# Feasibility Study Report

## Molasses Creek Fish Barrier and Habitat Improvement Project

**August 2, 2023**

King County

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# Feasibility Study Report

## Molasses Creek Fish Barrier and Habitat Improvement Project

Prepared for
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# Executive Summary

As part of its work to improve fish passage and habitat conditions in the Cedar River Watershed, King County (County) initiated a feasibility study of improving fish passage in Molasses Creek in the Fairwood residential area in unincorporated King County. The project area focuses on the piped section of Molasses Creek from approximately river (creek) mile (RM) 0.9 to RM 1.15. The piped creek is approximately 15 feet below grade and extends beneath public and private properties. The piped creek is a fish passage barrier and not maintainable due to fish passage regulations.

Three alternatives for improving fish passage were developed and evaluated. The alternatives included a Status Quo option under which existing conditions would remain, and two alternatives under which daylighting of the creek was proposed (Historical Alignment Daylighting and Current Alignment Daylighting). For each alternative, a project footprint was defined, and design concepts were developed in GIS drawings. The design concepts were informed by an existing conditions review, property needs/ownership, utilities, and geotechnical considerations. Potential stream alignments were presented to the Fairwood Homeowner's Association and other stakeholders including Seattle Public Utilities in July of 2022. Computer Aided Design (CAD) figures, property needs, and high-level cost estimates were developed. The alternatives were evaluated using a set of criteria provided by the County.

Both daylighting options would restore fish passage and improve ecological conditions in a manner that would generally be self-sustaining. However, both daylighting options would require the acquisition of at least four to six residential properties. Currently, there is not sufficient interest from property owners in selling their homes to the County to make either of these options imminently viable. Even though the status quo option is not a sustainable solution, it will remain in effect while the County initiates a longer-term effort to find suitable properties to allow for daylighting of the creek. Restoration may not be feasible for years to decades depending on availability of property and availability of funding for acquisition, design, and restoration.

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# Introduction

As part of its work to improve fish passage and habitat conditions in the Cedar River Watershed, King County (County) initiated a feasibility study of improving fish passage in Molasses Creek in the Fairwood residential area in unincorporated King County. This study focuses on a 1,250-foot-long section of the creek, which flows through a series of 48-inch-diameter pipes buried more than 15 feet below ground. The piped section of Molasses Creek is a fish passage barrier that separates a forested wetland and high-quality upstream habitat from the lower forested ravine of Molasses Creek and the confluence with the Cedar River.

This study began with an evaluation of existing conditions (Herrera 2023, Appendix A) and a presentation to the Fairwood West Homeowner's Association (HOA) on July 14, 2022, followed by development of conceptual alternatives for improving fish passage and habitat conditions through the project area (Herrera 2022). This feasibility study presents an evaluation of alternatives identified during the Conceptual Alternatives Analysis and outlines recommended considerations for future project development.

## Study Purpose and Goals

The Molasses Creek pipe system in the Fairwood residential area will eventually need to be replaced when it reaches the end of its functional life. It is not possible to accurately predict the remaining timespan for this pipe system. When it needs to be replaced, it will be subject to environmental regulations that require a fish-passable system unless an alternative fish passage mitigation project is approved by state and federal regulatory agencies. Other portions of the pipe system have previously malfunctioned and it is expected that such malfunctions or failures will eventually occur within the Fairwood residential area. This feasibility study is intended to inform future stormwater management and fish passage prioritization efforts as well as future discussions with residential property owners and other relevant stakeholders. The objective of the study is to evaluate the feasibility of improving fish passage through the study reach. Two different alternatives for daylighting Molasses Creek were developed and compared with a status quo alternative under which existing conditions are maintained. Another objective of this feasibility study was to identify property needs and gauge property owner interest in voluntarily selling their property to the County to enable open channel restoration.

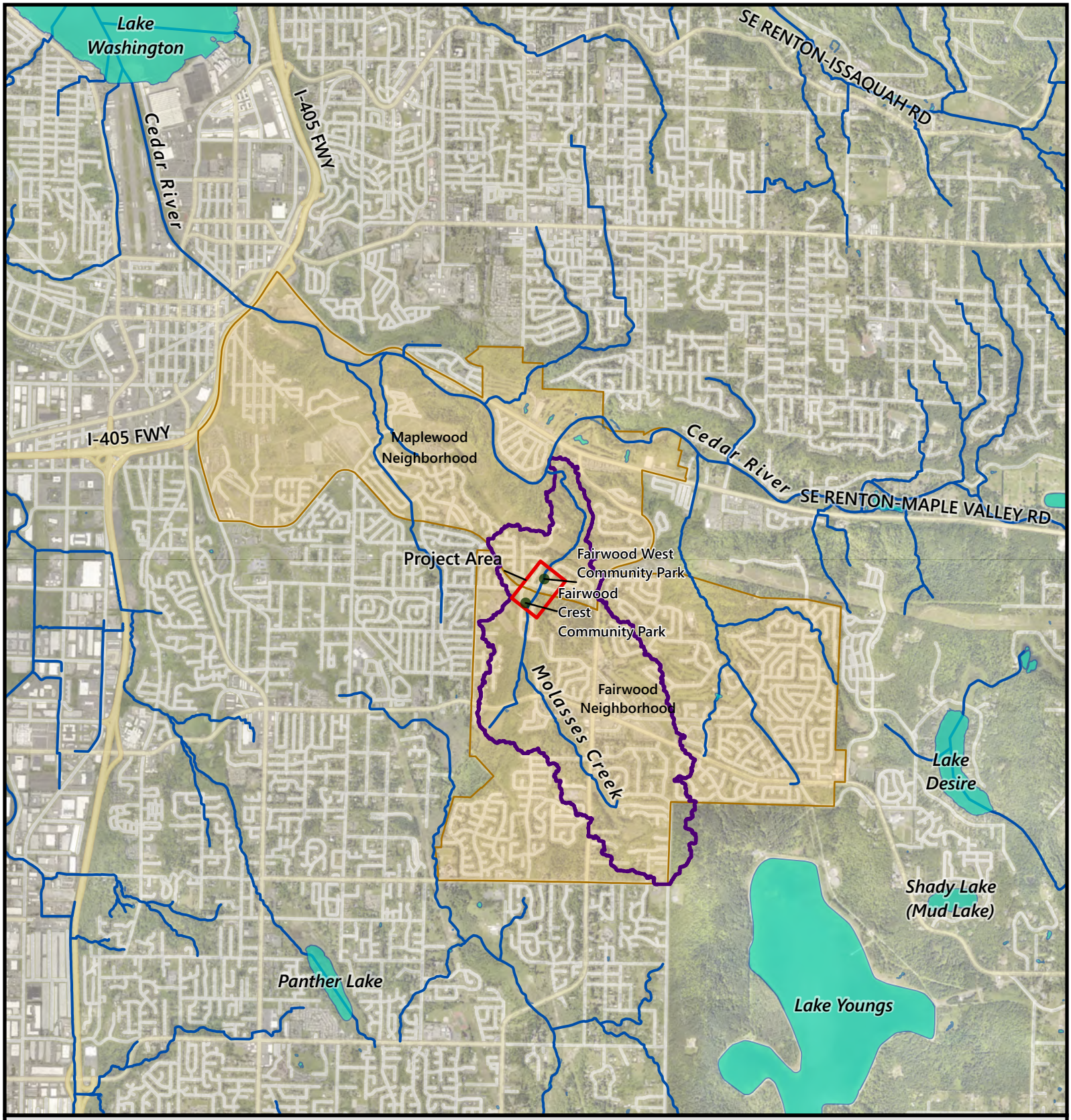
As part of the County's commitment to equity, an Equity and Social Justice Plan was prepared using the County's Equity Impact Review Tool to identify and describe the positive and negative impacts of the proposed project. The tool helps project planners evaluate whether a project will have an impact on equity, and then develop mechanisms to mitigate for negative impacts and enhance positive impacts and can be found in Appendix B.

## Project Area and Study Area

Molasses Creek is a salmon-bearing tributary of the lower Cedar River, in Water Resource Inventory Area (WRIA) 8: Cedar-Sammamish. The study area extends along Molasses Creek downstream from Southeast Petrovitsky Road to the confluence with the Cedar River and encompasses hillslopes draining to the creek in addition to the creek channel and its small floodplain areas (Figure 1). The project area focuses on the piped section of Molasses Creek from approximately river (creek) mile (RM) 0.9 to RM 1.15 (Figure 2, King County 2022). It is in unincorporated King County near the southeastern limits of the city of Renton, in Section 27, Township 23 North, Range 05E of the Willamette Meridian.

For planning purposes, Molasses Creek was divided into five reaches in the larger study area (Appendix A, Herrera 2023), including reference reaches and areas identified as current or potential restoration areas. At the upstream limit of the study area in Reach 5, Molasses Creek has high-quality stream habitat and flows through undeveloped parcels that contain several large wetlands. Downstream of these wetlands Molasses Creek flows through the Fairwood residential area in Reach 4 where it is confined to a narrow channel between single-family homes. Reach 3 is the recently daylighted and restored reach of Molasses Creek in Fairwood Crest Community Park. Reach 2 extends from Fairwood Crest Community Park downstream to Fairwood West Community Park (Figure 2), where Molasses Creek flows through a series of pipes beneath parks, a property owned by Seattle Public Utilities (SPU), and privately owned residential properties. This piped stream section is approximately 1,250 feet long, approximately 15 to 25 feet below the ground surface, and identified as a full fish barrier due to the slope of the pipe (WDFW 2022). Reach 1 continues downstream through a forested ravine with relatively steep side slopes that are prone to landslides (Herrera 2023; King County 2022). A former gravel pit area and the Soos Creek Park and Trail system are amid the forested slopes in this ravine. Molasses Creek passes through a corrugated steel (CST) arch culvert, and a set of three round CST pipes along with a fish ladder near its confluence with the Cedar River at approximately RM 4.1.

At the downstream limit of the project area, a pipe segment beneath Fairwood West Community Park was replaced in 2017 with a box culvert to support fish passage. There have been numerous projects related to fish passage, pipe failure, and flooding along the piped reach of Molasses Creek in recent decades. The "daylighting" alternatives presented in this report would complement past actions and address remaining Molasses Creek piped infrastructure vulnerabilities in the project area.




**Legend**

- Project Area
- Molasses Creek Subbasin Boundary
- Neighborhood
- Lakes
- Streams
- Community Park

Roads

- Highway
- Major Road
- Street


**Figure 1.**
**Vicinity Map for the Molasses Creek Fish Barrier and Habitat Improvement Study.**

N

0 0.5 1 Miles

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King County (Aerial, Watercourse, Subbasin)

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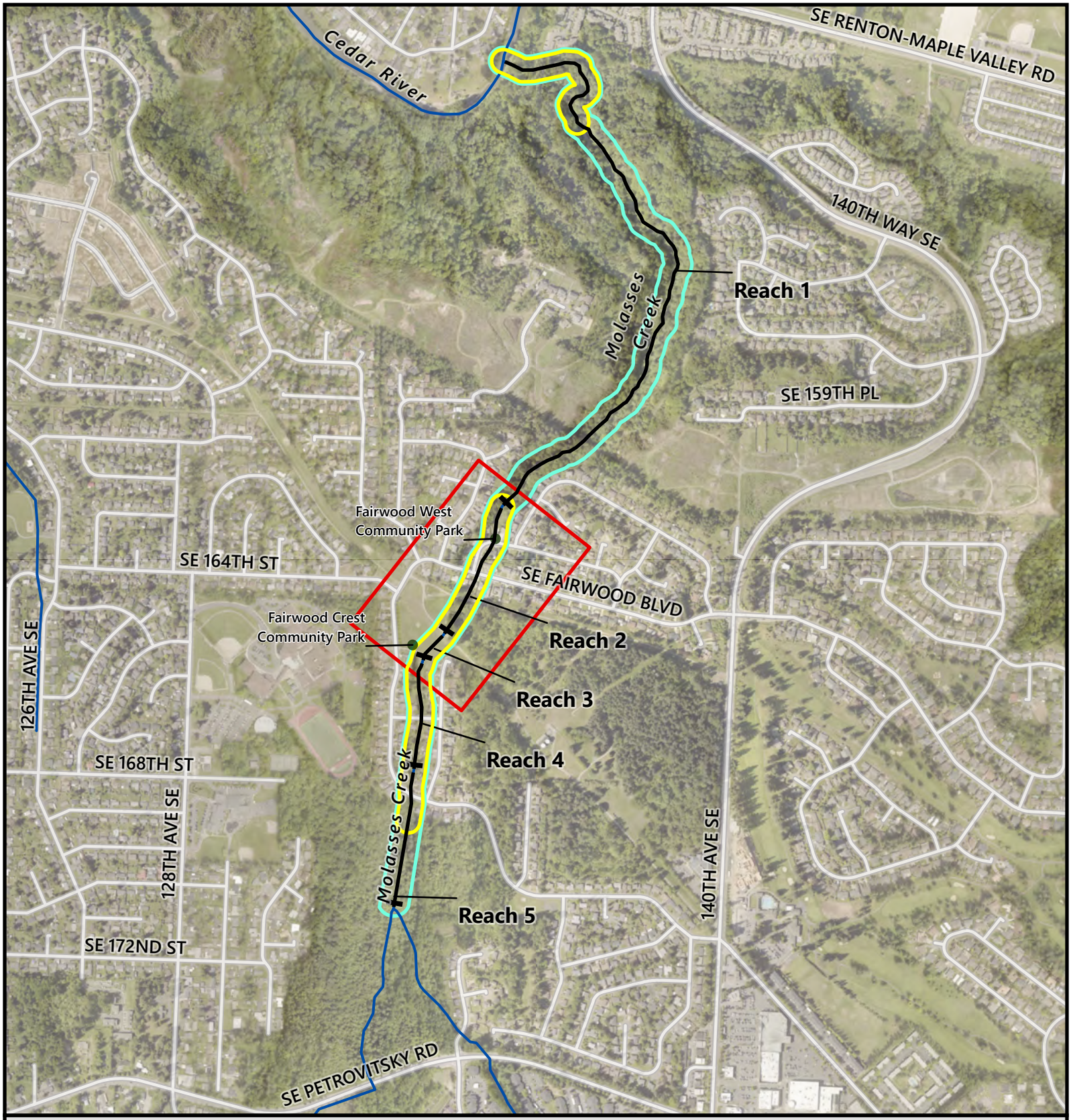


## Legend

- Streams
- Streets
- Reaches
- Community Park
- Reconnaissance Areas
- Project Area
- Study Area

**Figure 2.**
**Site Map for the Molasses Creek Fish Barrier and Habitat Improvement Study.**

N

0 500 1,000 2,000 Feet

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King County (Aerial, Watercourse)

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# Community Engagement and Outreach

Community engagement and outreach activities were undertaken by the County to share information about the feasibility study with the Fairwood community, learn about the community's interest in potential daylighting and fish passage improvement alternatives, and identify property owners who might be interested in voluntary sale of their property to support the project.

King County staff held a public discussion of the project and alternatives at a meeting of the Fairwood West Homeowner's Association (HOA) on July 14, 2022. An informational flyer about the study was sent to 23 property owners who live within or near the historical creek alignment, including those whose property lies above the current pipe system. The flyer included instructions for requesting translation and/or interpreter services in English and Spanish. The flyer was also sent electronically to the Fairwood West HOA to post on their website. At the HOA meeting, King County provided a short presentation about the feasibility study goals, provided background information on the current and historical Molasses Creek alignment, and described why the County is proposing to remove the fish barrier. The County project manager and consultant team led by Herrera dedicated a significant amount of time to answering questions and soliciting input from homeowners at this meeting. Approximately 12 to 14 HOA members attended the meeting.

While several individuals expressed general support for the project and removal of fish barriers, there were questions about property needs associated with the alternatives. King County clarified at the meeting that eminent domain is not being considered; only voluntary property sales would be pursued. King County encouraged all property owners along or adjacent to the historical channel and current piped alignments to contact the County Project Manager to share their interest in the project and perspectives on selling to the County. As a follow-up to the HOA meeting, project information including the presentation given to HOA members on July 14, 2022, was posted to the County's Molasses Creek project webpage.

# Alternatives Development

The feasibility study began with documentation and evaluation of existing conditions (Appendix A) including geology, geomorphology, hydrology, hydraulics, and ecology in the project area where Molasses Creek is entirely piped, and in adjacent upstream and downstream reaches. Existing utilities that cross this piped reach of Molasses Creek were also mapped and include a regional water supply line owned and managed by SPU, a City of Renton fiber optics conduit, a Cedar River Water and Sewer District (CRWSD) sewer line, and a power line (Figure 3). In 2022, building on the existing conditions information, the project team developed three alternatives for this study:

- Alternative 1 (Status Quo) – No changes to existing conditions.
- Alternative 2 (Current Alignment Daylighting) – Daylighting 1,250 feet of piped stream length generally centered on the existing piped system alignment.
- Alternative 3 (Historical Alignment Daylighting) – Daylighting 1,250 feet of creek channel in the historical alignment.

These alternatives were described in a Conceptual Alternatives Technical Memo (Herrera 2022) and presented to the community via the HOA and to SPU. Following this and County review of the alternatives, some modifications to the proposed alternatives were made as described below. Per SPU's recommendation, Alternative 2 was extended beyond the limits of the SPU parcel to tie into Molasses Creek downstream of the Fairwood West Community Park fish passage culvert built by the County in 2017. The daylighted channel under Alternative 2 would flow just to the west of the current culvert alignment. Alternative 3 was refined to include variable widths and side slopes along the proposed stream channel to reduce the impacts to private property and limit construction in steep slope areas. Other design changes based upon stakeholder input primarily included minor shifts in the alignment of the proposed daylighting alternatives to reduce impacts to private property, minimize utility conflicts, and limit excavation in areas with steep slopes.

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# Figure 3.
# Existing Utilities in the Project Area.

UTILITY LEGEND

- OHP — OVERHEAD POWER
- UP — UNDERGROUND POWER
- G — GAS
- FO — FIBER OPTIC
- SS — SANITARY SEWER
- W — WATER
- SD — STORM DRAIN
- STREAM
- T — UNDERGROUND TELECOMMUNICATIONS

UTILITY LOCATIONS ARE APPROXIMATE AND BASED ON VARIOUS SOURCES

SOURCE LEGEND

- COR GIS — CITY OF RENTON GIS (RENTON 2022)
- KING COUNTY 2018 — KING COUNTY 2018 AS BUILT RECORD DRAWINGS FOR FAIRWOOD WEST HOA PIPE REPLACEMENT
- KING COUNTY GIS — GIS DATA OBTAINED FROM IMAP (KING COUNTY 2022)
- SURVEY — KING COUNTY 2018 SURVEY

RENTON FIBER OPTICS OVERHEAD (COR GIS)

CEDAR RIVER WATER AND SEWER DISTRICT SEWER LINE (COR GIS)

OVERHEAD POWER (COR GIS)

CEDAR RIVER WATER AND SEWER DISTRICT WATER LINE (COR GIS)

RENTON FIBER OPTICS CONDUIT (COR GIS)

SPU WATER LINES (COR GIS)

CEDAR RIVER WATER AND SEWER DISTRICT SEWER LINE (KING COUNTY 2018)

MOLASSES CREEK 48-IN CMP (KING COUNTY GIS)

RENTON FIBER OPTICS CONDUIT (COR GIS)

PRIVATE STORM DRAIN (COR GIS)

UNKNOWN GAS LINE (ASSUMED)

UNKNOWN UNDERGROUND ELECTRIC/COMMUNICATIONS (ASSUMED)

SURVEY LIMITS (SURVEY)

BOX CULVERT REPLACEMENT (KING COUNTY 2018)

MOLASSES CREEK

13309 FAIRWOOD BLVD
13313 FAIRWOOD BLVD
13401 FAIRWOOD BLVD
13406 FAIRWOOD BLVD
13407 FAIRWOOD BLVD
13418 FAIRWOOD BLVD
16301 134TH AVE SE
16305 134TH AVE SE
16311 134TH AVE SE
13405 SE 163RD ST
13415 SE 163RD ST
16227 135TH AVE SE
16221 135TH AVE SE

0 40' 80'
US SURVEY FEET

Produced by Herrera Environmental Consultants (herrerainc.com)

NOTE: OTHER UNMAPPED UTILITIES ARE PRESENT IN PROJECT VICINITY. ONLY UTILITIES READILY AVAILABLE FROM PUBLICLY AVAILABLE GIS SOURCES ARE SHOWN

O:\proj\Y2020\20-07412-016\CAD\Exhibits\Ex Utilities - 22 X 34 Figure.dwg | 6/22/2023 7:51 AM | Conan Witzel

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# Alternative 1 – Status Quo

This alternative would maintain the piped reach of Molasses Creek in the project area in the existing condition, or the status quo, as shown in Figure 4 and in Appendix D. Although there would be no direct costs associated with property acquisition or construction, this alternative would result in future costs as sections of the pipe eventually malfunction or fail and require emergency repairs and associated environmental mitigation. Pipe malfunction or failure is inevitable because the County cannot currently conduct proactive maintenance or improvements on culverts that are fish barriers. The same types of malfunctions that occurred in the recent past upstream and downstream near the Fairwood West and Fairwood Crest community parks are highly likely and could occur anywhere along the extent of the piped creek length.

