Southwest Washington I-5 Wildlife Crossings Conceptual Design Report

Prepared for

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Table of Contents

Executive Summary

Implementation of wildlife passage improvements in the Interstate 5 (I-5) corridor in southwest Washington will improve the ease with which wildlife move throughout the region. This overarching goal will be achieved by reducing wildlife mortality from collisions, providing safe passage for species which are unlikely to exhibit avoidance behavior towards roads, and connecting fragmented habitats separated by human-constructed barriers.

Wildlife connectivity is essential for species success as movement is directly related to improved fitness, population growth, and generational resilience. There is a greater chance of preserving biodiversity and promoting healthy wildlife populations through conserving passages between habitat types. The area around the I-5 corridor in southwest Washington is ecologically significant to many wildlife species. There are species of concern which are at a greater risk of direct and indirect impacts from I-5 and vehicle collisions. The primary species of concern in this project area are Dunn's salamander, Cascade torrent salamander, northern alligator lizard, western toad, western gray squirrel, Mazama pocket gopher, Pacific fisher, black bear, cougar, elk, black-tailed deer, American beaver, and prairie butterfly species.

Eleven projects are proposed to improve wildlife passage and habitat connectivity in the corridor. Seven projects are proposed in the southern project area between the Toutle River bridge and the Cowlitz River bridge, and four projects are proposed in the northern project area between Scatter Creek and Salmon Creek. Projects include new overcrossings at milepoint (MP) 55.6, 90.5, 92.8, and 96.1; culvert replacements with wildlife crossings at MP 53.07, 53.9, 56.1, and 58.6; retrofits of existing bridges with native vegetation, habitat structure, and sound mitigation at MP 51.7 and 59.1; and retrofit of an existing culvert with amphibian fencing at MP 98.1. Wildlife fencing is proposed in association with the proposed crossing structures to prevent animals from entering the roadway and guide them to suitable crossing locations.

A decision matrix was developed to support project partners in evaluating the trade-offs of the proposed crossings. The decision matrix categories include presence of species of special concern, human disturbance potential, landscape context, and modeled wildlife movement. Within the southern project area, the MP 55.6 overcrossing and MP 53.07, MP 53.9, and MP 56.1 undercrossings scored highly. In the northern project area, the MP 92.8 and MP 96.1 overcrossings scored highly. Decision matrix scores should be considered alongside other factors including cost, constructability, and partnership efforts in determining a corridor strategy for wildlife crossings.

The anticipated range of costs (2024$) for design, permitting, construction, monitoring, and maintenance of the proposed projects and associated fencing is approximately $23.2M to $30.1M for the overcrossings, $21.5M to $40.3M for the undercrossings, $768K to $2.0M for the bridge retrofits, and $488K for the amphibian fencing retrofit. Anticipated design, permitting, and construction schedules (once funding is secured) range from within a year for the retrofits to 3 to 4 years for the overcrossings to 5 to 10 years for the undercrossings. These schedules assume that permitting can be completed concurrently with design development.

1 Introduction

1.1 Scope of Study

Conservation Northwest (CNW) retained Samara Group, LLC (SG) and River Design Group, Inc. (RDG) to perform an alternatives analysis and conceptual design for potential wildlife crossings along Interstate 5 (I-5) in two zones identified by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022): the Southern Linkage Zone (SLZ) from the Toutle River bridge (MP 51.7) to the Cowlitz River bridge (MP 59.1) and the Northern Linkage Zone (NLZ) from the Scatter Creek bridge (MP 90.4) to an unnamed tributary (UNT) of Salmon Creek (MP 98.1) (**Figure 1-1**). The goal of this work is to increase the overall permeability for wildlife to move between areas east and west of the highway and to reduce wildlife-vehicle collisions (WVCs) which are dangerous to drivers and wildlife populations alike.

This Conceptual Design Report presents a summary of Task 1 (kickoff and review of existing information, Task 2 (project partner interviews), Task 3 (corridor analysis and preliminary site selection), Task 4 (design context) and Task 5 (alternatives analysis). This report presents the conceptual designs developed for the preferred alternatives selected for each site.

This report follows four design workshops as well as interviews and background research. The draft report was reviewed by the SW WA I-5 wildlife crossings steering committee (SC) and technical advisory group (TAG) and was further informed by the final design workshop which included the development of the corridor strategy (**Figure 1-2**).

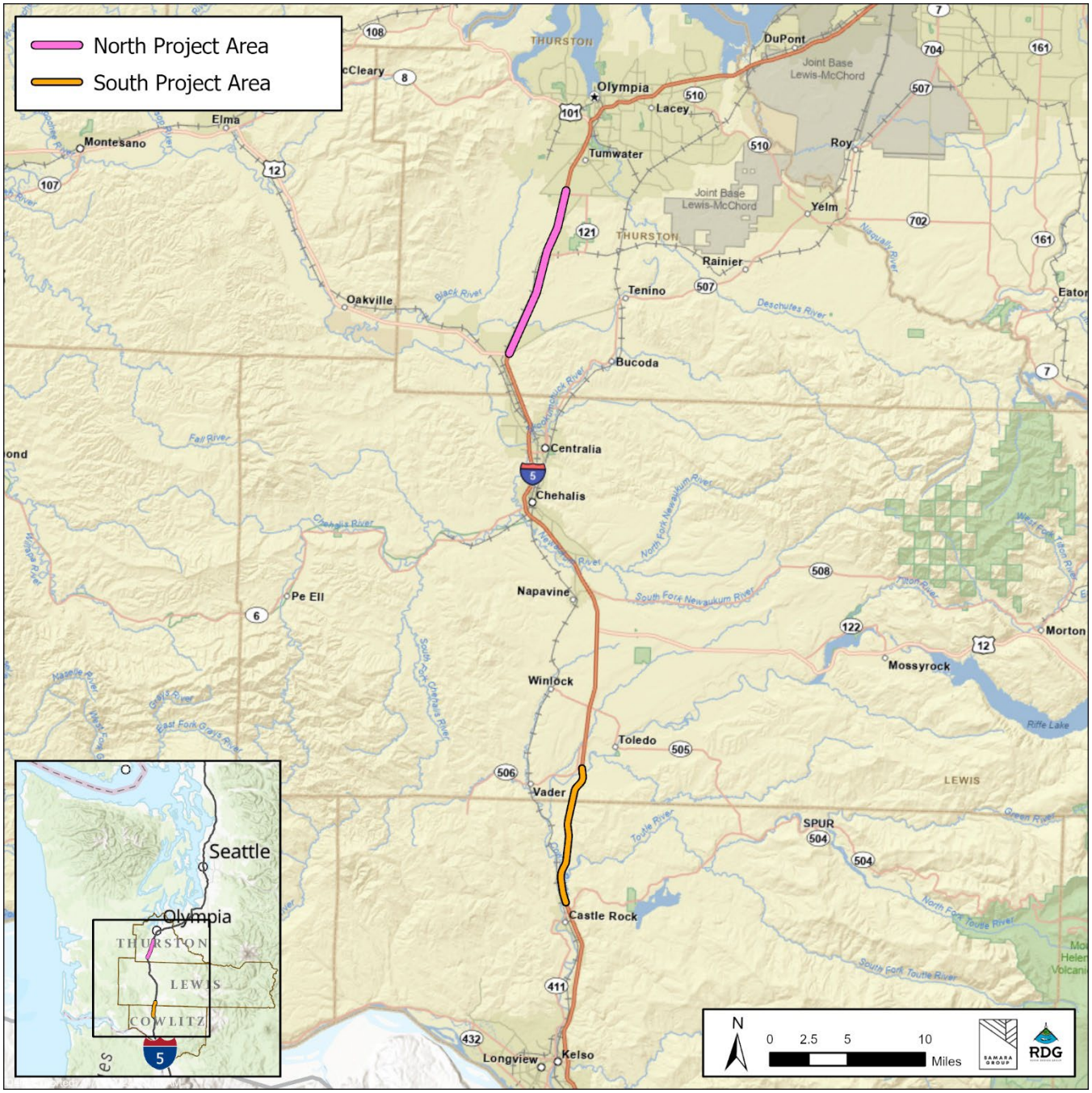

Figure 1-1. Vicinity map showing the project areas within the Washington State Department of Transportation (WSDOT) priority crossing areas along I-5.

October	Nov/Dec	January	March	May	*Pause for In-Water Work June – October*	November
Kickoff and Compile Existing Information.	Site Assessment and Site Visit (Nov 16)	Corridor Analysis and Preliminary Site Selection	Confirmation of Sites for Alternative Analysis	Alternatives Analysis Report		Conceptual Design Report
Project Partner Interviews	Project Partner Interviews	Design Workshop 1: Preliminary Site Selection	Workshop 1.5: Site Confirmation	Design Workshop 2: Preferred Alternative Selection		Design Workshop 3: Conceptual Design Handoff

Figure 1-2. Progress on the project timeline.

1.2 Project Partner Engagement

Improving wildlife movement across I-5 is an important mission that affects many varied species, including humans. Multiple organizations and agencies have a vested interest in creating or restoring crossing structures in southwest Washington. It was therefore essential to include project partners throughout the decision-making process. It is important to consider different perspectives, experiences, and approaches for this kind of project. A kickoff meeting gave members of the SC and TAG an outline of how each site would be evaluated, where new potential crossings may be considered and the process for evaluating alternatives for each site to advance the design to a conceptual level with sufficient detail to begin preliminary design. Members of the SC and TAG were invited to participate in this decision-making process (**Figure 1-3**) through a series of interviews and workshops.

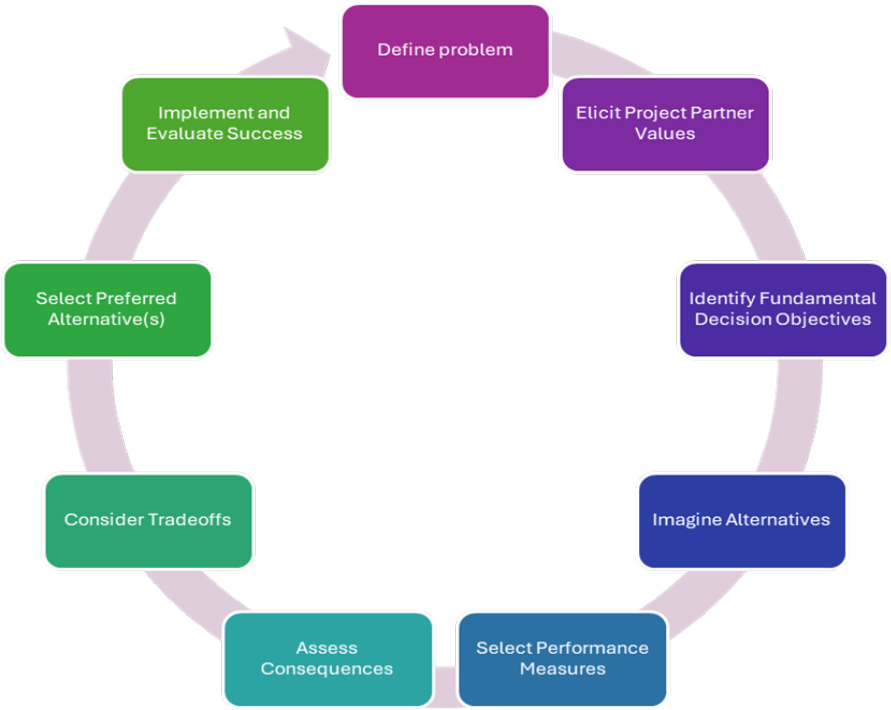

Figure 1-3. Overview of the structured decision-making process (Conroy and Peterson, 2013).

1.3 Interviews

Following the kickoff meeting, individual, or small group interviews were conducted with members of the coalition to gauge priorities and perspectives across agencies. A total of 15 interviews were conducted with 26 individuals from 11 different organizations/agencies (**Appendix A**). All interviews were held between October 2023 and December 2023.

Interviewees were asked the following questions/prompts:

- When/how did you get involved or otherwise connected with the SW WA I-5 wildlife crossings?
- What are your expectations for this phase of the work? What are your goals/outcomes for you or your organization/agency? What are your top priorities for a final crossing structure design?
- What do you see as potential roadblocks to reaching the goals/outcomes stated above?
- Are there any other considerations or things we should know?

Responses from the interviews were analyzed to understand common themes and identify all opportunities and constraints of potential crossing structures that group members brought attention to. From these interviews a draft decision matrix was prepared that highlighted species of concern and potential constructions or retrofits to crossing structures that could benefit wildlife movement. This information was used to guide the full partner workshops.

1.4 Site Assessment

The design team visited several sites on November 16 and 17, 2023 to observe baseline conditions and begin discussion of potential wildlife crossing improvements with members of the SC and TAG. They visited six sites on day 1 and six sites on day 2 (**Figure 1-4** and **Figure 1-5**) with the menu of wildlife crossing improvement opportunities (**Appendix B**) in mind. **Table 1-1** summarizes the baseline conditions for existing structures observed within the SW WA I-5 project corridor. Observations for each site with a proposed crossing structure are discussed in greater detail in Section 5. The other sites (without a preferred alternative selected for advancement into conceptual design) are discussed in the Alternatives Analysis Report.

Table 1-1. Summary of baseline conditions for existing structures observed during November, 2023 site visits.

Site	Existing Structure	Existing Species Use
MP 51.7 Toutle River	Single-span steel tied arch bridges (one structure each northbound and southbound), constructed in 1969, “fair” condition	Likely to occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote.

Site	Existing Structure	Existing Species Use
MP 53.9 UNT Cowlitz River	2 ft corrugated metal pipe culvert, very long (approximately 700 ft) diagonal under highway	Currently unable to pass any species
MP 56.1 UNT Hill Creek	10 ft x 10 ft concrete box culvert at inlet transitioning to 10 ft diameter corrugated metal pipe culvert at outlet	Likely passing bear, raccoon, and other species comfortable with wading through water.
MP 58.6 Foster Creek	8 ft tall x 10 ft wide concrete box culvert, outlet apron detached from culvert structure	Likely passing bear, raccoon, and other species comfortable with wading through water.
MP 59.1 Cowlitz River	Two-span steel truss bridges (one structure each northbound and southbound) supported on concrete T-beams, constructed in 1953, “fair” condition	Likely to occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote.
MP 90.4 Scatter Creek	Single-span concrete slab bridge (one structure for both northbound and southbound), constructed in 2010, “good” condition	During low flows, this structure likely accommodates most terrestrial species but may be difficult for terrestrial amphibians because of extensive riprap. Lack of habitat structure may also discourage some small mammal movement, although cover may be available in larger sized rock. High flow periods prohibit most terrestrial species movement, except for small species able to use narrow steep margins at the end of the structure. Salmonids have been observed and Lamprey and other fish are likely to pass easily during high flows.
MP 92.5-92.8 Vets Farm and Maytown	N/A no existing structures	Unknown, but wildlife activity noted nearby including elk and bear. Not an aquatic passage so not suitable for fish.
MP 96.1 Basalt Roadcut	N/A no existing structures	Unknown, but wildlife activity noted nearby including deer and cougar. Not an aquatic passage so not suitable for fish.

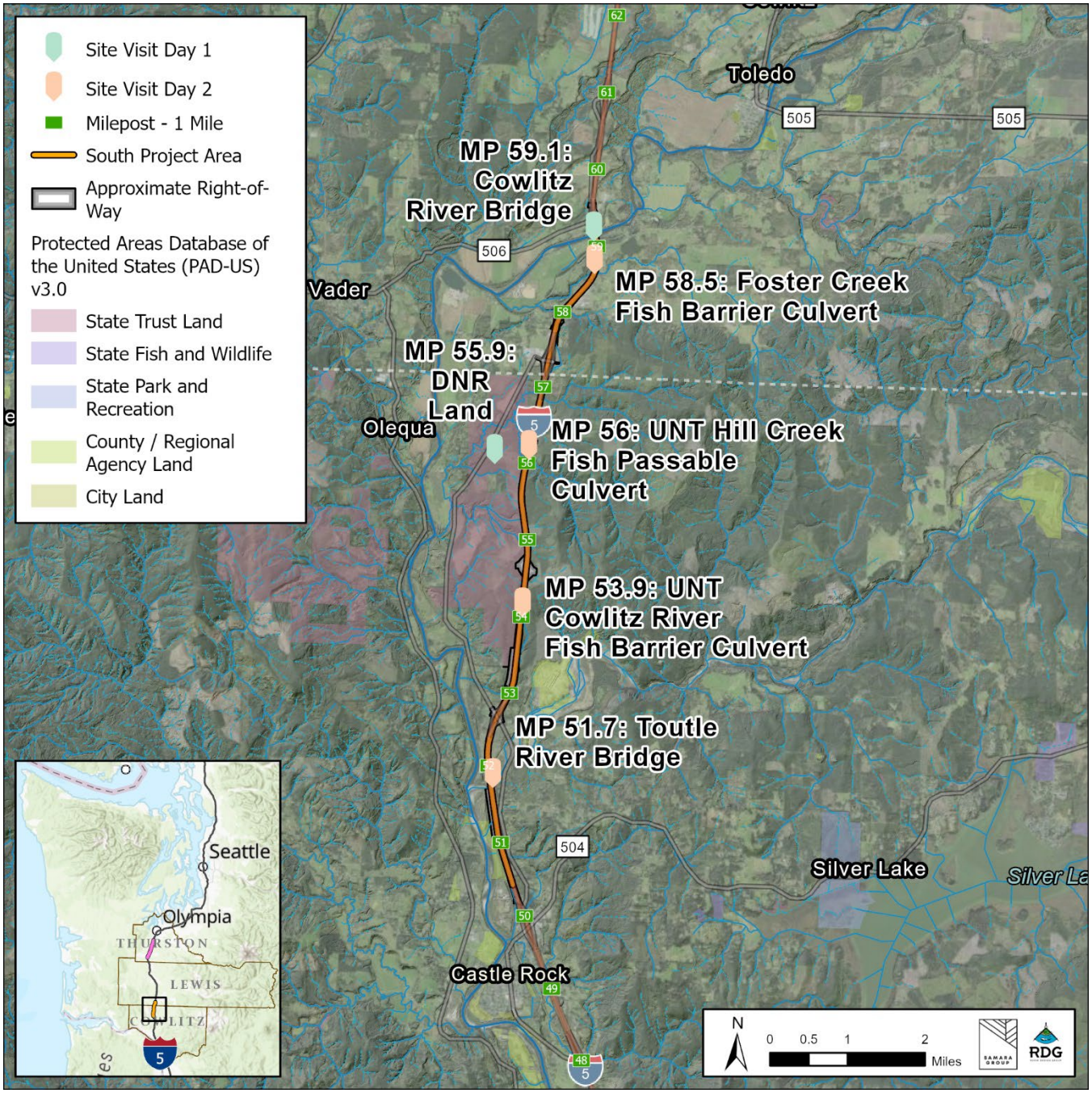

Figure 1-4. Southern project area site assessment stops.

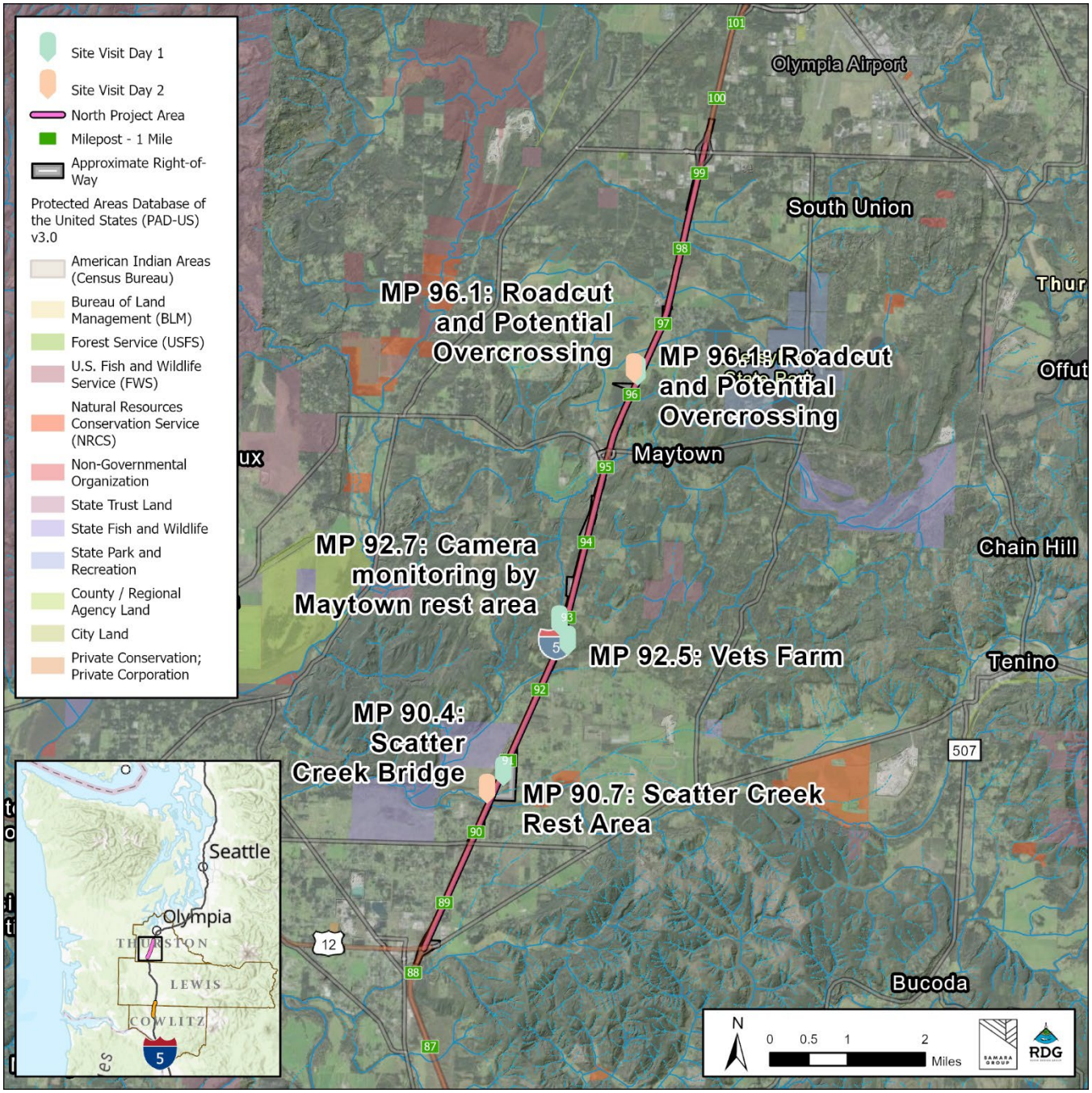

Figure 1-5. Northern project area site assessment stops.

1.5 Workshops

A series of design workshops helped to inform the engineering basis of design through the collaborative development of design alternatives and conceptual designs. This process involves building the project knowledge base and providing opportunity for feedback from the project partners as designs advance.

January 16, 2024 | Virtual Baseline Conditions, Opportunities and Constraints Workshop:

This meeting covered the main takeaways and outcomes from the project partner interviews, reviewed baseline conditions in the corridor, and identified preliminary sites selected for the alternatives analysis. The different perspectives from the interviews gave essential insights into the planning of potential crossing structures and highlighted wildlife species of concern. Overall, the consensus was to prioritize permeability and movement for this entire stretch of I-5 in the two zones. There were four recurring priority categories discussed, each of which had their own opportunities and challenges. The following priorities were used to outline the draft decision matrix: species of special concern; landscape context; human disturbance potential; and multiple benefit locations. Coalition members had the opportunity to comment on or ask questions about the draft decision matrix. We reviewed the corridor context from available spatial data and site assessment observations from the site visit in November 2023. A site-by-site review was presented, details of which can be found in Section 2, Baseline Conditions, of the Alternatives Analysis Report. Preliminary sites for the alternatives analysis were discussed and members were invited to provide additional feedback and site recommendations after the workshop. The sites selected for this alternatives analysis are discussed in Section 3, Wildlife Passage Alternatives, of the Alternatives Analysis Report.

March 19, 2024 | Hybrid Site Confirmation Workshop:

This workshop reconvened the SC and TAG members to confirm the site selection for the alternatives analysis. Feedback from workshop 1 indicated that the group members needed additional time for comment and consideration of the sites before moving into the alternatives analysis. SG and RDG presented the original sites from workshop 1 and additional sites suggested by SC and TAG members via a poll conducted prior to the workshop. Eleven sites were selected during this workshop for consideration in the alternatives analysis (see Section 3 of the Alternatives Analysis Report for discussion of the sites selected).

May 14, 2024 | Virtual Preferred Alternative Selection and Conceptual Design Kickoff Workshop:

The purpose of this workshop was to select preferred alternatives for advancement into conceptual design. SG and RDG presented a summary of the draft alternatives analysis report and made preliminary recommendations of a preferred alternative at each site. Their recommendations were based on the Draft Decision Matrix developed during the project partner interviews. They facilitated discussion and solicited feedback from the project partners to reach consensus on one preferred alternative for each site. These decisions are documented in Section 4 of the Alternative Analysis Report.

November 13, 2024 | Virtual Conceptual Design Review and Decision Matrix Workshop:

The purpose of this workshop was to confirm the relative ranking of the preferred alternative conceptual design for each crossing site, develop the corridor strategy, and discuss comments received on the draft conceptual design report. SG and RDG presented a summary of the draft conceptual design report and the relative ranking of each site based on the Draft Decision Matrix.

The conceptual design report was updated based on feedback received during the workshop. Bat spp. observations, modeled mountain beaver movement, and the Panthera model of cougar movement were removed from the matrix. Distance from nearest rest area was added to the matrix. The definition of protected lands used in the matrix was refined to exclude private timber and forestlands except those owned by Weyerhaeuser and Port Blakely. Proposed fencing was extended in two locations (MP 95.2 and 98.4) to tie in with culverts that are to be replaced (by others) with structures providing wildlife passage. An appendix with a list of species observed via iNaturalist and species documented during WSDOT camera monitoring and Central Washington University reptile/amphibian surveys was added (Appendix G).

1.6 Standard of Practice

This conceptual design was performed or directed by a Professional Engineer (PE) and Registered Geologist (RG) licensed to practice civil engineering and geology in the State of Washington with over 10 years of experience with fish passage, river restoration, and transportation improvement projects and a wildlife ecologist with over 15 years of experience in habitat connectivity assessment and modeling, wildlife crossing monitoring, and transportation ecology study. The standard of care used to develop this study meets those of a planning level, alternatives study based on available budget constraints and existing data provided to RDG and SG from CNW, WSDOT, Washington Department of Fish and Wildlife (WDFW), Wildlands Network (WN), Panthera, Washington Department of Natural Resources (WDNR), iNaturalist, Open Street Maps, Lewis County, Cowlitz County, Thurston County, and other publicly available datasets.

2 Corridor Context

The corridor context was evaluated through a combination of literature review, desktop analyses, site visits, and review of information shared by SC and TAG members. Physical and ecological setting informs the site constraints and opportunities for development of the alternatives.

2.1 Ecological Setting

The Southwest Washington I-5 Wildlife Crossings project areas include 3 EPA Level IV Ecoregions in the immediate vicinity of I-5 including the Cowlitz/Newaukum Prairie Floodplains, the Cowlitz/Chehalis foothills in the southern project area (**Figure 2-1**), and the Southern Puget Prairies in the northern project area (**Figure 2-2**).

WSDOT has been collecting data on species presence using remote trigger cameras in the habitats adjacent to I-5 in both project areas. The density of this extensive data collection effort closely mirrors the extents of the North and South project areas (**Figure 2-3** and **Figure 2-4**). or each proposed crossing structure, data from camera monitoring stations located within 3 km was reviewed (**Table 2-1**). The number of stations associated with each crossing varies and some of the 3 km buffers overlap such that data from one monitoring station may have been included in multiple crossing structure assessments. Camera monitoring stations were deployed and collected data for varying numbers of days. Future analysis by WSDOT will account for the varying number of cameras and camera trap days to better assess the differences in the number of species detections per area. Data collection is ongoing, and future WSDOT reports will include additional monitoring information. It is important to note that the absence of a detection for a given species does not necessarily preclude them from being present in the area.

The southern project area includes 43 camera monitoring locations, and the northern project area includes 31. Excluding humans, domestic animals, vehicles, and generic species detections (i.e. taxa groups), 47 species were documented utilizing habitats within both project areas (Appendix G). Those records were composed of 26 species of bird and 21 species of mammal. There were 20 mammal species detected in the southern project area, and 16 detected in the northern project area. Many of these species were detected in both areas, but some were exclusively detected in one area or the other. We further refined the data we utilized in this report to species specifically mentioned as a priority for the project partners and/or those who were modeled by the WWHCWG (WWHCWG, 2022). Ultimately, we were able to assess detection data for American beaver, black bear, black-tailed deer, elk, fisher, and cougar (**Table 3-1**). All of these species were found in both project areas with varying frequencies, with the exception of fisher. Fisher was only detected once within the southern project area and, while experts in the species agree it is most probably an image of a fisher, the photo itself was not particularly clear and was challenging to identify.

While remote cameras are an excellent tool for documenting large and medium mammal activity, they are less successful in collecting occurrences of reptile and amphibian species. Complementing the remote camera monitoring effort, WSDOT funded researchers at Central Washington University to conduct surveys at 19 locations within a 1 km buffer of each proposed crossing location to determine presence of amphibian and reptile species (Irwin, 2024). Through that effort the presence of 7 species was confirmed in the southern project area, and 10 species in the northern project area (Appendix G). Of the species detected, 3 were mentioned as priority species by project partners and/or have special conservation status in the state of Washington: the Dunn's salamander, northern alligator lizard, and the western toad.

Wildlife sightings throughout the project area are reflected in iNaturalist observations. Research grade observations from the southern project area (**Figure 2-3**, Appendix G) from 2014 to 2023 include 11 amphibian species (36 records), 56 bird species (155 records), 9 mammal species (19 records), and 7 reptile species (19 records). Research grade observations in the northern project area (**Figure 2-4**) from 2014 to 2023 include 11 amphibian species (112 records), 114 bird species (712 records), 27 mammal species (103 records), and 9 reptile species (138 records). These observations mark where humans have come into contact with wildlife

and recorded their occurrence, not necessarily where wildlife are most numerous. While this is not a complete account of all vertebrate species that may be present within the project area, it clearly indicates that a diversity of species have been present.

Table 2-1. Camera monitoring stations and amphibian and reptile survey locations associated with proposed crossing locations.

Proposed Crossing Location	Number of cameras	Number of reptile and amphibian survey locations
MP 51.7 Toutle River Bridge Retrofit	14	2
MP 53.07 UNT Cowlitz River Undercrossing	16	2
MP 53.9 UNT Cowlitz River Undercrossing	16	2
MP 55.6 Overcrossing	23	2
MP 56.1 UNT Hill Creek Undercrossing	19	4
MP 58.6 Foster Creek Undercrossing	8	4
MP 59.1 Cowlitz River Bridge Retrofit	6	4
MP 90.5 Overcrossing	6	3
MP 92.8 Overcrossing	13	5
MP 96.1 Overcrossing	11	4
MP 98.1 UNT Salmon Creek Amphibian Retrofit	2	2

Habitat connectivity efforts to support viable populations of wildlife, plants, and ecological function are needed across the landscape to counteract the barrier effect of roads. These projects can take many years to complete, are costly, and the locations selected need to support connectivity for the long-term. Given the lifetime of these structures, it is also essential to consider potential future conditions in the face of climate change. Researchers at Washington State University (Nuñez et al., 2013) developed a model to illustrate present day connectivity compared to potential future conditions with climate change (**Figure 2-5**). A large proportion of the center of the southern project area shows high modeled connectivity value for both current and future conditions, while the northern project area model outputs suggest that future connectivity pathways will be most important. According to this model, Investment in wildlife crossing projects in the southern project area are of high value in the more immediate term, while the northern project area will be a priority in the future. Both of these potential crossing locations are projected to maintain their value long term in regard to climate change influences on connectivity value.

In its most recent modeling effort, the WWHCWG developed Least-Cost Corridor analysis maps for five focal species: American beaver, Pacific fisher, western gray squirrel, mountain beaver, and cougar (WWHCWG, 2022). Due to the inherent instability and rapid change that describe mountain beaver habitat (early seral forests), project partners agreed that the

habitat conditions used in the model are not reliable for planning purposes, and so this model was excluded from this report. The remaining maps help to identify possible areas of wildlife habitat connectivity pathways across the project areas (**Figure 2-6** through **Figure 2-12**). Most species models show multiple locations that indicate habitat connectivity pathways intersecting with the southern and northern project areas; however, the western gray squirrel species range did not overlap with the southern project area at any point, and therefore no map for the western gray squirrel is provided for the southern project area. The WWHCWG also looked at the overlapping results of all focal species least-cost corridor analysis within the project area and does include mountain beaver model outputs. These Overlapping Networks show locations in the project area where multiple species model outputs intersect, with potential for multi-species benefits if pathways are maintained or enhanced by wildlife crossing opportunities (**Figure 2-13**).

The Olympic Cougar Project (unpublished analyses) developed a cougar connectivity analysis that utilizes known cougar movement data among other inputs. These data indicate several movement pathways intersecting with the southern and northern project areas (**Figure 2-14** and **Figure 2-15**).

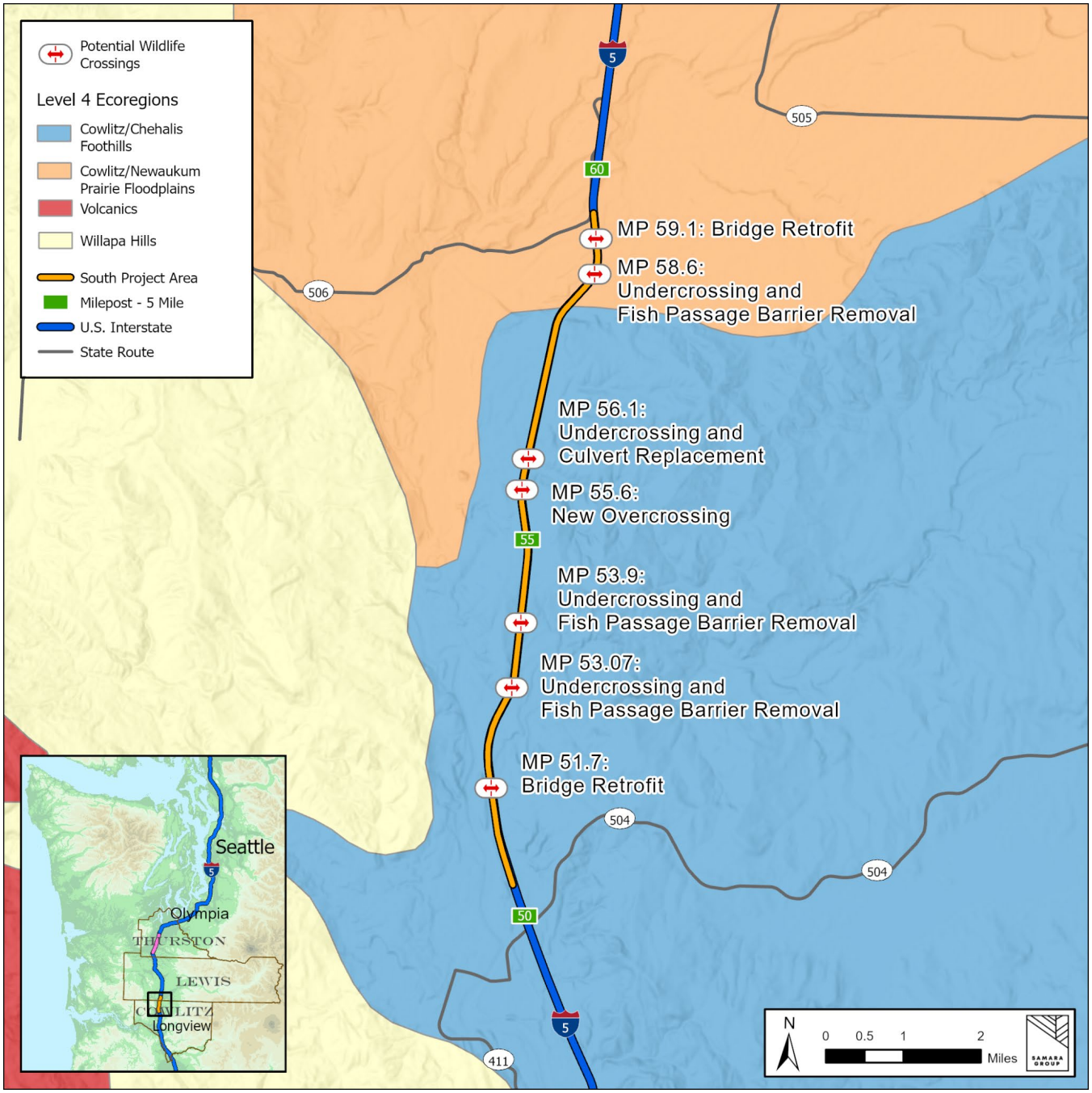

Figure 2-1. EPA Level IV Ecoregions in the southern project area. Location and approximate boundaries of EPA Level IV Ecoregions. Cowlitz/Newaukum Prairie Floodplains intersect with a small portion of the project area, with the majority intersecting with the Cowlitz/Chehalis Foothills.

Figure 2-2. EPA Level IV Ecoregions in the northern project area. Location and approximate boundaries of EPA Level IV Ecoregions. Southern Puget Prairies intersect with the entire project area.

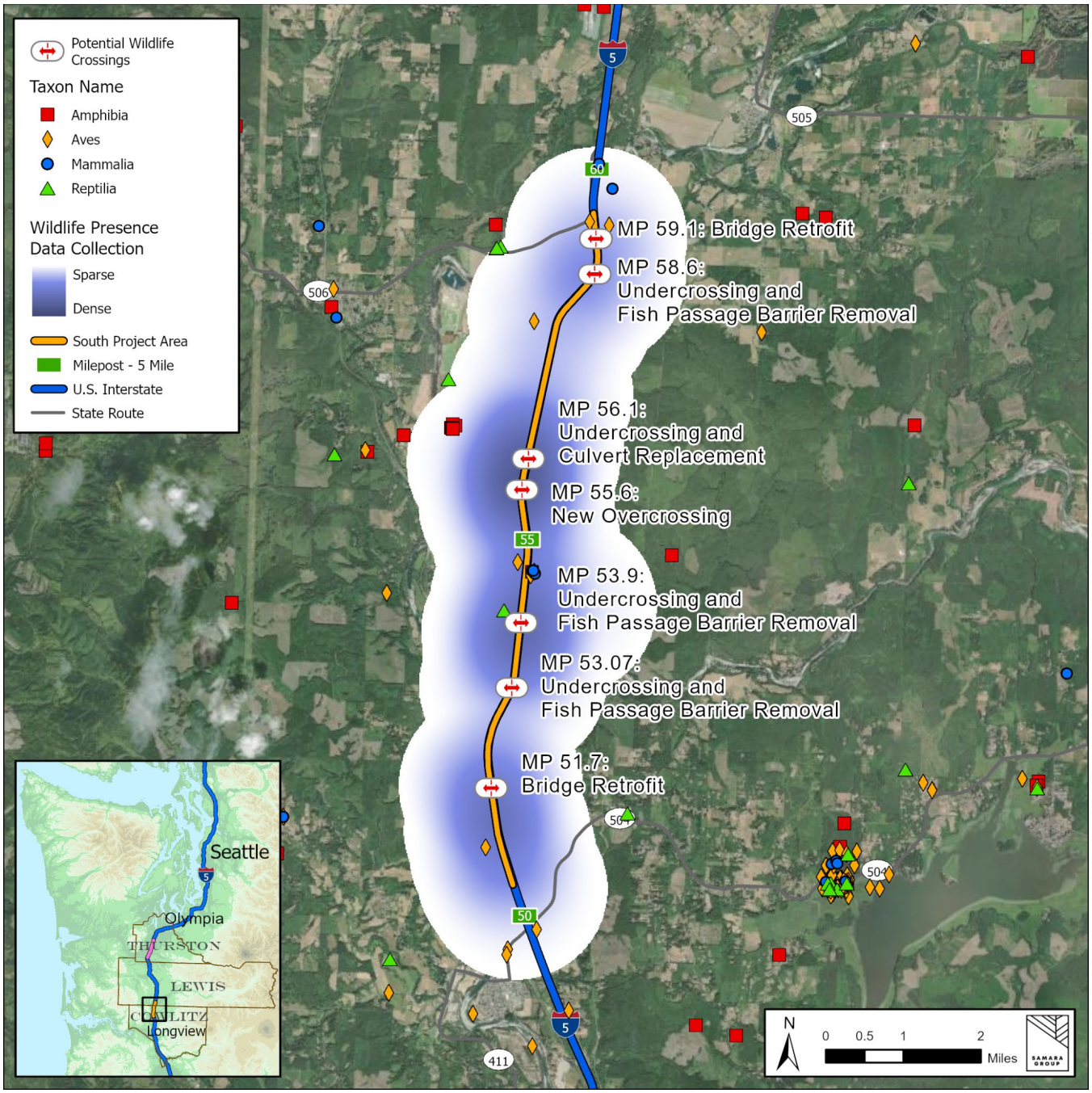

Figure 2-3. Known species occurrence from iNaturalist observations and distribution of camera monitoring stations for the southern project area. iNaturalist research grade observations of terrestrial vertebrate taxa within the project area from 2014 to 2023. These observations include 11 amphibian species (36 records), 56 bird species (155 records), 9 mammal species (19 records), and 7 reptile species (19 records).

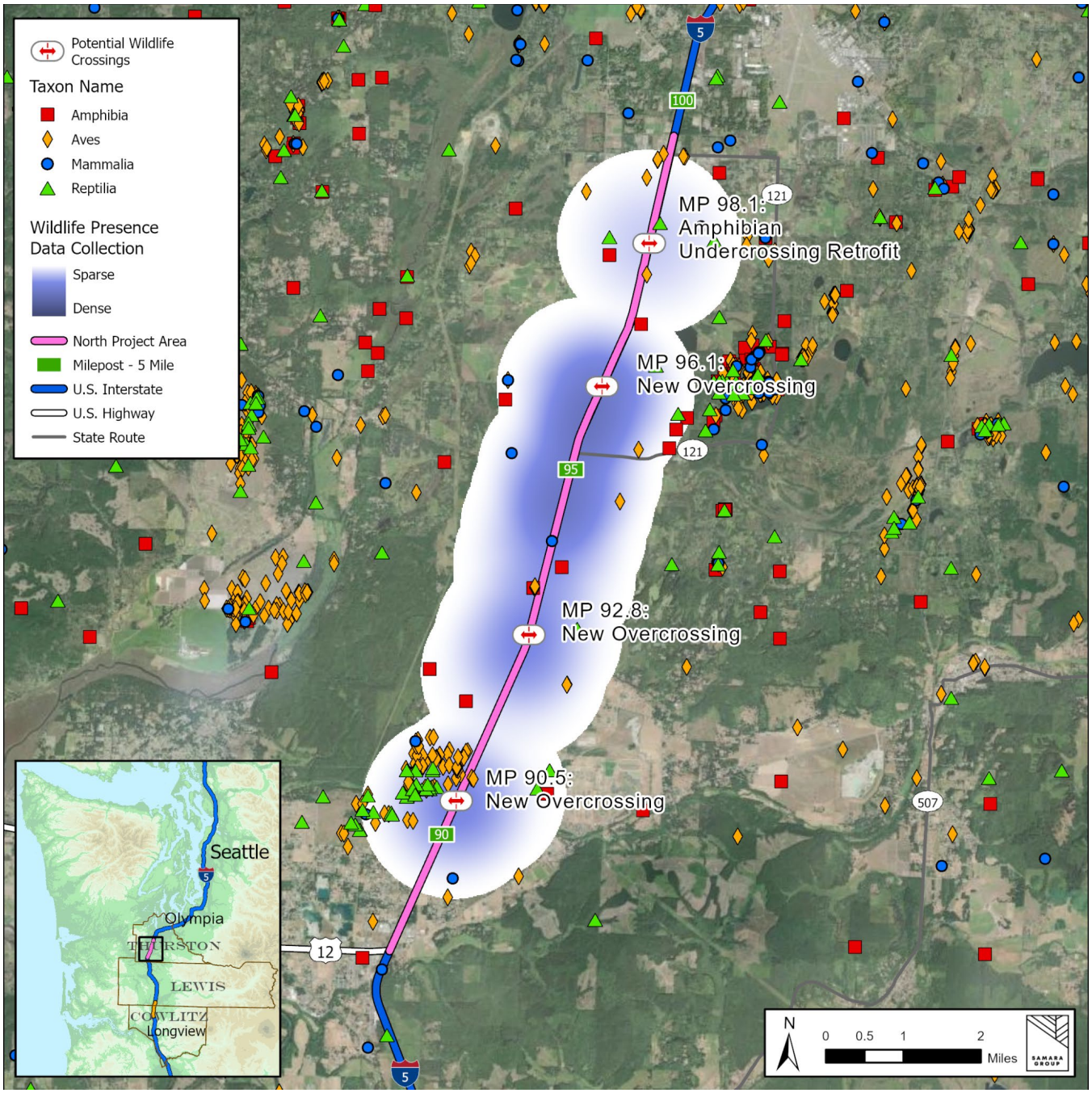

Figure 2-4. Known species occurrence from iNaturalist observations and distribution of camera monitoring stations for the northern project area. iNaturalist research grade observations of terrestrial vertebrate taxa within the project area from 2014 to 2023. These observations include 11 amphibian species (112 records), 114 bird species (712 records), 27 mammal species (103 records), and 9 reptile species (138 records).

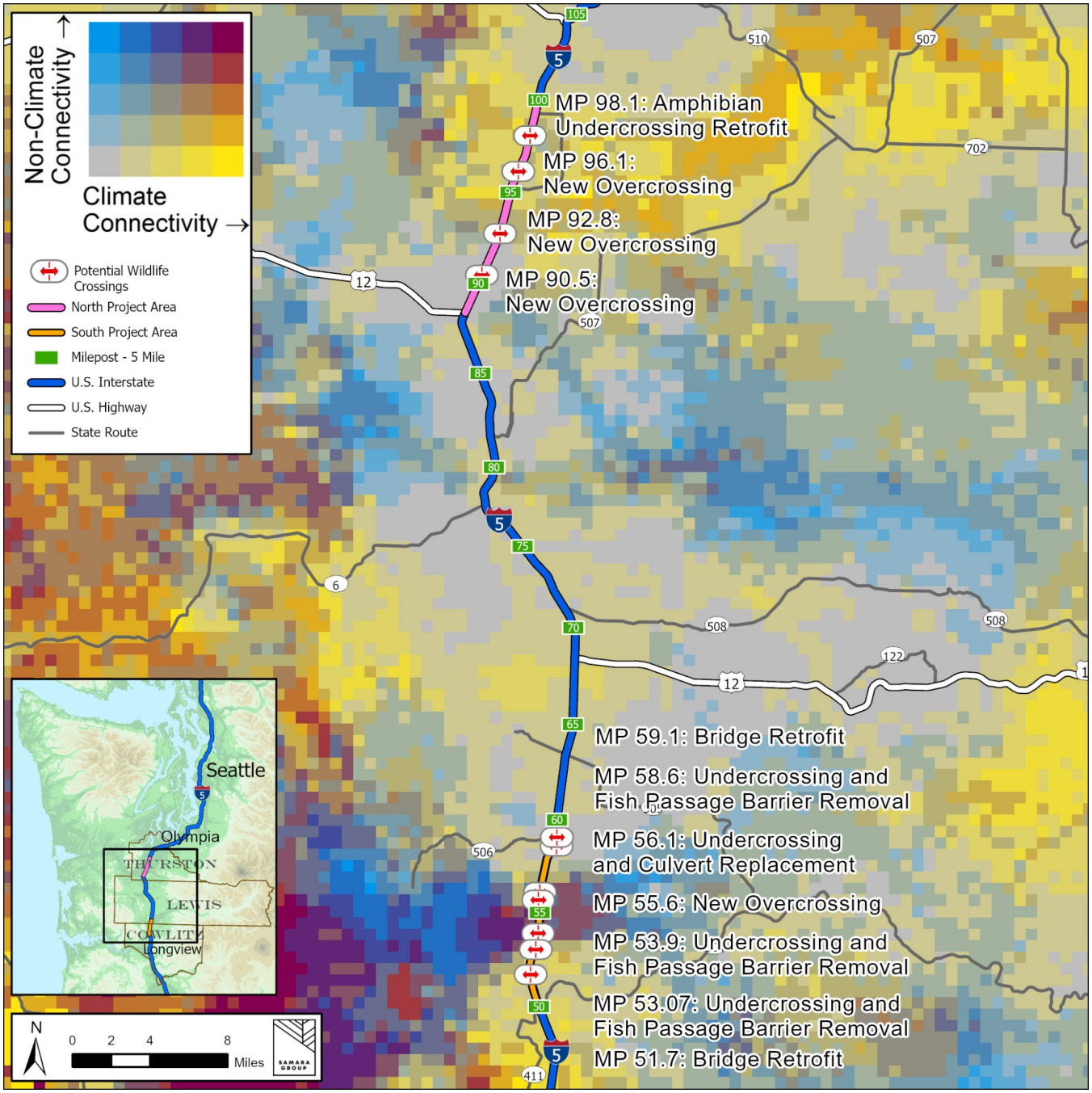

Figure 2-5. Modeled habitat connectivity under future climate scenarios showing both the northern and southern project area. Modeled wildlife habitat connectivity value under current conditions (blue), projected climate change scenarios (yellow) and those areas that provide both current and projected connectivity value (purple) are shown within the project area (Nuñez et al., 2013).

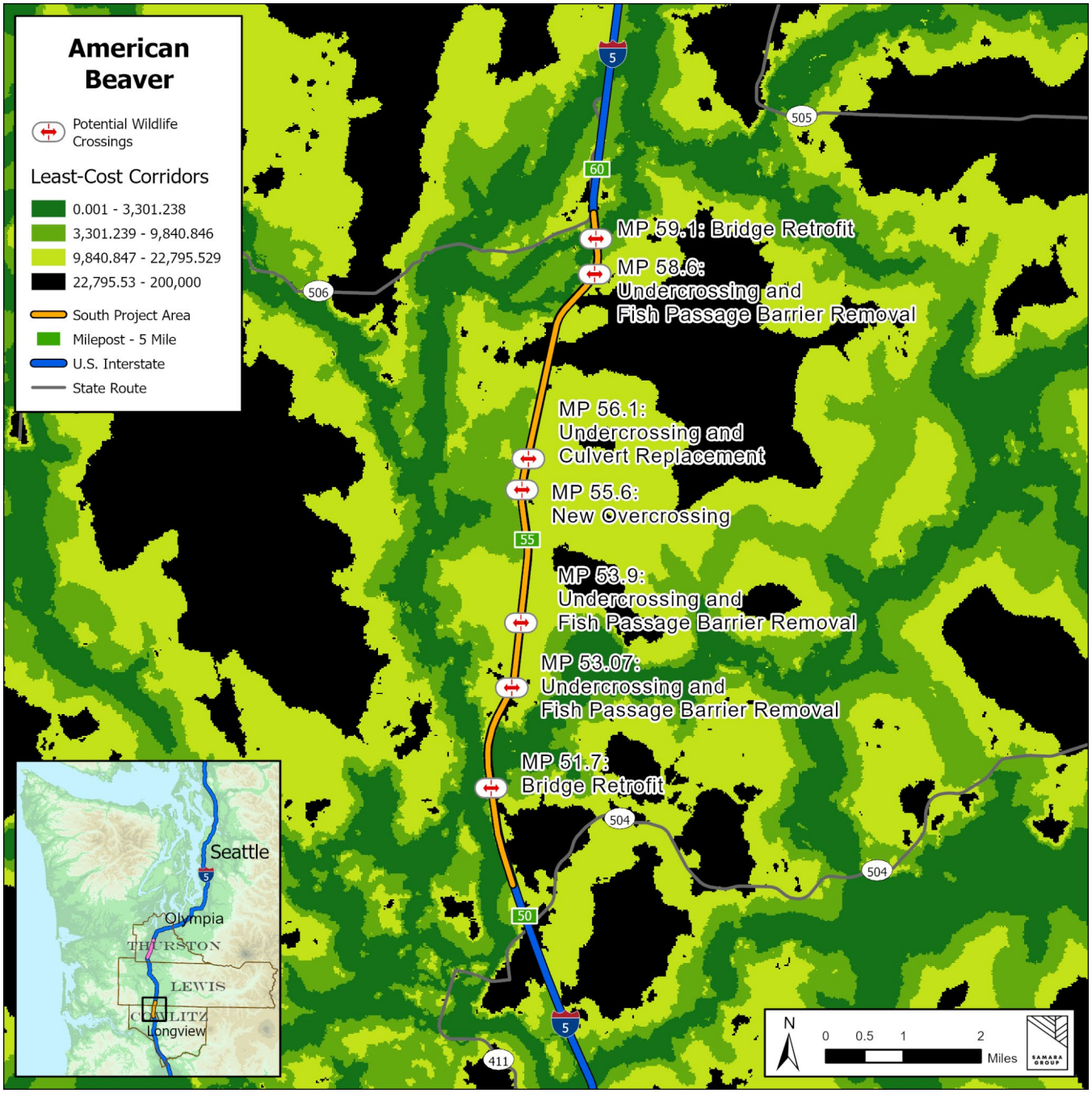

Figure 2-6. American beaver least-cost corridor analysis within the southern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The three highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the three lowest numbered classes were symbolized as graduated shades of green, to represent high connectivity/low cost, with the darkest shade as highest connectivity/lowest cost.

