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Natural Resource Consultants Since 1921

MEMORANDUM

DATE: April 30, 2018

TO: Susan Wright, Kelly Laustsen, and Krista Purser (Kittelson & Associates, Inc.)

FROM: McKay Larrabee and Stuart Myers (Mason, Bruce & Girard, Inc. [MB&G])

SUBJECT: Pleasant Valley Transportation System Plan (TSP) Refinement - Natural Resources Review of Roadway Alternatives

Introduction

MB&G reviewed available Geographic Information System (GIS) natural resource data associated with 15 road alignment segments for the Pleasant Valley TSP Refinement to provide a preliminary assessment of potential natural resource impacts that could result from implementation of various road segment combinations. Each road segment is a different geometric variation of the following potential new or improved roadways within the Pleasant Valley TSP Refinement:

- SE Jenne Road (Jenne)
- SE 174th Avenue (174th)
- SE Giese Road (Giese)
- SE Foster Road (Foster)
- SE 172nd Avenue (172nd)
- A new tee (road) segment (Additional Tee)

The 15 road segments can be merged in different combinations to form five distinct Pleasant Valley TSP Refinement Alternatives (Alternatives). These Alternatives are briefly described in Table 1 and are shown in the Alternative figures located in Appendix A. Some road segments have the same geometry in two or more of the alternatives while having different geometries in the others. For instance, the SE 172nd Avenue alignment has the same geometry for Alternatives 1 and 2, but differs for each of the remaining Alternatives.

Analyzing each individual road segment for potential natural resource impacts allows project stakeholders the opportunity to review the cumulative potential impact of each Alternative, and provides the ability to estimate potential impacts from different road segment combinations. MB&G used preliminary road segments provided by the Kittelson Team overlaid with coarse resolution, publically-available natural resource GIS layers to produce a natural resources impact matrix for each road segment. This memorandum describes the scoring criteria, natural resource categories, and regulatory detail to aid in the assessment of Alternatives for the Pleasant Valley TSP Refinement. It should be noted that because the information used in this analysis is derived from coarse resolution GIS data without field verification,

the natural resource impacts are rough estimates and a field survey is necessary for determining specific impacts for each road segment and Alternative.

Table 1. Brief descriptions of the Pleasant Valley TSP Refinement Alternatives.

Alternative	Brief Description
1: Planned Improvements Only	Jenne Road Improvements 172nd Extension 172nd to 172nd Extension as North-South Connection Localize Foster East-West Giese Extension
2: Extend 174th and Localize Foster	174th Extension 172nd Extension 172nd to 172nd Extension as North-South Connection Localize Foster East-West Giese Extension
3: Improve Jenne, Foster, and 172nd; Connect and Tee Giese;	Jenne Road Improvements Foster Road Improvements 172nd to Foster as North-South Connection East-West Giese Extension Additional Connection Tees to Foster
4: Improve Jenne and Foster; Connect and Tee Giese	Jenne Road Improvements Foster Road Improvements Foster to Foster as North-South Connection East-West Giese Extension Additional Connection Tees to Foster
5: Improve Jenne and Foster; Tee Giese	Jenne Road Improvements Foster Road Improvements Foster to Foster as North-South Connection Giese Connection Tees to Foster

Methods

Impact scores for each natural resource category were established at intervals of 1, 5, or 10. A score of 1 represents a relatively lower impact to natural resources while a score of 10 represents a relatively higher impact to natural resources. The road segments were overlaid with natural resource layers in GIS resulting in an acreage or linear feet of impact where these layers intersected. In order to provide a three-tiered scoring matrix (*i.e.,* 1, 5, or 10), the range of impacts across all 15 road segments for each natural resource category was calculated. The minimum, mean, and maximum impact values within each category range informed the three final scores (*i.e.,* 1, 5, or 10) for each natural resource category of each road segment. Appendix B includes the ranges used for the ranking criteria as well as the raw impact values for each natural resource category and road segment.

Each road segment was analyzed based off of the limits of earthwork to construct or improve each segment. The earthwork extents were provided by the Kittelson Team for the SE Jenne Rd (for Alternatives 1, 3, and 4) and the SE 174th Avenue (for Alternative 2) segments. For all other segments, the Kittleson Team provided centerlines, which were then buffered based on the following assumptions:

- Arterial streets = 110 feet wide (80 feet impervious surface, 15 feet earthwork on either side)

- Collector streets = 105 feet wide (75 feet impervious surface, 15 feet earthwork on either side)
- Local streets = 90 feet wide (65 feet impervious surface, 15 feet earthwork on either side)

These assumptions allow for a conservative approach as these road widths are likely wider than the actual earthwork. Below is a list of the seven natural resource categories analyzed, rationale for the individual impact thresholds, and the specific regulatory requirements and considerations required for each.

Wetlands

- GIS layers analyzed: National Wetland Inventory, Local Wetland Inventory, and Hydric Soils (merged and dissolved).
- Impact level for this category was based on the acreage of wetland (NWI/LWI/Hydric Soils dissolved) overlapping each road segment. The acreage of impact for this analysis were also used to estimate potential mitigation costs (larger impacts = higher cost).
- Mitigation for wetlands outside of the Environmentally Sensitive/Restoration Area (ESRA) or Metro Title 13 lands that are not deemed locally significant wetlands may use the Foster Creek Mitigation Bank (Cost = $250,000/acre, currently 1.57 ac available [3/27/2018]). The costs of permittee-responsible mitigation are comparable to using a bank when considering the added time and responsibility required by the project owner.
- The costs to permit impacts to wetlands can vary (though not enough to warrant the inclusion of these costs in this analysis) depending on regulatory thresholds. The regulatory permitting thresholds are listed below:
    - Impacts below 0.5 acre may qualify for a US Army Corps of Engineers Nationwide Permit.
    - Impacts below 5,000 cubic yards of removal/fill in non-wetland water with no greater than 0.5 acre of permanent wetland impact may qualify for the Oregon Department of State Land's (DSL) General Permit.
    - If the project exceeds these thresholds, an individual Permit will be required from both agencies.
- This analysis does not include field-delineated wetlands/waters. It is likely that additional wetlands are present within all road segments and that some of the remotely-sensed wetland configurations are inaccurate.
- A wetland/water delineation and report will be required for all road segments to determine accurate wetland/waters locations and dimensions.
- Impacts to wetlands and waters are likely to result from all alternative alignments; therefore, the following laws and regulations will apply to the project: Sections 404 and 401 of the Clean Water Act, administered by the USACE and the Department of Environmental Quality (DEQ), respectively; and the Removal Fill Law, administered by the DSL.

Stormwater Treatment

- GIS layers analyzed: Roadway extents (earthwork – see assumptions above) of each road segment.
- Impact level for this category was based on the total acreage of each road segment as a rough estimate of how much impervious surface would require stormwater treatment. Existing and proposed roadways were scored equally because stormwater treatment requirements for each are the same in terms of impacts to Endangered Species Act (ESA)-listed fish species.