## Benefits

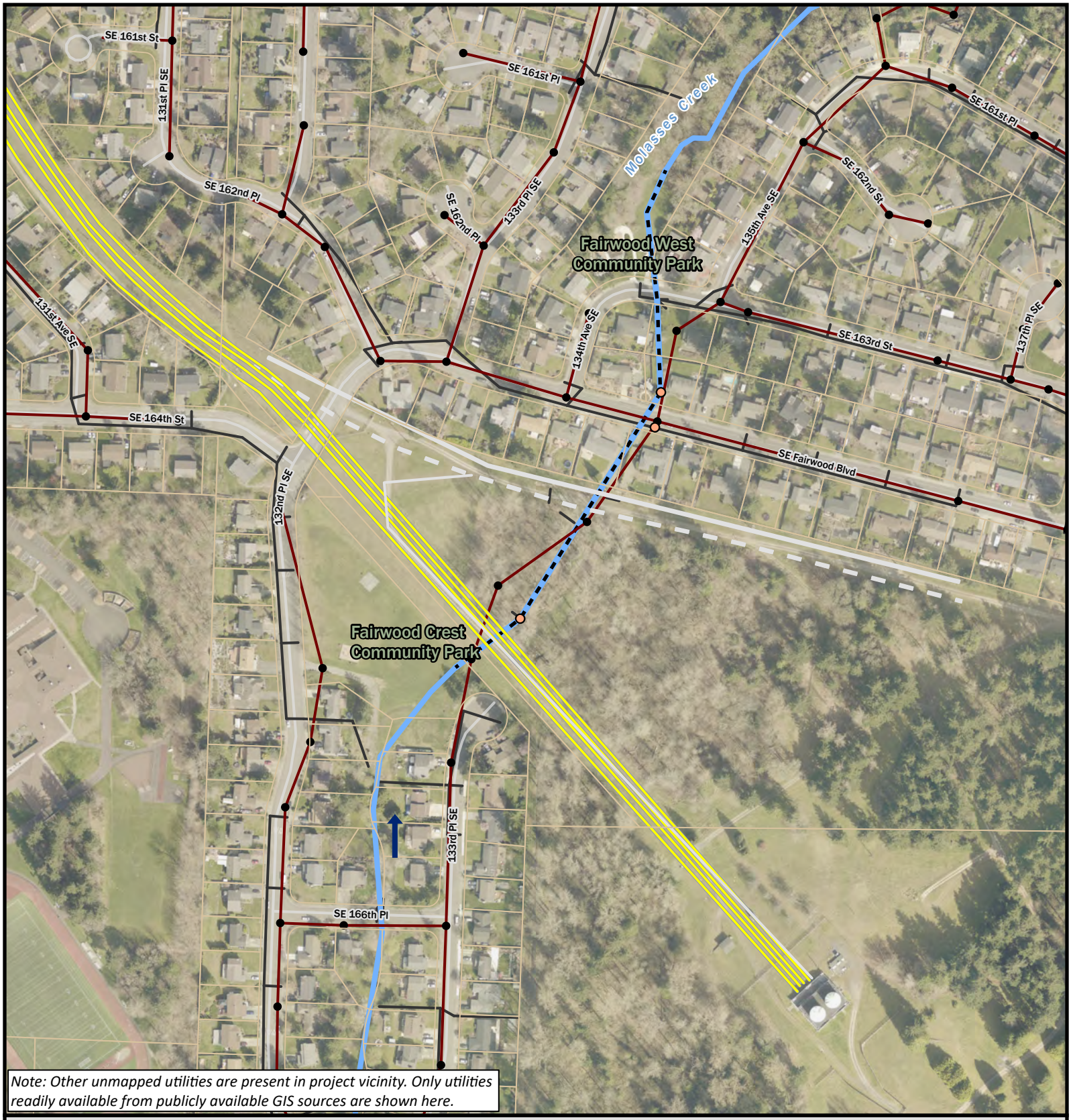
Benefits of Alternative 1 – Status Quo include:

- No additional permitting or costs beyond existing operations and maintenance requirements (aside from those associated with addressing an incremental malfunction).
- Maintains existing site use without property acquisition or additional easements.
- Maintains current uses at Fairwood West Community Park.

## Challenges

Challenges with Alternative 1 – Status Quo include:

- Retains the existing fish passage barrier that blocks salmonid access to quality habitat in upstream reaches.
- Does not provide ecological uplift or habitat condition improvements.
- Retains a series of pipes conveying Molasses Creek that are located beneath private property, public right-of-way, and amid several important utility corridors and that have a substantial risk of malfunction. Access for repairs may be difficult due to proximity of residences to the pipe and costs for property damage could be high.
- Perpetuates maintenance risks by leaving in place a piped system. As sections of the conveyance system fail, it will not be possible to obtain County, state, and federal regulatory agency permits for repair without either upgrading the pipe to make it fish passable or mitigating those impacts elsewhere in the Cedar River Watershed because local, state, and federal agencies would likely view the repairs as enabling the continued existence of a fish passage barrier.
- As state and federal regulatory agencies will not issue permits for repair of fish passage barriers, maintenance would mostly likely only be triggered by public safety issues such as a sinkhole or some other pipe "malformity/malfunction." Emergency repairs would not address fish passage but would be focused on restoring conveyance and therefore would likely require additional mitigation.




## Legend

- Renton Fiber Conduit
- Renton Fiber Overhead
- Water - SPU Pipeline
- Storm Drain
- Sewer - CRWSD
- Manhole
- Sewer Structure - CRWSD
- Roads
- Parcels
- Stream
- Piped Stream

**Figure 4.**
**Alternative 1 - Status Quo Site Plan.**

N

0 125 250 500 Feet

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City of Renton 2022 (fiber, water, sewer, storm); King County 2022 (stream, roads, parcels, aerial (2021))

K:\Projects\Y2020\20-07412-016\PRO\Molasses_Alternatives\Molasses_Alternatives.aprx\Figure4.Alt1

## Alternative 2 – Current Alignment Daylighting

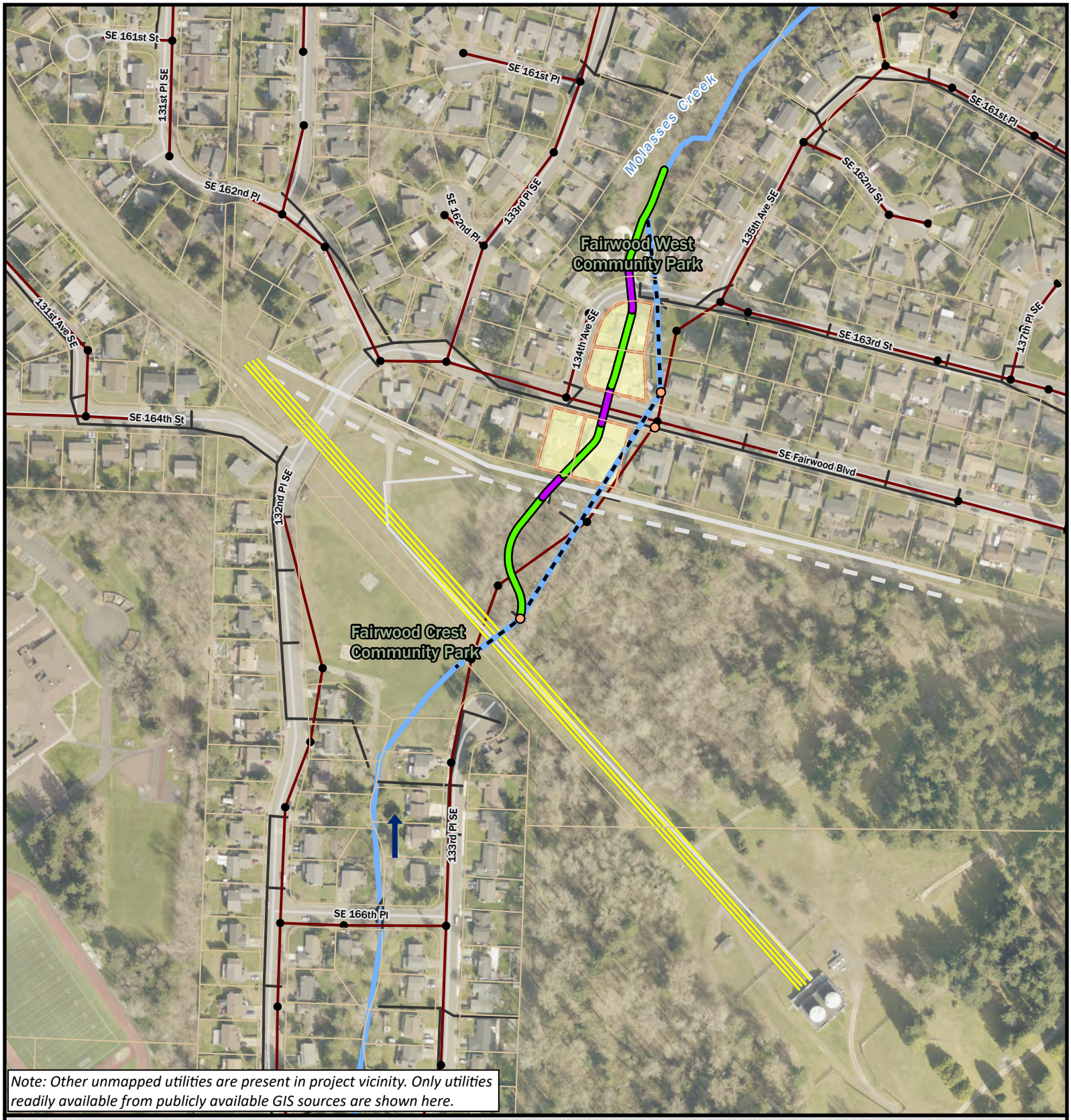
In the Conceptual Alternatives Technical Memo (Herrera 2022), Alternative 2 only included fish passage improvements with creek channel daylighting on the SPU property. Alternative 2 has been modified since the Conceptual Alternatives Technical Memo to include a greater extent of channel daylighting and culvert replacement with fish passable culverts from the SPU property downstream to Fairwood West Community Park. Alternative 2 includes daylighting Molasses Creek from the Fairwood West Park to just downstream of the SPU water pipelines, except at the road crossings where new fish-passable culverts would be installed. The section of pipe that extends beneath the SPU water pipeline and Fairwood Crest HOA property would remain. This remaining 275-foot-long, 48-inch-diameter pipe would need to be reassessed to determine if it would be considered a fish passage barrier. The daylighting alignment in this alternative shows an open channel west of the current pipe alignment. As no property owners have expressed interest to the County in selling their property, this alternative was developed to minimize the number of properties that would need to be purchased. However, a new stream channel could also be developed on the east side of the current piped creek alignment if property owners were interested in selling their property.

This alternative includes the following key points as illustrated in Figure 5 and detailed in Appendix D:

- Additional flood storage would be incorporated in a historical Molasses Creek floodplain area that is low lying terrain and likely a wetland. A wetland delineation has not been conducted in this area so refinement of the site design, including the full extent of flood storage that could be created, would be determined during permitting and design after a wetland delineation is completed.
- The increased extents of daylighting would require acquiring at least four parcels and impact recreational uses (ballcourt and play structure) at Fairwood West Community Park.
- Replacing the piped stream system with an open channel would eliminate the potential for pipe maintenance problems in the future, except where new culverts are installed beneath roads. If the existing pipe system failed or needed maintenance, it would not be possible to obtain permits for repair without triggering fish passage requirements. The County would then need to install fish passable culverts or mitigate off site. However, because of a court-mandated injunction the Washington Department of Fish and Wildlife (WDFW) is becoming more resistant to considering offsite mitigation.

As conceptually designed, this alternative would replace the existing piped stream with an open channel beginning downstream of Fairwood Crest Community Park and extending to Fairwood West Community Park (Figure 5). Daylighting would begin on the north side of the SPU water lines and extend through historical floodplain located on the parcel owned by SPU and minimally across four privately owned parcels that would need to be acquired for this alternative to be feasible. The proposed daylighting on SPU property, as shown in Figure 5, follows low topography so the new channel is conceptually placed slightly west of the existing alignment. The existing pipe segments could be left in place to convey stormwater, or abandoned, which involves filling a pipe with material so that it will not collapse and cause ground surface deformation.

Three new fish passable culverts would be needed: one at the SPU property access road, a second beneath Southeast Fairwood Boulevard, and a third near the intersection of 134th Avenue Southeast and Southeast 163rd Street. The new culverts would be designed to ensure they are fully fish passable.




## Legend

- Renton Fiber Conduit
- Renton Fiber Overhead
- Water - SPU Pipeline
- Storm Drain
- Sewer - CRWSD
- Manhole
- Sewer Structure - CRWSD
- Roads
- Parcels
- Potential Parcel Aquisition
- Stream
- Piped Stream
- Proposed Fish-passable Crossing
- Proposed Daylighting

# Figure 5.
# Alternative 2 - Current Alignment Daylighting Site Plan.

N

0 125 250 500 Feet

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City of Renton 2022 (fiber, water, sewer, storm); King County 2022 (stream, roads, parcels, aerial (2021))

K:\Projects\Y2020\20-07412-016\PRO\Molasses_Alternatives\Molasses_Alternatives.aprx\Figure5.Alt2

## Benefits

Benefits of Alternative 2 – Current Alignment Daylighting include:

- Removes 1,025 feet of fish passage barrier pipes and culvert (including the 96-foot-long, 8-foot by 8-foot box culvert that was recently installed by the County).
- Restores fish passage to an additional 1,000 feet of stream habitat in Molasses Creek.
- Creates just over 1,000 feet of new creek channel and substantial uplift to ecological conditions through improved riparian conditions, added channel complexity, and increased wetland and floodplain connectivity.
- Restores natural processes through daylighting and floodplain restoration and increases natural flood storage, thereby reducing flood risk and providing better overall climate resiliency.
- Eliminates permitting challenges of maintaining a pipe that conveys a stream by replacing stream pipes with a self-sustaining creek channel.
- Complements the recently completed, County-led fish passage and stream conveyance improvement project (Fairwood Crest Fish Barrier Removal Project).

## Challenges

Challenges of Alternative 2 – Current Alignment Daylighting include:

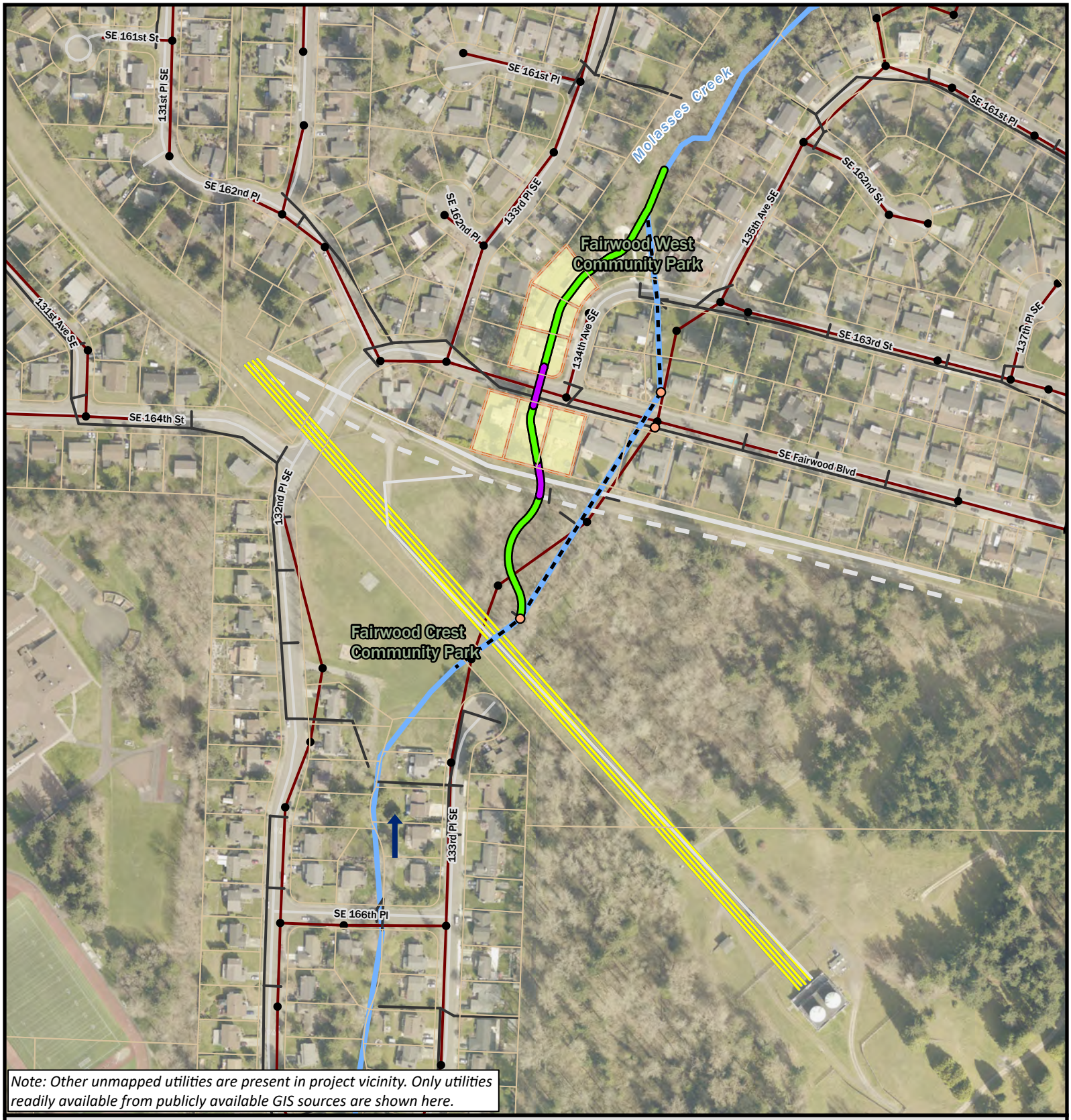
- Requires acquisition of at least four private properties.
- Requires construction of three new fish-passable structures at road crossings, each of which represents substantial construction work and long-term maintenance obligations.
- Requires additional geotechnical evaluation to ensure creek bank slopes would not compromise adjacent private properties.
- Shifts use of Fairwood West Community Park from active recreational use to more passive use as a natural area.
- Likely requires additional security considerations to prevent public access to SPU property where water supply pipelines are located.

## Alternative 3 – Historical Alignment Daylighting

Alternative 3 would involve daylighting Molasses Creek by rerouting the channel to flow close to its historical alignment along the west edge of Fairwood West Community Park where it would connect with the existing channel (Figure 6; Appendix D). The Alternative 3 alignment would require acquiring at least six parcels and reconstructing a new channel through those parcels. The pipe that currently conveys the creek could be abandoned in place or retained and used for stormwater management. Cognizant there were few interested property owners along the historical alignment that indicated an interest in selling, for the purposes of this report as a comparative assessment, this alternative shows the stream channelized with the minimum number of parcels needed. Two new fish-passable culverts would be required. One at the SPU access road to avoid impacts to the existing CRWSD sewer line and a second at Southeast Fairwood Boulevard. The new culverts would be designed according to current fish passage design standards and other requirements would be met to ensure future fish passage. Altogether, habitat condition improvements would complement the recently completed King County fish passage restoration project at Fairwood Crest Community Park and extend over 1,200 feet in stream length.

This alternative includes the following key improvements as illustrated in Figure 6 and detailed in Appendix D:

- The daylighted portion of the channel would shift from the existing piped stream alignment to add sinuosity, improve wetland and floodplain connectivity, and minimize impacts to existing vegetation.
- As with Alternative 2, additional flood storage would be incorporated in a historical floodplain area that is low-lying and a potential wetland. A wetland delineation has not been completed in this area so refinement of the site design, including the full extent of flood storage that could be created, would be determined during permitting and design after a wetland delineation is completed.
- Eliminate existing fish passage barriers and extend fish access to over 1,000 feet of upstream habitat.
- Significantly reduce the length of piped and culverted stream, with two new fish-passable culverts, reducing the risk of culvert and pipe malfunction that would require repairs along private property.