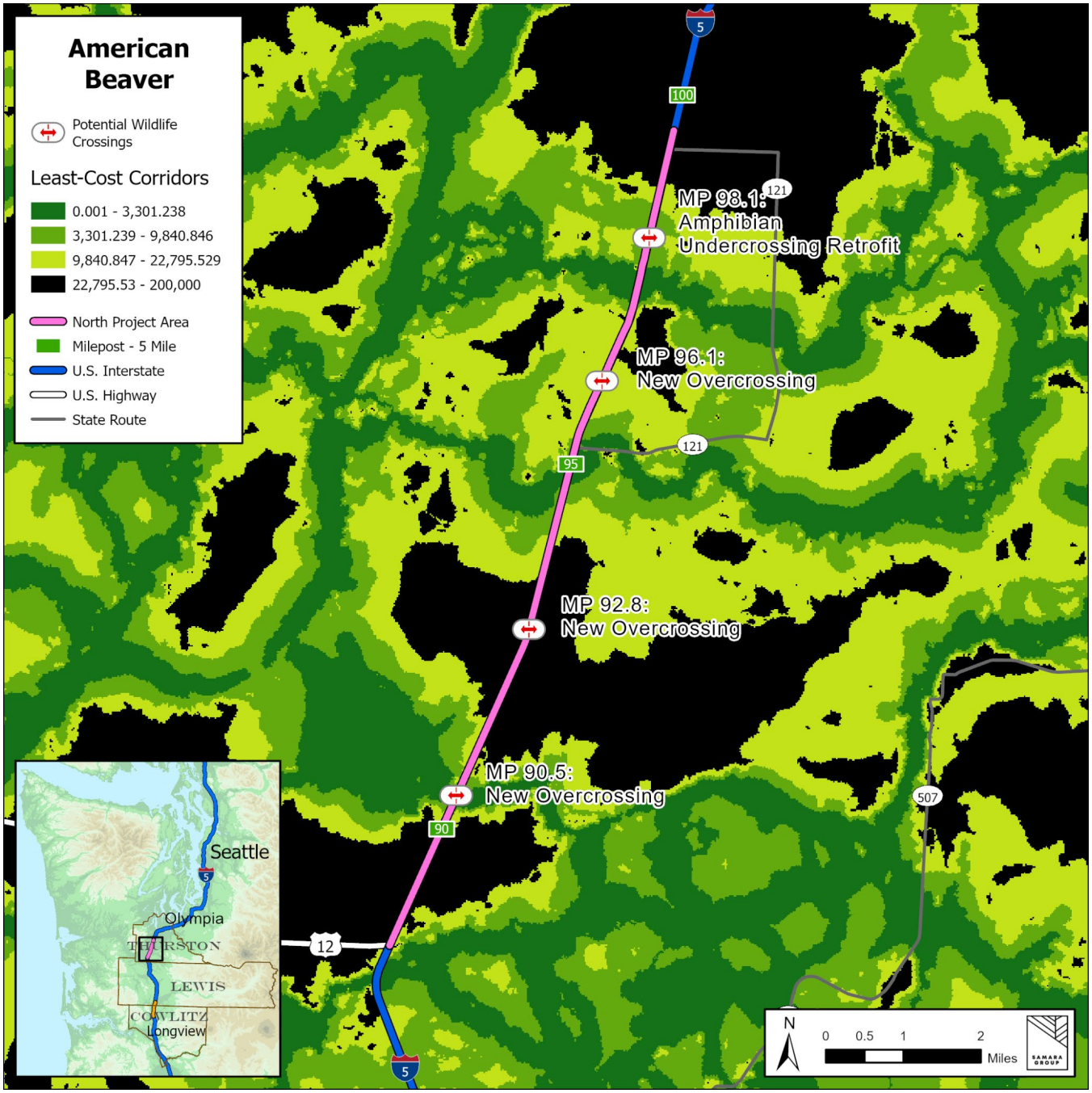

Figure 2-7. American beaver least-cost corridor analysis within the northern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The three highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the three lowest numbered classes were symbolized as graduated shades of green, to represent high connectivity/low cost, with the darkest shade as highest connectivity/lowest cost.

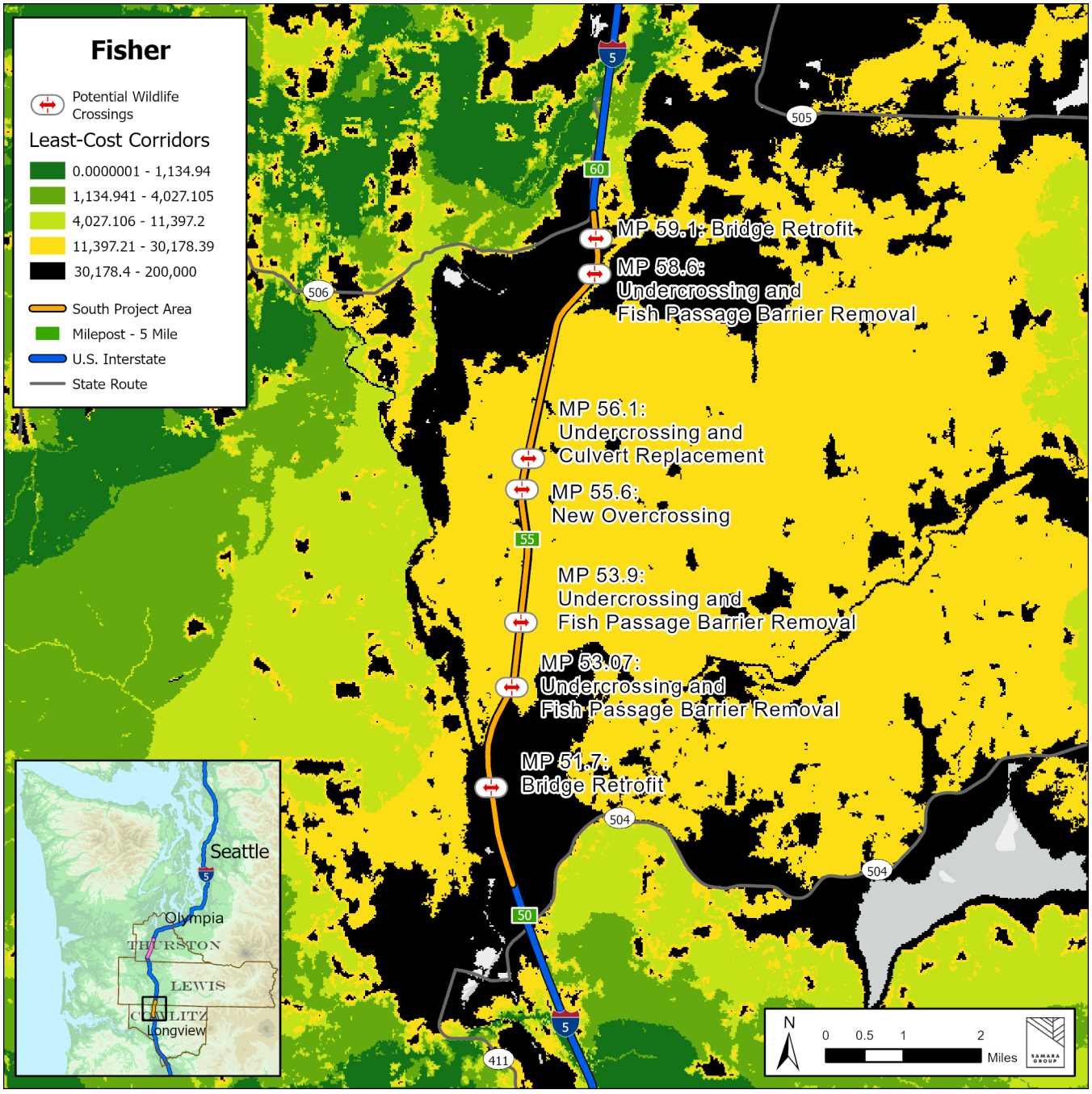

Figure 2-8. Pacific fisher least-cost corridor analysis within the southern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The two highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the four lowest numbered classes were symbolized as graduated shades of green and yellow, to represent high connectivity/low cost, with the darkest shade indicating the highest connectivity/lowest cost.

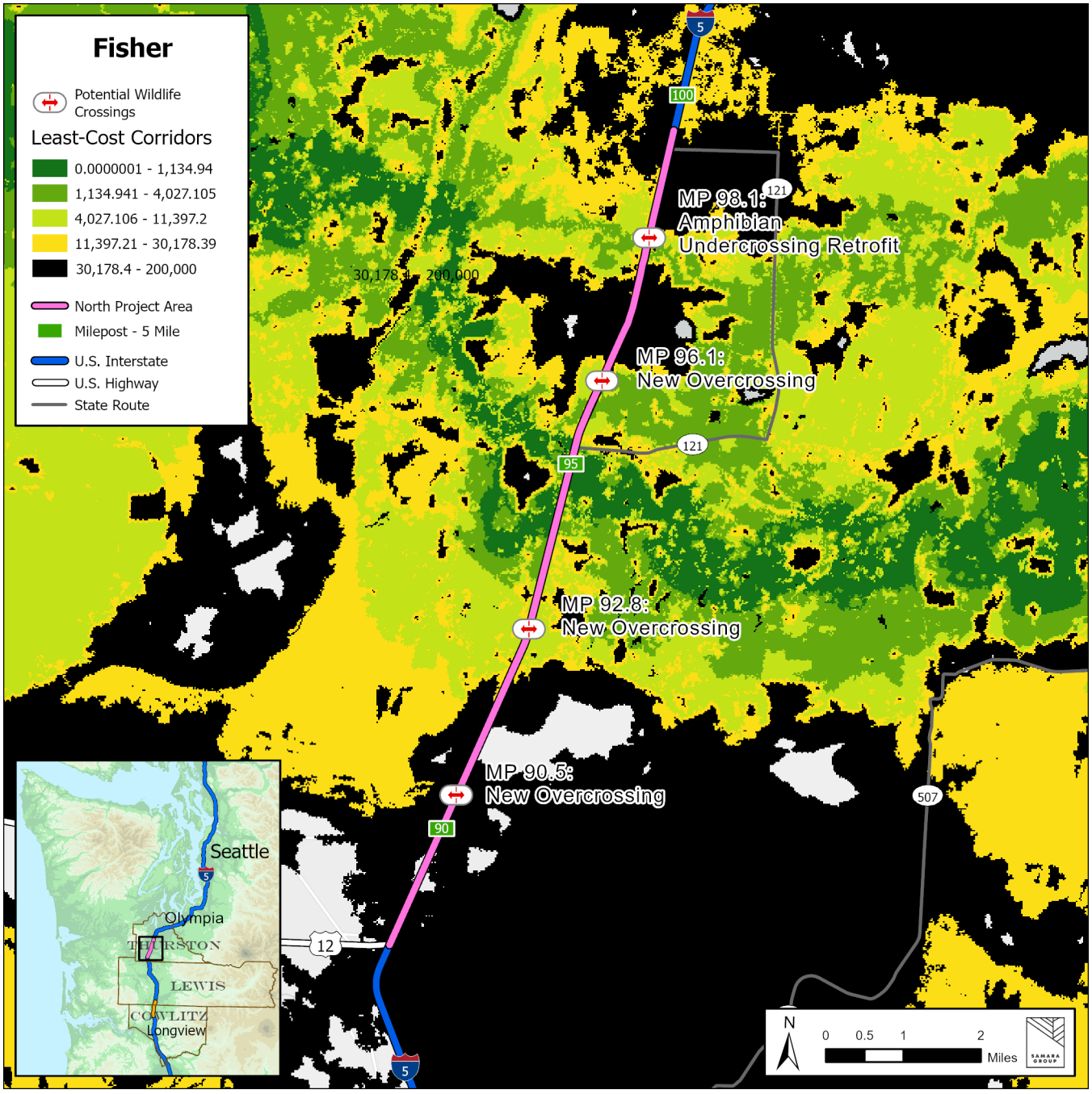

Figure 2-9. Pacific fisher least-cost corridor analysis within the northern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The two highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the four lowest numbered classes were symbolized as graduated shades of green and yellow, to represent high connectivity/low cost, with the darkest shade indicating the highest connectivity/lowest cost.

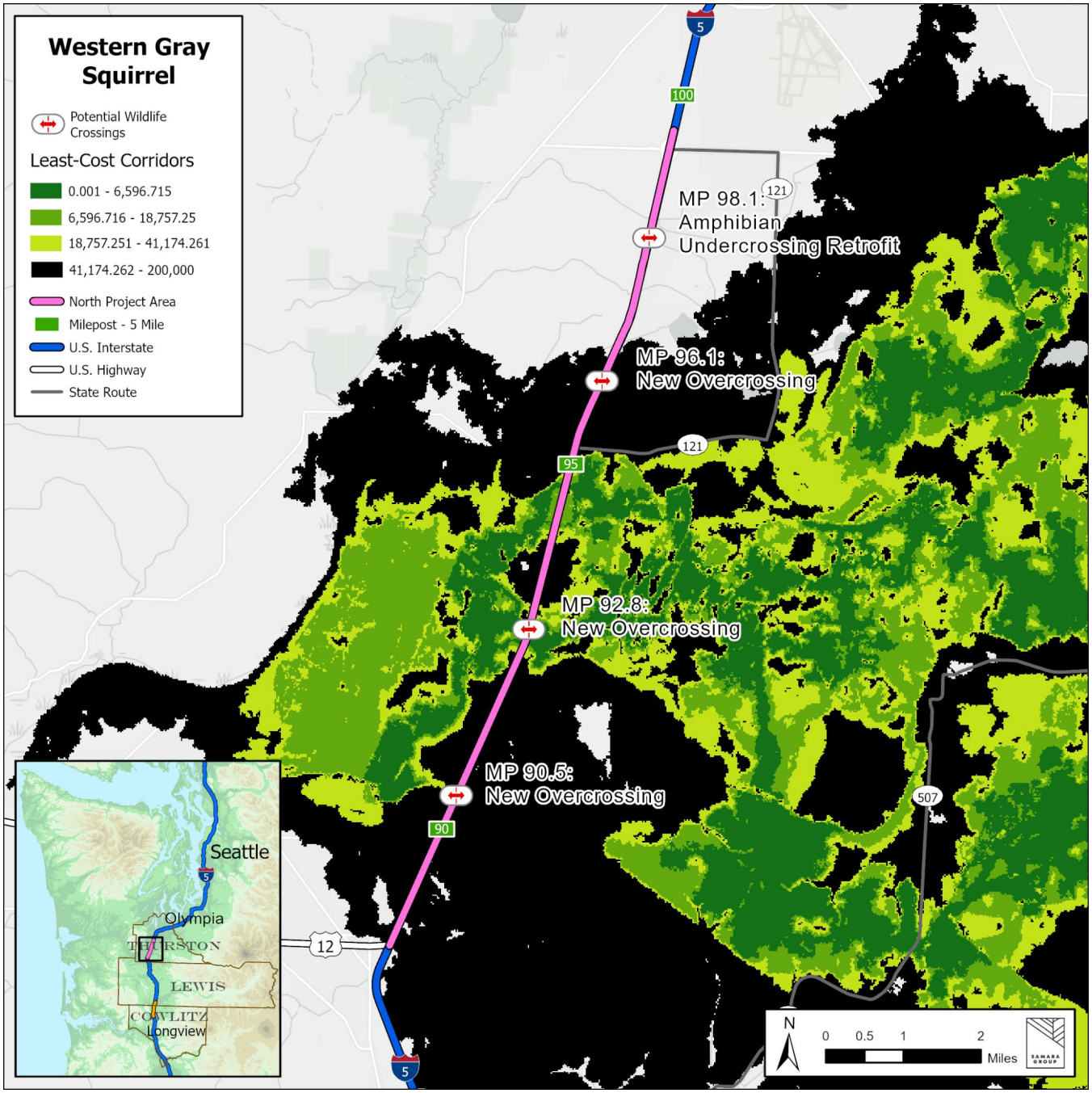

Figure 2-10. Western gray squirrel least-cost corridor analysis within the northern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The three highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the three lowest numbered classes were symbolized as graduated shades of green, to represent high connectivity/low cost, with the darkest shade as highest connectivity/lowest cost.

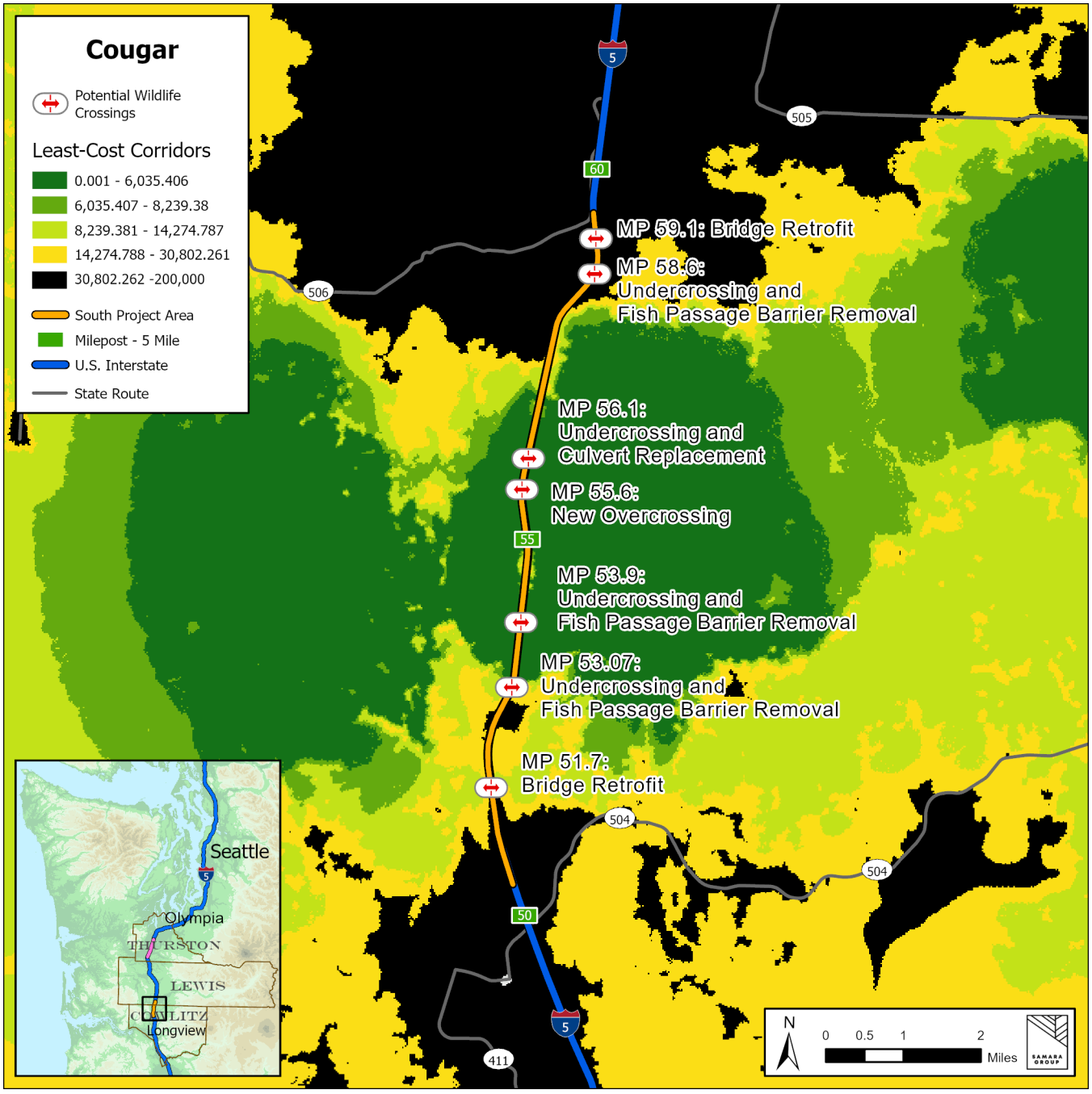

Figure 2-11. Cougar least-cost corridor analysis within the southern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The two highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the four lowest numbered classes were symbolized as graduated shades of green and yellow, to represent high connectivity/low cost, with the darkest shade indicating the highest connectivity/lowest cost.

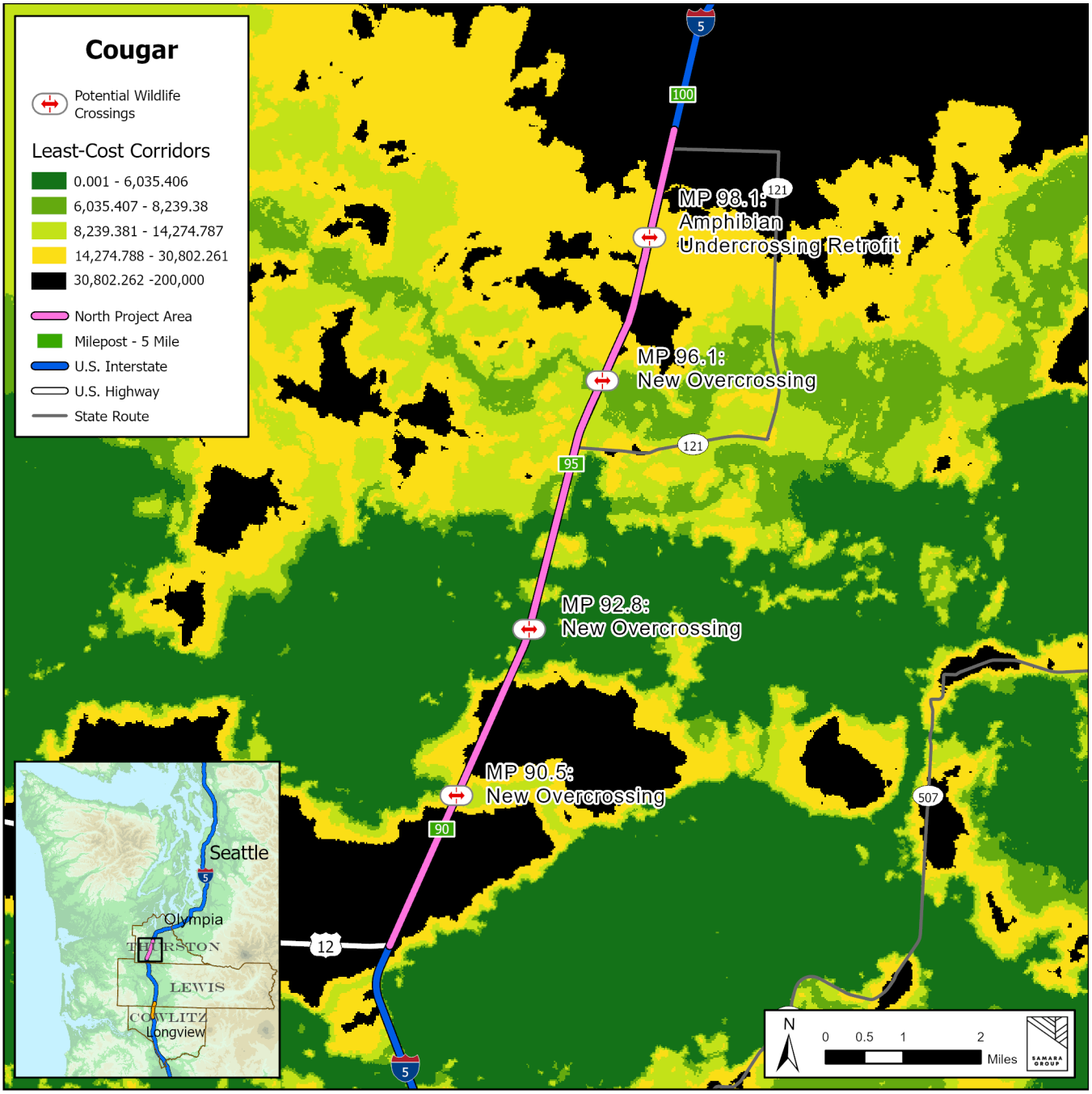

Figure 2-12. Cougar least-cost corridor analysis within the northern project area for the Cascades to Coast region created by the Washington Wildlife Habitat Connectivity Working Group (WWHCWG, 2022). The data was symbolized using a Geometric Interval method with six classes. The two highest numbered classes were symbolized as black to represent very low to no connectivity/highest cost, and the four lowest numbered classes were symbolized as graduated shades of green and yellow, to represent high connectivity/low cost, with the darkest shade indicating the highest connectivity/lowest cost.

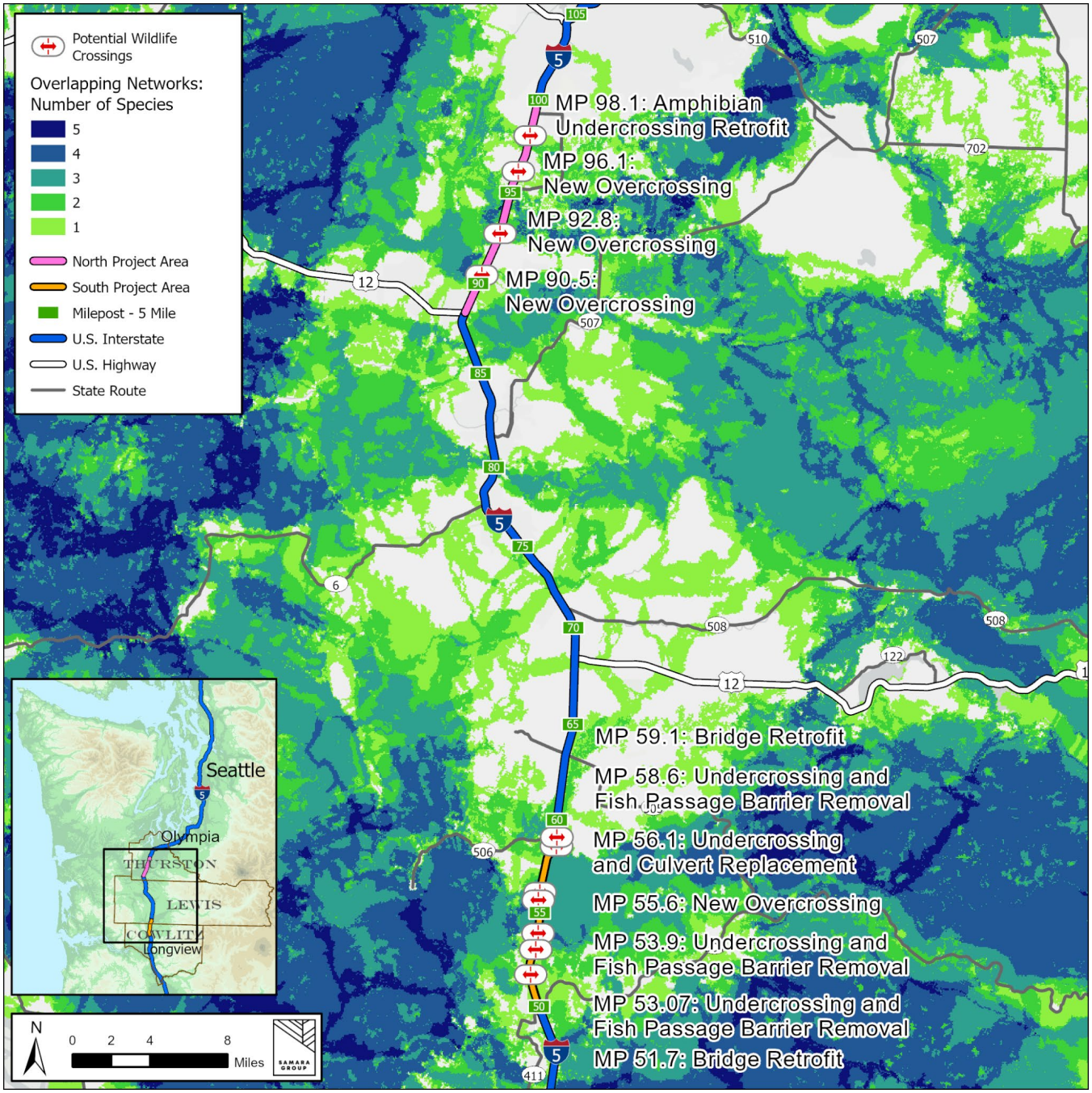

Figure 2-13. Overlapping networks multi-species composite data for the Cascades to Coast region created by the WWHCWG. This map shows the overlapping results of least-cost corridor analysis within the project area for landscape integrity and five focal species: cougar, western gray squirrel, mountain beaver, Pacific fisher, and American beaver (WWHCWG, 2022).

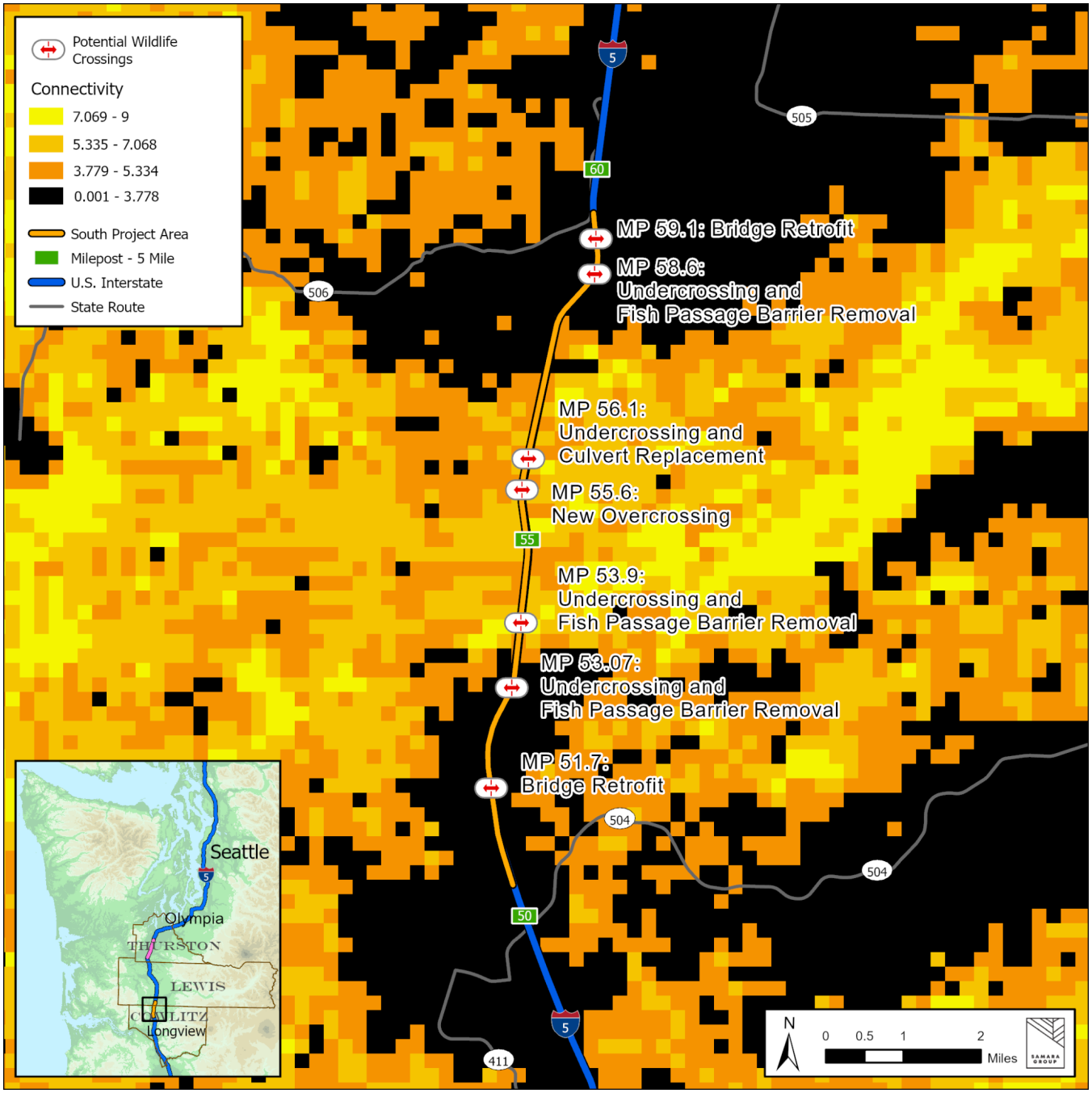

Figure 2-14. Cougar Connectivity raster data in the southern project area developed by the Olympic Cougar Project (unpublished analyses). These data were classified using the Geometric Interval method with six classes. The three lowest numbered classes were symbolized as black (to show low to no connectivity) and the three highest numbered classes were symbolized as graduated shades of orange to yellow to show higher connectivity, with the lightest shade of yellow representing the highest.

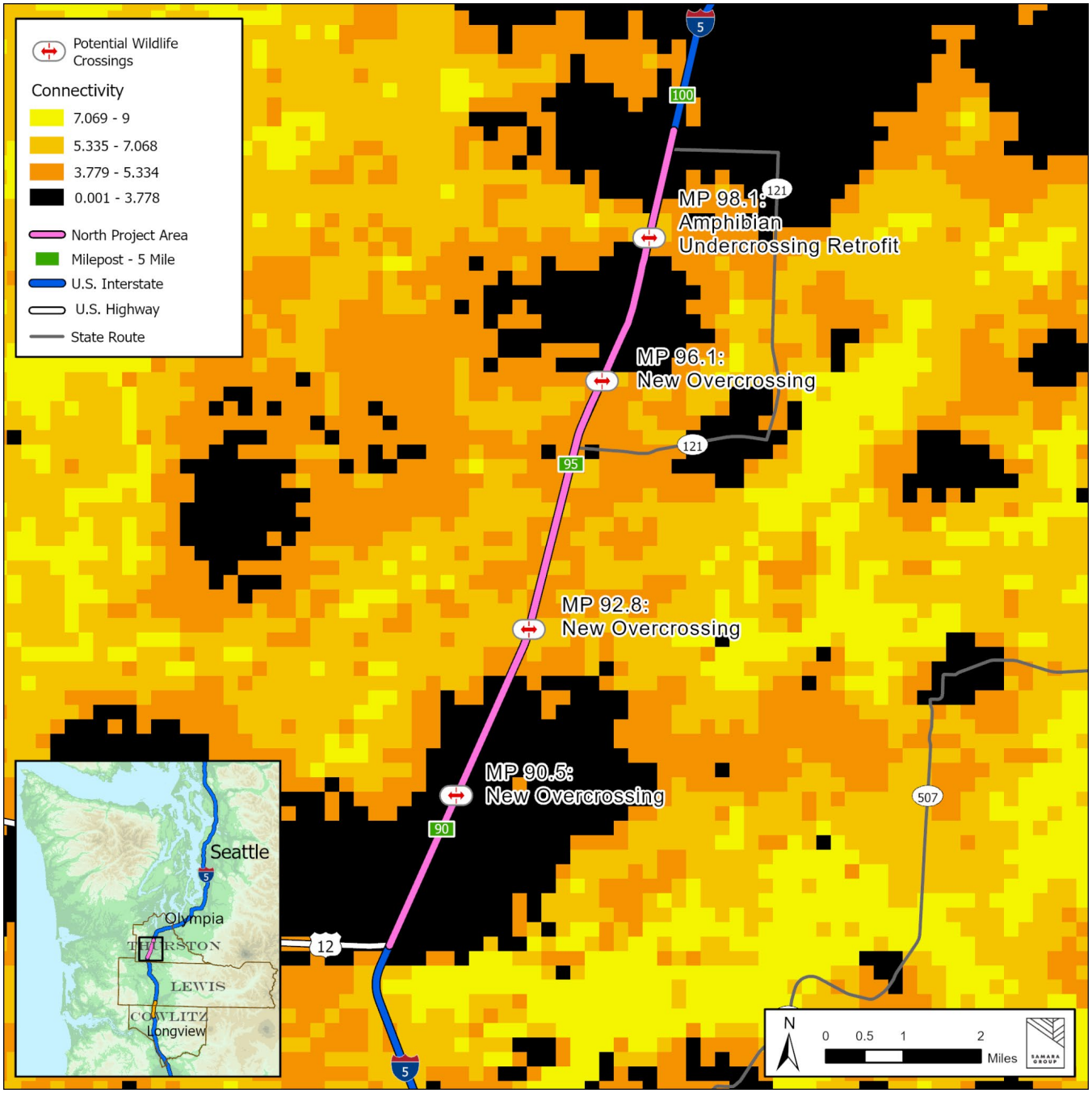

Figure 2-15. Cougar Connectivity raster data in the northern project area developed by the Olympic Cougar Project (unpublished analyses). These data were classified using the Geometric Interval method with six classes. The three lowest numbered classes were symbolized as black (to show low to no connectivity) and the three highest numbered classes were symbolized as graduated shades of orange to yellow to show higher connectivity, with the lightest shade of yellow representing the highest.

2.2 Physical Setting

The landscape in the project corridor is formed by a combination of volcanic, glacial, and fluvial (flowing water) processes which are continuing today (**Figure 2-16** and **Figure 2-17**). The southern project area has not experienced continental glaciation and has defined drainages with higher relief (total elevation change) compared to the northern project area.

In the southern project area, Miocene basalt flows (23 to 5 million years ago) similar to those found in the Columbia River Gorge are exposed near MP 53. The basalts are covered by the Pleistocene (2.58 million to 11,700 years ago) pre-Fraser alpine drift glacial sediments and Quaternary (11,700 years ago to present day) volcanic materials from Mt. St. Helens. The Toutle River is responding to the recent volcanic sediment through aggradation (filling in the channel bed) and widening; these processes are likely to continue for the foreseeable future. The Cowlitz River headwaters include Mt. Rainier and the river is likely to transport volcanic and glacial sediments.

In the northern project area, a small outcropping of Eocene (56 to 33.9 million years ago) basalt is exposed near MP 96 amidst the glacial sediments. The glacial sediments are a combination of till (compacted clays and silts deposited underneath glaciers) and outwash (sands, gravels, and boulders deposited by streams flowing out from the glaciers). Finer continental outwash sediments (sands and gravels) are present from approximately MP 95 to MP 100 and coarser continental outwash sediments (gravels and boulders) are present from approximately MP 88 to 92. Alpine glacial outwash (sands, gravels and boulders) is present from approximately MP 92 to 95.

Land use in the project area varies, with generally more protected and publicly-owned lands and large parcels of private timberland in the southern project area (**Figure 2-18**). The northern project area is more variable, with smaller parcels overall and more of them in private ownership (**Figure 2-19**).

Several non-highway roads (paved and unpaved) are present within the corridor which may affect wildlife movement (**Figure 2-20** and **Figure 2-21).** A road impact score was calculated for each proposed crossing site. The road impact score is a function of the density of roads within a 3-km buffer from the crossing site. Road density was determined by the length of road within the buffer multiplied by an impact factor:

- Paved roads with high traffic volume (highways, trunks, motorways) have an impact factor of 5.
- Paved roads with medium-high traffic volume (arterials, tertiary, secondary, and primary) have an impact factor of 4.
- Paved roads with medium traffic volume (residential, service) have an impact factor of 3.
- Paved roads with low-moderate traffic volume (track, driveway, alley), and unpaved roads with high traffic volume (USFS Operational Maintenance level 2) have an impact factor of 2.

- Trails and low volume unpaved roads (footway, cycleway, paths) have an impact factor of 1.

Road type (highway, arterial, residential, etc.) was used as a proxy for traffic volume for this analysis. This analysis used a combination of publicly available datasets including "Roads Data" downloaded from the Washington Geospatial Open Data Portal and Open Street Maps. This desktop analysis is for planning purposes. Road presence and type should be ground-truthed during design development.

In addition to site-specific conditions, general roadway baseline conditions affect the applicable engineering design criteria (**Appendix C**) and conceptual site designs (**Appendix D)**.

Roadway baseline conditions for I-5 in the project area include:

- Posted speed of 70 mph
- Roadway widths vary:
    - MP 51.7 to 56: three 12-ft lanes in each direction with 10-ft paved shoulders and variable-width paved median (total roadway width varies from approximately 60 ft to 100 ft)
    - MP 56 to 59.2: two 12-ft lanes in each direction with 10-ft paved shoulders and variable-width paved median (total roadway width varies from approximately 50 ft to 65 ft)
    - MP 90 to 98.1: three 12-ft lanes in each direction with 10-ft paved shoulders and variable-width paved median and climbing lanes (total roadway width varies from approximately 70 ft to 120 ft)
- Functional class designation: Rural Interstate
- T-1 freight and goods transportation system truck corridor (more than 10 million annual tons)
- Traffic flow (average annual daily traffic (AADT)) as of December 31, 2022:
    - MP 51.7 to 59.1: 44,000
    - MP 90.4 to 98.1: 68,000
- Truck flow (AADT) as of December 31, 2022:
    - MP 51.7 to 59.1: 12,000
    - MP 90.4 to 98.1: 12,000

Several rest areas are present within the northern and southern project areas. These are locations where human presence is currently high. If a structure were built nearby, the likelihood that humans may interact with that structure could be greater than in other locations (**Figure 2-22** and **Figure 2-23**).

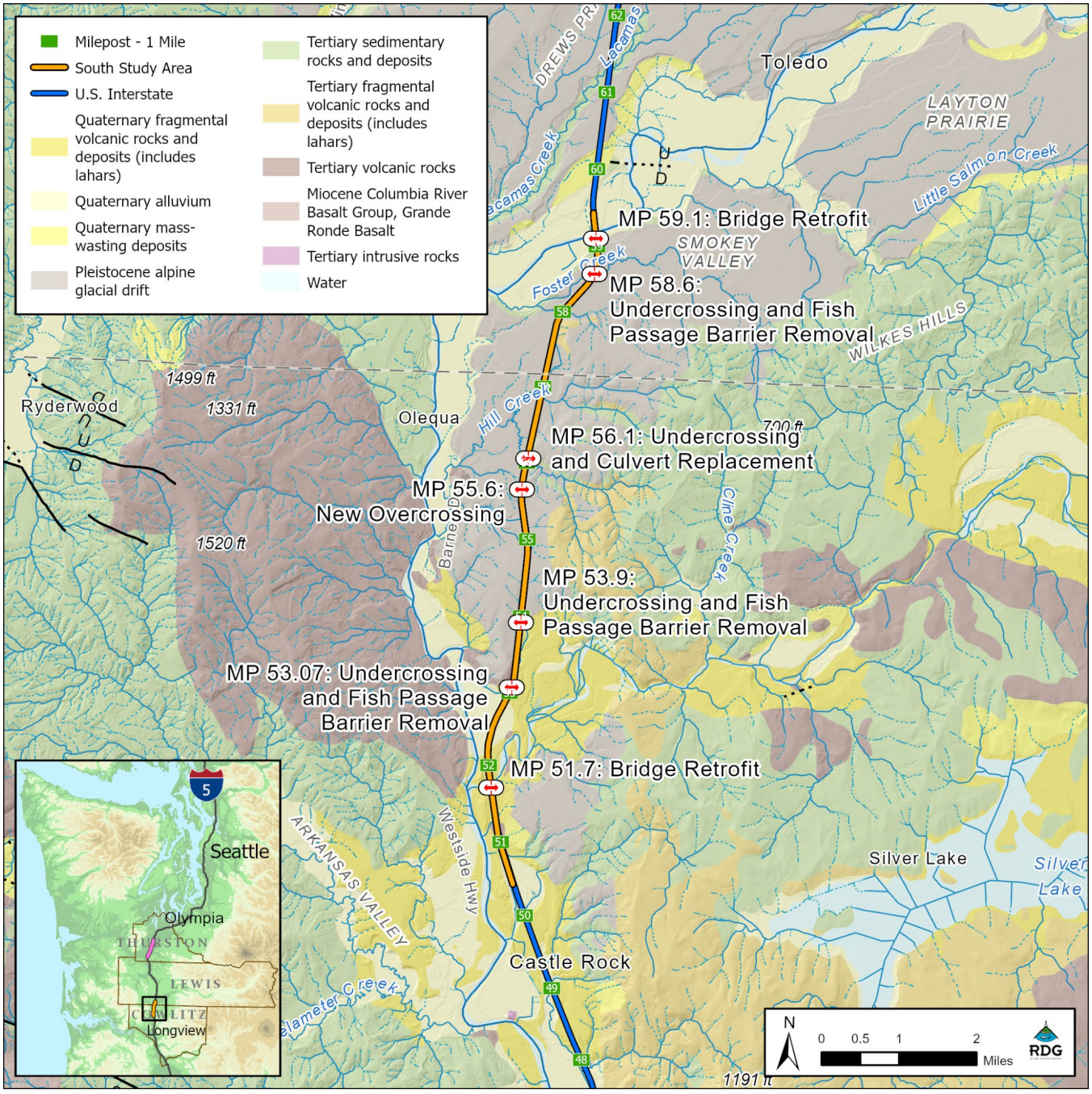

Figure 2-16. Surficial geology and faults in the South project area (WDGER, 2016).

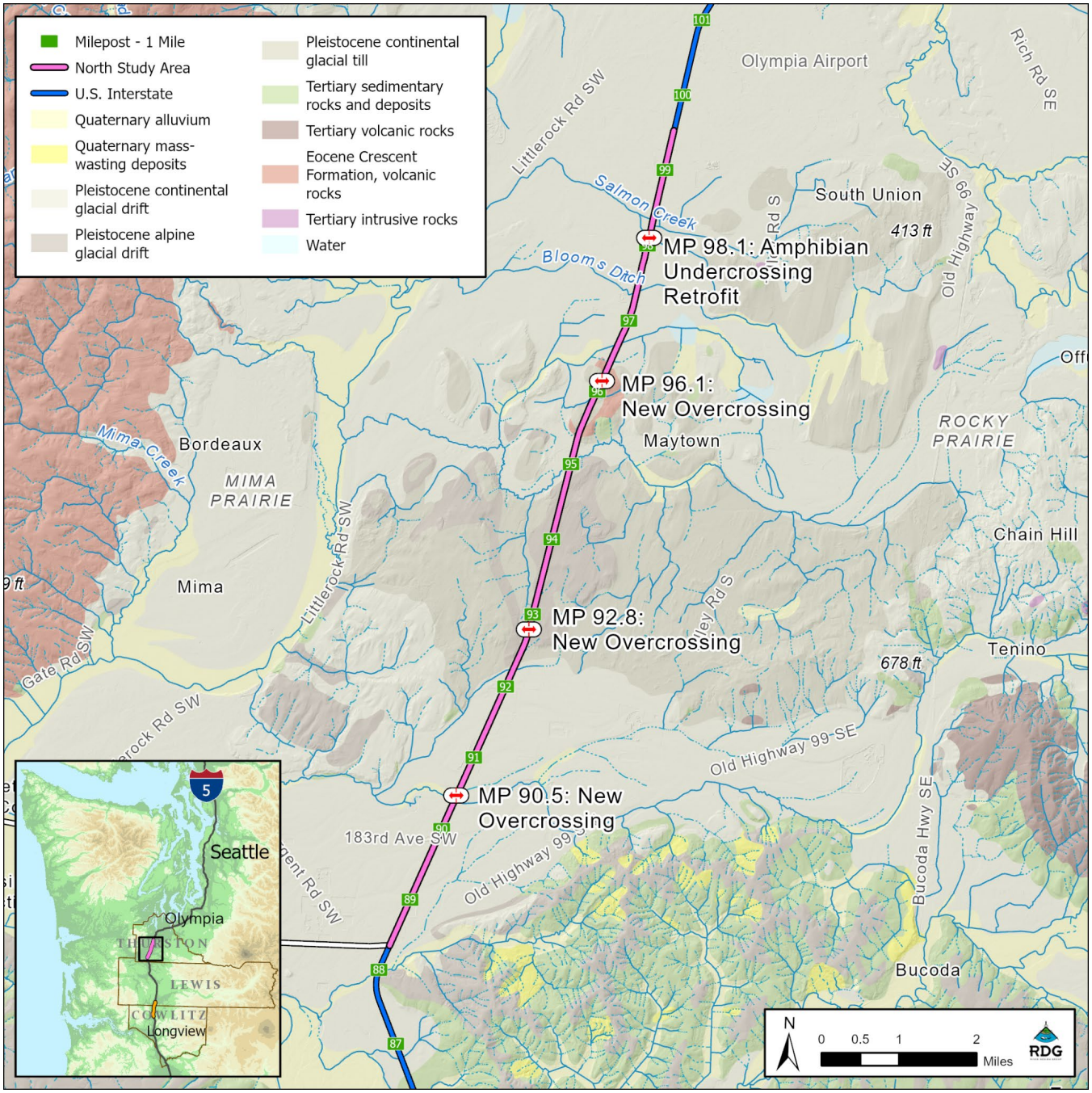

Figure 2-17. Surficial geology and faults in the North project area (WDGER, 2016).

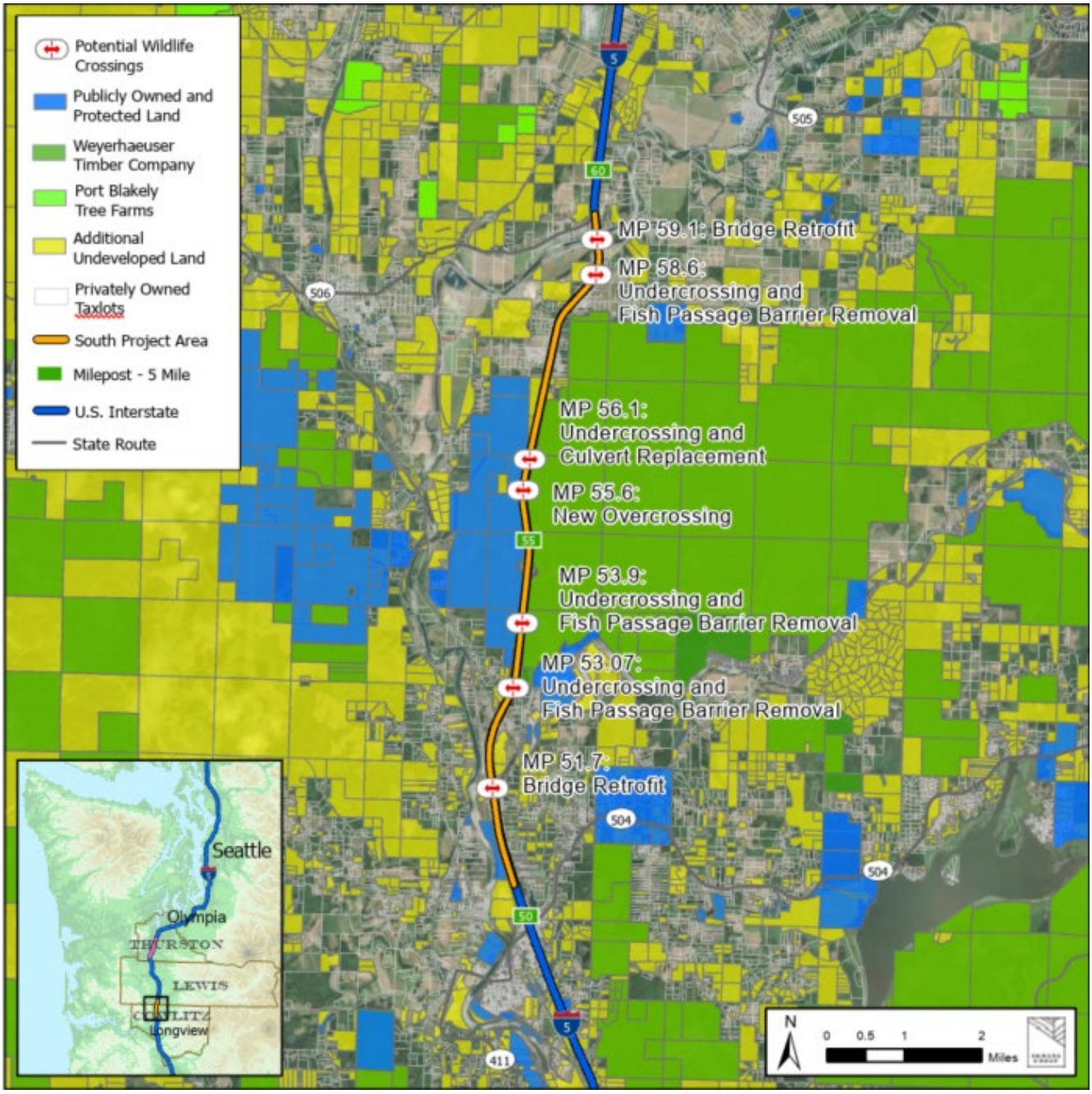

Figure 2-18. Land use, publicly owned lands, and conserved lands within the southern project area. "Publicly Owned and Protected Lands" were determined using a combination of USA Parks, WA DNR Land Parcels, and USGS Protected Areas Database. Other designations were determined using three parcel datasets for the respective counties within the project areas, Thurston, Lewis, and Cowlitz.

