

# Technical Memorandum

September 6, 2024

Project# 27003.014

To: Lisa Cornutt, Oregon Department of Transportation

Karl MacNair, City of Medford

From: Marc Butorac, PE, PTOE, PMP, Darren Hippenstiel, PE, Eza Gaigalas

RE: Task 5.2.1B: Refined Alternatives and Cost Opinions

## INTRODUCTION

This memorandum documents the refinements to and cost opinions Recommended Overpass and Underpass Alternatives with compatible Interchanges identified in *TM #5.2.2: Refined (Most Promising) Alternative Analysis*. Based on the information documented herein, the project team recommends the two Phase 1 and two Phase 2 alternatives be advanced for further consideration.

## ALTERNATIVES

The modified O-2 and O-4 alternatives have a different horizontal and vertical geometry than the original O-2 and O-4 alternatives. To cross Bear Creek at closer to 90 degrees and to reduce the skew angle crossing I-5, the alignment was shifted slightly north until it crosses I-5. The alignment then passes through a reversing curve east of I-5 to align with an east/west tangent just south of the Pacific Power & Light (PPL) substation. The vertical profile is also modified to minimize the impact to the Bear Creek floodplain.

The modified I-2 and I-4 alternatives have the same overpass/underpass geometry as the modified O-2 and O-4 alternatives, respectively, with the addition of the ramp alignments. The orientation of the ramps is the same as the previous I-2 and I-4 with modifications to match the modified overcrossing and undercrossing geometries and minimize impacts to wetlands. The overall modifications are summarized below:

### Overpass/underpass Alternative Modifications

- Shift alignment north to cross the Bear Creek Floodway and flood-plain at a close to perpendicular angle and with less skew to I-5

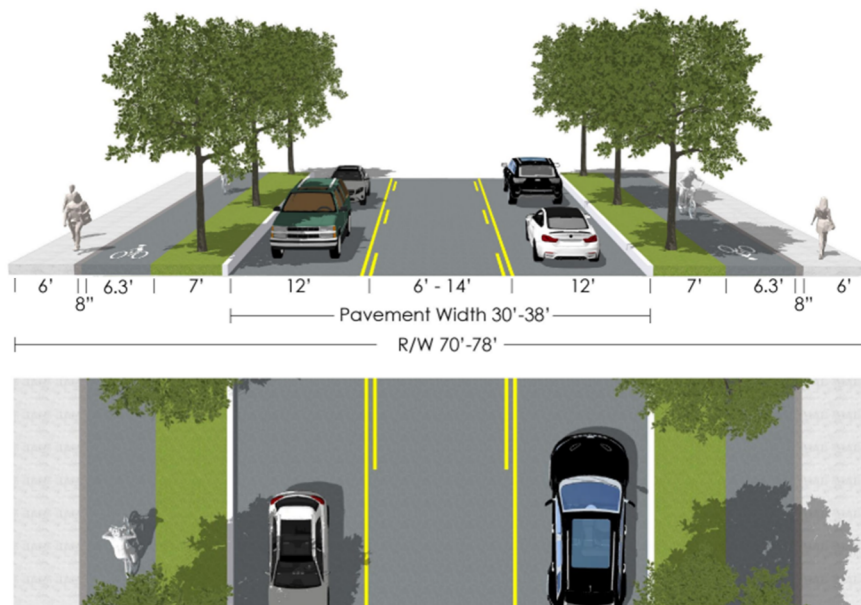
- Introduce a reverse curve on the east side of I-5 to travel along the south side of the PPL substation
- Extend the tangent section of South Stage east of the current PPL substation to allow for future expansion of the substation to the east
- Introduce another reverse curve beyond the wetland area that ties into the South Stage Road extension from Phoenix Road and does not impact the properties to the north