- Sensitive fish species may be impacted indirectly by stormwater runoff originating from impervious surfaces. The additional stormwater generated by widening or creating new road alignments can result in project constraints and costs due to limited right-of-way and/or lack of space required for stormwater treatment facilities.
- ESA-listed fish species including Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*), as well as native western brook lamprey (*Lampetra richardsoni*) and Pacific lamprey (*L. tridentate*) are known to occur in Kelley Creek and Johnson Creek (ODFW 2003). A relatively high abundance of lampreys further supports making protection of Kelley Creek a high priority.
- Potential impacts (increase in impervious surface, culvert/bridge construction or widening) will require consultation with National Marine Fisheries Service (NMFS) prior to project implementation.
    - Consultation may be done under either the Standard Local Operating Procedures for Endangered Species (SLOPES V) Biological Opinion or the Federal Aid Highway Programmatic (FAHP) Biological Opinion if Federal Highway Administration funding is used.
    - If the conditions of SLOPES V or FAHP are not met, a Biological Assessment and individual consultation with NMFS may be required.
    - NMFS typically requires bridges to be designed to span 1.5 times the average active channel width of the stream to be crossed (for single-span bridges).

Stream Crossings

- GIS layers analyzed: Streams (City of Gresham 2017).
- Impact level for this category was based off of the linear feet of stream crossing and whether the crossing would be considered new or improved. Linear feet of stream crossing for improved culverts were multiplied by 1, new culverts by 2. The assumption is that new stream crossings would be a greater impact on natural resources than an improved crossing. However, under Oregon's fish passage law, all culvert improvements would have to meet fish passage criteria (or be granted a waiver or exemption), in essence, creating a net benefit for fish species at these crossings.
- Any crossing with current or historic native migratory fish or lamprey species presence will trigger Oregon's Fish passage Law:
    - New or improved stream crossings will need to be designed to provide fish passage in accordance with the law.
    - Fish Passage Plans will need to be prepared to document compliance and submitted to the Oregon Department of Fish and Wildlife (ODFW).
    - Stream crossings must span at least the average active channel width to comply with the Oregon Fish Passage Law.
    - These requirements also apply to temporary bridges that may be needed to facilitate construction of bridges.
    - The ODFW-preferred In-Water Work Window for the Clackamas River/Johnson Creek and their tributaries is July 15 - August 31. All work below the ordinary high water mark of streams must be completed during this window.

Mature Trees

- GIS layers analyzed: LiDAR tree canopy height (DOGAMI 2016).
- LiDAR tree height data were derived from subtracting the bare earth Digital Elevation Model (DEM) from the highest hit DEM. The resulting DEM of tree heights was then reclassified to select all pixels taller than 80 feet. The selected raster was then converted to a vector and intersected with each road component.
- This modeling effort assumes that any tree over 80 feet tall is mature enough to consider protection and that removal would likely require mitigation due to the biological significance provided by large trees in terms of habitat, shading, movement corridors, and food sources for multiple species.

Riparian Wildlife Habitat

- GIS layers analyzed: Title 13 Natural Resource Inventory (Portland Metro 2005).
- Title 13 Riparian Corridors / Wildlife Habitat Classes I and II were included in this analysis. Class II supports 1 and 2 primary riparian functions and Class I supports 3 or more riparian functions. Class III was not included in this analysis because it supports only secondary riparian functions outside wildlife areas.
- These data were used to determine potential impacts on riparian habitat, stream functions, fish species, and increases in habitat fragmentation.
- Impact scores were ranked based on the extent to which the road segments impact the riparian wildlife habitat polygons (dissolved Class I and II polygons).

Upland Wildlife Habitat

- GIS layers analyzed: Title 13 Natural Resource Inventory (Portland Metro 2005).
- Title 13 Upland Wildlife Habitat Classes A and B were included in this analysis. Class A and Class B include areas with secondary riparian value that have a high and medium value for wildlife habitats, respectively. Class C was not included in this analysis because it includes areas with secondary riparian value that have only a low value for wildlife habitats.
- These data were used to determine potential impacts on upland habitat and increases in habitat fragmentation.
- Impact scores were ranked based on the extent to which the road segments impact the upland wildlife habitat polygons (dissolved Class A and B polygons).

Habitat Fragmentation

- GIS layers analyzed: Length of new road created.
- Some road components have both existing and new geometries. For this analysis, only the new portion was calculated.
- The assumption is that any new road, regardless of nearby habitat, will create fragmentation. A new road cutting through agricultural land would be considered a lesser impact than one transecting forested habitat. Nonetheless, fragmentation in degraded habitats can cause shifts in wildlife movement corridors and could lead to a bottleneck, especially for small mammals. In addition, new roads can cause safety concerns with increases in wildlife/car collisions due to large ungulates moving through agricultural landscapes.

Although this analysis does not measure the acreages of ESRA or the Portland "v" Overlay, they are significant natural resource layers that provide administrative protections for streams, wetlands, riparian areas, and upland wildlife habitat. Hence, these layers are discussed below to provide a better understanding of mitigation requirements and road construction constraints.

ESRA

- Impacts within the ESRA boundaries will likely require permittee-responsible mitigation (often comparable to using a bank, but more time and labor intensive).
- Mitigation is required at a 2:1 ratio or per the DSL/USACE functional and area replacement standards.
- Mitigation must occur within ESRA-PV areas, adjacent to ESRA-PV, or within the Kelley Creek or Johnson Creek watersheds.
- The Pleasant Valley Plan District Code Section 4.1442 states:
    - Where the right-of-way or public access easement crosses a stream, the crossing must be by bridge or a bottomless culvert;
    - No fill or excavation can occur within the ordinary high water mark of a stream, unless necessary and any required permits are obtained from the USACE and/or the DSL;
    - The DSL has approved any work that requires excavation or fill in a wetland;
    - Any work that will take place within the banks of a stream must be conducted during the specified in water work window, as determined by ODFW for each specific water body, or must be approved by the ODFW; and
    - Mitigation is required as specified in section 4.1445.

Portland "v" Overlay (Portland Protection Zone)

- Mitigation for impacts within the overlay must occur at a 2:1 ratio.
    - For right-of-ways, mitigation must occur in the Kelley Creek watershed. Hence, impacts within the overlay will likely require permittee-responsible mitigation (often comparable to using a mitigation bank, but more time and labor intensive).
    - Mitigation areas include specific requirements for plants including type, density, diversity, and size requirements.
    - Title 33, Section 33.465.160 states:
        - Where the road segment crosses a stream, the crossing must be by bridge.
        - No fill or excavation may occur within the ordinary high water mark of the stream.
        - The DSL has approved any work that requires excavation or fill in a wetland.
        - Any work that will take place within the banks of a stream must be conducted between June 1 and August 31, or must be approved by the ODFW.
        - Mitigation is required as specified in Section 33.465.180.
        - The following rights-of-way are allowed in the Pleasant Valley Natural Resources overlay zone. All other rights-of-way are prohibited:
            - Streets that are shown on the Pleasant Valley Street Network Plan;
            - Common greens; and
            - Pedestrian connections.