## Legend

- Renton Fiber Conduit
- Renton Fiber Overhead
- Water - SPU Pipeline
- Storm Drain
- Sewer - CRSWD
- Manhole
- Sewer Structure - CRWSD
- Roads
- Parcels
- Potential Parcel Aquisition
- Stream
- Piped Stream
- Proposed Fish-passable Crossing
- Proposed Daylighting

**Figure 6.**
**Alternative 3 - Historical Alignment Daylighting Site Plan.**

N

0 125 250 500 Feet

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City of Renton 2022 (fiber, water, sewer, storm); King County 2022 (stream, roads, parcels, aerial (2021))

K:\Projects\Y2020\20-07412-016\PRO\Molasses_Alternatives\Molasses_Alternatives.aprx\Figure6.Alt3

## Benefits

Benefits of Alternative 3 – Historical Alignment Daylighting include:

- Removes 1,025 feet of fish passage barrier pipe and culvert (including the 96-foot-long, 8-foot by 8-foot box culvert that was recently installed by the County).
- Restores fish passage to an additional 1,000 feet of stream habitat in Molasses Creek.
- Creates 1,000+ feet length of new creek channel and substantial uplift to ecological conditions through improved riparian conditions, added channel complexity, and increased wetland and floodplain connectivity.
- Restores natural processes through daylighting and floodplain restoration and increases natural flood storage, thereby reducing flood risk and providing better overall climate resiliency.
- Eliminates permitting challenges of maintaining a pipe that conveys a stream by replacing stream pipes with a self-sustaining creek channel.
- Complements the recently completed, County-led fish passage and stream conveyance improvement project (Fairwood Crest Fish Barrier Removal Project).

## Challenges

Challenges of Alternative 3 – Historical Alignment Daylighting include:

- Requires acquisition of at least six properties.
- Requires design and construction of two new road crossings of the creek, each of which represents substantial construction work and long-term maintenance obligations.
- Requires additional geotechnical evaluation and likely geotechnical engineering to ensure creek bank slopes would not compromise adjacent private properties.
- Shifts use of Fairwood West Community Park from active recreational use to more passive use as a natural area.
- Likely requires additional security considerations to prevent public access to SPU property where water pipelines are located.

# Key Alternative Development Considerations

As the fish passage and habitat restoration alternatives were developed, several feasibility and design objectives and constraints were identified to meet regulatory requirements, avoid major utility conflicts, and minimize impacts to private property and existing functioning habitats. These considerations, briefly described below, were used to inform the conceptual site design plans that were developed for each daylighting alternative (Appendix D) and should be considered if either of the daylighting options move forward in the future.

## Fish Passage and Channel Dimensions

The reach of Molasses Creek within the project area is characterized by WDFW as a complete fish passage barrier (WDFW 2022) due to the slope of the extensive pipe system, which is difficult for fish to swim through. Downstream fish passage improvements were recently completed by the County at Fairwood West Community Park (2017) and upstream at Fairwood Crest Community Park (2021), although they have not been formally assessed for fish passage since construction.

Within the project area, the stream is conveyed through a 1,250-foot-long series of pipes generally located over 15 feet below the existing ground surface. Daylighting a creek channel at the current depth of the pipe system would require laying back side slopes substantially, or building significant earth retaining structures where laying back side slopes is not possible. Constructing a new riparian corridor with steep slopes presents risks such as the potential for increased erosion and difficulty establishing vegetation. Steep slopes are harder to vegetate and to retain vegetation on, potentially reducing the habitat value. Conversely, while more gentle slopes would provide greater ecological benefits, they would require more property acquisition and associated impacts to utilities. The design concepts presented in this report attempt to balance impacts to private property with ecological gains.

For this study, an 8-foot or wider channel bottom was desired to match reference reaches of Molasses Creek. However, in restricted areas a 6-foot-wide channel bottom width, was deemed sufficient for flow conveyance capacity, to support fish passage, and meet regulatory guidelines. For Alternative 2, the daylit channel design concept includes an 8-foot-wide channel bottom with 2H:1V side slopes, resulting in top widths that vary from 22 feet to 65 feet depending on where the channel would tie into the existing ground surface. For Alternative 3, the stream channel bottom width in the design concept varies. Where possible, Alternative 3 includes a channel bottom width of 8 feet with 2H:1V side slopes. Downstream of Southeast Fairwood Boulevard, however, the channel bottom width was narrowed to 6 feet with 1.5H:1V side slopes in the conceptual design to avoid cutting into existing steep slopes or extending the side slopes onto adjacent properties. This slight modification to the proposed Alternative 3 channel dimensions would minimize the number of privately owned parcels that would need to be acquired.

## Utilities

As part of the existing conditions review, Herrera conducted a site visit and performed a desktop analysis to identify subsurface utilities within the project area that could be affected by the proposed project or

would present design constraints for proposed alternatives (Figure 3). Design considerations related to the major utilities include:

- Storm drains, sewer lines, water lines, gas lines, and underground power—these utilities would need to be realigned at the proposed road crossings and coordination with the respective utility providers would be required for both daylighting alternatives.
- A Cedar River Water and Sewer District (CRWSD) trunk sewer line parallels Molasses Creek along 132nd Place Southeast then crosses the creek twice on the SPU parcel—both daylighting alternatives would reduce the number of sewer crossings of Molasses Creek from two to one on the SPU property. Elevations for this trunk sewer line are not available. It is assumed that this sewer line is located below the SPU water lines and the existing pipes conveying Molasses Creek, but survey is necessary to confirm potential conflicts with channel daylighting in this area.

## Community and Property Needs

Based on the channel dimensions necessary for fish passage and channel stability in the proposed alignments, it is estimated that Alternative 2 would require acquisition of four parcels and Alternative 3 would require the acquisition of six parcels. However, it should be noted that either daylighting alignment could be modified based on the location of willing property sellers so continued engagement with the community will be necessary for the County to find a long-term sustainable solution. Community feedback would also be needed on either of the daylighting options to determine if the shift from active to passive recreational uses of Fairwood West Community Park would necessitate replacement lands elsewhere for active play facilities. Property needs and estimated acquisition costs associated with each of the alternatives are summarized in Appendix C.

## Wetland Impacts

While wetlands were previously delineated within Reaches 1 and 5 of the study area, those wetlands would not be impacted by the alternatives. However, wetlands were not formally delineated within Reaches 2, 3, or 4 of Molasses Creek. As such, it will be necessary to collect data to evaluate impacts of any alternative on wetlands that may be present in these areas. A site visit by a Herrera biologist onto SPU property observed wetland indicators such as surface water ponding, flow seeping from uphill forested areas, and hydrophytic (wet-tolerant) vegetation. Additional data will be needed to make an official wetland determination. The potential wetland on the SPU parcel was visually estimated to be 230 feet long and 110 feet wide. This portion of Reach 2 was likely historical floodplain habitat associated with Molasses Creek, prior to placement of the creek in a pipe through the SPU property.

Undersized pipes and culverts restrict flow and can cause a backwatering effect, which can cause wetlands to develop upgradient of pipes and culverts. Daylighting of the creek on the SPU property would need to be designed to ensure associated wetlands on the SPU property would not be drained. Local, state, and federal agencies may require wetland mitigation for loss of the corresponding wetland functions. However, it is unlikely that substantial loss of wetlands would occur, as a section of pipe on the SPU property under the existing water supply pipeline would remain.

## Steep Slopes and Geologic Hazards

Steep slopes and geologic hazards were important considerations in developing alternative geometry for both daylighting alternatives as both Alternatives 2 and 3 would require extensive excavating to reach the level of the restored creek bottom and rebuild a new channel. Review of available King County geologic hazard mapping indicates that Molasses Creek traverses areas designated as potential erosion hazard areas (Appendix A, Figure 8). Seismic hazard areas are also mapped along the south end of the project area. The seismic hazard areas coincides with areas mapped as peat and alluvium soil types. The hazard associated with alluvium is the potential for loose, saturated soils to experience liquefaction during an earthquake.

The northern end of the project area encroaches into the 50-foot buffer zone of a potential landslide hazard area (Appendix A, Figure 8). The relatively deep excavations for the two daylighting alternatives would create side slopes that would tie into the steep side slopes at the downstream end of the project area. To reduce the chances for increased erosion hazards, the channel side slopes were kept as shallow as possible in the concept design plans while also trying to minimize property impacts. Similarly, the daylit channel of Alternative 3 was narrowed downstream of Southeast Fairwood Boulevard to avoid disturbance of the existing steep western slope in that area. At this preliminary stage of concept development, it is assumed that Alternative 3 would require retaining walls and scour protection at the slope toe (such as an engineered log revetment) to further reduce risks of exacerbating slope instability or other erosion hazards.

# Alternatives Evaluation

This section discusses a variety of evaluation criteria that were used to compare the alternatives. A summary of the evaluation is also provided in Appendix E.

## Criteria

Evaluation criteria were developed by King County to compare the three alternatives with each other and evaluate the potential benefits and impacts associated with each alternative. Eleven criteria were included, based on a comparison matrix template provided by the County that it uses for planning and assessing the feasibility of various projects. Table 1 lists and describes each criterion.

**Table 1. Evaluation Criteria.**

| Criteria | Description |
|---|---|
| Operations and Maintenance | • Accessible and maintainable |
| Acquisitions/Easements Required | • Addresses the need for additional land through property acquisitions and/or easement establishment to allow for replacement of community park, construction, operation, and maintenance of the project |
| Construction Cost | • Cost of construction |
| Total Project Cost | • Includes land acquisition, design, permitting, and construction costs of major components; excludes demolition of residences, operation and maintenance costs |
| Project Pros | • Environmental benefits, such as improvements to fish passage and quality of habitat |
| Project Cons | • Long-term negative environmental impacts |
| Risks | • Risk of impacts if a malfunction were to occur (liability to County), potential for added environmental mitigation costs, and community engagement (e.g., property acquisition requirements, park modifications).<br>• Resistance from the community park (HOA) |
| Permits Required | • The level of effort to obtain permits, and complexity of permits required to construct improvements, including potential complications that may arise during the permitting process |
| Geotechnical Issues | • Issues that may arise due to soil suitability to support the design configuration |
| Constructability | • Addresses the complexity or simplicity associated with completing construction, including any issues that may require additional infrastructure or design components |

# Comparative Evaluation

## Operation and Maintenance

This criterion focuses on how the alternatives differ in terms of accessibility and maintenance.

### *Accessibility*

The existing Molasses Creek pipe system is accessible by foot at the upstream and downstream limits of the project area (at Fairwood Crest Community Park and Fairwood West Community Park, respectively), and by vehicle at the right-of-way crossings at Southeast Fairwood Boulevard and Southeast 163rd Street. In addition, the County maintains drainage easements along the existing pipe alignment. Under the status quo alternative, the access capability would not change.

Under either of the daylighting alternatives, access for inspections and maintenance would be improved compared with the existing pipe system, which is difficult to access given its depth and location under private properties. The newly created/restored creek channel would be accessible by vehicle from multiple roads including at Fairwood Crest and Fairwood West community parks, the access roads on SPU property, Southeast Fairwood Boulevard, and 134th Avenue Southeast. Vehicle access to the bottom of the creek channel would not be possible throughout the newly created channel length. However, vehicle access may be considered to enable easy inspections and use of heavy equipment for maintenance or repair in the creek channel if necessary. Footpaths for access could be an added component for both daylighting alternatives but were not addressed in this study.

### *Operations and Maintenance*

The biggest difference between the alternatives with respect to Operations and Maintenance is in their ability to ensure continued flow conveyance in the project area. Under the status quo alternative, the County would still need to complete periodic inspections of the pipe system—likely via a combination of visual and closed-circuit television video (CCTV) inspections. Depending on inspection indicators observed, work orders for maintenance would be issued. Most of the typical maintenance actions would require state and federal permits (Table 2) and many of those maintenance actions trigger fish passage requirements. Local permits from King County would also be required for most actions described in Table 2, including activities that could affect buffer areas surrounding Molasses Creek. All permitting requirements would need to be verified with agencies prior to conducting maintenance work outlined in Table 2.

| Table 2. Potential Permits for Pipe Maintenance Work Orders. | | |
|---|---|---|
| **Inspection Indicators (Level I or II)** | **Associated Work Order** | **Potential Permits** |
| Unable to locate pipe ends/pipe ends buried (I) | Using tools or machinery remove earthen material or sediment that is covering the pipe end and clear the area immediately around pipe end to restore flow. | All pipe end repairs adjacent to daylighted stream segments would require a Hydraulic Project Approval (HPA) from WDFW, a Clean Water Act Section 404 permit from the Corps, and local permits; would not trigger fish passage. |
| Defects related to rust or corrosion larger than 1 inch (I or II) | May require a Level II inspection depending how far down the pipe the defect is noticed; repairs could be made with patch or lining; if major, replacement of pipe could be needed. | Some minor repair may not require HPA or Corps permits, although pipe lining and work below the ordinary high-water mark (OHWM) (such as full pipe or culvert replacement) would require a HPA, Corps permit, and local permits; likely fish passage trigger. |
| Joint separation either in pipe or where pipe joins to the catch basin (CB) wall (I or II) | If separation in pipe joint a section may be replaced or whole pipe replaced; at CB wall grout may be needed to fill in cracks or separation; possible Level II CCTV to determine why pipe has separated from the CB wall. | Some minor repair may not require a HPA or Corps permit. Replacing sections of pipe, or whole pipe or culvert replacement or potential fish exposure to wet grout or concrete would require a HPA, Corps permit, and local permits; likely fish passage trigger. |
| Cracks, separation, or punctures causing structural integrity to be compromised (I or II) | Depending on pipe material and extent of the defect pipe section or whole pipe replacement may be needed; Level II CCTV may be needed to further assess defect. | Whole or partial pipe replacement would require a HPA, Corps permit, and local permits; and trigger fish passage requirements. |
| Dents or deflection that reduces the cross-sectional area reducing flow or impacting structural integrity (I or II) | Depending on pipe material and extent of the defect pipe section or whole pipe replacement may be needed//surface factors need to be assessed for source of dent/deflection//Level II CCTV may be needed. | CCTV may not require permits. If fish bypass, grading, or excavation is needed, an HPA, Corps permit, and local permits would be required. |
| Root intrusion through pipe ends or through pipe joints/separations (I or II) | Roots need to be manually removed via jetting/rooting machine; Level II CCTV inspection may be needed after to assess damage in pipe/pipe joints/root entry. | CCTV may not require permits. If fish bypass, grading, jetting/rooting machine, or excavation is needed, an HPA, Corps permit, and local permits may be required. |
| Sediment or debris accumulation in the pipe or other type of obstruction reducing the free flow of water (I) | Jetting/Vactoring needed to flush material from the pipe and appropriate disposal of polluted sediment is required. | If fish bypass, grading, jetting/rooting machine, or excavation is needed, an HPA, Corps permit, and local permits may be required. May trigger fish passage requirements. |
| Vegetation growing at the pipe end reducing flow or creating an obstruction (I) | Remove or thin excessive vegetation and clear any debris or sediment from the area to restore flow. | HPA would be required. Sediment removal would require Corps permit or review. Would not trigger fish passage requirements. |
| If there is a debris barrier, no components broken or missing, attached improperly, or otherwise impacted (I) | Repair damaged components or replace entire debris barrier and if one is missing install a new one | HPA would be required if in-water work will occur where fish may be present; may not trigger fish passage requirements. |

The existing pipe and culvert system is a complete fish passage barrier (WDFW 2022). An 8-foot by 8-foot box culvert was installed at the downstream end of this long, piped section below Southeast 163rd Street to meet fish passage standards using the hydraulic design method. Since it was constructed, however, the County has had difficulty maintaining stream bed sediment in the bottom of the culvert. WDFW completed a level A barrier assessment after the box culvert (Site ID: 609261) was installed and still identifies this pipe network as a barrier due to slope in their fish passage barrier database (https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html).

Neither WDFW nor the U.S. Army Corps of Engineers (Corps) will issue permits for activities that extend the life of a fish passage barrier. This means that pipe and culvert maintenance or rehabilitation actions such as liners or spot replacement of short pipe sections would not be permittable without either offsite fish habitat mitigation or a future commitment for full replacement of the structure with a fish passable structure or open channel. Therefore, it will become more challenging to implement operations and maintenance under Alternative 1 as time goes on. In contrast to Alternative 1 – Status Quo, Alternatives 2 and 3 would eliminate the need for planned, routine maintenance. For stream restoration projects, and especially for daylighting projects where the historical channel has been filled and piped for some time, there are often non-routine adaptive management needs, particularly during the first 5 to 10 years following construction as the channel and floodplain adjust to their restored flow and sediment regime. Adaptive management needs could include revegetation following a big storm event, or invasive plant management, or repositioning of large woody material if it becomes dislodged and is causing damage.

## Acquisitions/Easements Required

Alternative 1 would not require any new property acquisition or easements, whereas both Alternatives 2 and 3 would require acquisition of several privately owned parcels to make space for the daylighted creek. A range of acquisition costs for each alternative were estimated (Table 3) based on current King County property assessment values and using Zillow market sales data. Assessed values often do not reflect true market costs, which can be as much as 30 percent above assessed values, so the Zillow data was added to provide a range of potential current market costs. The acquisition cost estimates also do not include associated transaction costs nor site preparation for demolition of existing structures. For both daylighting alternatives, temporary construction easements would be needed and would be defined further along in the design process. If either of the daylighting alternatives moves forward, identification of permanent easement needs would also need to occur, including any easements associated with utility access.

**Table 3. June 2023 Property Requirements and Cost.**

| Alternative | Properties to be Acquired | Acquisition Cost Range |
|---|---|---|
| Alternative 1: Status Quo | None | $0 |
| Alternative 2: Current Alignment Daylighting | 4 | $2.3M to $2.4M |
| Alternative 3: Historical Alignment Daylighting | 6 | $3.5M to $3.8M |

At the present time, there are not enough property owners who are willing to sell their property to the County to make either Alternative 2 or Alternative 3 feasible. However, the County will eventually need to replace the pipe system with a fish passable configuration or negotiate a major offsite mitigation agreement with WDFW if a pipe repair or new system is installed that does not enable complete fish passage.

## Construction Cost

Planning level construction cost estimates were developed for each of the daylighting alternatives. Estimates include removal and abandonment of existing pipes, installation of new fish passable structures and wingwalls at road crossings, excavation, temporary traffic control, streamflow bypass, and temporary erosion and sediment control, as well as surveying and spill prevention, control, and countermeasures (SPCC) plans during construction. Alternative 3 also includes costs for a retaining wall.

The estimated construction cost for Alternative 2 is approximately $7,100,000 in 2023 dollars.

The estimated construction cost for Alternative 3 is approximately $6,300,000 in 2023 dollars.

## Emergency Response and Total Life Cycle Costs

Total cost for each of the alternatives was estimated and includes construction, design, and permitting costs plus land acquisition costs. Table 4 tabulates the costs for each of these project elements including 100 percent contingency which was applied to the subtotal of these estimates resulting in a total estimated cost of $22,500,000 for Alternative 2 and $22,100,000 for Alternative 3. These cost estimates are at a planning level and subject to change over time due to variability in property costs, uncertain design requirements, inflation, construction cost escalation, and other factors such as availability of materials and labor. These cost estimates include major cost items, but a detailed bid-item level cost estimation was not done. Cost estimates would need to be refined through the design process for either of the alternatives.