Interchange Alternative Modifications

- Shift the northbound on-ramp to avoid impacts to wetlands

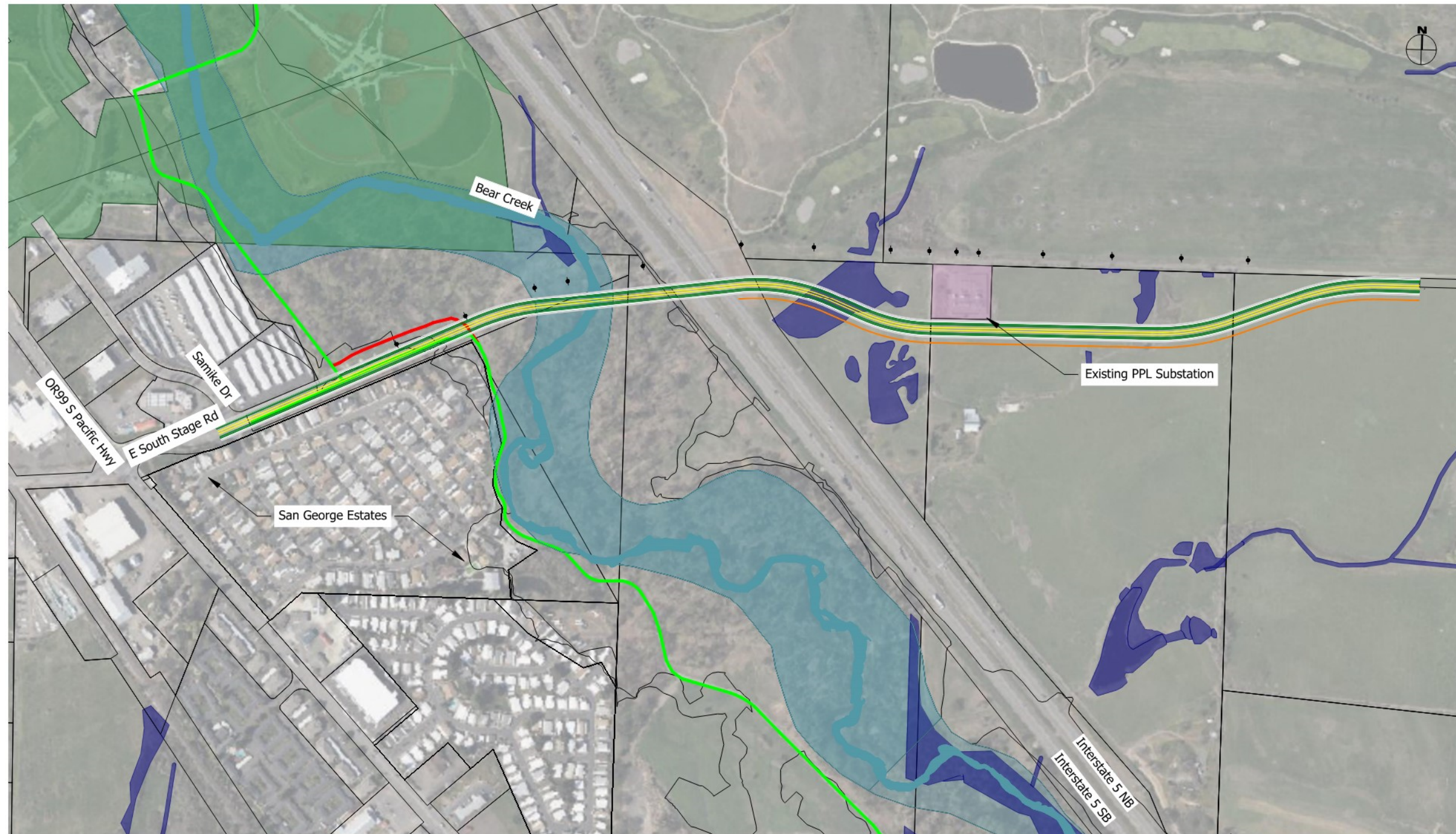
Double-line drawings of all the modified alternatives are shown below in Figure 1 to Figure 4. The assumed cross section for the overpass/underpass included in the alternatives is included in Exhibit 1.

