French Prairie Bridge Project
Memorandum

Date: September 26, 2018

To: Technical Advisory Committee

From: Project Management Team

RE: TAC Meeting #4 – Project Update

Attached to this memorandum you will find meeting packet information for Technical Advisory Committee (TAC) Meeting #4 to be held on Wednesday, October 3, 2018.

Our primary meeting objective is to review and receive TAC members' comments on the draft Bridge Type Evaluation Report. Please review the packet and come to the meeting with comments on the Report.

This meeting packet includes:

Prior to the October 3rd TAC meeting, the PMT asks that each TAC member reviews the Report and come prepared to the meeting with comments, questions and suggested revisions to the project team's ranking of bridge types for each selection criterion.

At the TAC meeting, the TAC members will share and discuss their assessments. As a group, the TAC will revise rankings for the five bridge types, and advise and make recommendations to the project Task Force regarding bridge type selection considerations.

French Prairie Bridge Project
Technical Advisory Committee
Draft Meeting Agenda
Wednesday, October 3, 2018
1:00 – 3:00 PM

Wilsonville City Hall
29799 SW Town Center Loop E, Wilsonville, OR
Willamette River Rooms I & II

Meeting Objectives:

- Review alignment selection decision
- Present bridge type selection and public engagement processes
- Discuss and receive comments on draft Bridge Type Evaluation Report
- Review and advise on the ranking of the five bridge types

1. Welcome and Meeting Purpose — 1:00 to 1:20 pm
    - Zach Weigel, City of Wilsonville
    - Anne Pressentin, Meeting Orientation
    - TAC members, Project Feedback

2. Project Updates — 1:20 to 1:40 pm
    - Zach Weigel, Overview

3. Bridge Type Selection Process — 1:40 to 1:55 pm
    - Bob Goodrich, Overview

4. Ranking of Bridge Types — 1:55 to 2:50 pm
    - Bob Goodrich, Overview
    - Discussion
    - Rankings to recommend

5. Next Steps — 2:50 to 3:00 pm
    - Bob Goodrich, Overview
    - Adjourn

Community members will be invited to provide comments to the Technical Advisory Committee as time allows. Written comments are always welcome by emailing Project Manager Zach Weigel and will be shared with Task Force members.

French Prairie Bridge Project Technical Advisory Committee Meeting #3

Meeting Summary
Wednesday, February 28, 2018
10:00– 12:00 PM

Wilsonville City Hall
29799 SW Town Center Loop E, Wilsonville,
OR Willamette River Rooms I & II

Members Present
Carrie Bond, Tod Blankenship, Anthony Buczek, Gail Curtis, Scott Hoelscher, Russ Klassen, Tom Loynes, Tom McConnell, Chris Neamtzu, Andrew Phelps, Kerry Rappold, Robert Tovar, Julia Uravich

Members Unable to Attend
Rick Gruen, Vince Hall, Tom Murtaugh, Nancy Bush, John Mermin

Project Management Team/ Staff
Karen Buehrig, Clackamas County; Bob Goodrich, OBEC Consulting Engineers; Reem Khaki, Oregon Department of Transportation (ODOT); Zach Weigel, City of Wilsonville; Kirstin Greene and Megan Burns, EnviroIssues

The meeting packet included Project Management Team scoring criteria for reference, original scoring with changes in red can be found at the end of this summary. Conversation is summarized by agenda item below.

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1. Welcome and Introduction
City of Wilsonville French Prairie Bridge Project Manager Zach Weigel welcomed Technical Advisory Committee (TAC) committee members and thanked them for staying with this important project. Acknowledging it had been a year since this committee had met, facilitator Kirstin Greene asked members to introduce themselves and briefly describe their agency and perspective. She recapped the purpose of the meeting, to review project team evaluation criteria scoring results and agree upon a set of scores to advance to the Task Force.

Kirstin asked if there were any corrections to the meeting summary of TAC Meeting #2. TAC members did not identify any changes needed.

2. Project Updates
For TAC members, Zach reviewed the project schedule. Since finalizing the evaluation criteria in May, Federal Highway Administration reviews decided that an Environmental Assessment is the best approach for this project to determine bridge location and type. This will be instead of pursuing what's known as a Categorical Exclusion under the National Environmental Policy Act (NEPA). Zach explained

this change should not affect the chartered work or schedule for this phase of the project as a whole. Key milestones include the following. Zach showed the updated project schedule. The current schedule, summarized in the bullets below, also is on the website at www.frenchprairiebridgeproject.org.

- The TAC is asked to score each alternative according to the evaluation criteria today. That information will be presented to the Task Force in April.
- The Task Force will consider the scoring, discuss, and will be asked to make a location recommendation to City Council at their April meeting.
- With that information, City Council is expected to select an alternative in May.
- With that information, project team members will work to present bridge types for committee and community consideration this summer/early fall, with a selection on final type by the end of the year.

3. Evaluation Criteria-Based Scoring of the Alternatives

Bob Goodrich, consulting team project manager with OBEC, presented the final evaluation criteria weighting determined by the Task Force last year. The complete methodology and process to develop alignment evaluation criteria are included in the Evaluation Criteria report memo.

Tom Loynes asked for more information on the Task Force evaluation criteria weighting process.

Kirstin offered that committee members spent considerable time on the criteria and associated weighting and reached consensus through discussion. Some, e.g., cost, was considered to be large among all alternatives and not necessarily a differentiator from the community's perspective. Likewise, they assumed that environmental regulations would need to be met for any alternative to be built.

Bob added that, regardless of which alignment was selected, Task Force members understood that the economic impact of the cost and the environmental impact would be given the thorough refinement it needed at the time of engineering and design. This information allowed members to settle on the final weighted criteria that emphasized other aspects that were important to them.

Zach added that the weighting of the criteria does not necessarily reflect those topics that are most important to the community, but rather what the task force thought the topics were most important in deciding between the three bridge locations. For example, environmental impact is important as an overall goal, but there may not be much difference between the three bridge locations, so it is not as important when comparing bridge locations.

Bob then led a discussion of each evaluation criteria vis a vis the rankings for each of the three alignments (W1, W2 and W3). A map of the alternatives is available online. TAC members discussed each criterion and the pre-scoring provided by the Project Management Team (OBEC, City of Wilsonville, Clackamas County, and Oregon Department of Transportation staff). Comments and questions follow.

Category A: Connectivity and Safety

- ODOT noted that the reason they scored A1 (connects to existing bike/pedestrian routes directly or using streets with sidewalks and bike lanes on north side of bridge) for Alignment W1 higher than the project team was due to existing bike lane facilities. Zach pointed out that the current bike lane ends north of this project site and becomes a shared lane where traffic volumes decrease.

  - Kirstin addressed the TAC asking if A1 W1 should be adjusted. Members agreed and A1 W1 was bumped up to a 7.
- TAC members did not have comments or changes to A2 or A3.
- ODOT scored A4 (connects to planned bike/pedestrian routes on south side of the bridge) for Alignment W3 a 3.
  - Karen Buehrig asked for why PMT scoring and ODOT scoring were significantly different.
  - Tom McConnell responded that ODOT thought the disparity should be greater than one point because W3 offered substantially less connection to regional bicycle and pedestrian network.
  - TAC members agreed to lower A4 W3 to 5.

<u>Category B; Emergency Access</u>

- ODOT scored B1 (connects to emergency routes directly, minimizing out of direction travel and response time at and near the south terminus) for Alignment W3 a 1.
  - Tom McConnell said that ODOT wanted a larger distinction between the three alignments.
  - TAC members agreed that the difference should be greater to better emphasize the capabilities of each alignment, and lowered B1 W3 from a 2 to a 1.
- Anthony Buczek asked if with B2 (connect to emergency routes directly, minimizing out of direction travel and response time at and near the south terminus), there was information on where emergency responders are typical heading on the south side of the river.
  - Zach responded that the Charbonneau community is a frequent, daily destination.
- TAC members did not have any other changes to the PMT scores for emergency access.

<u>Category C: Environmental Impacts</u>

- Tom Loynes suggested that since all criterion had a 10% weighting, Category C responses should have a greater spread between the points for each alignment as there also are fewer subcategories. Tom suggested that considering the variation of vegetation on the south landing, that C1 (avoid or minimize adverse impacts on wildlife habitat and trees) and C2 (avoid or minimize adverse impacts on waters and wetlands) for alignment W3 be lowered.
  - Tom McConnell said that ODOT had C1 alignment W1 scored at 7 and alignment W3 scored as a 2 because of the existing trees and vegetation on the south landing that would be impacted.
    - Gail Curtis suggested that the text for that category be changed to reflect the environmental impact of that route.
  - TAC members agreed and decided to change the scoring for C1 to 7 for alignment W1, 8 for alignment W2, and 2 for alignment W3.
- Russ Klassen asked why alignment W1 was less favorable for impacts to wildlife compared to alignment W2.
  - Bob responded that there will be tree impact for both W1 and W2.
  - Russ asked whether a creek flows through that area.
  - Bob didn't think there was a creek but noted that there is a railroad track.
- Carrie Bond felt that for category C2 (avoid or minimize adverse impacts on waters and wetlands) alignment W1 with its proximity to wetlands warranted a lower score than

alignment W2.

  - TAC members agreed to lower C2 alignment W1 to a 6 due to wetland impacts. They lowered alignment W3 to a 2 due to the potential impact on the tributaries.
- TAC members discussed C3 (avoid or minimize adverse impacts on cultural and historic resources).
  - Tom McConnell justified ODOTs lower ranking of each alignment due to the unknown impacts for this category, especially because of the high probability of cultural resources in this area.
  - Chris Neamtzu and Carrie Bond gave the alignments scores of 6-6-7 also due to the unknown factors.
  - Karen Buehrig said that given alignment W1's location on the historical Native American crossing and the high probability of archaeological potential, W1 should be ranked one lower than the other two alignments.
  - Given the unknown factors and alignment W1's proximity to highly probability archaeological cultural resources, TAC members agreed to score alignment W1 a 5, and alignments W2 and W3 6.

<u>Category D: Compatibility with Recreational Goals</u>

- TAC members agreed to lower D1 for Alignment W3 from a 4 to a 3, which matched ODOT's score, to better reflect the much less positive user experience.
- The TAC had no change to D2.
- TAC members agreed to lower D3 alignment W3 from a 10 to an 8 due to the impacts on parking, both current parking infrastructure and projected parking from the community driving to the new bridge to walk and bike over it.
- They agreed to lower the score for D4 alignment W3 from a 4 to a 3 due to poor river access.

<u>Category E: Compatibility with Existing Built Environment</u>

- TAC members agreed to lower the score for section E2 alignment W1 from a 7 to a 6 due to the close proximity to a private resident.
- No other changes to the Project Management Team scoring were made in this Category.

<u>Category F: Cost and Economic Impact</u>

- Since there are no actual numbers to work with for cost and economic impact, all scoring is relative to one another based on potential cost difference. Lowest scores received a 10, higher costs were proportionally scaled downward.
  - Russ asked if the numbers included the cost for easements and property acquisitions.
    - Bob responded that F2 addresses those impacts and costs.
- Decimal points for F1 were used because the relative costs for the three alignments were very close.
  - TAC members advised to remove the decimal points to avoid overstating the level of accuracy for costs at this early planning stage of the project.
  - TAC agreed that final scoring for F1 should be 9-9-8 due to environmental mitigation expected for alignment W3.
    - Gail advocated for the lowering of the final score and wanted to be sure that the task force be explained the consideration for environmental mitigation costs are the reasoning behind the change.
    - Bob will rewrite the narrative to explain the scoring is a combination of the

proportioning of costs and a qualitative consideration of environmental mitigation.

- TAC members agreed to lower F2 alignment W3 from a 7 to a 6.
  - Reem had a change to the note for W3, and would like it to say, 'moderate impact to ODOT maintenance facility and future I5 bridge expansion.'
  - Bob confirmed that he expected that maintenance functions should not be impacted and will put in the notes 'moderate impact to ODOT maintenance property but facilities will not be impacted."
- TAC members agreed to lower F3 alignment W3 from a 3 to a 1 because of the highest potential for a significant utility impact: The City's wastewater outfall. Relocation would be very expensive.
- Participants discussed the cost of displacement of the wastewater outfall and where that cost should be represented. In the end, TAC members decided to omit the cost from F1 and modifying the F1 narratives to clarify/limit the costs that are included for that score.

Kirstin closed the scoring evaluation criteria agenda item by recapping what was decided (outlined above). Kirstin then asked if the TAC was comfortable recommending the decided upon scoring to the task force. All TAC members agreed they were comfortable advancing that scoring to the Task Force.

4. Next Steps

Zach advised TAC members of the Task Force meeting date scheduled for April 12th.

Kirstin mentioned that a meeting summary would be provided and encouraged folks to leave their comment forms and notes to be incorporated. Kirstin also said that a packet would be put together providing Task Force members with the TAC recommendations, who will use this information to make an alignment selection recommendation for City Council.

Bob recapped the upcoming steps:

- Bridge type selection is the next milestone after a bridge landing recommendation is approved.
- Bob updated the TAC on the project timeline.
  - Task Force meeting on April 12th
  - Final bridge landing recommendation to City Council in May
  - Towards the end of summer/early fall the City will host an Open House to present bridge types to community members
  - In the fall, the City will host another round of TAC and Task Force meetings for bridge type selection, narrowing to two bridge types, and finally recommending a preferred bridge type to City Council by the end of the year.

With no other business, Kirstin adjourned the meeting.