Potential Mitigation

- Mitigation costs can vary greatly depending on the type of resource, land ownership, and land availability.
- Mitigation for wetlands and for upland/riparian wildlife habitat will likely require permittee-responsible mitigation for areas included under certain local land use classifications (ESRA or "v" Overlay). Permittee-responsible mitigation is comparable to using a bank when considering the added time and responsibility required by the project owner. Due to local land use requirements, mitigation for impacts to wetlands and upland/riparian wildlife habitat will likely have to occur locally and not outside the Kelley Creek or Johnson Creek watersheds.
- This analysis utilizes the Foster Creek wetland bank as a surrogate for estimating wetland mitigation costs ($250,000/ac). In addition, the analysis relied on local knowledge of upland/riparian mitigation costs calculated from the "Impact Area" of Metro's Title 13 Natural Resources Inventory ($45,000/ac, pers. comm., M. Wallace, 2018). On average, upland/riparian onsite mitigation generally costs $40,000 to $50,000 per acre. Hence, this analysis uses the midpoint of the range ($45,000/ac) for calculating potential mitigation costs. This includes site prep, planting, mulching and staking, and irrigation installation of the site initially and 5-years of maintenance and irrigation. This cost does not include land costs for purchasing, permit planning costs, any type of earth moving that might be needed, and extensive vegetation removal prior to planting (pers. comm., M. Wallace, 2018)
- Metro's Title 13 "Impact Area" is similar to what is proposed by the City of Gresham's upland/riparian wildlife impact area (pers. comm., K. Majidi, 2018). Hence, the Title 13 "Impact Area" is an appropriate layer to utilize for the potential cost of impacts to upland/riparian wildlife habitat.
- Potential mitigation costs were calculated by multiplying the acreage of wetlands (NWI/LWI/hydric soils) by $250,000 and adding that to the acreage of Title 13 "Impact Area" multiplied by $45,000. This is a conservative approach, considering most of the wetland acreage overlaps with the Title 13 "Impact Area" (effectively double-counting in many areas).

Results and Discussion

The analysis described above resulted in the rankings of the various road segments and alternatives based on their potential impact on focal natural resources. These resources were assessed due to either their regulatory nature or uniqueness in the project vicinity. Compilation of the scores was done to aid the review and Alternatives vetting process. The seven natural resource categories were compiled into three higher order ("Rolled Up") categories. Specifically, the Mature Trees, Riparian Wildlife Habitat, Upland Habitat, and Habitat Fragmentation categories were compiled in a single Habitat category. Similarly, the Stormwater and Stream categories were combined into a higher order Stream category given the relationships between stormwater runoff and stream health. The Wetland category remained consistent in both scaling exercises. Results of the analysis at both scales for each road segment are provided in Tables 2 and 3. Results of the analysis at both scales for each Alternative are provided in Tables 4 and 5. Appendix B includes the ranges used for the ranking criteria as well as the raw impact values for each natural resource category for each road component and alternative.

Table 2. Baseline Natural Resource Impact Rankings for each Road Segment.

Segment (Alternative)	Wetland	Stormwater	Stream	Mature Trees	Riparian Wildlife	Upland Wildlife	Fragmentation
172nd (1,2)	5	5	1	1	1	-	1
172nd (3)	1	1	-	-	-	-	-
172nd (4)	1	1	-	-	-	-	1
172nd (5)	1	1	-	-	-	-	1
174th (2)	1	5	10	10	5	10	10
Additional Tee (3,4)	-	1	-	-	-	-	1
Foster (1,2)	1	5	1	1	1	-	1
Foster (3)	10	10	1	1	5	1	1
Foster (4)	10	10	5	5	10	-	1
Foster (5)	10	10	10	5	10	1	-
Giese (1,2,3,4)	1	5	1	1	1	1	1
Giese (5)	-	1	-	-	-	-	1
Jenne (1,4,5)	1	1	1	5	-	1	-
Jenne (2)	1	1	1	5	-	1	1
Jenne (3)	1	5	5	5	1	1	1

Table 3. Compiled Natural Resource Impact Rankings for each Road Segment.

Segment (Alternative)	Wetland	Rolled Up Stream	Rolled Up Habitat	Potential Mitigation Cost (Wetland/Upland/Riparian)
172nd (1,2)	5	1	1	1
172nd (3)	1	1	-	1
172nd (4)	1	1	1	1
172nd (5)	1	1	1	1
174th (2)	1	10	10	5
Additional Tee (3,4)	-	1	1	-
Foster (1,2)	1	1	1	5
Foster (3)	10	5	1	10
Foster (4)	10	10	5	10
Foster (5)	10	10	5	10
Giese (1,2,3,4)	1	1	1	1
Giese (5)	-	1	1	-
Jenne (1,4,5)	1	1	1	1
Jenne (2)	1	1	1	1
Jenne (3)	1	5	1	1

Both the 174th alignment for Alternative 2 and the Foster alignment for Alternative 5 had the higher impact scores, indicating these segments might result in a relatively higher impact to natural resources than the other segments (Tables 2 and 3). The 174th road component received higher impact scores due to the number of new stream crossings, the larger amount of potential mature tree removal, and the amount of upland wildlife habitat transected. In addition, 174th resulted in a higher fragmentation score resulting from the length of proposed new road. The Foster alignment for Alternative 5 received high scores due to the amount of stream crossings, the amount of wetland crossed, and the amount of riparian wildlife habitat crossed. This alignment also scored higher for stormwater treatment due to the amount of

additional impervious surface created by road improvements. The Giese alignment for Alternative 5 and the Additional Tee alignment for Alternatives 3 and 4 had the lower impact scores because these segments did not cross any wetland, upland or riparian wildlife habitat, or streams, and did not remove any mature trees (Tables 2 and 3).

Table 4. Baseline Natural Resource Impact Rankings for each Alternative.

Alternative	Wetland	Stormwater	Stream	Mature Trees	Riparian Wildlife	Upland Wildlife	Fragmentation
Alternative 1	1	1	1	1	1	1	1
Alternative 2	1	10	10	10	5	10	10
Alternative 3	10	10	1	1	5	1	1
Alternative 4	10	5	1	5	10	1	1
Alternative 5	10	1	10	1	10	1	1

Table 5. Compiled Natural Resource Impact Rankings for each Road Segment.