**Exhibit 1. Assumed Pedestrian and Bicycle Facilities**

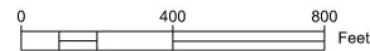


Source: City of Medford Transportation System Plan

Figure 1. South Stage Southerly Realignment: Modified O-2 Alternative

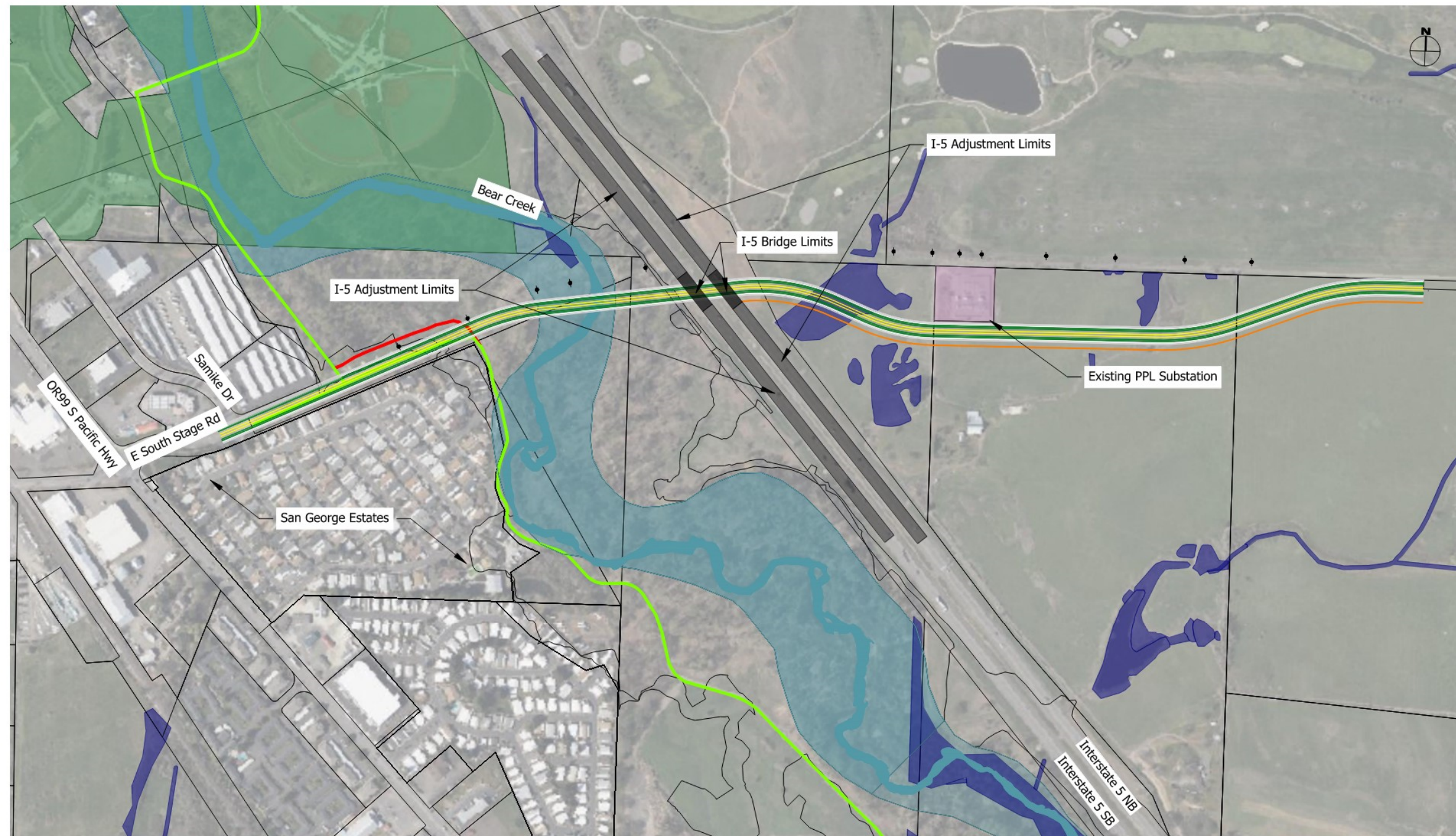


- Legend
- Bear Creek
  - 100-Year Floodway
  - Wetlands
  - Parks
  - Bear Creek Greenway
  - Bear Creek Greenway Proposed Alignment
  - 5-Lane ROW Line