French Prairie Bridge Project

Scoring for Task Force Review

March 23, 2018

A	Connectivity and Safety	W1	W2	W3	Notes
A-1	Connects to existing bike/pedestrian routes directly or using streets with sidewalks and bike lanes on north side of the bridge	7	3	4	Assume Boones Ferry Road connection slightly higher priority than I-5 undercrossing trail. W1: No pedestrian facilities. Direct connection to SB bike lane on Boones Ferry Rd. W2: Connects east & west via Tauchman St, with no pedestrian or bicycle facilities. W3: Non-direct connection along Tauchman St. to a path towards Memorial Park.
A-2	Connects to existing bike/pedestrian routes directly or using streets with sidewalks and bike lanes on south side of the bridge	2	2	3	No bike/ped routes exist on the south side. All connect directly to Butteville Road. W3: Connects to north side Butteville Road. No need to cross road to travel west or access marina.
A-3	Connects to planned bike/pedestrian routes on north side of the bridge	10	6	5	W1: Directly connects w/ regional Ice Age Tonquin Trail (IATT). Connects to EB local trail. W2: Non-direct connection to both IATT and EB local trail. W3: About the same as W2. Further from regional IATT.
A-4	Connects to planned bike/pedestrian routes on south side of the bridge	8	7	5	W1: Direct regional bike connection west and local ped/bike trail connection east. No planned ped. connection west. W2: Same as W1, but located further from regional connection. W3: Non-direct regional bike connection west and local ped/bike connection east. No planned ped. connection west.
20.0%	Criteria A Weighting	13.5	9.0	8.5	

French Prairie Bridge Project

Scoring for Task Force Review
March 23, 2018

B	Emergency Access	W1	W2	W3	Notes
B-1	Connect to emergency routes directly, minimizing out of direction travel and response time at and near the north terminus	10	6	2	W1: Direct route from Wilsonville Road to Boones Ferry Rd. W2: Some out of direction travel through the park onto Tauchman St. W3: Significant out of direction travel through the park onto Tauchman St.
B-2	Connect to emergency routes directly, minimizing out of direction travel and response time at and near the south terminus	5	7	6	W1: Longest distant from I-5/Miley Rd. Slow access loop. W2: Fairly direct connection to I-5/Miley Rd. via Butteville Rd. with a less constrained access loop. W3: Closest access to I-5/Miley Rd., but requires out of direction travel.
B-3	Minimize emergency response impacts on residents, park activities, and marina operations	6	2	3	W1: Furthest from and least impact to residents, minor impact to marina access, minimal impact to parking. W2: Closer to residents on both sides of river, minimal impact to marina operations, major impact to middle of park. W3: Closest and most impacts to residents, no impact to marina, potential for impact to east edge of park facilities.
20.0%	Criteria B Weighting	14.0	10.0	7.3	

French Prairie Bridge Project

Scoring for Task Force Review
March 23, 2018

C	Environmental Impacts	W1	W2	W3	Notes
C-1	Avoid or minimize adverse impacts on wildlife habitat and trees	7	8	2	W1: Some tree and vegetation impacts on south side. W2: Mostly avoids wildlife & trees impact. W3: Moderate impacts to wildlife & trees on both sides of river.
C-2	Avoid or minimize adverse impacts on waters and wetlands	6	7	2	W1: Minimal impacts to river with potential wetland impacts. W2: Minimal impacts to river with potential wetland impacts. W3: Minimal impacts to river with likely impacts to wetlands and tributary crossings.
C-3	Avoid or minimize adverse impacts on cultural and historic resources	5	6	6	W1: Known resources are present (orchard and ferry crossing). Moderate to high potential for impacts. W2: Moderate potential for impacts, but most areas are previously disturbed. W3: Avoids known resources. Moderate potential for impacts. Area is undisturbed, so unidentified resources possible. *Each assessment based on potential for impacts as identified in the Opportunities and Constraints Report dated April 5, 2017.
11.5%	Criteria C Weighting	6.9	8.1	3.8	

French Prairie Bridge Project

Scoring for Task Force Review
March 23, 2018

D	Compatibility with Recreational Goals	W1	W2	W3	Notes
D-1	Provide a positive user experience (e.g. noise, aesthetics, view, security, compatible with other travel modes, exceeds design standards for turns and slopes)	8	9	3	W1: Secure/visible, view of RR bridge & river, some noise impact from train. Very good user experience. W2: Secure/visible, located away from existing bridges, least noise impact. Great user experience. W3: Natural setting, but less secure/visible. I-5 noise, least favorable views, wastewater plant nearby. Poor user experience.
D-2	Maximize compatibility with and flexibility for recreational uses including parks and the river on the north side.	9	4	8	W1: Compatible with existing park being located on edge of existing undeveloped park land. Easily integrate into future uses. W2: Minor displacement of existing open lawn and picnic area. Splits open lawn in half, limiting flexibility for future uses. W3: Compatible with existing park being located on edge of existing undeveloped park land. May limit incorporating local trail and existing drainage channel into future uses.
D-3	Maximize compatibility with and flexibility for recreational uses, including parks, the marina and the river on the south side.	3	5	8	W1: Compatible with existing use, but limits flexibility for marina parking, ramps, and slips. Limits use of land beneath bridge. W2: Similar to W1 with less parking impact, but potential building impacts. Parking impacts are more concerning to the County. W3: Avoids all related impacts.
D-4	Maintain or improve river access	8	6	3	W1: Provides new river view from bridge. Provides best opportunity to improve river bank access via old ferry landing. W2: Provides best new views of river from the bridge. Limited opportunity to improve public access to the river bank. W3: Provides view of river to the west from the bridge. Little opportunity to improve river bank access due to I-5 Bridge, Wasterwater Treatment Plant outfall, and drainage channel.
20.0%	Criteria D Weighting	14.0	12.0	11.0	

French Prairie Bridge Project

Scoring for Task Force Review
March 23, 2018

E	Compatibility with Existing Built Environment	W1	W2	W3	Notes
E-1	Minimize bridge location and access impacts on residences in Old Town	6	5	6	W1: Close to residents on Boones Ferry Rd. W2: Close to residents on Tauchman St and requires travel through the neighborhood, which includes underrepresented populations. W3: Not close to residents, but requires the most travel through the neighborhood, which includes underrepresented populations.
E-2	Minimize bridge location and access impacts on residences at south terminus in Clackamas County	6	2	3	No underrepresented populations identified south of the river. W1: In close proximity to one residence. W2: Directly impacts two small lot, waterfront residences. W3: Directly impacts two large lot rural residences.
E-3	Minimize bridge location and access impacts on marina facilities	6	5	10	W1: Potential impact to parking that can be mitigated. Impact to marina slips and operations not anticipated. W2: Impact to marina operations or building is anticipated, but can be mitigated. Impact to marina slips and parking not anticipated. W3: Avoids all marina impacts.
E-4	Minimize bridge location and access impacts to possible future infrastructure improvements (e.g. Railroad, ODOT)	6	10	5	W1: Located on railroad property, but can accommodate future improvements. Meeting w/RR provided confidence moving forward. W2: No impact to future infrastructure improvements. W3: Located on ODOT property, but can likely accommodate future
17.0%	Criteria E Weighting	10.2	9.4	10.2	

French Prairie Bridge Project

Scoring for Task Force Review
March 23, 2018

F	Cost and Economic Impact	W1	W2	W3	W2
F-1	Minimize total project cost (e.g. bridge, retaining wall, on grade path, environmental mitigation). This project cost does not consider architectural features or amenities.	9	9	8	Design Team initial calculation based on relative cost as determined by the proportion of bridge (most expensive), wall, and on-grade path (least expensive) for each alignment. Then potential environmental mitigation qualitatively considered. W1: 1200-ft bridge; 5100-sq ft wall; 850-ft on-grade path. W2: 1160-ft bridge; 11400-sq ft wall; 740-ft on-grade path. W3: 1180-ft bridge; 2400-sq ft wall; 1400-ft on-grade path. Most significant
F-2	Minimize property acquisition (e.g. right-of-way, easements) and avoid displacement of residences and businesses	9	3	6	W1: Minor impacts to two properties with no displacements anticipated. W2: Major/moderate impact to three properties with potential displacement of a residence and business. W3: Moderate/minor impact to three properties with no displacements anticipated. ODOT property impacted, but maintenance facility avoided.
F-3	Minimize the displacement of utilities	5	4	1	W1: Adjacent to underground gas line. Overhead power lines that can be easily relocated. W2: Crosses underground gas line. Overhead power lines on Butteville Road/River Vista intersection that can be easily relocated, but intersection presents more challenges. W3: Potential impact to wastewater treatment plant outfall pipe that cannot be easily relocated. Might conflict with bridge foundation even if in proximity rather than directly.
F-4	Maximizes economic benefit through tourism and access to commercial and regional destinations and trail system connections	9	9	6	W1: Provides significant benefit to local and regional economies. Closest to regional trails and parks, directly connects to Boones Ferry Rd, some noise impact from railroad. Also see D-1. W2: Provides significant benefit to local and regional economies. Good connection to regional trails and parks, good views, limited impact from I-5 and railroad. Also see D-1. W3: Provides some benefit to local and regional economies. Furthest from regional trails and parks, close to I-5, noise impacts, some out of direction travel. Also see D-1.
11.5%	Criteria F Weighting	9.2	7.2	6.0	
100%	Total, Weighted Score	68	56	47	

DRAFT

Bridge Type Evaluation Report

FRENCH PRAIRIE BRIDGE PROJECT

September 2018

Prepared for the City of Wilsonville

WILSONVILLE OREGON

Prepared By

OBEC CONSULTING ENGINEERS

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APPENDICES

Introduction

The City of Wilsonville is undertaking a project to develop preliminary designs for the French Prairie Bridge, a proposed bicycle/pedestrian/emergency vehicle crossing of the Willamette River between Interstate 5 (I-5) and the Portland and Western Railroad Bridge. The project addresses bridge location, bridge type selection, 30% design, and preliminary environmental documentation. In May 2018, City Council approved the Task Force's recommended Alignment, W1, as shown in Figure 1.

Prior to preparation of this report, the project team performed preliminary investigations of the project site and compiled the resulting information into reports. These reports were prepared using the project team’s best judgement, and were supplemented with guidance offered by the Technical Advisory Committee (TAC). This information is summarized in the Opportunities and Constraints Report.

Following development of the Opportunities and Constraints Report, the project team, with input from the TAC, Task Force, an open house, Wilsonville City Council, and Clackamas County Board of Commissioners, prepared a list of criteria to evaluate the relative merits of each location. These criteria are based on the needs and values of the community, including City and County goals. The Task Force assigned relative weighting to the criteria to provide for a quantitative comparison of the locations. This work is summarized in the Evaluation Criteria Memo.

The project team then prepared the Location Selection Summary, which served as a capstone document for determining and documenting the preferred bridge location using the information prepared in the technical reports, Opportunities and Constraints Memo, and Evaluation Criteria Memo.

This report focuses on evaluation of bridge types. The discussion below presents the proposed selection criteria and range of bridge types followed by a description of each of the five considered bridge types plus a brief description of types considered infeasible. The report concludes with a ranking summary of the alternatives. The next steps include the TAC reviewing the technical analysis of the bridge types, requesting public input, and finally, the Clackamas County Board of Commissioners (BCC) and the Wilsonville City Council selecting two bridge types for further evaluation.

The comparative ranking matrix for the five alternatives is included in Appendix A.

Design Criteria and Constraints

Any bridge at French Prairie must meet minimum functionality requirements and effectively address site constraints. The proposed bridge is intended to serve multiple functions. It will provide a safer river crossing for bicyclists and pedestrians than currently provided by the I-5 structures. It will also provide an alternative route for emergency vehicles when I-5 is blocked and access across the Willamette River is required. Finally, it will provide a redundant crossing in case of a major seismic event.

The design pedestrian loading for a pedestrian bridge is 90 pounds per square foot. The H20 truck, a notional design loading, will be considered for emergency vehicle use. Typically, the pedestrian load, when applied over the entire structure, is heavier than a single emergency vehicle. The heavy point loads associated with emergency vehicle wheels tend to control the design of localized elements and connections. The proposed bridge will be designed to remain serviceable following a Cascadia Subduction Zone event and to avoid collapse during the 1,000-year return period earthquake.

The recommended bridge width is 17 feet, based on the potential for simultaneous emergency vehicle and recreational use. A vehicle travel lane is typically 12 feet, and Oregon Department of Transportation's (ODOT) minimum sidewalk width is five feet. These two items serve as the basis for the bridge width recommendation.

The route will need to comply with the requirements of the Americans with Disabilities Act (ADA). The maximum slope along the path cannot exceed five percent. The maximum cross slope cannot exceed two percent. Recommended maximum slopes of 4.8 percent and 1.5 percent, respectively, allow for construction tolerances.

The minimum radius of curvature used on the path needs to accommodate both the design speed for bicycle use and off tracking of large emergency vehicles. A design speed of 20 miles per hour for cyclists using a 20-degree lean angle results in a radius of 74 feet. This radius accommodates most emergency vehicles with minimal off tracking.

The Willamette River is a navigable waterway regulated by the United States Coast Guard (USCG). Preliminary consultation with the USCG and river users has indicated that a new crossing of the Willamette River must provide a navigational clearance comparable to the bridges located immediately upstream and downstream. This results in a minimum horizontal clearance of approximately 240 feet and a minimum overhead obstruction elevation of 130 feet, which is 76 feet above the approximate low-water surface elevation of 54 feet. Temporary reductions in the navigational channel may be negotiated with the USCG and the Oregon State Marine Board (OSMB).

The bridge will need to comply with FEMA Floodway regulations. This project area is within a regulated floodway. New bridge piers located within the FEMA floodway will require mitigation to prevent a rise in the 100-year flood elevation.

In addition to USCG navigational requirements, the selected alignment passes over the Boones Ferry Marina and Boones Ferry Boat Ramp access road and parking area.

A desktop study of the geotechnical site setting has been performed. This investigation researched existing records of subsurface explorations in the project area and concluded that the site is predominantly alluvial deposits (silts, gravels, and sands) over the Troutdale Formation (stiff clays). These soils will require deep foundations in the form of driven piles or drilled shafts.

The alluvial deposits vary in density and composition and may be subject to liquefaction, depending on water table elevation and intensity of shaking during an earthquake. Lateral spread and seismic-induced slope instability are risks on both river banks. The detailed bridge design will need to address these issues to comply with the seismic design criteria. Significant additional investigations, testing, and analyses will be required to determine what, if any, mitigation is necessary.

Selection Criteria

The bridge type selection process has three phases. The first phase involves identifying bridge structure types that are potentially suitable for the French Prairie Bridge, given the site constraints. The second phase includes a preliminary evaluation of each type of structure. The bridge types are then compared and the two most suitable bridge types are selected for further investigation. Finally, a more rigorous investigation of the two remaining structure types will be performed in phase three. The available data will then be analyzed to determine the most suitable structure type for the French Prairie Bridge.

All potentially suitable alternatives meet the minimum functionality criteria discussed above, and were investigated considering the opportunities and constraints previously identified. The bridge types were compared qualitatively and ranked with respect to project economics, constructability, project impacts, and bridge aesthetics. Alternatives are ranked 1 to 5, with 1 being assigned to the alternative that best meets the respective criterion. A discussion of each of the criterion considered is included below. A ranking summary table is located in Appendix A.