The Molasses Creek pipe system in the project area is trending toward the end of its useful life and will eventually need to be replaced with a fish passable structure. Incremental repairs and any emergency response work would be allowed by WDFW only as a temporary measure to restore function and public safety. However, flood damage or other property damage costs, and potential environmental mitigation costs could be incurred. For this reason, the life cycle costs of the alternatives may be a more effective way of comparing the costs of all three alternatives. The comparison of construction costs above suggests that Alternative 1 is more cost effective and would cost no money in the near term. However, if life cycle costs are considered, the Status Quo alternative could be more expensive than either of the daylighting alternatives. Estimating a life cycle cost for the Status Quo alternative is challenging as there is a lot of uncertainty regarding how the existing pipes will deteriorate over time, what repairs or emergency response might be needed, whether permits would be issued for such work, and whether mitigation might be needed.

| Table 4. Total Conceptual Level Estimated Cost by Alternative. | | | |
|---|---|---|---|
| **NEAR TERM/ CONSTRUCTION COSTS** | **Alternative 1: Status Quo[a]** | **Alternative 2: Current Alignment** | **Alternative 3: Historical Alignment** |
| Construction costs | $0 | $7.1M | $6.3M |
| Design/Soft Costs | $0 | $2.6M | $2.4M |
| Home Demolition | $0 | $0.3M | $0.5M |
| *100% Contingency* | *NA* | *$10.1M* | *$9.1M* |
| Acquisition Costs | $0 | $2.4M | $3.8M |
| Near Term/Construction Subtotal | $0 | $22.5M | $22.1M |
| **FUTURE EMERGENCY RESPONSE COSTS[b]** | | | |
| Emergency Failure Response[c] | $500K | NA | NA |
| Temporary Pipe Repairs | $1M | NA | NA |
| Mitigation | $2 to $3M | NA | NA |
| Miscellaneous Damage Repairs | $50,000 | NA | NA |
| Future Daylighting[a] | $22.1M to $22.5M (does not include inflation and escalation) | NA daylight channel | NA daylight channel |
| **TOTAL LIFECYCLE COST** | **$25.6M to $27.0M (does not include inflation and escalation)** | **$22.5M (+ costs associated with adaptive management if needed)** | **$22.1M (+ cost associated with adaptive management if needed)** |

[a] Note: While there is no Near Term/Construction cost for status quo, eventually the County will have to provide fish passage.

[b] Future replacement costs based on current construction estimates and would need to be inflated based on timing of replacement.

[c] Emergency response permitting would likely include requirement for full fish barrier correction in the future.

[d] Adaptive management may include addressing changes in stream corridor due to unforeseen flow conditions.

NA = not applicable

Life cycle costs for Alternative 1 would include:

- Potential emergency response associated with a pipe malfunction or failure.
- Liability for damage to roadways, utilities, habitat, and private property associated with a pipe malfunction or failure.
- Temporary repairs and required mitigation.
- Future replacement with a fish passable structure, or channel daylighting.

Life cycle costs would also be affected by changes in property values, inflation, construction cost escalation, and likely increasing costs of any mitigation over time. The daylighting alternatives are intended to be self-sustaining, so aside from maintaining roadway crossings, the estimated life cycle

costs are not much greater than the estimated total construction costs listed in Table 4, although relatively minor costs for adaptive management or vegetation maintenance could be applicable in the future.

An estimate of the total life cycle costs including emergency response and temporary repairs is shown in Table 4. This estimate is based on a scenario that includes the failure of a section of pipe beneath private property and includes the costs for emergency response, temporary repair, property disturbance costs (e.g., driveway repair and landscaping), mitigation and likely requirements for eventual correction of the fish passage barrier. Should such a scenario occur in the future, there would be additional costs for inflation, escalation, and property acquisition costs. It is also assumed that permitting agencies would require added mitigation as a condition of permits for repairs that do not remove or correct the fish passage barrier. The estimated $2- to $3-million cost for mitigation is based on a construction cost estimate for a proposed mitigation project further downstream on Molasses Creek that the County is currently developing (Evan Lewis, personal communication). The estimated cost of that project, which is mitigating for replacement of a 30-foot section of pipe, while still in conceptual design stage, is already over $1 million. Given the extent of pipe that could potentially need to be repaired and mitigated for, the cost for mitigation associated with this project could be higher. Even the $2 to 3M estimate may not be a sufficient reflection off future mitigation costs. Over time, as simpler and more cost-effective mitigation projects are completed, the remaining mitigation options are expected to increase in cost and complexity.

Because there are few maintenance activities that could be permitted, maintenance costs are expected to be relatively low for Alternative 1 and therefore not itemized in Table 4. For Alternatives 2 and 3, maintenance costs are not expected to vary significantly and would primarily be focused on maintenance of the roadway crossings. Given the large size of the proposed new road crossings, wood and other debris should pass freely and not constrict flow. The open channel section would be designed to be as self-sustaining as possible under each of the daylighting alternatives, so while some post-construction monitoring and periodic adaptive management may be required, significant routine maintenance is not expected.

## Project Pros – Habitat and Ecosystem Benefits

The Status Quo alternative will not provide added habitat or ecosystem benefits. A moderate lift in habitat and ecosystem benefits would be realized under Alternatives 2 and 3, with Alternative 2 having somewhat greater habitat benefits over Alternative 3 due to the potential for added flood storage/reconnection, adjacency to existing forested wetlands, gentler slopes, and ability to provide an 8-foot-wide channel bottom throughout the daylighted creek length.

### *Fish Passage*

Improved fish passage would be the most significant benefit of the daylighting alternatives, each of which would eliminate the current fish barrier enabling access to more than 1,000 feet of newly restored habitat. This would leave only a small remaining steel pipe between the downstream end of Fairwood Crest Community Park on the south side of SPU's water supply pipelines and the proposed new channel on the north side of SPU's water lines. Should that remaining pipe section be replaced in the future, fish

would have easier access to much of the remainder of the upper watershed. This study did not propose replacement of the section of the pipe beneath SPU's water supply line as it was deemed too complicated and costly to address at this time due to the utility conflicts.

### *Instream, Riparian, Wetland, and Floodplain Habitats*

Alternative 1 would have no direct benefits to instream, riparian, or floodplain habitats. Both daylighting alternatives would have similar benefits of adding over 1,000 feet of new instream, riparian, and floodplain habitat. Under Alternatives 2 and 3, daylighting Molasses Creek through acquired properties and the SPU property could potentially restore historical floodplain habitat, function, and connectivity to wetlands and wetland habitat within Reach 2.

The existing riparian canopy cover is limited in the project area and variable in the overall project vicinity. Revegetation of the daylighted channel corridor under each of Alternatives 2 and 3 could improve overall canopy along Molasses Creek depending on the width of the riparian buffer. Depending on the alignment, some of the existing mature vegetation growing above the piped creek could be impacted. For both daylighting alternatives, habitat improvements would be greatest along the corridor where residences would be purchased.

## Project Cons – Habitat and Ecosystem Impacts

### *Fish Passage*

Alternative 1 is a fish barrier based on water depth and water speed (velocity) than can inhibit passage for fish that attempt to swim through the pipe. This alternative would continue to block fish access to more than 1,000 feet of Molasses Creek habitat upstream of the pipe system.

### *Instream, Riparian, Wetland, and Floodplain Habitats*

Alternatives 2 and 3 would each result in net improvements to ecological functions and habitats, but each could result in some impacts to existing wetlands. There would likely be impacts to existing vegetation due to clearing and grading, but they could be mitigated through planting.

### *Risks*

There are several risks associated with the Status Quo alternative. These include possible liability for property damage if a section(s) of existing Molasses Creek pipe system fails. Most of the existing Molasses Creek pipe infrastructure was installed in the 1960s. For concrete pipes, the typical lifespan may approach 100 years, although this varies considerably due to location, installation, and quality of materials.

As listed in Table 2, many of the likely future pipe or culvert maintenance activities will not be permittable without fish passage improvements or mitigation. Should the pipe system, or portions of it degrade and result in water leaking out of the pipe, this could cause underground voids or sink holes to form. If this occurs beneath roadways, utilities, or buildings such as on the residential parcels under which the pipe system is buried, the County could be responsible for property damages, possible mitigation, emergency

repairs, and ultimately full pipe replacement. Proactively managing this risk will be important for maintaining community relations and trust.

Future risks and impacts could include flooding, erosion, undermining of the pipe/voids forming underground, and emergency repair. Under an emergency failure scenario, the County would not only need an immediate emergency repair solution and possible mitigation for environmental impacts of the repair work; the County would also be required to ensure fish passage in the repaired section of the piped stream within a 5-year time frame. Risks associated with the daylighting alternatives are primarily related to cost and construction impacts, and the time frame needed for property acquisition to enable construction. The estimated cost of construction for either of these alternatives would need to be refined through the design process and after additional topographic survey and geotechnical information is developed, and environmental documentation for permit applications is completed. Construction risks associated with Alternative 3 also would be due to work in a steep slope area.

## Permits Required

Permits would not be required for Alternative 1 – Status Quo, until a repair situation emerges and in that situation some of the permitting might be done "after the fact" if the repair has to be completed immediately. Permitting requirements are anticipated for Alternatives 2 and 3; these are listed in Table 5. Alternative 3 would require a geotechnical review due to the location of the lower portion of the creek daylighting within a mapped landslide/steep slope hazard area. Alternative 2 would also likely require some geotechnical assessment.

In Washington State, fish passage projects may qualify for streamlined permitting via the Fish Habitat Enhancement Program (FHEP) or the Habitat Recovery Pilot Program (HRPP), both of which are designed to streamline state and local permitting for fish passage and habitat recovery projects. The daylighting alternatives may be good candidates for streamlined permitting through WDFW and should be considered if/as either alternative is advanced. The streamlined permitting under FHEP bypasses State Environmental Policy Act (SEPA) review and waives local government permits and fees (with some exceptions). Federal permitting requirements are not affected.

To be eligible for the FHEP pathway the project must: 1) be fish habitat enhancement (remove fish barrier, restore streambank, place large wood instream or restore kelp, eelgrass or native oyster beds), 2) be approved, endorsed or sponsored in one of several ways that are specified in RCW 77.55.181(1)(c), 3) be located in freshwater or estuarine environment for fish passage projects, 4) be solely for fish habitat enhancement, 5) be a complete project, 6) be of size and scale that it does not raise concerns regarding public health and safety, and 7) have no significant adverse impacts that can't be mitigated through a Hydraulic Project Approval (HPA). These FHEP criteria generally align with the project daylighting alternatives, but would require consideration of whether any public health and safety concerns are present that could eliminate the project from using the streamlined pathway. This may be more of a potential concern for Alternative 3 due to critical areas (steep slopes).

| Table 5. Permitting Requirements for Alternatives 2 and 3. | | | |
|---|---|---|---|
| **Permit/Approval** | **Lead Agency** | **Jurisdiction/Trigger** | **Submittal Information** |
| **Federal** | | | |
| Clean Water Act Section 404 Permit | U.S. Army Corps of Engineers Seattle District | Discharge of dredged or fill material in waters of the United States (Molasses Creek). If wetlands could potentially be drained/ impacted from creek daylighting, additional mitigation may be required under Section 404. | • Joint Aquatic Resources Permit Application (JARPA)<br>• Design drawings (to Corps standards)<br>• Cultural resources documentation<br>• Critical Areas Report and Mitigation Plan |
| Endangered Species Act Section 7 Consultation | U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) Fisheries Service | The Corps must consult with USFWS and NOAA Fisheries to determine if the project could impact federally listed species or designated critical habitat for listed species to issue the Section 404 Permit. | • Biological Assessment report |
| **State** | | | |
| Clean Water Act Section 401 Water Quality Certification | Washington State Department of Ecology (Ecology) | Federal permits affecting waters of the United States, including Molasses Creek.<br>Note: Many activities that are covered under Section 404 permitting with the Corps typically have programmatic Section 401 Water Quality Certification approval and may only require a concurrence letter from Ecology. | • JARPA Form<br>• Design drawings |
| Hydraulic Project Approval (HPA) | Washington Department of Fish and Wildlife (WDFW) | Activities in or near state waters that will use, divert, obstruct, or change the natural flow or bed of salt waters or fresh waters of the state, including Molasses Creek. | • Application submitted online through Aquatic Protection Permitting system (APPS)<br>• State Environmental Policy Act (SEPA) Determination<br>• Critical Areas Report and Mitigation Plan<br>• Design drawings |
| National Historic Preservation Act Section 106 Review | Washington Department of Archaeology and Historic Preservation (DAHP) | Projects receiving federal funding, license, or permits. | • Historical/Cultural Resources Assessment |
| Coastal Zone Management Act (CZMA) Federal Consistency Determination | Ecology | Projects authorized by the Corps and/or receiving federal funding or permits within 1 of Washington's 15 coastal counties, including King County. | • Certification of Consistency Form with CZMA<br>• JARPA and Corps permit application number<br>• Design drawings<br>• Notice of Intent (NOI) number for NPDES Permit |

| Table 5 (continued). Permitting Requirements for Alternatives 2 and 3. | | | |
|---|---|---|---|
| **Permit/Approval** | **Lead Agency** | **Jurisdiction/Trigger** | **Submittal Information** |
| **Local – King County** | | | |
| Pre-Application Conference | King County Department of Local Services Permitting Division | Required by King County prior to submitting Critical Areas Alteration Exception Application. | • Request for Pre-Application Conference form |
| SEPA Determination | King County Department of Local Services Permitting Division | In-water activities require SEPA review by the local agency. | • SEPA Checklist |
| Critical Area Alteration Exception | King County Department of Local Services Permitting Division | Required for activities that affect critical areas, including Molasses Creek, wetlands, and landslide/steep slope hazard areas. Landslide/steep slope hazard areas are mapped within the Alternative 3 corridor and thus geotechnical review for this area would be required. | • Critical Areas Alteration Exception Application<br>• Land Use Permit Application<br>• Critical Areas Report and Mitigation Plan<br>• Geotechnical Evaluation (for Alternative 3 only)<br>• Design drawings<br>• SEPA Checklist<br>• Permit review fees |
| Land Use Permit | King County Department of Local Services Permitting Division | Any substantial ground disturbing activities (excavation or fill) within King County. | • Land Use Permit Application Form |

The HRPP is designed to streamline the local and state environmental permitting process for habitat recovery projects that benefit freshwater, estuarine, or marine fish, or their habitats. It is intended to streamline permitting for a broader range of habitat types than the FHEP. To be eligible, projects must be identified in at least one of several identified restoration programs or be funded through one of several funding programs focused on habitat restoration.

The daylighting alternatives would be a good match for this program, which has broader goals than fish passage, if it were identified by one of the listed restoration programs. Of those listed, the Salmon Recovery Funding Board, Brian Abbott Fish Barrier Removal Board and Puget Sound Acquisition and Restoration Accounts seem most relevant to this project. However, this is a pilot program that is only authorized through 2025 so it is uncertain if this streamlined process will be an option in the future. Like the FHEP program, if approved, state and local permitting would be streamlined, but federal permitting process would be unchanged.

## Geotechnical Issues and Geologic Hazards Specific to Alternatives 2 and 3

### *Geologic Hazard Related to Steep Slopes and Landslide Hazard Areas*

Both Alternative 2 and Alternative 3 would require extensive excavating and the creation of steep slopes within proximity to existing steep slopes and landslide hazard areas to reach the restored creek channel elevation. As a result, both Alternatives 2 and 3 would likely require additional geotechnical investigation, evaluation of existing and potential slope instability, and assessment of potential landslide hazards and risks. The design of proposed creek channel side slope angles would be informed by the geotechnical analysis as design would have to address factors of safety to satisfy applicable design standards. For example, it may be necessary to grade the site with flatter side slopes than previously anticipated to meet stability requirements. If this is the case, design for either of these alternatives would need to determine if side slope grading could extend farther than shown in the proposed alternative geometry (e.g., additional property acquisition likely being needed), or if a retaining wall(s) or other slope stabilization measures could be implemented to limit excavation extents.

A review of the 2018 record drawings (King County 2018) showing "existing" ground contours of Molasses Creek prior to the installation of the Fairwood West box culvert indicates that the historical channel near the downstream half of the project reach was deep and narrow. This implies that downcutting of the native soil materials formed naturally steep slopes such that it could be feasible to maintain the creek channel side slopes under Alternatives 2 and 3 without need for expensive slope stabilization measures. Future design development would include performing explorations to provide more precise subsurface data, which would be assessed to evaluate if the site is underlain by soils that correlate with landslide hazards. This soil investigation work would confirm if the proposed improvements would extend into areas underlain by glacial lacustrine soils known for developing preferential failure planes that can cause slope movement in material that is otherwise strong. Assessing the extent and engineering properties of local fill soils would also be important, as fill slopes would need to be flatter if the soil is less competent than native soils. The southern end of the project area may also extend into soft wetland (marsh) and alluvial deposits, which would also require a gentler slope configuration than can be accomplished in more competent glacial soils.

### *Geologic Hazard Related to Erosion and Scour Potential*

Natural processes such as erosion and scour induced by streamflow would affect the stability of the proposed slopes under either of Alternatives 2 or 3. As a result, measures to protect the toes of the slopes from erosion would be important for maintaining slope stability. These measures may consist of adding or deepening walls adjacent to the stream where scour is predicted or installing large woody debris or channel bank erosion protection such as revetments. The proposed improvements should be such that they limit the need for long-term maintenance and are not susceptible to degradation or decomposition when exposed periodically to water. For example, wall types like gabion baskets or structural earth walls with welded wire fascia should not be used as they are subject to rusting (even with galvanizing) and eventual failure.

### *Geologic Hazard Related to Seismicity*

Seismic geologic hazards are related to the potential for settlement and slope instability, primarily due to soil liquefaction. Liquefaction occurs when loose to medium dense granular soils below the ground water table lose strength as a result of ground shaking during an earthquake. For this project area, earth fill and alluvium materials may be present below the ground water table and could result in liquefaction induced settlement or slope instability. Where settlement and slope instability do not impact structures, the occurrence of these materials are not likely to impact design; however, design for walls and culvert foundations would need to address the loss of strength of potentially liquefiable soils. It is expected that the depth of liquefiable soils is limited to the shallow alluvial or fill materials located above dense glacial soils. As a result, liquefaction mitigation would likely consist of removing the liquefaction prone soils from beneath and around the improvements and replacing them with suitable engineered fill materials to support the slopes and culvert foundations.

## Constructability

Both daylighting alternatives would require construction of one or more culverts beneath existing roadways. These culverts would be deep, on the order of 20 to 30 feet below the existing ground surface. Stream culverts placed at that depth in western Washington are typically three-sided concrete box structures or steel arch structures. Available site geologic data suggests that the new culverts would be founded on competent glacially consolidated soils and could be constructed using conventional spread footings. Depths of footings would likely be determined based on scour prevention requirements and may require several feet of excavation below the proposed creek channel bed elevations. Wing walls at the ends of a culvert could likely be completed with structural earth walls or cast-in-place concrete, though this choice would depend on the results of a scour evaluation. If the project is subject to design for scour per the Washington State Department of Transportation requirements, providing abutment support could require use of soldier pile or secant pile walls at the abutments.

Constructability also includes how to maintain traffic flow in the project area. For the new roadway culverts under Alternatives 2 and 3, a full road closure would enable the shortest possible construction duration but may not be feasible. Full road closures simplify the construction phasing and reduce the total construction cost.

Where spread footings or walls that require temporary excavation are installed, the constructability assessment should evaluate if temporary shoring may be needed to excavate to the base of the new structure foundations. How existing utilities can be adjusted/maintained to provide uninterrupted service during construction is another important issue to incorporate into the constructability considerations.

For either daylighting alternative construction work that is in contact with the creek's flow, particularly below the ordinary high-water mark of an existing stream channel would be restricted to occur during an approximately 1- to 2-month summer "fish window" deemed a critical period for salmon and other fish species. However, for both daylighting alternatives, much of the new creek channel could be constructed outside of this restricted fish window. An advantage of this approach is that the existing pipe system would be intact during much of the construction period so a streamflow bypass would not be needed throughout the entire construction period. Once the new channel is constructed, grading and other work

needed to connect to the existing stream channel at the upstream and downstream ends could be done during the permitted fish window with a temporary flow bypass.

### Equity and Social Justice

Population groups potentially affected by the alternatives discussed in this report include: 1) residents living above the piped creek; 2) owners (and possibly tenants) of properties that would have to be acquired for creek channel daylighting, 3) other local residents in the Fairwood West HOA, and 4) Native American Tribes with treaty rights to fish that may or may not use the project area.

As there would be no properties acquired and no construction under Alternative 1, there are no impacts for residents and the Fairwood West Community Park with this alternative. However, in the longer term, if/as the existing Molasses Creek pipe system ages, there could be negative impacts on property owners/residents whose driveways and yards are located above potential problematic pipe section(s). The status quo alternative has negative impacts on Native American Tribes as the fish passage barrier would remain indefinitely.

The daylighting alternatives would have significant impacts on the property owners/residents whose properties would need to be acquired for creek channel daylighting and would have negative impacts on the broader community that uses Fairwood West Community Park unless the affected park features were replaced nearby. However, daylighting the creek could provide natural area access and environmental education opportunities for nearby schools. The daylighting alternatives would provide benefits of improved fish passage and habitat for Native American Tribes.