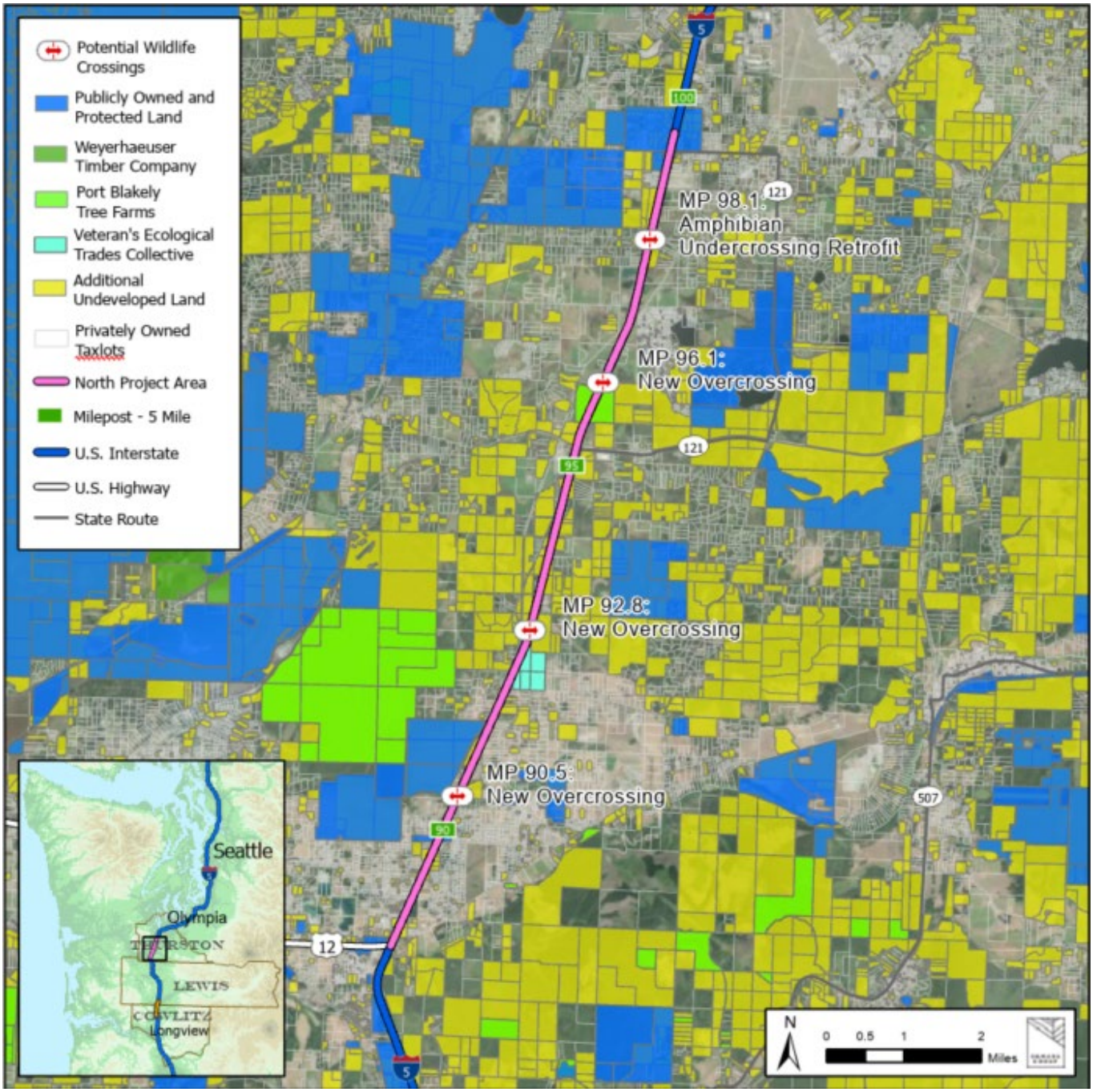

Figure 2-19. Land use, publicly owned lands, and conserved lands within the northern project area. "Publicly Owned and Protected Lands" were determined using a combination of USA Parks, WA DNR Land Parcels, and USGS Protected Areas Database. Other designations were determined using three parcel datasets for the respective counties within the project areas, Thurston, Lewis, and Cowlitz.

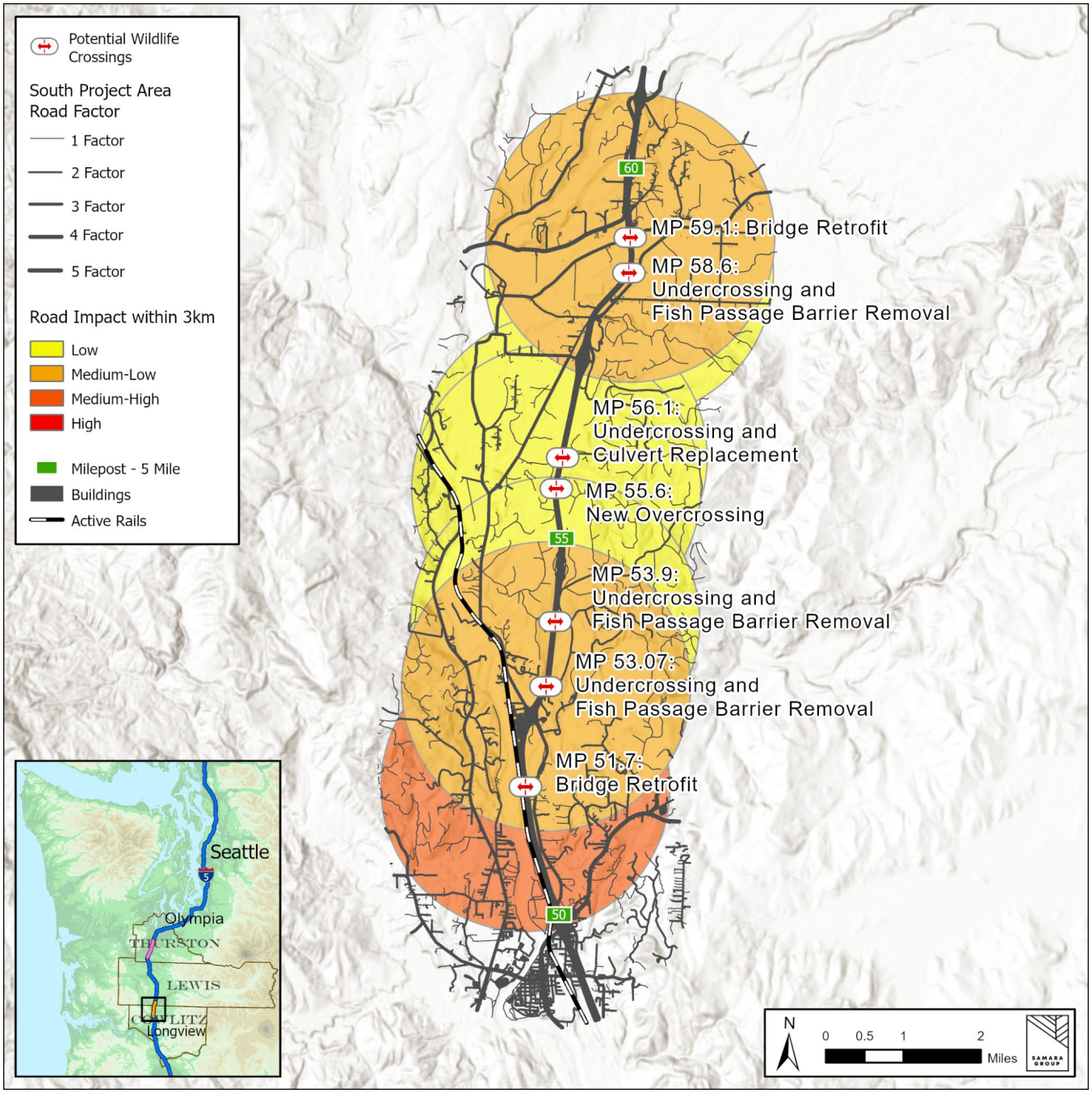

Figure 2-20. Road impact score in the southern project area. The road impact score is a function of the density of roads and trails within a 3-km buffer from the crossing site. Road density was determined by the length of road within the buffer multiplied by an impact factor ranging from 5 to 1, with 5 being assigned to roads with the highest theoretical traffic volume such as highways, and a factor of 1 being assigned to trails and low volume unpaved roads.

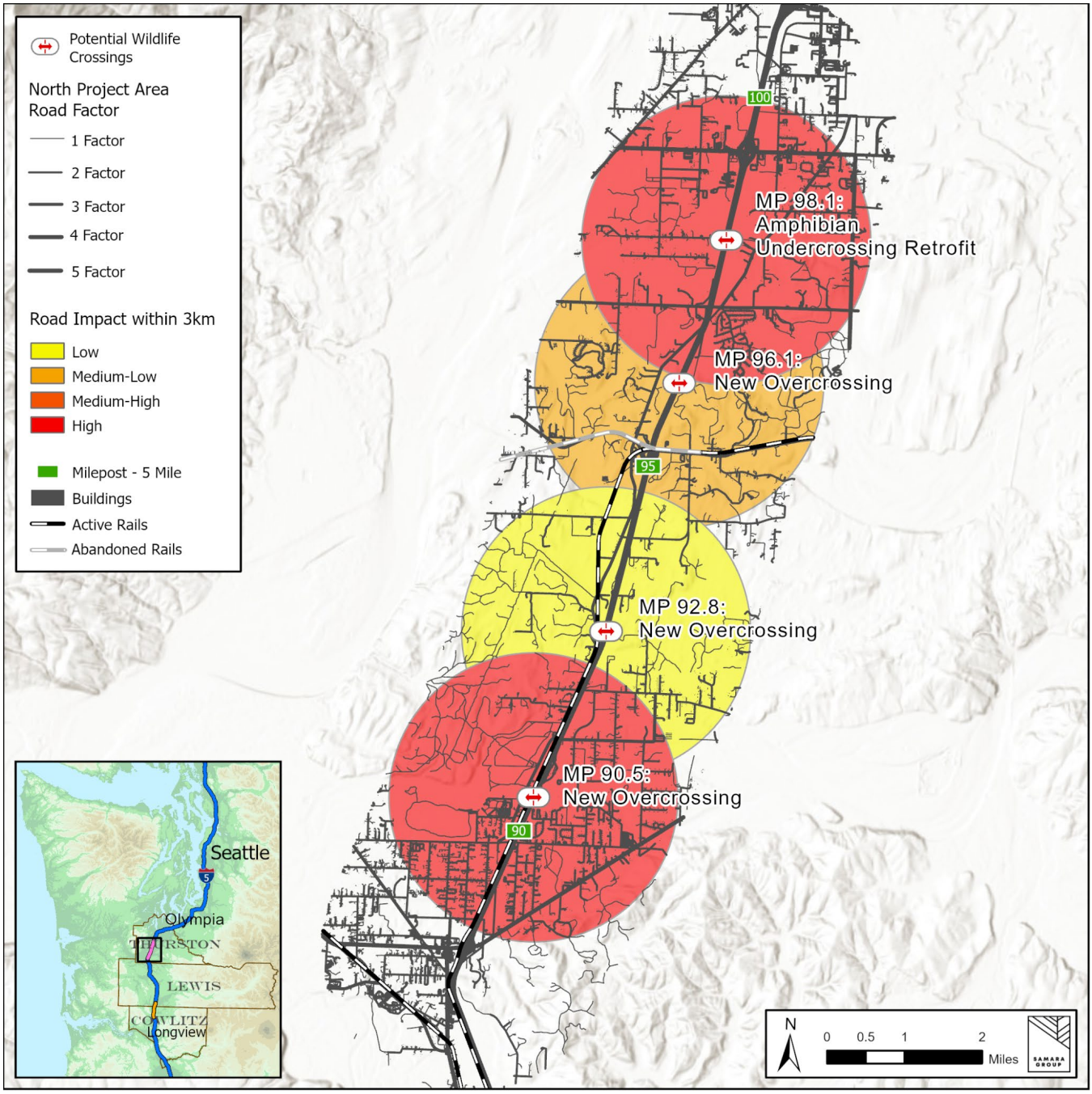

Figure 2-21. Road impact score in the northern project area. The road impact score is a function of the density of roads and trails within a 3-km buffer from the crossing site. Road density was determined by the length of road within the buffer multiplied by an impact factor ranging from 5 to 1, with 5 being assigned to roads with the highest theoretical traffic volume such as highways, and a factor of 1 being assigned to trails and low volume unpaved roads.

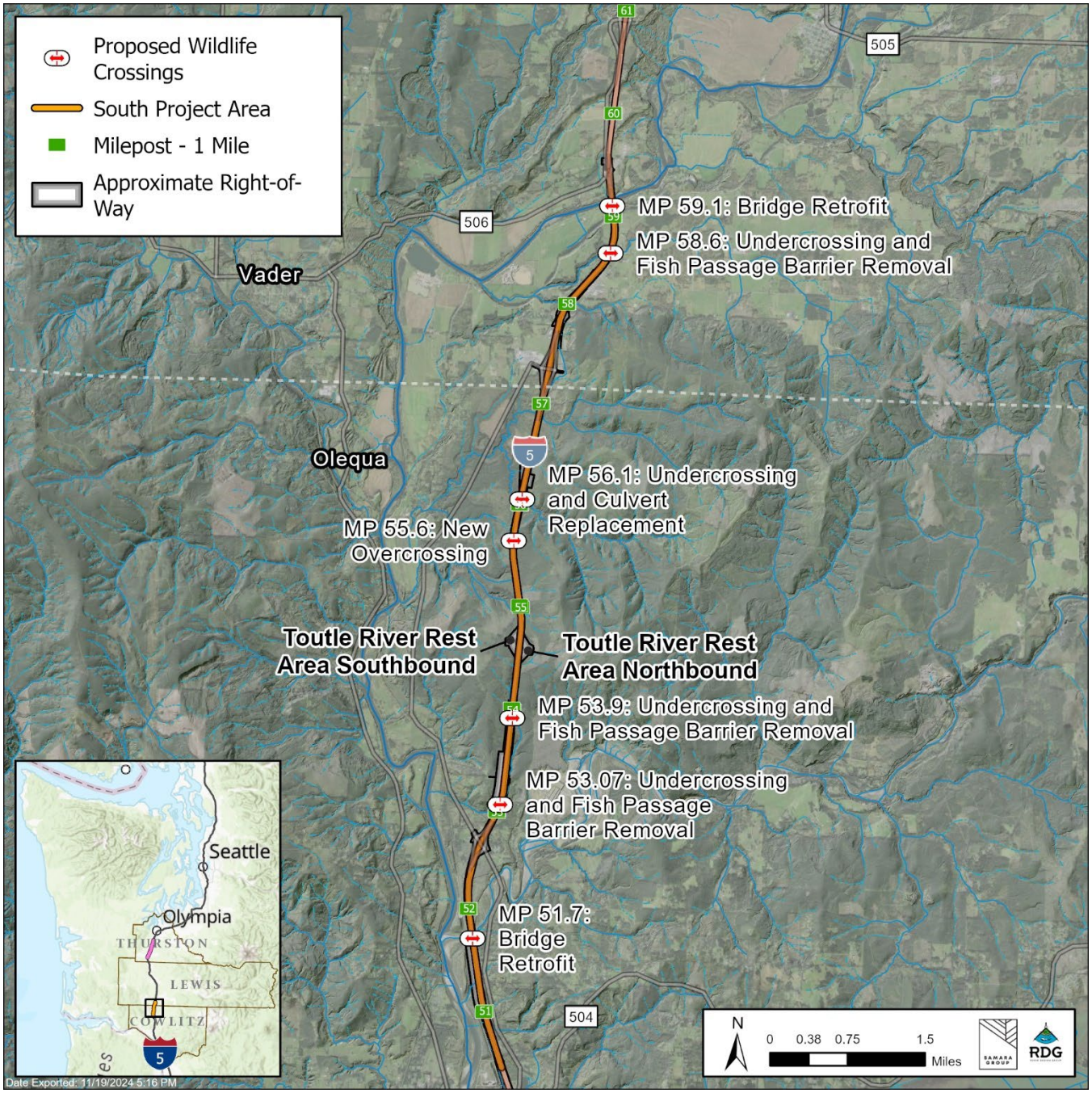

Figure 2-22. Location of rest areas within the southern project area.

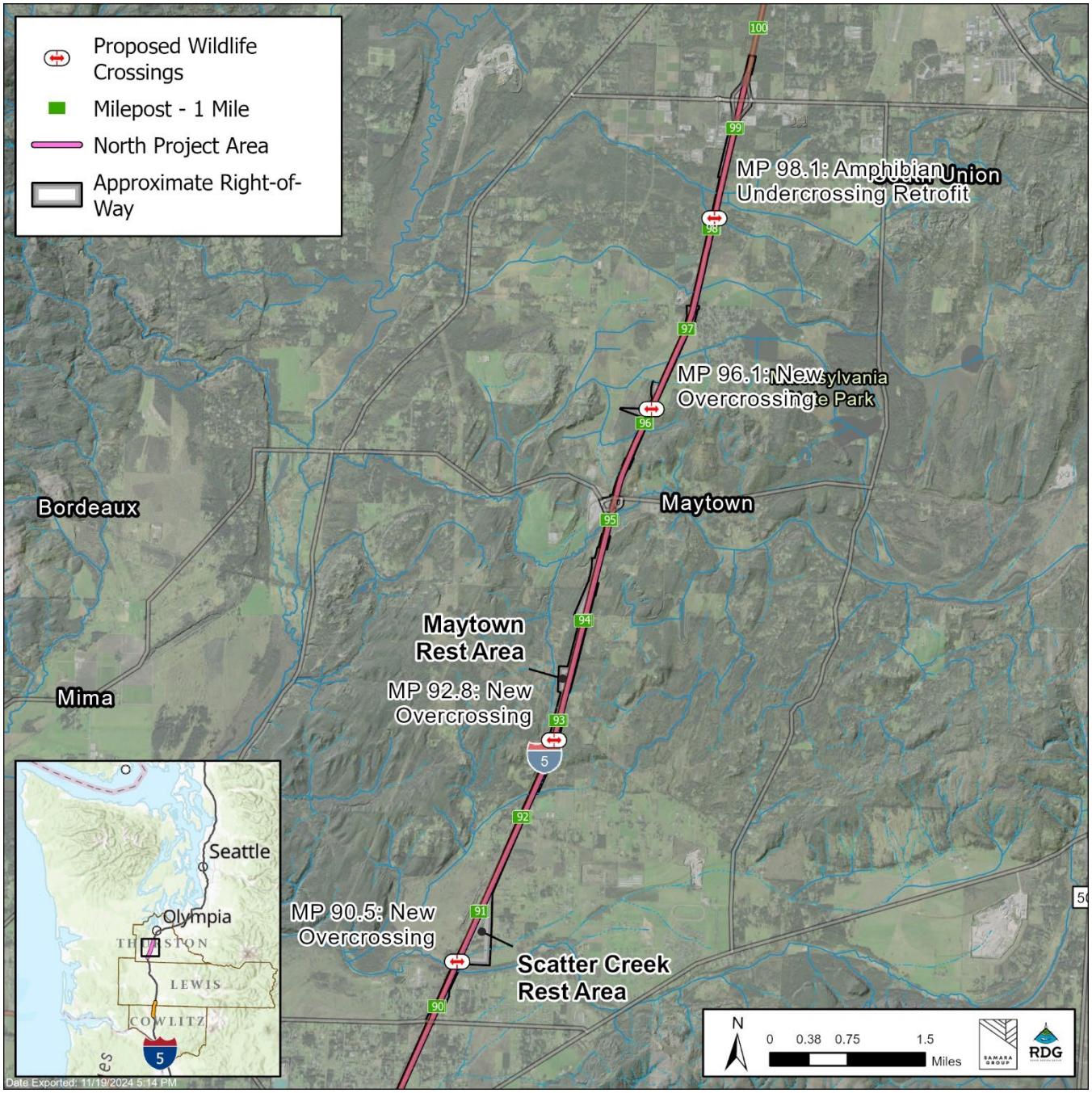

Figure 2-23. Location of rest areas within the northern project area.

3 Decision Matrix

The purpose of the decision matrix is to compare the proposed crossings in a corridor context. The matrix was developed collaboratively by SG, relying on their expertise as well as the contributions from project partner interviews, existing data provided by SC and TAG members, the full partner meeting, and design workshops. The decision matrix (**Table 3-1**) was developed based on the priorities and concerns that the TAG shared during the interview process. The decision matrix converts data from the project area and the proposed crossing structure locations into a score based on desired conditions. These values are then combined to provide a total score.

This information can support project partners in evaluating the trade-offs when choosing which crossing structure(s) to move forward with first in a corridor strategy. These data are provided as a decision support tool; however, not all the priorities discussed were associated with available data. In addition, group priorities may change or new information, such as additional camera monitoring data and subsequent reports from WSDOT, may alter and influence group decision making.

The categories included in this decision matrix framework are:

1. Species of Special Concern (Presence)
2. Human Disturbance Potential
3. Landscape Context
4. Modeled Wildlife Movement

To evaluate species of special concern we first analyzed remote camera and reptile/amphibian survey data provided by WSDOT and assessed detections of species described as priorities by the TAG during the interview process and/or reptile/amphibians of species conservation status in Washington state (see Section 2.1). Some priority species were not detected during camera monitoring activities and are thus excluded from the decision matrix, including western gray squirrel, Mazama pocket gopher, Cascade torrent salamander, and prairie butterfly species. To assign scores for each species, we determined the maximum number of detections at any one location and used that value to calculate a percentage of the maximum for each species at each proposed crossing location. This percentage then informed the decision matrix score ranging from 0 to 3, with 0% = 0, >0-25% = 1, >25%-70% = 2, and >70% = 3. These data were not normalized by trap effort, and further analysis and reporting by WSDOT may provide more nuanced results.

Human disturbance potential includes the proximity of rest areas, the density of the road network (road impact score, see Section 2.2) and the proximity to roads. The presence and proximity of these elements would enhance the likelihood of human presence at a potential crossing structure location and were scored with negative values ranging from 0 indicating the least impact, to -3 indicating the greatest impact. The proximity of rest areas was scored by measuring the distance from the proposed project location to the nearest rest area. Using common standards for walkable distances we determined that rest areas less than 0.5 miles (2,640 ft) would have the highest potential for human presence and was given a score of -3, with each additional quarter mile increasing the score as follows: 0.5-0.75 miles = -2, >0.75-

1.0 miles = -1, and >1.0 miles = 0. Actual values were measured in feet and ranged from 1,983 ft, to 24,731 ft. The road impact score and proximity to nearest road were both scored relative to each other with 0 being the lowest likelihood of disturbance to wildlife and -3 being the highest. Quartiles were used to differentiate between decision matrix scores. Road impact scores for proposed crossing sites ranged from 775,366 to 1,202,735. Proximity to nearest road ranged from 47 ft to 746 ft.

The landscape context categories consider various factors within a 3 km buffer around each proposed crossing structure:

- The Protected Lands category includes current parcels for Washington State downloaded from the Washington Geospatial Open Data Portal website on February 19, 2024. Additionally, data from USA Parks, USA Federal Lands, USGS Protected Area Database, and WA DNR Managed Land data were added to the map and merged to represent publicly owned and/or protected lands. Based on feedback from project partners we included Weyerhaeuser, Port Blakely, and Veterans Trade Collective parcels in the calculated percentage based on current and expected cooperation and conservation agreements if a wildlife crossing project is implemented adjacent to these areas. Values ranged from 7% to 70% protected land use coverage. Scores were assigned as follows: ≤ 25% = 1, >25%-50% = 2, >50% = 3.

- Collision Risk Value scores were assessed using an Optimized Hot-spot Analysis Polygon Heatmap provided by WSDOT (large animal carcass removal data 2013-2022). The dataset classifies areas by confidence level of a hot spot with a confidence level of 99% classified as 3, 95% as 2, 90% as 1, and statistically insignificant areas classified as 0. The results show that of the 12 polygons that fall within 3km of the potential crossings in the northern project area, all are of no statistical significance except one. Of the 12 polygons that fall within 3km of the potential crossings in the southern project area, 6 are 99% confidence hot spots, 4 are 95% confidence hot spots, 1 is a 90% confidence hot spot, and 1 has no statistical significance. These results are for the polygons that fall along I-5 only and no other roads that fall within the buffered areas. A collision risk metric was calculated for each site by summing the classification of all polygons within 3km of the site and calculating the percentage of that value relative to the highest possible value (where each polygon is classified as 3). Decision matrix scores were then assigned based on the percentage, with 0% = 0, >0-33% = 1, >33-66% = 2, and >66% = 3

- Fish passage barrier status indicates if the crossing location will correct a fish passage barrier and is scored between 0, indicating no correction, and 1 if the location will correct a fish passage barrier.

- Climate Connectivity (Current and Future) category considers whether the climate model pixels are in a “current” and “future” connectivity projection (see purple-hued pixels in Figure 2-5). Values ranged from 0% to 65%. If 0% = 0, >0-25% = 1, >25-50% = 2 and values >50% = 3.

- Riparian Forested Landcover Area was assessed by comparing the proportion of linear feet of streams that also intersect with forest cover. Values ranged from 92% to 35% with scores <40% = 1, 40-80% = 2, >80% = 3.

The Modeled Wildlife Movement category considered average home range sizes for each species and then compared the percentage of the area within that buffer, that also falls within the top 3 or 4 categories of the model output as indicated in Figure 2-6 through Figure 2-12. Scores were distributed with 0% = 0, >0-33% = 1, >33-66% = 2, >66% = 3.

Table 3-1. Decision Matrix

		Southern Project Area							***Northern Project Area***			
Evaluation Category	***Evaluation Metric***	MP 51.7 Bridge Retrofit	MP53.07 Undercrossing	MP 53.9 Undercrossing	MP 55.6 Overcrossing	MP 56.1 Undercrossing	MP 58.6 Undercrossing	MP 59.1 Bridge Retrofit	MP 90.5 Overcrossing	MP 92.8 Overcrossing	MP 96.1 Overcrossing	MP 98.1 Amphibian Retrofit
Species of Special Concern (Presence) Is the proposed crossing structure within a 3 km buffer from known species presence locations, score indicates the level of detection for the given species at each monitoring location	Dunn's salamander	0	3	3	3	3	0	0	0	0	0	0
	Northern alligator lizard	0	0	0	0	0	0	0	0	3	3	0
	Western toad	0	0	0	3	0	0	0	0	0	0	0
	Black bear	1	1	2	2	2	1	0	1	3	1	0
	American beaver	3	3	3	2	2	1	1	0	1	1	2
	Black-tailed deer	1	2	2	3	3	2	1	1	2	2	1
	Cougar	1	2	2	3	3	0	0	0	2	1	0
	Elk	1	1	2	2	2	0	0	0	3	1	0
	Pacific fisher	0	3	3	3	3	0	0	0	0	0	0
	Total Species of Special Concern (Presence)	**7**	**15**	**17**	**21**	**18**	**4**	**2**	**2**	**14**	**9**	**3**
Human Disturbance Potential	Road Impact Score	-2	-1	-1	-1	-1	-1	-1	-3	-1	-2	-3
	Proximity to Nearest Road	-3	-2	-1	-2	-2	-1	-3	-1	-1	-1	-2
	Proximity to Nearest Rest Area	0	0	-2	-1	0	0	0	-3	-2	0	0
	Total Human Disturbance Potential	**-5**	**-3**	**-4**	**-4**	**-3**	**-2**	**-4**	**-7**	**-4**	**-3**	**-5**
Landscape Context Categories consider various factors within a 3 km buffer around each proposed crossing structure	Protected Lands	1	2	3	3	3	1	1	2	1	1	1
	Collision Risk Value	3	3	3	3	3	2	2	0	0	0	1
	Fish passage barrier status	0	1	1	0	0	1	0	0	0	0	1
	Climate Connectivity (Current & Future)	1	2	3	3	2	0	0	0	0	0	0
	Riparian Forested Landcover Area	3	3	3	3	3	2	2	2	3	2	1
	Total Landscape Context	**8**	**11**	**13**	**12**	**11**	**6**	**5**	**4**	**4**	**3**	**4**
Modeled Wildlife Movement Percentage of area within buffer that falls within the top categories of the least-cost corridor	American beaver (245m buffer)	3	1	3	3	3	3	3	3	0	3	3
	Western gray squirrel (325m buffer)	0	0	0	0	0	0	0	1	3	0	0
	Fisher (20km buffer)	2	3	3	3	3	2	2	1	3	3	2
	Cougar (20km buffer)	2	2	2	2	2	2	1	3	3	2	2
	Total Modeled Wildlife Movement	**7**	**6**	**8**	**8**	**8**	**7**	**6**	**8**	**9**	**8**	**7**
	Total Score	**17**	**29**	**34**	**37**	**34**	**15**	**9**	**7**	**23**	**17**	**9**

4 Corridor Strategy

We recommend that the Decision Matrix be used to compare sites within each project area and not between areas. While the majority of the high values are found in the southern project area, it is useful to consider that the two project areas represent distinct habitat types, supporting different species assemblages and providing differing resources. Habitat connectivity in the northern project area is most constrained by development and private land parcels and some of the crossing locations may be part of some of the last viable pathways of movement for large ranging species. A crossing would maintain safe movement across I5 and through that investment would also emphasize the importance of preserving the larger, landscape level connectivity pathway.

Considering the Decision Matrix scores in the southern project area the top value was associated with the MP 55.6 Overcrossing. This location scored among the highest in most categories with the highest value for Species of Special Concern (Presence), the fourth highest for Human Disturbance Potential, the second highest for Landscape Context, and the highest value for Modeled Wildlife Movement. The undercrossings at MP 53.07, MP 53.9, and MP 56.1 also had relatively high scores. The undercrossings at MP 53.07 and MP 53.9 should be packaged for implementation because the crossings are located on the same stream, and both fish passage barriers would need to be removed to achieve greater aquatic habitat connectivity.

The remaining sites in the southern project area are of lower priority based on the Decision Matrix values. These locations could still contribute habitat connectivity value if constructed but may be less valuable than the higher scoring structures. The bridge retrofits at MP 51.7 and MP 59.1 had relatively low scores due to low species detections and high potential for human disturbance; however, vegetation retrofits may provide multiple benefits to wildlife and recreation at relatively low cost. More information is needed on bridge expansion joint retrofits to determine feasibility and probable cost.

Considering the Decision Matrix scores in the northern project area the top value was associated with the overcrossing proposed at MP 92.8. This location scored highest in all categories in the northern project area. The proposed overcrossing at MP 96.1 also scored favorably and while the score is less than 92.8, we recommend MP 96.1 also be considered a high priority due to constructability considerations in that it is adjacent to a large WSDOT right of way area that could be more easily used for staging of construction materials.

The proposed overcrossing at MP 90.5 scored relatively low based on the Decision Matrix values. An additional consideration at the proposed overcrossing at MP 90.5 is that the habitat area nearby includes mapped wetlands that construction would likely impact. While the proposed amphibian fencing retrofit at MP 98.1 also scored relatively low, this is not indicative of the value of the crossing structure itself. The proposed retrofit will be a favorable addition to the crossing replacement at this location, but our contributions within this report only include fencing features, and therefore are not directly comparable to the other sites.

This information can support the TAG in evaluating a variety of factors when choosing which crossing structure(s) to move forward and is provided as a decision support tool. However,

the applications are necessarily limited. The Decision Matrix topics represent concepts and species that were determined to be a priority, and also had corresponding data available to us. Importantly, data was not available for every priority and as efforts continue group priorities may change or new information may alter and influence group decision making. Additional factors not currently included in the decision matrix may ultimately be weighted more heavily if a given proposed crossing location moves forward (i.e. cost, constructability, new species/biological data, partnership efforts, etc). Project partners should continue working together to determine appropriate priorities and next steps toward constructing one or several of the proposed structures. **Table 4-1** summarizes decision matrix scores and total probable costs (see Section 10) for the proposed crossing sites.

Table 4-1. Summary of Decision matrix scores and opinions of probable cost for proposed wildlife crossings.

	Proposed Crossing Project Location	Decision Matrix Score	Total Probable Cost (Millions)
Northern Project Area	MP 55.6 Overcrossing	37	$23.24
	UNT Cowlitz River MP 53.9 Undercrossing	34	$40.31
	UNT Hill Creek MP 56.1 Undercrossing	34	$27.99
	UNT Cowlitz River MP 53.07 Undercrossing	29	$30.07
	Toutle River MP 51.7 Bridge Retrofit	17	$1.96
	Foster Creek MP 58.6 Undercrossing	15	$21.50
	Cowlitz River MP 59.1 Bridge Retrofit	9	$0.77
Southern Project Area	MP 92.8 Overcrossing	23	$29.79
	MP 96.1 Overcrossing	17	$27.09
	Scatter Creek MP 90.5 Overcrossing	7	$27.72
	UNT Salmon Creek MP 98.1 Amphibian Fencing	9	$0.49

5 Wildlife Passage Conceptual Designs

This section of the report summarizes the baseline conditions and conceptual design for each proposed wildlife crossing. The proposed crossings were selected collaboratively with the design team and project partners during Workshop 2 and subsequent discussions.

Conceptual designs were developed for 11 crossings in the project corridor (**Table 5-1**):

- 7 crossings in the southern project area between MP 51.7 and 59.1 (**Figure 5-1**), and
- 4 crossings in the northern project area between MP 90.5 and 98.1 (**Figure 5-2**).

Proposed projects fall into 4 categories:

1. New overcrossings (4 sites),
2. Undercrossings replacing existing culverts (4 sites),
3. Bridge retrofits to reduce noise (2 sites), and
4. Directional fencing retrofit for amphibians (1 site).

Conceptual design drawings were developed for each proposed wildlife crossing (**Appendix D**). Wildlife fencing is an essential component of successful wildlife crossings. Fencing design is discussed in greater detail in Section 6. Sections 7 through 11 contain additional details including design data needs, anticipated permit requirements, and costs for the project.

Proposed new structures include undercrossings and overcrossings. The layout and geometry of each crossing depends on the adjacent terrain and roadway configuration. All alternatives assume there will be no modification of the existing road geometry. Future design phases will need to consider the potential for roadway widening, guardrail installation, or other road modifications. All structures with spans (measured along roadway centerline) greater than 20 ft would likely be added to the National Bridge Inventory and require regular bridge inspections.

Table 5-1. Conceptual design summary.

Site	Crossing Type	Existing Species Usage	Anticipated Species Usage
MP 51.7 Toutle River	Bridge retrofit with native vegetation and engineered structures in expansion joints	Likely to occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote.	Aquatic species, small and medium mammals
MP 53.07 UNT Cowlitz River	Undercrossing (culvert replacement)	Unknown. Fish passage barrier.	Aquatic species, small and medium mammals, large mammals if approach conditions are suitable

Site	Crossing Type	Existing Species Usage	Anticipated Species Usage
MP 53.9 UNT Cowlitz River	Undercrossing (culvert replacement)	Currently unlikely to pass any species. Fish passage barrier.	Aquatic species, small and medium mammals, large mammals if approach conditions are suitable
MP 55.6	Overcrossing	N/A no structure exists at this location	Terrestrial species including vegetation, invertebrates, and birds
MP 56.1 UNT Hill Creek	Undercrossing (culvert replacement)	Likely passing bear, raccoon, and other species comfortable with wading through water. Not listed as a fish passage barrier.	Aquatic species, small and medium mammals, large mammals if approach conditions are suitable
MP 58.6 Foster Creek	Undercrossing (culvert replacement)	Likely passing bear, raccoon, and other species comfortable with wading through water. Fish passage barrier.	Aquatic species, small and medium mammals, large mammals if approach conditions are suitable
MP 59.1 Cowlitz River	Bridge retrofit with native vegetation and engineered structures in expansion joints	Likely to occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote.	Aquatic species, small and medium mammals
MP 90.5	Overcrossing	N/A no structure exists at this location	Terrestrial species including vegetation, invertebrates, and birds
MP 92.8	Overcrossing	N/A no structure exists at this location	Terrestrial species including vegetation, invertebrates, and birds
MP 96.1	Overcrossing	N/A no structure exists at this location	Terrestrial species including vegetation, invertebrates, and birds
MP 98.1 UNT Salmon Creek	Amphibian Retrofit	Unknown. Fish passage barrier.	Aquatic species, small and medium mammals, large mammals if approach conditions are suitable

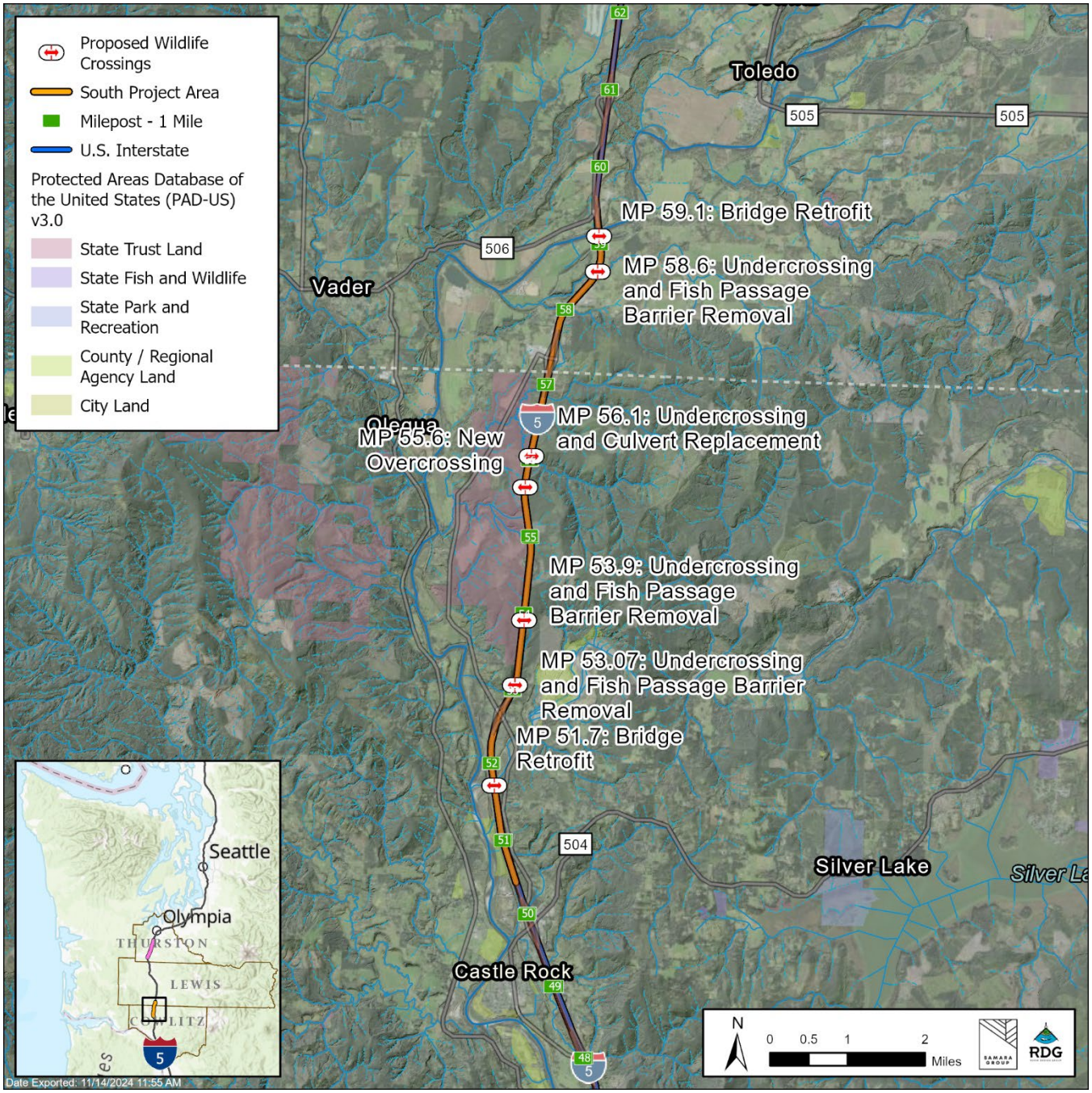

Figure 5-1. Proposed crossings in the southern project area.

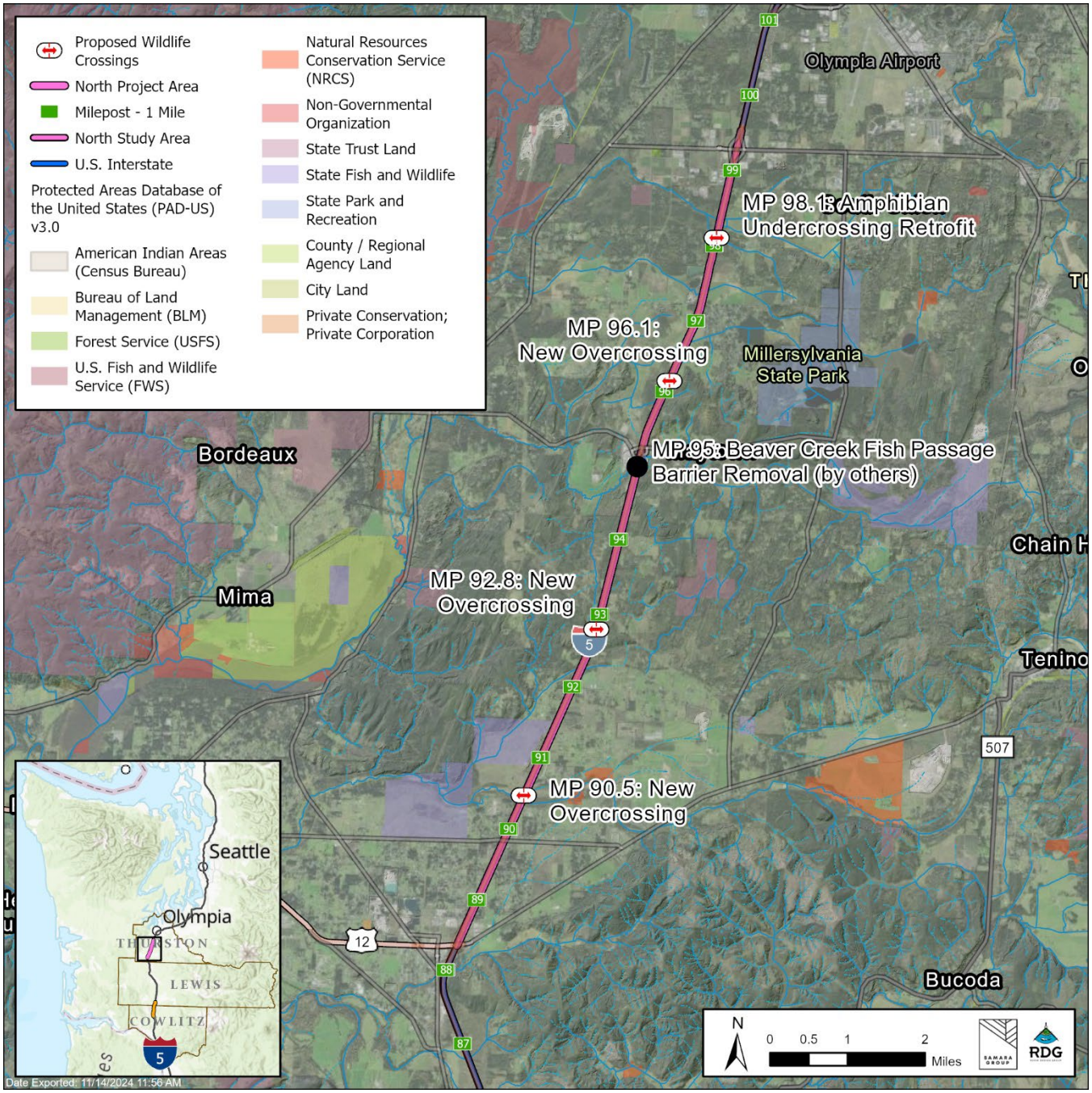

Figure 5-2. Proposed crossings in the northern project area.

5.1 General Undercrossing Design

The undercrossings are intended to provide passage for fish, amphibians, and small or medium sized animals. Undercrossings are proposed with a minimum vertical clearance (within the crossing structure) of 15 ft above the dry bench which is a minimum of 5 ft above the bottom of the channel. Undercrossings are designed with a minimum openness ratio (calculated as the product of width and height divided by crossing length, all dimensions in feet) of 18 and a preferred openness ratio of 23. The undercrossing may pass large animals such as elk if the behavioral conditions for approach are suitable (i.e. animals are willing to approach the crossing based on surrounding landscape conditions). An undercrossing is unlikely to change plant community connectivity compared to baseline conditions. Undercrossing designs would restore the existing highway geometry after the crossing is constructed (no change to roadway geometry).

The proposed undercrossings were sized to accommodate the bankfull channel width including the potential for lateral migration. A dry bench is included above the likely active floodplain to facilitate wildlife passage at all flows. Detailed hydrologic, hydraulic, and geomorphic analysis will be completed in future design phases (beyond conceptual design) to refine the channel design if an undercrossing is selected for implementation.

Construction of the undercrossings would require disruption of the existing roadway and likely lane closures to excavate the new crossing. Construction extending beyond the existing right-of-way will require landowner agreements or land acquisition. The channels conveyed in the existing culverts will be impacted during construction and require temporary water management. Construction will likely be limited to the approved in-water work windows. Design and permitting costs include the geomorphic, hydrologic, and hydraulic analyses for fish passage and hydraulic project approval prior to construction.

5.2 General Overcrossing Design

The overcrossings are intended to provide passage to terrestrial wildlife species of all sizes including deer and elk, a pathway for invertebrate travel safe from vehicle strikes, connectivity for the plant community through vegetation over the crossing, and safer routes for low flying and more terrestrially based bird species. The overcrossing may also provide passage to amphibians by including microtopography that would support temporary ponding during snowmelt and precipitation events. Sidewalls and vegetation on the structure may also mitigate potential wildlife behavioral impacts caused by noise, smell, wind turbulence, and artificial light generated by the highway below.

Overcrossings would be a minimum of 150 ft wide (perpendicular to wildlife movement). The low chord would be approximately 20 ft (minimum above the pavement surface) to provide clearance for high freight traffic. The total length of the overcrossing and total area of impact depends on how the overcrossing ties into the adjacent terrain and roadway geometry. **Figure 5-3** illustrates typical overcrossing configurations. Retaining walls may be required to support the approaches for overcrossings that are not located in existing roadcuts. This detail will be refined during future design phases. Noise barrier berms or walls could be added to extend the noise, light, and smell mitigation further along the highway by the approaches to the crossing.

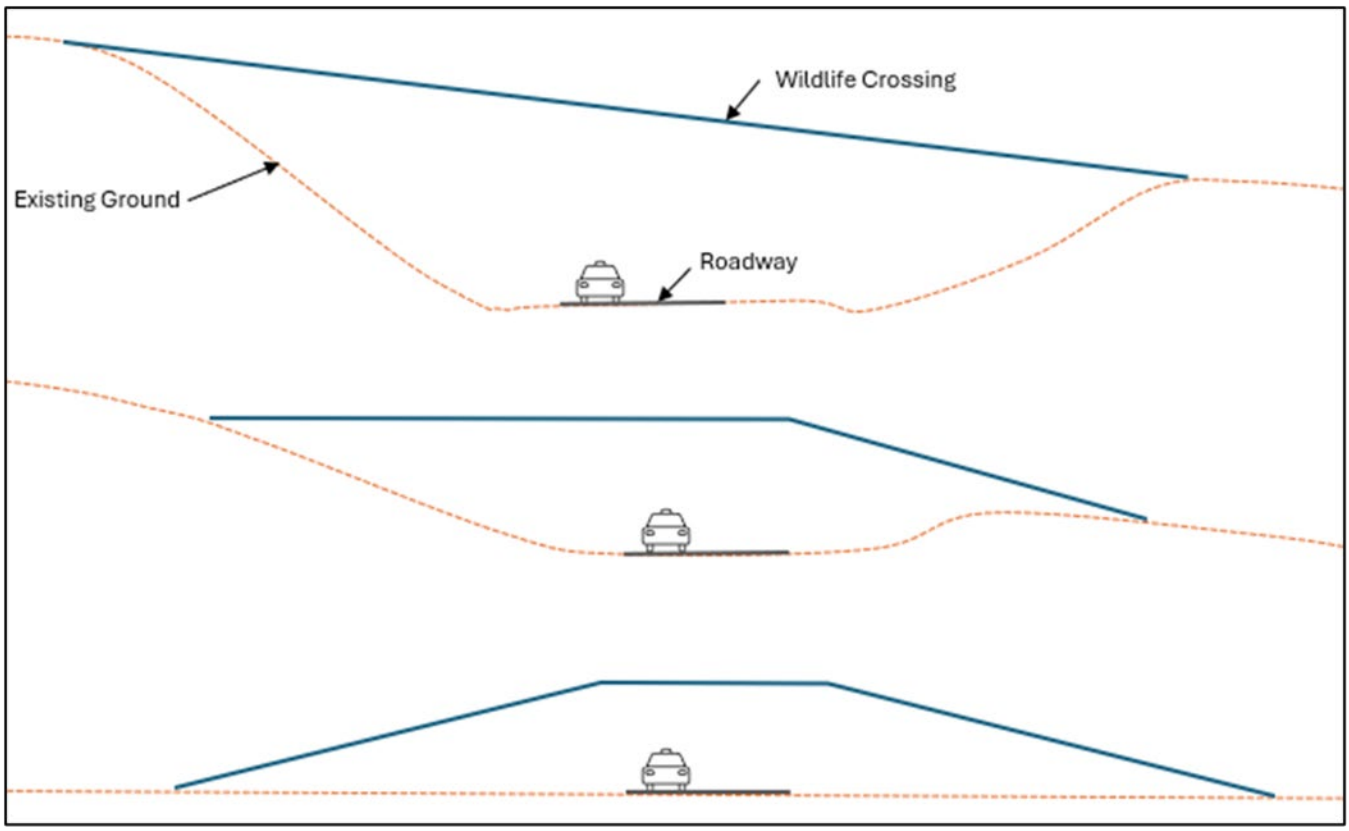

Figure 5-3. Three typical overcrossing sections, viewed from a driver's perspective. Overcrossings may tie into existing road cuts or high ground on one or both sides of the road (middle and top sections) or may be constructed in relatively flat areas with no road cut.

Vegetation on the overcrossing structure will provide browse and cover to attract wildlife to the crossing and buffer wildlife from noise, light, and vehicle exhaust. Vegetation would include a mix of deciduous and evergreen understory trees or large shrubs along the perimeter with increasingly shorter vegetation towards the center (native understory and floral species). Woody material, rock piles with good solar exposure, and scattered boulders would provide cover for smaller species using the crossing. Small depressions in the soil could create temporary areas of ponded water during snowmelt which could be attractive to amphibians. Solid walls at the edge of the crossing (a minimum of 8 ft tall) would buffer wildlife from road noise, lights and smells and maintain safety to avoid items falling onto the roadway.

Construction of the overcrossing may require partial closures of the northbound or southbound lanes with traffic routed into single lanes during structure placement. No disturbance of the road subgrade or pavement is anticipated for the overcrossings.

5.3 General Bridge Retrofit Design

The geometries of the existing bridges at MP 51.7 Toutle River and MP 53.9 Cowlitz River are suitable for passage of large mammals; however, the noise and level of human use may deter animals from approaching the bridge. Bridge retrofits to reduce noise adjacent and underneath the bridges may increase use by some wildlife. The scope of this project does not change the human use of this site.

A study of noise pollution reduction in an urban forest park (Maleki and Hosseini, 2011) showed effective reduction of noise from roads and industrial activities with a dense mixed stand of pine and black locust trees. Current WSDOT guidance for noise barriers along the highway is that "Trees and shrubs can decrease highway-traffic noise levels if high enough, wide enough, and dense enough (cannot be seen through), but are often impractical. It would take at least 100 ft of dense vegetation to provide the same benefit as our smallest feasible noise wall. Trees do provide a visual shield and some psychological benefit. The Federal Highway Administration has not approved using vegetation for noise abatement" (WSDOT, n.d.).

Dense mixed native vegetation in the bridge approaches could improve multi-species passage conditions and plant connectivity and may mitigate some of the behavioral considerations related to noise, smell, and lights. Plantings would have multiple benefits of reducing the bridge noise while providing cover for small and medium wildlife. The vegetation should have multiple canopy levels and a variety of deciduous and coniferous species to disrupt the sound waves (Attal et al., 2021).

Plantings would not require traffic disruption as all construction would occur outside of the existing roadway. Design and permitting would need to include hydraulic analysis of flood capacity with the addition of vegetation. Maintenance of the vegetation may be challenging due to frequent human use and replanting may be required if vegetation is damaged or removed.

Expansion joints between bridge spans may be contributing to the noise pollution at the existing bridges. A University of Washington study of the SR 520 floating bridge identified potential retrofits for the expansion joints to reduce noise pollution (Reinhall et al., 2022). The two-month study evaluated two types of flexible foam structures added to the existing expansion joints and concluded with a more than 70 percent reduction in road noise at a distance of 160 ft. The retrofit structures are experimental and would require additional design and testing for durability.

Installation of the retrofit structures would require temporary disruption of traffic on the bridges. The retrofit could occur entirely within the existing right-of-way and would not require excavation, embankment, or new structure installation.

Design and permitting costs are likely to be high for expansion joint retrofits due to the experimental nature. The retrofit structures would need to be inspected and monitored. This monitoring may be in addition to the regular bridge inspections.

5.4 MP 51.7: Toutle River Bridge Noise Reduction Retrofit

Noise reduction measures including dense native plantings and bridge expansion joint retrofits are proposed at the existing bridges over the Toutle River at MP 51.7 (**Figure 5-4**). Noise-dampening panels and other structures on the bridge are not proposed due to the conflict with the need for bridge inspections (clear line of sight to the bridge structure).

The bridges (WSDOT structure IDs 0008335A and 0008335B) are single-span steel tied-arch bridges carrying northbound and southbound traffic separately. The bridge spans (perpendicular to the direction of animal movement) are between 304 ft and 309 ft. The total

width (in the direction of animal movement) is approximately 100 ft for both bridges. The bridges were constructed in 1969 and have a 'fair' condition rating from the bridge inspections. The right-of-way on the south side includes the railroad and does not include the railroad on the north side.