Economics

This criterion is related to initial and long-term project costs. It is also related to how soon the bridge could be in service measured from the time funding is secured.

Design & Construction Cost – Bridge types that are less time-consuming to design and less expensive to construct receive a higher ranking.

Design & Construction Duration – Simple bridge types, or those with fewer stages of construction and conventional access requirements, will take less time to design and build. Permits can potentially be secured more easily and quickly for bridge types with less in-water footprint. Bridge types that can be completed sooner provide a greater local and regional economic benefit and minimize the effect of inflation on overall project costs. Types achieving these objectives will be ranked higher.

Maintenance – Simpler structural systems and bridge types with fewer components or that are easier to inspect are ranked higher.

Constructability

This criterion is related to how each bridge is constructed, specifically focusing on site access requirements and overall complexity. Access considerations include the necessary staging and work areas, the need for temporary work roadways and/or bridges, and whether or not cofferdams will be necessary. Complexity is considered to include overall construction sequencing, equipment and technology needs, construction materials, and anticipated contractor capabilities.

Substructure Access Requirements – Depending on the bridge type, the substructure's foundation elements and configuration may vary significantly. Different configurations and elements will have different equipment, staging, and access requirements. Foundation elements could include driven piles, prebored piles, or drilled shafts that support columns, piers, or towers. Factors affecting the score include the type, number, location, and size of foundation elements and supported members. Bridge types that avoid or minimize the number of foundation elements in the water or at the water's edge, particularly the deeper sections of the river where access is more challenging, rank higher.

Substructure Complexity – Depending on the bridge type's foundation elements and configuration, the complexity to design and construct the substructure elements can vary significantly. Factors affecting the ranking include the overall arrangement and configuration of individual bridge foundation elements and supported members, any construction staging or sequencing of the elements, and the capabilities of local contractors to perform the work. Bridge types with less complex foundation elements rank higher. Bridge types with arch rib or pylon foundations are more complex than those with only typical columns.

Superstructure Access Requirements – Depending on the bridge type, the superstructure's girder and deck elements and configuration may vary significantly. Different configurations and elements will have different equipment, staging, and access requirements. Superstructure elements could include steel girders, trusses, cables, arches, and precast concrete deck panels. Factors affecting the ranking include the type, number, placement method, and size of superstructure elements. Bridge types that are more readily constructible and limit access needs in or above the water rank higher.

Superstructure Complexity –Depending on the bridge type's girder and deck elements and configuration the complexity to design and construct the superstructure elements can vary significantly. Factors affecting the ranking include the overall arrangement and configuration of individual elements, how these elements connect to the substructure, any construction staging or sequencing of the elements, and the capabilities of local contractors to perform the work. Bridge types with less complex superstructure elements rank higher. Bridges with arch ribs and/or cable systems and precast deck panels are more complex than those with typical girder and deck systems.

Impacts

This criterion is related to the overall site impacts resulting from temporary construction access and staging needs, as well as the permanent project impacts associated with the bridge's footprint. A range of impacts are considered, from natural and cultural resources to physical constraints, such as navigational clearance and public and private property. The impacts will be organized and described by area, as shown in Figure 1.

Temporary Resource Impacts – Bridge types with less temporary construction impact to archeological and historic resources; terrestrial habitat and wildlife; and waters, wetlands, and State and Federally managed species will be ranked higher.

Temporary Built Environment Impacts – Bridge types with less temporary construction impact to private residences, public parks, marina property and structures, the river floodway and its navigational channel, railroad property, and existing utilities will be ranked higher.

Permanent Resource Impacts – Bridge types with less permanent impact to archeological and historic resources; terrestrial habitat and wildlife; and waters, wetlands, and aquatic wildlife will be ranked higher.

Permanent Built Environment Impacts – Bridge types with less permanent impact to private residences, public parks, marina property and structures, the river floodway and its navigational channel, railroad property, and existing utilities will be ranked higher.

Aesthetics

Aesthetic considerations relate to the bridge's setting, user experience, and visual impact. Though aesthetic preferences are subjective, higher rankings will be given to the bridge types that look appropriate within the site and relate to the surrounding natural and built environments. The team also considered whether the appearance of the bridge would be a draw to users beyond just the utilitarian function. This helps determine whether the bridge type should blend in or stand out as a signature structure.

Bridge Types Considered

Five bridge types have been identified as most suitable for this project site: a steel girder, a steel truss, a tied-arch, a cable-stayed bridge, and a suspension bridge. The following five sections evaluate these bridge types against the criteria presented above.

Steel Girder

Steel girders consist of either I-beams or a box. Individual segments can be spliced together through bolted connections.

Springwater Trail Bridges: Johnson Creek Crossing, Portland, OR

The proposed steel girder alternative consists of I-girders cut from steel plate and welded together. The steel could be uncoated weathering steel or painted. A concrete deck would be placed on the girders. The heights of the girders can be increased at the supports, at an additional cost, to improve structural efficiency and provide architectural interest. To maintain visual consistency, the approach spans would also use welded steel plate girders.

An approximate structure layout was performed. As initially visualized, the structure consists of two frames. The north frame crosses the river and extends to the middle of the parking lot with spans of 185'-275'-275'-185'. The south frame continues from the north frame, ending south of Butteville Road with two 110-foot spans. See Figure 2 for elevation and section views.

This alternative is being evaluated as it is capable of economically achieving the necessary span lengths with appropriate structure depths and temporary impacts, given the project constraints. This structure type is commonly constructed by local bridge fabricators and contractors, and is similar to the I-5 bridges downstream.

Steel box girders could be considered, but are significantly more expensive than the I-beams. These structures are best suited for highly curved horizontal alignments, which are not required for this project. In addition to the higher construction cost, box girders are more difficult to inspect due to the enclosed space.

Economics

Design & Construction Cost and Duration

Of all the alternatives analyzed, the welded steel plate girder is the most straight-forward to design and construct. The substructures would likely be single columns on large-diameter drilled shafts. No unique analysis or design tasks are required. The design duration would be approximately one year.

The construction cost of this structure is the least of all the alternatives considered. The construction duration would be approximately two years.

Maintenance

Maintenance of a steel girder pedestrian bridge is similar to maintenance of steel girder highway bridges, which are common in the area. The highest maintenance cost typically associated with steel bridges is related to the coating (paint) systems. The use of weathering steel will minimize or eliminate this consideration. Other common maintenance items are expansion joints and girder bearings.

The routine condition inspection of a steel girder bridge is similar to the regularly scheduled bridge inspections for highway bridges, except at a longer interval between inspections. There are a number of connections between various steel members, such as the splices and cross frames, that will need to be inspected regularly. Inspection access walkways and ladders can be included as part of the design to aid in this work. Under-bridge inspection trucks (UBIT, "snooper cranes") or other similar equipment would occasionally be required to closely inspect the exterior faces of the girders. Designing the superstructure as a three-girder system, as shown in Figure 2, eliminates the higher level of inspection required for fracture-critical structures.

The steel plate girder bridge would require three in-water piers, which increases the risk of debris accumulating on the bridge. It also requires underwater inspections by divers at a minimum of every five years.

Constructability

Access Requirements

There would be piers located in the river on either side of the navigation channel. The drilled shafts for these piers would need to be constructed from a work bridge or barge. With the locks at Willamette Falls currently closed, the practicality of getting a barge of adequate size to the project site needs to be investigated, but it appears that modular systems could be employed.

Access from the north shore to the pier north of the navigation channel would be via a work bridge extending from the ferry access road, approximately 400 feet downstream. Access to a work bridge for the piers in the river between the navigation channel and the south shore would be challenging to locate without impacting the use of a portion of the Boones Ferry Marina dock. This work bridge would start from the boat ramp access road, located west of the dock and east of the railroad bridge. The remaining pier locations on the south bank are all easily accessed.

Installation of the girders would require a combination of barges (if used) and cranes. Shoring towers may be required to temporarily support girder segments. Girder placement over the boat dock is the most challenging location. There are numerous ways the girders could be placed in this location with varying impacts to the dock, ramp access road, and parking lot. For this analysis, it was assumed that temporary shoring towers could be placed within the limits of the boat dock, resulting in the lowest construction cost. A work containment system and short closure windows would be required to prevent debris from falling on the dock below during a variety of work tasks.

Complexity

This bridge type is seen as relatively simple to build when there is good access. It is more complicated if barges, girder launching, and/or hanging splices are required. The girders, while large, are within the capabilities of steel fabricators located in the Portland area. Due to the slenderness of the girders, stability of the individual girder segments would likely require additional temporary shoring towers in the river. Construction of the piers in the deep portion of the river is a work item not typically accomplished by local contractors.

Impacts

The various impacts to the project site resources and built environment are summarized below as permanent or temporary. Impacts are discussed according the six areas identified on Figure 1.

Resource Impacts

Permanent Impacts

Boones Ferry Park – There will be a loss of upland vegetation and open space in the undeveloped portion of Boones Ferry Park west of Boones Ferry Road, including in the historic orchard further north.

North Bank – There will be a loss of riparian vegetation where the bridge crosses, both at the top of the bank and under the bridge. The three piers within the floodway will require mitigation to avoid raising the flood elevation. Excavating along the north bank is the most likely mitigation. Since this river bank is steep and the required area of excavation to balance the area of the new bridge columns is large, the entire hillside may need to be cut back to the top of the slope.

Willamette River – There will be three piers in the river. It also may be necessary to install additional structures, such as dolphins, to protect the piers from vessel collisions.

South Bank – There will be a loss of riparian vegetation where the bridge crosses the top of the bank and under the bridge.

Ramp Access Road, Parking Lot, and Butteville Road – Some ground disturbance will be required at the south approach span piers.

South Approach Path – This on-grade segment will have upland vegetation removal and ground disturbance under its footprint.

Temporary Impacts

There will be a local increase in construction traffic, noise, emissions, and dust.

Boones Ferry Park – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

North Bank – Additional riparian vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Willamette River – To access the pier work and place girders, the navigational channel and other portions of the river will need to be partially restricted at times. Some of the additional towers required to safely place the girder segments over the river will have to be located within the limits of the boat dock. Temporary piles and cofferdams will need to be installed and removed.

Ramp Access Road, Parking Lot, and Butteville Road – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

South Approach Path – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Built Environment Impacts

<u>Permanent Impacts</u>

Boones Ferry Park – There will be bridge approaches in the park and a new path accessing Boones Ferry Road. There would be minor revisions required to the Boones Ferry Park Master Plan (MP) that is currently in development.

North Bank – There is no built environment currently present to be impacted.

Willamette River – Remnants of the north bank ferry slip may be impacted due to construction access and placement of the work bridge (if used). There will be a new structure over the Boones Ferry Marina and dock. Pier 3 is located approximately 100 feet from the boat docks, which may impact maneuverability and access to them.

Ramp Access Road, Parking Lot, and Butteville Road – There will be a new structure over the ramp access road, the primary Boones Ferry Boat Launch parking lot, and Butteville Road. One pier column will be required in the parking lot, resulting in the loss of one parking space for a truck with trailer.

South Approach Path – The approach path will partially be constructed on the existing fill for the railroad bridge approach.

<u>Temporary Impacts</u>

Boones Ferry Park – Construction activities will increase traffic on Boones Ferry Road and increase noise levels in the park. Impacts could increase or decrease, depending on the timing for constructing park improvements identified in the MP.

North Bank – There is no built environment currently present to be impacted.

Willamette River – Placing girders and other work over the boat dock will require temporary closures of portions of the dock. There may be a need to place temporary shoring towers within the limits of the dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be occasional closures of portions of the parking lot and the ramp access road to construct the piers and install the superstructure. There is a possibility that full closures of the parking lot will be necessary for short periods of time. There will be short duration closures and construction traffic on Butteville Road.

Impact Summary

The defining permanent impact of this alternative is the anticipated need to excavate a portion of the north bank to ensure no rise in the water level upstream of the bridge during the 100-year flood.

The primary temporary impacts are related to the use and operation of the river, parking lot, ramp access road, and boat docks due to the necessary shoring towers and girder placement.

Aesthetics

For path users, this alternative would feel very open with no bridge elements extending above the bridge rail. Views upstream and downstream would be unobstructed.

For people viewing the bridge from locations other than the path, this alternative will have a relatively heavy deck appearance, but be visually simple. This alternative does not have trusses, arch ribs, cables, or towers that would increase the visual impact of the structure. The bridge would not stand out against its surroundings, given its relatively simple lines and girder color options, such as weathering steel, that could match the adjacent railroad trusses.

Steel Truss

Steel trusses are formed by arranging steel members to extend the span lengths beyond the range of steel girders. For spans longer than 150 feet, box-shaped trusses are required for stability. The box-shaped trusses can be either below the deck (deck trusses) or the deck can go through the box (through trusses). Deck trusses were not considered for this location due to the required superstructure depth above the navigational channel.

Portland and Western Railroad Bridge, Wilsonville, OR

The proposed steel truss alternative consists of steel through-truss main spans. The through-trusses would be similar to the railroad bridge immediately upstream of the project. The steel could be uncoated weathering steel or painted. The approach spans at both ends would be steel plate girders, as described above for the steel girder alternative, to maintain visual consistency with the railroad bridge. A concrete deck would be placed the full length of the bridge. See Figure 3 for elevation and section views.

A preliminary structure layout was performed. As initially visualized, the structure consists of four frames. The north approach frame is a single 181-foot span of steel plate girders extending from the river bank to the first pier in the river. The steel trusses make up the middle two frames with spans of 315 feet each. The south frame of steel plate girders continues from the trusses, ending south of Butteville Road with spans of 107'-123'-107'.

This alternative is being evaluated as it is capable of achieving the necessary span lengths; can be designed with a shallower deck system compared to the steel plate girder bridge; reduces the height of the path over the navigation channel; uses construction methodologies familiar to local bridge fabricators and contractors; and is similar to the railroad bridge upstream.

Economics

Design & Construction Cost and Duration

The welded steel plate girder approach spans are straight-forward to design and construct. While trusses are familiar to some in the bridge design community, the main truss spans are slightly more complicated to design compared to the steel plate girder option. Construction of the truss spans is slightly more complicated, as well, due to the increased number of member connections. The substructures would likely be single columns on large-diameter drilled shafts. No unique analysis or design tasks are required. The design duration would be approximately one year.