Alternative	Wetland	Rolled Up Stream	Rolled Up Habitat	Potential Mitigation Cost (Wetland/Upland/Riparian)
Alternative 1	1	1	1	1
Alternative 2	1	10	10	10
Alternative 3	10	5	1	10
Alternative 4	10	5	5	10
Alternative 5	10	1	1	10

When comparing the Alternatives, Alternative 2 had the highest score and Alternative 1 the lowest, indicating a relatively higher or lower impact on natural resources than the other alternatives, respectively (Tables 4 and 5). The higher scores for Alternative 2 were predominantly the result of higher habitat and stream impact scores from the 174th road component. Alternative 1 received the lowest scores in every natural resource category, indicating that this alternative would have the lowest impact to natural resources when compared to the others.

This analysis does not provide a detailed account of natural resources at a finer scale. There are many assumptions and unknowns which would require field verification in order to quantify actual impacts to natural resources within the study area. Jenne Butte is one such resource that warrants additional discussion.

Jenne Butte is a unique area within the project study area in that it has had limited disturbance in the past 100 years. The forested area on the butte is a mixture of pure deciduous forest at the butte's summit next to the water reservoir to mixed deciduous/evergreen forest on the flanks. The area immediately around the reservoir contains 20-40 year old deciduous forest predominantly composed of red alder (*Alnus rubra*), big leaf maple (*Acer macrophyllum*), and scattered Oregon ash (*Fraxinus latifolia*). The herbaceous and shrub layers are intact and predominantly native expect for holly (*Ilex aquifolium*) and Himalayan blackberry (*Rubus armeniacus*) presence. The flanks of the butte are a mix of 40-100 year old mixed deciduous/evergreen forest predominantly made up of Douglas fir (*Pseudotsuga menziesii*), Western red cedar (*Thuja plicata*), and bigleaf maple *(Acer macrophyllum*). The herbaceous and shrub layers are predominantly native species with limited invasives (pers. comm., M. Wallace, 2018).

The wildlife use of the butte is extensive because of the quality of the habitat and lack of disturbance and human presence. Observed species include deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), opossum (*Didelphis virginianus*), grey owl (*Strix nebulosi*), great horned owl (*Bubo virginianus*), barred owl (*Strix varia*), pileated woodpeckers (*Hylatomus pileatus*), sapsuckers (*Sphyrapicus* sp.), flickers (*Colaptes auratus*), red-tailed hawk (*Colaptes auratus*), and numerous passerines (pers. comm., M. Wallace, 2018). Red-legged frogs have been observed and captured on both the west and east side of the butte. The Oregon slender salamander has been detected on other butte in the area, increasing the likelihood of an unknown population on Jenne Butte (pers. comm, K. Majidi, 2018). The butte contains the habitat needed for this species but surveys have not been performed so it cannot be ruled out they could be present.

Sensitive species might also be present within or adjacent to other road components in the study area. The initial desktop analysis did not reveal the presence of any known terrestrial sensitive species within the road segment impacts areas. However, a field investigation may uncover the presence of sensitive of ESA-listed species. If found, impacts to these species and/or their designated critical habitat may require consultation with the US Fish and Wildlife Service (USFWS).

It should be noted that even though Alternative 2 scores higher in natural resource impacts, only Alternatives 1 and 2 allow for mitigation opportunities at the existing Foster/Kelley Creek crossings. Mitigation, restoration, and/or enhancement of wetland or wildlife habitats here could supply a net benefit to the project. In addition, mitigation costs for the Foster alignment for Alternative 5 were almost twice that of the 174th alignment for Alternative 2 (scores in Table 2, raw data in Appendix B). The Foster alignments for Alternatives 3, 4, and 5 had the highest mitigation cost estimates presumably because they cross Kelley Creek. Widening Foster here would likely result in greater impacts to Kelley Creek, the wetland surrounding the creek, and upland/riparian wildlife habitat relative to the other road components.

Citations

City of Gresham. 2017. High resolution 3D stream network data. Provided by Quantum Spatial.

DOGAMI (Oregon Department of Geology and Mineral Industries). 2016. LiDAR derived highest hit digital surface model of the greater Portland Metro area. Data collected by Watershed Sciences, Inc., for DOGAMI. Published November 16, 2016.

Majidi, Kathy, Natural Resources Program Coordinator, City of Gresham. April 25, 2018 personal communication with McKay Larrabee (MB&G).

Oregon Department of Fish and Wildlife (ODFW). 2003. Abundance and Distribution of Fish in City or Portland Streams. Volume 1 – Final Report of Research. ODFW, Clackamas, Oregon.

Portland Metro. 2005. Title 13 Inventory, Portland Metro Region, Metro Long Range Planning Office. ESRI shapefile.

Wallace, Mike, Natural Resources Program Biologist, City of Gresham. April 27, 2018 meeting and May 1, 2018 personal communication (email) with McKay Larrabee (MB&G).

Appendix A
Figures

MB&G

MASON, BRUCE & GIRARD, INC.
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Johnson Creek

SE Jenne Rd

SE 174th Ave

Jenne Creek

SE Giese Rd

SE Foster Rd

Kelley Creek

SE 172nd Ave

Alternatives Analyzed

1
2
3
4
5

μ

Feet
0 250 500

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Johnson Creek

SE Jenne Rd

SE 174th Ave

Jenne Creek

SE Giese Rd

SE Foster Rd

Kelley Creek

SE 172nd Ave

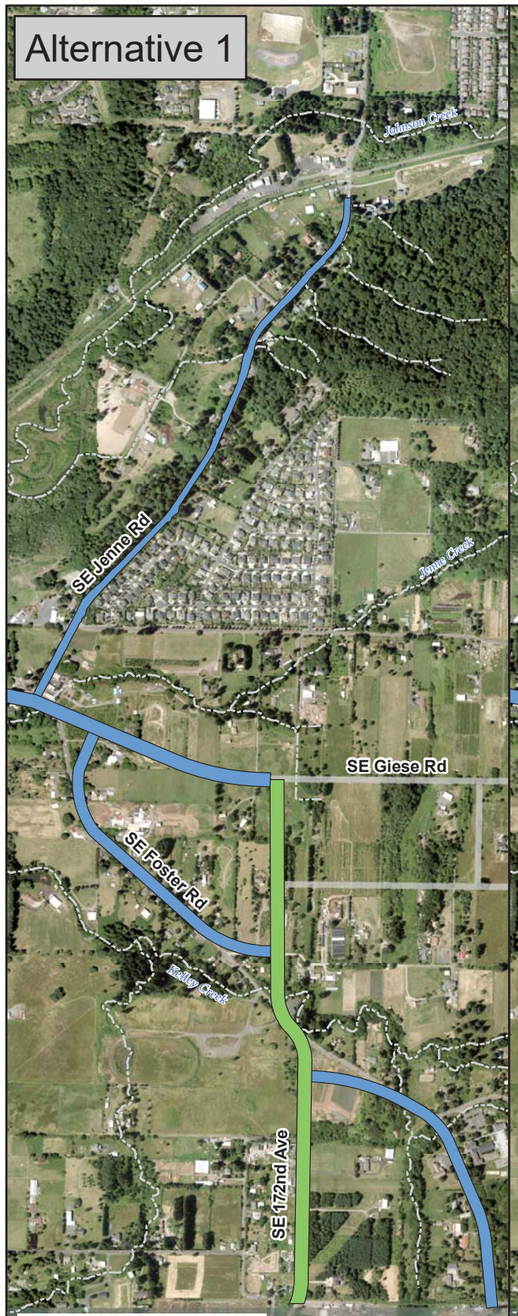
Natural Resource Categories

- Upland Wildlife Habitat
- Riparian Wildlife Habitat
- Mature Tree
- Wetland
- Streams