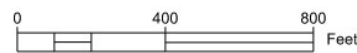


Overpass

Figure 2. South Stage Underpass: Modified O-4 Alternative

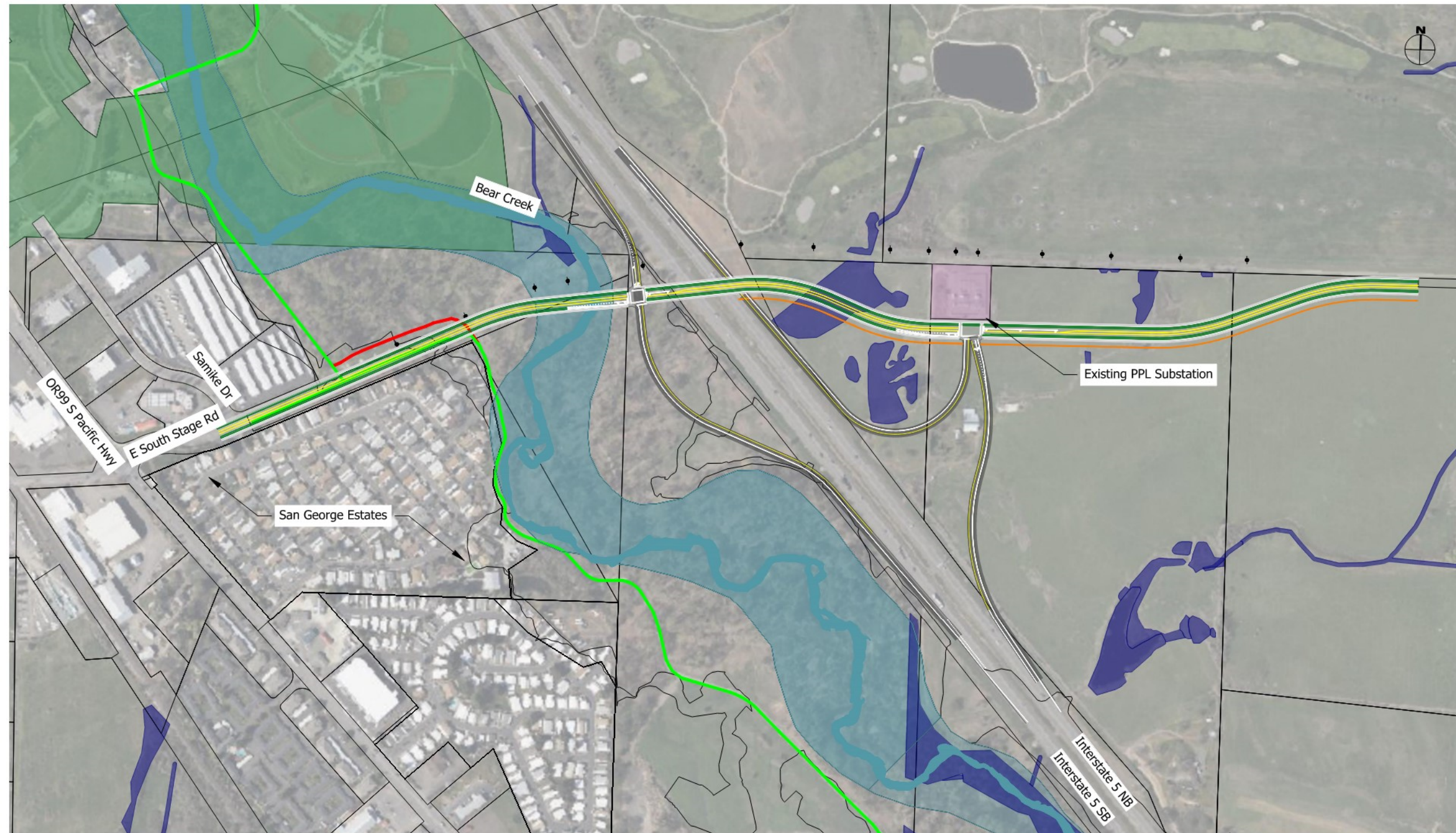


- Legend
- Bear Creek
  - 100-Year Floodway
  - Wetlands
  - Parks
  - Bear Creek Greenway
  - Bear Creek Greenway Proposed Alignment
  - 5-Lane ROW Line



Underpass

Figure 3. South Stage Southerly Realignment: Modified I-2 Alternative



Overpass Interchange



- Legend
- Bear Creek
  - 100-Year Floodway
  - Wetlands
  - Parks
  - Bear Creek Greenway
  - Bear Creek Greenway Proposed Alignment
  - 5-Lane ROW Line