The construction cost of this structure is estimated to be the second least expensive, but somewhat more than the steel girder option. The construction duration would be approximately two years.

Maintenance

Maintenance of a steel truss pedestrian bridge is similar to maintenance of steel girder highway bridges, which are common in the area. The highest maintenance cost typically associated with steel bridges is related to the coating (paint) systems. The use of weathering steel would minimize or eliminate this consideration. Other common maintenance items are expansion joints and girder bearings.

The routine condition inspection of steel truss approach spans is similar to the regularly scheduled bridge inspections for highway bridges, except at a longer interval between inspections. Truss bridges are typically considered fracture-critical, which require more stringent and time-consuming inspections. There are a number of connections between various steel members, such as the splices and cross frames, that will need to be inspected regularly. Under-bridge inspection trucks or other similar equipment would be required to inspect the superstructure under the deck. Manlifts would be required to access the tops of the trusses and related connections.

The steel truss bridge would require three in-water piers, which increases the risk of debris accumulating on the bridge. It also requires underwater inspections by divers at a minimum of every five years.

Constructability

Access Requirements

There would be piers located in the river on either side of the navigation channel. The drilled shafts for these piers would need to be constructed from a work bridge or barge. With the locks at Willamette Falls currently closed, the practicality of getting a barge of adequate size to the project site needs to be investigated, but it appears that modular systems could be employed.

Access from the north shore to the pier north of the navigation channel would be via a work bridge extending from the ferry access road, approximately 400 feet downstream. Access to a work bridge for the piers in the river between the navigation channel and the south shore would be challenging to locate without impacting the use of a portion of the Boones Ferry Marina dock. This work bridge would start from the boat ramp access road, located west of the dock and east of the railroad bridge. The remaining pier locations on the south bank are all easily accessed.

Installation of the trusses and girders would take some combination of work bridges, barges, and cranes. Shoring towers would be required to temporarily support truss segments if not fully assembled on the ground and lifted or launched into place. The approach girder segments may also require shoring towers. Truss placement over the boat dock is the most challenging location. There are numerous ways the girders could be placed in this location with varying impacts to the dock, ramp access road, and parking lot. For this analysis, it was assumed that temporary shoring towers could be placed within the limits of the boat dock, resulting in the lowest construction cost. A work containment system and short closure windows would be required to prevent debris from falling on the dock below during a variety of work tasks.

Complexity

This bridge type is seen as relatively straight-forward to build. The trusses and girders are within the capabilities of steel fabricators located in the Portland area. Construction of the piers in the deep portion of the river and installation of the superstructure are the only items not typically accomplished by local contractors.

Impacts

The various impacts to the project site resources and built environment are summarized below as permanent or temporary. Impacts are discussed according the six areas identified on Figure 1.

Resource Impacts

<u>Permanent Impacts</u>

Boones Ferry Park – There will be a loss of upland vegetation and open space in the undeveloped portion of Boones Ferry Park west of Boones Ferry Road, including in the historic orchard further north

North Bank – There will be a loss of riparian vegetation where the bridge crosses, both at the top of the bank and under the bridge. The three piers within the floodway will require mitigation to avoid raising the flood elevation. Excavating along the north bank is the most likely mitigation. Since this river bank is steep and the required area of excavation to balance the area of the new bridge columns is large, the entire hillside may need to be cut back to the top of the slope.

Willamette River – There will be three piers in the river. It also may be necessary to install additional structures, such as dolphins, to protect the piers from vessel collisions.

South Bank – There will be a loss of riparian vegetation where the bridge crosses the top of the bank and under the bridge.

Ramp Access Road, Parking Lot, and Butteville Road – Some ground disturbance will be required at the south approach span piers.

South Approach Path – This on-grade segment will have upland vegetation removal and ground disturbance under its footprint.

<u>Temporary Impacts</u>

There will be a local increase in construction traffic, noise, emissions, and dust.

Boones Ferry Park – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

North Bank – Additional riparian vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Willamette River – To access the pier work and place girders, the navigational channel and other portions of the river will need to be partially restricted at times. Temporary piles and cofferdams will need to be installed and removed.

Ramp Access Road, Parking Lot, and Butteville Road – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

South Approach Path – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Built Environment Impacts

<u>Permanent Impacts</u>

Boones Ferry Park – There will be bridge approaches in the park and a new path accessing Boones Ferry Road. There would be minor revisions required to the Boones Ferry Park MP that is currently in development.

North Bank – There is no built environment currently present to be impacted.

Willamette River – Remnants of the ferry slip may be impacted due to the placement of the work bridge (if used). There will be a new structure over the Boones Ferry Marina and dock. Pier 3 is located approximately 100 feet from the boat docks, which may impact maneuverability and access to them.

Ramp Access Road, Parking Lot, and Butteville Road – There will be a new structure over the ramp access road, the primary Boones Ferry Boat Launch parking lot, and Butteville Road. One pier column would be required in the parking lot, resulting in the loss of one parking space for a truck with trailer.

South Approach Path – The approach path will partially be constructed on the existing fill for the railroad bridge approach.

<u>Temporary Impacts</u>

Boones Ferry Park – Construction activities will increase traffic on Boones Ferry Road and increase noise levels in the park. Impacts could increase or decrease, depending on the timing for constructing park improvements identified in the MP.

North Bank – There is no built environment currently present to be impacted.

Willamette River – Placing trusses and other work over the boat dock will require temporary closures of portions of the dock. There may be a need to place temporary shoring towers within the limits of the dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be occasional closures of portions of the parking lot and the ramp access road to construct the piers and install the superstructure. There is a possibility that full closures of the parking lot will be necessary for short periods of time. There will be short duration closures and construction traffic on Butteville Rd.

Impact Summary

The defining permanent impact of this alternative is the anticipated need to excavate a portion of the north bank to ensure no rise in the water level upstream of the bridge during the 100-year flood.

The primary temporary impacts are related to the use and operation of the river, parking lot, ramp access road, and boat docks due to the necessary shoring towers and truss and girder placement.

Aesthetics

For path users, this alternative would feel the most enclosed of all options. The through trusses have significant members extending alongside the deck and overhead. Views of the river would be somewhat obstructed by the structure. The use of weathering steel for the above deck truss members may result in patches of rust colored staining on the bridge deck. Alternatively, these members could be painted to minimize staining, but that would increase the maintenance needs.

For people viewing the bridge from locations other than the path, this alternative would blend in with the railroad trusses, as they are approximately the same configuration, height, and possibly color, if weathering steel or matching paint is used.

Tied-Arch

Arches can span significant distances by transferring the vertical deck loads into axial compression in the arch ribs. The form and construction of these structures can be extremely varied. For example, they can be formed out of concrete or steel; apply the thrust in the ribs into the foundations or be tied together on itself like a bowstring; and the ribs can be fully below the deck, fully above the deck, or some combination thereof.

Peter Courtney Minto Island Pedestrian Bridge, Salem, OR

Three Countries Pedestrian Bridge, Germany, Switzerland, France

The proposed tied-arch alternative consists of a single semi-through-tied-arch main span over the river. The term "semi-through" indicates that portions of the arch ribs are located both above and below the deck. Vertical hold-downs would be required at each end of the arch to help resist the lateral loads at the bases of the arch. Portions of the bridge deck below the arch rib would be supported on suspender cables. The remainder of the bridge would be ground-supported. The portion of the arch ribs above the deck could be either concrete or steel. The approach spans at both ends would be concrete slabs to maintain visual consistency. A concrete deck would be placed the full length of the bridge. The suspended portion would use precast panels. See Figure 4 for elevation and section views.

Tempe Town Lake Bridge, Tempe, AZ

A preliminary structure layout was performed. As initially visualized, the proposed structure consists of three frames. The north approach frame is a single 50-foot span of cast-in-place post-tensioned concrete extending from the river bank to the end of the arch system. The arch system has a continuous deck consisting of 552 feet of suspended precast concrete below the arch, sandwiched by twin adjoining cast-in-place post-tensioned concrete spans of 122.5 feet. The precast concrete deck panels are suspended from the arch. The arch itself has a span from support to support of 663 feet with a crown height 80 feet above the deck. The south frame of post-tensioned concrete continues from the end of the arch frame, connecting south of Butteville Road with spans of 108'-125'-108'.

This alternative is being evaluated as it is capable of achieving the necessary span lengths; can be designed with a very shallow deck system over the river, further reducing the height of the path over the navigation channel;

could limit in-water work to the arch foundations on each bank; and is a distinctive signature-type structure.

A river crossing consisting of two tied-arch spans was considered, but not carried forward as it has the same level of complexity as the single-span, includes a pier in the river between the navigational channel and the boat dock, and doesn't fit the site as well as a single-span. A deck arch was also investigated and dismissed due to the required raising of grade to clear the navigational channel and boat dock, the inefficient low rise-to-span ratio, and lack of competent foundation soils to resist the lateral thrust.

Economics

Design & Construction Cost and Duration

The cast-in-place concrete approach spans are straight-forward to design and construct. The main arch span is more complicated due to the height of the structure above the river and its inherent instability prior to being fully connected together. Temporary towers, either in the river and/or on the river banks, would likely be required to support the arch ribs during construction. The arch rib foundations would be large-diameter drilled shafts or driven pile groups. The approach span substructures will most likely be single columns on large-diameter drilled shafts. The vertical hold-downs at the ends of the arch frame would require either rock anchors or large-diameter drilled shafts to resist the expected uplift. The arch span and hold-downs require a level of unique analysis and design to account for construction staging and final structure balancing. The design duration would be approximately two years.

The construction cost of this structure is estimated to be the highest of all five options considered. The construction duration would be approximately three years.

Maintenance

Maintenance of a tied-arch pedestrian bridge is moderate. The use of weathering steel or concrete for the arch rib to avoid painting, if selected, will minimize maintenance needs. The hanger systems for the suspended portion of the deck require additional inspection effort. Since no piers will be in the river during low-water periods, no underwater diver inspections would be required. Other common maintenance items are expansion joints and girder bearings.

Under-bridge inspection trucks or other similar equipment would be required to inspect the superstructure under the deck. Manlifts would be required to access the tops of the arch ribs and hangers.

Constructability

Access Requirements

The two main arch span piers would be located on either bank of the river. The one on the north bank is at the bottom of the steep hill and not directly accessible from the park above. A temporary work bridge from the end of the ferry slip access road would be required to access this pier. The pier on the south bank would be located between the boat dock and the boat ramp access road, and a short work bridge off the parking lot would be required to access this location. Small cofferdams would probably be required to dewater the base of the arch piers to allow forming and placement of the concrete. Temporary shoring of the boat ramp access road would be required.

Installation of the arch ribs would require some combination of work bridges, barges, and cranes. Shoring towers, either in the river or on the banks with cable supports to the arch, would be required to temporarily support the arch segments. If the arch ribs are steel or precast concrete, access is required to lift the individual pieces into place. The arch rib placement over the boat dock is the most challenging location. A work containment system and/or short closure windows would be required to prevent debris from falling on the dock below during a variety of work tasks. The approach girder segments would require ground-supported falsework, and the vertical clearance over Butteville Road may be temporarily reduced below 17 feet.

The remaining pier and vertical tie-down locations on the north and south banks are all easily accessed.

Complexity

The tied-arch bridge type is seen as very challenging to build in this location and not typically accomplished by local contractors. Based on OBEC's experience with similar structures, the construction sequence of the arch span substructure and superstructure is critical to an efficient, constructible design. The post-tensioned approach spans are relatively straight-forward, common construction.

Impacts

The various impacts to the project site resources and built environment are summarized below as permanent or temporary. Impacts are discussed according the six areas identified on Figure 1.

Resource Impacts

<u>Permanent Impacts</u>

Boones Ferry Park – There will be a loss of upland vegetation and open space in the undeveloped portion of Boones Ferry Park west of Boones Ferry Road, including in the historic orchard further north.

North Bank – There will be a loss of riparian vegetation where the bridge crosses, both at the top of the bank and under the bridge. The two piers within the floodway will require mitigation to avoid raising the flood elevation. Excavating along the north bank is the most likely mitigation. Since this river bank is steep and the required area of excavation to balance the area of the new bridge columns is large, the entire hillside may need to be cut back to the top of the slope.

Willamette River – Piers will be located at the edge of the ordinary high water line, resulting in a loss of riparian vegetation.

South Bank – There will be a loss of riparian vegetation where the bridge crosses the top of the bank and under the bridge.

Ramp Access Road, Parking Lot, and Butteville Road – Some ground disturbance will be required at the south approach span piers.

South Approach Path – This on-grade segment will have upland vegetation removal and ground disturbance under its footprint.

<u>Temporary Impacts</u>

There will be a local increase in construction traffic, noise, emissions, and dust.

Boones Ferry Park – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

North Bank – Additional riparian vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Willamette River – Construction of the arch ribs will require work bridges and/or barges for access. Installation and removal of the temporary shoring towers (piles if required) will impact the river, as well. The navigational channel and other portions of the river will need to be partially restricted at times due to the shoring towers and during deck panel placement.

Ramp Access Road, Parking Lot, and Butteville Road – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

South Approach Path – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Built Environment Impacts

<u>Permanent Impacts</u>

Boones Ferry Park – There will be bridge approaches in the park and a new path access to Boones Ferry Road. There would be minor revisions required to the Boones Ferry Park MP that is currently in development.

North Bank – There is no built environment present to be impacted.

Willamette River – Remnants of the ferry slip may be impacted due to the placement of the work bridge (if used). There will be a new structure over the Boones Ferry Marina and dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be a new structure over the ramp access road, the primary Boones Ferry Boat Launch parking lot, and Butteville Road. One pier column would be required in the parking lot, resulting in the loss of one parking space for a truck with trailer.

South Approach Path – The approach path will partially be constructed on the existing fill for the railroad bridge approach.

Temporary Impacts

Boones Ferry Park – There will be construction traffic on Boones Ferry Road. Impacts could increase or decrease, depending on the timing for constructing park improvements identified in the Master Plan.

North Bank – There is no built environment present to be impacted.