A trail crosses under the bridge on the south (river-left) side and informal trails are present on the north (river-right) side (**Figure 5-5**). The channel of the Toutle River appears well-connected to overbank areas with areas of sediment deposition and channel widening observed at the confluence with the Cowlitz River downstream. This condition reflects the recent volcanic deposits of Mount St. Helens in the watershed and sediment deposition is likely to continue. No wetlands mapped in the national wetland inventory are present other than the river channel.

The existing bridge has high human activity and very loud road noise from existing traffic. Because of these disturbances it is unlikely that more sensitive species such as large carnivores will frequent the area. It is likely that the Toutle River bridge does occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote. These species are mostly likely to use the structure during periods of low traffic volume and reduced human presence. The vegetation cover is well established throughout the passage area and vegetation is likely to provide connectivity for small mammals, amphibians, and reptiles. This again assumes use by species that are not sensitive to noise and human presence and/or are able to use the structure when traffic and human activity is low. The bridge is not included in the WDFW state fish passage database and is passable.

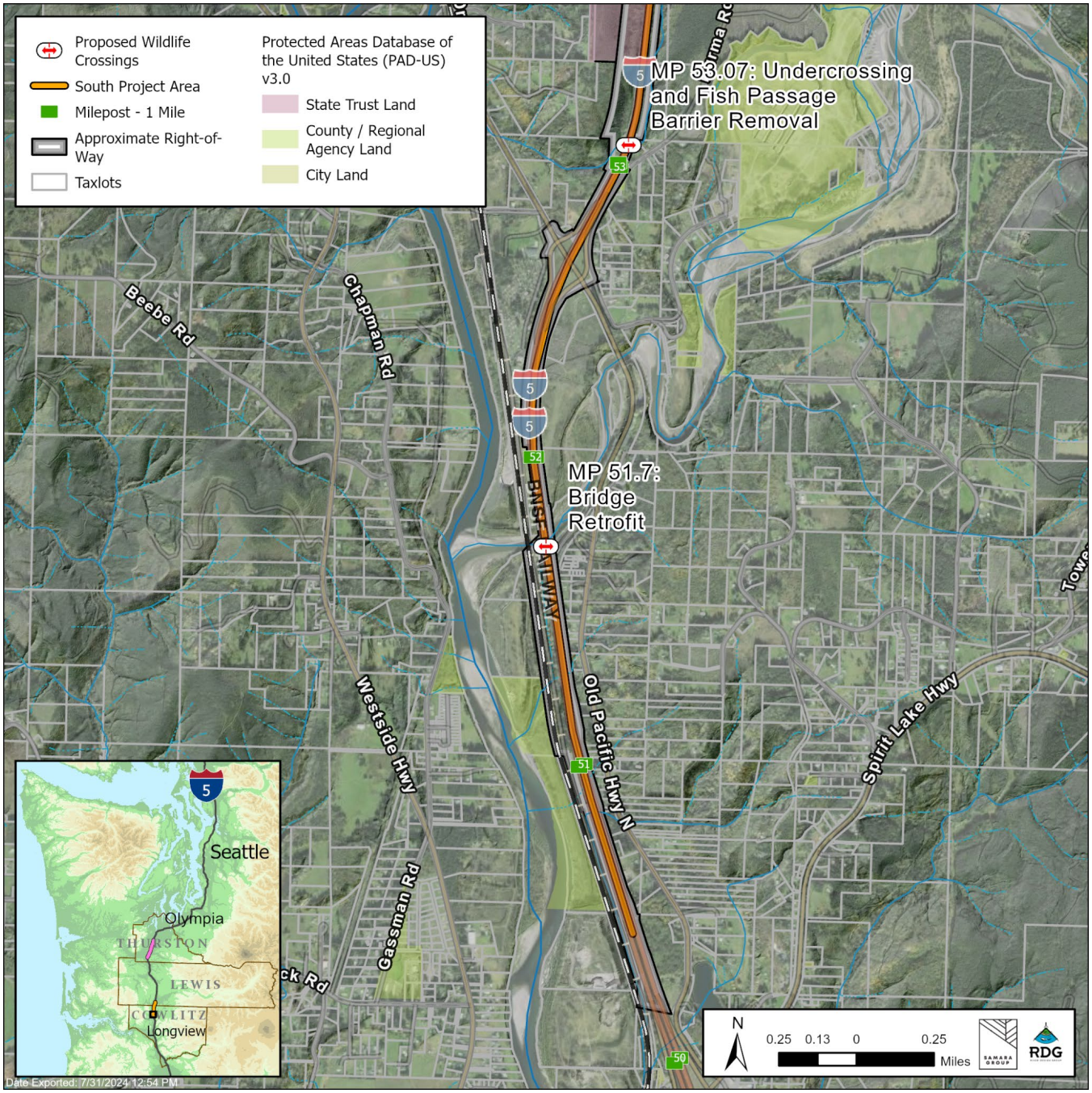

Figure 5-4. MP 51.7 Toutle River bridge site.

Figure 5-5. Trail on south (left) bank of Toutle River under the southbound bridge.

Dense mixed native plantings are proposed in the bridge approaches. Once established, the vegetation would improve multi-species passage conditions, plant connectivity, and may mitigate some of the behavioral considerations related to noise, smell, and lights (see Section 5.3). The retrofit could occur entirely within the existing right-of-way and would not require excavation, embankment, or new structure installation.

Bridge expansion joint retrofits with experimental flexible foam structures is proposed at this site. Expansion joints between bridge spans may be contributing to the noise pollution at the existing bridge. Installation of engineered structures in the expansion joints would not change multi-species passage conditions or plant connectivity but may mitigate some of the behavioral considerations related to noise (Reinhall et al., 2022). See Section 5.3 for additional considerations.

Fencing is not proposed as part of this retrofit. Fencing associated with the MP 53.07 Undercrossing would end on the north side of the bridges.

5.5 MP 53.07: Undercrossing (UNT Cowlitz River culvert replacement)

Replacement of an existing culvert at MP 53.07 is proposed to provide terrestrial wildlife passage and improve fish passage (**Figure 5-6**). The existing culvert conveying the UNT of the Cowlitz River is a 42-inch diameter pre-cast concrete pipe culvert (**Figure 5-7**). The existing pipe is approximately 100 ft long.

WSDOT Stream Restoration Program staff located the culvert outlet in December 2023 and observed conditions that would indicate a fish passage barrier including excessive water surface drop and shallow downstream depths. The culvert is in the WDFW fish passage database (site ID 992602) and classified as a 33% physical barrier. December 2023 site observations indicate that the pipe is a 100% barrier and should be reassessed. Potential species using the UNT Cowlitz River include coho salmon, steelhead, sea-run cutthroat trout, and resident trout. The upstream potential habitat gain is reported as 3,210 m (approximately 2 mi).

The size and length of the existing structure make it unlikely to pass most species, but it may be used by habituated species that are comfortable with small dark spaces such as raccoon, coyote, and possibly mustelids and foxes, if present.

Removal of the fish passage barrier at MP 53.07 on the UNT Cowlitz River is recommended in concert with the fish passage barrier removal at MP 53.9 to achieve aquatic habitat connectivity. The barriers are on the same stream.

A proposed wildlife undercrossing replacing the existing culvert (fish passage barrier) on the UNT to the Cowlitz River would be approximately 112 ft long and 158 ft wide with a minimum vertical clearance of 31 ft above upland benches, with an openness ratio of 50. Construction of this crossing would extend beyond the WSDOT right-of-way on the east side and be within the existing right-of-way on the west side. Construction would likely impact approximately 0.9 acres beyond the structure itself.

Fencing is proposed as part of this crossing design as described in Section 6.

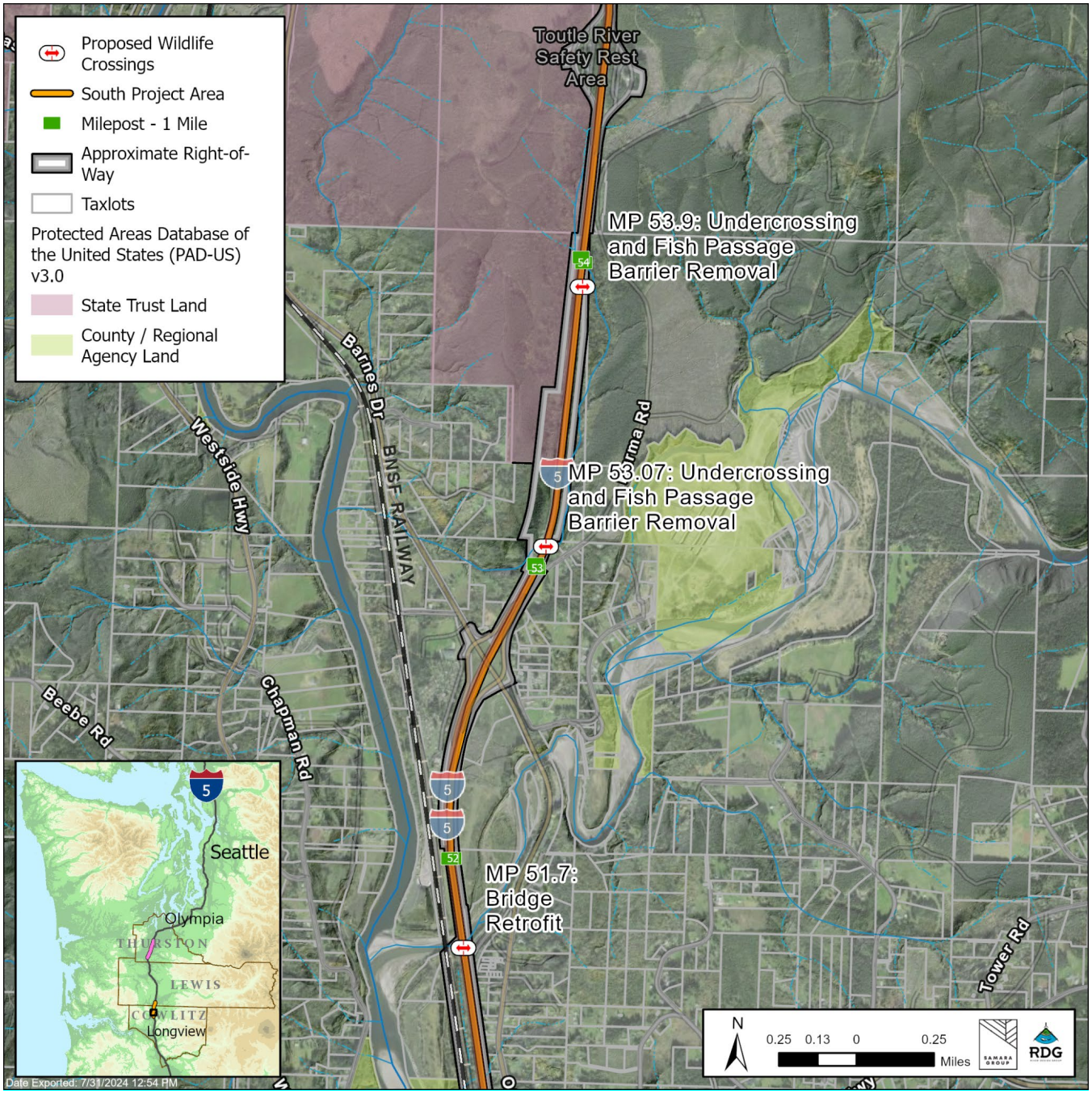

Figure 5-6. UNT Cowlitz River culvert replacements.

Figure 5-7. MP 53.07 UNT Cowlitz River culvert outlet from December 2023 WSDOT fish passage assessment.

5.6 MP 53.9: Undercrossing (UNT Cowlitz River culvert replacement)

Replacement of an existing culvert at MP 53.9 is proposed to provide passage for aquatic and terrestrial wildlife (see **Figure 5-6**). This culvert is on the same tributary as the MP 53.07 undercrossing and both fish passage barriers should be removed to achieve greater aquatic habitat connectivity. Removal of the barrier at MP 53.9 would not be effective without removal of the downstream barrier at MP 53.07.

The existing culvert conveying the UNT of the Cowlitz River is a 36-inch diameter corrugated metal pipe culvert. The existing pipe alignment is diagonal under I-5 and approximately 700 ft long. Other stormwater pipes may enter the culvert at a manhole near the inlet. The outlet was not located during the November 2023 site assessment due to dense vegetation and woody material (**Figure 5-8**). No mapped wetlands are present other than the creek channel.

WSDOT fish passage staff located the culvert outlet and inlet in December 2023 and observed a water surface drop that would indicate a fish passage barrier. The culvert is in the WDFW fish passage database (site ID 992608) and classified as a 100% physical barrier. Potential species using the UNT Cowlitz River include coho salmon, steelhead, sea-run cutthroat trout, and resident trout. The upstream potential habitat gain is reported as 667 m (approximately 0.4 mi).

The current size (36 inches) and length (700 ft) make it unlikely to pass most species, but it may be used by habituated species that are comfortable with small dark spaces such as raccoon, coyote, and possibly mustelids and foxes.

A proposed wildlife undercrossing replacing the existing culvert (fish passage barrier) on the UNT to the Cowlitz River would be approximately 120 ft long and 170 ft wide with a minimum vertical clearance of 32 ft above upland benches and an openness ratio of 55. Construction of this crossing would extend beyond the WSDOT right-of-way on the east side and be within the existing right-of-way on the west side. Construction would likely impact approximately 2.3 acres beyond the structure itself.

Fencing is proposed as part of this crossing design as described in Section 6.

Figure 5-8. Channel downstream of the MP 53.9 culvert (culvert outlet not located during site assessment).

5.7 MP 55.6: Overcrossing

An overcrossing is proposed at an existing roadcut at MP 55.6 (see **Figure 5-9**). The adjacent ground is approximately 35 ft above the existing roadway on the east side of the roadway, and 30 ft above the existing roadway on the west side of the roadway. The crossing structure length including tie-in grading is approximately 320 ft and the width is 150 ft. Construction would likely impact approximately 0.8 acres beyond the structure itself if retaining walls are

used to retain the structure abutments. Construction of this crossing would extend beyond the WSDOT right-of-way on the west side and be within the existing right-of-way on the east side.

The overcrossing is proximate to conserved lands (WADNR) on the west side of the roadway. No mapped wetlands are present at the site, however, drainages adjacent to the highway would need to be routed through the crossing abutments.

Fencing is proposed as part of this crossing design as described in Section 6.

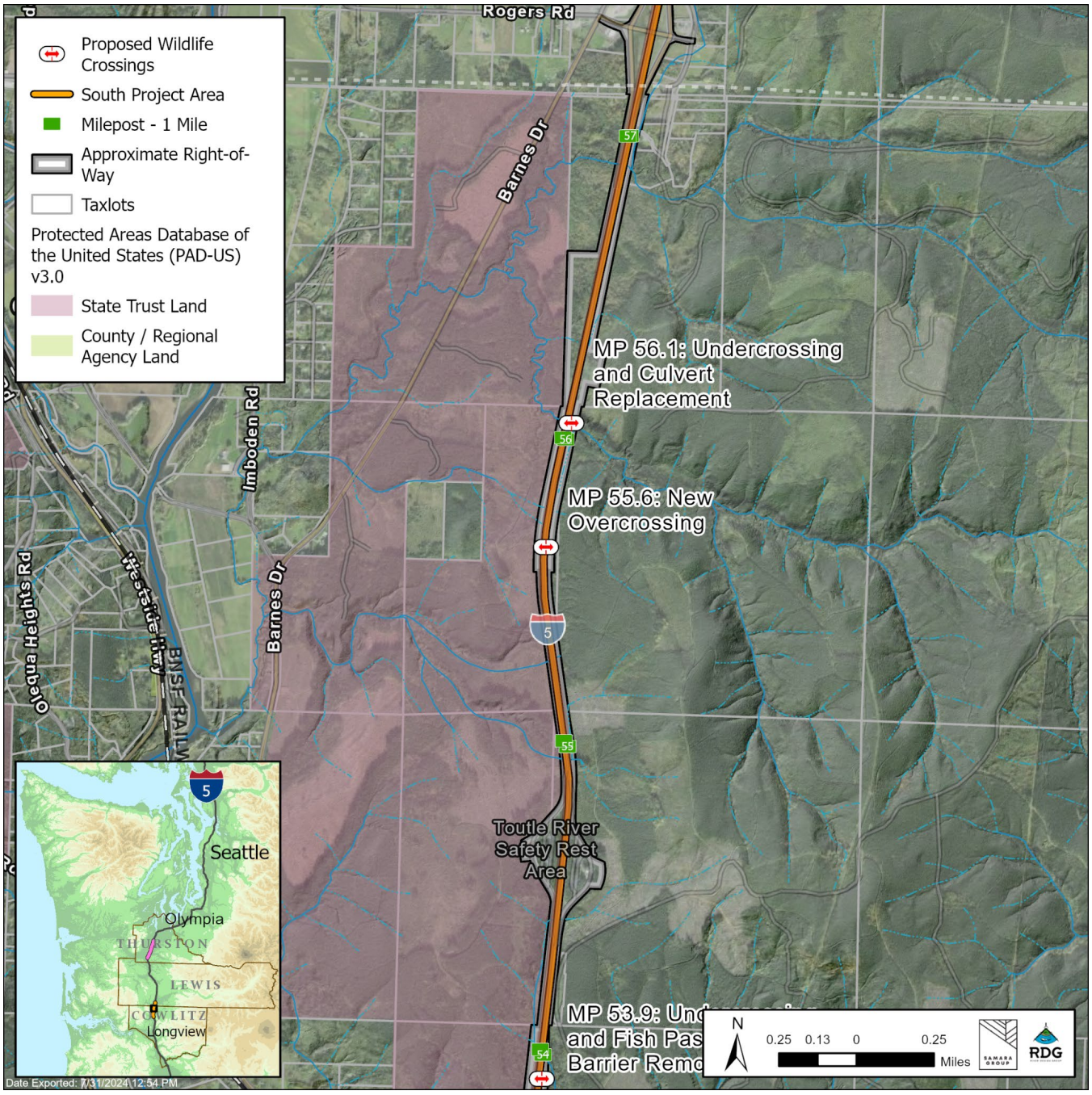

Figure 5-9. MP 56.1 UNT Hill Creek potential wildlife crossings.

5.8 MP 56.1: Undercrossing (UNT Hill Creek culvert replacement)

Replacement of an existing culvert is proposed to improve terrestrial wildlife passage at MP 56.1 (see **Figure 5-9**). The existing culvert conveying UNT Hill Creek is a 10 ft by 10 ft concrete box culvert at the inlet and a 10 ft diameter corrugated metal pipe culvert at the outlet. The existing pipe alignment is straight under I-5 and approximately 300 ft long with light visible through it from the inlet during the November site assessment (**Figure 5-10**). No wetlands mapped in the National Wetland Inventory are present other than the creek channel.

The culvert is in the WDFW fish passage database (site ID 991594) and classified as 100% passable. Potential species using the UNT Hill Creek include chum salmon, coho salmon, steelhead, sea-run cutthroat trout, and resident trout. WSDOT fish passage staff visited the site in December 2023 and recommended an updated passage assessment (it was last assessed in 2000).

This structure is relatively quiet and not located in a high traffic human area. The culvert likely provides passage for large and medium mammals that are comfortable with wading through water such as bear and raccoon. Deer may occasionally use the structure. Small mammals are unlikely to attempt to use this structure as it is fully wet. At the time of observation, flow was slow and could be suitable for aquatic amphibians or reptiles such as garter snakes that are comfortable with swimming. The structure is undersized for elk passage.

A proposed wildlife undercrossing replacing the existing culvert (potential fish passage barrier) on the UNT Hill Creek would be approximately 100 ft long and 160 ft wide, with a minimum vertical clearance of 35 ft above upland benches and an openness ratio of 67. Construction of this crossing would extend beyond the WSDOT right-of-way on the west side and be within the existing right-of-way on the east side. Construction would likely impact approximately 1.0 acres beyond the structure itself.

Fencing is proposed as part of this crossing design as described in Section 6.

Figure 5-10. MP 56.1 UNT Hill Creek culvert inlet during November 2023 site assessment.

5.9 MP 58.6: Undercrossing (Foster Creek culvert replacement)

Replacement of an existing culvert at MP 58.6 is proposed to improve aquatic and terrestrial wildlife passage (see **Figure 5-11**). The existing culvert conveying Foster Creek is an 8 ft wide by 10 ft tall concrete box culvert approximately 170 ft long with light visible through it from the inlet during the November site assessment (**Figure 5-12, Figure 5-13**). No wetlands mapped in the national wetland inventory are present other than the creek channel.

The culvert is in the WDFW fish passage database (site ID 990152) and classified as 33% passable. Potential species using the UNT Hill Creek include coho salmon, steelhead, sea-run cutthroat trout, and resident trout. The upstream potential habitat gain is reported as 6,939 m (approximately 4.3 mi). WSDOT fish passage staff visited the site in December 2023 and observed that the culvert apron at the outlet has detached (**Figure 5-13**) and may be a total passage barrier; they recommended an updated passage assessment (it was last assessed in 2000).

This structure is relatively quiet and not located in a high traffic human area. The structure likely provides passage for large and medium mammals that are comfortable with wading through water such as bear and raccoon. Deer may occasionally use the structure. Small mammals are unlikely to attempt to use this structure as it is fully wet. At the time of observation, flow was slow and could be suitable for aquatic amphibians or reptiles such as garter snakes that are comfortable with swimming. The structure is undersized for elk passage.

The proposed wildlife undercrossing replacing the existing culvert (fish passage barrier) on Foster Creek would be approximately 86 ft long and 152 ft wide, with a minimum vertical clearance of 19 ft above overbank benches and an openness ratio of 41. Construction of this crossing would extend beyond the WSDOT right-of-way on the west side and be within the existing right-of-way on the east side. Construction would likely impact approximately 0.7 acres beyond the structure itself.

Fencing is proposed as part of this crossing design as described in Section 6.

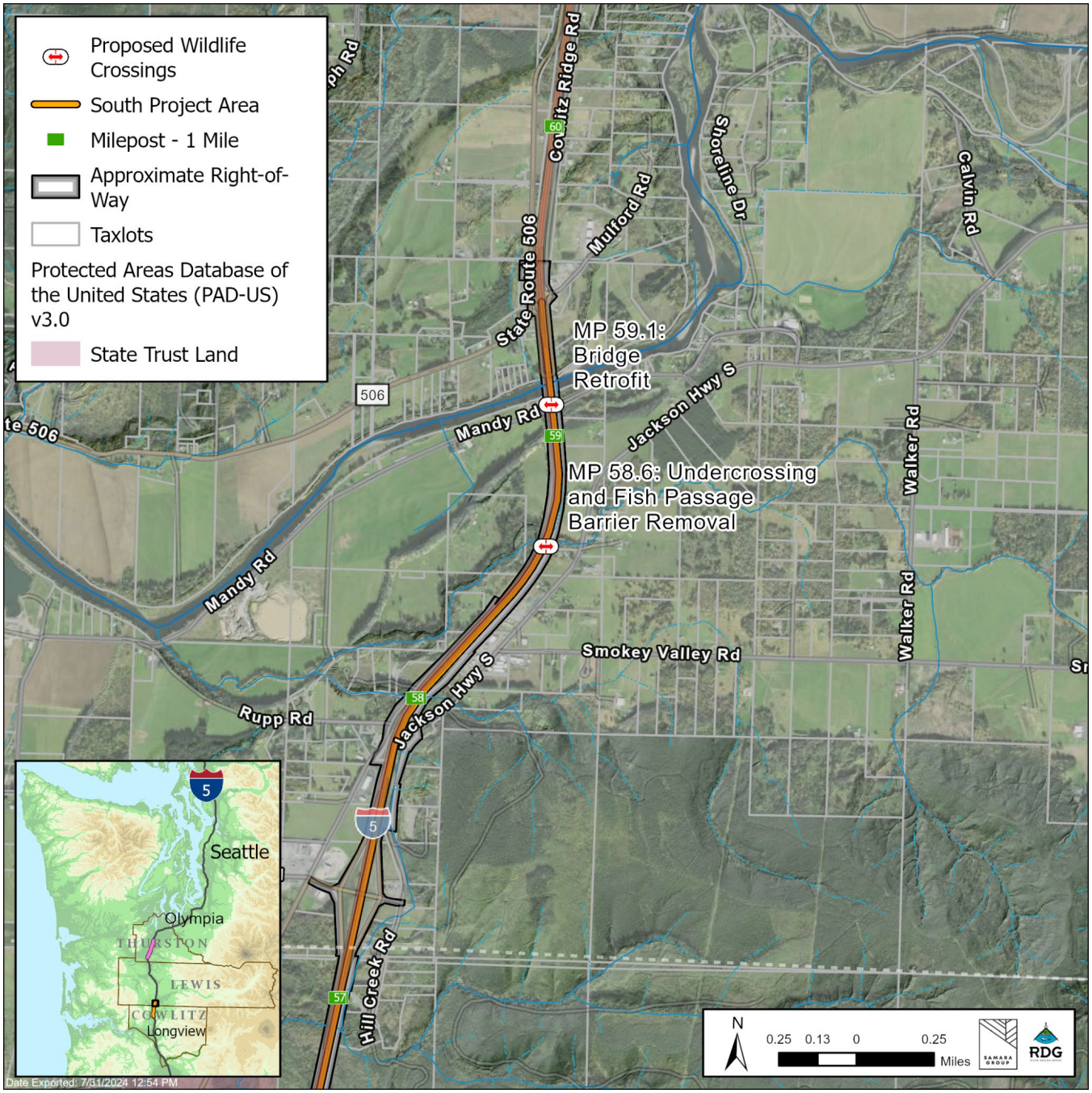

Figure 5-11. MP 58.6 Foster Creek undercrossing and MP 59.1 Cowlitz River bridge retrofit sites.

Figure 5-12. MP 58.6 Foster Creek culvert inlet from November 2023 site assessment.

Figure 5-13. MP 58.6 Foster Creek culvert outlet from December 2023 WSDOT fish passage assessment.

5.10 MP 59.1: Cowlitz River Bridge Noise Reduction Retrofit

Noise reduction measures including vegetation management and bridge expansion joint retrofits are proposed at existing bridges over the Cowlitz River at MP 59.1 (see **Figure 5-11**).

The existing bridges (WSDOT structure IDs 0004367A and 0004367B) are multi-span steel truss bridges on concrete t-beams carrying northbound and southbound traffic separately (**Figure 5-14**). The total bridge span (perpendicular to the direction of animal movement) is 760 ft with maximum spans of 240 ft. The total width (in the direction of animal movement) is approximately 70 ft for both bridges. The bridges were constructed in 1953 and have a 'fair' condition rating from the bridge inspections. The right-of-way does not include the parking lot or boat launch on the downstream river-left side of the bridges.

Mandy Road and a trail cross under the bridges on the south (river-left) side and Cowlitz Loop Road crosses under the bridges on the north (river-right) side (**Figure 5-14**). The channel of the Cowlitz River appears disconnected from overbank areas with no observed areas of scour, sediment deposition, or channel widening. The distant headwaters of the Cowlitz River are on Mt. Rainier and the volcanic and glacial sediments are likely to be transported through the river network in the future. Freshwater emergent and forested/shrub wetlands are mapped in the National Wetland Inventory in addition to the river channel.

The existing bridges have high human activity and very loud road noise from existing traffic. Because of these disturbances it is unlikely that more sensitive species such as large carnivores will frequent the area. It is likely that the bridges do occasionally pass highly habituated species such as resident deer, and/or those with high tolerance for human presence such as raccoon and coyote. These species are most likely to use the structure during periods of low traffic volume and reduced human presence. The vegetation cover is well established throughout the passage area and is likely to provide connectivity for small mammals, amphibians, and reptiles. This again assumes use by species that are not sensitive to noise and human presence and/or are able to use the structure when traffic and human activity is low. The bridge is not included in the WDFW state fish passage database and is assumed to be passable.

Similar to the MP 51.7 Toutle River bridge, the Cowlitz River bridge has high levels of human use and noise. Noise reduction retrofits may be beneficial though they would not change the frequency or character of human use (see discussion in Section 5.4).

Dense mixed native plantings are proposed in the southwest bridge approach. Once established, the vegetation would improve multi-species passage conditions, plant connectivity, and may mitigate some of the behavioral considerations related to noise, smell, and lights (see Section 5.3). The retrofit could occur entirely within the existing right-of-way and would not require excavation, embankment, or new structure installation.

Bridge expansion joint retrofits with experimental flexible foam structures are proposed at this site. Expansion joints between bridge spans may be contributing to the noise pollution at the existing bridge. Installation of engineered structures in the expansion joints would not change multi-species passage conditions or plant connectivity but may mitigate some of the behavioral considerations related to noise (Reinhall et al., 2022). Design and permitting costs

are likely to be high for bridge joint retrofits due to their experimental nature. See Section 5.3 for additional considerations.

Fencing is not proposed as part of this retrofit. Fencing associated with the MP 58.6 Undercrossing would end on the south side of the bridge.

Figure 5-14. Existing bridge over the Cowlitz River; photo taken from south (river-left) bank looking north.

5.11 MP 90.5: Overcrossing

An overcrossing is proposed at MP 90.5 near the existing Scatter Creek bridge (Figure 5-15. MP 90.5 overcrossing site.**Figure 5-15**). The adjacent terrain is mostly level, and the overcrossing would be built up above existing ground. The crossing structure length including tie-in grading is approximately 360 ft and the width is 150 ft. Construction would likely impact approximately 1.3 acres beyond the structure itself if using retaining walls to retain the structure abutments. This structure extends beyond the WSDOT right-of-way on the west side and is within the WSDOT right-of-way on the east side. Construction on the west side may be within the Tacoma Rail right-of-way, but construction would not impact the actual railroad. The area east of the proposed crossing location is a Mazama pocket gopher mitigation

site owned by WSDOT. State-threatened Mazama pocket gophers have been documented in this location by WSDOT and may be impacted by the construction of a crossing structure.

Freshwater forested-shrub wetlands are mapped near the railroad west of the crossing and drainages adjacent to the highway would need to be routed through the crossing abutments. Forested lands along Scatter Creek within the WSDOT right-of-way are present to the east.

Fencing is proposed as part of this crossing design as described in Section 6.

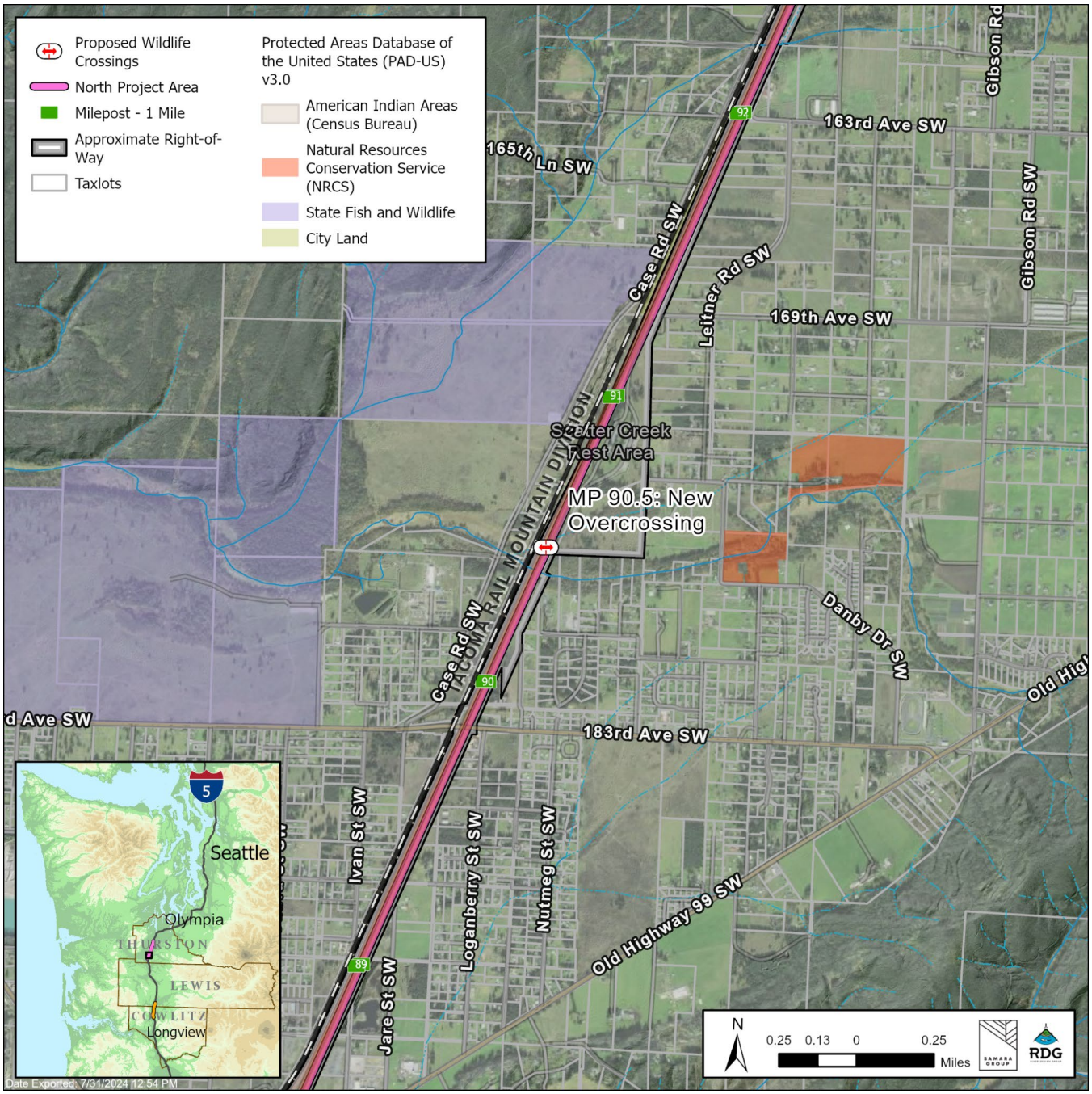

Figure 5-15. MP 90.5 overcrossing site.

5.12 MP 92.8: Overcrossing

An overcrossing is proposed at MP 92.8. The adjacent ground is approximately 15 ft above the existing roadway to the east and drops away to the west. The crossing structure length including tie-in grading is approximately 350 ft and the width is 150 ft. Construction would likely impact approximately 1.0 acres beyond the structure itself if using retaining walls to retain the structure abutments. This structure is within the WSDOT right-of-way on both sides. The west end of the crossing is approximately 500 ft from the Tacoma Mountain railroad and 600 ft from Case Rd.

Freshwater forested-shrub wetlands are mapped near the railroad west of the crossing and drainages adjacent to the highway would need to be routed through the crossing abutments.

There is no existing structure at this location (**Figure 5-16**); however, wildlife activity has been noted nearby including elk, bears, cougars and bobcat. Immediately east of the proposed crossing location is private forestland. To the southeast, the area around the Veterans Ecological Trades Collective property is managed as a combination of pasture, ponds, and forest (**Figure 5-17**). The site visit on the west side near the Maytown rest area identified open woodland with areas of emergent vegetation (**Figure 5-18**).

Fencing is proposed as part of this crossing design as described in Section 6.

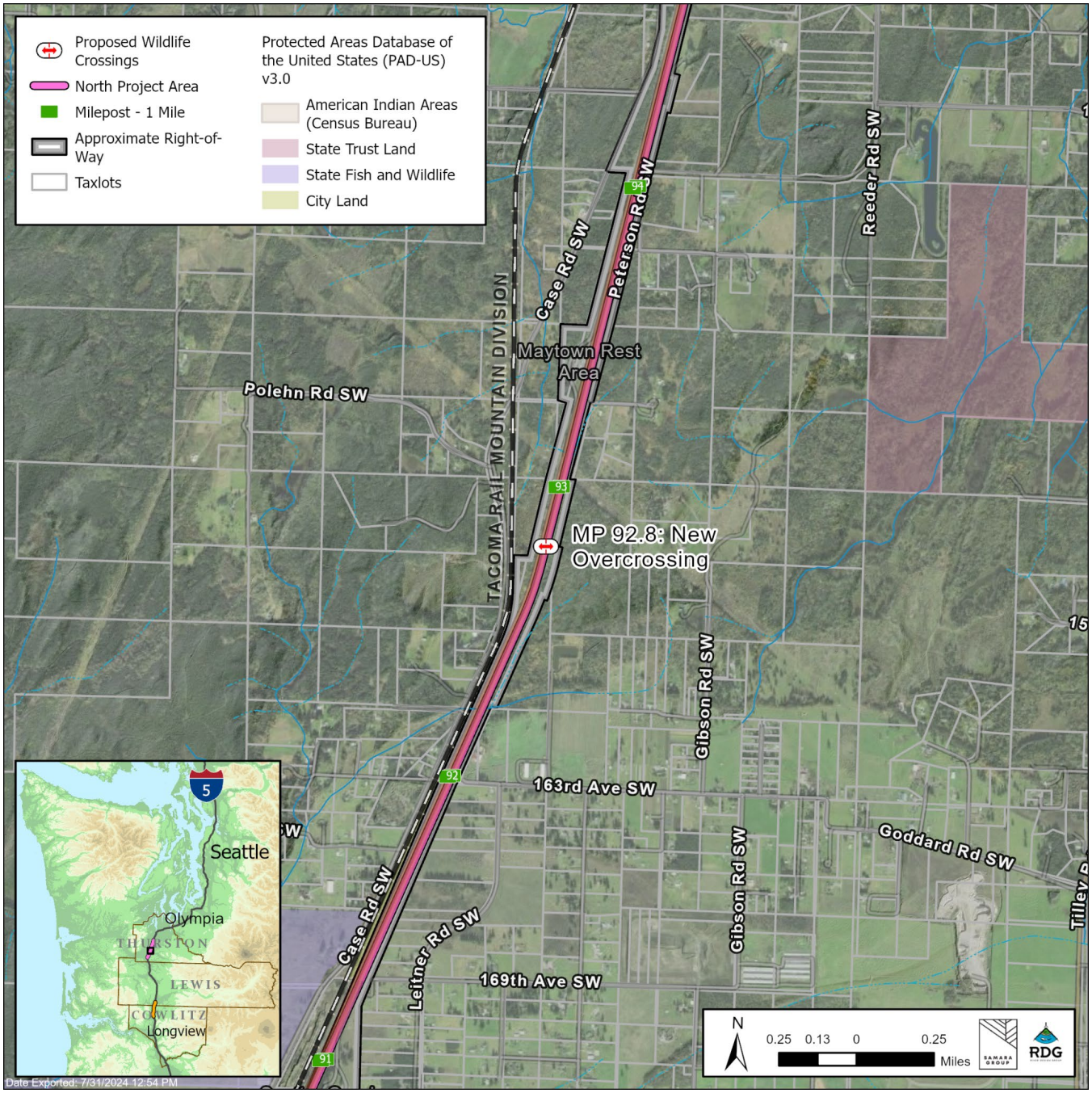

Figure 5-16. MP 92.8 overcrossing site.

Figure 5-17. Pasture near Vets farm looking west towards I-5 embankment.

Figure 5-18. Wooded area at site assessment stop near Maytown, looking east towards I-5 and minor roadcut.

5.13 MP 96.1: Overcrossing

An overcrossing is proposed at the existing roadcut at MP 96.1 (**Figure 5-20**). The adjacent ground is approximately 40 ft above the existing roadway on the east 30 ft above the existing roadway on the west. The crossing structure length including tie-in grading is approximately 250 ft and the width is 150 ft. Construction would likely impact approximately 0.7 acres beyond the structure itself if using retaining walls to retain the structure abutments. This structure is within the WSDOT right-of-way on the east side and extends beyond the WSDOT right-of-way on the west side.

The roadcut at MP 96.1 is an exposure of Eocene basalt above the glacial outwash sediments with a wide WSDOT right-of-way around a stormwater facility on the west side of the highway. The top of the roadcut is approximately 40 ft above the existing roadway surface (**Figure 5-19**) which is suitable vertical clearance for an overcrossing. No mapped wetlands are present but drainages adjacent to the highway would need to be routed through the crossing abutments.

There is no existing structure at this location; however, wildlife activity has been observed nearby including deer, cougar, black bear, and elk. The area around the proposed crossing location is Port Blakely timber land.

Fencing is proposed as part of this crossing design as described in Section 6.

Figure 5-19. The top of the basalt roadcut at MP 96.1 is approximately 40 ft above the existing road surface. Photo taken from west side of highway looking east during November 2023 site assessment.

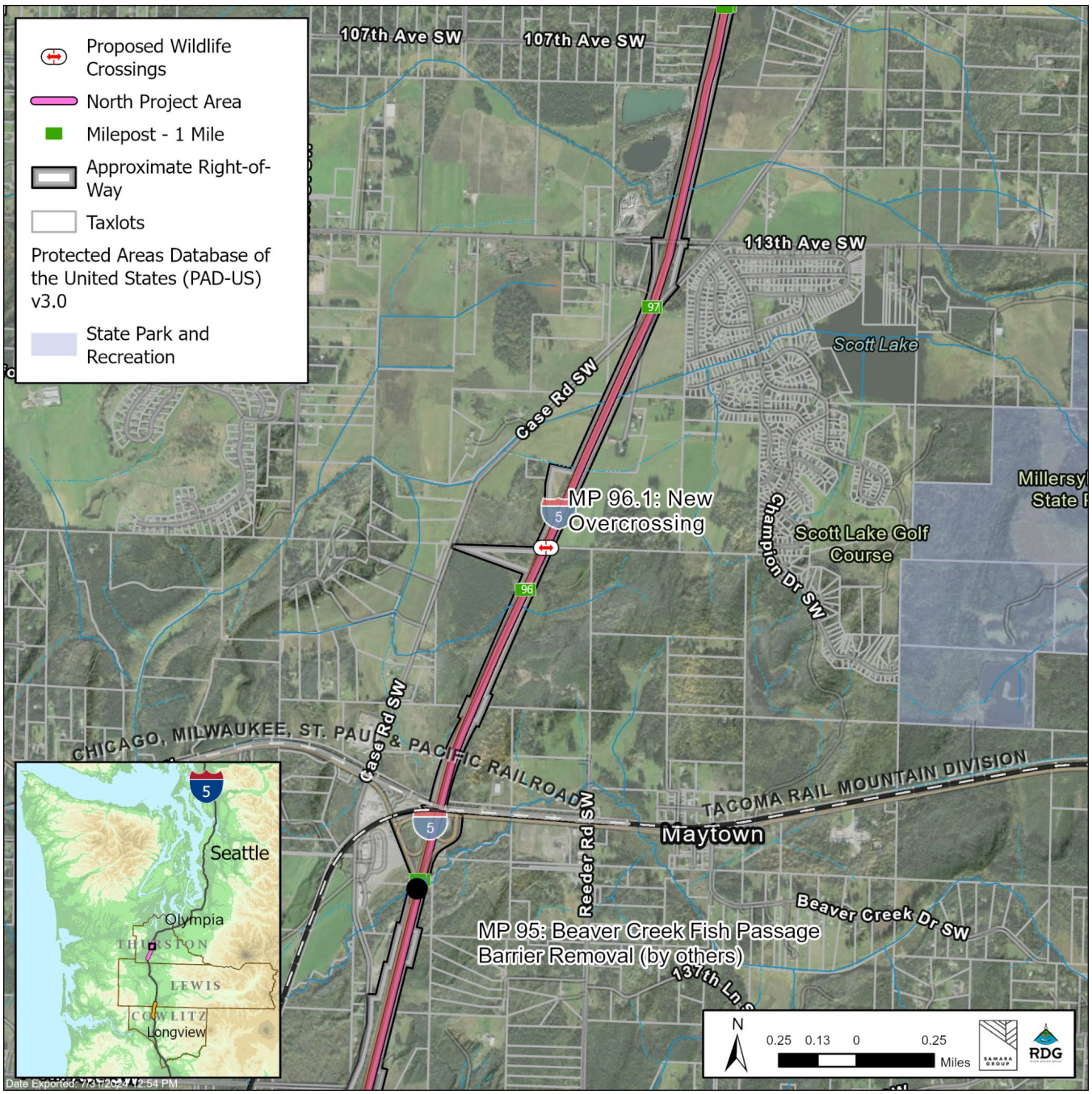

Figure 5-20. MP 96.1 basalt roadcut site.

5.14 MP 98.1: Amphibian Directional Fencing Retrofit (UNT Salmon Creek undercrossing)

The existing fish passage barrier on the UNT Salmon Creek at MP 98.1 is being removed and replaced with a passable crossing (**Figure 5-21**). The crossing design is underway by others. State-endangered Oregon spotted frog have been observed near this crossing (UWFWS, personal communication, November 13, 2024). This project proposes directional fencing specific to amphibians as a retrofit to increase amphibian use of the crossing structure.

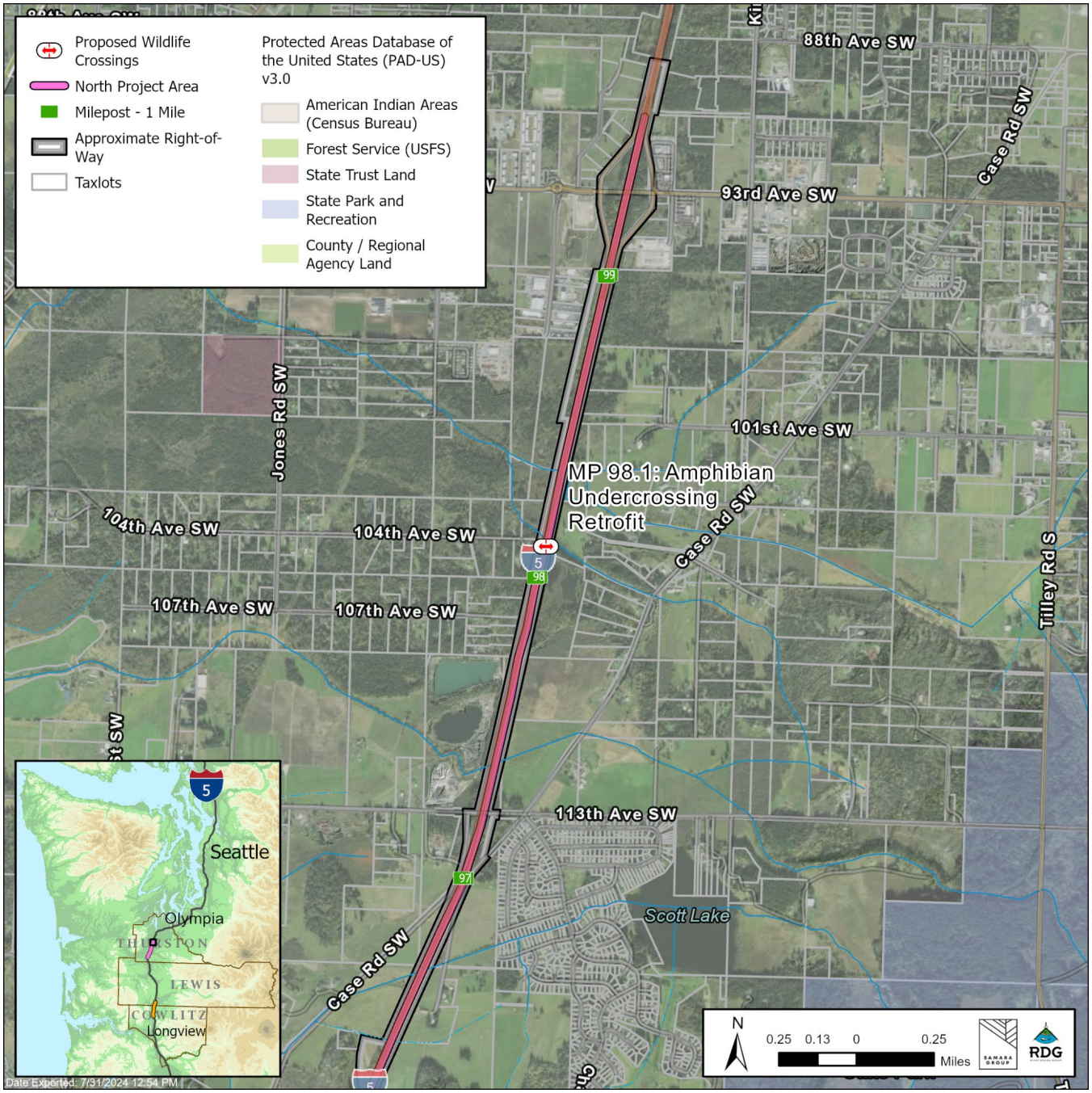

Figure 5-21. MP 98.1 UNT Salmon Creek site.

Per current guidance from CalTrans (Brehme and Fisher, 2021), the directional fencing should extend beyond the crossing structure between 40 m and 50 m (approximately 130 ft and 160 ft). These distances are derived from species specific data (California tiger salamanders in Stanford, CA, and Yosemite toads in the Sierra National Forest) and should be evaluated for the species found in the UNT Salmon Creek area. The fence material should be solid to prevent small amphibians from crossing through and decrease the chance that animals will spend energy and time attempting to go "through" the fencing. Additionally, the fence ends should have hooked turnarounds to guide animals back towards the crossing structure (**Figure 5-22**). The final design of the amphibian fence should include soil ramp jumpouts on the road side of the fence to allow access back to the wetlands for any amphibians that may have bypassed the fence (**Figure 5-23**).

A conceptual layout is provided in **Appendix D** following the existing channel of the UNT Salmon Creek. The final design should be adjusted to match the new fish passage structure**.**

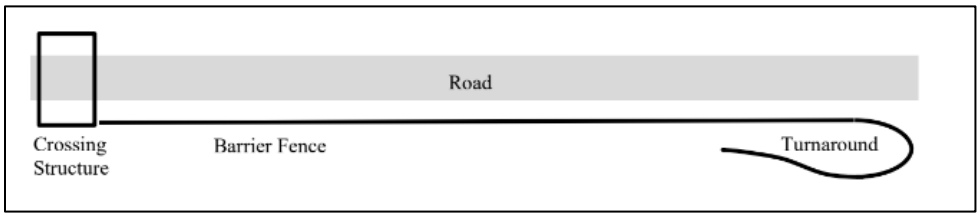

Figure 5-22. Amphibian fencing layout should include hooked turnarounds to guide animals back towards the crossing structure. Figure from Brehme and Fisher, 2021.

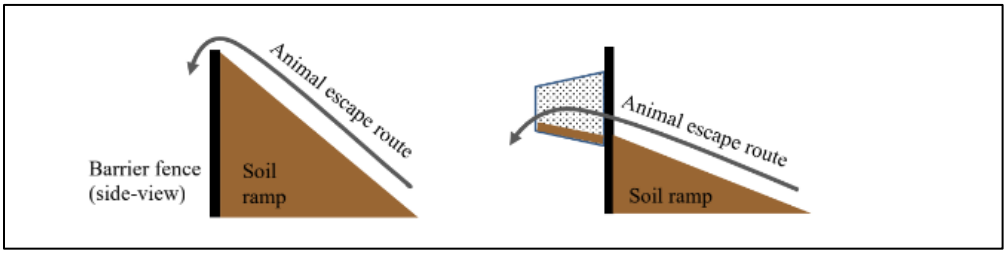

Figure 5-23. Typical details of soil ramp jumpouts for amphibian fencing. Figure from Brehme and Fisher, 2021.

This retrofit could improve conditions for amphibian passage without affecting other species' usage, plant connectivity, or behavioral considerations. The retrofit would not change the proximity to conserved lands, other development and roads, or human disturbance potential. The retrofit may be eligible for multiple funding sources if sensitive species are present.

This retrofit would not require traffic disruption as all construction would occur outside of the existing roadway. The retrofit could occur entirely within the existing right-of-way and would not require excavation, embankment, or new structure installation. Design and permitting costs would need to include analysis of impacts to the adjacent wetlands including any temporary access during construction. The fence will require monitoring and maintenance especially to trim back vegetation which may 'bridge' over the fence allowing amphibians to bypass the crossing and enter the roadway.

No additional wildlife fencing is proposed as part of this retrofit. Wildlife fencing associated with the MP 96.1 Overcrossing would end at this undercrossing.

6 Fencing Design

Wildlife fencing is recommended in association with the proposed crossing structures to prevent animals from entering the roadway and guide them to suitable crossing locations. Jumpout structures between crossings allow animals who are on the road side of the fence to escape over the fence without allowing easy access from the non-roadway side of the fence. Fencing coupled with crossing structures reduced collision rates on US97 at Lava Butte by 86% compared to the same area without fencing before the project (Bliss-Ketchum and Parker, 2015).

A total of approximately 29.6 miles of wildlife fencing is proposed along 14.7 miles of roadway in the project areas. Approximately 14.6 miles of fencing is proposed in the southern project area from MP 51.8 (tying into the Toutle River bridge) to MP 58.6 (tying into the Cowlitz River bridge). In the northern project area, approximately 15.9 miles of fencing is proposed from MP 90.4 (tying into the existing undercrossing at Scatter Creek) to MP 95 (tying into the existing undercrossing at Beaver Creek) and from MP 95.3 (tying into an existing underpass) to MP 98.1 (tying into the undercrossing at UNT Salmon Creek). Fencing is not recommended between MP 95 and MP 95.3 due to the on- and off- ramps and intersecting roads and railroad that would require gaps in the fence and could not be gated. **Table 6-1** summarizes proposed wildlife fencing for each crossing.

Fencing may be implemented in a phased approach with each crossing structure or as a standalone project following the construction of proposed crossing structures as opportunities arise. The preliminary fencing layout included in this concept design is proposed for a scenario in which all proposed crossings are constructed. The fencing layout should be re-evaluated if only some of the crossings are built.