0 250 500 Feet

Wetland Category

Alternative 1

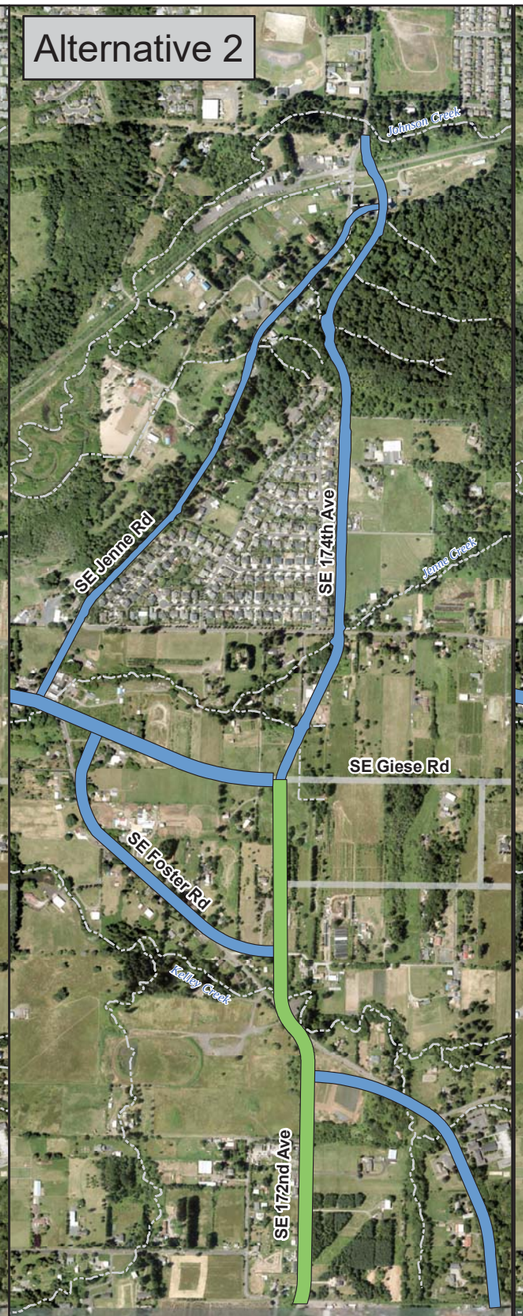


Natural Resource Analysis Score

- 1
- 5

Feet: 0 500 1,000

Alternative 2

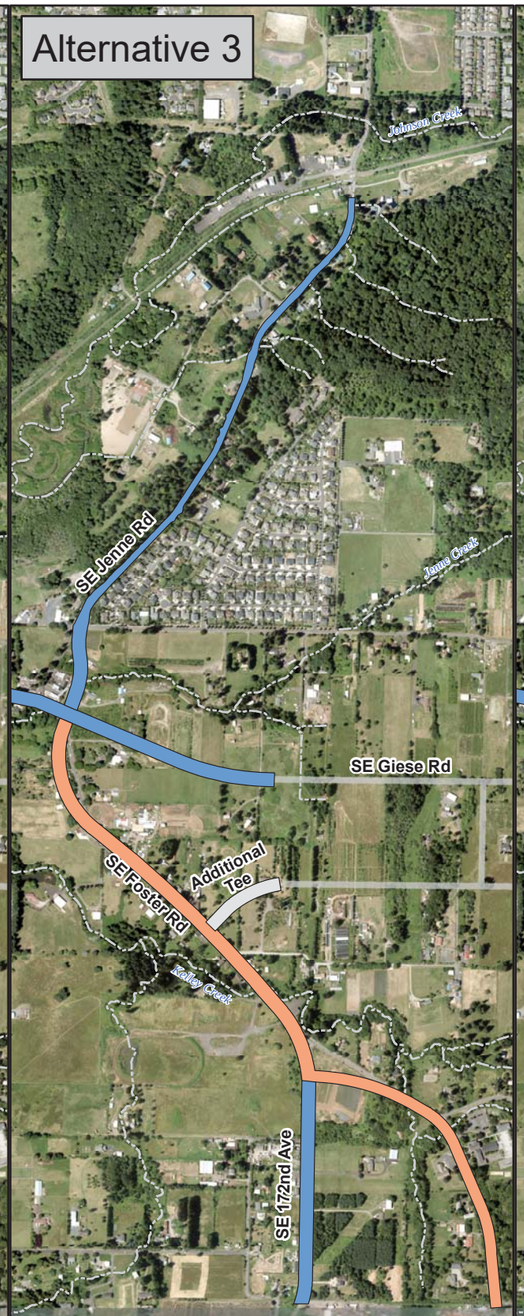


Natural Resource Analysis Score

- 1
- 5

Feet: 0 500 1,000

Alternative 3

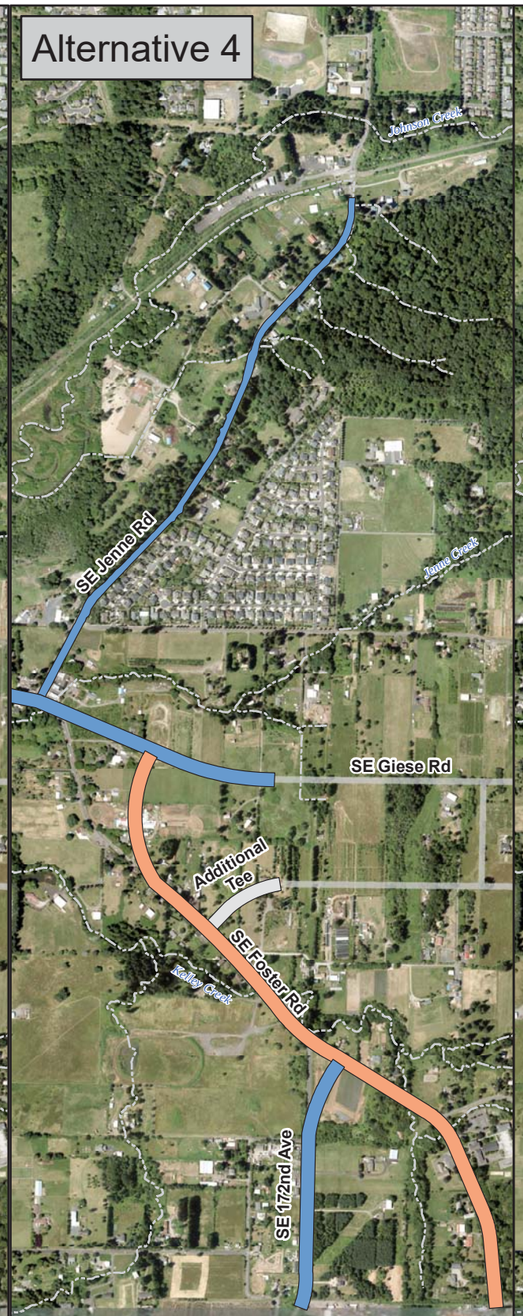


Natural Resource Analysis Score

- NA
- 1
- 10

Feet: 0 500 1,000

Alternative 4

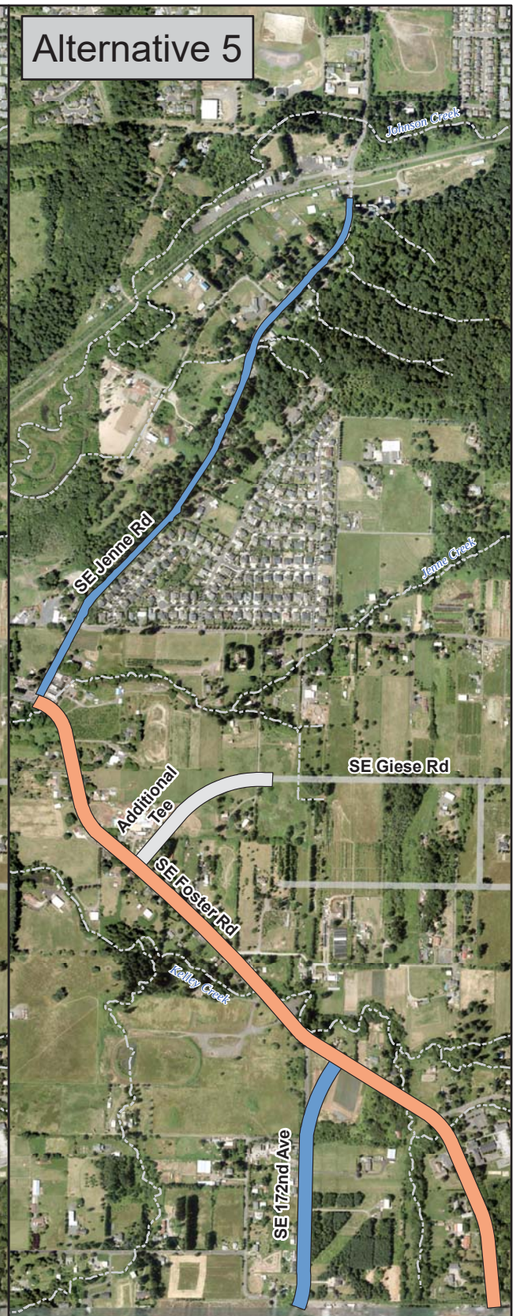


Natural Resource Analysis Score

- NA
- 1
- 10

Feet: 0 500 1,000

Alternative 5



Natural Resource Analysis Score