## Default Option: Status Quo

Given the current lack of landowner support to sell their property for either of the daylighting alternatives, Alternative 1 – Status Quo is the default option at this time and the only feasible option for the County to pursue. Despite being the default option, planning efforts such as those listed in the Recommendations section below should occur to support a future daylighting option. Both daylighting alternatives would require the County to acquire multiple properties. At this time there are not enough willing sellers to make either daylighting alternative feasible, and the County prefers not to pursue eminent domain for this project.

Typically, an alternatives analysis and feasibility study for a project of this scale and complexity would involve developing quantitative criteria and applying scores to the criteria to generate numeric rankings for the alternatives. This feasibility study relied on mostly qualitative information during the Alternatives Analysis because of the lack of land availability at the present time.

While this study did not apply criteria scores during the Alternatives Evaluation process, the evaluation results revealed several advantages of both daylighting alternatives compared with the status quo alternative. These include improved fish passage, support for tribal treaty rights, greater habitat value, improved future access and maintenance, reduced risks of pipe system failure and property damage, and reduced life cycle costs.

Alternatives 2 and 3 would be generally similar in the extent of habitat improvements and length of creek channel that would be made available for fish use. Alternative 2 would have slightly greater habitat benefits compared to Alternative 3 (due to greater channel width and gentler side slopes that would allow for more floodplain connectivity and a wider range of native vegetation species to be planted on) and fewer impacts to private property compared with Alternative 3. If property acquisition was not an issue causing daylighting to be infeasible, it is likely that Alternative 2 would have been the highest scoring alternative given the greater ecological value, reduced property needs, and reduced constructability concerns.

# Recommendations

The Molasses Creek current pipe system is not sustainable and cannot be maintained over time due to the inability to obtain permits to repair the pipe, which is considered a fish passage barrier. The pipe system is buried deep beneath several residential properties and will eventually need to be replaced with a fish passable configuration that potentially involves channel daylighting, or a mitigation settlement would need to be reached with state and federal regulatory agencies and treaty Tribes each time a permit is sought for repairs. With these challenges in mind, this section includes recommendations to support future planning efforts.

## Surveys and Assessments

If future creek daylighting or replacement of the existing Molasses Creek pipes with fish passable structures is pursued, the following surveys and assessments would be necessary:

- Topographic survey is needed to confirm elevations of utility infrastructure, property boundaries, and key landscape features that would influence the design and would be needed for permitting.
- Wetland delineation to better understand potential impacts of creek channel daylighting on existing wetlands and how this would affect permitting requirements including potential mitigation for wetland impacts. Wetland delineations prior to design would also help evaluate the potential for habitat connectivity and flood storage along the SPU parcel.
- Geotechnical borings and evaluation of subsurface soil and groundwater conditions to confirm proposed slope stabilization measures, optimal channel alignment, and need for retaining structures under either of the daylighting alternatives. The specific locations of borings should be selected to evaluate the conditions of fill, native soils, and suitable side slope inclinations and the need for retaining walls, as well as preliminary determination of new roadway crossing culvert foundations and wall types.
- Cultural resources investigations are recommended to support future capital project planning.

## Community and Property-Owner Outreach

Implementing either of the daylighting alternatives would require acquisition of several parcels, and it is unlikely that there are any daylighting scenarios that could be completed without the acquisition of properties. The County should consider property owner outreach and develop funding strategies including applicable grant sources to support these efforts.

The proposed alternative creek alignments could be modified based on the locations of willing property sellers, including abandoning a section of roadway to allow for construction of a stream channel in that roadway. Using the public right-of-way could reduce the need for acquisition of private properties but would result in Southeast 163rd Street dead-ending near the current Fairwood West Community Park between 135th Avenue Southwest and 134th Avenue Southeast. If/as daylighting alternatives are considered in the future, it may be helpful to evaluate whether any of the existing features within

Fairwood West Community Park (play structure and ball court) could be relocated nearby to avoid the permanent loss of those features in the community.

## Evaluate Mitigation Options

The current pipe system is not maintainable, as state and regulatory agencies will no longer issue permits for work that perpetuates fish passage barriers. In some cases, temporary repairs may be permitted in conjunction with a negotiated mitigation agreement to provide fish passage or habitat improvements elsewhere. However, these mitigation agreements are not guaranteed, and can be difficult to negotiate as state, tribal and federal governments have different preferences for mitigation. Furthermore, it is increasingly difficult to find suitable locations for fish passage mitigation projects as development pressures in King County consume potential sites. Regulatory agencies typically require mitigation in the same water body or proximate to areas with similar habitat value and that support the same fish and wildlife species and their lifecycles as are in the project area. There are few remaining opportunities for fish passage in the Molasses Creek basin. The County is already evaluating fish passage improvements near the mouth of Molasses Creek as mitigation for previously completed work. This fish passage improvement is estimated to cost over $1M. There are few comparable streams draining to adjacent reaches of the Cedar River that could provide potential mitigation opportunities. Over time, as the simpler and less costly mitigation projects are constructed, the cost and complexity of finding suitable mitigation sites will increase.

However, it may be useful to identify potential mitigation options and mitigation costs to help the County better understand how mitigation cost and complexity compares to other alternatives. Also, knowing that portions of the Molasses Creek pipe system will continue to fail over time and that it may not be possible to complete minor repairs without mitigation, it is advisable to have potential mitigation sites and plans available should they be needed to support permitting of smaller repairs. This would be a useful efficiency that increases in value if emergency repairs become necessary, but it is important to keep in mind that negotiated mitigation agreements usually do not permanently eliminate the obligation for future fish passage. For instance, if a permit was issued to repair a section of the Molasses Creek pipe system and included a mitigation agreement, King County could still be required to provide mitigation in the future should another section of the same pipe need future repairs. Over time, the incremental costs for mitigation could exceed the cost of completely replacing the existing fish barrier with an open channel or a combination of open channel and culverts.

## Proactive Maintenance

Given the age and condition of this pipe system, and the difficulty the County will encounter in obtaining permits for repairs, a more aggressive and proactive maintenance schedule should be considered to prevent further damage to the pipes. This could include increased frequency of visual inspections of the pipe inlet and outlet, pre- and post-storm checks, routine cleaning of debris to prevent debris from blocking the pipe that could otherwise induce water to erode the banks or undermine the culvert, and periodic CCTV inspections to understand the pipe condition and the need for cleaning. Maintenance experts should discuss whether there are any concerns about routine jetting due to the condition of the pipes. Routine video inspection of the pipes beneath private property to evaluate their integrity is recommended.

## Capital Project Planning

The existing Molasses Creek pipe system in the project area will eventually reach the end of its lifespan and need to be removed or replaced. The costs of daylighting a new creek channel to replace the pipe system, replacing the pipe system in its entirety with a fish passable structure(s), or incrementally repairing sections of the pipe system and mitigating for perpetuating the fish passage barrier will be high. It is recommended that future capital project plans include funding and staffing capacity to continue engaging the community and identifying willing property sellers, developing design plans, and/or identifying and completing fish habitat mitigation.

# References

Herrera. 2022. Molasses Creek Fish Passage Feasibility Study Conceptual Alternatives Technical Memo. Prepared for King County Department of Natural Resources and Parks, Water and Land Resources Division by Herrera Environmental Consultants, Seattle Washington. November 2022.

Herrera. 2023. Molasses Creek Fish Passage Feasibility Study Existing Conditions Technical Memorandum. Prepared for King County Department of Natural Resources and Parks, Water and Land Resources Division by Herrera Environmental Consultants, Seattle Washington. June 27.

King County. 2018. Fairwood West HOA Pipe Replacement Record Drawings. Prepared by King County Water and Land Resources Division, Seattle, Washington. Final Revisions dated January 2018.

King County. 2022. King County iMap. King County. Accessed January 12, 2022. <https://gismaps.kingcounty.gov/iMap/?mapset=wria>.

Renton, City of. 2022. City of Renton (COR) Online GIS Maps. Accessed March 2022. <https://www.rentonwa.gov/city_hall/executive_services/Information_technology/maps___g_i_s_data>.

WDFW. 2022. Washington State Fish Passage. Washington Department of Fish and Wildlife. Accessed January 12, 2022, and May 17, 2023 (Site 609261). <https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html>.

# Appendix A

## Existing Conditions Technical Memorandum

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Science + Planning + Design

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# MOLASSES CREEK

# EXISTING CONDITIONS TECHNICAL MEMORANDUM (MOLASSES CREEK FISH PASSAGE FEASIBILITY STUDY)

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June 26, 2023

**Note:**
Some pages in this document have been purposely skipped or blank pages inserted so that this document will print correctly when duplexed.

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# INTRODUCTION

King County seeks to improve fish passage and habitat conditions in Molasses Creek where it currently flows through a series of 48-inch-diameter culverts that are buried more than 15 feet deep below ground in the Fairwood residential area in unincorporated King County near the city of Renton. The culverted stream section is approximately 1,250 feet long and separates a forested wetland and quality stream habitat located upstream from a forested ravine and the Cedar River located downstream. The culverted stream section has poor habitat quality and is a fish passage barrier.

To inform alternatives for restoring fish passage and improving habitat in this section of Molasses Creek, a thorough assessment of existing conditions is needed. This memorandum characterizes existing geology, geomorphology, hydrology, hydraulics, utilities, and ecology in the area where Molasses Creek is entirely culverted, and in the surrounding drainage basin for context, and provides recommendations for fish passage and habitat improvements to be featured in the development of alternatives.

## Project Area and Study Area

Molasses Creek is a tributary of the lower Cedar River, in Water Resource Inventory Area (WRIA) 8: Cedar-Sammamish. The project area focuses on the culverted section of Molasses Creek from approximately river mile (RM) 0.9 to RM 1.15 (King County 2022a). It is located in unincorporated King County near the southeastern limits of the city of Renton, in Section 27, Township 23 North, Range 05E of the Willamette Meridian (Figure 1).

To provide context for Molasses Creek conditions within the project area, the stream reaches immediately upstream and downstream of the project area were investigated during the field reconnaissance described in this report, for a total stream length of approximately 1.8 miles. The study area extends from Southeast Petrovitsky Road to the Molasses Creek confluence with the Cedar River, and encompasses hillslopes draining to the creek in addition to the creek channel and its small floodplain areas (Figure 2). At the upstream limit of the study area, Molasses Creek flows through undeveloped parcels that contain several large wetlands. Downstream of these wetlands it flows through the Fairwood residential area where it is periodically confined to a narrow channel between single-family homes and the Fairwood Crest Community Park, and then piped under houses until it enters the ravine downstream of Fairwood West Community Park. This ravine has relatively steep side slopes that are prone to landslides. A former gravel pit area and the Soos Creek Park and Trail system are amid the forested slopes in this ravine. Molasses Creek passes through two culverts and a fish ladder near its confluence with the Cedar River at approximately its river mile (RM) 4.1.

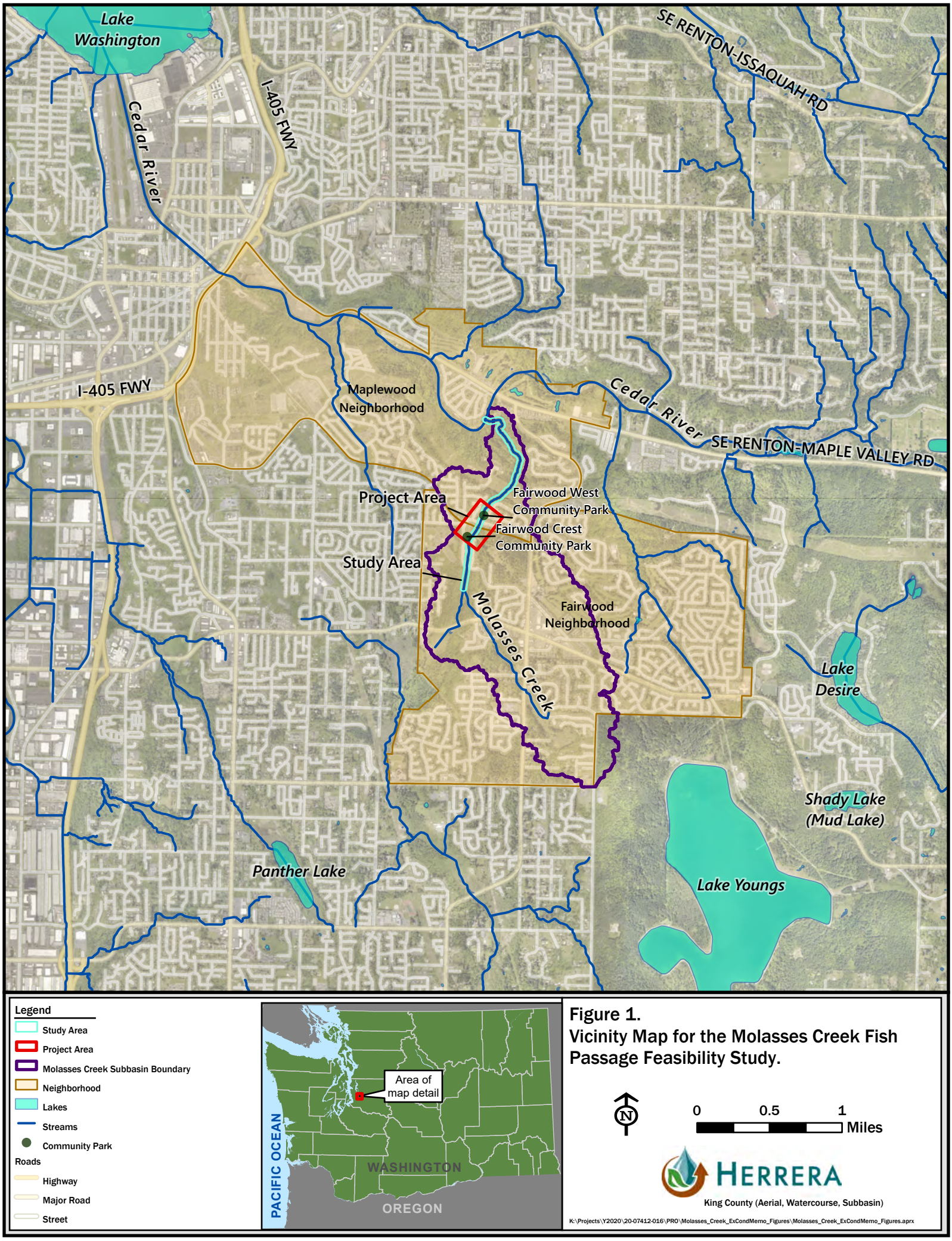
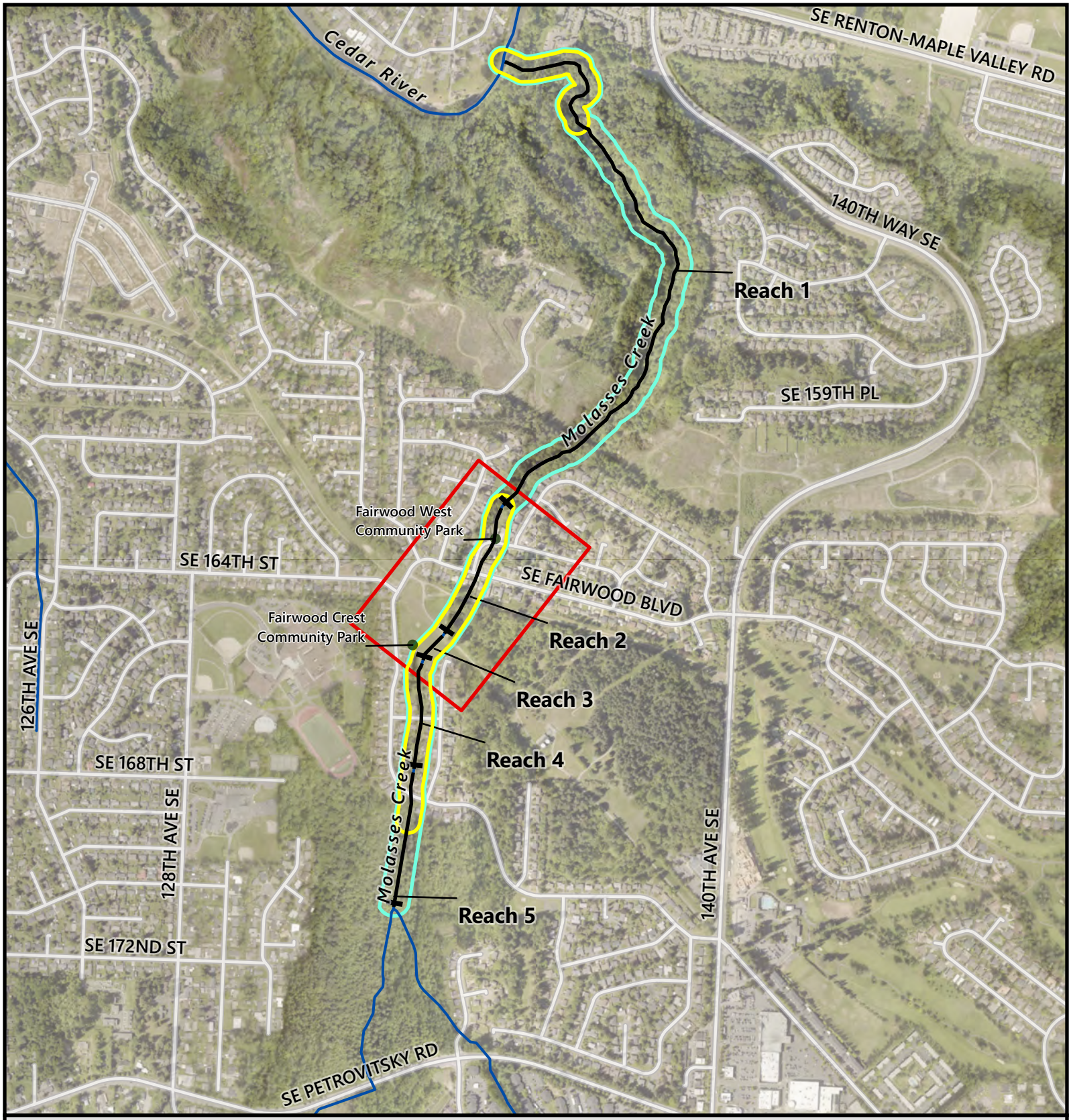



**Figure 1.**
**Vicinity Map for the Molasses Creek Fish Passage Feasibility Study.**




## Legend

- Streams
- Streets
- Reaches
- Community Park
- Reconnaissance Areas
- Project Area
- Study Area

**Figure 2.**
**Site Map for the Molasses Creek Fish Passage Feasibility Study.**

N

0 500 1,000 2,000 Feet

HERRERA

King County (Aerial, Watercourse)

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Existing conditions of Molasses Creek and its drainage basin are described in the following five reaches (see Figure 2):

- Reach 1 – the ravine from the confluence with the Cedar River to Fairwood West Community Park where it flows through a box culvert (only the lower 0.21 mile of Reach 1 were investigated by field personnel).
- Reach 2 – the culverted length of Molasses Creek from Fairwood West Community Park upstream to Fairwood Crest Community Park.
- Reach 3 – the recently "daylighted" and restored section of Molasses Creek in Fairwood Crest Community Park.
- Reach 4 – the portion of Molasses Creek flowing parallel to 133rd Place Southeast between residential properties upstream of Reach 3 to Southeast 168th Street.
- Reach 5 – the portion of Molasses Creek where it flows through wetlands upstream (south) of Southeast 168th Street. Only the lowermost section was observed from the right (east) bank during site reconnaissance due to access restrictions.

## Background

Molasses Creek has been extensively impacted by development since the 1970s. In addition to confining it within long culverts to enable development amid its former channel and floodplains, repairs associated with a sinkhole that resulted from a leak in one of the culverts and altered flows related to water withdrawals have adversely affected aquatic habitat in much of the length of the creek. Due to steep slopes and associated geologic instability in the ravine downstream of Fairwood West Community Park, land development has been limited adjacent to Reach 1 where the creek flows in a natural channel through the ravine. In 2011, a sinkhole developed along the culverted portion of Molasses Creek in Reach 2, requiring 100 feet of the culvert pipe to be replaced near 133rd Place Southeast. The sinkhole re-formed and was again repaired in 2017, which included realigning 180 feet of the culvert system. Water rights held by Fairwood Golf and Country Club allow for withdrawal of up to 450 gallons per minute from Molasses Creek to irrigate the golf course, for up to 127.5 acre-feet of water use during the irrigation season (April 1 through October 31). To mitigate for water withdrawals, the Fairwood Golf and Country Club must provide instream flow augmentation of 185.2 acre-feet per year between April 1 and December 10. Continuous flow augmentation is required along Molasses Creek when flows decrease below 350 gallons per minute (1.1 cubix feet per second).