It may be necessary to modify the proposed fencing extents based on funding availability. Fencing should be prioritized in areas closer to suitable crossing locations and with high animal use observed in the surrounding area.

The preliminary fencing layouts (**Appendix E**) were developed using the following design guidelines:

- Minimum distance from crossing structure: ½ mile (except where fencing ties into an existing crossing or natural barrier)
- Preferred distance from crossing structure: 2 miles
- Maximum distance from crossing structure: 4 miles
- Locate fence outside the clear zone (estimated, needs to be ground-verified during future design phases)
- Locate fencing on or 12 inches inside of right-of-way line, depending on terrain
- Follow approximately constant elevation to the greatest extent possible

- Cross over tops of culverts conveying streams where possible to maintain drainage and small animal access; roadside drainage culverts may be within roadway side of the fence.
- End fences in areas with minimal known WVCs and good sight lines to avoid collisions

The proposed fencing crosses roads in several locations in the corridor, which may necessitate gaps in the fence. Where possible, gates or double cattle guards should be installed to prevent animals from entering the roadway at gaps in the fencing.

Table 6-1. Proposed wildlife fencing summary.

Site	Total wildlife fencing length (mi)
MP 51.7 Toutle River Bridge Retrofit	–
MP 53.07 UNT Cowlitz River Undercrossing	3.4
MP 53.9 UNT Cowlitz River Undercrossing	3.5
MP 55.6 Overcrossing	1.4
MP 56.1 UNT Hill Creek Undercrossing	2.0
MP 58.6 Foster Creek Undercrossing	4.2
MP 59.1 Cowlitz River Bridge Retrofit	–
MP 90.5 Overcrossing	2.7
MP 92.8 Overcrossing	6.9
MP 96.1 Overcrossing	6.3
MP 98.1 UNT Salmon Creek Amphibian Retrofit	–

Table 6-2 summarizes the culverts conveying streams through the corridor that should remain accessible to smaller species of wildlife (the inlets and outlets would be on the outside of the fence) (WSDOT, 2024c). Each of these stream crossings would need gates for access on both sides of the roadway and may need protection from traffic if the inlet or outlet is within the clear zone.

Wildlife fencing should be at least 8 ft tall with woven wire fence fabric varying from 3-inch to 7-inch spacing (vertically), with smaller mesh closer to the ground. An anti-burrow apron consisting of fencing fabric extending along the ground line on the non-roadway side of the fence may be used to prevent small animals from passing under the fence. Monitoring may determine areas where anti-burrow aprons are needed. Access gates should be 8 ft tall using the same woven wire fabric as the fence. All new gates must be approved on limited access highways by FHWA (WSDOT, 2023). Wildlife jumpouts are gently sloped earthen embankment ramps, supported by modular concrete blocks at the fence interface, extending approximately 6 ft above the surrounding grade with a 15 ft wide cutout in the fencing fabric. Turnarounds should be considered at fence ends to encourage animals to move towards crossings. Fence geometry should avoid sharp corners to prevent animals from becoming stuck.

Amphibian fencing is proposed at MP 98.1 UNT Salmon Creek and may be implemented at other crossing sites with known amphibian presence. See Section 0 for more detail on amphibian fencing design.

Fencing maintenance is included in the opinion of probable costs for a 5-year period. Maintenance will be required if fence sections are damaged by fallen trees, vehicle collisions, or people cutting the fence. Hazard tree removal during the design and implementation phases may reduce future fence maintenance needs. Any tree removal will require environmental compliance (see Environmental notes in Section 7.2).

Table 6-2. Existing culverts in the proposed fencing extents to remain accessible to wildlife.

Milepoint	Stream Name	Culvert Description
52.3	Unnamed	24-in circular pipe
53.3	Unnamed	24-in circular pipe
53.4	Unnamed	24-in circular pipe
53.5	Unnamed	24-in circular pipe
53.6	Unnamed	2 24-in circular pipes
54.4	UNT Cowlitz River	30-in circular pipe
54.9	UNT Hill Creek	30-in circular pipe
55.4	UNT Hill Creek	24-in circular pipe
56.4	Unnamed	36-in circular pipe
56.9	Hill Creek	10 ft x 12 ft box culvert
58.0	UNT Foster Creek	5 ft x 5 ft box culvert
93.2	Unnamed	24-in circular pipe
93.5	Unnamed	24-in circular pipe
93.8	UNT Beaver Creek	24-in circular pipe
94.6	UNT Beaver Creek	48-in circular pipe
95.0	Beaver Creek	Box culverts (to be replaced by others)
96.0	Unnamed	36-in circular pipe
96.7	Allen Creek	4 ft x 10 ft box culvert
97.4	Blooms Ditch	8 ft x 10 ft box culvert
97.6	Unnamed	36-in circular pipe
98.3	Salmon Creek	Box culvert (to be replaced by others)

7 Design and Permitting Scoping Notes

The following scoping notes were developed during the alternatives analysis and conceptual design process. This list of notes is suitable for planning purposes, and it is anticipated that additional scope details will be identified during future design development.

High Level Requirements: The crossings within WSDOT right-of-way need to comply with the WSDOT design standards (see summary in **Appendix C**). The baseline need is to improve wildlife habitat connectivity and driver safety with contextual needs to enhance vegetation community connectivity and improve visual conditions in the corridor.

Traffic Data Analysis: Traffic flow (average annual daily traffic (AADT)) as of December 31, 2022:

- MP 51.7 to 59.1: 44,000
- MP 90.4 to 98.1: 68,000

Truck flow (AADT) as of December 31, 2022:

- MP 51.7 to 59.1: 12,000
- MP 90.4 to 98.1: 12,000

Many WVCs have been recorded throughout the corridor.

Recommended Solution: Bridge retrofits at MP 51.7 Toutle River and MP 53.9 Cowlitz River; undercrossings (culvert replacements) at MP 53.07 UNT Cowlitz River, MP 53.9 UNT Cowlitz River, MP 56.1 UNT Hill Creek and MP 58.6 Foster Creek; new overcrossings at MP 55.6, MP 90.5, MP 92.8, and MP 96.1; amphibian fence retrofit at MP 98.1 UNT Salmon Creek undercrossing.

Construction Scoping Notes and **Project Risks** are discussed in Sections 8 and 9, respectively.

7.1 Planning

These projects support the following plans:

- Washington Habitat Connectivity Action Plan (2025)
- Highway System Plan
    - Safety: Reducing wildlife-vehicle collisions
    - Healthier Environment: Removal of fish passage barriers, improved terrestrial wildlife habitat connectivity
- Strategic Highway Safety Plan: Target Zero
    - Reducing wildlife-vehicle collisions
- 2035 Washington Transportation Plan: Manage the Transportation System to Foster Environmental Sustainability

The crossings which require work outside of the WSDOT right-of-way will need to comply with the applicable local landuse regulations.

7.2 Environmental

- All projects will require compliance with the State Environmental Protection Act (SEPA) and Washington Administrative Code (WSDOT, 2023).
- Crossings will need to comply with the National Environmental Protection Act (NEPA) if there is a federal nexus. The Federal Highways Administration will be the likely federal nexus (WSDOT, 2023).
- Undercrossings will require hydraulic project approvals from WDFW and fish passage design including collaboration with the tribes (WSDOT, 2023).
- Jurisdictional waterways (streams and wetlands) will need to be delineated and evaluated at all sites. Unavoidable impacts may require mitigation.
- Bird nesting surveys are likely required in trees within and adjacent to the work areas especially if trees are being removed during construction.
- The conceptual design minimum wildlife bench width is 10 ft, minimum vertical clearance above the wildlife bench is 20 ft.

7.3 Hydrology & Stormwater Management

- The 2080 100-year projected flood shall be used for the design of water crossings, unless the State Hydraulics Office has determined that the 2080 projected flood is not practicable (WSDOT, 2024).
- The 100-year design flood will be used for culverts along the ditch line through the overcrossings (WSDOT, 2024).
- Assume stormwater management for replaced impervious surfaces at undercrossings. Assume no stormwater management (no new or replaced impervious surface) for overcrossings.
- Include temporary water management and erosion control measures in design.
- The growing medium on the overcrossings is intended to retain moisture with native vegetation intercepting precipitation. Underdrains may be required to prevent excess soil moisture from entering the crossing structure and falling on the roadway.
- Fish passage barrier removals will need to follow the fish passage design process (WSDOT, 2024). Woody material and habitat boulders within the crossings will need to be evaluated for stability during the 1% annual exceedance probability (100-year) design flood.

7.4 Utilities

- Potential utility coordination around fencing and temporary access.
- Potential utility coordination for undercrossings.
- No impacts likely from overcrossings.

7.5 Survey

- Conceptual designs based on remotely-sensed terrain data.
- Need detailed topographic survey including utilities, right-of-way boundary mapping, vegetation, and jurisdictional resources at proposed crossing locations.
- May need survey for fence alignments depending on final design.
- Need center of railway track at MP 90.5 and MP 92.8 for railroad right-of-way encroachment permits.

7.6 Roadway

- No permanent changes to the existing roadway alignment, grade or section
- The roadway will be restored to pre-project conditions if disturbed during construction
- Assume no widening (crossings will need to be enlarged if lanes are added in the future)
- The conceptual designs include 20 ft of vertical clearance over the existing pavement within the overcrossings.

7.7 Bridge

- Preliminary bridge plans for Unusual or Complex bridges on the interstate require FHWA approval (WSDOT, 2023).
- All structures exceed 20-ft span and will need to be added to the national bridge inventory and regularly inspected (FHWA, 2022).
- Bridge and wall designs should accommodate artwork and/or signs on superstructure.
- Bridge structures should include bat crevices and-or spaces for bat boxes to be installed.
- Undercrossing structures:
    - Single-span structures preferred to maintain openness ratio for undercrossings.
    - Concrete girders preferred to minimize road noise through crossings.
    - Minimum design openness ratio ($\frac{Height \times Width}{Length}$), all dimensions from the perspective of animal movement and in feet, is 18. Preferred openness ratio is 23.
    - Maximum 2h:1v bridge abutment slopes preferred for elk suitability.
    - Conceptual designs assume a bridge deck thickness of 2’-0” to determine vertical clearance (measured from channel thalweg to structure low chord) within crossing for wildlife.
    - Do not place angular rock (riprap) on channel beds or banks in undercrossings. Coordinate design of buried scour protection with hydraulic engineers if needed.
    - Design foundations and retaining walls in coordination with geotechnical engineers.
    - Incorporate guardrail or other barrier in coordination with roadway engineers.

- Overcrossing structures:
    - Confirm type and size of overcrossing structures.
    - Not intended for vehicular traffic.
    - Support fire equipment in emergencies.
    - Minimum width 150 ft (perpendicular to direction of animal movement).
    - 2 ft minimum shy distance from edge of shoulder to abutments.
    - Single-span structure preferred to maintain existing road geometry (no median).
    - Conceptual design dimensions assume a minimum vertical clearance of 20’-0” over the existing roadway at the edge of pavement (including the shoulder) and a minimum of 2’-0” structural backfill over top of the structures.
    - Crossing structure width shall maintain ditch flow lines along the roadway.
- Bridge retrofits: No bridge design work anticipated for the addition of vegetation under the existing bridges. Hydraulic engineers will design sufficient freeboard and scour protection.
- Bridge engineers will need to evaluate the suitability of the modular noise reduction retrofits in coordination with FHWA.

7.8 Geotechnical

- No subsurface investigations were conducted as part of the conceptual design process.
- All crossing structures will require geotechnical evaluation and analysis.
- All crossings need to meet seismic design standards.
- All abutments, retaining walls, and reinforced slopes within WSDOT Right of Way or whose construction is administered by WSDOT shall be designed in accordance with the Geotechnical Design Manual (WSDOT, 2022) and the following documents:
    - Bridge Design Manual (LRFD) M 23-50
    - Design Manual M 22-01 (WSDOT, 2023)
    - AASHTO LRFD Bridge Design Specifications, U.S
- Overcrossings
    - Embankment slopes on overcrossing approaches 4h:1v maximum. Maintain gentle slopes for vegetation establishment.
    - Design embankment material to support vegetation.
    - Evaluate embankment and growing medium material suitability for pocket gophers in northern project area.
    - Design retaining walls for noise, light and sound mitigation. Extend to noise barrier berms or walls beyond the crossing in coordination with wildlife fencing.
- Undercrossings
    - Maximum 2h:1v bridge abutment slopes preferred for elk suitability.
    - Limit use of vertical abutments and retaining walls to maintain visual suitability for elk (see conceptual design drawings)

- Do not use buried bridges or arches where elk are expected to use the crossing.
- Evaluate single-lane (northbound and/or southbound) shoring during temporary excavation and/or shoofly bridges to maintain movement of traffic.

7.9 Traffic

- Signage by overcrossings may benefit public awareness of wildlife habitat connectivity
- Add signage at dual-use undercrossings (MP 51.7 Toutle River and MP 59.1 Cowlitz River)
- Exclude vehicular traffic from all other crossings.
- Roadway illumination may be beneficial within crossings tunnels depending on length
- Anticipated single-lane closures (northbound or southbound) during overcrossing structure installation and backfill
- Full closures and/or detours may be required for undercrossings depending on the depth and shoring of the temporary excavations.
- I-5 is a freight route and a seismic lifeline route; emergency vehicle access must be maintained.
- Conceptual designs assume concrete barriers along the road shoulder within the overcrossings.
- Conceptual designs assume guardrail along the road shoulder over the undercrossings.

7.10 Hazardous Materials

- No hazardous materials assessments or site surveys were performed during the conceptual design process.
- Site-specific hazardous material assessments will be required especially for undercrossings which involve significant excavation.

7.11 Right-of-Way

- Need to map right-of-way boundary at all crossing sites (used county tax lot GIS data as proxy for the conceptual designs).
- Grading outside of the right-of-way will require permanent easements or acquisitions.
- All crossings may need temporary construction easements outside of the right-of-way.

7.12 Roadside Development and Landscape Architecture

- The crossings need to maintain and enhance the scenic views through the corridor to the greatest extent possible. The shape of the embankments, fences, and walls should enhance the landscape and scenic context. Landscape architects should lead this part of the design development in coordination with civil and structural engineers.
- The revegetation strategy should be implemented by an interdisciplinary team of plant ecologists and wildlife biologists including a site-specific planting palette with consideration for plant species adapted to future climate scenarios.

- Native vegetation should be used on the overcrossings to provide continuity of habitat across the road corridor. Native pollinator-friendly species should be included. It may be beneficial to harvest seeds from local sources and contract-grow container plants for faster establishment. Temporary irrigation is likely to be required during the plant establishment period.
- Habitat features (logs and rock piles) should be placed to provide cover and resting areas for smaller species utilizing the crossings. Coordinate design with wildlife biologists to identify spacing, sizes, and material specifications. The habitat features should also be used to discourage human use of the crossings.
- 5 years of plant establishment may be needed in situations where it is important to provide a full cover of vegetation to achieve the environmental or operational functions and plant establishment may take up to 10 years if using woody vegetation (WSDOT, 2023).

7.13 Maintenance

- The crossing structures will be regularly inspected as part of the NBI program. Additional inspection and maintenance of vegetation will be required during the establishment period.
- Special attention needs to be paid to the fencing system (including the double cattle guards, gates, and jumpouts) to maintain its function and minimize potential harm to wildlife or public safety. The opinions of probable cost include some funds for monitoring, maintenance and adaptive management of the crossings and associated fence features.
- Vegetation management and removal will likely be required at fence ends to maintain clear sight lines for safe stopping sight distances.
- Maintain access to existing culverts and cross-drains through proposed fencing with gates sufficient for maintenance vehicles.
- Snow removal / accumulation areas and maintenance road gates through the proposed fence are needed.

7.14 Community Affairs

- An educational campaign about habitat connectivity and wildlife crossings should be concurrent with design development to build public support for the projects.
- Continue to partner with the Cascades to Coast Landscape Collaborative for outreach and engagement with neighbors
- Continue highlighting importance of wildlife connectivity in the region
- Continue discussions with neighboring jurisdictions about protection of wildlife movement corridors

8 Construction Scoping Notes

8.1 Staging

Staging is assumed to occur within the existing WSDOT right-of-way along the shoulders and right-of-way near the proposed crossings. Staging may also be possible within the roadway if the northbound or southbound lanes are temporarily closed during construction. In some locations, staging on adjacent lands may be possible with landowner agreement. Staging areas will need to be identified and surveyed during future design phases. Staging areas should be located to avoid and minimize impacts to existing native vegetation. Staging for the fencing may require partial lane closures if the shoulders are not wide enough for safe staging.

8.2 Temporary Access

Temporary access roads may be required for construction of the overcrossings and for maintenance access post-construction. Vegetation removal may be required for fence installation.

9 Project Risks

The following risks were identified during the development of the conceptual designs. This list of risks is suitable for planning purposes, and it is anticipated that additional risks may be identified during design development and on-site investigations including survey, permitting evaluations, and subsurface explorations.

9.1 Planning

- Confirm compatibility with adjacent land use plans and zoning.

9.2 Environmental

- None of the sites have been fully surveyed for cultural resources within one half-mile of the project area. The extent of the proposed fencing has not been reviewed for cultural resources.
- State-threatened Mazama pocket gophers may be present near proposed crossing locations. Survey should confirm and designs may need to be modified to avoid impacts.
- Likely to be NEPA Class I project and require an environmental impact statement (EIS).
- Likely to have SEPA Determination of Significance and require an EIS.

9.3 Hydrology & Stormwater Management

- Need to identify reference reach and evaluate watershed conditions for fish passage design.

- May need flow control exception for replacing existing impervious surface for undercrossings due to limited right-of-way width and steep topography unsuitable for flow detention.

9.4 Utilities

- No utility mapping or locates done during conceptual design. Potential utility conflicts are unknown.

9.5 Survey

- Conceptual designs based on remotely-sensed terrain data. All designs need ground-truthing and topographic survey including trees, utilities, and right-of-way boundaries.
- Topographic survey along proposed fence alignments required including trees.

9.6 Roadway

- Confirm whether I-5 will be widened within the service life of the crossing structures. Design crossing structures to accommodate future road width.

9.7 Bridge

- May be considered “unusual” structures and require FHWA approval.
- Confirm clear span structures possible.

9.8 Geotechnical

- Tall embankments for undercrossings will require stabilization during construction.

9.9 Traffic

- Maintaining movement of traffic during construction may require partial lane closures and/or shoofly bridges (which may require additional right-of-way).

9.10 Hazardous Materials

- No known risks.

9.11 Right-of-Way

- Will need permission for work outside of existing WSDOT right-of-way (all projects except retrofits and MP 92.8 Overcrossing)
- Temporary access and construction staging will likely occur outside of the existing WSDOT right-of-way
- Coordinate with railroads for any encroachment into their right-of-way especially at MP 90.5 and MP 92.8

9.12 Roadside Development and Landscape Architecture

- May need design exceptions to add native browse and cover vegetation in roadside at bridge retrofits and overcrossings.
- Consider the cost and benefit of temporary irrigation during the establishment period – where is the nearest water source, and are water rights required?

9.13 Community Affairs

- EIS will have extensive public involvement.

10 Opinions of Probable Cost

Opinions of total project probable cost including design, permitting, implementation, monitoring and maintenance, and adaptive management were developed for each site. The costs range from approximately $488K to $2.0M for the bridge retrofits (revegetation and amphibian fencing only), $21.5M to $40.3M for the undercrossings, and $23.2M to $30.1M for the overcrossings. The construction costs utilize bid items from the WSDOT Standard Specifications (2024) to the greatest extent possible. Unit costs were based on the averages from 2023 and 2024 in the Western regions. All prices are in 2024 dollars without adjustment for future inflation.

Structure costs were estimated using the guidance in Chapter 12 of the Bridge Design Manual (WSDOT, 2024b). Bridge expansion joint retrofit costs were excluded from the opinions of probable cost as costs are uncertain for these experimental structures.

The temporary traffic management costs for overcrossings were estimated as 10% of the construction subtotal costs assuming nighttime construction and partial road closure (northbound or southbound lanes separately). Temporary traffic management costs for undercrossings were estimated as 20% of the construction subtotal costs assuming full road closure and detours or shoofly bridges due to the depth of excavation. Monitoring, maintenance and adaptive management is recommended for a minimum of 5 years with costs informed by other wildlife crossing projects in the Pacific northwest.

Design and permitting costs assume that WSOT is completing these tasks. Funds for monitoring, adaptive management and maintenance are included. Construction costs assume one year of construction for each site including the fencing installation.

Wildlife fencing costs are assumed to include jumpouts (locations to be determined during future design phases), maintenance access gates at existing drainage structures, and fence end treatments. The estimated costs for the wildlife fencing can approach or exceed the crossing structure costs and may be implemented in a separate contract. The fencing contract would need to include provisions for ongoing inspection and maintenance of the fencing.

Class 4 opinions are recommended by the Association for the Advancement of Cost Engineering for concept evaluation and preliminary budgeting (AACE, 2005). These opinions are appropriate for conceptual (1%- 15%) design phases and include high and low contingencies of +50% and -15% respectively (AACE, 2005). Each opinion of cost assumes a

standalone project. Combining multiple crossings into one project may result in cost efficiencies during design and implementation. The low-contingency cost (-15%) could be used for combining projects in close proximity (within 2 – 4 miles) and on the same schedule.

Opinions of probable cost are included for each site in **Appendix F**. **Table 10-1** summarizes the opinions of probable cost for each site. These opinions are for scoping purposes and will be refined during future design phases.

Table 10-1. Summary of opinions of probable cost.

Site	Design, Permitting, Monitoring & Maintenance Subtotal Cost, 2024$	Fencing Design, Construction & Maintenance Subtotal Cost, 2024$	Total Probable Cost, 2024$	Total Probable Cost, Low (-15%), 2024$	Total Probable Cost, High (+50%), 2024$
MP 51.7 Bridge Retrofit (Plantings Only)	$309,000	$0	$1,955,100	$1,662,000	$2,933,000
MP 53.07 Undercrossing	$2,307,000	$2,250,000	$30,073,100	$25,562,000	$45,110,000
MP 53.9 Undercrossing	$2,307,000	$2,310,000	$40,310,250	$34,264,000	$60,465,000
MP 55.6 Overcrossing	$2,082,000	$1,050,000	$23,240,650	$19,755,000	$34,861,000
MP 56.1 Undercrossing	$2,307,000	$1,410,000	$27,988,150	$23,790,000	$41,982,000
MP 58.6 Undercrossing	$2,307,000	$2,730,000	$21,498,900	$18,274,000	$32,248,000
MP 59.1 Bridge Retrofit (Plantings Only)	$309,000	$0	$768,200	$653,000	$1,152,000
MP 90.5 Overcrossing	$2,082,000	$1,830,000	$27,720,300	$23,562,000	$41,580,000
MP 92.8 Overcrossing	$2,082,000	$4,350,000	$30,079,100	$25,567,000	$45,119,000
MP 96.1 Overcrossing	$2,082,000	$3,990,000	$27,666,450	$23,516,000	$41,500,000
MP 98.1 Amphibian Retrofit	$306,000	$270,000	$487,500	$414,000	$731,000

11 Anticipated Design and Construction Duration

The overcrossings are anticipated to be in design development for one to three years and constructed in one season each (total project duration of approximately four years assuming funding is secured). The permitting for the overcrossings will likely require a visual resource inventory and cultural resources surveys. The permitting for the overcrossings is anticipated to take 18 - 24 months concurrent with design development. The overcrossings are not limited to in-water work windows and should be constructed in dry months especially for the placement and compaction of the backfill materials. The opinions of probable cost assume

14 weeks of active construction and temporary traffic control for the overcrossings. Topsoil placement and vegetation installation should occur during the fall planting window to maximize establishment success. All overcrossings assume up to 5 years of plant establishment with supplemental irrigation while the soils develop and retain moisture.

The undercrossings have a longer design and permitting timeline to incorporate fish passage. The design and permitting process is assumed to be a minimum of 5 years with construction occurring in at least one season (depending on whether the crossings are bundled into one project). Construction may extend across multiple years if the crossings are bundled. Undercrossing construction will be limited to the in-water work window for each creek. The total project duration is between at least 6 years to 10 years (assuming funding is secured). The opinions of probable cost assume 14 weeks of active construction and temporary traffic control for the undercrossings. Vegetation establishment is assumed to take 5 years and supplemental irrigation is not required due to proximity of the channels.

The retrofits with vegetation at MP 51.7 Toutle River bridge and MP 59.1 Cowlitz River bridge could be designed within 1 year and construction is anticipated to occur within 1 month. Permitting for the bridge retrofits is anticipated to take 6 - 12 months concurrent with the design development. The opinions of probable cost assume 2 weeks of active construction for the bridge retrofits with vegetation. The timeline for evaluation and permitting for the modular bridge noise retrofits is assumed to take at least 5 years including FHWA approval. The installation could happen within one year if permission is granted.

12 References

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13 Appendices

A) Summary of Interviews

B) Illustrated Menu of Passage Improvement Options

C) Engineering Design Matrices

D) Conceptual Site Plans for Alternatives

E) Preliminary Fencing Layouts

F) Opinions of Probable Costs

G) Species Detections

Appendix A

Summary of Interviews

Full List of Interviewees

Name	Affiliation	Date of Interview
Alan Yanahan	USFWS	10/30/2023
Anna Arensmeyer	WSDOT	11/30/2023
Fraser Shilling	UC Davis Road Ecology	10/30/2023
Glen Kalisz	WSDOT	10/30/2023
Marc Hershfield	WSDOT	10/31/2023
Mark Elbroch	Panthera	11/20/2023
Bob Armine	Lewis County	12/1/2023
Brian Calkins	WDFW	11/27/2023
Brian Stewart	CNW	11/20/2023
C Donehower	Cowlitz Tribe	12/1/2023
Chris Mongeon	DNR	11/20/2023
Dalton Fry	Cowlitz Tribe	12/1/2023
David Howe	WDFW	11/27/2023
Elliot Winter	WDFW	11/27/2023
Eric Holman	WDFW	11/27/2023
George Fornes	WDFW	11/27/2023
James Blacklaw	Contractor	11/29/2023
Jeff Azerrad	WDFW	11/27/2023
Jeremy Romero	NWF	11/29/2023
Jerry Mizar	DNR	11/20/2023
Julia Michalak	WDFW	11/27/2023
Michelle Tirhi	WDFW	11/27/2023
Noll Steinweg	WDFW	11/27/2023
Renee Wend	DNR	11/20/2023
Sandra Jonker	WDFW	11/27/2023
Madeline Nolan	WDFW	11/27/2023

Appendix B

Illustrated Menu of Passage Improvement Options

Vegetation Management/Additions

Fencing

Fencing Associated Features

Habitat Structure in Crossing

Dry Bench / Shelf

Full Culvert Replacement and/or Conversion to Bridge

Overcrossing

Appendix C

Engineering Design Matrices

SW WA Wildlife Crossings Design Criteria Summary

This workbook summarizes the appliable design criteria for the proposed wildlife crossings along I-5 in SW WA.
This summary was prepared for project scoping and conceptual design purposes and is not inclusive of all design requirements.

Prepared By: Melanie C. Klym, PE, LG - River Design Group, Inc.
Date: 29-Dec-23

Key Definitions	
Standard	Required design element (typically using the words "shall" or "must")
Guidance	Recommended design element (not required, typically using the words "should" or "may")
Deviation or Exception	Design elements not meeting Standards (requires approval by region/state/federal authorities)
Span	Structure width, measured along top of structure (roadway centerline for undercrossings).
Cover	Depth of material (roadway pavement, subgrade, and embankment) over the top of a buried structure (culvert, bridge)
Vertical Clearance	Least available height from lower roadway surface (including usable shoulders) to the bottom of the bridge
Sight Distance	(for stopping): The distance traveled during perception / reaction time and the distance to stop the vehicle
Clear Zone	Clear roadside border area beginning at the edge of the traveled way for a vehicle driver or bicyclist to recover when their path is altered due to environmental, human, or vehicle/bicycle factors.

Key Acronyms	
AASHTO	American Association of State Highway and Transportation Officials - source of many design standards.
ABC	Accelerated Bridge Construction
ADT	Average daily traffic (how many vehicles use a segment of roadway)
FHWA	Federal Highway Administration - source of many design standards and funding.
HQ	Headquarters
LRFD	Load Rating Factor Design
NBI	National Bridge Inventory
NCHRP	National Cooperative Highway Research Program
PEL	Planning and Environmental Linkages

Links	**Manuals Accessed September - December 2023.**
Design Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/design-manual
Roadside Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/roadside-manual
Environmental Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/environmental-manual
Bridge Design Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/bridge-design-manual-lrfd
Geotechnical Design Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/geotechnical-design-manual
Project Management Guide	https://wsdot.wa.gov/engineering-standards/project-management-training/project-management/project-management-guide
Project Delivery Methods	https://wsdot.wa.gov/business-wsdot/how-do-business-us/project-delivery-methods
Design Bulletin 2022-03	https://wsdot.wa.gov/sites/default/files/2022-10/Vertical-Clearance-Considerations-Design-Bulletin-2022-03.pdf
Hydraulics Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/hydraulics-manual
Maintenance Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/maintenance-manual
Right of Way Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/right-way-manual
Roadside Policy Manual	https://wsdot.wa.gov/engineering-standards/all-manuals-and-standards/manuals/roadside-policy-manual

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Project Delivery	Nonstandard bid item use requires HQ approval	Design Manual	300
All Crossings	Standard	Project Delivery	Special Provisions require HQ approval	Design Manual	300
Overcrossings	Standard	Project Delivery	Preliminary bridge plans for Unusual/Complex Bridges on the Interstate require FHWA Approval	Design Manual	300
All Crossings	Guidance	Fencing	Locate fencing on, or depending on terrain, 12 inches inside right of way line	Design Manual	560.02(1)
All Crossings	Standard	Fencing	Fencing is mandatory on highways with full and partial limited access control	Design Manual	560.02(2)
All Crossings	Standard	Fencing	Type 3 fencing may be used within the Design Clear Zone	Design Manual	560.03(1)(a)
All Crossings	Standard	Fencing	All new gates must be approved on limited access highways by FHWA	Design Manual	560.04
All Crossings	Guidance	Project Delivery	WSDOT HQ geotechnical office and regional materials engineer will provide information about subsurface materials and geotechnical investigation needs for design	Design Manual	610.01
All Crossings	Guidance	Bridge	Submit structure site data to HQ for all bridges defined as structures with a clear span of 30 feet or greater measured along the roadway alignment, including buried structures	Design Manual	710.02
All Crossings	Guidance	Bridge	Definition of bridge: structure with opening greater than 20 feet measures along the roadway alignment, including buried structures.	Design Manual	720.01
Overcrossings	Standard	Roadway Clearance	Maintain 16.5 ft of vertical clearance for all falsework (temporary construction supports)	Design Manual	720.03(5)(a)
Undercrossings	Standard	Roadway Clearance	large objects are approved to be placed beneath the	Design Manual	720.03(5)(b)(iv)
Undercrossings	Standard	Hydraulic Conveyance	debris, under or inside water crossing structures are	Design Manual	720.03(5)(b)(iv)
Overcrossings	Standard	Roadway Clearance	Vertical clearance over interstates >16.5 ft	Design Manual	Exhibit 720-3
All Crossings	Guidance	Geometry	Summary of mechanically stabilized earth gravity wall/slope options	Design Manual	Exhibit 730-1

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Guidance	Roadside	"WSDOT is committed to highway designs that meet the transportation needs in a way that reduces the potential for fatal and injury crashes, is cost-effective, ecologically appropriate, context appropriate, and maintainable by managing roadsides that balance the natural and environmental functions within the right of way."	Design Manual	900.01
All Crossings	Standard	Project Delivery	Region Landscape Architect designs, supervises, has approval authority over, and stamps plans for wetland mitigation, roadside restoration, and revegetation; provides visual discipline reports for environmental documents, coordinates the visual elements within highway corridors with the State Bridge and Structures Architect	Design Manual	900.02(1)
All Crossings	Standard	Vegetation	A minimum of 3 years of plant establishment is required for all planted areas in western WA	Design Manual	900.02(4)
All Crossings	Guidance	Vegetation	5 years of plant establishment may be needed in situations where it is important to provide a full cover of vegetation to achieve the environmental or operational functions	Design Manual	900.02(4)
All Crossings	Guidance	Vegetation	Plant establishment may take up to 10 years if using woody vegetation	Design Manual	900.02(4)
All Crossings	Guidance	Project Delivery	Safe System Approach: eliminate death and serious injuries, support safe road use, reduce large crash forces, share responsibility, strengthen all part, safety is proactive	Design Manual	1100.02(2)
All Crossings	Guidance	Project Delivery	Determine project baseline need and contextual needs	Design Manual	1100.04(3)
All Crossings	Guidance	Project Delivery	Baseline need is primary reason a project has been proposed at a location, usually evolves from WSDOT planning and/or priority programming processes	Design Manual	1101.02

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Guidance	Project Delivery	Contextual needs are opportunities that may be addressed during project delivery and are not expected to add significant cost to the project	Design Manual	1101.05
All Crossings	Guidance	Project Delivery	Design controls: design year, modal priority, access control, design speed, terrain classification	Design Manual	1103.01
All Crossings	Standard	Project Delivery	Required Design Elements	Design Manual	Exhibit 1105-1
All Crossings	Standard	Safety	Sight distance broken out as stopping sight distance, passing sight distance, and decision sight distance	Design Manual	1260.01
All Crossings	Standard	Safety	Design Stopping Sight Distance is calculated using the design speed and a constant deceleration of 11.2 ft/second and a perception/reaction time of 2.5 seconds.	Design Manual	1260.03(1)(1)
All Crossings	Standard	Safety	Table of design stopping sight distances by design speed and vertical curves	Design Manual	Exhibit 1260-1 and Exhibit 1260-2
All Crossings	Standard	Safety	Existing stopping sight distances may be used if there is no identified collision trend, the existing vertical and horizontal alignment is retained, the existing roadway pavement is not reconstructed, the roadway will not be widened, the sightline obstruction is existing, and roadway improvements to sight distance are within existing right of way	Design Manual	1260.03(7) and Exhibit 1260-10
All Crossings	Standard	Safety	Clear zone graphics	Design Manual	Exhibit 1600-1
All Crossings	Standard	Safety	Conduct Clear Zone Inventory: document all roadside and median features within clear zone, whether they are existing or proposed, the corrective actions considered, estimated cost to correct, and if the correction is planned or not	Design Manual	1600.02
All Crossings	Guidance	Roadside	Roadside environmental functions include habitat connectivity	Roadside Manual	Exhibit 110-2

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Roadside	Roadside has three zones: 1) pavement edge zone with mowed veg, 2) operational zone with no vegetation stem >4" diameter typically includes clear zone, zone 3) buffer with native vegetation	Roadside Manual	Exhibit 110-3
All Crossings	Guidance	Roadside	Sustainable Roads: 20-year planning horizon; projected life cycle costs; utilize, protect and support the roadway and roadside infrastructure; continued cooperative involvement	Roadside Manual	120.05
All Crossings	Guidance	Regulatory	List of Federal Environmental Preservation and Protection acts	Roadside Manual	210.02
All Crossings	Guidance	Regulatory	Executive order 13514 …federal agencies conduct transportation…missions in an environmentally, economically, and fiscally sound, integrated, continuously improving, efficient and sustainable manner.	Roadside Manual	210.02(10)
All Crossings	Guidance	Regulatory	Presidential Memorandum on Environmentally Beneficial Landscaping directs federal agencies (including federally funded projects) to use regionally native plants, construct with minimal impact to habitat, reduce use of fertilizers/pesticides/other chemicals, use water-efficient and runoff-reduction practices, use demonstration projects employing these practices	Roadside Manual	210.02(12)
All Crossings	Guidance	Regulatory	List of Federal Visual Quality and Scenic Enhancement acts	Roadside Manual	210.03
All Crossings	Standard	Regulatory	RCW 4740.010 establishes that "the planting of any shrubs, trees, hedges or other domestic or native ornamental growth, the improvement of roadside facilities and view points, and the correction of unsightly conditions, upon the right-of-way of any state highway is hereby declared to a proper state highway purpose."	Roadside Manual	220.02(1)
All Crossings	Standard	Regulatory	State Environmental Policy Act (SEPA)	Roadside Manual	220.03(1)
All Crossings	Standard	Regulatory	WA Water Quality Rules	Roadside Manual	220.03(2)

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Regulatory	WA Biology/Wetlands Rules	Roadside Manual	220.03(3)
All Crossings	Standard	Regulatory	WA Noise Rules	Roadside Manual	220.03(4)
All Crossings	Standard	Regulatory	WA Visual Quality Rules	Roadside Manual	220.03(5)
All Crossings	Guidance	Vegetation	"It is necessary to have healthy soil to revegetate a site. Revegetation is necessary to provide slope stabilization, erosion control, biofiltration and infiltration for water quality, screening, local climate modification, habitat, and so forth. Revegetation might also be necessary to meet permit or environmental requirements. As a result, healthy topsoil is an important component of a construction project."	Roadside Manual	700
All Crossings	Guidance	Vegetation	Table of recommended practices for preserving and enhancing soils along the roadside	Roadside Manual	Figure 700.2
All Crossings	Guidance	Vegetation	Structural soils to support vegetation and loads/compaction	Roadside Manual	700-7
All Crossings	Guidance	Roadside	Contour grading for roadside berms	Roadside Manual	720
All Crossings	Guidance	Roadside	Earth berms	Roadside Manual	Figure 720.5
All Crossings	Guidance	Vegetation	Wildlife habitat included in functions for vegetation	Roadside Manual	800-6
All Crossings	Standard	Vegetation	Minimum setbacks from traffic barriers: 2 ft for shrubs, 6 ft for trees	Roadside Manual	800-10
All Crossings	Standard	Vegetation	Do not use herbs in roadside seed mixes where there are deer	Roadside Manual	800-11
All Crossings	Standard	Vegetation	Consider ability to maintain or enhance habitat values for wildlife, where this is desirable. This is determined on a site specific basis in conjunction with the region's environmental office	Roadside Manual	800-11
Undercrossings	Guidance	Vegetation	Restoration of vegetation for fish passage projects	Roadside Manual	830

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
Overcrossings	Guidance	Bridge	Design enhancement for tunnel portals, bridges, noise walls, etc. "It may consist of a landform, water feature, wall or barrier texture, color, pavement type, brick variation, site furnishings, or a combination of elements. "	Roadside Manual	910
Overcrossings	Standard	Bridge	Design enhancement cost is above and beyond WSDOT obligation for structural costs	Roadside Manual	910
All Crossings	Guidance	Regulatory	Secretary's Executive Order on Protections and Connections for High Quality Natural Habitats (E 1031.02) directs WSDOT to promote and support processes that identify potentially affected fish and wildlife habitats as early as possible.	Environmental Manual	200.02
All Crossings	Guidance	Regulatory	Likely to be NEPA Class I project and require an environmental impact statement (EIS)	Environmental Manual	300.04
All Crossings	Guidance	Regulatory	Likely to have SEPA Determination of Significance (DS) and require an EIS	Environmental Manual	300.05
Undercrossings	Guidance	Regulatory	Policies for working in/around wetlands and other waters of the state or United States	Environmental Manual	431
Undercrossings	Guidance	Regulatory	Policies for working in/around special flood hazard areas AKA FEMA floodplains	Environmental Manual	432
All Crossings	Guidance	Regulatory	Policies for working in/around sensitive wildlife, fish, plants and their habitats	Environmental Manual	436
All Crossings	Guidance	Regulatory	Noise regulations	Environmental Manual	446
All Crossings	Standard	Roadside	Any noise abatement constructed is required to be maintained in perpetuity.	Environmental Manual	446.08
All Crossings	Guidance	Regulatory	Cultural resources policies	Environmental Manual	456
All Crossings	Guidance	Regulatory	Department of Transportation Act of 1966 Section 4(f) "to preserve the natural beauty of the countryside, public park and recreation land, wildlife and waterfowl refuges, and historic sites"	Environmental Manual	457
All Crossings	Guidance	Regulatory	Visual impacts policies	Environmental Manual	459
Overcrossings	Standard	Bridge	FHWA requires a Type, Size & Location (TS&L) report for 'major or unusual bridges'	Bridge Design Manual	2.1.5

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
Overcrossings	Standard	Bridge	End of bridge deck set 3 ft min back from top of embankment slope	Bridge Design Manual	Figure 2.3.1-3
Overcrossings	Standard	Bridge	Design bridges to minimize risk of catastrophic collapse by using redundant supporting elements (columns and girders)	Bridge Design Manual	2.3.1.H
Overcrossings	Guidance	Bridge	Bridge types - prestressed concrete girder sections have a variety of lengths, including up to 250 ft	Bridge Design Manual	2.4.1.E
Overcrossings	Guidance	Bridge	Composite steel plate girder /composite steel box girder up to 400 ft and relatively low dead load compared to concrete	Bridge Design Manual	2.4.1.F / 2.4.1.G
Overcrossings	Guidance	Bridge	Steel truss 300' to 1200' spans and construction by cantilever	Bridge Design Manual	2.4.1.H
Overcrossings	Guidance	Bridge	Segmental concrete box girder 200' to 700' spans and construction by cantilever	Bridge Design Manual	2.4.1.I
All Crossings	Guidance	Bridge	Accelerated bridge construction methods: "In general, where time on a job site ought to be minimized, ABC would make a good choice to consider."	Bridge Design Manual	14
All Crossings	Guidance	Bridge	Examples of accelerated and innovative bridge construction	Bridge Design Manual	14.7
All Crossings	Guidance	Bridge	Seismic design considers the safety evaluation earthquake per bridge design manual and functional evaluation earthquake (for essential/critical bridges)	Geotechnical Manual	6-1.2.1

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Guidance	Bridge	"Bridge approach embankments and fills through which cut-and-cover tunnels are constructed should be designed to remain stable during the design seismic event because of the potential to contribute to collapse or inadequate performance of the structure should they fail or deform excessively. The aerial extent of approach embankment (and embankment surrounding cut-and-cover tunnels) seismic design and mitigation (if necessary) should be such that the structure is protected against instability or loading conditions that could result in collapse or inadequate performance. The typical distance of evaluation and mitigation is within 100 feet of the abutment or tunnel wall, but the actual distance should be evaluated on a case-by-case basis."	Geotechnical Manual	6-1.2.1
All Crossings	Standard	Bridge	"All retaining walls and abutment walls, including reinforced slopes steeper than 0.5H:1V, which shall be considered to be a wall (see Section 15-5.6), shall be evaluated and designed for seismic stability internally and externally (i.e. sliding, eccentricity, and bearing capacity), with the exception of walls that meet the AASHTO LRFD Bridge Design Manual "No Seismic Analysis" provisions in AASHTO Article 11.5.4.2. Noise walls, as well as reinforced slopes steeper than 1.2H:1V, shall also be evaluated for seismic stability."	Geotechnical Manual	6-1.2.1
All Crossings	Standard	Bridge	Spread footings are best suited for dense, nonliquifiable soils. Deep foundations are best when spread footings cannot be founded on competent soils or rock at a reasonable cost.	Geotechnical Manual	8.4

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
Overcrossings	Guidance	Bridge	The WSDOT Standard Specifications define rock embankment as “all or any part of an embankment in which the material contains 25 percent or more by volume of gravel or stone 4 inches or greater in diameter.”	Geotechnical Manual	9-2.1.1
Overcrossings	Guidance	Bridge	Three types of materials are commonly used in WSDOT earth embankments, including common, select, and gravel borrow. Bridge approach embankments should be constructed from select or gravel borrow, although common borrow may be used in the drier parts of the State, provided it is not placed below a structure foundation or immediately behind an abutment wall.	Geotechnical Manual	9-2-1.2.
Overcrossings	Standard	Bridge	Any fill placed near or against a bridge abutment or foundation, or that can impact a nearby buried or above-ground structure, will likewise require stability analyses by the geotechnical designer.	Geotechnical Manual	9-2.3
Overcrossings	Standard	Project Delivery	All abutments, retaining walls, and reinforced slopes within WSDOT Right of Way or whose construction is administered by WSDOT shall be designed in accordance with the Geotechnical Design Manual (GDM) and the following documents: • Bridge Design Manual (LRFD) M 23-50 • Design Manual M 22-01 • AASHTO LRFD Bridge Design Specifications, U.S	Geotechnical Manual	15-1
Undercrossings	Guidance	Hydraulic Conveyance	Two elements determine vertical clearance under bridges and inside buried structures: hydraulic design freeboard and maintenance clearance.	Design Bulletin 2022-03	
Undercrossings	Guidance	Maintenance	Initial maintenance clearance target: 6 ft from the highest ground elevation to the controlling top elevation of the structure	Design Bulletin 2022-03	

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
Undercrossings	Guidance	Maintenance	10 ft maintenance clearance for machinery access	Design Bulletin 2022-03	
Undercrossings	Guidance	Geometry	Structure free zone is measured from the highest ground elevation to the controlling top elevation. Can be used to increase clearance beyond freeboard and maintenance clearance, for example wildlife connectivity	Design Bulletin 2022-03	
Undercrossings	Standard	Geometry	Minimum structure-free zone width can never be less than the hydraulic width and will be established by the WSDOT engineer before (design-build) request for proposal (RFP)	Design Bulletin 2022-03	
Undercrossings	Guidance	Geometry	Minimum structure-free zone height needs to consider whether roadway profile must be raised or if less freeboard or maintenance clearance is acceptable	Design Bulletin 2022-03	
Undercrossings	Guidance	Hydraulic Conveyance	Boulders should be stable and placed in a way to promote localized scour/pool development	Hydraulics Manual	7-4.10.1
Undercrossings	Standard	Geometry	When a buried structure is used as the crossing structure, wing walls shall be used to minimize the overall length of the buried structure. Wing walls can also increase the efficiency of the crossing structure. Wing walls shall be a minimum of 10 feet in length designed for scour and shall be increased based on the potential impacts of lateral migration as assessed by the hydraulics engineer of record.	Hydraulics Manual	7-4.6
Undercrossings	Standard	Geometry	Minimum hydraulic opening = greater of (1.2 * BFW + 2 ft OR 1.3* BFW). BFW = bankfull width	Hydraulics Manual	7-4.4
Undercrossings	Standard	Hydraulic Conveyance	Design floods for crossings	Hydraulics Manual	Table 7-1
Undercrossings	Standard	Hydraulic Conveyance	Design freeboard requirements for buried structures	Hydraulics Manual	Table 7-2
Undercrossings	Guidance	Geometry	Structure-free zone may be increased to accommodate wildlife connectivity	Hydraulics Manual	7-4

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Bridge	"The Bridge and Structures Office is concerned with the placement of temporary or permanent wildlife habitat structures (peregrine falcon platforms, bat boxes, etc.) on state bridges due to their potential negative impact to inspections of all bridges in accordance with the federally-mandated National Bridge Inspection Standards and the potential negative affects to maintain the bridge structure itself. **The Bridge and Structures Office discourages the practice of placing these habitat structures on state bridges.** Therefore, all plans to place temporary or permanent wildlife habitat structures on state bridges are to be reviewed by the Bridge Preservation Engineer. This is consistent with the review process for all other attachments to bridges."	Maintenance Manual	5-7
All Crossings	Guidance	Roadside	Roadside functional zones 2 and 3 include "provide wildlife habitat where compatible with roadway traffic" (zone 2) and "preserve wetlands and wildlife habitat" (zone 3)	Maintenance Manual	Exhibit 6-3
All Crossings	Standard	Roadside	"Studies have shown that wildlife warning reflector systems are ineffective at reducing the accident potential for motor vehicle/wildlife collisions. **WSDOT policy is to no longer design, place, or maintain wildlife reflectors.**"	Maintenance Manual	8-16
All Crossings	Standard	Maintenance	For maintenance purposes, major structures are identified as those bridges included in the Bridge List M 23-09. The State Bridge and Structures Engineer is the responsible authority for these structures and must be contacted prior to any major maintenance or modifications to them. The designated contact in Olympia is the Bridge Preservation Engineer.	Maintenance Manual	5-2

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Maintenance	For maintenance purposes, minor structures are identified as those drainage structures (culverts, etc.), retaining walls, acoustical barriers, cribbing, etc., that are not listed in the Bridge List. The Region Maintenance Engineer is the responsible authority for minor structures.	Maintenance Manual	5-3
All Crossings	Standard	Bridge	Modifications to bridges need to be detailed in drawings and submitted to the Bridge Preservation Engineer for as-built documentation and future reference. All bridge structural as-built information is maintained at the Bridge Preservation Office	Maintenance Manual	5-4
All Crossings	Standard	Roadside	Integrated Roadside Vegetation Management (IVRM) Plans are updated and published annual for all regions and areas of the state	Maintenance Manual	6-2
All Crossings	Standard	Roadside	... agency policy dictates (Section 1.1 of the Roadside Policy Manual) that **design coordinate with local maintenance managers on roadside planting design**. Once roadsides have been redesigned and constructed following highway improvement projects, the plans for ongoing management are added to the locally adapted Region/Area IRVM plans.	Maintenance Manual	6-5
All Crossings	Guidance	Roadside	The integrated vegetation management (IVM) process relies on Highway Activity Tracking System (HATS) and the IRVM Plans, in combination with annual crew training to deliver the most practical and long-term sustainable solutions to roadside vegetation management challenges throughout the state.	Maintenance Manual	6-7

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Standard	Maintenance	"The remains of animals killed by motor vehicles should be removed promptly and buried at convenient locations. If license tags are present on domestic pets, notification of appropriate city or county is encouraged. A HATS record must be completed for this activity. This record of killed wildlife aids in the placement of signing and other preventive measures"	Maintenance Manual	6-9
All Crossings	Standard	Regulatory	Pursuant to RCW 47.52.050, WSDOT shall acquire fee title to all property acquired for a limited access facility.	Right of Way Manual	6-5.1
All Crossings	Guidance	Regulatory	WSDOT may acquire an easement when it needs a nonexclusive right to enter upon the property of another. The easement will set forth WSDOT's right to the use of the property under specified circumstances.	Right of Way Manual	6-5.1
Overcrossings	Standard	Vegetation	**Provide permanent irrigation** for lawns, ornamental plantings, public art or gateway areas or permanent flower displays **only where the initial cost, ongoing cost, and maintenance are provided by a local jurisdiction, unless roadside planting would be impossible without it (raised planting areas, freeway lids, etc.).**	Roadside Policy Manual	2-2.8
Overcrossings	Guidance	Roadside	Visual design / scenic considerations for all structures	Roadside Policy Manual	2.3.3
Overcrossings	Guidance	Roadside	Textural / architectural considerations for structures	Roadside Policy Manual	4.2.3
Overcrossings	Guidance	Regulatory	Chapter 4 - roadside restoration toolkit	Roadside Policy Manual	4

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Guidance	Project Delivery	Initiation is the process of defining and authorizing the project or phase, selecting the project manager and identifying the project team. Region or organization management provides the team with the initial project information, project phase, legislative milestone commitments and project boundaries (limits).	Project Management Guide	
All Crossings	Standard	Regulatory	Project Management (E.O. 1032.02) - Directs the use of the WSDOT project management process and clarifies the requirements for executives, project managers, project team members, and others in WSDOT who participate in project management.	Project Management Guide	
All Crossings	Guidance	Project Delivery	Project delivery methods: A+B bidding, Design-build, Flexible start date, Interim completion date, Lump sum traffic control	Project Delivery Methods	
All Crossings	Guidance	Project Delivery	A+B bidding is a cost-plus-time bidding procedure. By providing a cost for each working day, the contract combines the cost to perform the work (A component) with the cost of the impact to the public (B component) to provide lowest cost to the public.	Project Delivery Methods	
All Crossings	Guidance	Project Delivery	Design-build is a method of project delivery in which WSDOT executes a single contract with one entity (the design-builder) for design and construction services to provide a finished product. This may save time compared to the design-bid-build process by eliminating the bidding phase of project delivery.	Project Delivery Methods	
All Crossings	Guidance	Project Delivery	Flexible start date: "Projects that have a fast track schedule, requiring completion as soon as possible, or where there is no likelihood of efficiencies being realized from this method should not be considered for this provision."	Project Delivery Methods	

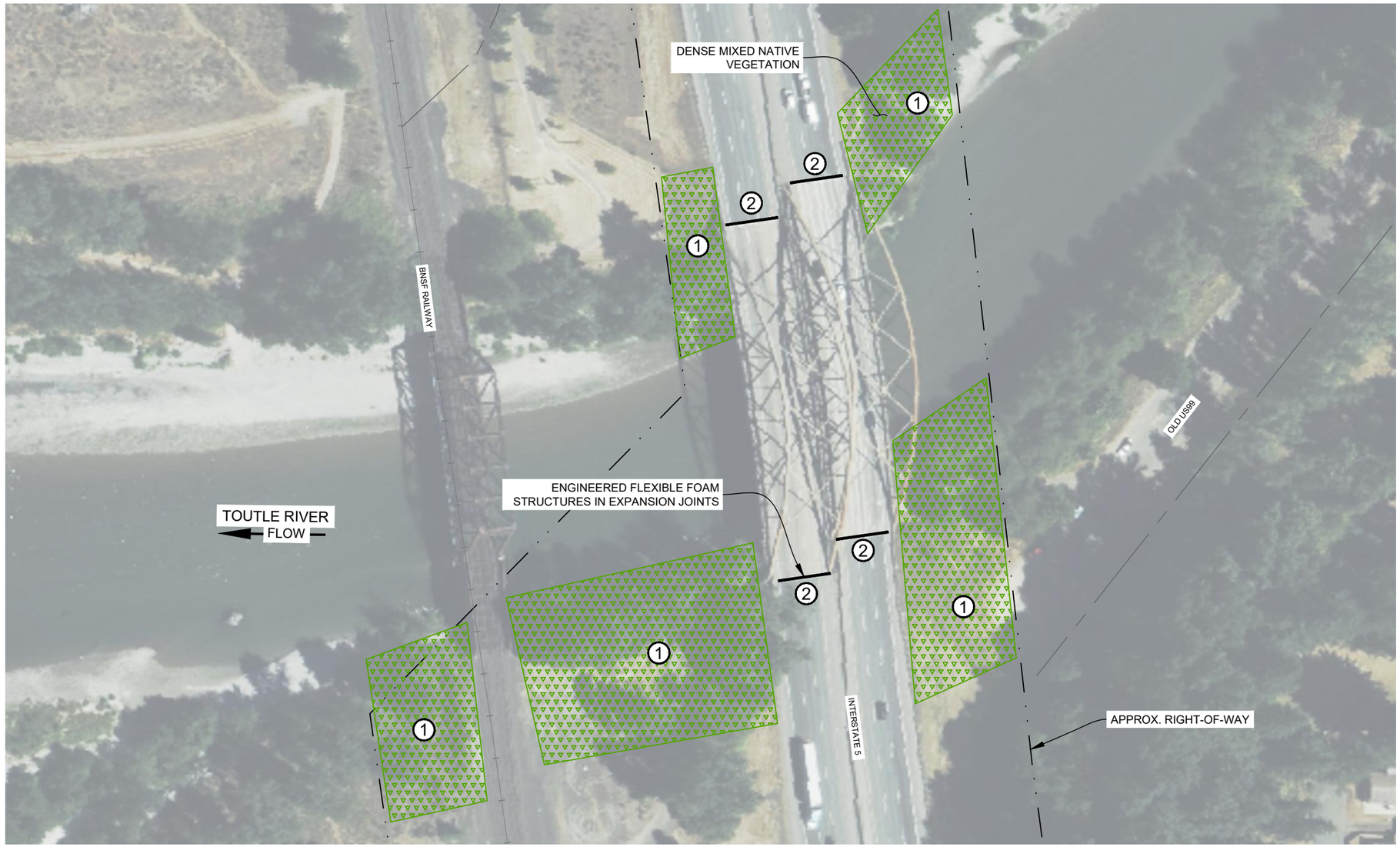
Crossing	Standard/Guidance	Type	Requirement	Source	Section
All Crossings	Guidance	Project Delivery	Interim completion dates are a method of providing the contractor with an incentive or disincentive to expedite the completion of specific portions of a contract. This is done by requiring a portion of the contract to be accomplished within a set duration or by a specified date. The portion requiring an interim completion may also include a prescribed start date.	Project Delivery Methods	
All Crossings	Guidance	Project Delivery	On some projects, the traffic control solution may vary significantly due to a contractor's proposed solution. Requiring a lump sum bid encourages the contractor to consider the direct traffic control cost in determining the most cost-effective solution. The fixed final traffic control cost offers a built-in advantage for the more organized contractor who is able to schedule all work efficiently into the smallest traffic control window. There is also a built-in incentive for the contractor keep costs low. This could potentially lead to more efficient use of the work force and more coordination between the prime contractor and the traffic control subcontractor.	Project Delivery Methods	

SW WA Wildlife Crossings Design Criteria Summary

Crossing	Standard/Guidance	Source	Type	Requirement
All Crossings	Guidance	FHWA	Geometry	See European Wildlife Traffic handbook: https://handbookwildlifetraffic.info/handbook-wildlife-traffic/
Overcrossings	Guidance	FHWA	Geometry	"If large species are involved that are sensitive to human disturbance, or if multiple habitats have to be provided for on an overpass, wildlife overpass structures are generally recommended to be at least 50–70 m (164–230 ft) wide"
Overcrossings	Guidance	NCHRP	Structure	Combined mitigation measures (over/underpasses and fencing) is more successful for a suite of species than a single design.
All Crossings	Guidance	FHWA	Noise	See https://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/polguide/

Appendix D

Conceptual Site Designs



1 MP 51.7 BRIDGE RETROFIT LAYOUT

1" = 100'

BRIDGE RETROFIT NOTES

1. THE PURPOSE OF THE RETROFIT IS TO REDUCE BRIDGE AND ROAD NOISE FOR WILDLIFE APPROACHING AND CROSSING UNDER THE BRIDGE. THE BRIDGE GEOMETRY WILL NOT BE ALTERED.