- NA
- 1
- 10

Feet: 0 500 1,000

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Alternative 1

Alternative 2

Alternative 3

Alternative 4

Alternative 5

Johnson Creek

Jenne Creek

Kelley Creek

SE Jenne Rd

SE Giese Rd

SE Foster Rd

SE 174th Ave

SE 172nd Ave

Additional Tee

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Stream/Stormwater

Natural Resource Analysis Score

1

10

5

Feet
0 500 1,000

Habitat Category

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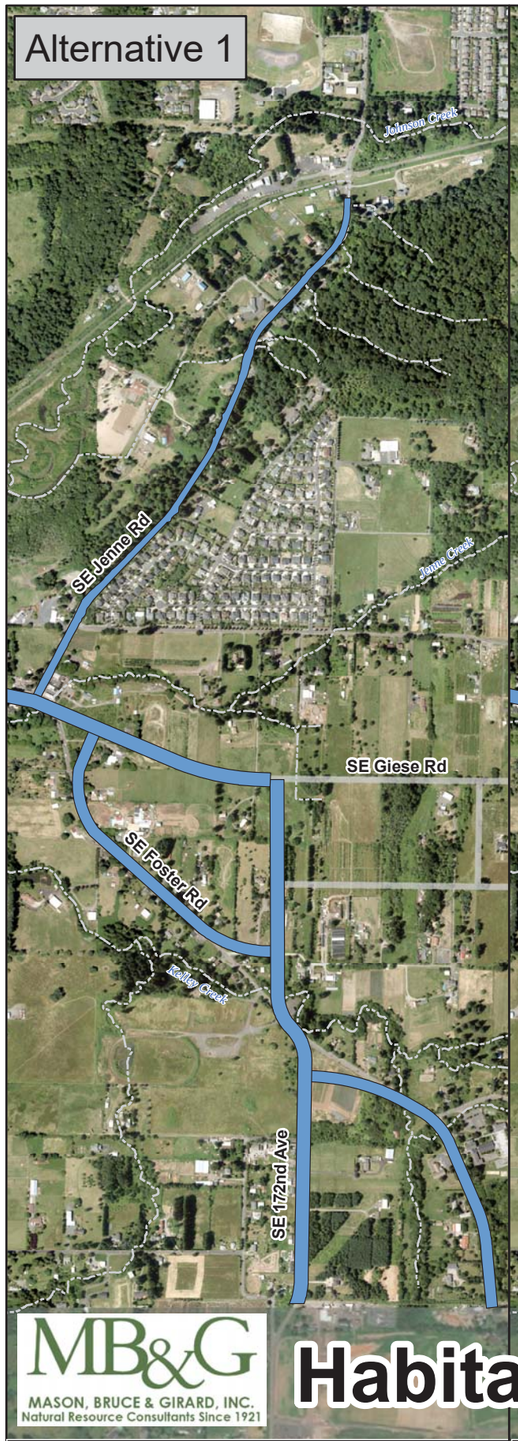
Alternative 1