Willamette River – Placing the arch ribs, deck panels, and other work over the boat dock will require temporary closures of portions of the dock. There may be a need to place temporary shoring towers within the limits of the dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be occasional closures of portions of the parking lot and the ramp access road to construct the piers and install the superstructure. There is a possibility that full closures of the parking lot will be necessary for short periods of time. There will be short duration closures and construction traffic on Butteville Road.

Impact Summary

The defining permanent impact of this alternative is the anticipated need to excavate a portion of the north bank to ensure no rise in the water level upstream of the bridge during the 100-year flood.

The primary temporary impacts are related to the use and operation of the river, parking lot, ramp access road, and boat docks due to the necessary shoring towers and arch rib placement.

Aesthetics

For path users, this alternative would feel somewhat enclosed through the arch with the large arch ribs, cross members, and hangers extending above the deck and overhead. The width of each arch rib is estimated to be 2.5 feet. Compared to the approximate 20-foot width of the superstructure, this could look out of proportion. Weathering steel, if used above the bridge deck, could stain portions of the deck an iron oxide red.

The form of the tied-arch alternative makes this a signature-type bridge. For people viewing the bridge from locations other than the path, this alternative makes a significant visual statement. This alternative would have significant visual mass and uniqueness of form compared to the adjacent bridges.

Cable-Stayed

Pedestrian Bridge across the Elbe River, Celakovice, Czech Republic

Cable-stayed bridges are cable-supported structures where the suspenders supporting the deck system are tied back directly to tall pylons. Cable-stayed structures can support very long spans and have very shallow superstructures.

The proposed cable-stayed alternative consists of a cable-stayed main span over the river supported from two pylons. The form of the pylons is somewhat flexible, depending on the aesthetic appearance desired. The stays supporting the main span are balanced with back-stays at each approach. The north backstays would be tied to an anchor block or ground anchors. The south backstays would support an approach span and be supplemented with vertical hold-downs supported by a drilled shaft or ground anchor. The suspended portion of the bridge deck would be connected to cables. The remainder of the bridge would be ground-supported. The approach spans at both ends would be concrete slabs to maintain visual consistency. A concrete deck would be placed the full length of the bridge. The suspended portion would use precast panels. See Figure 5 for elevation and section views.

I-5: Gateway Pedestrian Bridge, Eugene, OR

A preliminary structure layout was performed. As initially visualized, the proposed structure consists of two frames. The cable-stayed frame consists primarily of precast deck panels with transitional cast-in-place segments and makes up the north 1,069 feet of the structure. The two pylons extend approximately 160 feet above the deck. The south frame, which consists of cast-in-place concrete slab, connects south of Butteville Road with two spans of 71.5 feet.

This alternative is being evaluated as it is capable of achieving the necessary span lengths; can be designed with a very shallow deck system over the river, further reducing the height of the path over the navigation channel; would eliminate in-water work with the pylon foundations on the top of each bank; and is a distinctive signature-type structure.

Cable-stayed structures with either one or three pylons were considered, but not carried forward as they would have the same level of complexity as the two pylon option, include at least one pier in the river between the navigational channel and the boat dock, and wouldn't fit the site as well as the two pylon structure. They would also require floodway mitigation, which is not necessary for the two pylon layout.

Economics

Design & Construction Cost and Duration

The cast-in-place concrete slab approach spans are straight-forward to design and construct. The main cable-stayed structure is more complicated due to the stay cable assembly and tensioning, and construction sequencing. Temporary towers would likely be required to support the pylons during construction. The pylon foundations would be groups of large-diameter drilled shafts. Since the cable-stayed bridge is anticipated to not have temporary or permanent in-water impacts as noted below, the permitting effort will be minimized. The approach span substructures will most likely be single columns on large-diameter drilled shafts. The cable-stayed portion of the structure requires unique analysis and design to account for construction staging and final structure balancing. The design duration would be approximately two years.

The construction cost of this structure is estimated to be second highest, only less than the tied arch option. The construction duration would be approximately three years.

Maintenance

Maintenance of a cable-stayed pedestrian bridge is moderate. The cables and related connection systems are typically painted or otherwise encapsulated to provide corrosion protection. These protection systems require regular maintenance. The cable-stayed systems require additional inspection effort. Since no piers will be in the river, no underwater diver inspections would be required. Other common maintenance items are expansion joints and girder bearings.

Under-bridge inspection trucks or other similar equipment would be required to inspect the superstructure under the deck. Working the inspection equipment around the stays can be awkward and time-consuming. Accessing the tops of the pylons and hangers for maintenance and inspection would require special accommodations during design.

Constructability

Access Requirements

The pylons on both banks would be located on the top of the river banks. The one on the north bank is in the currently undeveloped portion of the park and is directly accessible from Boones Ferry Road. The pylon on the south bank would be between the boat ramp access road and the parking lot. Temporary relocation and/or closure of the boat ramp access road would be required to access this location.

Installation of the pylons would require large cranes. Shoring towers would be required to temporarily support the pylons. The approach girder segments would require ground-supported falsework, and the vertical clearance over Butteville Road may be temporarily reduced below 17 feet. The deck panel and hanger placement over the boat dock is the most challenging location. A work containment system would be required to prevent debris from falling on the dock below. Deck panel placement will most likely take place primarily from the pylons outward across the river.

The remaining pier locations on the south banks are all easily accessed.

Complexity

The cable-stayed bridge type is seen as relatively challenging to build and not typically accomplished by local contractors. Based on OBEC's experience with similar structures, the construction sequence of the cable-stayed portion of the substructure and superstructure is critical to an efficient, constructible design, and requires close coordination between the engineers and contractor. The approach spans are relatively straight-forward, common construction.

Impacts

The various impacts to the project site resources and built environment are summarized below as permanent or temporary. Impacts are discussed according the six areas identified on Figure 1.

Resource Impacts

Permanent Impacts

No hydraulic impact is expected for this alternative; therefore, no mitigation will be required.

Boones Ferry Park – There will be a loss of upland vegetation and open space in the undeveloped portion of Boones Ferry Park west of Boones Ferry Road, including in the historic orchard further north. One of the main pylon piers will be located at the edge of the north bank.

North Bank – There will be a loss of riparian vegetation where the bridge crosses, both at the top of the bank and under the bridge.

Willamette River – No permanent impacts are anticipated.

South Bank – There will be a loss of riparian vegetation where the bridge crosses the top of the bank and under the bridge.

Ramp Access Road, Parking Lot, and Butteville Road – Some ground disturbance and riparian and upland vegetation removal will be required at the south pylon footing and approach span piers. The ramp access road may need to be relocated to provide room for the pylon.

South Approach Path – This on-grade segment will have upland vegetation removal and ground disturbance under its footprint.

Temporary Impacts

There will be a local increase in construction traffic, noise, emissions, and dust.

Boones Ferry Park – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

North Bank – No temporary impacts are anticipated on the north bank.

Willamette River – The navigational channel and other portions of the river will need to be partially restricted at times during deck panel placement.

Ramp Access Road, Parking Lot, and Butteville Road – Additional riparian and upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

South Approach Path – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Built Environment Impacts

Permanent Impacts

Boones Ferry Park – There will be bridge approaches and backstay anchors in the park and a new path access to Boones Ferry Road. There would be minor to moderate revisions required to the Boones Ferry Park MP that is currently in development.

North Bank – There is no built environment present to be impacted.

Willamette River – There will be a new structure over the Boones Ferry Marina and dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be a new structure over the primary Boones Ferry Boat Launch parking lot, and Butteville Road. One tie-down column would be required in the parking lot for the configuration shown in Figure 5, resulting in the loss of one parking space for a truck with trailer. Alternatively, a larger tie-down south of Butteville Road and an asymmetrical stay arrangement could be used to eliminate piers in the parking lot.

South Approach Path – The approach path will partially be constructed on the existing fill for the railroad bridge approach.

Temporary Impacts

Boones Ferry Park – There will be construction traffic on Boones Ferry Road. Impacts could increase or decrease, depending on the timing for constructing park improvements identified in the MP.

North Bank – There is no built environment present to be impacted.

Willamette River – Placing the deck panels and other work over the boat dock will require temporary closures of portions of the dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be occasional closures of portions of the parking lot and the ramp access road to construct the piers and install the superstructure. There is a possibility that full closures of the parking lot and/or ramp road will be necessary for short periods of time. The ramp road would likely need to be temporarily realigned to construct the Pier 3 pylon and foundation. There will be short duration closures and construction traffic on Butteville Road.

Impact Summary

The defining permanent impact of this alternative is the anticipated need to relocate a portion of the ramp access road to provide room for the south pylon between the ramp and the parking lot.

The primary temporary impacts are related to the use and operation of the parking lot and ramp access road.

Aesthetics

For path users, this alternative would feel open, with only the pylons and hangers extending above the deck and overhead. The pylons would extend approximately 180 feet above the bridge deck. With a superstructure width of only 20 feet, the towers may appear out of proportion to the pylons. The form of the cable-stayed alternative makes this a signature-type bridge. For people viewing the bridge from locations other than the path, this alternative would not particularly stand out from its surroundings due to the minimal mass of the suspended deck system and stay systems and the location of the pylons on the river banks in line with the riparian vegetation.

Suspension

Fort Edmonton Park Pedestrian Bridge, Edmonton, AB, Canada

Suspension bridges are cable-supported structures where the suspenders supporting the deck system are tied to the primary suspension cables spanning between pylons. The pylons for a suspension bridge are approximately one-half as tall as those for a cable-stayed bridge with a similar span. Suspension bridges support the longest spans in the world and can have very shallow superstructures.

Defazio Bridge, Eugene, OR

For the proposed suspension alternative, the form of the pylons is somewhat flexible, depending on the aesthetic appearance desired. The back spans of the main suspension cables would support some of the approaches and be tied to anchor blocks with ground anchors. The suspended portion of the bridge deck would be connected to hanger cables. The remainder of the bridge would be ground-supported. The approach spans at both ends would be concrete slabs to maintain visual consistency. A concrete deck would be placed the full length of the bridge. The suspended portion would use precast panels. See Figure 6 for elevation and section views.

A preliminary structure layout was performed. As initially visualized, the proposed structure consists of two frames. The suspension frame consists primarily of precast deck panels with transitional cast-in-place segments and makes up the north 1,088 feet of the bridge. The two pylons extend approximately 80 feet above the deck. The south frame of cast-in-place concrete slab connects south of Butteville Road with two spans of 71.5 feet.

This alternative is being evaluated as it is capable of achieving the necessary span lengths; can be designed with a very shallow deck system over the river, further reducing the height of the path over the navigation channel; would eliminate in-water work with the pylon foundations on the top of each bank; and is a distinctive signature-type structure.

Economics

Design & Construction Cost and Duration

The cast-in-place concrete slab approach spans are straight-forward to design and construct. The main suspension structure is more complicated due to the suspender cable connections and erection of the suspended spans without falsework. Temporary towers would likely be required to support the pylons during construction. The pylon foundations would be groups of large-diameter drilled shafts. At the ends of the suspension bridge cables, anchorages are required to resist the horizontal forces of the structure. These anchorages are likely to be constructed from drilled shafts with large concrete caps. Since the suspension bridge will not have permanent in-water impacts as noted below, the permitting effort will be minimized. The approach span substructures will be single columns on large-diameter drilled shafts. The suspended portion of the structure requires unique analysis and design to account for construction staging. The design duration would be approximately two years.

The estimated construction cost of this structure is significantly higher than the steel truss and somewhat less than the cable-stayed option. The construction duration would be approximately three years.

Maintenance

Maintenance of a suspension pedestrian bridge is moderate. The cables and related connection systems typically are painted or otherwise encapsulated to provide corrosion protection. These protection systems require regular maintenance. The suspension system requires additional inspection effort. Since no piers will be in the river, no underwater diver inspections would be required. Other common maintenance items are expansion joints and girder bearings.

Under-bridge inspection trucks or other similar equipment would be required to inspect the superstructure under the deck. Working the inspection equipment around the hangers can be awkward and time-consuming. Accessing the tops of the pylons and hangers for maintenance and inspection would require special accommodations during design.

Constructability

Access Requirements

The pylons on both banks would be located on the top of the river banks. The one on the north bank is in the currently undeveloped portion of the park and is directly accessible from Boones Ferry Road. The one on the south bank would be between the boat ramp access road and the parking lot. Temporary relocation and/or closure of the boat ramp access road would be required.

Installation of the pylons would require large cranes. Shoring towers would be required to temporarily support the pylons. The approach girder segments would require ground-supported falsework, and the vertical clearance over Butteville Road may be temporarily reduced below 17 feet. The deck panel and hanger placement over the boat dock is the most challenging location. A work containment system would be required to prevent debris from falling on the dock below. Deck panel placement for the main span will probably take place primarily from the middle of the river outward towards the pylons.

The remaining pier locations on the south banks are all easily accessed.

Complexity

The suspension bridge type is seen as relatively challenging to build and not typically accomplished by local contractors. Based on OBEC's experience with similar structures, the construction sequence of the suspended portion of the substructure and superstructure is simpler than the cable-stayed bridge, but still requires specialty equipment. The approach spans are relatively straight-forward, common construction.

Impacts

The various impacts to the project site resources and built environment are summarized below as permanent or temporary. Impacts are discussed according the six areas identified on Figure 1.

Resource Impacts

<u>Permanent Impacts</u>

No hydraulic impact is expected for this alternative; therefore, no mitigation will be required.

Boones Ferry Park – There will be a loss of upland vegetation and open space in the undeveloped portion of Boones Ferry Park west of Boones Ferry Road and in the historic orchard further north. One of the main pylon piers will be located at the edge of the north bank.

North Bank – There will be a loss of riparian vegetation where the bridge crosses, both at the top of the bank and under the bridge.

Willamette River – No permanent impacts are anticipated.

South Bank – There will be a loss of riparian vegetation where the bridge crosses the top of the bank and under the bridge.

Ramp Access Road, Parking Lot, and Butteville Road – Some ground disturbance and riparian and upland vegetation removal will be required at the south pylon footing and approach span piers. The ramp access road may need to be relocated to provide room for the pylon.

South Approach Path – This on-grade segment will have upland vegetation removal and ground disturbance under its footprint.

<u>Temporary Impacts</u>

There will be a local increase in construction traffic, noise, emissions, and dust.

Boones Ferry Park – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

North Bank – No temporary impacts are anticipated on the north bank.

Willamette River – The navigational channel and other portions of the river will need to be partially restricted at times during deck panel placement.