BRIDGE RETROFIT NOTES

(1) DENSELY PLANT MIXED NATIVE VEGETATION TO REDUCE NOISE AT THE BRIDGE APPROACHES. DO NOT PLANT VEGETATION DIRECTLY BENEATH THE BRIDGES.

(2) INSTALL ENGINEERED FLEXIBLE FOAM STRUCTURES IN THE EXISTING BRIDGE EXPANSION JOINTS.

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MP 51.7 TOUTLE RIVER BRIDGE RETROFIT

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
1.0

Drawing 1 of 11

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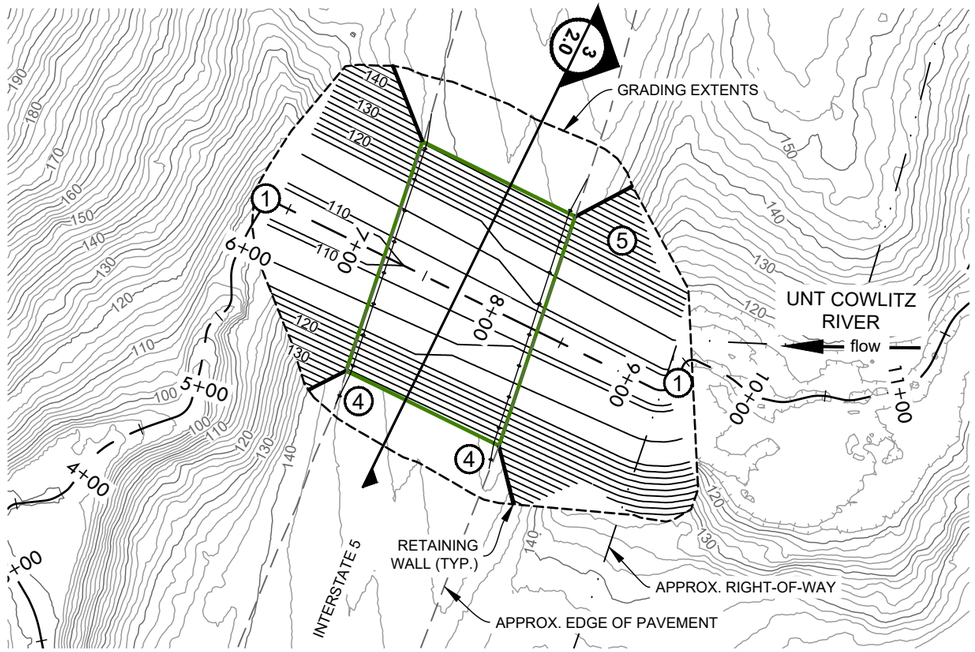


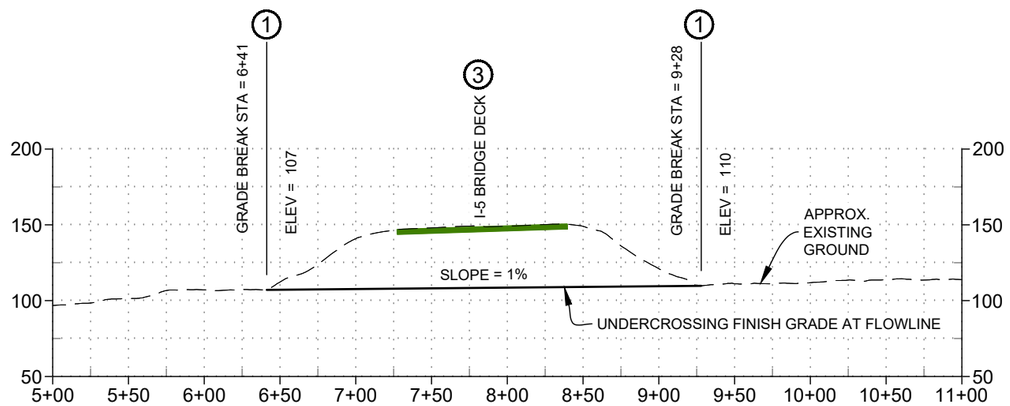
1 MP 53.07 UNDERCROSSING LAYOUT
1" = 100'

GENERAL NOTES

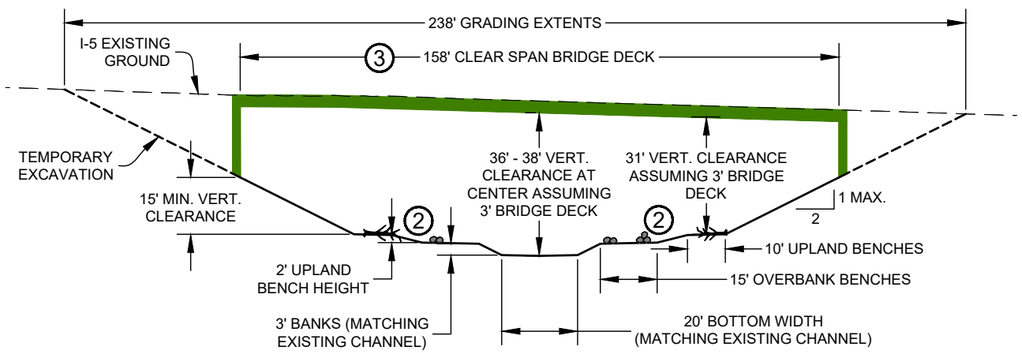
1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL CROSSING DIMENSIONS ARE APPROXIMATE AND WILL BE REFINED IF SELECTED FOR ADVANCEMENT INTO PRELIMINARY DESIGN.
3. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
4. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM WA-DNR. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
5. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
6. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
7. WILDLIFE FENCING NOT SHOWN. SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.
8. CHANNEL DIMENSIONS ARE APPROXIMATE. DESIGN CHANNEL AND CROSSING FOR FISH PASSAGE IN ADDITION TO TERRESTRIAL WILDLIFE PASSAGE.

CONSTRUCTION NOTES

1. CONSTRUCT UNDERCROSSING THROUGH APPROX. 290 FT OF UNNAMED TRIBUTARY CHANNEL. TRANSITION TO MATCH EXISTING CHANNEL GEOMETRY AT ENDS OF CROSSING. MINIMIZE IMPACTS TO EXISTING VEGETATION.
2. PLACE ROCK PILES AND LOGS THROUGH CROSSING TO PROVIDE DRY PASSAGE AT MODERATE FLOWS. MAINTAIN FREEBOARD FOR HIGHWAY SAFETY. MINIMIZE USE OF ANGULAR ROCK IN STREAMBED AND BANKS.
3. INSTALL 158 FT (MIN.) CLEAR SPAN BRIDGE OVER CROSSING TO MATCH EXISTING ROAD PROFILE AND SECTION. LAYOUT ASSUMES 3 FT BRIDGE DECK DEPTH. CONCRETE GIRDER PREFERRED TO MINIMIZE ROAD NOISE THROUGH CROSSING.
4. INSTALL GUARDRAIL, OR OTHER APPROVED BARRIER, ALONG ROADWAY OVER CROSSING.
5. RESTORE ALL DISTURBED AREAS OUTSIDE LIMITS OF PAVEMENT WITH NATIVE VEGETATION.



2 MP 53.07 UNDERCROSSING PROFILE
HORIZ 1" = 100'
VERT 1" = 100'



3 MP 53.07 UNDERCROSSING SECTION
HORIZ 1" = 40'
VERT 1" = 40'

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MP 53.07 UNT COWLITZ RIVER UNDERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
2.0

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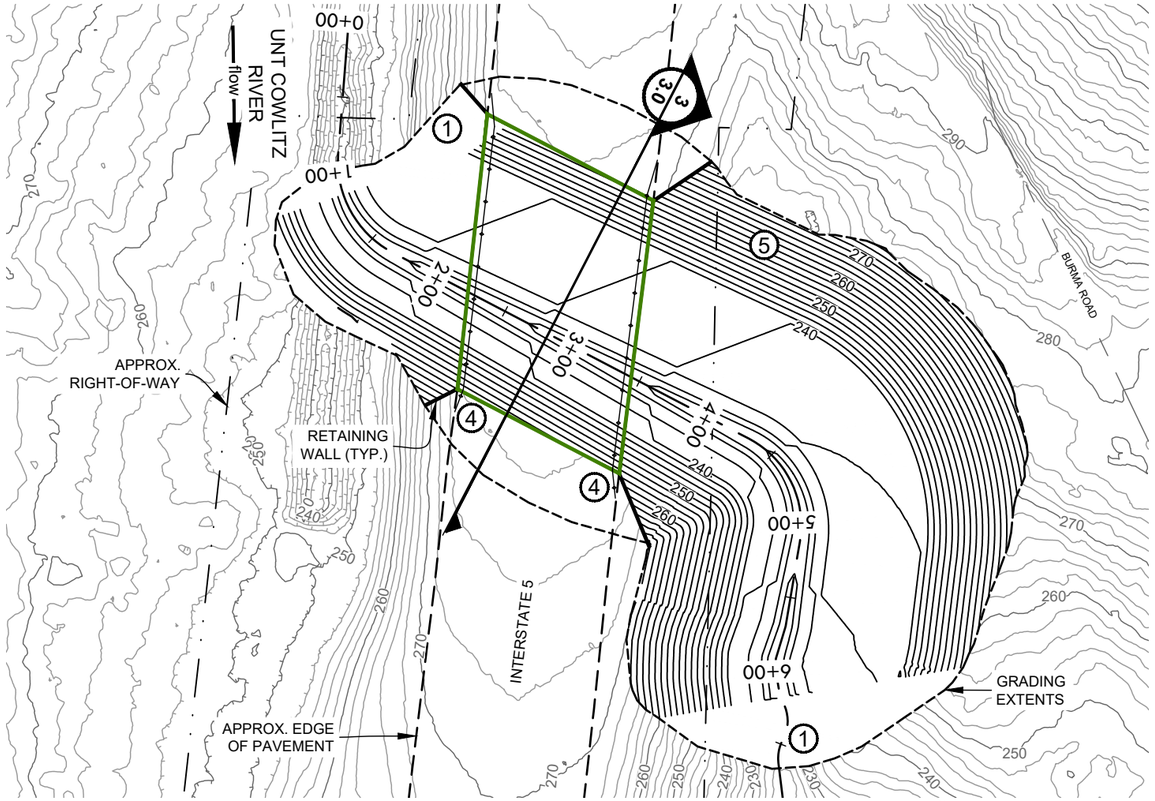
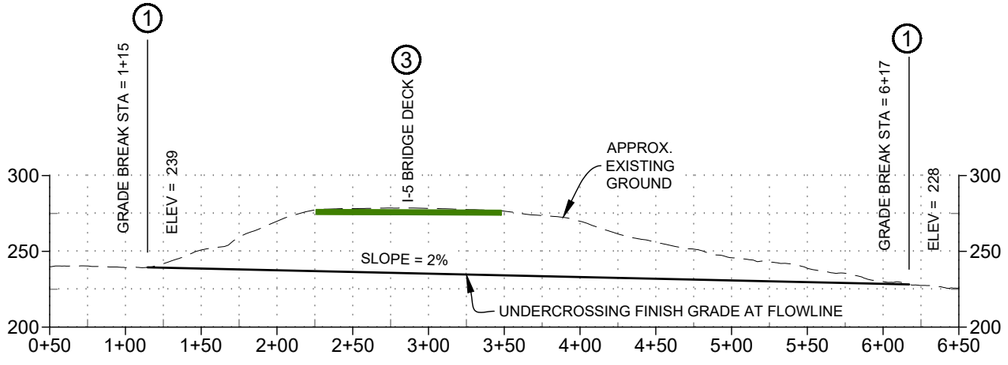


1 MP 53.9 UNDERCROSSING LAYOUT

1" = 100'



2 MP 53.9 UNDERCROSSING PROFILE

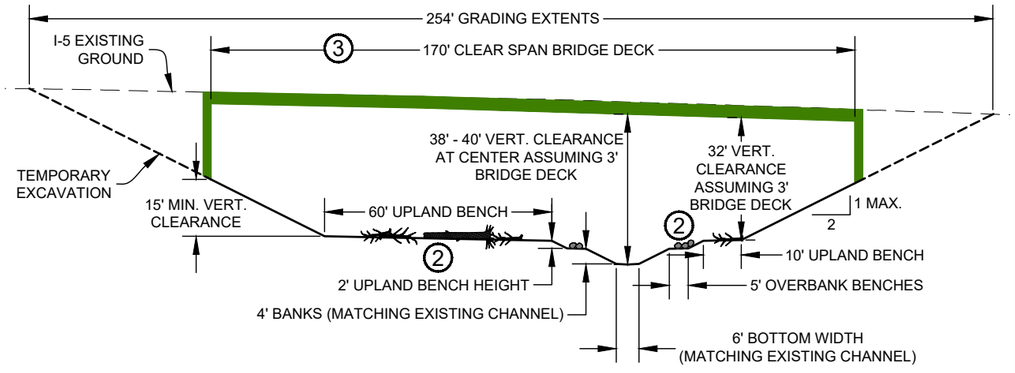
HORIZ 1" = 100'
VERT 1" = 100'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL CROSSING DIMENSIONS ARE APPROXIMATE AND WILL BE REFINED IF SELECTED FOR ADVANCEMENT INTO PRELIMINARY DESIGN.
3. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
4. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM WA-DNR. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
5. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
6. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
7. WILDLIFE FENCING NOT SHOWN. SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.
8. CHANNEL DIMENSIONS ARE APPROXIMATE. DESIGN CHANNEL AND CROSSING FOR FISH PASSAGE IN ADDITION TO TERRESTRIAL WILDLIFE PASSAGE.

CONSTRUCTION NOTES

1. CONSTRUCT UNDERCROSSING THROUGH APPROX. 500 FT OF UNNAMED TRIBUTARY CHANNEL. TRANSITION TO MATCH EXISTING CHANNEL GEOMETRY AT ENDS OF CROSSING. MINIMIZE IMPACTS TO EXISTING VEGETATION.
2. PLACE ROCK PILES AND LOGS THROUGH CROSSING TO PROVIDE DRY PASSAGE AT MODERATE FLOWS. MAINTAIN FREEBOARD FOR HIGHWAY SAFETY. MINIMIZE USE OF ANGULAR ROCK IN STREAMBED AND BANKS.
3. INSTALL 170 FT (MIN.) CLEAR SPAN BRIDGE OVER CROSSING TO MATCH EXISTING ROAD PROFILE AND SECTION. LAYOUT ASSUMES 3 FT BRIDGE DECK DEPTH. CONCRETE GIRDER PREFERRED TO MINIMIZE ROAD NOISE THROUGH CROSSING.
4. INSTALL GUARDRAIL, OR OTHER APPROVED BARRIER, ALONG ROADWAY OVER CROSSING.
5. RESTORE ALL DISTURBED AREAS OUTSIDE LIMITS OF PAVEMENT WITH NATIVE VEGETATION.



3 MP 53.9 UNDERCROSSING SECTION

HORIZ 1" = 40'
VERT 1" = 40'

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MP 53.9 UNT COWLITZ RIVER UNDERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
3.0

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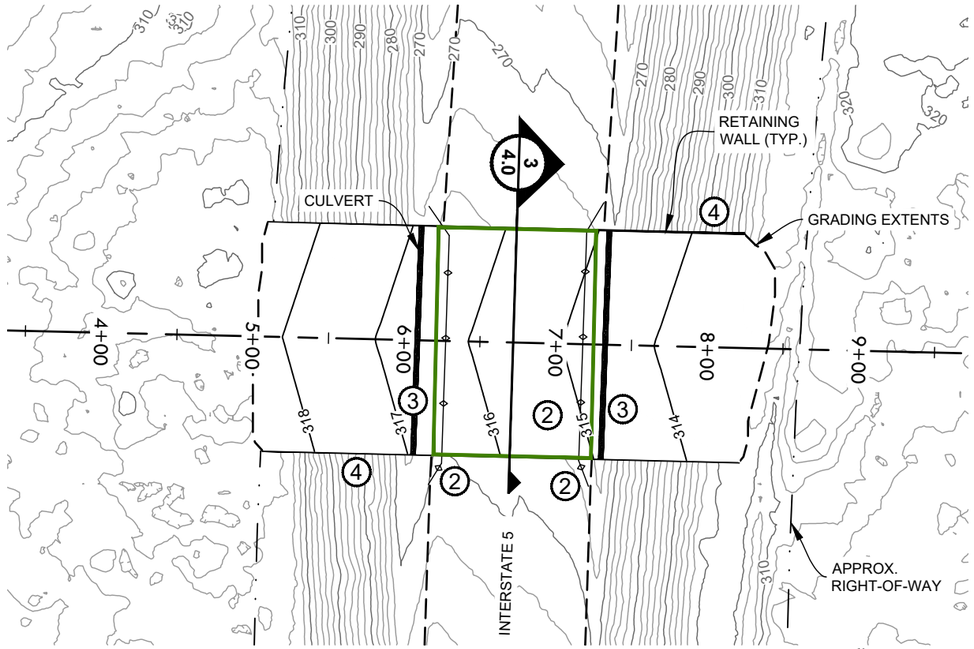
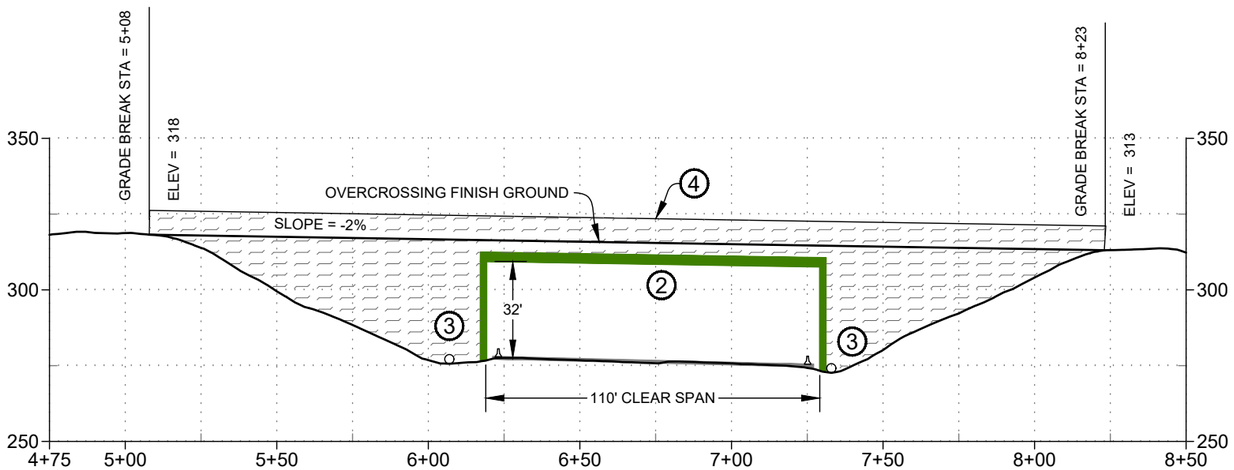


1 MP 55.6 OVERCROSSING LAYOUT

1" = 100'



2 MP 55.6 OVERCROSSING PROFILE

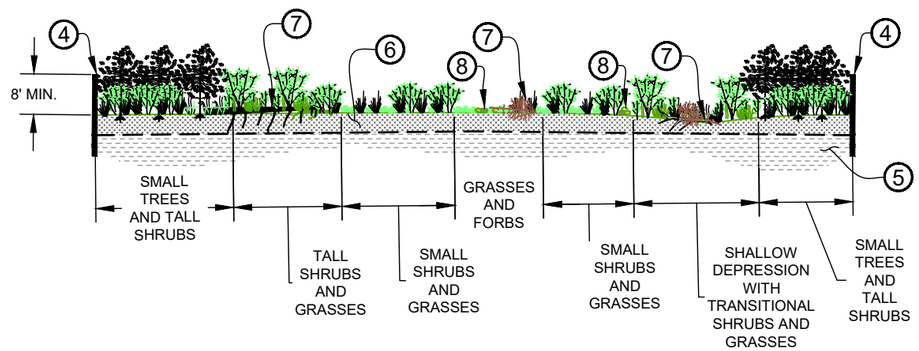
HORIZ 1" = 50'
VERT 1" = 50'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL WORK IS TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
3. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM THE OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
4. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
5. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
6. WILDLIFE FENCING NOT SHOWN; SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.

CONSTRUCTION NOTES

1. MAINTAIN TWO LANES OF DAYTIME TRAFFIC. UTILIZE PARTIAL NIGHTTIME CLOSURES FOR BRIDGE INSTALLATION. MAINTAIN EMERGENCY VEHICLE ACCESS.
2. INSTALL PRE-STRESSED CONCRETE GIRDER BRIDGE: 110' SPAN X 150' LENGTH. INSTALL CONCRETE BARRIER THROUGH CROSSING.
3. INSTALL CULVERT IN EXISTING DITCH LINE TO MAINTAIN ROADSIDE DRAINAGE.
4. CONSTRUCT RETAINING WALLS AROUND STRUCTURE. EXTEND SIDEWALLS 8' MIN. ABOVE TOPSOIL OVER CROSSING STRUCTURE TO BUFFER WILDLIFE FROM ROAD NOISE, SMELLS, AND LIGHTS.
5. BACKFILL STRUCTURE WITH GRANULAR STRUCTURE BACKFILL AND SELECT GENERAL BACKFILL.
6. INSTALL 4' MIN. TOPSOIL WITH DEPRESSIONS TO POND WATER TO 3-9 IN. DEPTH AND PLANT NATIVE VEGETATION.
7. PLACE DOWNED WOODY MATERIAL IN CONTACT WITH TOPSOIL.
8. PLACE ROCK CLUSTERS ON SURFACE OF TOPSOIL. DO NOT EMBED.



3 OVERCROSSING TYPICAL SECTION

HORIZ 1" = 30'
VERT 1" = 30'

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MP 55.6 OVERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
4.0

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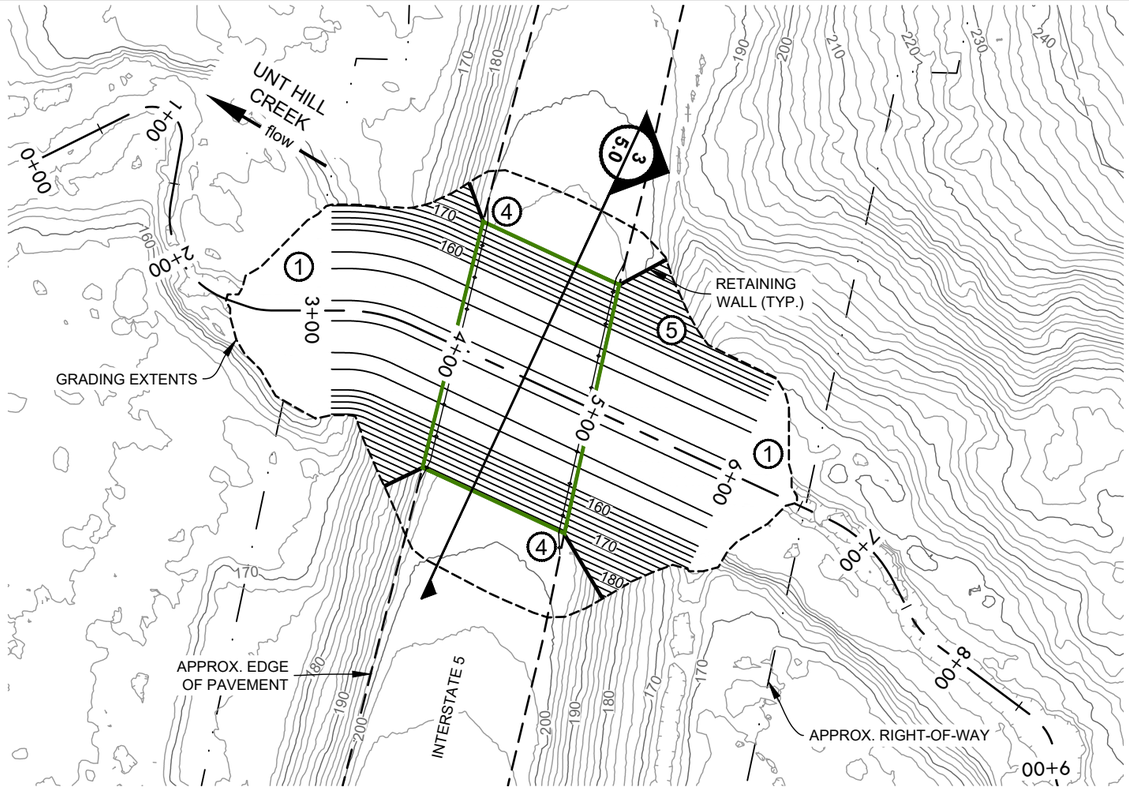
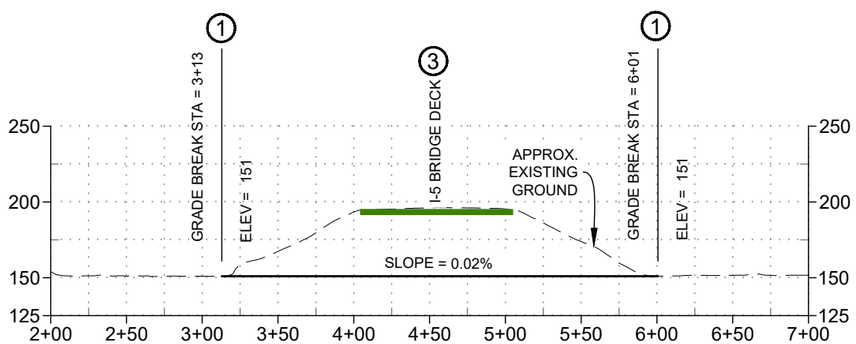


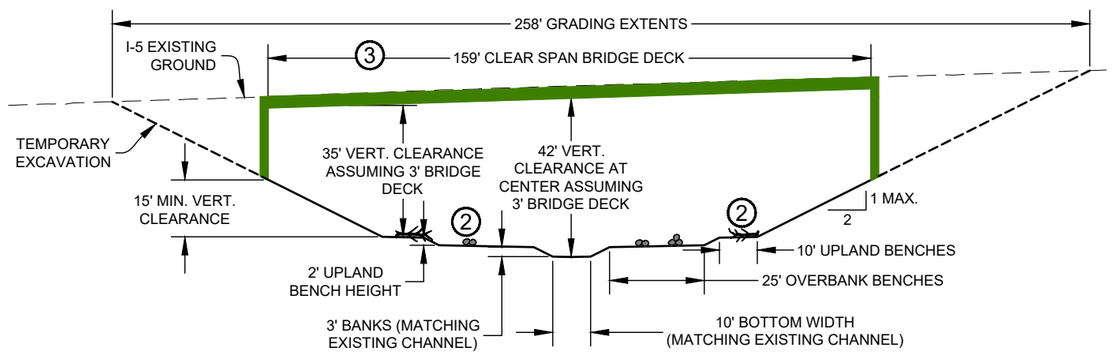
1 MP 56.1 UNDERCROSSING LAYOUT

1" = 100'



2 MP 56.1 UNDERCROSSING PROFILE

HORIZ 1" = 100'
VERT 1" = 100'



3 MP 56.1 UNDERCROSSING SECTION

HORIZ 1" = 40'
VERT 1" = 40'

DRAFT

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL CROSSING DIMENSIONS ARE APPROXIMATE AND WILL BE REFINED IF SELECTED FOR ADVANCEMENT INTO PRELIMINARY DESIGN.
3. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
4. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM WA-DNR. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
5. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
6. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
7. WILDLIFE FENCING NOT SHOWN. SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.
8. CHANNEL DIMENSIONS ARE APPROXIMATE. DESIGN CHANNEL AND CROSSING FOR FISH PASSAGE IN ADDITION TO TERRESTRIAL WILDLIFE PASSAGE.

CONSTRUCTION NOTES

1. CONSTRUCT UNDERCROSSING THROUGH APPROX. 290 FT OF UNNAMED TRIBUTARY CHANNEL. TRANSITION TO MATCH EXISTING CHANNEL GEOMETRY AT ENDS OF CROSSING. MINIMIZE IMPACTS TO EXISTING VEGETATION.
2. PLACE ROCK PILES AND LOGS THROUGH CROSSING TO PROVIDE DRY PASSAGE AT MODERATE FLOWS. MAINTAIN FREEBOARD FOR HIGHWAY SAFETY. MINIMIZE USE OF ANGULAR ROCK IN STREAMBED AND BANKS.
3. INSTALL 159 FT (MIN.) CLEAR SPAN BRIDGE OVER CROSSING TO MATCH EXISTING ROAD PROFILE AND SECTION. LAYOUT ASSUMES 3 FT BRIDGE DECK DEPTH. CONCRETE GIRDER PREFERRED TO MINIMIZE ROAD NOISE THROUGH CROSSING.
4. INSTALL GUARDRAIL, OR OTHER APPROVED BARRIER, ALONG ROADWAY OVER CROSSING.
5. RESTORE ALL DISTURBED AREAS OUTSIDE LIMITS OF PAVEMENT WITH NATIVE VEGETATION.

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MP 56.1 UNT HILL CREEK UNDERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
5.0

Drawing 5 of 11

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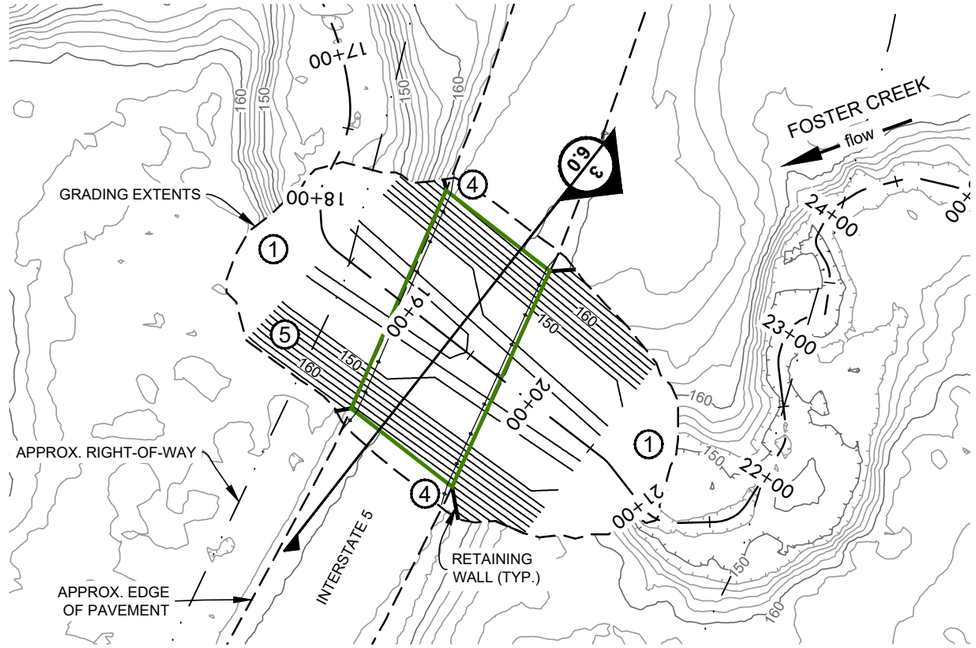
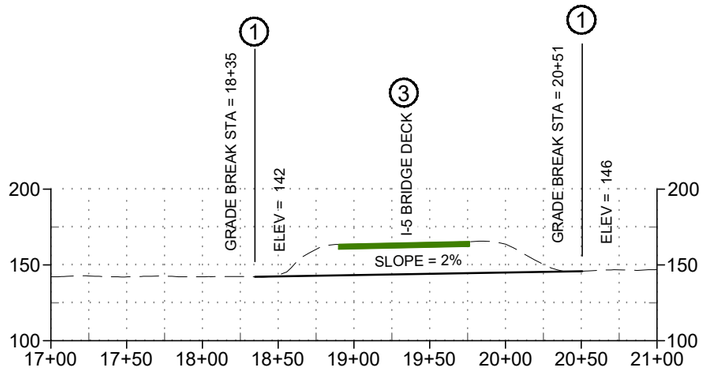


1 MP 58.6 UNDERCROSSING LAYOUT

1" = 100'



2 MP 58.6 UNDERCROSSING PROFILE

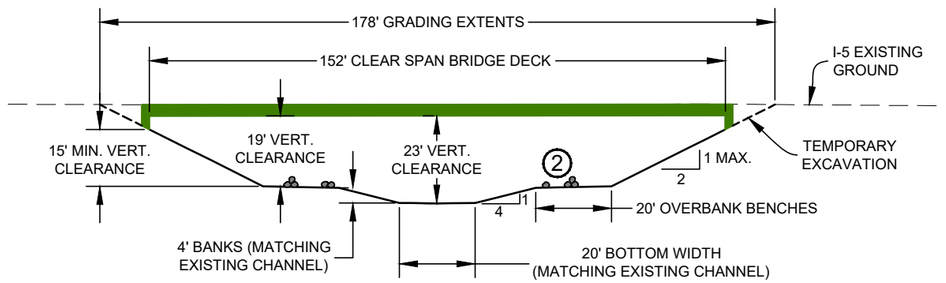
HORIZ 1" = 100'
VERT 1" = 100'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL CROSSING DIMENSIONS ARE APPROXIMATE AND WILL BE REFINED IF SELECTED FOR ADVANCEMENT INTO PRELIMINARY DESIGN.
3. ALL WORK TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
4. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM WA-DNR. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
5. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
6. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
7. WILDLIFE FENCING NOT SHOWN. SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.
8. CHANNEL DIMENSIONS ARE APPROXIMATE. DESIGN CHANNEL AND CROSSING FOR FISH PASSAGE IN ADDITION TO TERRESTRIAL WILDLIFE PASSAGE.

CONSTRUCTION NOTES

1. CONSTRUCT UNDERCROSSING THROUGH APPROX. 220 FT OF FOSTER CREEK CHANNEL. TRANSITION TO MATCH EXISTING CHANNEL GEOMETRY AT ENDS OF CROSSING. MINIMIZE IMPACTS TO EXISTING VEGETATION.
2. PLACE ROCK PILES THROUGH CROSSING TO PROVIDE DRY PASSAGE AT MODERATE FLOWS. MAINTAIN FREEBOARD FOR HIGHWAY SAFETY. MINIMIZE USE OF ANGULAR ROCK IN STREAMBED AND BANKS.
3. INSTALL 152 FT (MIN.) CLEAR SPAN BRIDGE OVER CROSSING TO MATCH EXISTING ROAD PROFILE AND SECTION. LAYOUT ASSUMES 3 FT BRIDGE DECK DEPTH. CONCRETE GIRDER PREFERRED TO MINIMIZE ROAD NOISE THROUGH CROSSING.
4. INSTALL GUARDRAIL, OR OTHER APPROVED BARRIER, ALONG ROADWAY OVER CROSSING.
5. RESTORE ALL DISTURBED AREAS OUTSIDE LIMITS OF PAVEMENT WITH NATIVE VEGETATION.



3 MP 58.3 UNDERCROSSING SECTION

HORIZ 1" = 40'
VERT 1" = 40'

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MP 58.6 FOSTER CREEK UNDERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
6.0

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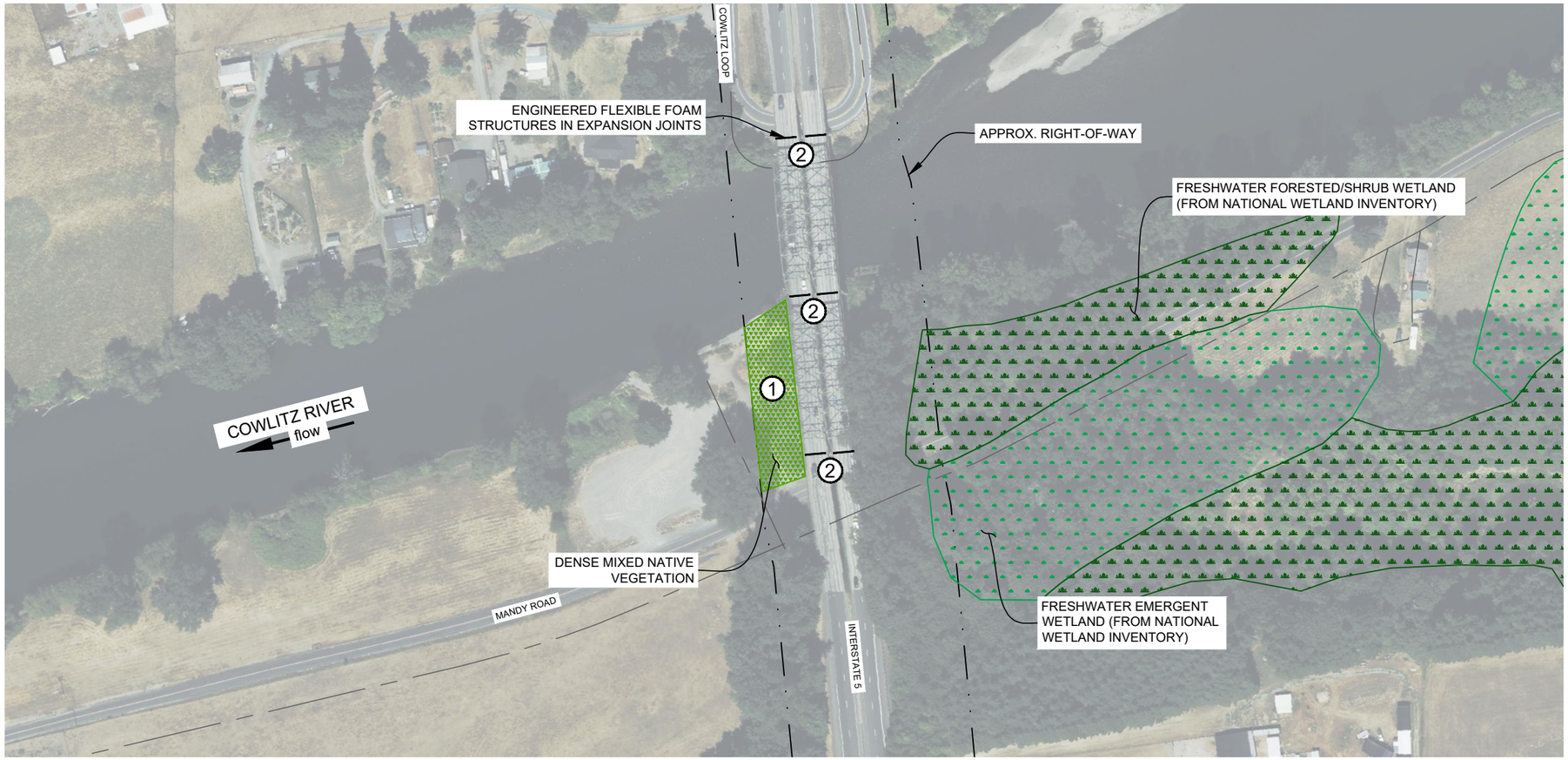

1 MP 59.1 BRIDGE RETROFIT LAYOUT

1" = 200'

BRIDGE RETROFIT NOTES

1. THE PURPOSE OF THE RETROFIT IS TO REDUCE BRIDGE AND ROAD NOISE FOR WILDLIFE APPROACHING AND CROSSING UNDER THE BRIDGE. THE BRIDGE GEOMETRY WILL NOT BE ALTERED.

BRIDGE RETROFIT NOTES

(1) DENSELY PLANT MIXED NATIVE VEGETATION TO REDUCE NOISE AT THE BRIDGE APPROACHES. DO NOT PLANT VEGETATION DIRECTLY BENEATH THE BRIDGES.

(2) INSTALL ENGINEERED FLEXIBLE FOAM STRUCTURES IN THE EXISTING BRIDGE EXPANSION JOINTS.

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COWLITZ RIVER BRIDGE RETROFIT

MP 59.1 CONCEPTS

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
7.0

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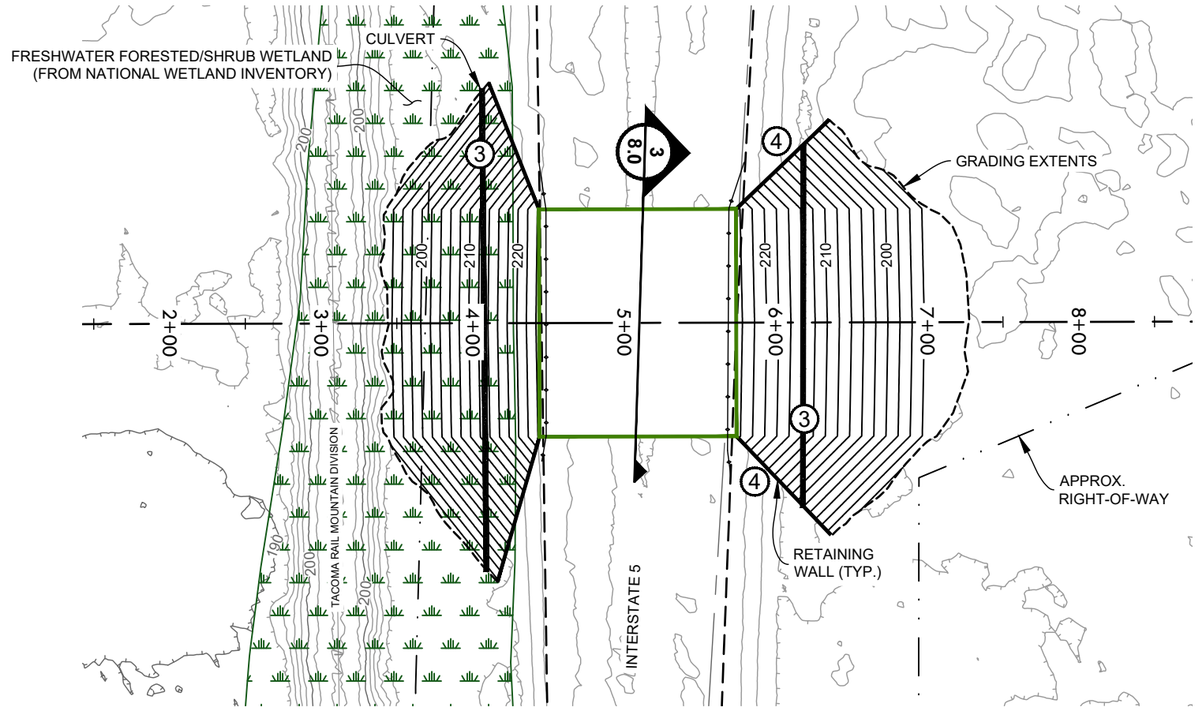


1 MP 90.5 OVERCROSSING LAYOUT

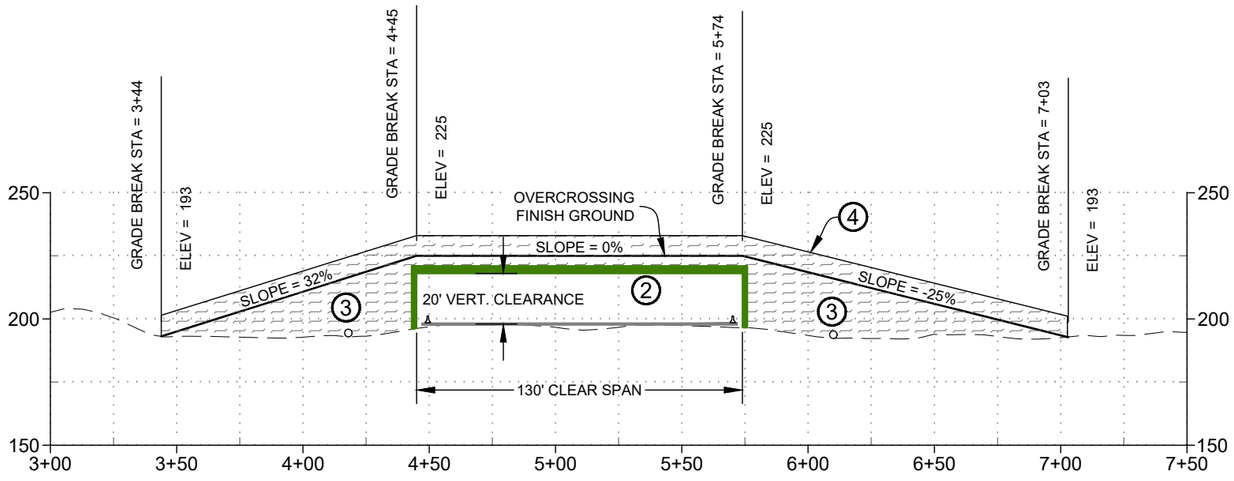
1" = 100'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL WORK IS TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
3. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM THE OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
4. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
5. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
6. WILDLIFE FENCING NOT SHOWN; SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.

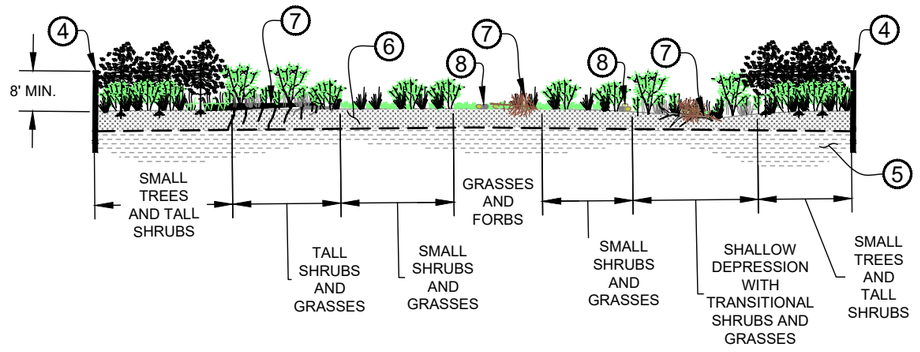
CONSTRUCTION NOTES

1. MAINTAIN TWO LANES OF DAYTIME TRAFFIC. UTILIZE PARTIAL NIGHTTIME CLOSURES FOR BRIDGE INSTALLATION. MAINTAIN EMERGENCY VEHICLE ACCESS.
2. INSTALL PRE-STRESSED CONCRETE GIRDER BRIDGE: 130' SPAN X 150' LENGTH. INSTALL CONCRETE BARRIER THROUGH CROSSING.
3. INSTALL CULVERT IN EXISTING DITCH LINE TO MAINTAIN ROADSIDE DRAINAGE.
4. CONSTRUCT RETAINING WALLS AROUND STRUCTURE. EXTEND SIDEWALLS 8' MIN. ABOVE TOPSOIL OVER CROSSING STRUCTURE TO BUFFER WILDLIFE FROM ROAD NOISE, SMELLS, AND LIGHTS.
5. BACKFILL STRUCTURE WITH GRANULAR STRUCTURE BACKFILL AND SELECT GENERAL BACKFILL.
6. INSTALL 4' MIN. TOPSOIL WITH DEPRESSIONS TO POND WATER TO 3-9 IN. DEPTH AND PLANT NATIVE VEGETATION.
7. PLACE DOWNED WOODY MATERIAL IN CONTACT WITH TOPSOIL.
8. PLACE ROCK CLUSTERS ON SURFACE OF TOPSOIL. DO NOT EMBED.