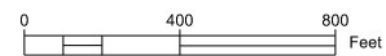
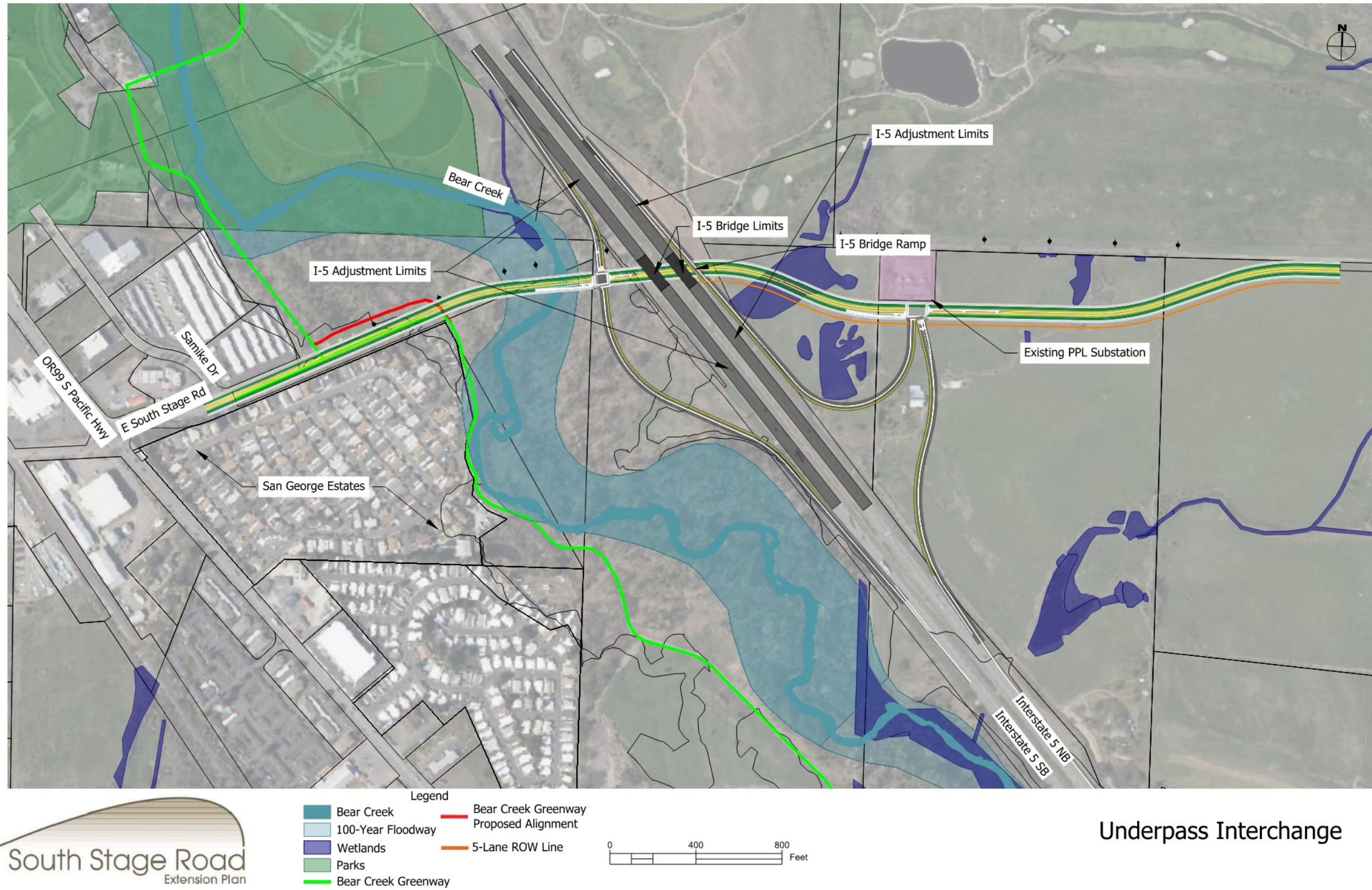


Figure 4. South Stage Underpass Interchange: Modified I-4 Alternative



## TECHNICAL FEASIBILITY

Each of the modified Phase 1 and Phase 2 alternatives was prepared using conceptual horizontal and vertical alignments based on the design criteria established in *TM #3.1.4: Structural and Constructability Methodology and Assumption Memorandum*. Attachment A shows the horizontal and vertical alignment geometry of the Recommended Overpass and Underpass Alternatives with Compatible Interchanges. Next, structure and constructability were assessed (see Attachment B for *TM #5.2.2.3: Structural and Constructability Analysis Appendix*).