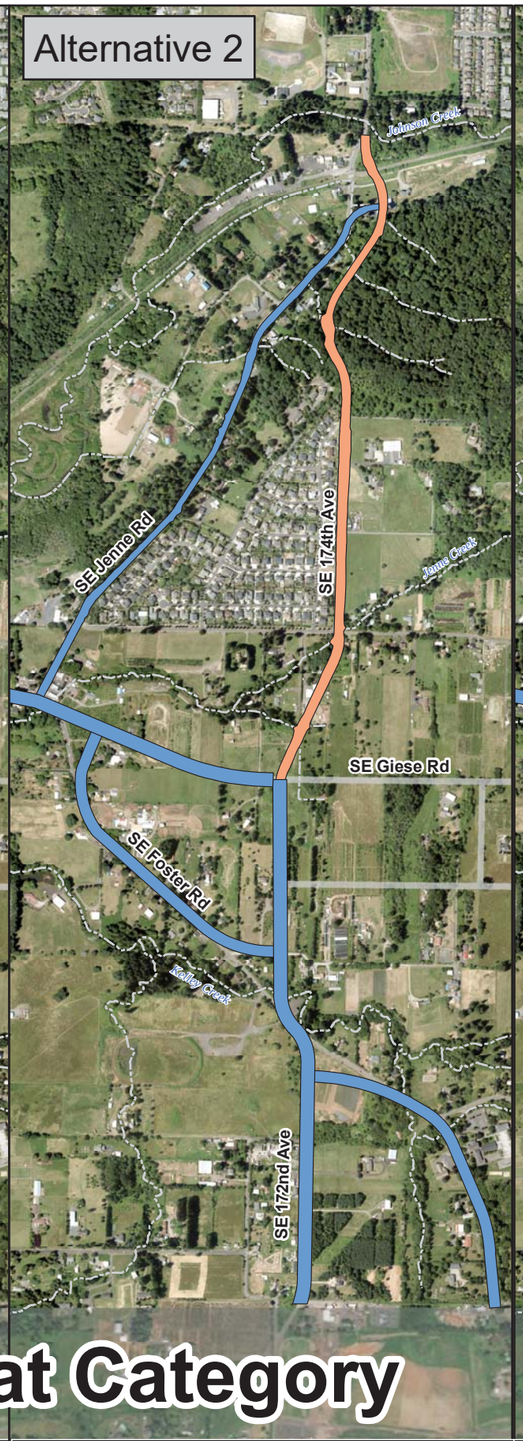


Natural Resource Analysis Score

- 1

Feet
0 500 1,000

Alternative 2

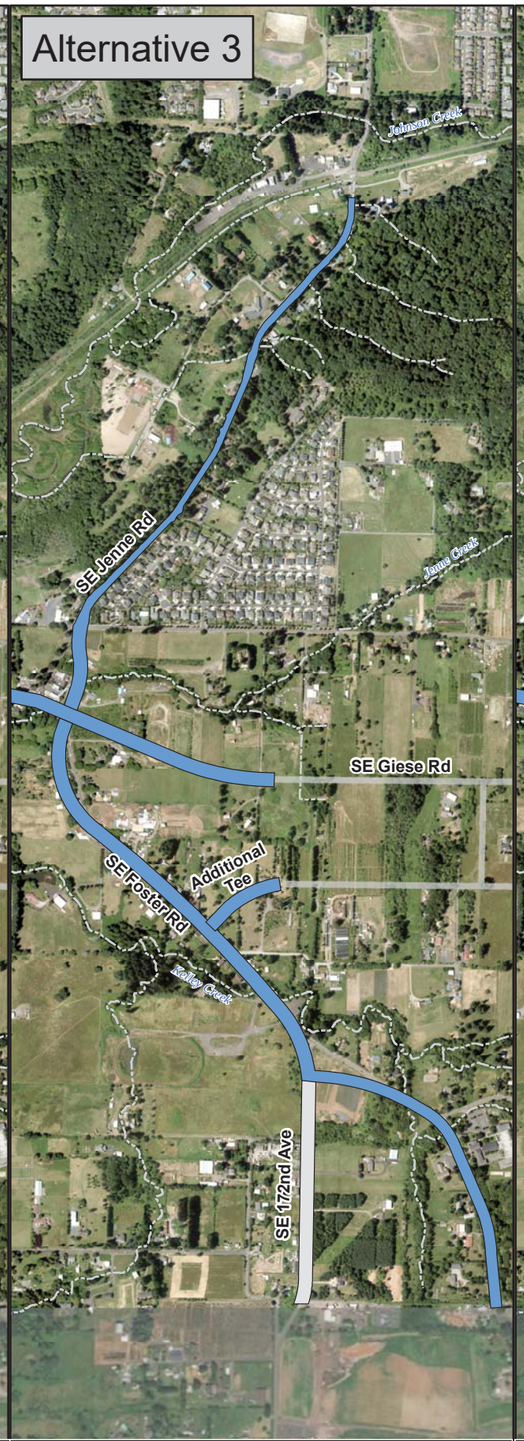


Natural Resource Analysis Score

- 1
- 10

Feet
0 500 1,000

Alternative 3

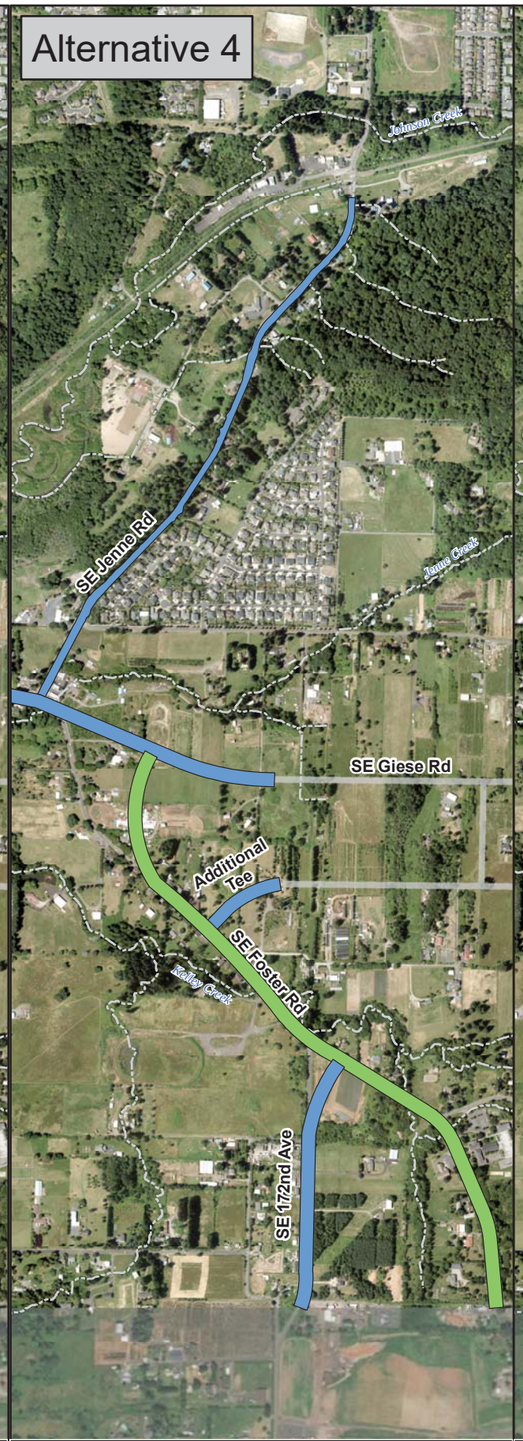


Natural Resource Analysis Score

- NA
- 1

Feet
0 500 1,000

Alternative 4

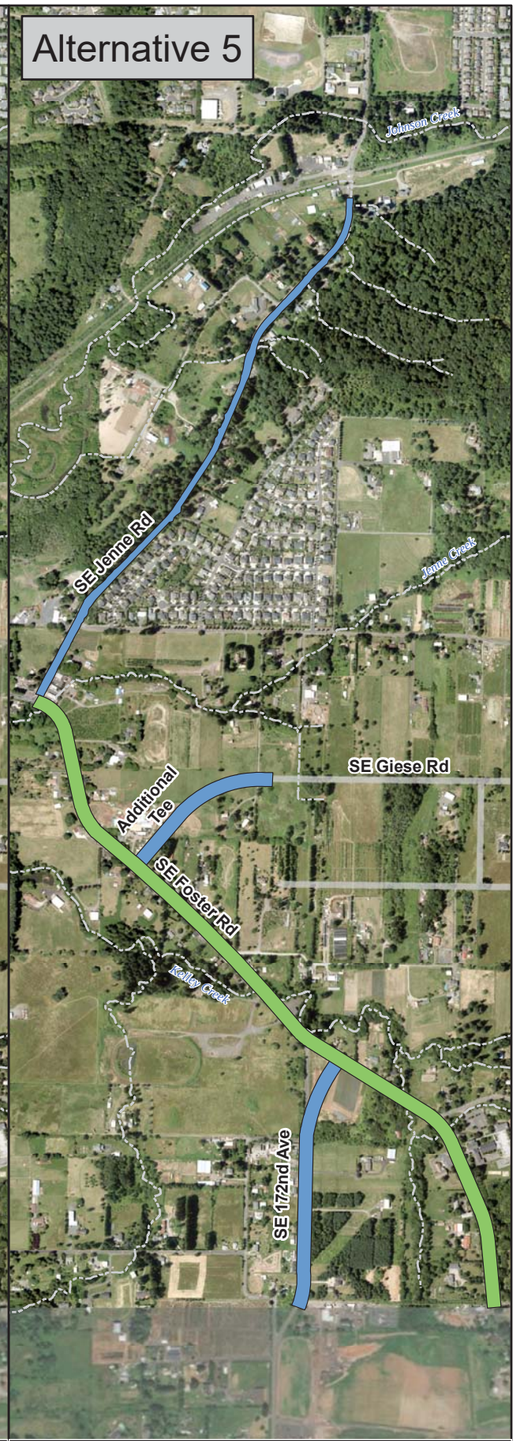


Natural Resource Analysis Score

- 1
- 5

Feet
0 500 1,000

Alternative 5



Natural Resource Analysis Score

- 1
- 5

Feet
0 500 1,000

Appendix B
Raw Data and Data Ranges

Raw Data

Segment	Wetland	Stormwater	Stream	Mature Trees	Riparian Wildlife	Upland Wildlife	Fragmentation	Mitigation (Wetland, Riparian, and Upland)
172nd (1,2)	0.534	10.587	397	0.085	0.658	-	1761	$180,552
172nd (3)	0.075	4.441	-	-	-	-	-	$18,639
172nd (4)	0.060	5.015	-	-	-	-	369	$15,030
172nd (5)	0.060	5.015	-	-	-	-	369	$15,030
174th (2)	0.183	9.557	1246	1.013	1.283	2.846	5450	$202,180
Additional Tee (3,4)	-	1.586	-	-	-	-	604	-
Foster (1,2)	0.285	10.820	161	0.218	0.719	-	1685	$162,277
Foster (3)	0.862	14.542	452	0.294	1.345	0.028	519	$369,278
Foster (4)	0.947	14.082	580	0.409	1.565	-	942	$413,312
Foster (5)	1.041	15.902	924	0.446	1.915	0.009	-	$464,913
Giese (1,2,3,4)	0.051	6.460	123	0.072	0.298	0.933	1972	$72,613
Giese (5)5	-	3.328	-	-	-	-	1266	-
Jenne (1,4,5)	0.048	6.086	357	0.573	-	0.285	-	$58,621
Jenne (2)	0.048	6.190	466	0.593	-	0.285	264	$58,808
Jenne (3)	0.090	6.901	593	0.555	0.457	0.285	692	$89,507

Ranges

