying alignment allowing for maximum grades of 4%, 4.9%, and 5.0% for corresponding lengths of 325', 224', and 244'.

Convenient Connections

This alignment provides continuation of Ann and Roy Butler Hike and Bike Trail and Country Club Creek Trail system. Similar to all proposed alignments, this alignment is intended to serve commuters, and recreational users. It removes the current deficient section of the Ann and Roy Butler Trail System; replaces the existing bridge connecting the unnamed peninsula and Holly shores; and replaces the existing underpass under Pleasant Valley Rd with two underpasses (one north of Longhorn Dam and the other south of Longhorn Dam). This alternative is the second longest composite alignment along Pleasant Valley and Ann and Roy Butler Hike and Bike Trail, see Appendix A.

Hydraulic Impact

This alignment proposes a low chord above the 100-year Energy Grade Line but includes obstructions in the floodplain, including four piers, and replacement of the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula. As a result, this alternative produces a maximum hydraulic impact of 0.09' just upstream of the project area and propagates upstream to IH-35 where the hydraulic impact is 0.05'. The alignment was refined to minimize the number of piers placed into the floodway and replaces the existing pedestrian bridge connecting Holly Shores and the unnamed peninsula. Replacement of the existing pedestrian bridge mitigates the impact caused from the additional piers.



This alternative may pose a much greater potential for scour relative to the other proposed alternatives as it is downstream of Longhorn Dam and would experience much higher velocities.

The impact of dam sheet piles installed north and south of the Longhorn Dam are not considered to be detrimental to the project, since expected trail elevations for both proposed underpasses are above the normal water elevation.

Environmental and Landscape

The downstream alternative was modified to account for environmental constraints defined by the Preliminary Constraints and Permitting Analysis Report, Appendix E. Two constraints were noted. One constraint is the downstream bridge alignment has the risk of affecting a spring fed wetland. The other constraints relative to this alignment are a series of three heritage and one protected tree located along the unnamed peninsula. The alignment was modified to avoid impacts to all trees.

The overall area of disturbance expected from this alignment is about 1.11 acres, which is the second smallest footprint proposed. Of the alternatives, this alignment provides the unobstructed downstream river views.

Construction Cost

A preliminary analysis was performed to evaluate the various alignments and corresponding bridge configurations proposed. The analysis quantified improvements to develop an initial cost estimate for each alternative, which included a contingency line item. Due to the preliminary nature of the current state of design, this contingency has been included to account for the preliminary nature of current design as well as minor components. Components of costs considered include quantified, unquantified, related project, and inflation. In total the downstream alternative was estimated to be second least cost effective option. A cost summary has been included in Section 6.0. A detailed breakdown of items considered to make up a significant amount of construction cost can be found in Appendix B.

Existing Bridge Widening Alternative (Alt E)

This alternative proposes a widening to the existing bridge that is integral with the Longhorn Dam, to allow for a wider shared use path on each side of Pleasant Valley Rd. A new bridge would replace the existing bridge connecting the unnamed peninsula and Holly shores. This scenario proposes a new Pleasant Valley Pedestrian underpass north of the existing underpass, which would continue to connect the Country Club Creek Trail and Ann and Roy Butler Hike and Bike Trail.