Recent restoration projects, specifically in Fairwood West Community Park and Fairwood Crest Community Park, have replaced culverted sections of the creek with open channels (commonly called daylighting a stream) or begun the work to improve fish access and habitat. At Fairwood West Community Park at the downstream-end of Reach 2, King County replaced a 100-foot-long section of 48-inch-diameter corrugated metal pipe culvert with an 8-foot-wide reinforced

concrete box culvert to provide fish passage in a private park tract. Streambed material was installed within the culvert bottom to improve habitat and fish passability. In Reach 3, the Fairwood Crest Community Park fish barrier removal project was constructed in 2021 and modified an in-stream stormwater detention facility in Molasses Creek. King County acquired parcel 2473400660 and daylighted approximately 183 feet of channel where the creek was previously conveyed in a 48-inch-diameter pipe. The County created approximately 190 feet of roughened stream channel, eliminating a 7-foot elevation drop between pipes that created a barrier to fish. The banks surrounding the restored channel were planted with native vegetation.

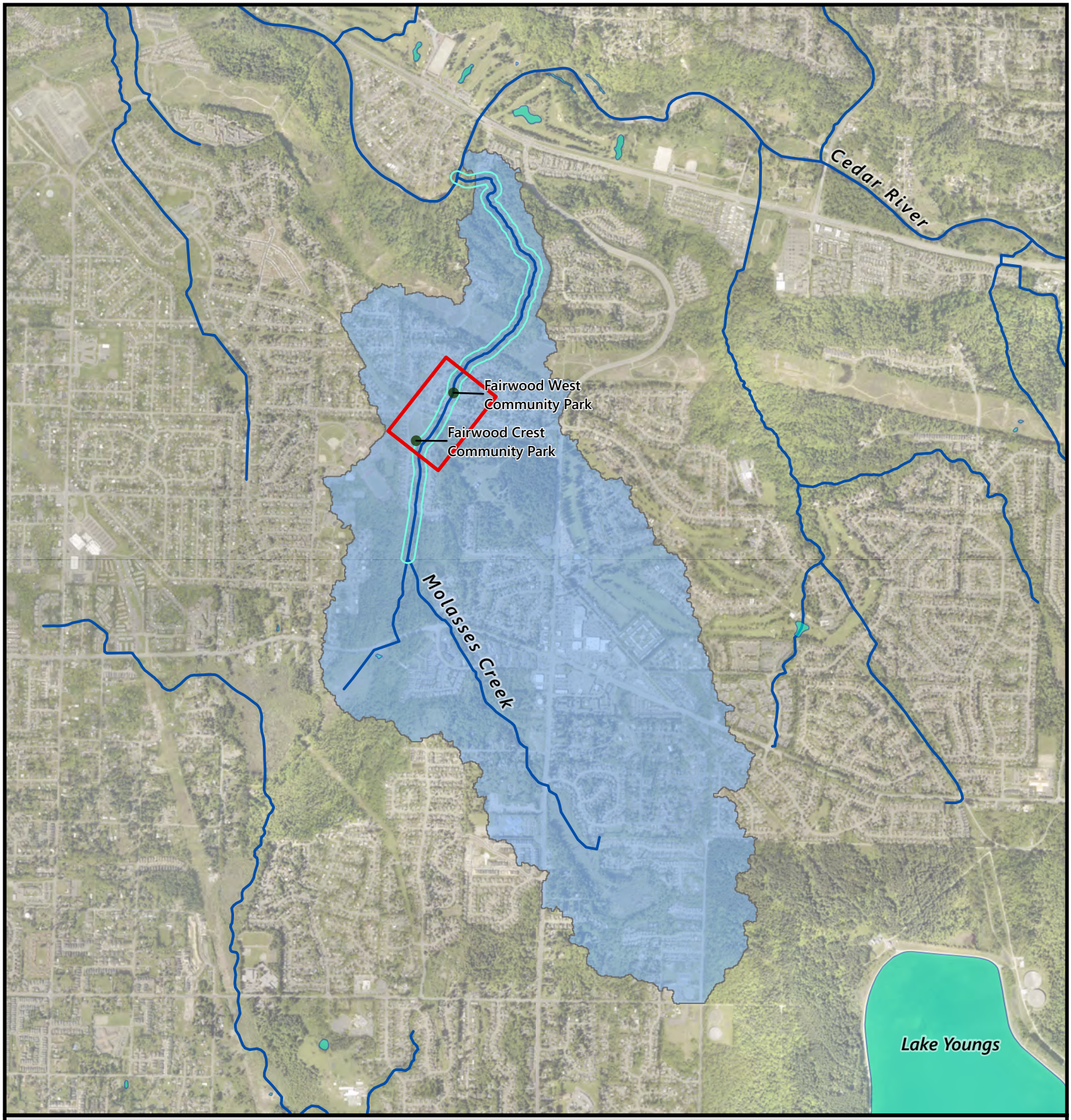
# Molasses Creek Subbasin Characterization

The Molasses Creek subbasin is part of the greater Cedar River Watershed (Figure 3) which is located in the north-central portion of the Puget Lowland. Molasses Creek drains an approximately 1.8 square mile subbasin area and enters the Cedar River near RM 4.1. A summary of some of the key subbasin characteristics, including the topography, geology, soils and land use and land cover conditions, is provided below. These characteristics affect hydrologic, hydraulic, water quality, and biological conditions in Molasses Creek and thus have a strong influence on potential future habitat conditions within the project area.

## Topographic Conditions

The Puget Lowland is an elongated topographic and structural depression bordered by the Cascade Mountains to the east and the Olympic Mountains to the west. The Puget Lowland is characterized by low-rolling relief with many deep creek ravines draining into large rivers.

Topographic conditions within the Molasses Creek subbasin are depicted in Figure 4. Subbasin topography is characterized by a broad upland plateau in the headwaters where elevations range between 350 and 550 feet (NAVD 88, GIS LiDAR citation). This plateau overlaps Reach 2 and extends upstream to the upper subbasin boundary. Molasses Creek flows through a steep, erosional ravine downstream of this plateau, dropping almost 300 feet in just less than a mile before entering the Cedar River floodplain where the river channel is close to the left bank (south) valley wall across from the Maplewood neighborhood. Figure 5 provides an elevation profile of Molasses Creek through the study area indicating the contrast in channel slopes between the reaches in the plateau and the reach in the ravine.




**Legend**

- Project Area
- Study Area
- Molasses Creek Subbasin
- Lakes
- Streams
- Community Park

**Figure 3.**
**Molasses Creek Subbasin Area.**

N

0 750 1,500 3,000
Feet

HERRERA

King County (Aerial, Watercourse, Subbasin)

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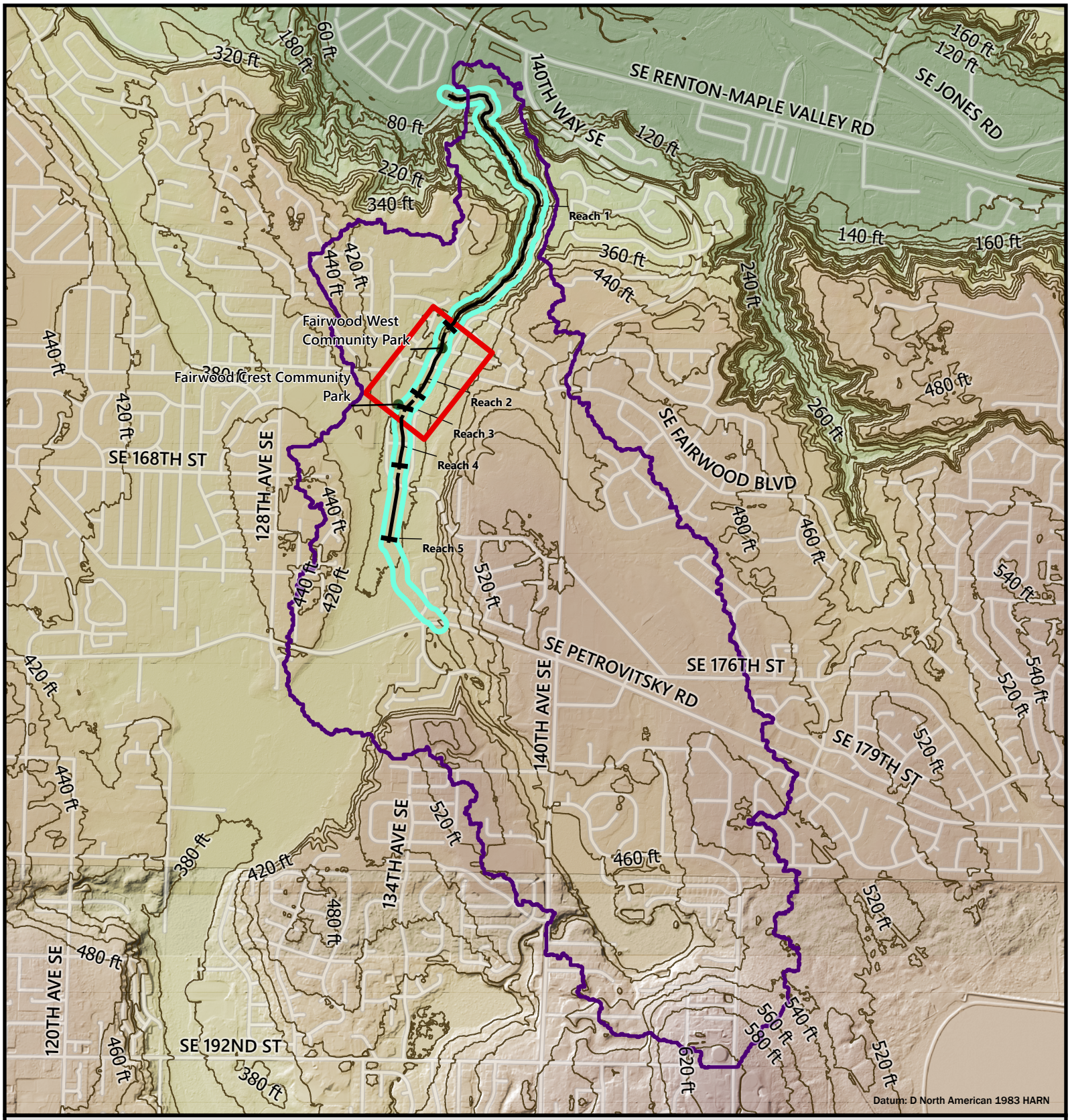


## Legend

- Streets
- Elevation Contour (20ft)
- Reaches
- Community Park
- Molasses Creek Subbasin Boundary
- Study Area
- Project Area

Elevation (ft)

555 ft

60 ft

- Mask

**Figure 4.**
**Topographic Conditions for the Molasses Creek Fish Passage Feasibility Study.**

N

0 750 1,500 3,000 Feet

HERRERA

King County (Topography, Subbasin)

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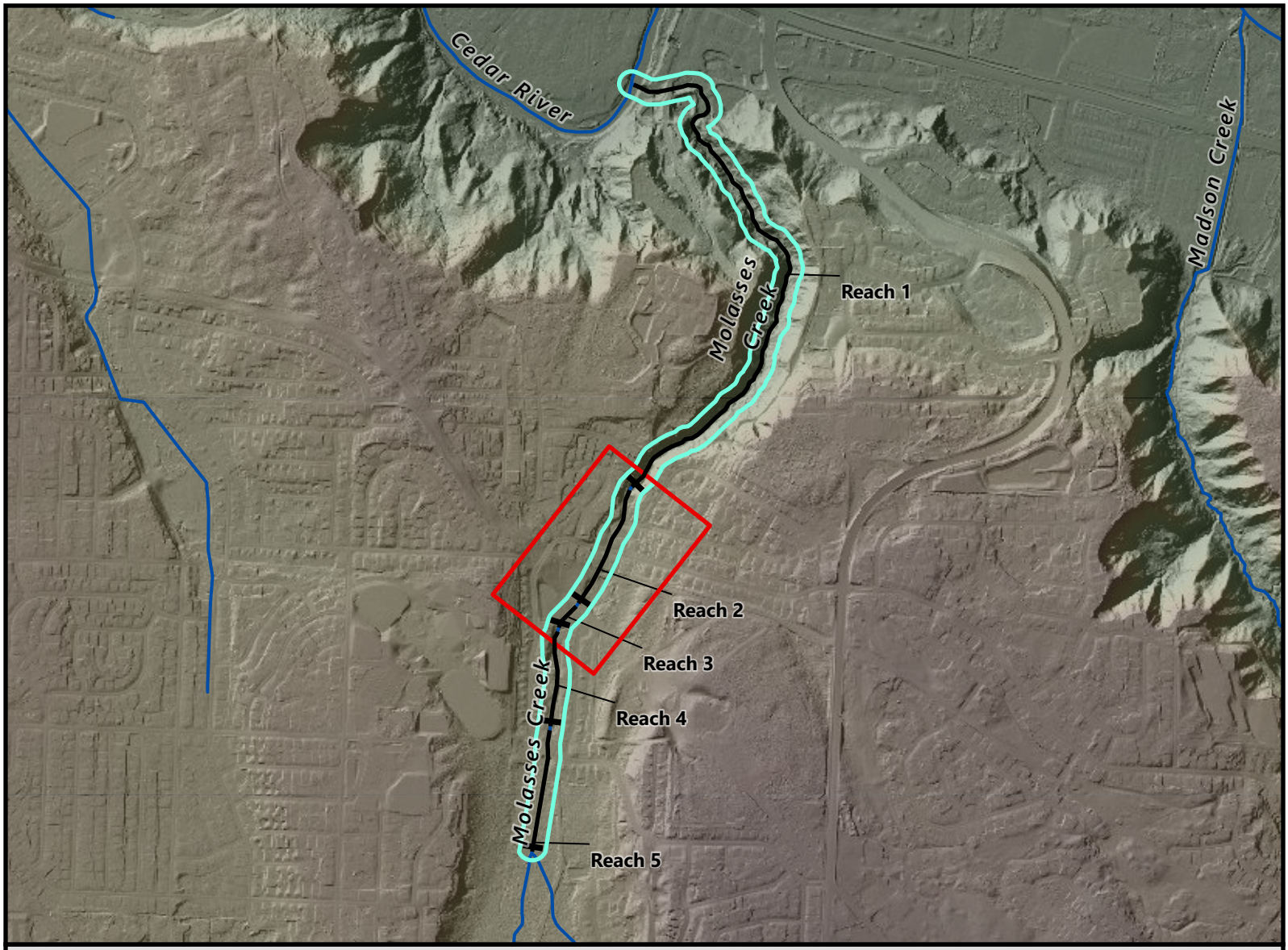


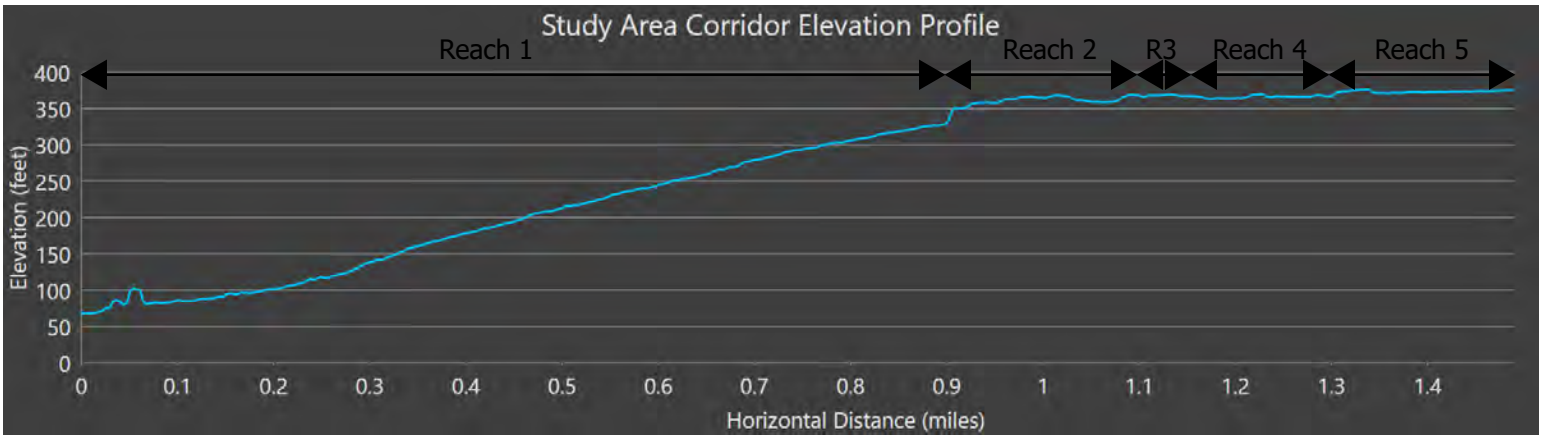


## Legend

- Project Area
- Study Area
- Reaches
- Streams

**Figure 5. Longitudinal Channel Profile for the Molasses Creek Fish Passage Feasibility Study.**

N

0 500 1,000 2,000 Feet

HERRERA

King County (LiDAR)

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# Geology and Soils

## *Puget Lowland Setting*

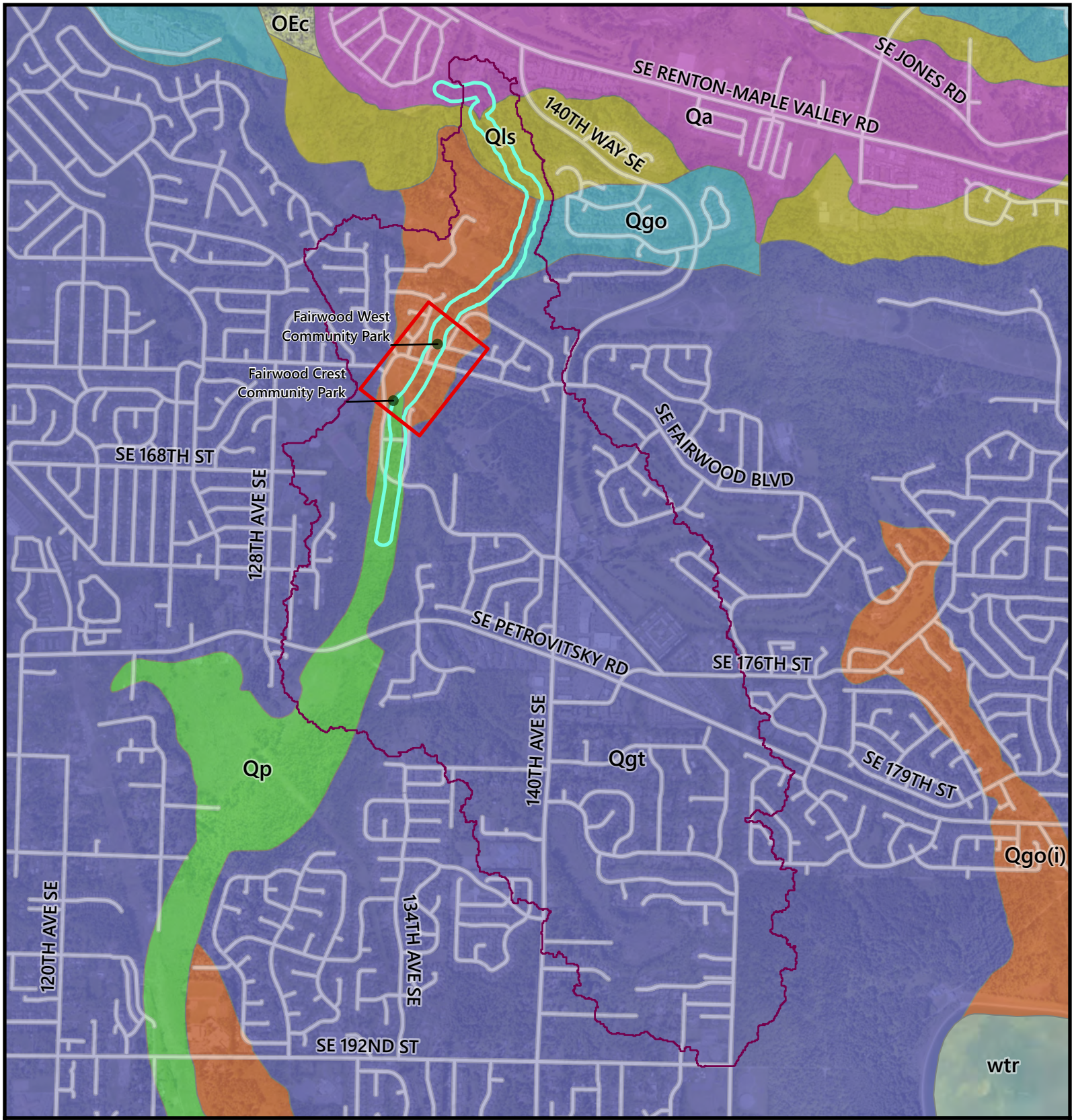
The Puget Lowland has periodically been occupied by a lobe of the Cordilleran Ice Sheet, one of two continental glaciers that developed during the recent ice ages of the Quaternary Period (2.6 million years ago to present). The Cordilleran Ice Sheet was centered over the Coast Ranges of British Columbia. A portion of the ice sheet, termed the Puget Lobe, advanced south from British Columbia to occupy the lowlands of western Washington. At least four such advances occurred. The southern termini of these glacial advances were generally in the area of the Black Hills, south of Olympia, Washington.