Scores	Acres	Acres	Linear Feet	Acres	Acres	Acres	Linear Feet	Wetland ($250,000/ac) Plus Riparian/Upland ($25,000/ac)
1	0.048 - 0.379	1.586 - 6.358	122 - 497	0.072 - 0.386	0.299 - 0.837	0.009 - 0.954	264 - 1,993	$15,029 - $219,564
5	0.379 - 0.710	6.358 - 11.130	497 - 871	0.386 - 0.700	0.837 - 1.376	0.954 - 1.900	1,993 - 3,721	$219,564 - $424,099
10	0.710 - 1.041	11.130 - 15.902	871 - 1,245	0.700 - 1.013	1.376 - 1.915	1.900 - 2.846	3,721 - 5,450	$424,099 - $628,633

Scores

Segment	Wetland	Stormwater	Stream	Mature Trees	Riparian Wildlife	Upland Wildlife	Fragmentation	Mitigation (Wetland, Riparian, and Upland)	Rolled Up Wetland	Rolled Up Stream	Rolled Up Habitat
172nd (1,2)	5	5	1	1	1	-	1	1	5	1	1
172nd (3)	1	1	-	-	-	-	-	1	1	1	-
172nd (4)	1	1	-	-	-	-	1	1	1	1	1
172nd (5)	1	1	-	-	-	-	1	1	1	1	1
174th (2)	1	5	10	10	5	10	10	5	1	10	10
Additional Tee (3,4)	-	1	-	-	-	-	1	-	-	1	1
Foster (1,2)	1	5	1	1	1	-	1	5	1	1	1
Foster (3)	10	10	1	1	5	1	1	10	10	5	1
Foster (4)	10	10	5	5	10	-	1	10	10	10	5
Foster (5)	10	10	10	5	10	1	-	10	10	10	5
Giese (1,2,3,4)	1	5	1	1	1	1	1	1	1	1	1
Giese (5)	-	1	-	-	-	-	1	-	-	1	1
Jenne (1,4,5)	1	1	1	5	-	1	-	1	1	1	1
Jenne (2)	1	1	1	5	-	1	1	1	1	1	1
Jenne (3)	1	5	5	5	1	1	1	1	1	5	1

Alternative Score

	Wetland	Stormwater	Stream	Mature Trees	Riparian Wildlife	Upland Wildlife	Fragmentation	Mitigation (Wetland, Riparian, and Upland)	Rolled Up Wetland	Rolled Up Stream	Rolled Up Habitat
Alternative 1	1	1	1	1	1	1	1	1	1	1	1
Alternative 2	1	10	10	10	5	10	10	10	1	10	10
Alternative 3	10	10	1	1	5	1	1	10	10	5	1
Alternative 4	10	5	1	5	10	1	1	10	10	5	5
Alternative 5	10	1	10	1	10	1	1	10	10	1	1