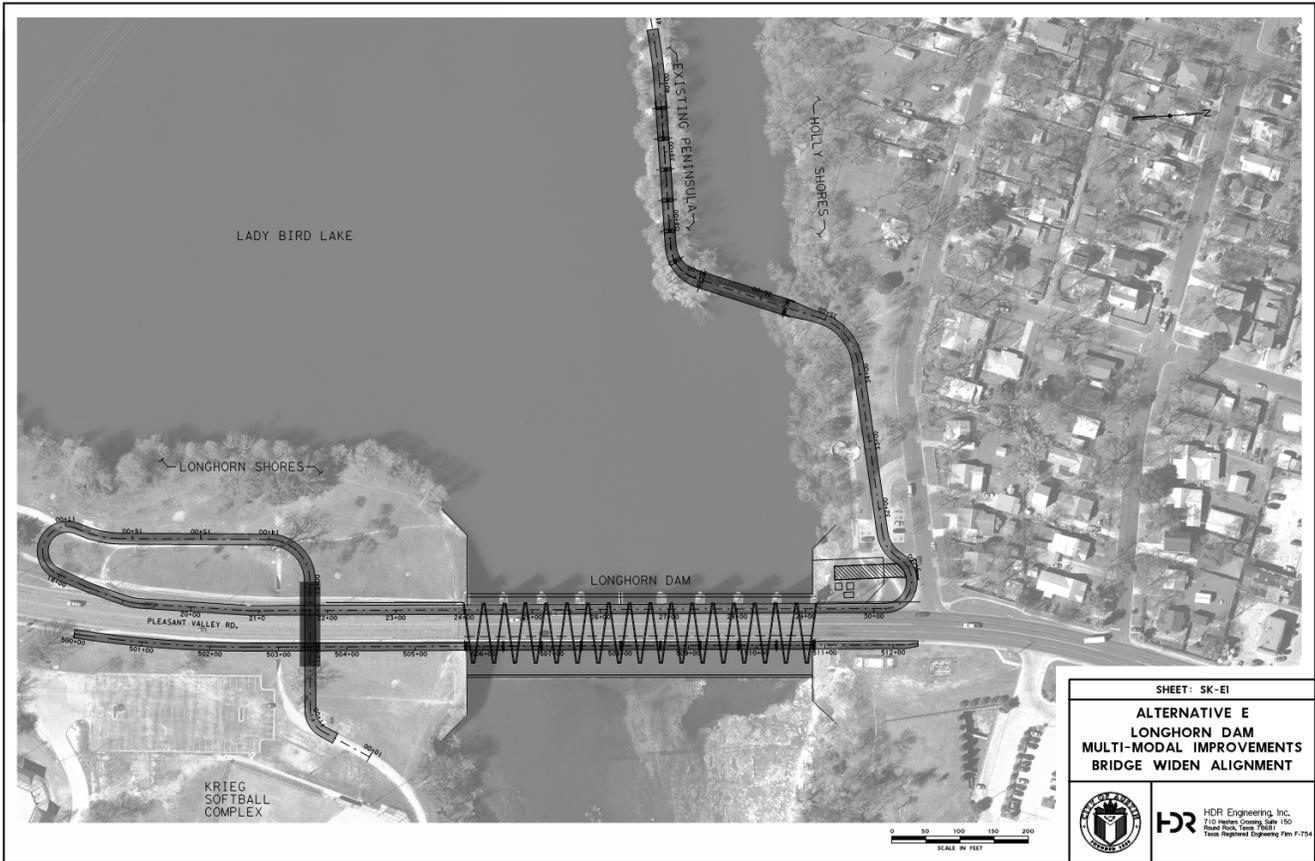


Figure 5.5: Existing Bridge Widening Alternative (Alt E)

Public Input

This alternative was presented at three public meetings. The initial recognition and concept modification occurred during Public Meeting #1, with further refinement taking place at Public Meeting #2, and the recommendation was presented at Public Meeting #3. This alternative scored the lowest with 6% of respondents selecting this option as their #1 choice. Refer to Appendix D for the score summary.

Existing Site Conditions/Geometric Constraints

Roadway

This alternative proposes changes to the existing conditions located at the project footprint. This alternative widens the existing bridge at the Longhorn Dam and replaces the existing bridge connecting Holly Shores and the unnamed peninsula. The overall length of improvements proposed by this alternative is approximately 4259', with 1012' of the length being supported by Longhorn Dam bridge deck and 404' of length being supported by the replacement bridge connecting the unnamed peninsula and Holly Shores. Along Longhorn Dam two shared use paths are defined. The main path is 14' wide connecting the Ann and Roy Butler Hike and Bike Trail, while the secondary path is 12' in width on the east end of the widened bridge. The replacement bridge deck connecting the unnamed peninsula to Holly Shores, varies in width from 24' (at Holly Shores) to 16' (on the unnamed peninsula). A total of 14 single column substructure units are required, with 8 columns for Longhorn Dam bridge extension and 6 columns for bridge replacement.



The alignment starts at Country Club Creek Trail and descends at a -1.5% grade under Pleasant Valley Rd. toward the Ann and Roy Butler Hike and Bike Trail on Longhorn Shores for over 279'. The profile then flattens over a distance of 391'. The Ann and Roy Butler Hike and Bike Trail connects from Longhorn Shores to the widened trail across the bridge over Longhorn Dam, which ascends at a rate of 5.0% for over 502'. The grade flattens on the bridge for over 689' and descends -3.3% for a length of 494' to Holly Shores. From Holly Shores to the beginning of the replacement bridge, the vertical profiles grade is -1.2% for 263'. Along the replacement bridge, the slope becomes a -5.0% downgrade for 246' past the abutment and flattens out along the unnamed peninsula. A summary of horizontal and vertical profiles can be found in Appendix A.

Geotech

The geotechnical memo, found in Appendix C, is comprised of project data collected from nearby projects, estimates, and foundation capacities for this site and considers all alternatives. Regardless of alignment, the shoreline slopes down from an elevation of approximately 435' to a flat bottom at elevation of approximately 410'. It is also noted, there is no geotechnical advantage for a particular alignment based on the consistent bathymetry and capacity data.