Between and following these glacial advances, the Puget Lowland was partially filled with alluvium (stream channel) and lacustrine (lake) sediments deposited by runoff from the western slopes of the Cascade Mountains and the eastern slopes of the Olympic Mountains. Erosion of alluvium and lacustrine deposits, as well as local re-deposition of sediments, further complicates the geologic setting. As a result, the Puget Sound area is underlain by a thick, complex sequence of glacial and interglacial sediments. Because they have been over-ridden by great thicknesses of glacial ice, the interglacial deposits are typically very hard/dense, exhibiting low compressibility and high shear strengths.

## *Site Geology*

According to the available geologic mapping (see Figure 6) the Molasses Creek corridor is predominately underlain by Ice-Contact Recessional Outwash (Qvic) and Peat Deposits (Qp); however, to the east and west of the stream channel, the ground is underlain with Continental glacial till (Qgt). Though not mapped, the site soils are overlain by varying amounts of fill and disturbed native soils that have been reworked by development of residential areas along Molasses Creek. The nature of each of these geologic units is discussed in more detail below.

**Fill and Disturbed Native Soils:** Fill is highly variable in composition, and its engineering properties are dependent upon the material sources and methods used to place it. Often, fill consists of reworked alluvial or outwash soils that are encountered during construction. These types of materials are anticipated to be present along much of the creek alignment due to the residential development and the presence of utility pipelines described later in this report.




**Legend**

- Streets
- Molasses Creek Subbasin
- Study Area
- Project Area
- Community Park

Surface Geology

- Qa: Quaternary alluvium
- Qp: Peat Deposits
- Qgo(i): Ice-Contact Recessional Glacial Outwash
- Qgo: Glacial Outwash
- Qls: Landslide/Mass-wasting Deposits
- Qgt: Continental glacial till

**Figure 6.**
**Geology for the Molasses Creek Fish Passage Feasibility Study.**

N

0 750 1,500 3,000
Feet

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DNR Geologic Survey

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**Alluvium and Peat Deposits:** Below the fill, alluvial deposits are commonly encountered and consist of soft to medium stiff, sandy organic silts and very loose to medium dense sands that accumulate in lakes, ponds, bogs or the low energy environments within Molasses Creek. These materials typically exhibit low shear strength, high settlement potential, and are potentially liquefiable during a moderate level earthquake. Alluvium can also include peat soils that are composed predominantly of somewhat consolidated remnant plant material and are present along the south end of Reach 2, as evidenced by the borings drilled by King County (in 2013) for the Fairwood 11 Culvert Replacement Project. Soil samples from those borings consisted of loose to medium dense silty sand to sandy silt, and variable amounts of peat and organic soils overlying medium dense to dense silty sand. These soils typically exhibit low strength, very high settlement potential, and are not typically liquefiable.

**Ice-Contact Recessional Outwash:** Ice contact recessional outwash typically consists of medium dense to dense sand to silty sand, as typified by the soils observed below the peat organic soils at the south end of Reach 2. These soils were deposited by glacial meltwater emanating from the retreating ice sheet. Because they have not been overridden by the weight of the glaciers, these soils are typically loose to medium dense and are often liquefiable.

**Glacial Till:** Glacial till is a general category of soils encompassing several different specific types of till including meltout, lodgment and ablation till and silty diamicts (i.e., a matrix-supported soil with the coarser material embedded in the finer grained matrix). Generally speaking, tills have relatively high shear strengths and low permeability and compressibility. At the margins of the Molasses Creek valley, the glacial till likely underlies the more recent deposits.

**Medium Dense to Very Dense Silt:** At the north end of the project site, King County (2014) completed a study for the Fairwood 4 Stormwater Improvement Project that encountered medium dense to very dense silt materials below the fill soils. This deposit is not typical of any of the glacial deposits mapped in the Molasses Creek subbasin and might be a glaciolacustrine material that was deposited in a slow moving environment during an interglacial period. Similar to till, it typically has high shear strength and low permeability.

## *Groundwater*

Groundwater conditions are expected to vary locally along the creek alignment. Groundwater was encountered in all for borings drilled by King County (2013 and 2014) and ranged from 9 to 20 feet below the existing ground surface over a relatively short distance at the time of drilling. The shallow organic or peat soils form relatively impermeable layers that impede water infiltration and create a shallow perched water table that is situated above the deeper valley groundwater table within the underlying glacial soils. Groundwater elevations are expected to vary seasonally and in response to rainfall (and associated creek flows) and flow from ephemeral tributary streams.

Based on observations made in the field, groundwater seepage at the ground surface appears to be collecting in depressions, such as the area north of the Seattle Public Utilities (SPU) water line corridor. Surficial water is ponding in this low area and is collected and piped into the culverted portion of Molasses Creek.

### *Soils*

According to the Soil Survey for King County as available from the Web Soil Survey maintained by the Natural Resources Conservation Service (NCRS 2022; see Figure 7), the surface soils consist of three soil types as described below.

Alderwood sandy gravelly loam,15 to 30 percent slopes (AgD): Alderwood soils are typically derived from underlying glacial till soils. Alderwood soils on steeper slopes have a moderate potential for water runoff and moderate to severe potential for erosion.

Everett very gravelly sandy loam, 8 to 15 percent slopes (EvC): Everett soils are typically derived from underlying glacial outwash soils. Everett soils typically have low runoff potential but a moderate to severe potential for erosion.

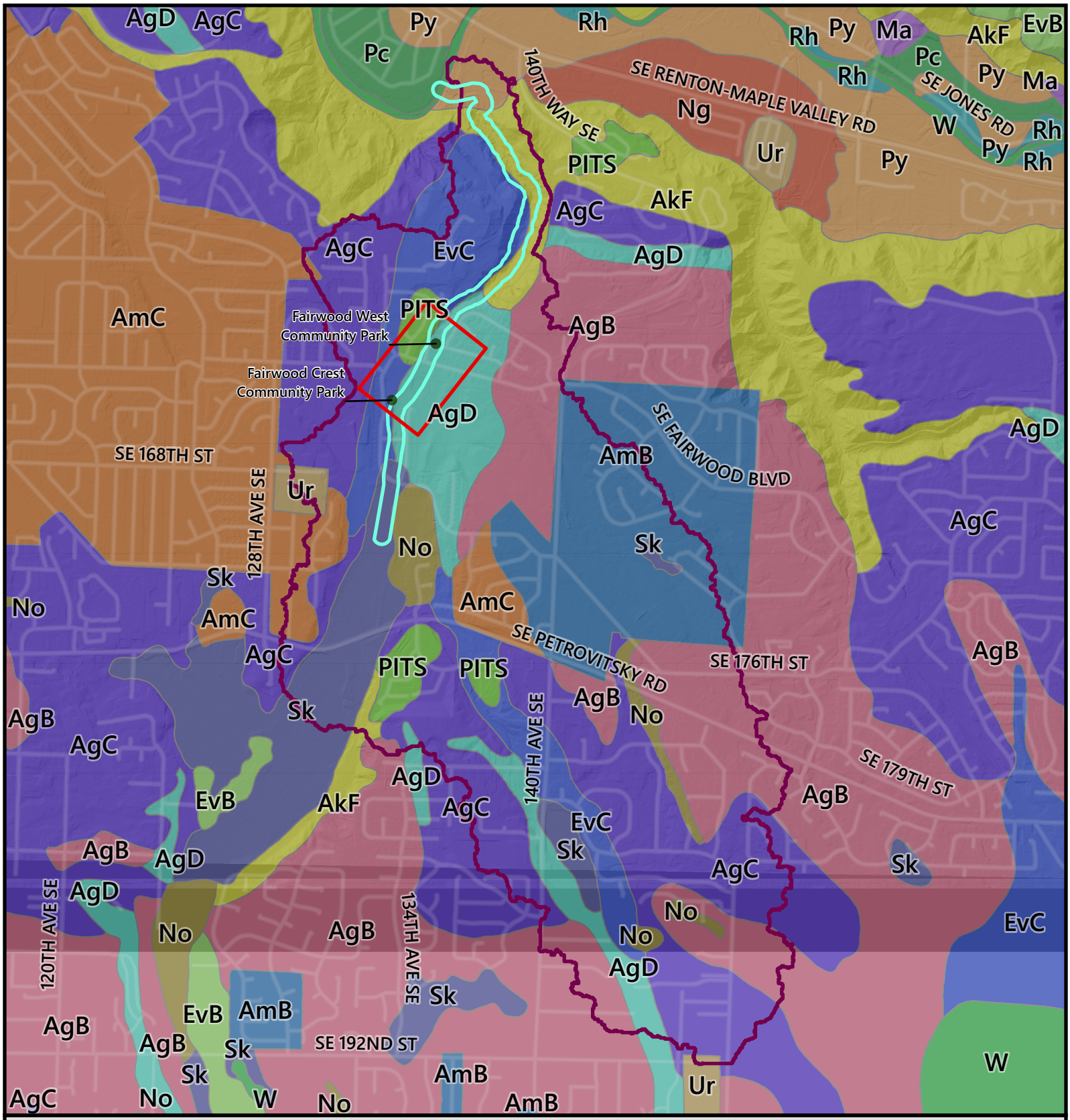
Seattle Muck (Sk): Muck typically represents peaty soils. These soils typically consist of organic materials and are located in areas of seasonally high ground water.

### *Geologic Hazards*

Review of the King County geologic hazard mapping indicates that Molasses Creek traverses areas designated as being potential erosion hazard areas (Figure 8). Seismic hazard areas are also mapped along the south end of the project area (Figure 8). This area is within the zones mapped geologically as peat and alluvium. The hazard associated with alluvium is the potential for loose, saturated soils to experience liquefaction during an earthquake. The northern end of the project areas encroaches into the 50-foot buffer zone of a potential landslide hazard area (Figure 8). Smaller unstable slopes may also occur anywhere in the actively expanding ravine downstream of the project area.

## Land Use and Land Cover Conditions

Settlement by non-native people in the Molasses Creek subbasin began in 1874 following the Georgetown to Renton railroad. The Fairwood residential neighborhood was mostly built out during the late 1960s and 1970s (King County 1993). However, the plateau upon which the Fairwood neighborhood is situated continued to be the focus of additional residential development densification in the 1990s and early 2000s. Today, land uses within the Molasses Creek Subbasin are predominantly high- and low-density single-family residential and open space. The residential land use is generally concentrated along the middle and upper reaches of the subbasin, whereas open space consists of wetlands along Reach 5 and the steep forested ravine along Reach 1.




Legend

- Study Area
- Project Area
- Molasses Creek Subbasin
- Streets
- Community Park

NRCS Soils

- AgB
- AgC
- AgD
- AkF
- AmB
- AmC
- EvB
- EvC
- Ma
- Ng
- No
- PITS
- Pc
- Py
- Rh
- Sk
- Ur
- W

**Figure 7.**
**Soil Conditions for the Molasses Creek Fish Passage Feasibility Study.**

N

0 750 1,500 3,000 Feet

HERRERA

USDA NRCS Soil Survey

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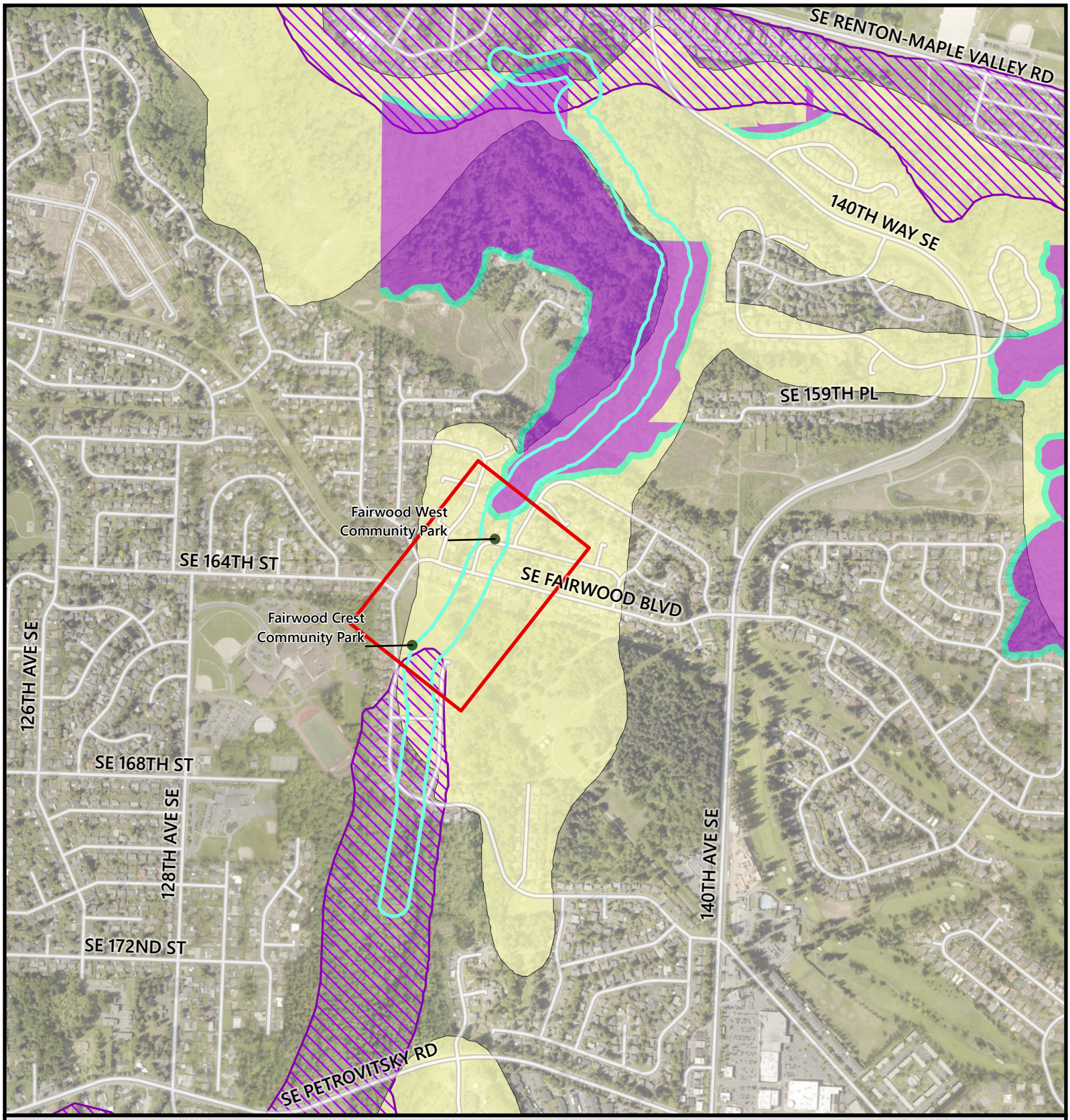


Legend

- Project Area
- Study Area
- Streets
- Potential landslide hazard areas (2016)
- Potential landslide hazard areas 50-foot buffer (2016)
- Erosion hazard (1990 SAO)
- Seismic hazard (1990 SAO)
- Community Park

**Figure 8.**
**Mapped Geologic Hazards for the Molasses Creek Fish Passage Feasibility Study.**

N

0 500 1,000 2,000 Feet

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King County Aerial, SAO 1990

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# PROJECT AREA CONDITIONS AND FIELD RECONNAISSANCE

Site reconnaissance was conducted by a multidisciplinary team and included an investigation of the lower portion of the ravine near the Molasses Creek confluence with the Cedar River, as well as the project area from Fairwood West Community Park and the creek corridor upstream through residential properties to the wetland area south of Southeast 168th Street. The site investigation did not include a complete reconnaissance of the wetland due to property access restrictions. Assessment methods and observations are provided by technical subject area below.

## Geomorphic Conditions

The geomorphic conditions of Molasses Creek within and near the project site are a product of the topography, geology, and soil conditions, combined with the hydrology and hydromodifications associated with local land use and land cover changes in the creek's subbasin in the last century. This section provides a concise summary of the geomorphic conditions within the context of the watershed geology and soil characteristics described above, as well as field observations of channel and floodplain conditions at, upstream, and downstream of the project site.

### *Geomorphic Field Assessment*

A Herrera stream engineer, geomorphologist, and biologist conducted a rapid assessment of geomorphic and physical habitat conditions in Molasses Creek on January 13, 2022. The weather was rainy in the morning and cleared up during the afternoon, which allowed for observations to be made both during a small rainfall runoff event as well as during high winter baseflow conditions. The field assessment began at the downstream end of the study area (Reach 1). Conditions were observed along the channel in the ravine, as well as throughout the project area as described above.