The modified O-2 alternative would consist of three bridge units that span over the Bear Creek Floodway, Bear Creek Greenway, and I-5. The overpass will be supported by Mechanically Stabilized Earth (MSE) walls on the east side of I-5. Structural revisions will likely be necessary to be compatible with a future interchange layout.

The modified O-4 alternative was raised above the 100-year flood elevation and freeboard<sup>1</sup> above the Bear Creek Floodway. This would require I-5 to be raised as well as adequate vertical clearance on South Stage Road under I-5. The I-5 bridges would be single-span with a combination of cut and fill walls. The South Stage Road underpass bridge would consist of two units. On the east side of I-5, very tall cut retaining walls may be necessary on the north side of South Stage Road. A more in-depth future study would be necessary to evaluate wall type, size, and location. Structural revisions would likely be necessary to be compatible with a future interchange layout.

The analysis from *TM #5.2.2.1: Transportation Analysis Appendix* did not demonstrate a need for auxiliary lanes between a new interchange at South Stage Road and the existing South Medford and Garfield interchanges, however this assumption should be confirmed with updated horizon year forecast traffic volumes. Therefore, both compatible Interchange Alternatives (I-2 and I-4) were evaluated with and without the inclusion of auxiliary lanes along I-5.

Based on this review and assessment, the Recommended Overpass and Underpass Alternatives with compatible Interchanges were all found to be likely technically feasible and were advanced.

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<sup>1</sup> Freeboard is the minimum clearance between the structure and the design highwater.

## ECONOMIC FEASIBILITY

The economic feasibility assessment was based on the magnitude of construction cost opinion range (in 2024 U.S. dollars) and the right-of-way (ROW), existing building structure, and other infrastructure impacts compared to operational effectiveness. Details of the factors used to determine the economic feasibility of the technically feasible modified Overpass/Underpass and Interchange Alternatives are shown in Table 1.

**Table 1. Overpass/Underpass and Interchange Alternative Economic Factors**

		Modified O-2	Modified O-4	Modified I-2	Modified I-4
<b>Description</b>	Unit	South Stage Southerly Realignment Modified	South Stage Underpass Modified	South Stage Southerly Realignment Modified	South Stage Underpass Interchange Modified
<b>Total right-of-way impacts</b>	SF	632,000	632,000	1,372,100	1,372,100
<b>Existing structure impacts</b>	Each	-	-	2	2
<b>Initial cost opinion: Low</b>		\$148M	\$199M	\$189M	\$242M
<b>High</b>		\$192M	\$259M	\$246M	\$315M

## Magnitude of Construction Cost Opinions

The initial construction cost opinions shown in Table 1 indicate a range of \$148 million to \$315 million for the technically feasible alternatives (see Attachment C for the modified alternative magnitude-of-cost opinion ranges). The cost opinion ranges are for comparative purposes only.

Assumptions made in the cost opinions are as follows:

- Mobilization – 10%
- Traffic control – 8%
- Construction staging – 0% for overpass, 10% for underpass due to I-5 adjustments
- Contingency – 35%
- Project Engineering/Construction Management – 25%

The Interchange Alternatives include an option to add northbound and southbound auxiliary lanes between the South Stage Road interchange and the South Medford interchange. The cost of the auxiliary lanes is estimated to be approximately \$22,700,000. This cost would be added to the cost of the Interchange Alternatives without auxiliary lanes.



## Right-of-Way (ROW), Existing Building Structure, and Other Infrastructure Impacts

Each alternative requires additional ROW and has the potential to impact existing building structures and other infrastructure. While the O-2/I-2 (overpass) alternatives have a lower overall cost opinion compared to the O-4/I-4 (underpass) alternatives, they are relatively close enough in magnitude that potential future identified visual and noise impacts with the Overpass Alternatives may necessitate further mitigation. Mitigation measures would bring the costs more closely together in the future environmental phase.