Ramp Access Road, Parking Lot, and Butteville Road – Additional riparian and upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

South Approach Path – Additional upland vegetation loss and ground disturbance over that included in the permanent impacts above will be necessary to access the work.

Built Environment Impacts

Permanent Impacts

Boones Ferry Park – There will be bridge approaches and main suspension cable anchors in the park and a new path access to Boones Ferry Road. There would be minor to moderate revisions required to the Boones Ferry Park MP that is currently in development.

North Bank – There is no built environment present to be impacted.

Willamette River – There will be a new structure over the Boones Ferry Marina and dock.

Ramp Access Road, Parking Lot, and Butteville Road – There will be a new structure over the primary Boones Ferry Boat Launch parking lot, and Butteville Road.

South Approach Path – The approach path will partially be constructed on the existing fill for the railroad bridge approach.

Temporary Impacts

Boones Ferry Park – There will be construction traffic on Boones Ferry Road. Impacts could increase or decrease, depending on the timing for constructing park improvements identified in the MP.

North Bank – There is no built environment present to be impacted.

Willamette River – Placing the deck panels and other work over the boat dock will require temporary closures of portions of the dock. Deck panel installation may also require use of barges.

Ramp Access Road, Parking Lot, and Butteville Road – There will be occasional closures of portions of the parking lot and the ramp access road to construct the piers and install the superstructure. There is a possibility that full closures of the parking lot and/or ramp road will be necessary for short periods of time. The ramp road would likely need to be temporarily realigned to construct the Pier 3 pylon and foundation. There will be short duration closures and construction traffic on Butteville Road.

Impact Summary

The defining permanent impact of this alternative is the anticipated need to relocate a portion of the ramp access road to provide room for the south pylon between the ramp and the parking lot.

The primary temporary impacts are related to the use and operation of the parking lot and ramp access road.

Aesthetics

For path users, this alternative would feel open with only the pylons, main suspension cable, and hangers extending above the deck and overhead. The form of the suspension alternative makes this a signature-type bridge. For people viewing the bridge from locations other than the path, this alternative would not particularly stand out from its surroundings due to the minimal mass of the suspended deck system and hanger systems and the location of the pylons on the river banks in line with the riparian vegetation.

Bridge Types Considered Infeasible

Concrete Girders

Concrete girders could be either precast, cast-in-place, or a combination of both. The maximum span length for precast I- or T-girders is limited to just over 200 feet. Precast segmental girders consist of discrete box-shaped sections tied together and can span significantly further than the I- or T-girders. However segmental girders require a complicated placement apparatus. The concrete girder options were not selected for further analysis for a number of reasons:

Owosso Pedestrian Bridge, Eugene, OR

- Precast concrete I- or T-girders have maximum spans of approximately 200 feet, which is not adequate to clear span the Willamette's approximately 240-foot-wide navigational channel and meet USCG requirements.
- Segmental post-tensioned concrete bridges can achieve the required spans, but are only economical when the bridge is long enough overall to realize savings due to repetition of superstructure segments.
- Traditional cast-in-place concrete, typically box, beams require significant falsework and associated access to construct. The height of the falsework would be more than 100 feet over the bottom of the river and could significantly restrict the navigational channel during a multi-year construction period.
- In all cases, the concrete girders would be deep, at five percent of the span, for the span lengths considered. This would require raising the path to clear the navigational channel and extending the approaches at each end.

Stress Ribbon

Stress ribbon bridges are tension structures with suspension cables embedded in the deck that follow a catenary curve between supports. The main spans sag between supports, much like power lines between poles. Stress ribbon options were not selected for further analysis for a number of reasons:

Rogue River Pedestrian Bridge, Grants Pass, OR

- To meet the ADA requirement to limit slopes along the path to five percent maximum and to meet USGS vertical clearance requirements, the tension in the supporting cables would have to be excessively high.

- The low point of the structure is also at mid-span due to the catenary curve, which would require raising the grade much like the concrete girders above.

Ranking of Bridge Types

OBEC ranked the five bridge types by subcriteria as shown in Appendix A. The rankings are on a 1 to 5 scale, with 1 being the best. Each criterion was then ranked based on the aggregate subcriteria ranking.

The OBEC rankings are summarized in Table 1. Lower totals indicate an alternative better meets project criteria.

Table 1 –OBEC Ranking and Scoring Summary

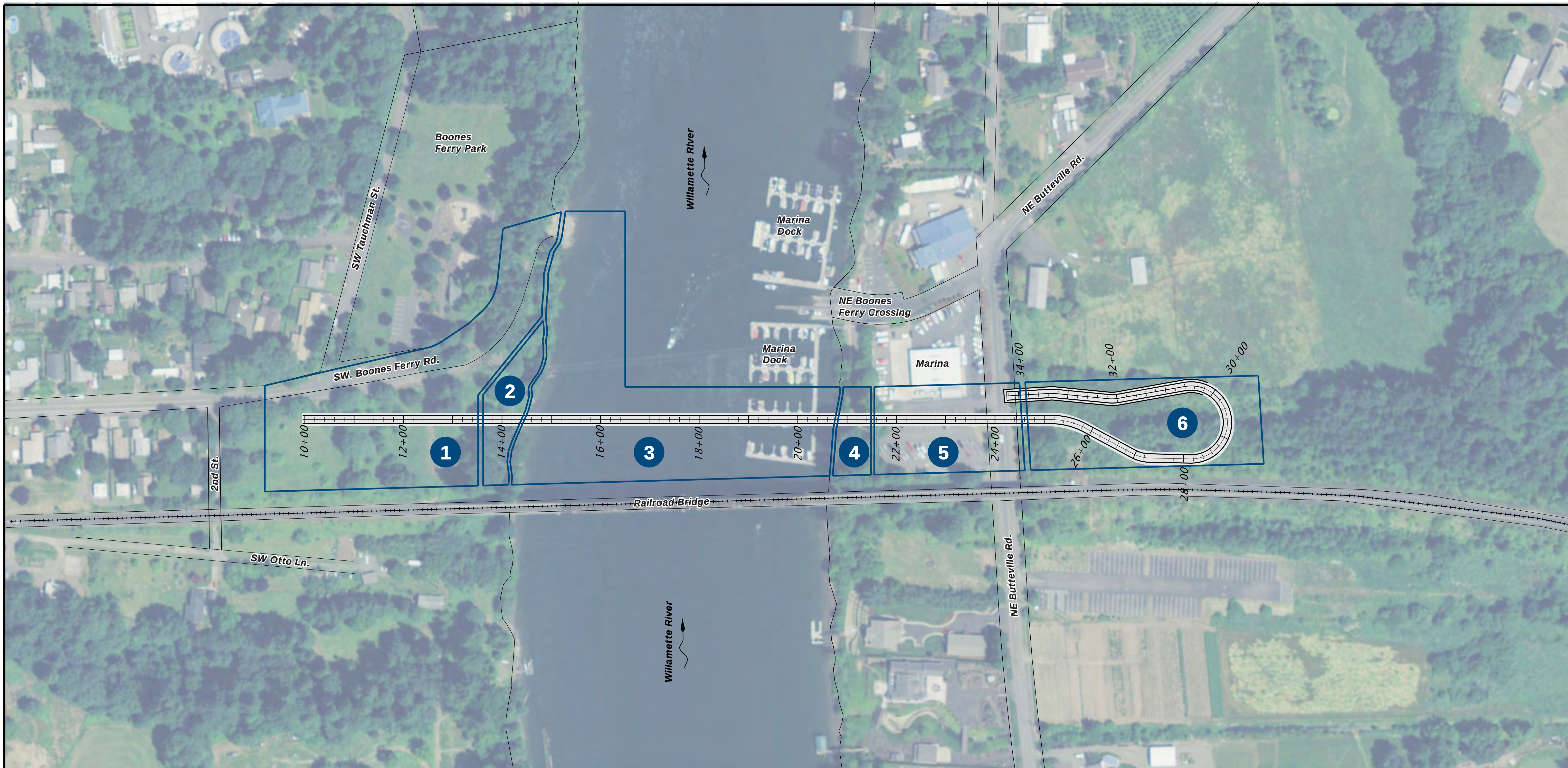
Criterion	Steel Girders	Steel Trusses	Tied Arches	Cable-Stayed	Suspen-sion
1 – Economics	1	2	5	4	3
2 – Constructability	4	1	5	1	1
3 – Impacts	5	4	3	2	1
4 – Aesthetics	3	3	5	2	1
TOTAL	13	10	18	9	6

Summary

In this report OBEC has: identified the possible bridge types for a crossing of the Willamette River along the identified alignment; identified the five types that best meet the needs of the project and site; developed preliminary layouts for the five types; broadly examined and evaluated the bridge types against the four criteria (economics, constructability, impacts, and aesthetics); and provided an initial bridge type ranking. Once the TAC provides technical analysis of the bridge types and the public has provided input, the BCC and the Wilsonville City Council will select two bridge types for further investigation. Three-dimensional renderings will be prepared for those two bridge types.

Following the additional investigation, the BCC and City Council will select the project's preferred bridge type.

FIGURES



Project Areas of Assessing Impacts

1. Boones Ferry Park
2. North Bank
3. Willamette River
4. South Bank
5. Ramp Access Rd., Parking Lot, Butteville Rd.
6. South Approach Area

FRENCH PRAIRIE BRIDGE PROJECT IN WILSONVILLE

WILSONVILLE OREGON

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OBEC CONSULTING ENGINEERS

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FRENCH PRAIRIE BRIDGE PROJECT
BOONES FERRY ROAD
MARION AND CLACKAMAS COUNTY

Designer: Eric E. Bonn, P.E. | Reviewer: Bob Goodrich, P.E.
Drafter: OBEC CAD | Checker: Andy Howe, P.E.

ALIGNMENT

SHEET NO. FIG. 1

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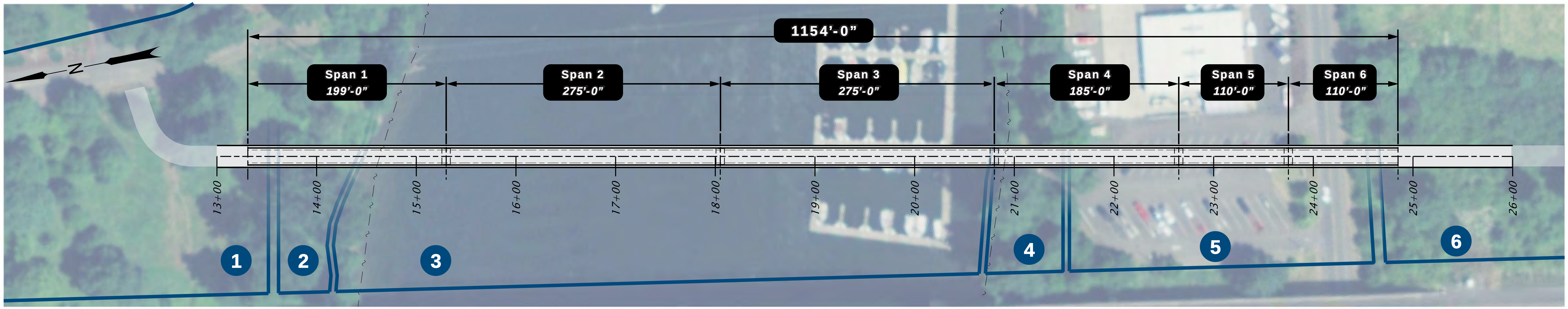

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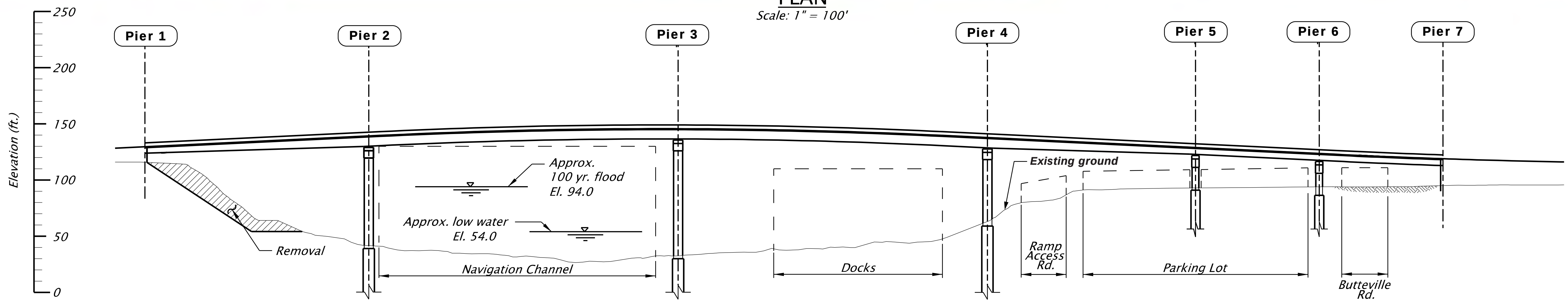

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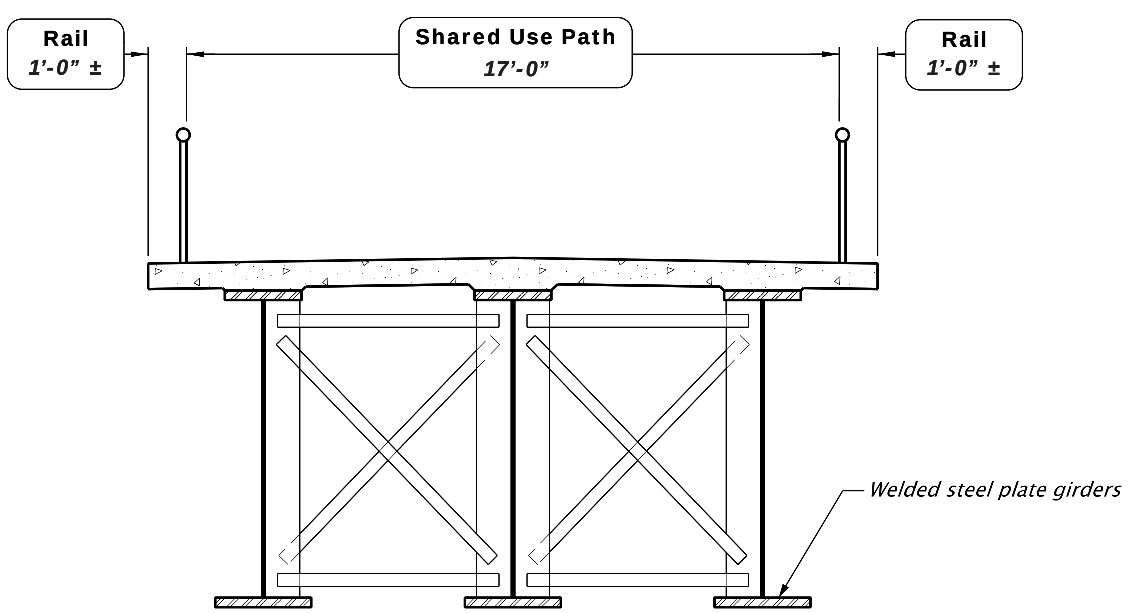

TYPICAL SECTION
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Packet Page 51 of 60

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BOONES FERRY ROAD
MARION AND CLACKAMAS COUNTY

Designer: Eric E. Bonn, P.E. Reviewer: Bob Goodrich, P.E.
Drafter: OBEC CAD Checker: Andy Howe, P.E.