Maintenance

This alternative extends the existing bridge over Longhorn Dam, therefore maintenance of the dam is not anticipated to be affected. The accessibility of boat access is considered to remain as is. Due to the extension of the existing bridge, potentially the maintenance equipment required on the bridge may change to reach critical areas.

This alternative would not allow for the pedestrian traffic to be removed from the west side of the bridge over Longhorn Dam, which would eliminate the option to strictly dedicate this area of the dam site for secure operations and maintenance of the dam by Austin Water. However, on the North West end of the dam, as shown in Figure [5.5], a dedicated space would be incorporated to facilitate management of the dam. Recommended best practices for dam owners is included in Appendix H.

Utilities

As shown in Table 5.6, the widening alternative creates potential conflicts with utilities attached to the existing bridge during construction and later with utility maintenance access. More information is needed about the function and owner of the unknown utility attached to the existing bridge. Unlike other alternatives, this one does not propose a new tunnel south of the lake and avoid potential conflicts with utilities for that excavation.

Preliminary Utility Conflict List
S Pleasant Valley Road Pedestrian
Bridge

Utility Conflict Summary	
0	YES
7	Potential
0	NO
7	Total Conflicts

Conflict #	Alternative	Utility Type	Utility Owner	Start Station	End Station	Conflict Type	Utility Orientation (crossing, longitudinal, point)	Comments	Risk Level (1-5)	Conflict
1	Widening	16" Gas	Texas Gas	17+40	30+10	Conceptual weir and bridge construction	Longitudinal	attached to bridge, high pressure	5	Potential
2	Widening	UG Comm	Spectrum	17+40	31+55	Conceptual weir and bridge construction	Longitudinal	attached to bridge	2	Potential
3	Widening	UG Comm	Logix	17+40	35+45	Conceptual weir and bridge construction	Longitudinal	attached to bridge	2	Potential
4	Widening	OH Illumination	Austin Energy	21+70	29+15	Conceptual weir and bridge construction	Longitudinal	attached to bridge	2	Potential
5	Widening	6" Gas	Texas Gas	31+20	35+45	Shared use path	Longitudinal	east side of Pleasant Valley	3	Potential
6	Widening	UG Comm	Fiberlight	29+50	35+45	Shared use path	Longitudinal	east side of Pleasant Valley	2	Potential
7	Widening	Unknown	Unknown	17+40	30+10	Conceptual weir construction	Longitudinal	attached to underside of existing bridge	3	Potential

Table 5.6: Existing Bridge Widening Alternative (Alt E) Conflict Matrix



Safety, Accessibility, Sustainability

This alignment proposes the widening of the existing deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam. The lifespan of improvements would be limited compared to a new bridge with a 75 year lifespan, due to the modification of the existing bridge being built in the late 1950's. All designs focused on minimizing grades and elevation changes, and to maximize widths and maintainability. However, to align with the existing alignment maximum grades of 5.0% with lengths of 502' and 246' were proposed.

Convenient Connections

This alternative provides a continuous connection between Ann and Roy Butler Hike and Bike Trail and Country Club Creek Trail system. It also widens the current deficient section of the Ann and Roy Butler Trail System along the bridge over Longhorn Dam; replaces the existing bridge connecting the unnamed peninsula and Holly shores; and replaces the existing underpass under Pleasant Valley Rd with a new underpass south of Longhorn Dam. This alternative is the longest composite alignment along Pleasant Valley and Ann and Roy Butler Hike and Bike Trail, see Appendix A.

Hydraulic Impact

This alternative proposes no additional obstructions into the existing flow area. As a result, this alternative produces no hydraulic impact upstream or downstream of the project area.

This alternative poses no additional scour issues.

Environmental and Landscape

The bridge widening alternative was modified to account for environmental constraints defined by the Preliminary Constraints and Permitting Analysis Report, Appendix E. All proposed alignments affect the one heritage tree located at the end of the unnamed peninsula, which was determined to not be in good health by the City of Austin arborist, which facilitates removal. .

Overall the area of disturbance expected from this alignment is approximately 1.43 acres, which is the largest footprint proposed.

Construction Cost

All alternatives were quantified based on a preliminary analysis to normalize the various alignments and corresponding bridge configurations. A cost estimate for each alternative was then developed using in-place quantities for major components. A contingency line item was included to account for the preliminary nature of current design as well as minor components. Components of costs considered include quantified, unquantified, related project, and inflation. In total the bridge widening was estimated to be least cost effective. Refer to Section 6.0 for a cost summary and Appendix B for a detailed breakdown of items considered to make up a significant amount of construction cost

6. OPINION OF PROBABLE CONSTRUCTION COST

Construction Cost Summary

An estimated construction cost for each alternative has been completed using historically applicable data for the type and location of the project. These estimated construction costs are developed using quantity of construction materials multiplied by an installed cost for each alternative.