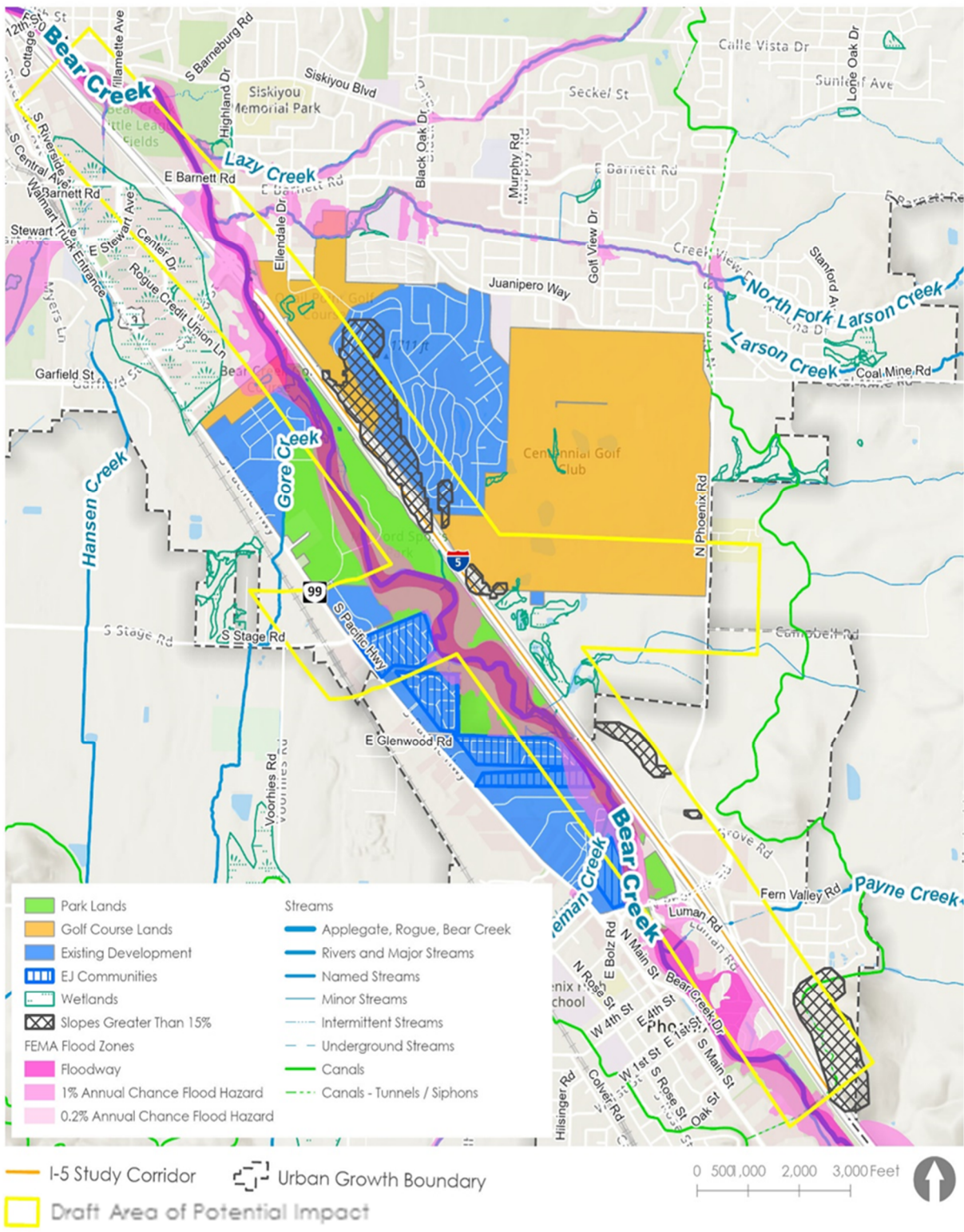
## ENVIRONMENTAL SCREENING

The project team used the environmental resource and topographical constraints map from *TM #5.1.3.2: Concept-Level Environmental Screening* (see Figure 5 below) and the modified double-line concepts shown previously to conduct a further refined initial environmental screening that included:

- Potential park impacts
- Potential wetland and water impacts
- Potential environmental justice impacts
- Potential floodplain impacts
- Potential historic resource impacts
- Potential community cohesion impacts
- Potential number of developed parcels with potential ROW takes
- Potential number of undeveloped parcels with ROW takes
- Potential number of structures requiring removal
- Potential total ROW acreage needed

Table 2 summarizes the potential impacts and provides an initial ranking of alternatives.