2 MP 90.5 OVERCROSSING PROFILE

HORIZ 1" = 60'
VERT 1" = 60'



3 OVERCROSSING TYPICAL SECTION

HORIZ 1" = 30'
VERT 1" = 30'

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MP 90.5 OVERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
8.0

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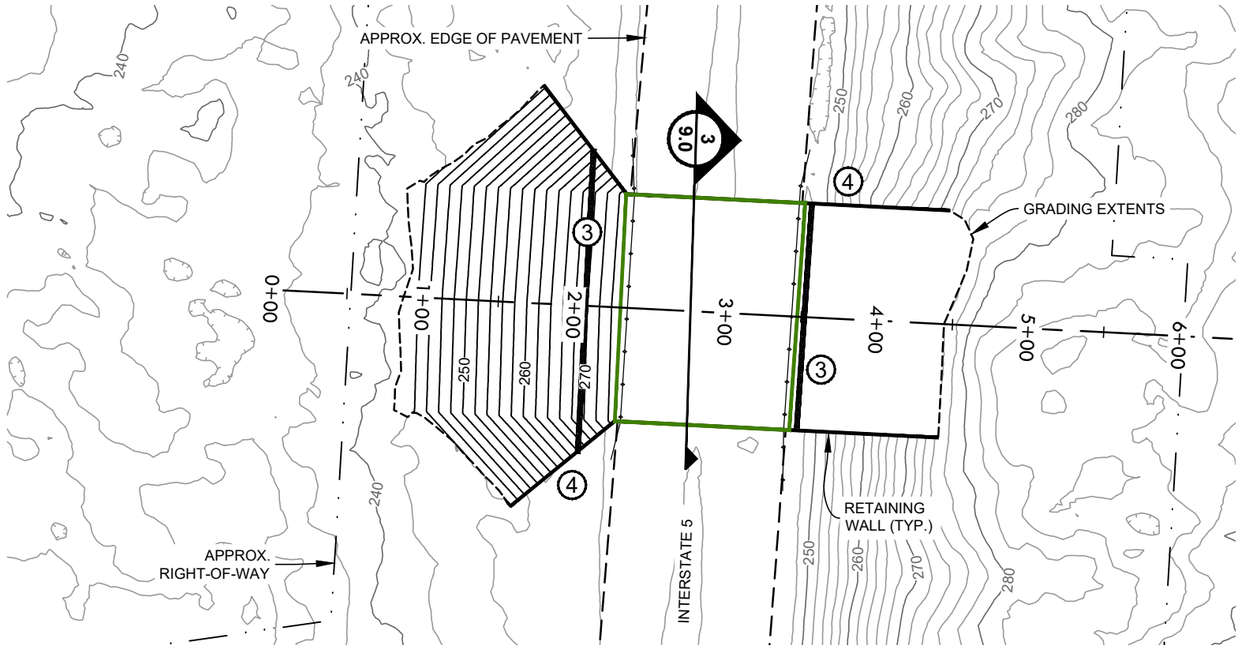
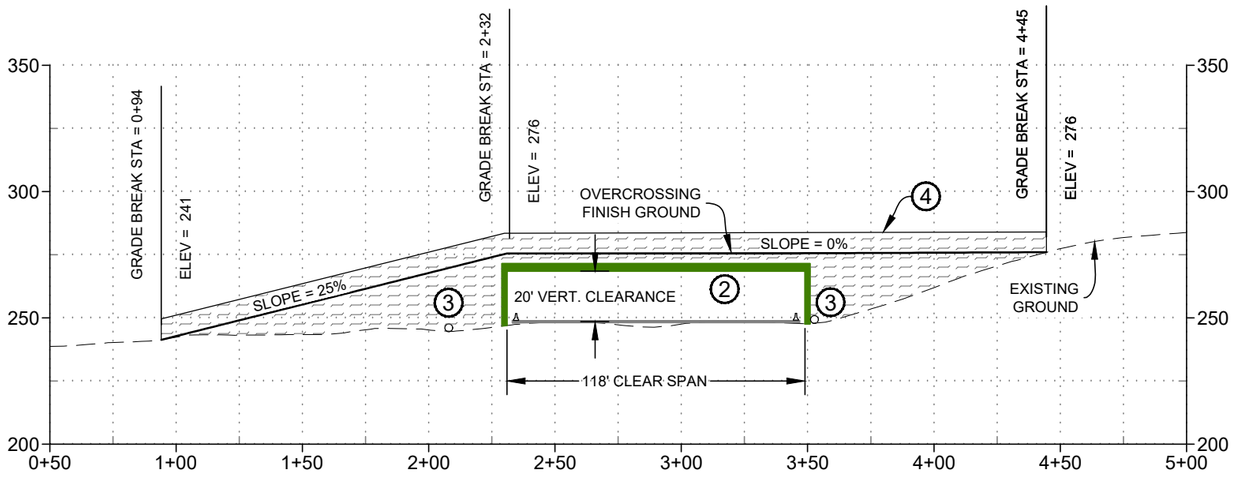


1 MP 92.8 OVERCROSSING LAYOUT

1" = 100'



2 MP 92.8 OVERCROSSING PROFILE

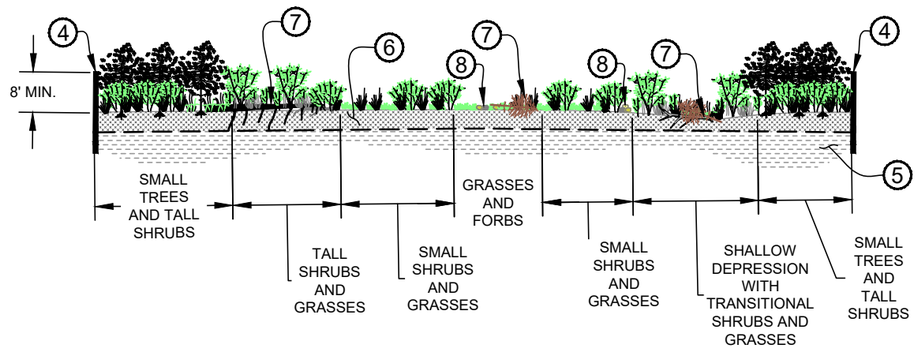
HORIZ 1" = 60'
VERT 1" = 60'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL WORK IS TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
3. CONCEPTS SHOWN ARE BASED ON REMOTELY-SENSED TERRAIN DATA (LIDAR) FROM THE OREGON DEPARTMENT OF GEOLOGY AND MINERAL INDUSTRIES. ALL ELEVATIONS VERTICAL DATUM NAVD88. NO SITE SURVEY OR SUBSURFACE INVESTIGATIONS WERE PERFORMED FOR THIS CONCEPTUAL DESIGN DEVELOPMENT.
4. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
5. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
6. WILDLIFE FENCING NOT SHOWN; SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.

CONSTRUCTION NOTES

1. MAINTAIN TWO LANES OF DAYTIME TRAFFIC. UTILIZE PARTIAL NIGHTTIME CLOSURES FOR BRIDGE INSTALLATION. MAINTAIN EMERGENCY VEHICLE ACCESS.
2. INSTALL PRE-STRESSED CONCRETE GIRDER BRIDGE: 118' SPAN X 150' LENGTH. INSTALL CONCRETE BARRIER THROUGH CROSSING.
3. INSTALL CULVERT IN EXISTING DITCH LINE TO MAINTAIN ROADSIDE DRAINAGE.
4. CONSTRUCT RETAINING WALLS AROUND STRUCTURE. EXTEND SIDEWALLS 8' MIN. ABOVE TOPSOIL OVER CROSSING STRUCTURE TO BUFFER WILDLIFE FROM ROAD NOISE, SMELLS, AND LIGHTS.
5. BACKFILL STRUCTURE WITH GRANULAR STRUCTURE BACKFILL AND SELECT GENERAL BACKFILL.
6. INSTALL 4' MIN. TOPSOIL WITH DEPRESSIONS TO POND WATER TO 3-9 IN. DEPTH AND PLANT NATIVE VEGETATION.
7. PLACE DOWNED WOODY MATERIAL IN CONTACT WITH TOPSOIL.
8. PLACE ROCK CLUSTERS ON SURFACE OF TOPSOIL. DO NOT EMBED.



3 OVERCROSSING TYPICAL SECTION

HORIZ 1" = 30'
VERT 1" = 30'

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MP 92.8 OVERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

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9.0

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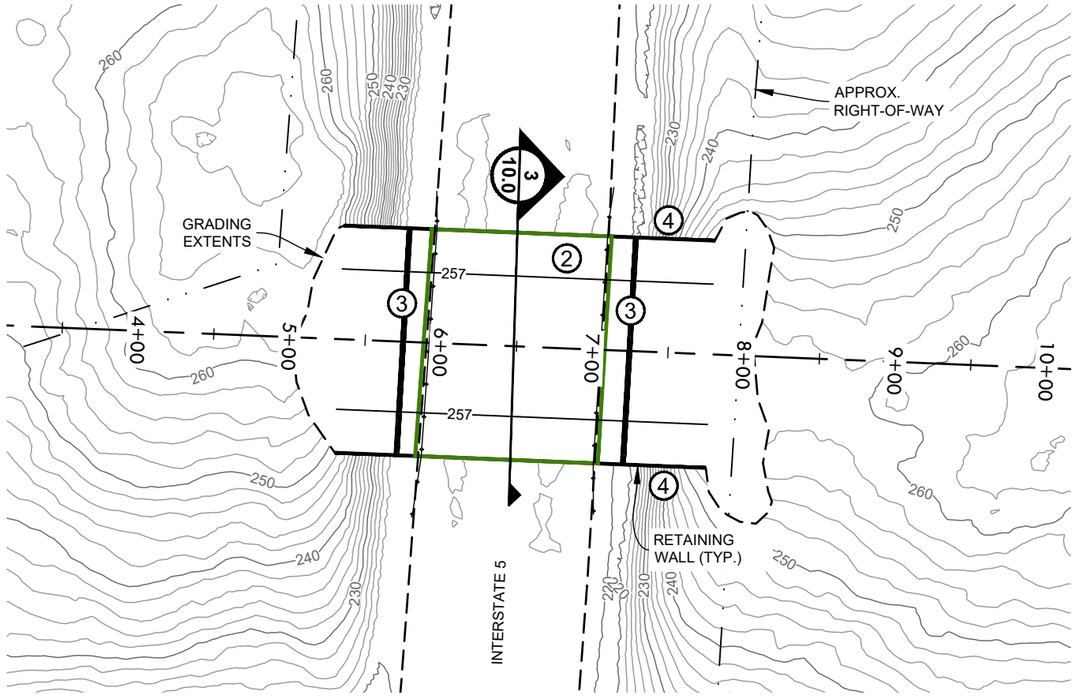
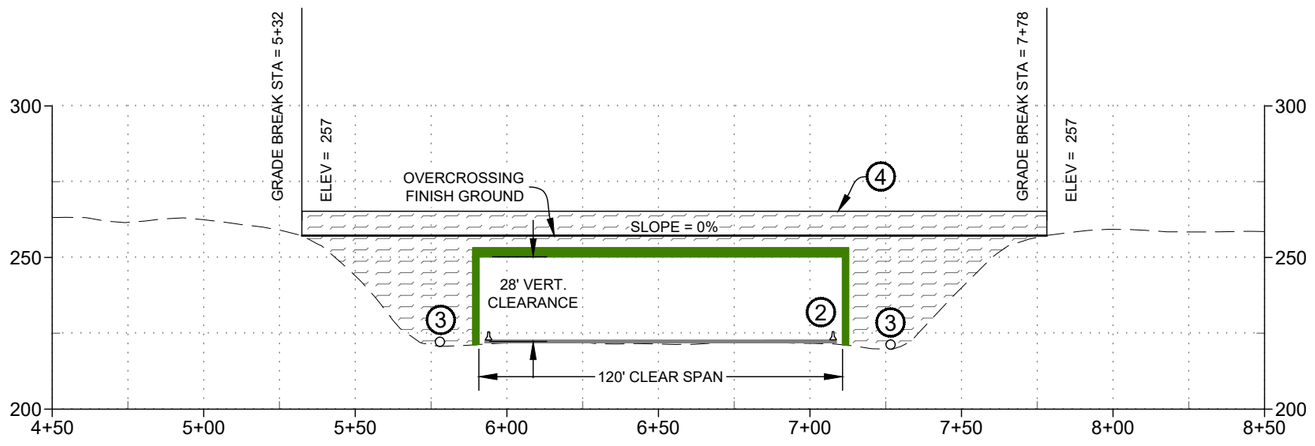


1 MP 96.1 OVERCROSSING LAYOUT

1" = 100'



2 MP 96.1 OVERCROSSING PROFILE

HORIZ 1" = 50'
VERT 1" = 50'

GENERAL NOTES

1. CONCEPTUAL DESIGNS WERE DEVELOPED IN COLLABORATION WITH SAMARA GROUP AND PROJECT PARTNERS. THE STANDARD OF CARE USED TO DEVELOP THIS DESIGN MEETS THAT OF A PLANNING LEVEL, CONCEPTUAL DESIGN STUDY.
2. ALL WORK IS TO BE PERFORMED IN ACCORDANCE WITH THE LATEST EDITION OF THE WSDOT STANDARD SPECIFICATIONS, STANDARD PLANS, AND DESIGN MANUALS.
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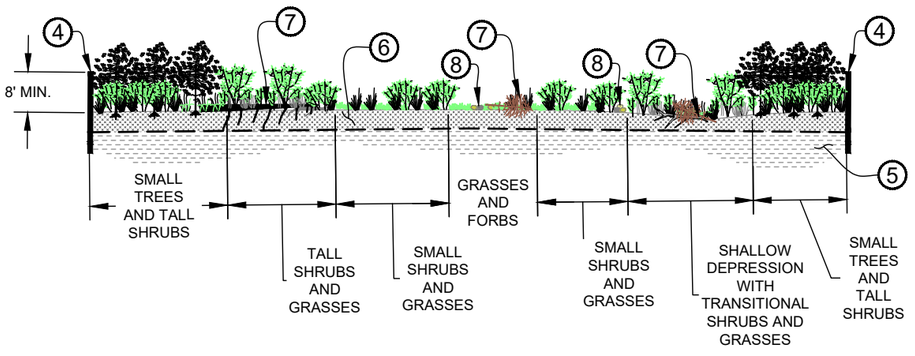
4. LOCATE UTILITIES DURING SITE SURVEY AND AVOID IMPACTS OR COORDINATE RELOCATION.
5. SURVEY EXISTING VEGETATION AND TREES. ADJUST LAYOUT TO AVOID AND MINIMIZE IMPACTS.
6. WILDLIFE FENCING NOT SHOWN; SEE FENCING LAYOUT DRAWINGS IN CONCEPTUAL DESIGN REPORT.

CONSTRUCTION NOTES

1. MAINTAIN TWO LANES OF DAYTIME TRAFFIC. UTILIZE PARTIAL NIGHTTIME CLOSURES FOR BRIDGE INSTALLATION. MAINTAIN EMERGENCY VEHICLE ACCESS.
2. INSTALL PRE-STRESSED CONCRETE GIRDER BRIDGE: 120' SPAN X 150' LENGTH. INSTALL CONCRETE BARRIER THROUGH CROSSING.
3. INSTALL CULVERT IN EXISTING DITCH LINE TO MAINTAIN ROADSIDE DRAINAGE.
4. CONSTRUCT RETAINING WALLS AROUND STRUCTURE. EXTEND SIDEWALLS 8' MIN. ABOVE TOPSOIL OVER CROSSING STRUCTURE TO BUFFER WILDLIFE FROM ROAD NOISE, SMELLS, AND LIGHTS.
5. BACKFILL STRUCTURE WITH GRANULAR STRUCTURE BACKFILL AND SELECT GENERAL BACKFILL.
6. INSTALL 4' MIN. TOPSOIL WITH DEPRESSIONS TO POND WATER TO 3-9 IN. DEPTH AND PLANT NATIVE VEGETATION.
7. PLACE DOWNED WOODY MATERIAL IN CONTACT WITH TOPSOIL.
8. PLACE ROCK CLUSTERS ON SURFACE OF TOPSOIL. DO NOT EMBED.



3 OVERCROSSING TYPICAL SECTION

HORIZ 1" = 30'
VERT 1" = 30'

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MP 96.1 OVERCROSSING

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
10.0

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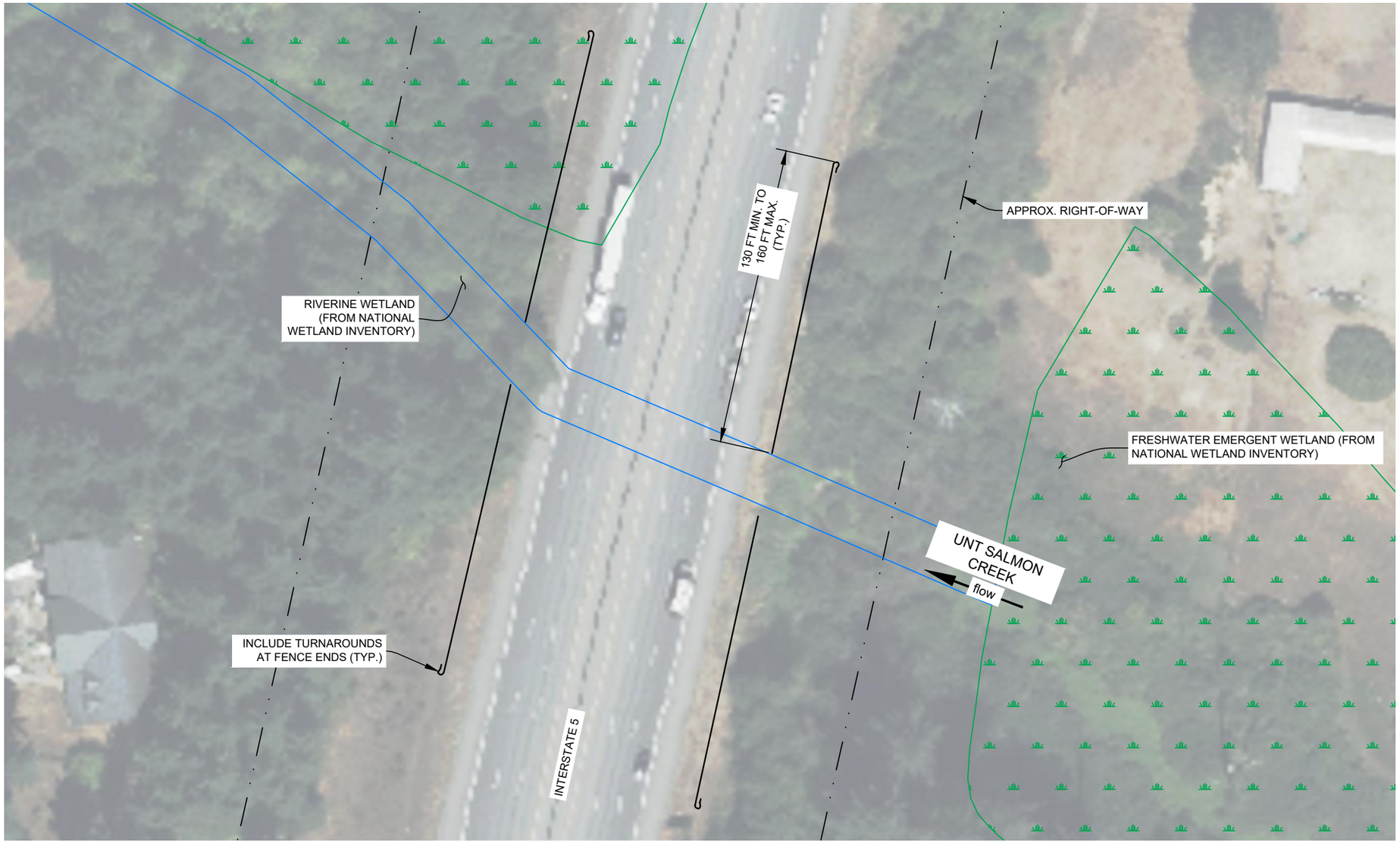

1 MP 98.1 RETROFIT LAYOUT

1" = 60'

AMPHIBIAN FENCE RETROFIT NOTES

1. THE PURPOSE OF THE RETROFIT IS TO PROVIDE DIRECTIONAL FENCING FOR AMPHIBIANS TO THE NEW CROSSING STRUCTURE (BY OTHERS).
2. THE FENCING SHALL EXTEND A MINIMUM OF 130 FT AND A MAXIMUM OF 160 FT PAST THE CROSSING STRUCTURE ON BOTH SIDES.
3. THE FENCE SHALL BE CONSTRUCTED OF A SOLID MATERIAL WITH A MINIMUM HEIGHT OF 3 FT.
4. PROVIDE JUMP-OUTS ON THE ROAD SIDE TO PROVIDE ACCESS TO THE HABITAT SIDE IF AN ANIMAL BYPASSES THE FENCE.
5. INCLUDE TURNAROUNDS AT FENCE ENDS TO GUIDE ANIMALS BACK TOWARDS CROSSING.

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MP 98.1 UNT SALMON CREEK AMPHIBIAN RETROFIT

SW WA I-5 WILDLIFE CROSSINGS
WASHINGTON STATE

NO.	DATE	BY	DESCRIPTION	CHK
*	10/02/24	JLW	CONCEPTS	LBK

PROJECT NUMBER
RDG-23-231

DRAWING NUMBER
11.0

Drawing 11 of 11

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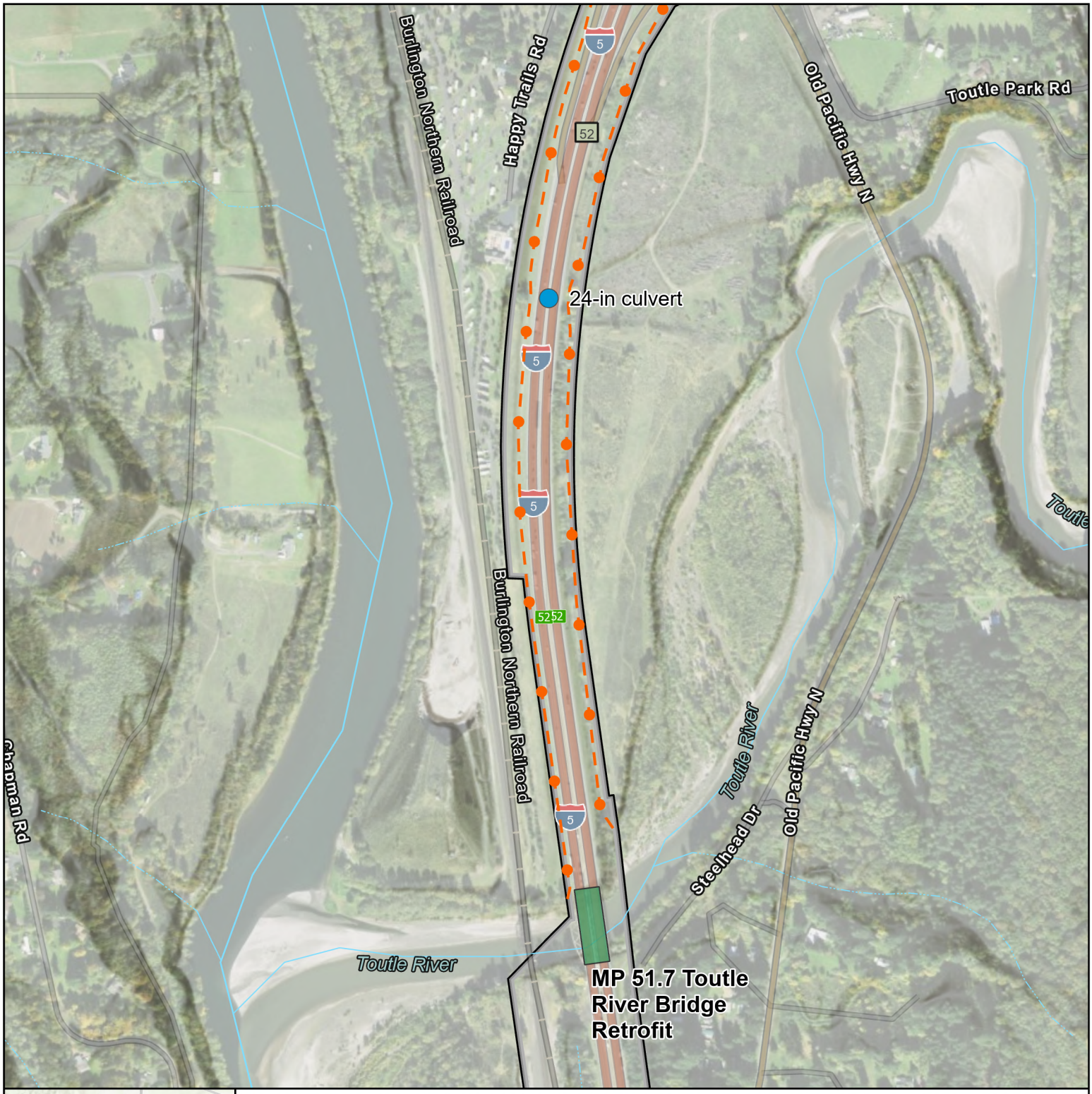
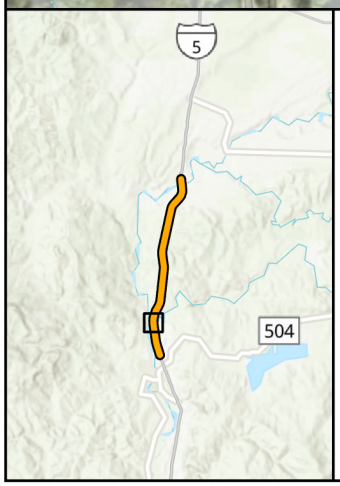
Appendix E

Preliminary Fencing Layouts





Preliminary Wildlife Fencing Layout - South

- Proposed Wildlife Fencing
- Proposed Wildlife Crossing Structure
- Existing Culvert - Maintain Wildlife Access
- Milepost - 1 Mile
- South Project Area
- Approximate Right-of-Way

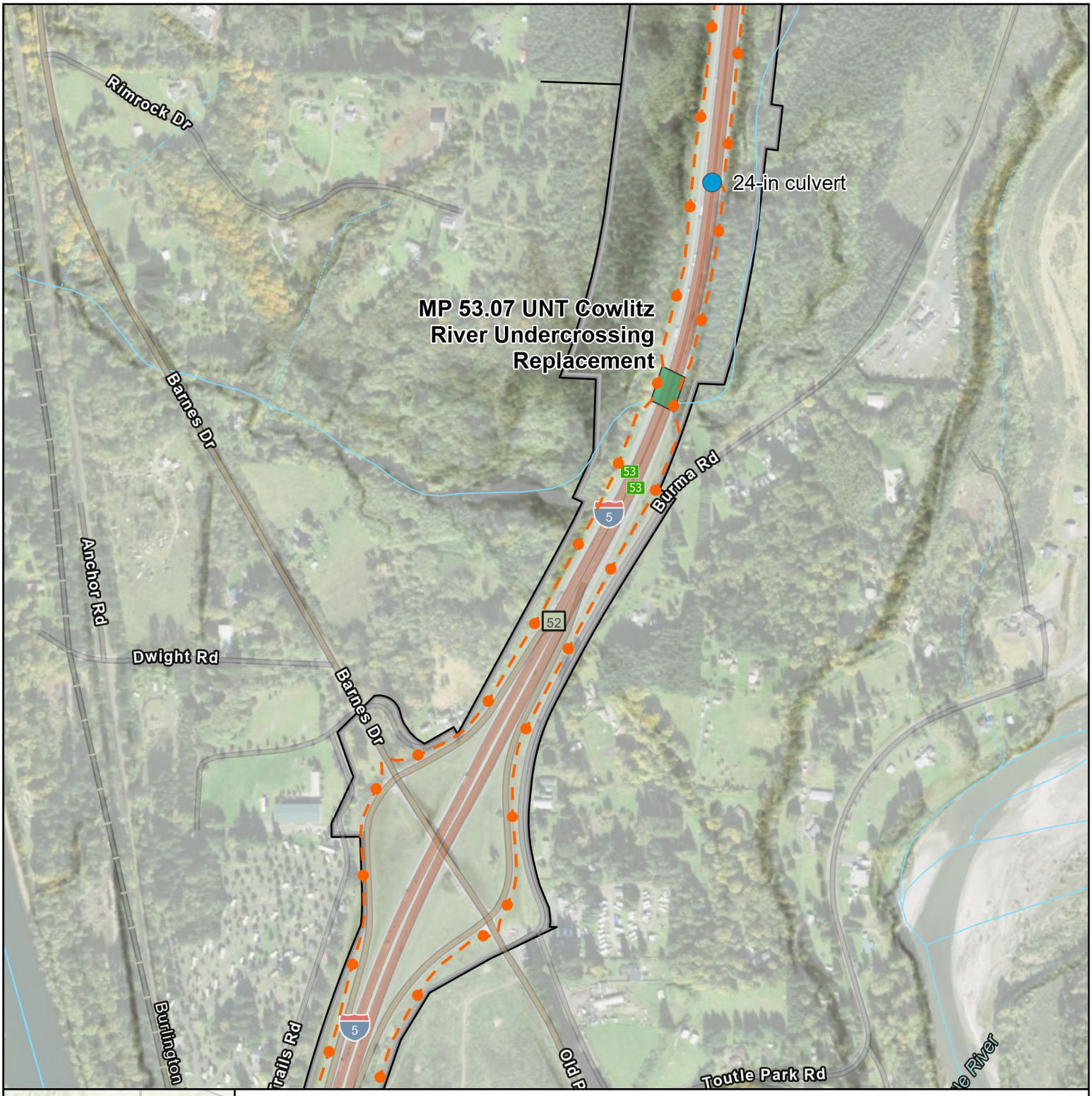
SAMARA GROUP

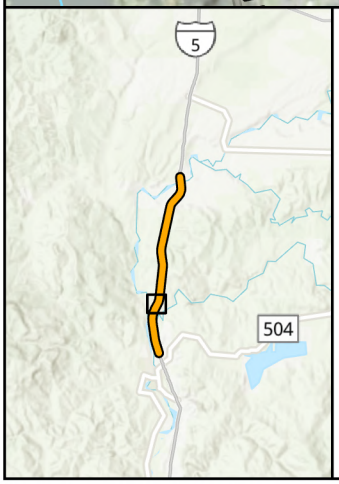
RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024





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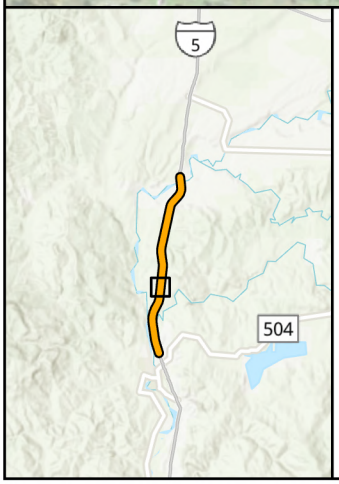
SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024



Preliminary Wildlife Fencing Layout - South

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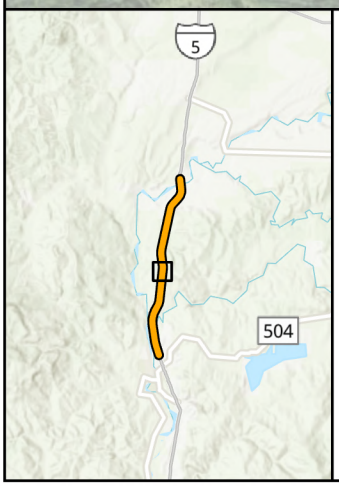
SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024



Preliminary Wildlife Fencing Layout - South

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SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024

Preliminary Wildlife Fencing Layout - South

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- Approximate Right-of-Way

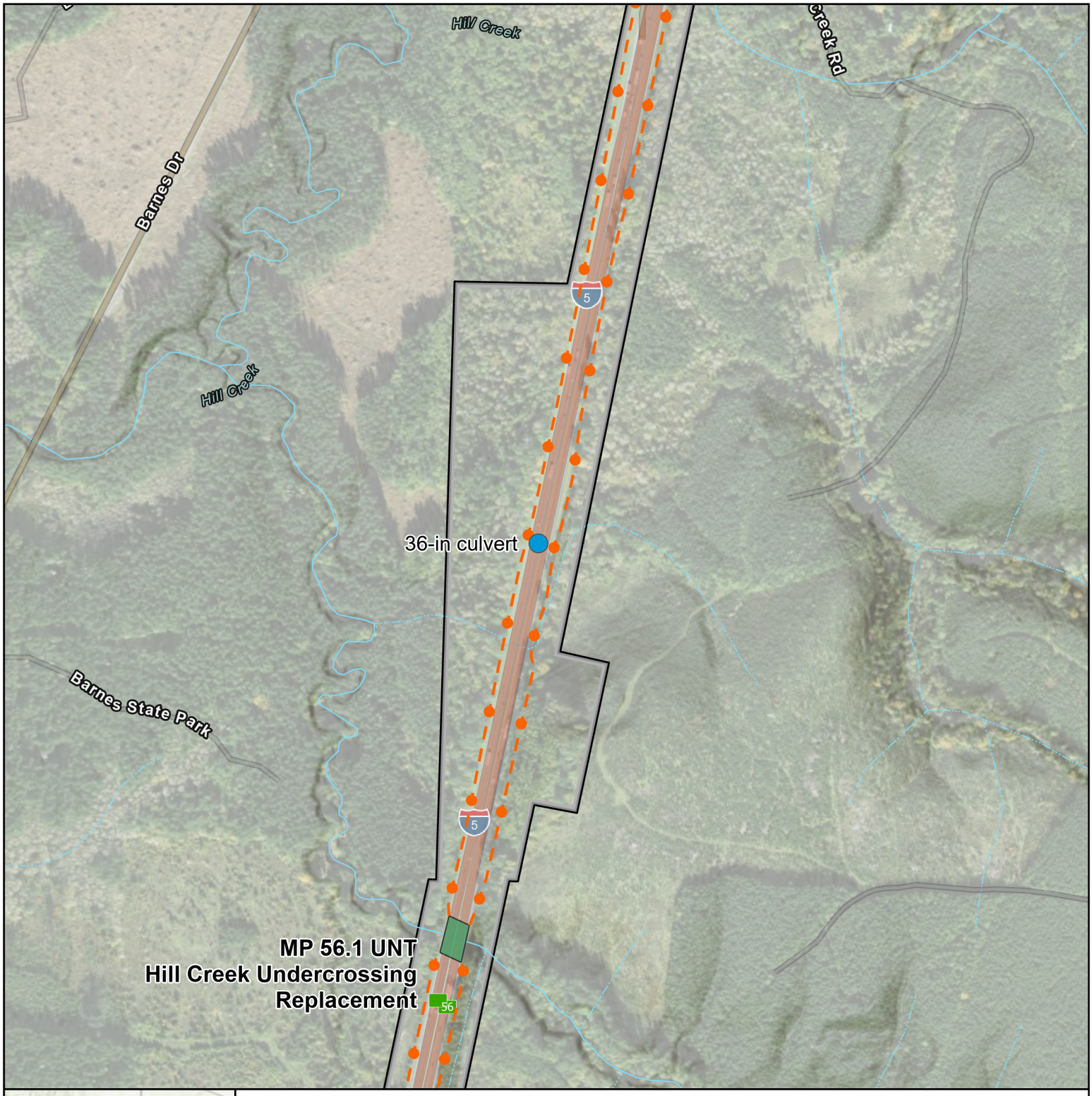
SAMARA GROUP

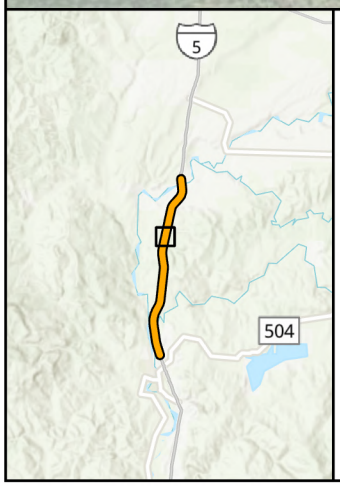
RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024





Preliminary Wildlife Fencing Layout - South

- Proposed Wildlife Fencing
- Proposed Wildlife Crossing Structure
- Existing Culvert - Maintain Wildlife Access
- Milepost - 1 Mile
- South Project Area
- Approximate Right-of-Way

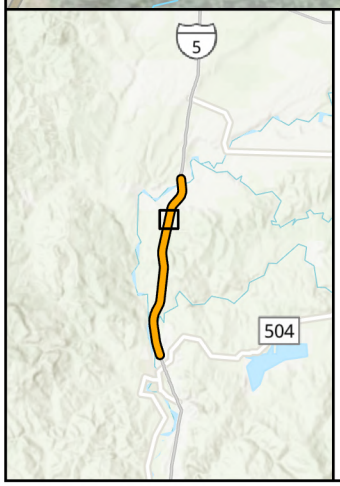
SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024



Preliminary Wildlife Fencing Layout - South

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- Approximate Right-of-Way

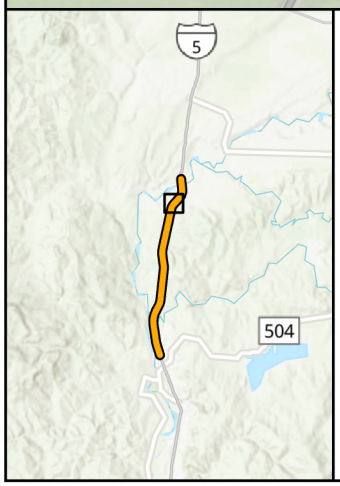
SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024



Preliminary Wildlife Fencing Layout - South

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- Existing Culvert - Maintain Wildlife Access
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- Approximate Right-of-Way

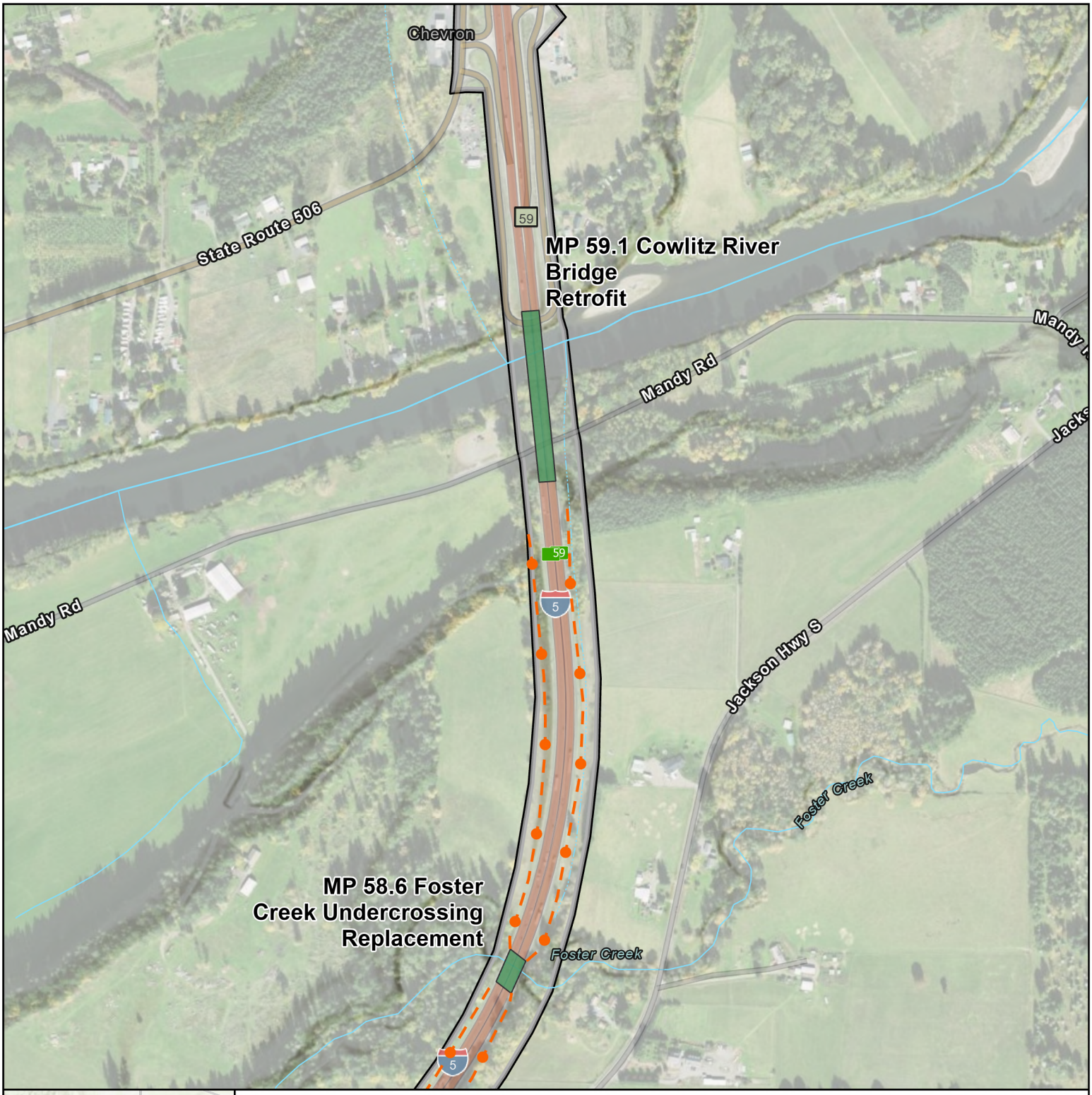
SAMARA GROUP

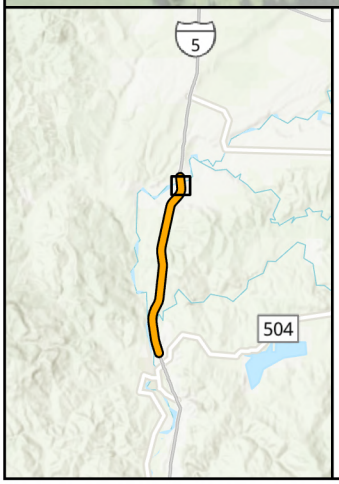
RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024





Preliminary Wildlife Fencing Layout - South

- Proposed Wildife Fencing
- Proposed Wildlife Crossing Structure
- Milepost - 1 Mile
- South Project Area
- Approximate Right-of-Way

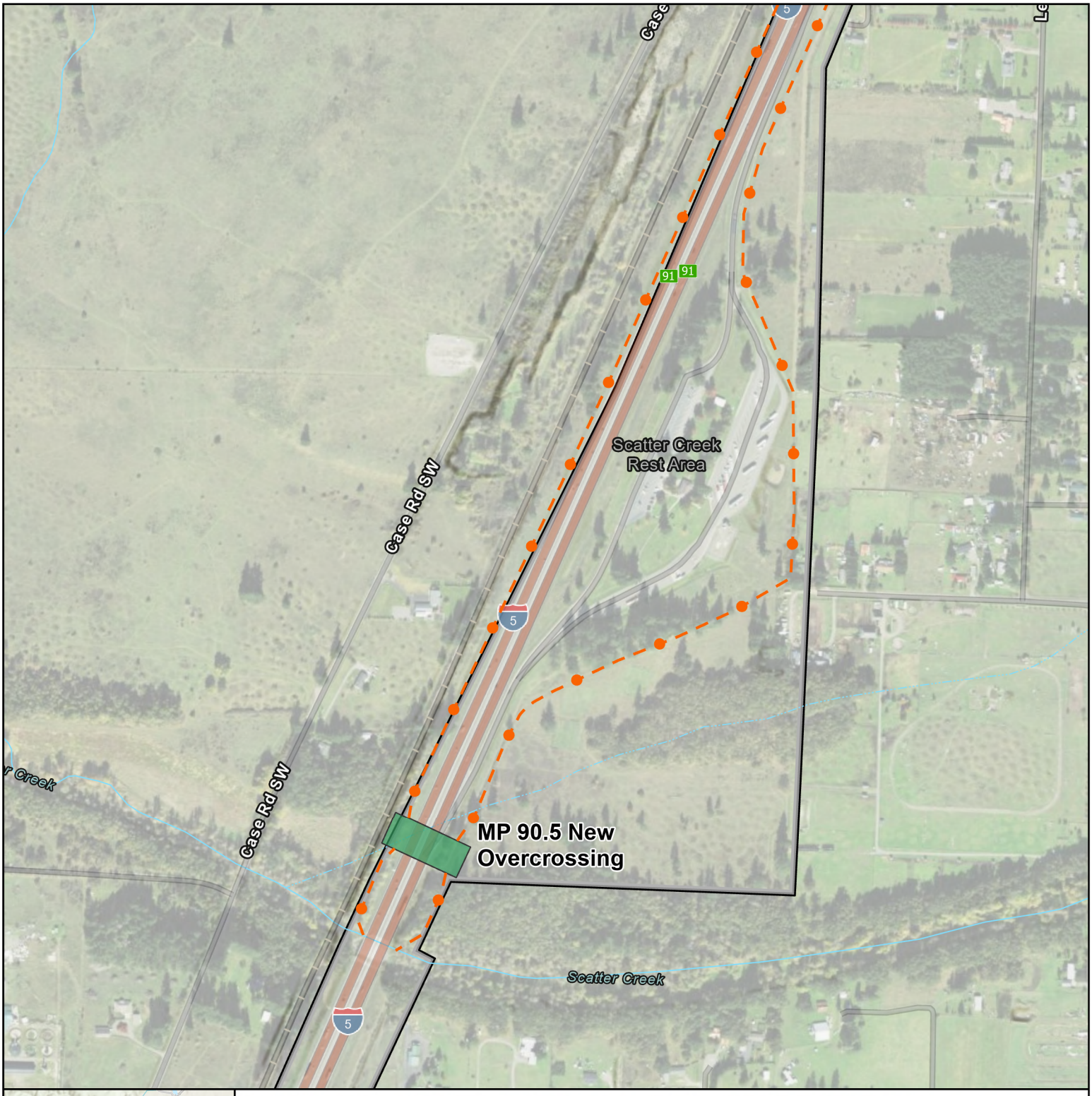
SAMARA GROUP

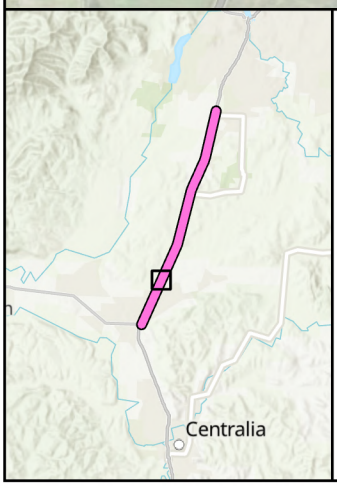
RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N

Date Exported: 10/21/2024





Preliminary Wildlife Fencing Layout - North

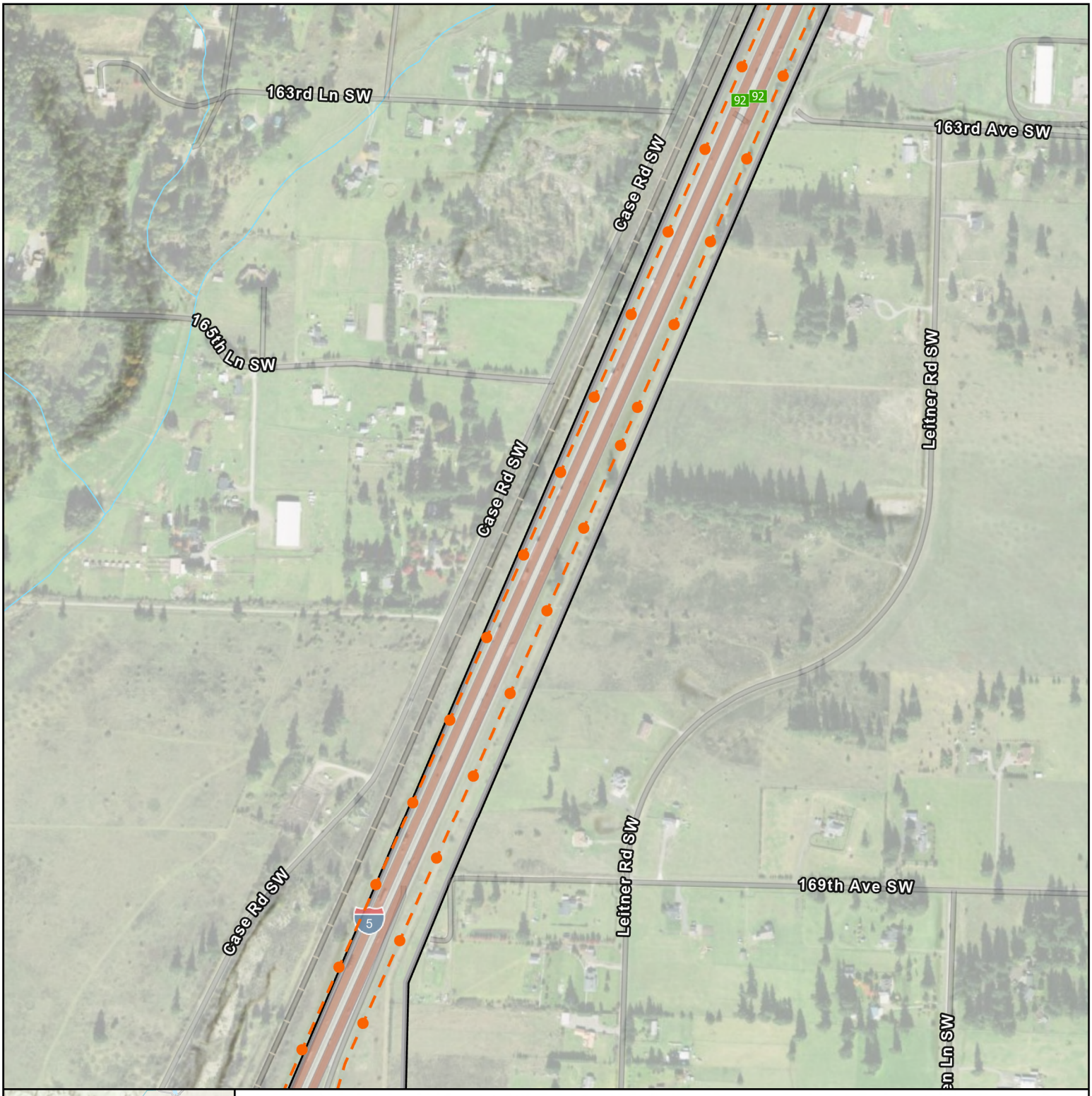
- Proposed Wildlife Fencing
- Proposed Wildlife Crossing Structure
- Existing Culvert - Maintain Wildlife Access
- Milepost - 1 Mile
- Approximate Right-of-Way
- North Project Area

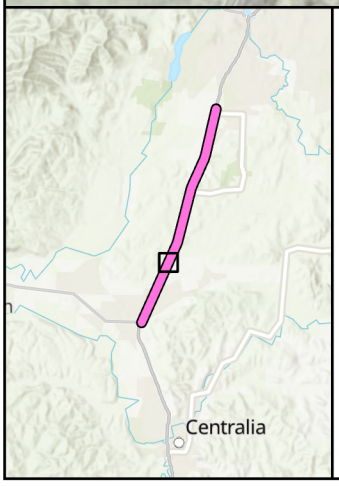
SAMARA GROUP

RDG RIVER DESIGN GROUP

0 150 300 600 Feet

N





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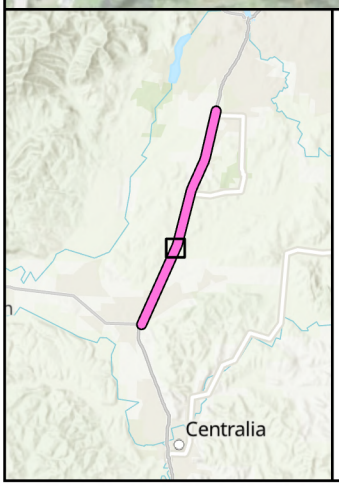

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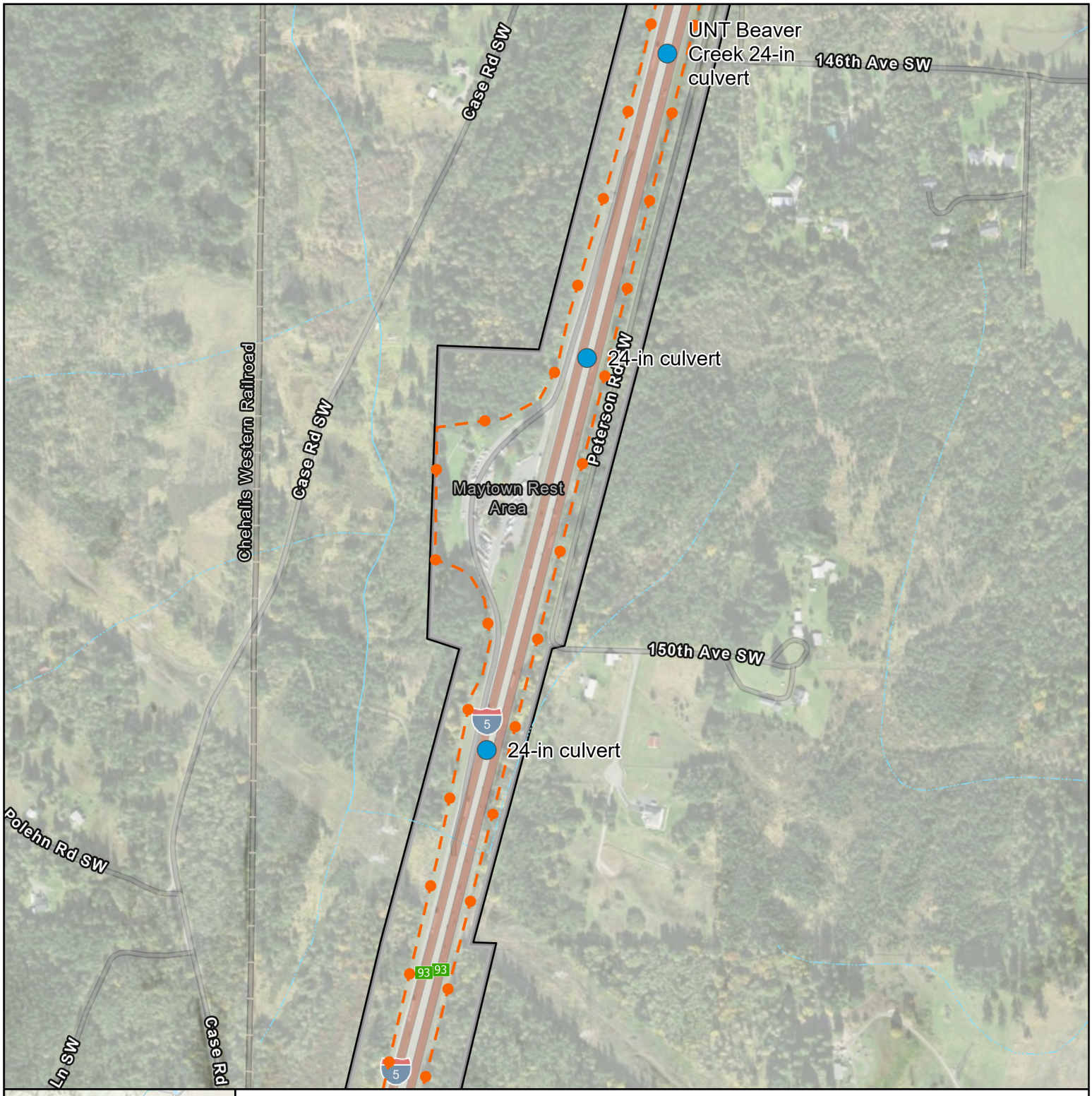