STEEL GIRDER

SHEET NO. FIG. 2

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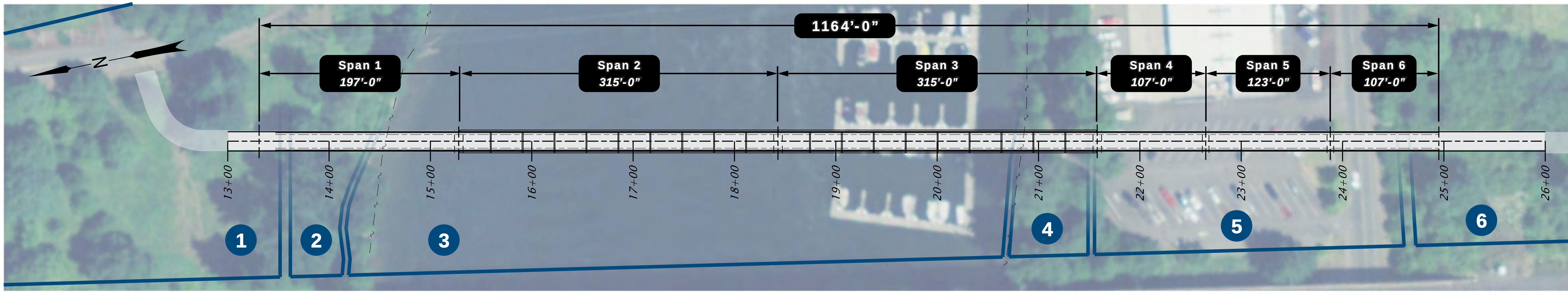

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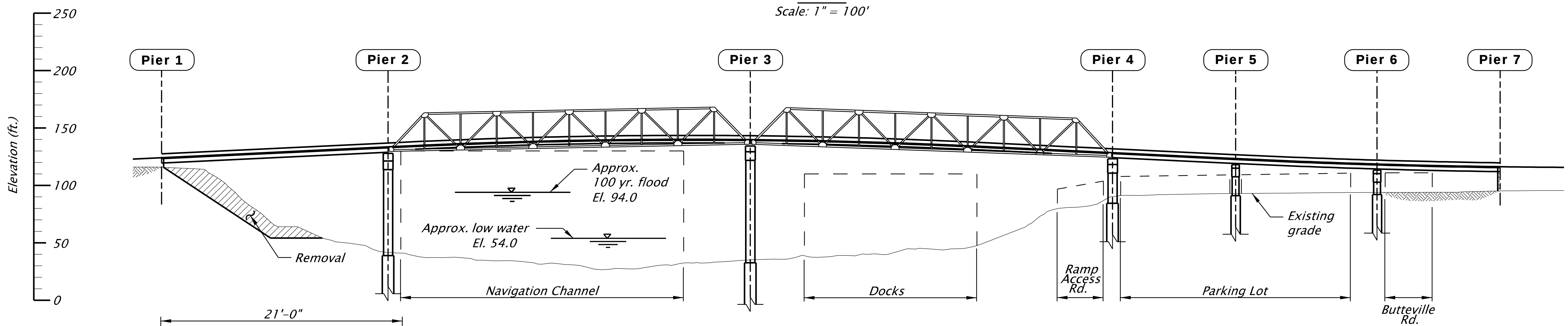

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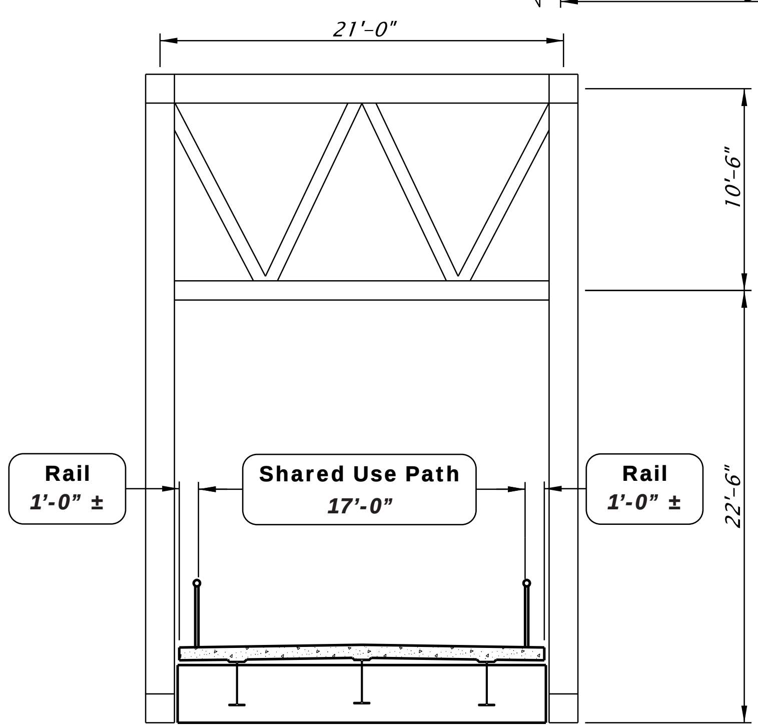

TYPICAL SECTION
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FRENCH PRAIRIE BRIDGE PROJECT IN WILSONVILLE

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Designer: Eric E. Bonn, P.E. | Reviewer: Bob Goodrich, P.E.
Drafter: OBEC CAD | Checker: Andy Howe, P.E.

STEEL TRUSS

SHEET NO. FIG. 3

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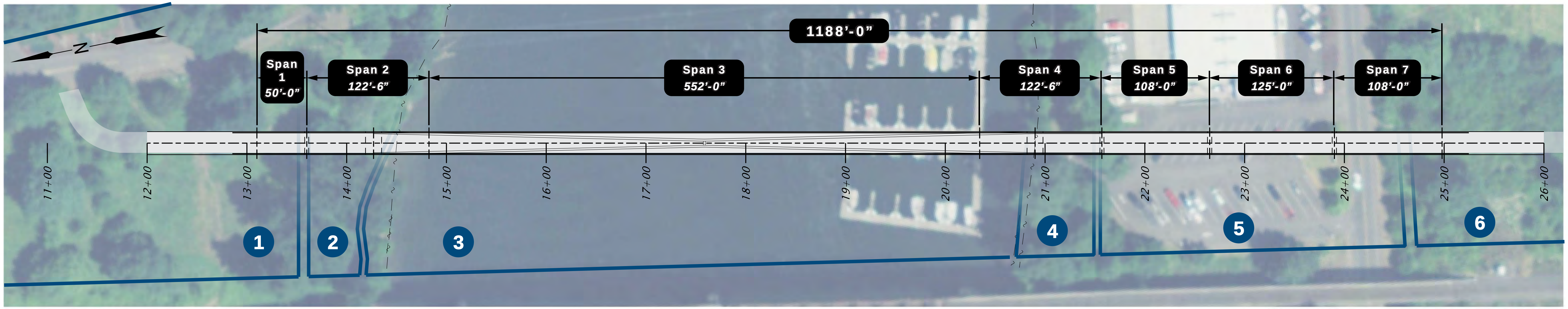

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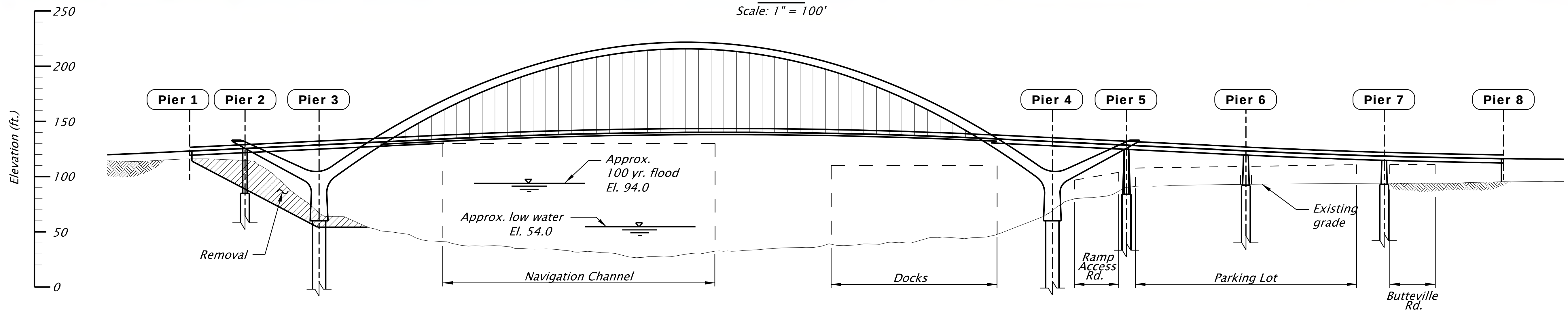

ELEVATION
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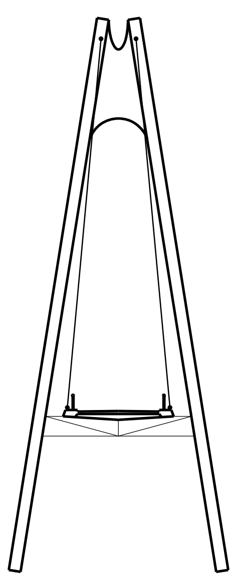

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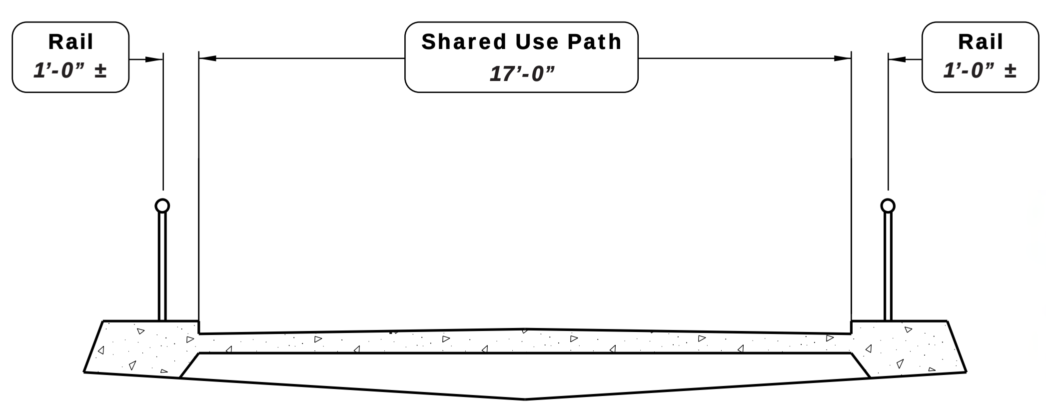

DECK SECTION
Scale: 1" = 5'

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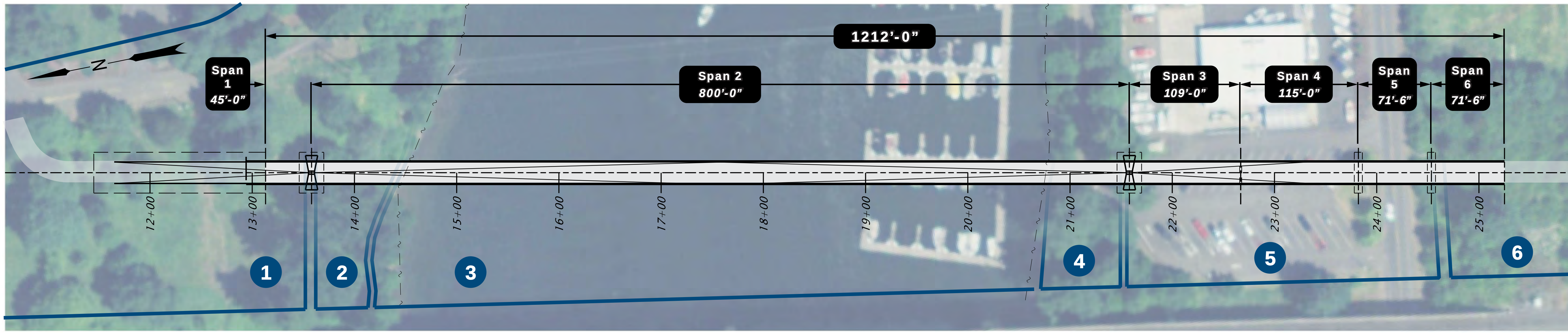
FRENCH PRAIRIE BRIDGE PROJECT
BOONES FERRY ROAD
MARION AND CLACKAMAS COUNTY

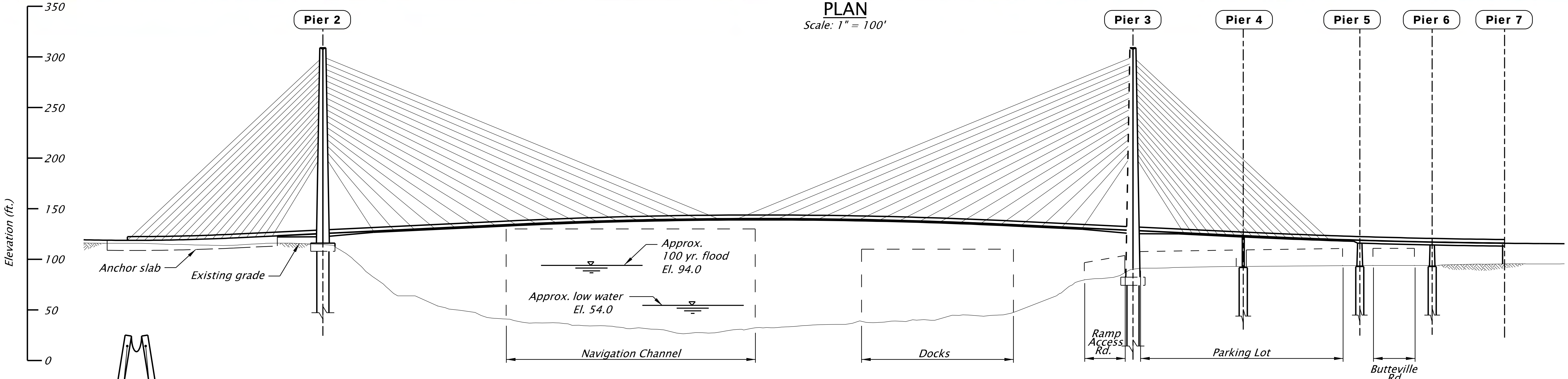
Designer: Eric E. Bonn, P.E. Reviewer: Bob Goodrich, P.E.
Drafter: OBEC CAD Checker: Andy Howe, P.E.