Figure 5. Environmental Resources and Topographic Constraints



**Table 2. Potential Environmental Impacts of the Proposed Technically and Economically Feasible Alternatives**

Measure	Modified O-2 Alternative	Modified O-4 Alternative	Modified I-2 Alternative	Modified I-4 Alternative
<b>Park - Section 4(f)<sup>1</sup></b>	109,000 SF	112,600 SF	286,600 SF	290,200 SF
<b>Rank</b>	1	2	3	4
<b>Wetlands and waters<sup>1</sup></b>	24,390 SF	24,390 SF	24,390 SF	24,390 SF
<b>Rank</b>	0 (Same)	0 (Same)	0 (Same)	0 (Same)
<b>Environmental justice</b>	No acquisitions. Noise and air quality effects to San George Estates.	No acquisitions. Noise and air quality effects to San George Estates. At-grade proximity to the property, which has potential opportunity for less environmental justice noise and visual impacts	No acquisitions. Noise and air quality effects to San George Estates.	No acquisitions. Noise and air quality effects to San George Estates. At-grade proximity to the property, which has potential opportunity for less environmental justice noise and visual impacts
<b>Rank</b>	0 (Same)	0 (Same)	0 (Same)	0 (Same)
<b>Floodplains<sup>1</sup></b>	4,800 SF	7,200 SF	4,800 SF	7,200 SF
<b>Rank</b>	1	2	1	2
<b>Historic resources<sup>2</sup></b>	None identified	None identified	None identified	None identified
<b>Rank</b>	0 (Same)	0 (Same)	0 (Same)	0 (Same)
<b>Community cohesion</b>	Does not split a neighborhood	Does not split a neighborhood	Does not split a neighborhood	Does not split a neighborhood
<b>Rank</b>	0 (Same)	0 (Same)	0 (Same)	0 (Same)
<b>Number of developed parcels with potential ROW takes</b>	2 developed parcels	2 developed parcels	2 developed parcels	2 developed parcels
<b>Rank</b>	0 (Same)	0 (Same)	0 (Same)	0 (Same)
<b>Number of undeveloped parcels with potential ROW takes</b>	4 undeveloped parcels	4 undeveloped parcels	5 undeveloped parcels	5 undeveloped parcels
<b>Rank</b>	1	1	2	2
<b>Number of structures requiring removal</b>	-	-	2 structures	2 structures
<b>Rank</b>	1	1	2	2
<b>Total ROW acreage</b>	632,000 SF	632,000 SF	1,372,090 SF	1,372,090 SF
<b>Rank</b>	1	1	2	2

<sup>1</sup> Impacts for parks, wetlands, and floodplains are based on the worst case for fill. These impacts will be refined based on assumptions for columns.

<sup>2</sup> Detailed survey has not been completed.

Rank: 1 = lowest impact; 4 = highest impact.



## RECOMMENDATIONS

Based on the refinements and cost opinions, the project team evaluated the technical and economic feasibility of the modified Phase 1 (O-2 and O-4) and Phase 2 (I-2 and I-4) alternatives. Each of the modified alternatives is likely feasible from a structural and constructability perspective, although further study of the tall-cut retaining wall is needed in future phases for O-4 and I-4. Differences between cost opinions are not significant enough to dismiss either the Overpass or Underpass Alternatives at this time. Furthermore, the potential future identified visual and noise impacts of the Overpass Alternatives may necessitate further mitigation, bringing the costs closer together in the future environmental phase.

Thus, the project team recommends advancing all the modified alternatives for further consideration to select a preferred alternative during the future environmental phase.

Attachment D shows renderings of the Recommended Overpass and Underpass Alternatives with Compatible Interchanges.



Attachment A: Horizontal and  
Vertical Alignment Geometry of the  
Recommended Overpass and  
Underpass Alternatives with  
Compatible Interchanges

Attachment B: TM #5.2.2.3: Structural  
and Constructability Analysis  
Appendix

Attachment C: Initial Alternative  
Magnitude of Cost Opinion Ranges

Attachment D: Renderings of the  
Recommended Overpass and Underpass  
Alternatives with Compatible Interchanges