All options included appropriate construction and TxDOT average low bid items for bridge and trail construction. All options included removal of existing infrastructure necessary to the corresponding alternative. All options received an equal amount for aesthetic treatments that was intended to cover, furnishings, landscaping, way finding, lighting, and shade structures. All options included a percentage of construction allowance for traffic control, erosion control, drainage, utilities, signing/stripping, mobilization, and contingency. All options included a percentage of construction cost for Engineering, CE&I, and City of Austin Management. A summary cost estimate is shown in Table 6.1. The detailed cost estimate can be found in Appendix B.

LONGHORN DAM MULTIMODAL IMPROVEMENTS PER					
Pedestrian Bridge Alternatives Estimated Construction Costs					
Alternative	Quantified Costs	UnQuantified Costs	Related Project Costs	Inflation	Total
Peninsula Alternative (Alt A)	\$5,200,000	\$2,048,000	\$2,464,000	\$3,088,000	\$12,800,000
Wishbone Alternative (Alt B)	\$5,116,000	\$2,015,000	\$2,425,000	\$3,044,000	\$12,600,000
Upstream Alternative (Alt C)	\$4,392,000	\$1,733,000	\$2,083,000	\$2,692,000	\$10,900,000
Downstream Alternative (Alt D)	\$5,553,000	\$2,186,000	\$2,631,000	\$3,330,000	\$13,700,000
Bridge Widening Alternative (Alt E)	\$5,148,000	\$2,703,000	\$2,669,000	\$3,380,000	\$13,900,000

Table 6.1: Estimated Construction Cost

It should be noted that the costs are preliminary and based on major work items and conceptual design; therefore, each estimated alternative cost includes a 25% contingency. An approach was developed to include costs for Engineering and Construction Oversight, Inflation, Miscellaneous Items, and Contingency. The timeframe to implement the build alternative was estimated at five years. Therefore the inflation costs were estimated at 4% compounded annually for seven years.

The current, conceptual, design, based on lidar survey, did not identify any ROW needs. Should the scope of the project change or refined additional survey may indicate a change to this finding.

7. EVALUATION OF ALTERNATIVES

Evaluation Summary

Each alternative has been developed in detail and evaluated against the criteria defined within this document. Each alternative was assigned a score based on its performance relative to each criteria. A weight was assigned to each criteria based on its relative importance to these improvements. The individual scores were multiplied by the weighting factor and summed. The overall scores were then normalized with “100” representing the preferred score, shown in Table 7.1.

LONGHORN DAM MULTIMODAL IMPROVEMENTS PER															
Evaluation Matrix															
Evaluation Criteria	Public Input		Existing Site Conditions/Geo Constraints		Safety Accessibility Sustainability		Convenient Connections		Hydraulic Impact		Environmental and Landscape Space		Construction Cost		Normalized Score
Weighting Factor	10		7		6		5		9		6		8		
Alternative	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total	
Peninsula Alternative (Alt A)	4	40	5	35	4	24	3	15	4	36	3	18	3	24	92
Wishbone Alternative (Alt B)	5	50	5	35	5	30	5	25	3	27	3	18	3	24	100
Upstream Alternative (Alt C)	4	40	4	28	3	18	3	15	1	9	4	24	5	40	83
Downstream Alternative (Alt D)	4	40	3	21	2	12	3	15	3	27	1	6	2	16	66
Bridge Widening Alternative (Alt E)	3	21	2	14	1	6	3	15	5	45	5	30	2	16	70

Table 7.1: Evaluation Matrix

8. RECOMMENDATIONS

Recommendations

The intent of this report was to evaluate the safety and mobility aspects of an improved trail crossing of Lady Bird Lake relative to public support, cost effectiveness, and engineering feasibility.

The conceptual trail alignments were defined and refined through a public input process as well as other design criteria identified and discussed herein. The positive and negative attributes of each alternative were discussed relative to the evaluation criteria. The evaluation criteria for each alternative considered public input, existing site conditions and geometry, safety, accessibility, sustainability, convenient connections, hydraulic impact, environmental and landscape, and construction cost.

An evaluation matrix was created to normalize performance of each alternative based on the criteria. The Wishbone Alternative scored higher than or equal to all of the other alternatives. During Public Meeting #2, the Wishbone Alternative was identified as the alternative with the highest level of support, which was the top pick of 42% compared to 19% for the second favored alternative. During Public Meeting #3, the Wishbone Alternative was presented as the preferred alternative. During this meeting, public preference was confirmed with high level of support for the project and selected alternative. The community responses from Public Meeting#3, as shown in Appendix D 3.2, documented over 96.5% support for the Wishbone Alternative. Based on this process, HDR recommends the Wishbone Alternative for further investigation.