SINGLE ARCH

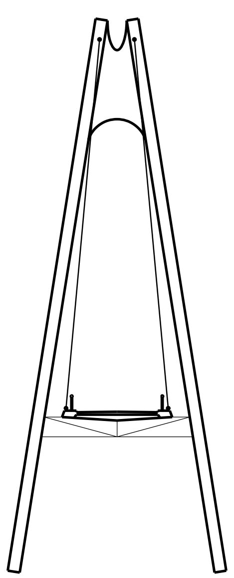
SHEET NO. FIG. 4



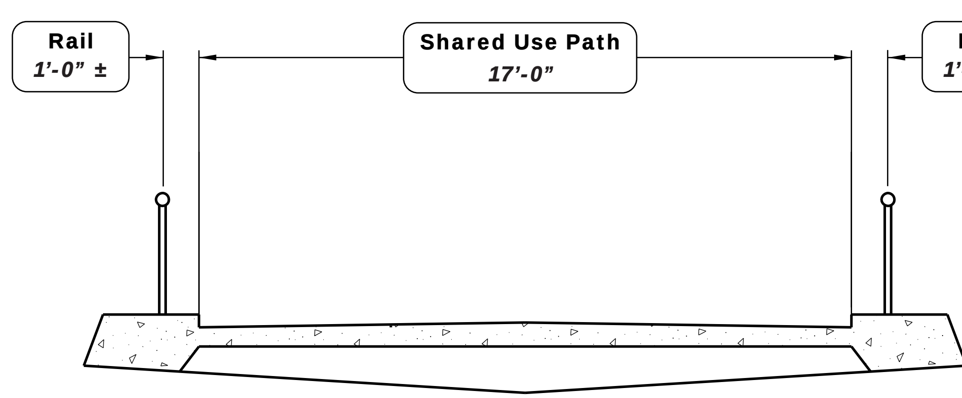
PLAN
Scale: 1" = 100'



ELEVATION
Scale: 1" = 100'



TYPICAL SECTION
Scale: 1" = 40'



DECK SECTION
Scale: 1" = 5'

FRENCH PRAIRIE BRIDGE PROJECT IN WILSONVILLE

WILSONVILLE OREGON

SCALE WARNING
If scale bar doesn't measure one inch then drawing is not to scale

STRUCTURE NO.	--------
BDS DWG NO.	0000x
CALC. BOOK	----
HWY:	
M.P.:	
COUNTY	Clackamas
DATE	Sept. 2018

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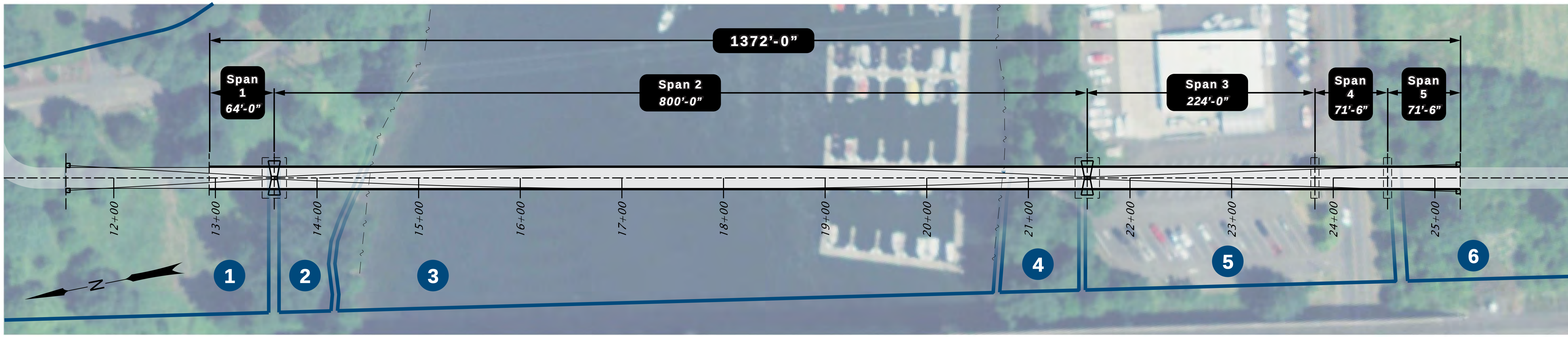
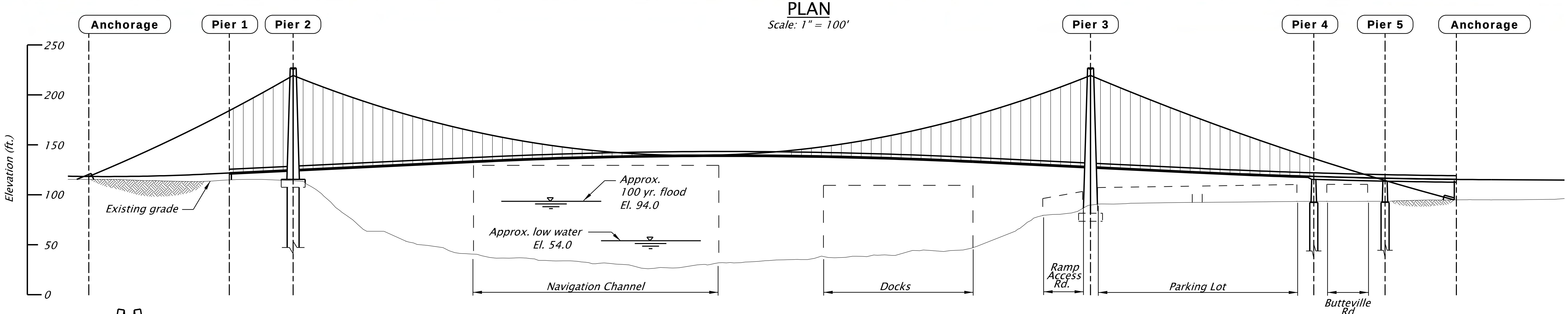
CABLE STAYED

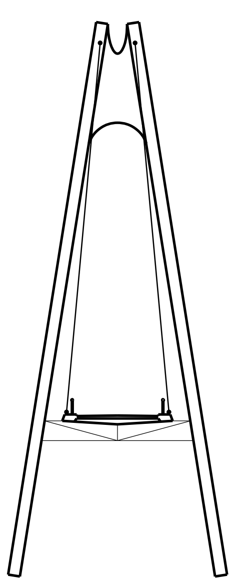
SHEET NO. FIG. 5



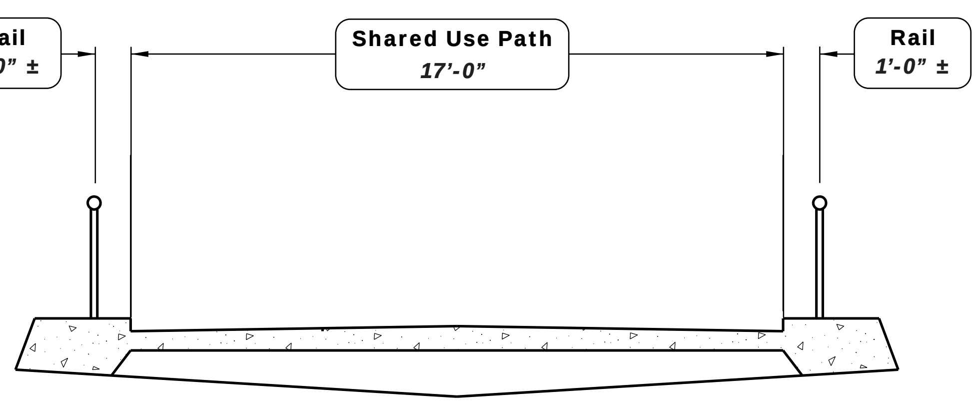
PLAN
Scale: 1" = 100'



ELEVATION
Scale: 1" = 100'



TYPICAL SECTION
Scale: 1" = 40'



DECK SECTION
Scale: 1" = 5'

SCALE WARNING
If scale bar doesn't measure one inch then drawing is not to scale

CONCEPT PLANS NOT FOR CONSTRUCTION

STRUCTURE NO.	--------
BDS DWG NO.	0000x
CALC. BOOK	----
HWY:	
M.P.:	
COUNTY	Clackamas
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SUSPENSION | SHEET NO. FIG. 6

BR_Suspension_PE_01.dgn :: border 9/5/2018 4:16:55 PM LWilhelm Rotation: 0° Scale: Full Size 1=1

APPENDIX A
Bridge Type Ranking Matrix

French Prairie Bridge Project

Bridge Type Scoring
September 2018

1	Economics	Steel Girders	Steel Trusses	Tied Arches	Cable-Stayed	Suspen-sion	Notes
1A	Design and Construction Cost	1	2	5	3	3	Steel girders: Least cost Steel trusses: Approximately 20% more than steel girders Tied arch: Highest cost Cable-stayed: Slightly higher than the suspension bridge due to taller pylons Suspension: Slightly less than the cable-stayed bridge due to shorter pylons
1B	Design and Construction Duration	1	2	5	3	3	Steel girders: Design 1 year/Construct 2 years Steel trusses: Design 1 year/Construct 2 years Tied arch: Design 2 year/Construct 3+ years Cable-stayed: Design 2 year/Construct 3 years Suspension: Design 2 year/Construct 3 years
1C	Maintenance	1	3	4	4	3	Steel girders: Substructure in river, minimal connections, reasonable access. Steel trusses: Substructure in river, multiple connections, reasonable access. Tied arch: No Substructure in river, multiple connections, challenging access Cable-stayed: No Substructure in river, multiple connections, challenging access Suspension: No Substructure in river, multiple connections, challenging access
	Criterion 1 Ranking	1	2	5	4	3	

French Prairie Bridge Project

Bridge Type Scoring
September 2018

2	Constructability	Steel Girders	Steel Trusses	Tied Arches	Cable-Stayed	Suspen-sion	Notes
2A	Substructure Access Requirements	4	4	3	1	1	Steel girders: Multiple in-river bents Steel trusses: Multiple in-river bents Tied arch: No in-river bents, acrh rib foundations on banks Cable-stayed: No in-river bents, all bents on top of banks Suspension: No in-river bents, all bents on top of banks
2B	Substructure Complexity	2	1	5	3	4	Steel girders: Single-column/drilled shafts Steel trusses: Single-column/drilled shafts Tied arch: Arch rib foundations with horizontal thrust, vertical hold-downs Cable-stayed: Pylon foundations, vertical hold downs Suspension: Pylon foundations, main cable anchors, vertical hold downs
2C	Superstructure Access Requirements	4	3	4	2	2	Steel girders: Work bridges or barges to place girders, shoring towers Steel trusses: Work bridges or barges to place girders, shoring towers Tied arch: Work bridges or barges to place arch ribs, shoring towers Cable-stayed: Precast panels placed off deck--incrementally launched, tall pylons Suspension: Precast panels placed off deck--incrementally launched, tall pylons
2D	Superstructure Complexity	1	2	5	4	3	Steel girders: Least complex Steel trusses: Slightly more complex than for steel girders Tied arch: Most complex Cable-stayed: Slightly less than for tied arch. Suspension: Slightly less than for tied arch.
	Criterion 2 Ranking	4	1	5	1	1	

French Prairie Bridge Project

Bridge Type Scoring
September 2018

3	Impacts	Steel Girders	Steel Trusses	Tied Arches	Cable-Stayed	Suspen-sion	Notes
3A	Temporary Resource Impacts	4	4	3	1	1	Steel girders: Maximum in-water work Steel trusses: Maximum in-water work Tied arch: Some in-water work Cable-stayed: No in-water work Suspension: No in-water work
3B	Temporary Built Environment Impacts	5	4	3	2	1	Steel girders: Highest dock impact, low parking lot impact Steel trusses: High dock impact, low parking lot impact Tied arch: High ramp access road and parking lot impact Cable-stayed: Highest ramp access road and parking lot impact Suspension: High ramp access road and parking lot impact
3C	Permanent Resource Impacts	4	4	3	1	1	Steel girders: Regrading of north bank for floodway Steel trusses: Regrading of north bank for floodway Tied arch: Regrading of north bank for floodway Cable-stayed: Minimal impact Suspension: Minimal impact
3D	Permanent Built Environment Impacts	3	3	2	5	1	Steel girders: Column in parking lot Steel trusses: Column in parking lot Tied arch: Column in parking lot Cable-stayed: Realigned ramp access road, hold-down in parking lot Suspension: Realigned ramp access road
	Criterion 3 Ranking	5	4	3	2	1	

French Prairie Bridge Project

Bridge Type Scoring
September 2018

4	Aesthetics	Steel Girders	Steel Trusses	Tied Arches	Cable-Stayed	Suspen-sion	Notes
4A	Bridge Aesthetics	3	3	5	2	1	Steel girders: Least visual impact Steel trusses: Matches railroad bridges, bulky Tied arch: Signature, out of character with surroundings Cable-stayed: Signature, tallest pylons, see-through main span Suspension: Signature, shorter pylons, see-through main span
	Criterion 4 Ranking	3	3	5	2	1	

Total Ranking	13	10	18	9	6	