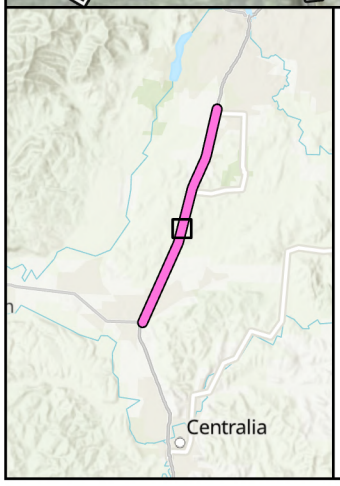

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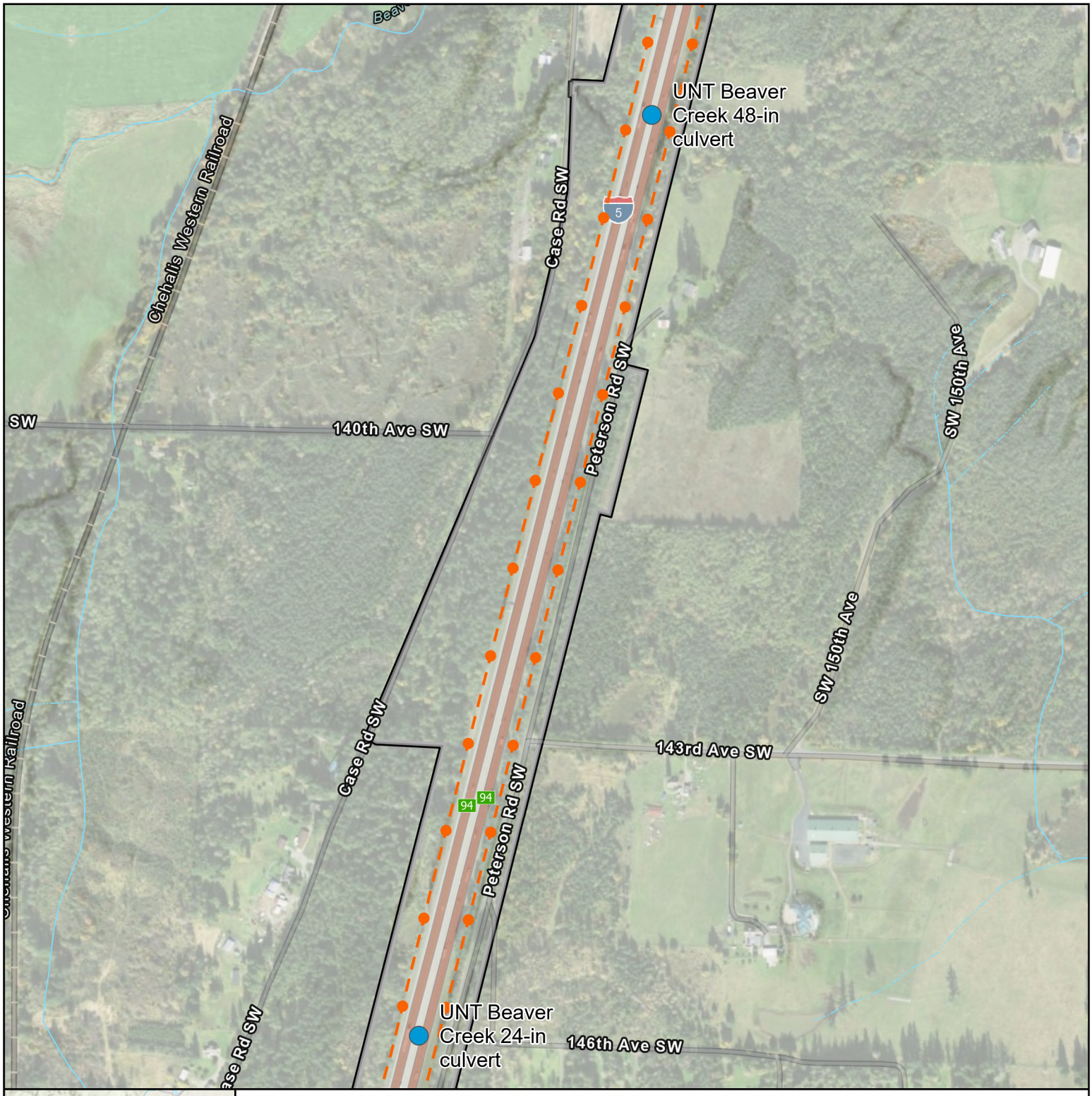

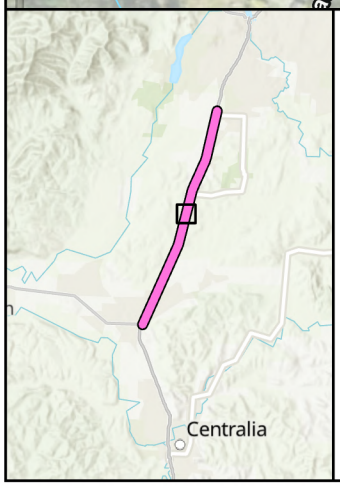

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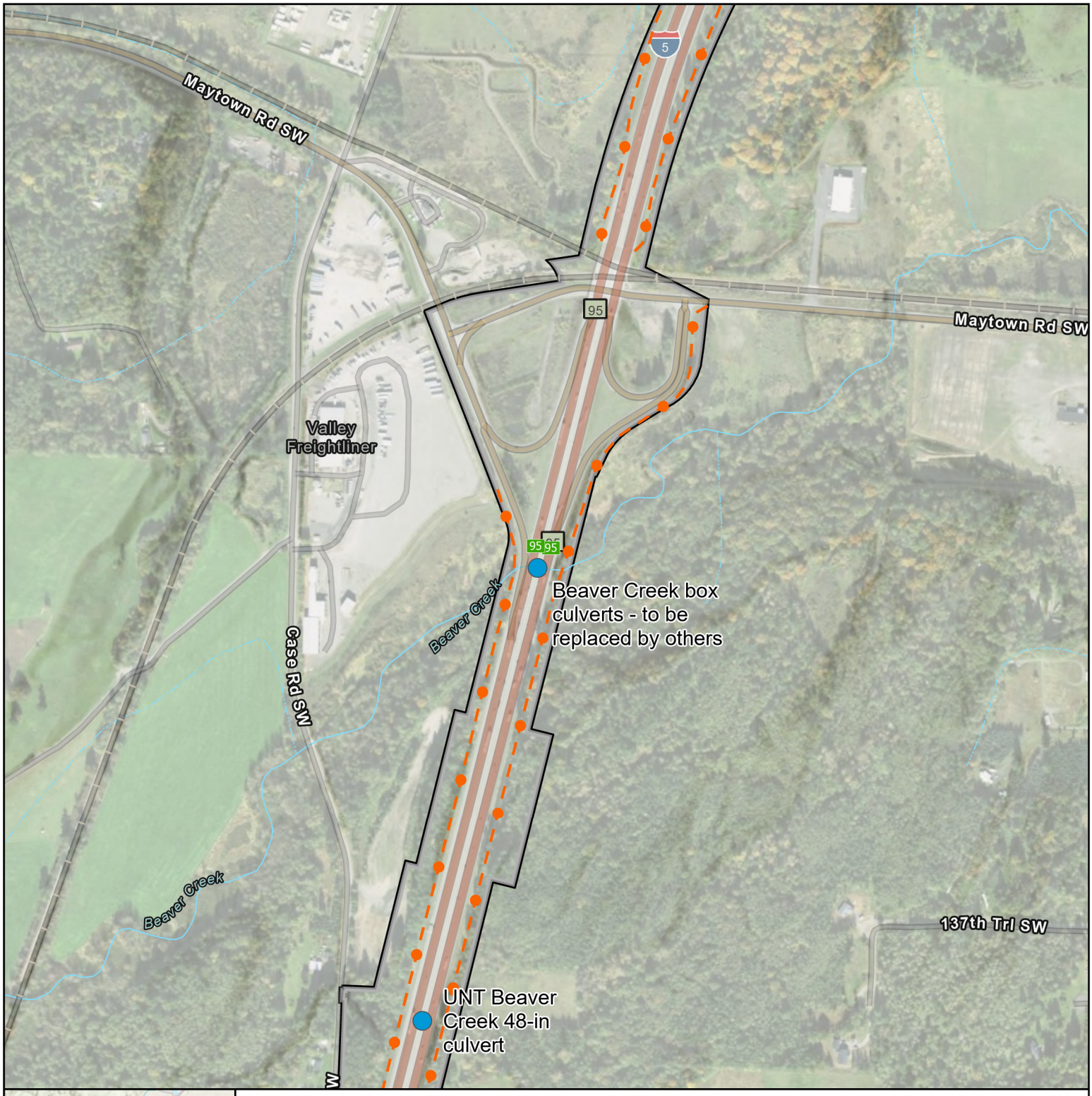

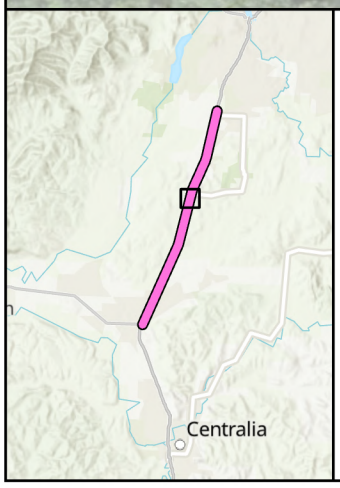

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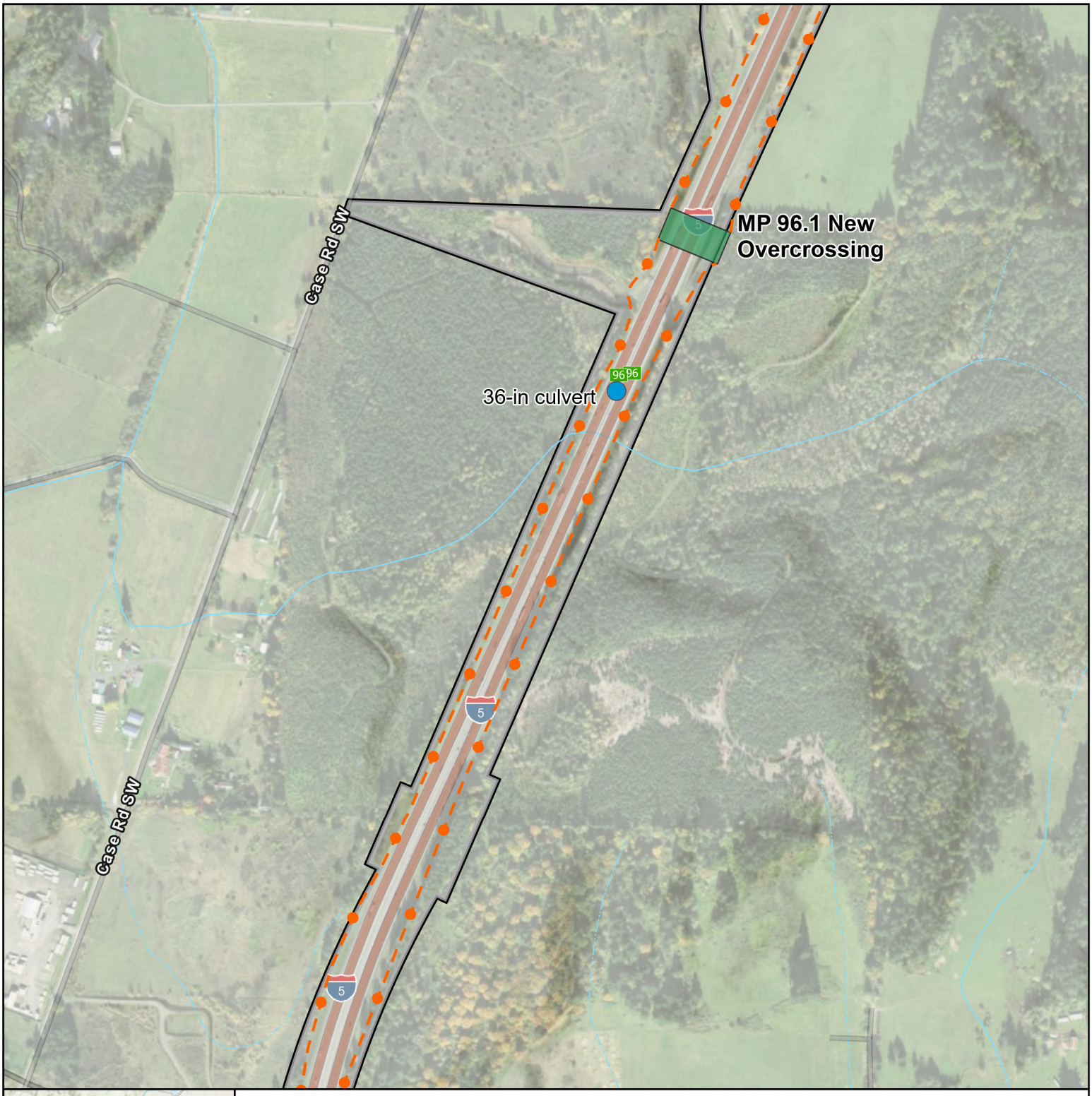

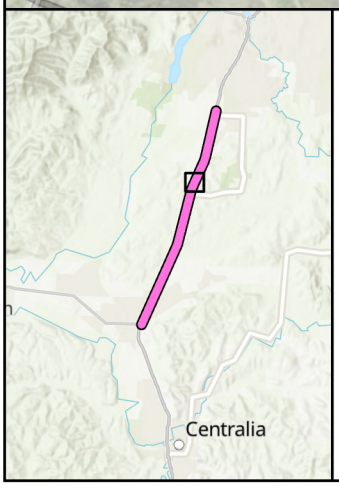

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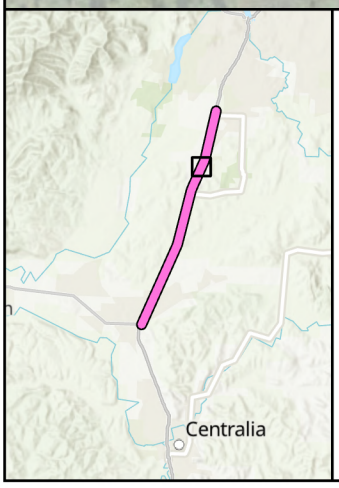

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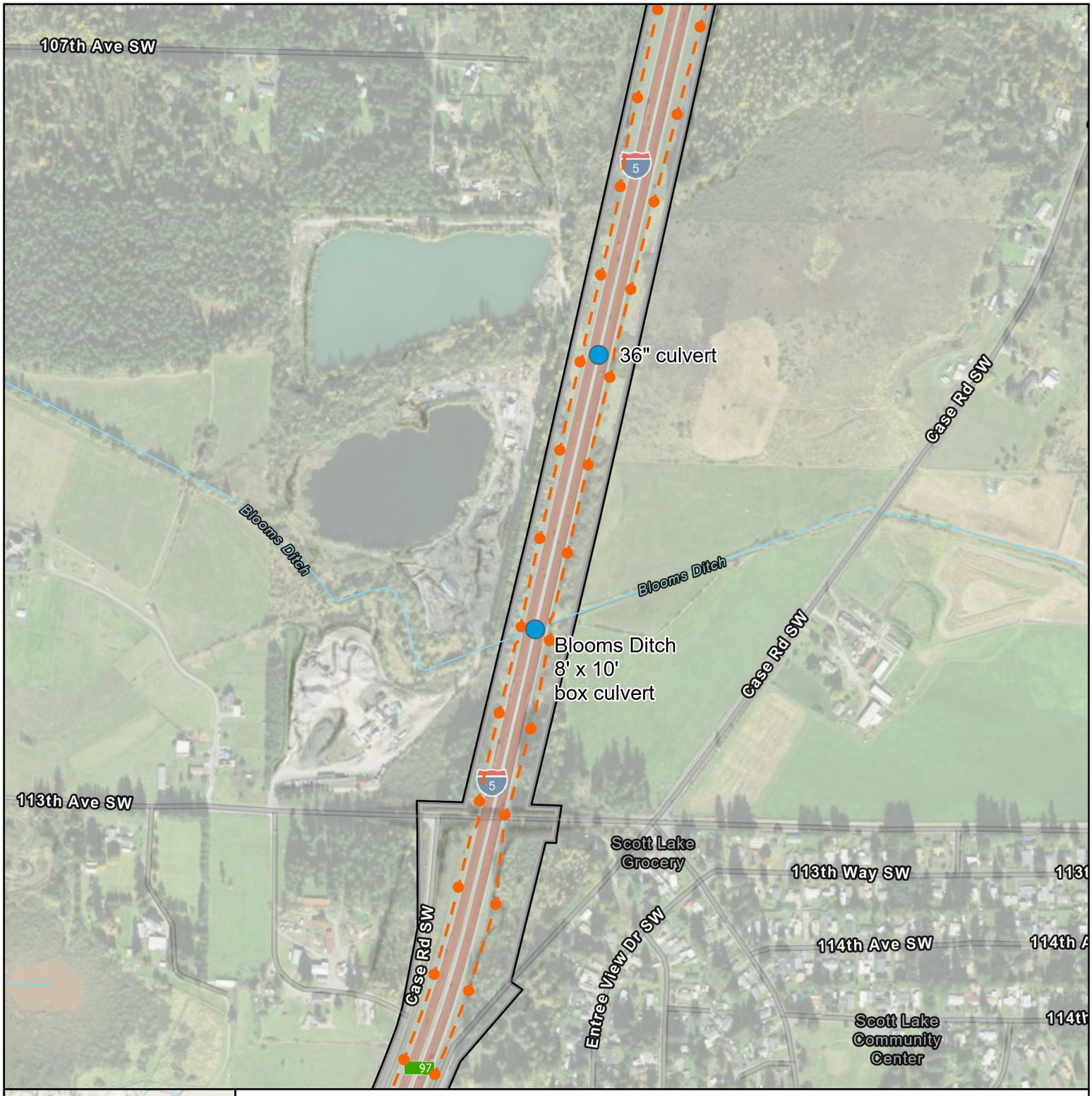

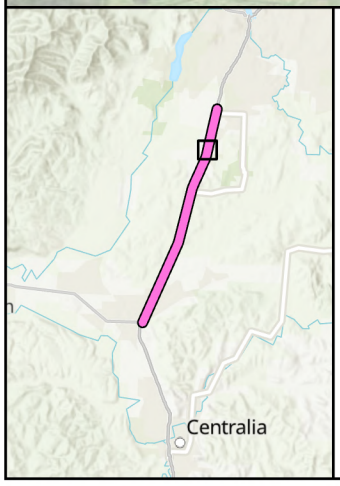

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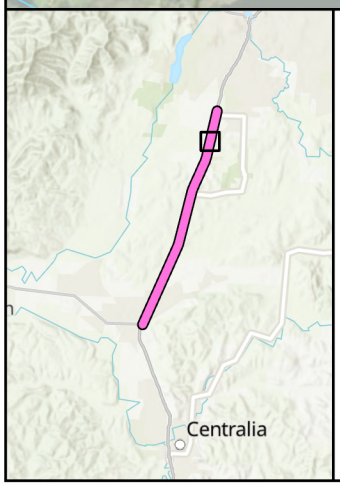

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SAMARA GROUP

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N

Appendix F

Opinions of Probable Costs

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 51.7 Bridge Retrofit (Plantings Only)*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 309,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 12,000	$ 12,000
		SURVEY FOR DESIGN	L.S.	1	$ 12,000	$ 12,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 60,000	$ 60,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 30,000	$ 30,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 30,000	$ 30,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 60,000	$ 60,000
		PUBLIC OUTREACH	L.S.	1	$ 15,000	$ 15,000
1	**PREPARATION**					**$ 132,000**
	0001	MOBILIZATION	L.S.	1	$ 132,000	$ 132,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 100,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 100,000	$ 100,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 1,084,100**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 14,000	$ 14,000
	6422	SEEDING AND MULCHING	ACRE	1.9	$ 20,000	$ 38,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	1.9	$ 200,000	$ 380,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	1.9	$ 50,000	$ 95,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	1.9	$ 50,000	$ 95,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	1.9	$ 50,000	$ 95,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	1.9	$ 50,000	$ 95,000
	6392	TOPSOIL TYPE B	S.Y.	9070	$ 30	$ 272,100
					Construction Subtotal =	**$ 1,316,100**
					Construction Administration and Engineering (25%) =	**$ 330,000**
					Construction Total =	**$ 1,646,100**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 309,000**
					Total Opinion of Probable Project Cost =	**$ 1,955,100**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 1,662,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 2,933,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 53.07 Undercrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,307,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 75,000	$ 75,000
		DESIGN: TRAFFIC	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FISH PASSAGE	L.S.	1	$ 225,000	$ 225,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 2,264,500**
	0001	MOBILIZATION	L.S.	1	$ 2,222,000	$ 2,222,000
	0025	CLEARING AND GRUBBING	ACRE	0.9	$ 25,000	$ 22,500
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
4	**DRAINAGE**					**$ 4,438,600**
	1035	CHANNEL EXCAVATION	C.Y.	40950	$ 100	$ 4,095,000
	1093	STREAMBED SEDIMENT	TON	790	$ 100	$ 79,000
	SP	STREAMBED COBBLES	TON	1190	$ 90	$ 107,100
	SP	BOULDERS	EACH	130	$ 250	$ 32,500
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	20	$ 500	$ 10,000
	3075	TEMPORARY STREAM DIVERSION	L.S.	1	$ 115,000	$ 115,000
8	**STRUCTURE**					**$ 7,497,600**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	180	$ 70	$ 12,600
	4415	TRAFFIC BARRIER	L.F.	400	$ 550	$ 220,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	17750	$ 400	$ 7,100,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	1650	$ 100	$ 165,000
9	**SURFACING**					**$ 530,000**
	SP	ROADWAY RESTORATION WITH HOT MIX ASPHALT	S.Y.	1060	$ 500	$ 530,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 937,400**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 555,500	$ 555,500
	6422	SEEDING AND MULCHING	ACRE	0.7	$ 20,000	$ 14,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	0.7	$ 200,000	$ 140,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	0.7	$ 50,000	$ 35,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	0.7	$ 50,000	$ 35,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	0.7	$ 50,000	$ 35,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	0.7	$ 50,000	$ 35,000
	6392	TOPSOIL TYPE B	S.Y.	2930	$ 30	$ 87,900
18	**TRAFFIC**					**$ 4,489,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 4,444,000	$ 4,444,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 2,055,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	3.4	$ 600,000	$ 2,040,000

Construction Subtotal =	**$ 22,212,100**
Construction Administration and Engineering (25%) =	**$ 5,554,000**
Construction Total =	**$ 27,766,100**
Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,307,000**
Total Opinion of Probable Project Cost =	**$ 30,073,100**
Low Estimate -15% (rounded up to the nearest $10,000) =	$ 25,562,000
High Estimate +50% (rounded up to the nearest $10,000) =	$ 45,110,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 55.6 Overcrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

RDG RIVER DESIGN GROUP — NOW PART OF SWCA ENVIRONMENTAL CONSULTANTS

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,082,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 135,000	$ 135,000
		DESIGN: TRAFFIC	L.S.	1	$ 75,000	$ 75,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 1,733,000**
	0001	MOBILIZATION	L.S.	1	$ 1,693,000	$ 1,693,000
	0025	CLEARING AND GRUBBING	ACRE	0.8	$ 25,000	$ 20,000
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
2	**GRADING**					**$ 1,290,000**
	0460	EMBANKMENT IN PLACE	C.Y.	21500	$ 60	$ 1,290,000
4	**DRAINAGE**					**$ 112,500**
	SP	BOULDERS	EACH	90	$ 250	$ 22,500
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	60	$ 500	$ 30,000
	3012	CORRUGATED POLYETHYLENE CULV. PIPE 36 IN. DIAM.	L.F.	300	$ 200	$ 60,000
8	**STRUCTURE**					**$ 9,447,200**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	1060	$ 70	$ 74,200
	4415	TRAFFIC BARRIER	L.F.	380	$ 550	$ 209,000
	4474	CONCRETE FASCIA PANEL	S.F.	14620	$ 100	$ 1,462,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	15600	$ 400	$ 6,240,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	14620	$ 100	$ 1,462,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 200,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 200,000	$ 200,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 1,550,950**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 423,250	$ 423,250
	6422	SEEDING AND MULCHING	ACRE	1.1	$ 20,000	$ 22,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	1.1	$ 200,000	$ 220,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	1.1	$ 50,000	$ 55,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	1.1	$ 50,000	$ 55,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	1.1	$ 50,000	$ 55,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	1.1	$ 50,000	$ 55,000
	6393	TOPSOIL TYPE C (4-FT DEPTH)	S.Y.	22190	$ 30	$ 665,700
18	**TRAFFIC**					**$ 1,738,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 1,693,000	$ 1,693,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 855,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	1.4	$ 600,000	$ 840,000

Construction Subtotal =	**$ 16,926,650**
Construction Administration and Engineering (25%) =	**$ 4,232,000**
Construction Total =	**$ 21,158,650**
Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,082,000**
Total Opinion of Probable Project Cost =	**$ 23,240,650**
Low Estimate -15% (rounded up to the nearest $10,000) =	$ 19,755,000
High Estimate +50% (rounded up to the nearest $10,000) =	$ 34,861,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 53.9 Undercrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

RDG RIVER DESIGN GROUP — NOW PART OF SWCA ENVIRONMENTAL CONSULTANTS

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,307,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 75,000	$ 75,000
		DESIGN: TRAFFIC	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FISH PASSAGE	L.S.	1	$ 225,000	$ 225,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 3,118,500**
	0001	MOBILIZATION	L.S.	1	$ 3,041,000	$ 3,041,000
	0025	CLEARING AND GRUBBING	ACRE	2.3	$ 25,000	$ 57,500
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
4	**DRAINAGE**					**$ 7,821,300**
	1035	CHANNEL EXCAVATION	C.Y.	74880	$ 100	$ 7,488,000
	1093	STREAMBED SEDIMENT	TON	720	$ 100	$ 72,000
	SP	STREAMBED COBBLES	TON	1070	$ 90	$ 96,300
	SP	BOULDERS	EACH	100	$ 250	$ 25,000
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	50	$ 500	$ 25,000
	3075	TEMPORARY STREAM DIVERSION	L.S.	1	$ 115,000	$ 115,000
8	**STRUCTURE**					**$ 8,704,900**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	170	$ 70	$ 11,900
	4415	TRAFFIC BARRIER	L.F.	440	$ 550	$ 242,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	20750	$ 400	$ 8,300,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	1510	$ 100	$ 151,000
9	**SURFACING**					**$ 630,000**
	SP	ROADWAY RESTORATION WITH HOT MIX ASPHALT	S.Y.	1260	$ 500	$ 630,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 1,885,550**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 760,250	$ 760,250
	6422	SEEDING AND MULCHING	ACRE	2.0	$ 20,000	$ 40,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	2.0	$ 200,000	$ 400,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	2.0	$ 50,000	$ 100,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	2.0	$ 50,000	$ 100,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	2.0	$ 50,000	$ 100,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	2.0	$ 50,000	$ 100,000
	6392	TOPSOIL TYPE B	S.Y.	9510	$ 30	$ 285,300
18	**TRAFFIC**					**$ 6,127,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 6,082,000	$ 6,082,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 2,115,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	3.5	$ 600,000	$ 2,100,000
					Construction Subtotal =	**$ 30,402,250**
					Construction Administration and Engineering (25%) =	**$ 7,601,000**
					Construction Total =	**$ 38,003,250**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,307,000**
					Total Opinion of Probable Project Cost =	**$ 40,310,250**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 34,264,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 60,465,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 56.1 Undercrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

RDG RIVER DESIGN GROUP — NOW PART OF SWCA ENVIRONMENTAL CONSULTANTS

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,307,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 75,000	$ 75,000
		DESIGN: TRAFFIC	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FISH PASSAGE	L.S.	1	$ 225,000	$ 225,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 2,100,000**
	0001	MOBILIZATION	L.S.	1	$ 2,055,000	$ 2,055,000
	0025	CLEARING AND GRUBBING	ACRE	1.0	$ 25,000	$ 25,000
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
4	**DRAINAGE**					**$ 4,558,100**
	1035	CHANNEL EXCAVATION	C.Y.	41690	$ 100	$ 4,169,000
	1093	STREAMBED SEDIMENT	TON	1000	$ 100	$ 100,000
	SP	STREAMBED COBBLES	TON	1490	$ 90	$ 134,100
	SP	BOULDERS	EACH	120	$ 250	$ 30,000
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	20	$ 500	$ 10,000
	3075	TEMPORARY STREAM DIVERSION	L.S.	1	$ 115,000	$ 115,000
8	**STRUCTURE**					**$ 7,000,000**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	150	$ 70	$ 10,500
	4415	TRAFFIC BARRIER	L.F.	390	$ 550	$ 214,500
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	16590	$ 400	$ 6,636,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	1390	$ 100	$ 139,000
9	**SURFACING**					**$ 615,000**
	SP	ROADWAY RESTORATION WITH HOT MIX ASPHALT	S.Y.	1230	$ 500	$ 615,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 901,050**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 513,750	$ 513,750
	6422	SEEDING AND MULCHING	ACRE	0.7	$ 20,000	$ 14,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	0.7	$ 200,000	$ 140,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	0.7	$ 50,000	$ 35,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	0.7	$ 50,000	$ 35,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	0.7	$ 50,000	$ 35,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	0.7	$ 50,000	$ 35,000
	6392	TOPSOIL TYPE B	S.Y.	3110	$ 30	$ 93,300
18	**TRAFFIC**					**$ 4,155,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 4,110,000	$ 4,110,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 1,215,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	2.0	$ 600,000	$ 1,200,000
					Construction Subtotal =	**$ 20,544,150**
					Construction Administration and Engineering (25%) =	**$ 5,137,000**
					Construction Total =	**$ 25,681,150**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,307,000**
					Total Opinion of Probable Project Cost =	**$ 27,988,150**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 23,790,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 41,982,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 58.6 Undercrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,307,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 75,000	$ 75,000
		DESIGN: TRAFFIC	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		DESIGN: FISH PASSAGE	L.S.	1	$ 225,000	$ 225,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 1,573,500**
	0001	MOBILIZATION	L.S.	1	$ 1,536,000	$ 1,536,000
	0025	CLEARING AND GRUBBING	ACRE	0.7	$ 25,000	$ 17,500
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
4	**DRAINAGE**					**$ 2,003,200**
	1035	CHANNEL EXCAVATION	C.Y.	15580	$ 100	$ 1,558,000
	1093	STREAMBED SEDIMENT	TON	1260	$ 100	$ 126,000
	SP	STREAMBED COBBLES	TON	1880	$ 90	$ 169,200
	SP	BOULDERS	EACH	140	$ 250	$ 35,000
	3075	TEMPORARY STREAM DIVERSION	L.S.	1	$ 115,000	$ 115,000
8	**STRUCTURE**					**$ 5,424,900**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	20	$ 70	$ 1,400
	4415	TRAFFIC BARRIER	L.F.	370	$ 550	$ 203,500
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	13000	$ 400	$ 5,200,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	200	$ 100	$ 20,000
9	**SURFACING**					**$ 150,000**
	SP	ROADWAY RESTORATION WITH HOT MIX ASPHALT	S.Y.	300	$ 500	$ 150,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 549,300**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 384,000	$ 384,000
	6422	SEEDING AND MULCHING	ACRE	0.3	$ 20,000	$ 6,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	0.3	$ 200,000	$ 60,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	0.3	$ 50,000	$ 15,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	0.3	$ 50,000	$ 15,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	0.3	$ 50,000	$ 15,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	0.3	$ 50,000	$ 15,000
	6392	TOPSOIL TYPE B	S.Y.	1310	$ 30	$ 39,300
18	**TRAFFIC**					**$ 3,117,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 3,072,000	$ 3,072,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 2,535,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	4.2	$ 600,000	$ 2,520,000
					Construction Subtotal =	**$ 15,352,900**
					Construction Administration and Engineering (25%) =	**$ 3,839,000**
					Construction Total =	**$ 19,191,900**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,307,000**
					Total Opinion of Probable Project Cost =	**$ 21,498,900**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 18,274,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 32,248,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 59.1 Bridge Retrofit (Plantings Only)*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

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Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 309,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 12,000	$ 12,000
		SURVEY FOR DESIGN	L.S.	1	$ 12,000	$ 12,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 60,000	$ 60,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 30,000	$ 30,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 30,000	$ 30,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 60,000	$ 60,000
		PUBLIC OUTREACH	L.S.	1	$ 15,000	$ 15,000
1	**PREPARATION**					**$ 37,000**
	0001	MOBILIZATION	L.S.	1	$ 37,000	$ 37,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 100,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 100,000	$ 100,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 230,200**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 4,000	$ 4,000
	6422	SEEDING AND MULCHING	ACRE	0.4	$ 20,000	$ 8,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	0.4	$ 200,000	$ 80,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	0.4	$ 50,000	$ 20,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	0.4	$ 50,000	$ 20,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	0.4	$ 50,000	$ 20,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	0.4	$ 50,000	$ 20,000
	6392	TOPSOIL TYPE B	S.Y.	1940	30	$ 58,200
					Construction Subtotal =	**$ 367,200**
					Construction Administration and Engineering (25%) =	**$ 92,000**
					Construction Total =	**$ 459,200**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 309,000**
					Total Opinion of Probable Project Cost =	**$ 768,200**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 653,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 1,152,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 90.5 Overcrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,082,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 135,000	$ 135,000
		DESIGN: TRAFFIC	L.S.	1	$ 75,000	$ 75,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 2,104,500**
	0001	MOBILIZATION	L.S.	1	$ 2,052,000	$ 2,052,000
	0025	CLEARING AND GRUBBING	ACRE	1.3	$ 25,000	$ 32,500
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
2	**GRADING**					**$ 1,226,400**
	0460	EMBANKMENT IN PLACE	C.Y.	20440	$ 60	$ 1,226,400
4	**DRAINAGE**					**$ 174,500**
	SP	BOULDERS	EACH	110	$ 250	$ 27,500
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	70	$ 500	$ 35,000
	3012	CORRUGATED POLYETHYLENE CULV. PIPE 36 IN. DIAM.	L.F.	560	$ 200	$ 112,000
8	**STRUCTURE**					**$ 10,853,800**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	890	$ 70	$ 62,300
	4415	TRAFFIC BARRIER	L.F.	410	$ 550	$ 225,500
	4474	CONCRETE FASCIA PANEL	S.F.	13810	$ 100	$ 1,381,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	19510	$ 400	$ 7,804,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	13810	$ 100	$ 1,381,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 200,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 200,000	$ 200,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 2,219,100**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 513,000	$ 513,000
	6422	SEEDING AND MULCHING	ACRE	1.7	$ 20,000	$ 34,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	1.7	$ 200,000	$ 340,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	1.7	$ 50,000	$ 85,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	1.7	$ 50,000	$ 85,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	1.7	$ 50,000	$ 85,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	1.7	$ 50,000	$ 85,000
	6393	TOPSOIL TYPE C (4-FT DEPTH)	S.Y.	33070	$ 30	$ 992,100
18	**TRAFFIC**					**$ 2,097,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 2,052,000	$ 2,052,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 1,635,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	2.7	$ 600,000	$ 1,620,000
					Construction Subtotal =	**$ 20,510,300**
					Construction Administration and Engineering (25%) =	**$ 5,128,000**
					Construction Total =	**$ 25,638,300**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,082,000**
					Total Opinion of Probable Project Cost =	**$ 27,720,300**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 23,562,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 41,580,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 92.8 Overcrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

RDG RIVER DESIGN GROUP — NOW PART OF SWCA ENVIRONMENTAL CONSULTANTS

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,082,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 135,000	$ 135,000
		DESIGN: TRAFFIC	L.S.	1	$ 75,000	$ 75,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 2,285,000**
	0001	MOBILIZATION	L.S.	1	$ 2,240,000	$ 2,240,000
	0025	CLEARING AND GRUBBING	ACRE	1.0	$ 25,000	$ 25,000
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
2	**GRADING**					**$ 1,423,800**
	0460	EMBANKMENT IN PLACE	C.Y.	23730	$ 60	$ 1,423,800
4	**DRAINAGE**					**$ 132,500**
	SP	BOULDERS	EACH	110	$ 250	$ 27,500
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	70	$ 500	$ 35,000
	3012	CORRUGATED POLYETHYLENE CULV. PIPE 36 IN. DIAM.	L.F.	350	$ 200	$ 70,000
8	**STRUCTURE**					**$ 9,934,100**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	830	$ 70	$ 58,100
	4415	TRAFFIC BARRIER	L.F.	440	$ 550	$ 242,000
	4474	CONCRETE FASCIA PANEL	S.F.	13130	$ 100	$ 1,313,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	17520	$ 400	$ 7,008,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	13130	$ 100	$ 1,313,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 200,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 200,000	$ 200,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 1,981,700**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 560,000	$ 560,000
	6422	SEEDING AND MULCHING	ACRE	1.4	$ 20,000	$ 28,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	1.4	$ 200,000	$ 280,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	1.4	$ 50,000	$ 70,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	1.4	$ 50,000	$ 70,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	1.4	$ 50,000	$ 70,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	1.4	$ 50,000	$ 70,000
	6393	TOPSOIL TYPE C (4-FT DEPTH)	S.Y.	27790	$ 30	$ 833,700
18	**TRAFFIC**					**$ 2,285,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 2,240,000	$ 2,240,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 4,155,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	6.9	$ 600,000	$ 4,140,000
					Construction Subtotal =	**$ 22,397,100**
					Construction Administration and Engineering (25%) =	**$ 5,600,000**
					Construction Total =	**$ 27,997,100**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,082,000**
					Total Opinion of Probable Project Cost =	**$ 30,079,100**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 25,567,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 45,119,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 96.1 Overcrossing*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

RDG RIVER DESIGN GROUP — NOW PART OF SWCA ENVIRONMENTAL CONSULTANTS

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 2,082,000**
		RIGHT-OF-WAY COORDINATION AND MAPPING	L.S.	1	$ 27,000	$ 27,000
		SURVEY FOR DESIGN	L.S.	1	$ 54,000	$ 54,000
		GEOTECHNICAL EVALUATION AND DESIGN	L.S.	1	$ 135,000	$ 135,000
		DESIGN: CIVIL	L.S.	1	$ 135,000	$ 135,000
		DESIGN: BRIDGE	L.S.	1	$ 216,000	$ 216,000
		DESIGN: ROADSIDE DEVELOPMENT (REVEGETATION)	L.S.	1	$ 135,000	$ 135,000
		DESIGN: TRAFFIC	L.S.	1	$ 75,000	$ 75,000
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		CROSSING MONITORING AND ADAPTIVE MANAGEMENT (5 YEARS)	YR	5	$ 75,000	$ 375,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: NEPA	L.S.	1	$ 270,000	$ 270,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 90,000	$ 90,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 135,000	$ 135,000
		PUBLIC OUTREACH	L.S.	1	$ 45,000	$ 45,000
1	**PREPARATION**					**$ 2,084,500**
	0001	MOBILIZATION	L.S.	1	$ 2,047,000	$ 2,047,000
	0025	CLEARING AND GRUBBING	ACRE	0.7	$ 25,000	$ 17,500
	0050	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	L.S.	1	$ 20,000	$ 20,000
2	**GRADING**					**$ 1,096,200**
	0460	EMBANKMENT IN PLACE	C.Y.	18270	$ 60	$ 1,096,200
4	**DRAINAGE**					**$ 102,500**
	SP	BOULDERS	EACH	70	$ 250	$ 17,500
	0918	WOODY MATERIAL-LOG WITHOUT ROOTWAD	EACH	50	$ 500	$ 25,000
	3012	CORRUGATED POLYETHYLENE CULV. PIPE 36 IN. DIAM.	L.F.	300	$ 200	$ 60,000
8	**STRUCTURE**					**$ 9,502,800**
	4025	GRAVEL BACKFILL FOR WALL	C.Y.	690	$ 70	$ 48,300
	4415	TRAFFIC BARRIER	L.F.	430	$ 550	$ 236,500
	4474	CONCRETE FASCIA PANEL	S.F.	10170	$ 100	$ 1,017,000
	SP	CONCRETE BOX GIRDER BRIDGE	S.F.	17960	$ 400	$ 7,184,000
	SP	REINFORCED CONCRETE RETAINING WALL	S.F.	10170	$ 100	$ 1,017,000
16	**IRRIGATION AND WATER DISTRIBUTION**					**$ 200,000**
	6071	IRRIGATION SYSTEM	L.S.	1	$ 200,000	$ 200,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 1,594,450**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 511,750	$ 511,750
	6422	SEEDING AND MULCHING	ACRE	1.1	$ 20,000	$ 22,000
	6552SP	PLANT SELECTION INCLUDING PLANT ESTABLISHMENT (PSIPE)	ACRE	1.1	$ 200,000	$ 220,000
	6606	PLANT ESTABLISHMENT – SECOND YEAR	ACRE	1.1	$ 50,000	$ 55,000
	6608	PLANT ESTABLISHMENT – THIRD YEAR	ACRE	1.1	$ 50,000	$ 55,000
	66SP	PLANT ESTABLISHMENT – FOURTH YEAR	ACRE	1.1	$ 50,000	$ 55,000
	66SP	PLANT ESTABLISHMENT – FIFTH YEAR	ACRE	1.1	$ 50,000	$ 55,000
	6393	TOPSOIL TYPE C (4-FT DEPTH)	S.Y.	20690	$ 30	$ 620,700
18	**TRAFFIC**					**$ 2,092,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 2,047,000	$ 2,047,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 3,795,000**
	7037	STRUCTURE SURVEYING	L.S.	1	$ 15,000	$ 15,000
	SP	WILDLIFE FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	6.3	$ 600,000	$ 3,780,000
					Construction Subtotal =	**$ 20,467,450**
					Construction Administration and Engineering (25%) =	**$ 5,117,000**
					Construction Total =	**$ 25,584,450**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 2,082,000**
					Total Opinion of Probable Project Cost =	**$ 27,666,450**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 23,516,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 41,500,000

Opinion of Probable Costs

PROJECT: *SW WA I-5 Wildlife Crossings*
SITE: *MP 98.1 Amphibian Retrofit*
TITLE: *Opinion of Probable Costs for Conceptual Design*
DATE: *11/14/24*
CLIENT: *Conservation Northwest*
DESCRIPTION: *Class 4 Cost Estimate (American Association of Cost Engineers)*
Conceptual designs dated 10/02/2024

Section	Item	Description	Unit	Quantity	Unit Cost (2024$)	Cost (2024$)
	DESIGN, PERMITTING, MONITORING AND MAINTENANCE					**$ 306,000**
		DESIGN: FENCING INCL. JUMPOUTS AND GATES/GUARDS	L.S.	1	$ 135,000	$ 135,000
		FENCE MAINTENANCE (5 YEARS)	YR	5	$ 15,000	$ 75,000
		PERMITTING: WETLANDS AND WATERWAYS	L.S.	1	$ 30,000	$ 30,000
		PERMITTING: CULTURAL RESOURCES	L.S.	1	$ 12,000	$ 12,000
		PERMITTING: NEPA	L.S.	1	$ 12,000	$ 12,000
		PERMITTING: WATER QUALITY PROTECTION	L.S.	1	$ 12,000	$ 12,000
		PERMITTING: SEPA & LOCAL	L.S.	1	$ 30,000	$ 30,000
1	**PREPARATION**					**$ 15,000**
	0001	MOBILIZATION	L.S.	1	$ 15,000	$ 15,000
17	**EROSION CONTROL AND ROADSIDE PLANTING**					**$ 9,500**
	6488	EROSION CONTROL AND WATER POLLUTION PREVENTION	L.S.	1	$ 1,500	$ 1,500
	6422	SEEDING AND MULCHING	ACRE	0.4	$ 20,000	$ 8,000
18	**TRAFFIC**					**$ 60,000**
	6971	PROJECT TEMPORARY TRAFFIC CONTROL	L.S.	1	$ 15,000	$ 15,000
	6890	PERMANENT SIGNING	L.S.	1	$ 45,000	$ 45,000
19	**OTHER ITEMS**					**$ 60,000**
	SP	AMPHIBIAN FENCE INCL. JUMPOUTS AND MAINTENANCE ACCESS GATES	MILE	0.1	$ 600,000	$ 60,000
					Construction Subtotal =	**$ 144,500**
					Construction Administration and Engineering (25%) =	**$ 37,000**
					Construction Total =	**$ 181,500**
					Design, Permitting, Monitoring and Maintenance Subtotal =	**$ 306,000**
					Total Opinion of Probable Project Cost =	**$ 487,500**
					Low Estimate -15% (rounded up to the nearest $10,000) =	$ 414,000
					High Estimate +50% (rounded up to the nearest $10,000) =	$ 731,000

Appendix G

Species Detections

Species detected through WSDOT camera monitoring activities in the Southern and Northern project area provided in October, 2024. Species list provided here excludes humans, domestic animals, vehicles, and generic species detections (i.e. taxa groups)

Southern Project Area		**Northern Project Area**	
American Beaver	American Crow	American Beaver	American Robin
American Black Bear	American Robin	American Black Bear	Belted Kingfisher
American Mink	Annas Hummingbird	Bat	Black-capped Chickadee
Bat	Barred Owl	Bobcat	California Scrub-Jay
Black-tailed Deer	Belted Kingfisher	Black-Tailed Deer	Cooper's Hawk
Bobcat	Great Blue Heron	Coyote	Double-crested Cormorant
Coyote	Mallard	Douglas's Squirrel	Goosander
Douglas Squirrel	Northern Band-tailed Pigeon	Eastern Gray Squirrel	Great Blue Heron
Eastern Cottontail	Northern Flicker	Elk	Hooded Merganser
Eastern Gray Squirrel	Owl	North American Porcupine	Mallard
Elk	Red-tailed Hawk	North American River Otter	Northern Flicker
Fisher	Rock Dove	Northern Flying Squirrel	Red-tailed Hawk
North American Porcupine	Steller's Jay	Northern Raccoon	Ring-necked Pheasant
North American River Otter	Varied Thrush	Puma	Spotted Towhee
Northern Raccoon	Wild Turkey	Townsend's Chipmunk	Steller's Jay
Nutria	Wood Duck	Virginia Opossum	Swainson's Thrush
Puma			Varied Thrush
Snowshoe Hare			Wood Duck
Townsend's Chipmunk			Yellow-bellied Sapsucker
Virginia Opossum			

Species detected during amphibian and reptile surveys conducted by Central Washington University (Irwin, 2024). Data provided October 2024.

Southern Project Area	**Northern Project Area**
Dunn's salamander, *Plethodon dunni*	American bullfrog, *Lithobates catesbeianus*
Ensatina, *Ensatina eschscholtzii*	Common garter snake, *Thamnophis sirtalis*
Long-toed salamander, *Ambystoma macrodactylum*	Long-toed salamander, *Ambystoma macrodactylum*
Northern red-legged frog, *Rana aurora*	Northern alligator lizard, *Elgaria coerulea*
Rough-skinned newt, *Taricha granulosa*	Northern red-legged frog, *Rana aurora*
Western redbacked salamander, *Plethodon vehiculum*	Northwestern garter snake, *Thamnophis ordinoides*
Western toad, *Anxyrus boreas*	Northwestern salamander, *Ambystoma gracile*
	Pacific chorus frog, *Pseudacris regilla*
	Rough-skinned newt, *Taricha granulosa*

Species detected through research grade iNaturalist observations of birds, mammals, amphibians, and reptiles between 2014 and 2024 for the general Northern and Southern project areas

Southern Project Area Amphibians	**Northern Project Area Amphibians**
American Bullfrog	American Bullfrog
Coastal Giant Salamander	Ensatina
Columbia Torrent Salamander	Long-toed Salamander
Ensatina	Northern Pacific Tree Frog
Long-toed Salamander	Northern Red-legged Frog
Northern Pacific Tree Frog	Northwestern Salamander
Northern Red-legged Frog	Oregon Ensatina
Northwestern Salamander	Oregon Spotted Frog
Rough-skinned Newt	Rough-skinned Newt
Western Red-backed Salamander	Western Long-toed Salamander
Western Toad	Western Red-backed Salamander
Southern Project Area Reptiles	**Northern Project Area Reptiles**
Common Garter Snake	Common Garter Snake
Garter Snakes	Northern Alligator Lizard
Northwestern Alligator Lizard	Northern Rubber Boa
Northwestern Garter Snake	Northwestern Alligator Lizard
Puget Sound Garter Snake	Northwestern Garter Snake
Red-spotted Garter Snake	Puget Sound Garter Snake
Valley Garter Snake	Wandering Garter Snake
	Western Terrestrial Garter Snake
Southern Project Area Mammals	**Northern Project Area Mammals**
Columbian Black-tailed Deer	American Beaver
Domestic Rabbit	American Black Bear
Douglas' Squirrel	American Shrewmole
Eastern Cottontail	California Myotis
European Rabbit	Coast Mole
Long-tailed Weasel	Columbian Black-tailed Deer
Striped Skunk	Common Raccoon
Townsend's Chipmunk	Coyote
Wapiti	Domestic Cat
	Douglas' Squirrel
	Eastern Cottontail
	Eastern Gray Squirrel
	Long-eared Myotis
	Long-tailed Weasel
	Mountain Lion
	Mule Deer
	North American River Otter
	Nutria
	Red Fox

	Northern Project Area Mammals - continued
	Roosevelt Elk Silver-haired Bat Townsend's Chipmunk Virginia Opossum Wapiti Western Deer Mouse Western Pocket Gopher Yuma Myotis
Southern Project Area Birds	**Northern Project Area Birds**
American Barn Swallow American Coot American Crow American Goldfinch American Robin Anna's Hummingbird Bald Eagle Barn Swallow Barred Owl Belted Kingfisher Black-capped Chickadee Brewer's Blackbird Bufflehead Bullock's Oriole Bushtit California Scrub-Jay Canada Goose Canada Jay Cedar Waxwing Chestnut-backed Chickadee Common Merganser Common Raven Common Yellowthroat Dark-eyed Junco Double-crested Cormorant Downy Woodpecker Evening Grosbeak Golden-crowned Kinglet Great Blue Heron Mallard Marsh Wren Mourning Dove Northern Red-shafted Flicker Northern Shoveler Orange-crowned Warbler	American Crow American Goldfinch American Kestrel American Robin American Wigeon Anna's Hummingbird Audubon's Warbler Bald Eagle Band-tailed Pigeon Barn Swallow Barred Owl Belted Kingfisher Bewick's Wren Black-capped Chickadee Black-headed Grosbeak Black-throated Gray Warbler Brewer's Blackbird Brown Creeper Brown-headed Cowbird Bufflehead Bullock's Oriole Bushtit California Quail California Scrub-Jay Canada Goose Canada Jay Cedar Waxwing Chestnut-backed Chickadee Chipping Sparrow Cliff Swallow Common Goldeneye Common Raven Common Yellowthroat Cooper's Hawk Dark-eyed Junco

Southern Project Area Birds - continued	**Northern Project Area Birds - continued**
Osprey	Domestic Mallard
Pacific Wren	Double-crested Cormorant
Pied-billed Grebe	Downy Woodpecker
Purple Finch	Eurasian Collared-Dove
Red-breasted Nuthatch	European Starling
Red-breasted Sapsucker	Evening Grosbeak
Red-tailed Hawk	Glaucous-winged Gull
Red-winged Blackbird	Golden-crowned Kinglet
Rock Pigeon	Golden-crowned Sparrow
Ruby-crowned Kinglet	Grasshopper Sparrow
Ruffed Grouse	Great Blue Heron
Song Sparrow	Great Horned Owl
Spotted Towhee	Hairy Woodpecker
Steller's Jay	Hooded Merganser
Swainson's Thrush	House Finch
Tree Swallow	House Sparrow
Western Grebe	House Wren
Western Tanager	Hutton's Vireo
Willow Flycatcher	Killdeer
Yellow Warbler	Lapland Longspur
Yellow-rumped Warbler	Lazuli Bunting
	Lesser Goldfinch
	Lesser Scaup
	Loggerhead Shrike
	Mallard
	Mountain Bluebird
	Mourning Dove
	North American Osprey
	Northern Flicker
	Northern Harrier
	Northern Pygmy-Owl
	Northern Shrike
	Orange-crowned Warbler
	Osprey
	Pacific Wren
	Pied-billed Grebe
	Pileated Woodpecker
	Pine Siskin
	Purple Finch
	Purple Martin
	Red Crossbill
	Red-breasted Nuthatch
	Red-breasted Sapsucker
	Red-tailed Hawk
	Red-winged Blackbird
	Ring-necked Duck

	Northern Project Area Birds - continued
	Ring-necked Pheasant
	Rough-legged Hawk
	Ruby-crowned Kinglet
	Rufous Hummingbird
	Savannah Sparrow
	Say's Phoebe
	Sharp-shinned Hawk
	Song Sparrow
	Spotted Towhee
	Steller's Jay
	Swainson's Thrush
	Tree Swallow
	Trumpeter Swan
	Turkey Vulture
	Varied Thrush
	Vesper Sparrow
	Violet-green Swallow
	Warbling Vireo
	Western Bluebird
	Western Flycatcher
	Western Meadowlark
	Western Red-tailed Hawk
	Western Tanager
	Western Wood-Pewee
	White-crowned Sparrow
	White-tailed Kite
	White-throated Sparrow
	Wild Turkey
	Willow Flycatcher
	Wilson's Warbler
	Wood Duck
	Yellow Warbler
	Yellow-rumped Warbler