Stream conditions were characterized for each of the four open channel reaches of Molasses Creek. The reach boundaries are shown in Figure 2, and conditions are summarized in Table 1. Photographs of each reach are provided in Appendix A. Bankfull channel widths were recorded with a measuring tape based on field indicators such as woody vegetation and morphologic features like stream side benches and the tops of banks. Reaches 1 and 4 were selected as reference reaches for relatively good habitat fish conditions and pebble counts were collected at representative cross section locations within those reaches to characterize the channel substrate. Pebble count results for Reaches 1 and 4, respectively, are provided in Figures 9 and 10.

| Table 1. Summary of Selected Geomorphic Conditions by Reach. | | | | | | |
|---|---|---|---|---|---|---|
| Reach[a] | Channel Type[b] | Bankfull Width (feet) | Reach Slope | Geomorphic Stability | Functional Large Wood[c] | Reference Reach Potential |
| 1 | Plane bed; Cascade | 10; 15-20 | 2-4% | Incising | None; At Risk | Yes |
| 2 | Culvert | n/a | 3-5% | n/a | n/a | No |
| 3 | Plane bed | 10 | 5% | Incising and Widening | At Risk | No |
| 4 | Plane bed; Glide; Excavated/Constructed | 10 | 0.7% | Forced Stable | No | Yes |
| 5 | Wetland | 12 | 0.3% | Stable | At Risk | Maybe |

[a] Reach 2 is not an open channel reach and therefore no geomorphic conditions could be assessed

[b] Channel type based on reach morphology classification per Montgomery and Buffington (1997)

[c] Functional Large Wood assessment is based on the size, quantity, function, and recruitment potential of large wood, adapted from Ralph et al. 1994, NMFS 1996, Beechie and Sibley 1997, Fox and Bolton 2007

n/a = not applicable

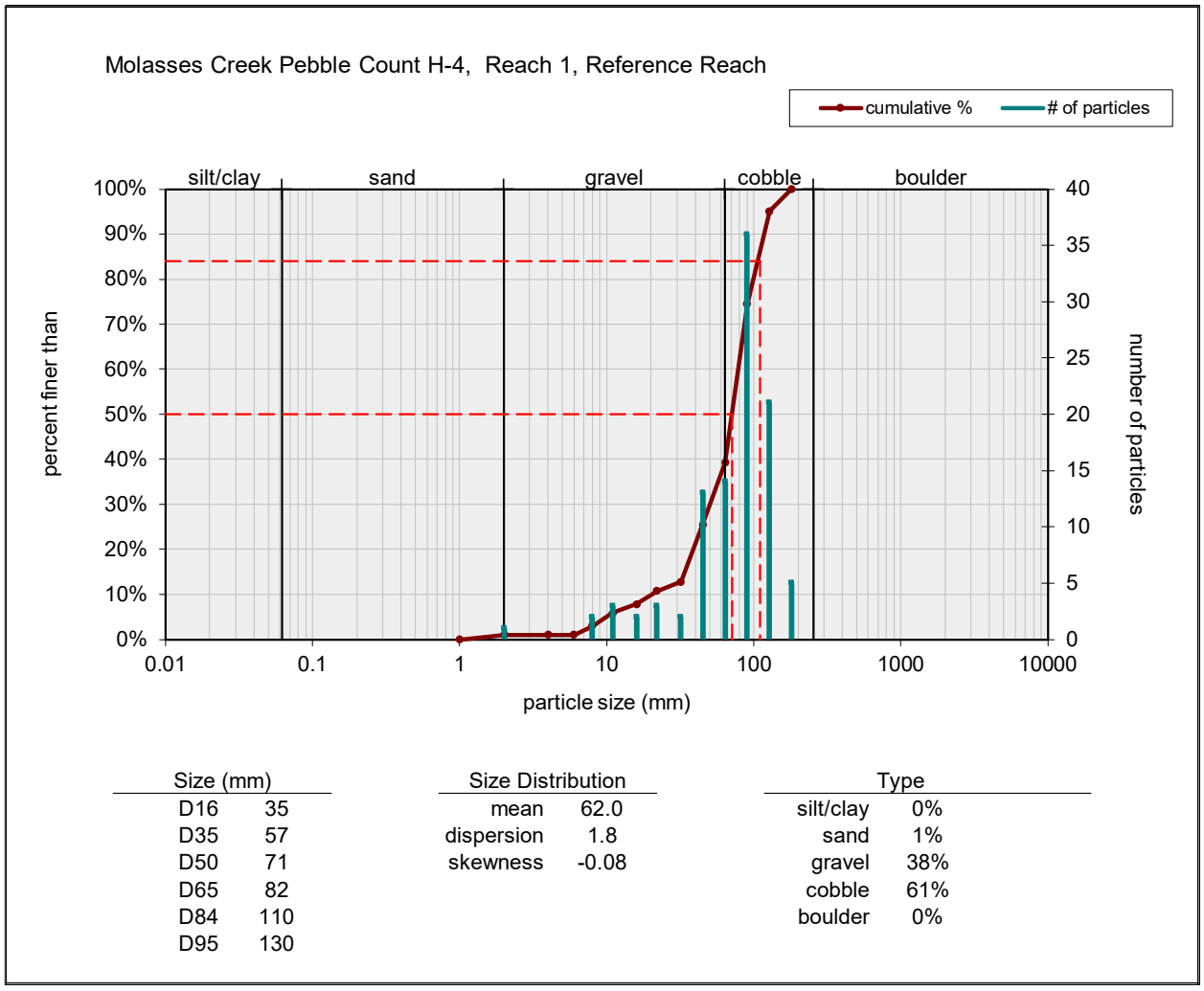



**Figure 9. Molasses Creek Reach 1 Pebble Count Results.**

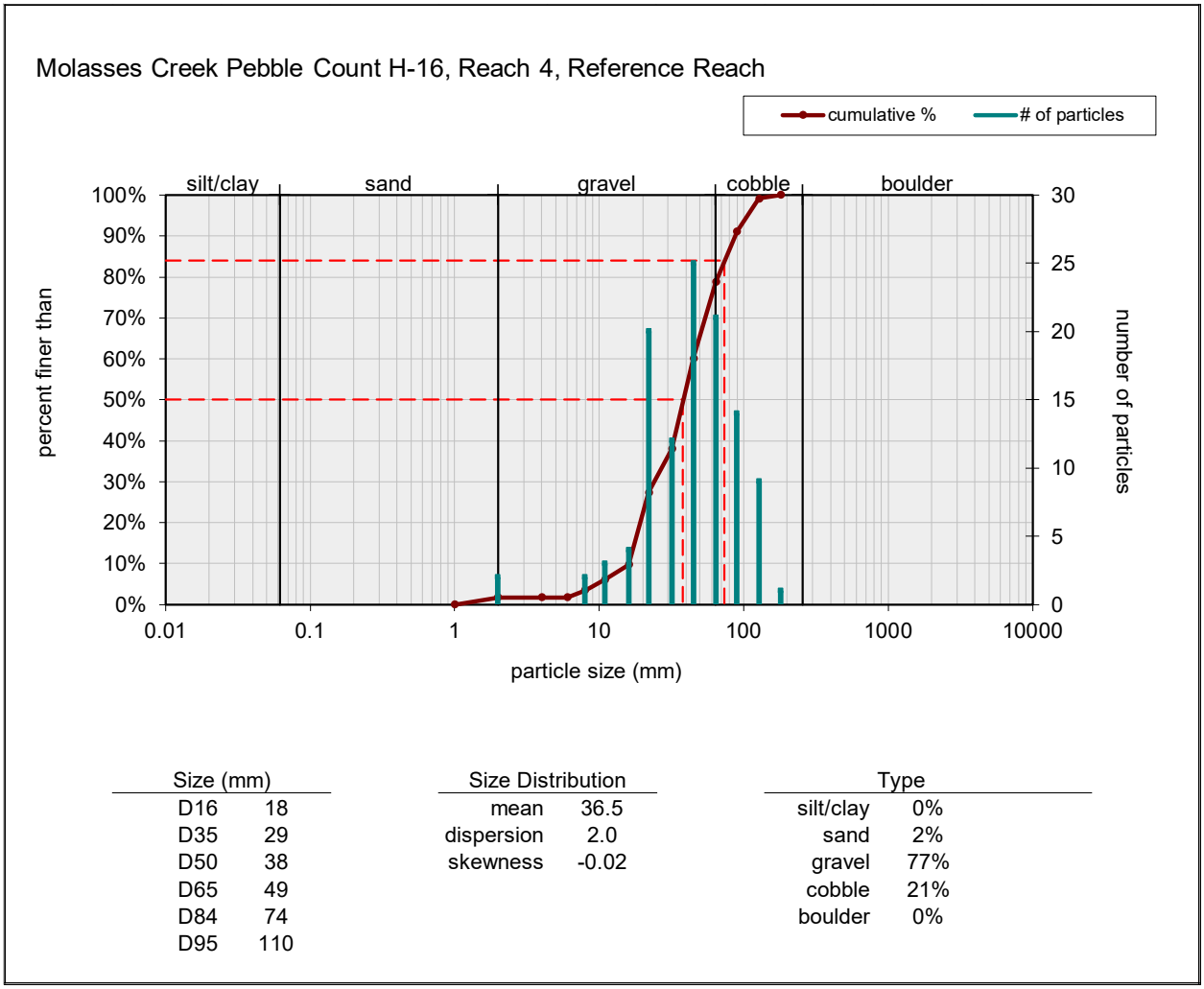



**Figure 10. Molasses Creek Reach 4 Pebble Count Results.**

## Reach 1

Reach 1 extends upstream from the creek mouth at the Cedar River through a fish ladder and series of culverts below the Soos Creek Trail, upstream through an old gravel pit area with large wetlands in the floodplain, and further upstream through a valley-confined ravine to the downstream end of the culverted project reach at Fairwood West Community Park. The creek channel is naturally incising into its glacial geology along the upstream two-thirds of Reach 1 where the channel is surrounded by forested riparian buffer that extends up the slopes. Minor erosion was observed along both banks, although historically Reach 1 has experienced erosion and landslide problems due to the erosive soils, steep topography, and seepage from upslope areas (King County 1993). The channel type in Reach 1 is cascade and plane bed. There is only a very narrow floodplain area, and although wood is present, there is not enough to be properly functioning or to support adequate pool habitat. There are a few bedrock outcroppings and adjacent areas of large boulder substrate, although the substrate is predominantly cobble and gravel elsewhere.

## Reach 2

Reach 2 is the culverted section of Molasses Creek between Fairwood West Community Park and the recently daylighted section of stream at Fairwood Crest Community Park. This reach is the primary focus of the potential fish passage and habitat improvements that the County is considering with this study. Most of the stream is conveyed through a 1,250-foot-long series of 48-inch-diameter culverts generally located between 13 and 15 feet below the existing ground, with the downstream-most 100 feet conveyed through a recently installed 8-foot by 8-foot box culvert with a roughened channel streambed in it. Herrera was unable to inspect the Reach 2 culverts directly but discussed general conditions with County personnel during the site reconnaissance (J. Polka, personal communication). Although streambed substrate was installed within the box culvert, some of that material has mobilized and streambed substrate is not expected to be continuously present in the culvert pipes upstream of the catch basin located in the Southeast 163rd Street right of way.

Upstream of Southeast 163rd Street, the Molasses Creek culvert is buried beneath a block of residential properties, Southeast Fairwood Boulevard, another block of residential properties, a large parcel owned by SPU for water supply pipelines (described later in this report), and part of Fairwood Crest Community Park. Parcel acquisition, structure removal, and significant regrading would be required to daylight the channel through the residential areas. However, the SPU parcel contains a historically forested floodplain and wetland area that is approximately 230 feet long by 110 feet wide and situated directly above the culverted stream. Stormwater runoff from adjacent slopes drains down to this forested floodplain area and an existing drainage structure and storm drain connects that drainage to the primary Molasses Creek culvert near the downstream (north) end of the SPU parcel.

## Reach 3

Reach 3 is the restored plane bed channel type located in Fairwood Crest Community Park. The channel and floodplain are artificially confined by houses and yards in the Fairwood neighborhood. In 2021, the County daylighted approximately 180 feet of Molasses Creek through Fairwood Crest Community Park. Log and boulder structures were placed throughout the re-created channel, but the channel is still adjusting to its new position and geometry and shows signs of incising and widening. The channel slope was designed to be about 5 percent. Erosion was observed along both banks through about a quarter of the reach length. Although the channel has incised below the placed logs, the logs help to encourage thalweg meandering, and support gravel sorting and localized bar formation. The functional large woody debris (LWD) included in this construction project is considered at risk because of the lack of future recruitment potential. The primary substrate is cobble and gravel.

### Reach 4

Upstream from Reach 3, this reach passes through residential properties. The channel in this reach is armored (by design) to hold a trapezoidal shape, to function as an in-line runoff retention and detention facility. The channel and banks have forced stability due to the buried riprap armoring. At the time of the site reconnaissance, Reach 4 was primarily composed of plane bed channel types with some local glide habitat. The channel slope here is lower than it is downstream, closer to 1 percent. There is no sinuosity and poor stream complexity, and no functional wood in the channel. Substrate material is primarily gravel and cobble.

### Reach 5

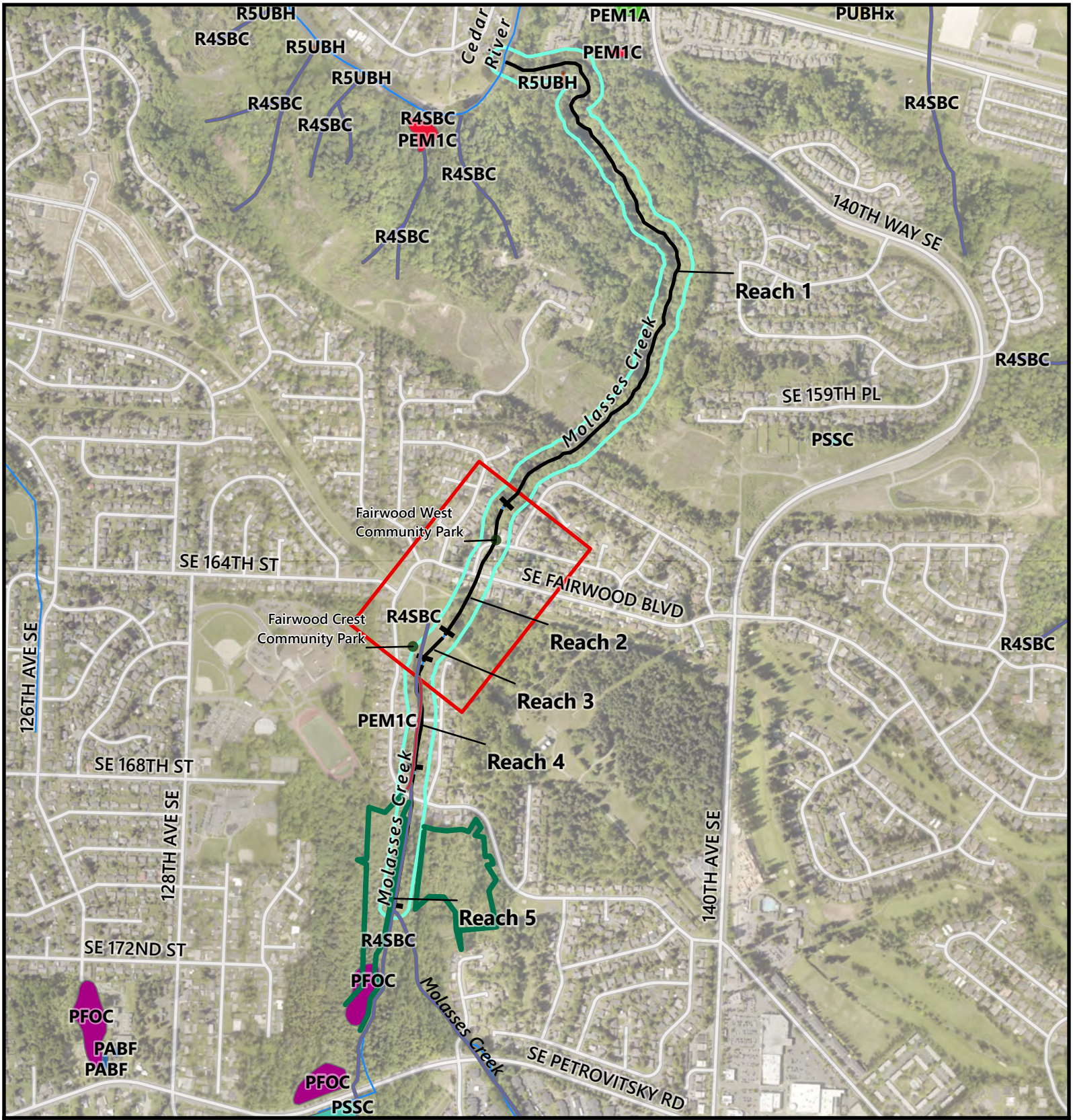
Only the lowermost section of Reach 5 was observed from the right bank (facing downstream) during the site reconnaissance due to access restrictions. Upstream of Southeast 168th Street, the Molasses Creek channel is adjacent to one residential parcel before it opens up into a broad forested wetland that extends upstream to Southeast Petrovitsky Road. The channel type is an unconfined wetland and there appear to be multiple flow paths through the wetland. The bankfull width of the primary channel observed at the downstream end of the wetland area was measured to be approximately 12 feet. Sinuosity increases in the upstream direction throughout Reach 5, based on channel delineation information presented in Holcomb and Rigos (2016). The observed channel bed and banks in Reach 5 were stable with less than 5 percent of the observed bank eroded. This intact bank condition likely continues upstream beyond the observed portion of the reach where the channel is not confined and connectivity with wetland habitat is high. Stream complexity is good but functional LWD is minimal with large key pieces missing and small woody debris predominant. Although some patches of small gravels were present in the observed channel section, stream substrate appeared to be dominated by sands and fines in most places, which is common in a flat stream reach in this geologic setting.

## Ecological Conditions

Molasses Creek is a heavily modified system resulting from intensive upland development. Risk of landslides and steep, unstable slopes prevent further development near the creek in Reach 1, which enables relatively intact natural instream and riparian habitat through the ravine. Ecological conditions of both upland and stream habitats varies widely among the reaches evaluated in this assessment as described below.

### *Riparian Habitat Conditions*

During the site reconnaissance on January 13, 2022, a Herrera biologist took notes of riparian plants and conditions, possible wetlands based on observed plants and hydrology, floodplain connectivity, and potential wildlife use. These observations were compared with conditions found in searches of publicly available databases and documents shared by King County. The results of the field and desktop analyses are shown on Figure 11 and discussed below.




Legend

- Study Area
- Project Area
- Reaches
- Streets
- Streams
- Approx. Wetland Boundary (Holcomb & Rigos 2016)
- Community Park

NWI Wetland and Riparian areas

- PABF
- PEM1A
- PEM1C
- PFOC
- PSSC
- PUBHx
- R4SBC
- R5UBH

**Figure 11.**
**Upland Habitat Conditions for the Molasses Creek Fish Passage Feasibility Study.**

N

0 500 1,000 2,000 Feet

HERRERA

NWI Wetlands, King County Aerial

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## Riparian Habitat

Riparian habitat conditions vary widely among the five reaches described in this report. Reach 1 flows through a large mixed forest with 100 percent intact canopy cover. The vegetative buffer extends for a distance ranging from 200 to 1,700 feet from the stream. The canopy is a mix of mature and juvenile coniferous and deciduous trees, including western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*), Douglas fir (*Pseudotsuga menziesii*), red alder (*Alnus rubra*), black cottonwood (*Populus trichocarpa*), and big-leaf maple (*Acer macrophyllum*). The coniferous tree presence increases moving upstream in the ravine. The understory is dominated by native forested scrub-shrub vegetation such as western sword fern (*Polystichum munitum*), salmonberry (*Rubus spectabilis*), common snowberry (*Symphoricarpos albus*), vine maple (*Acer circunatum*), devil's club (*Oplopanax horridus*), and horsetail (*Equisetum* spp.). Invasive and non-native species present include Himalayan blackberry (*Rubus armeniacus*), holly (*Ilex* spp.), herb Robert (*Geranium robertianum*), and creeping buttercup (*Ranunculus repens*), but this vegetation did not have dominant coverage except in open spaces near development.

In Reach 2, Fairwood West Community Park contains mature coniferous trees and landscaped lawn and shrubs. There is otherwise no riparian habitat in this reach to take advantage of if the stream is daylighted because the remainder of the land uses along the creek's alignment are associated with residences and roadway right of way.

Near the upstream end of Reach 2, Molasses Creek flows beneath parcel 2723059020 at 16501 140th Avenue Southeast, which is owned and operated by SPU. Additional surface runoff from uphill drains to a low area in the center of the parcel that contains a mix of native and invasive forested scrub-shrub species. A catch basin collects runoff in this low area and routes it into Molasses Creek. Within the mixed forest area there is 100 percent canopy coverage with a riparian buffer that ranges from approximately 135 feet to over 650 feet. The surrounding areas to the north, west, and south are developed with minimal riparian vegetation.

A portion of Molasses Creek was recently restored within Fairwood Crest Community Park and represents Reach 3 as discussed in this report. All vegetation along the restored channel length has been planted recently, and consists of salmonberry, red osier dogwood (*Cornus sericea*), and willows (*Salix* spp.). As the vegetation matures, assuming it grows as intended, it will provide 100 percent riparian cover with a buffer extending from 30 feet to 80 feet wide; however, the vegetation will take at least 10 years to provide riparian functions as it matures.

Where the creek flows between private residences in Reach 4, riparian canopy cover is variable, between 0 to 20 percent and the riparian buffer similarly varies from 0 to 80 feet wide depending on extents of property owner landscaping. Riparian vegetation contains a mix of native coniferous and deciduous trees and native, ornamental, and invasive shrubs and groundcover. The upstream portion of this reach has substantial reed canarygrass (*Phalaris arundinacea*) cover encroaching on the stream channel. Invasive species, such as reed canarygrass and Himalayan blackberry, often degrade conditions for fish habitat and movement.

Reach 5 was not fully assessed due to access restrictions. Riparian canopy cover appears consistently near 100 percent throughout the reach, with a riparian buffer that extends from

400 to 900 feet wide. Tree cover at the downstream end of the reach is dominated by deciduous species, mainly red alder and black cottonwood. Understory vegetation is a mix of native and invasive scrub-shrub wetland and upland vegetation, such as red osier dogwood, salmonberry, reed canarygrass, and Himalayan blackberry, which is consistent with the vegetation identified in a wetland delineation report of the area (Holcomb and Rigos 2016).

### Wetland Habitat

Wetlands have been delineated and identified within Reaches 1 and 5 within the study area. In Reach 1 there is a 0.17-acre freshwater emergent wetland located east of Molasses Creek near the intersection of Southeast Renton-Maple Valley Road and 140th Way Southeast. This is consistent with the location of a wetland observed during the site reconnaissance, with emergent and forested scrub-shrub vegetation and snags, which create good habitat for wildlife. Surface outflows from the wetland may enter Molasses Creek through a culvert. The three wetlands in Reach 5 are rated Category II depressional and riverine wetlands, separated by an access road (Holcomb and Rigos 2016). Molasses Creek is braided as it flows through the wetlands in Reach 5 with four small tributaries. The wetlands in Reach 5 provide substantial flood storage and good habitat for fish and wildlife.

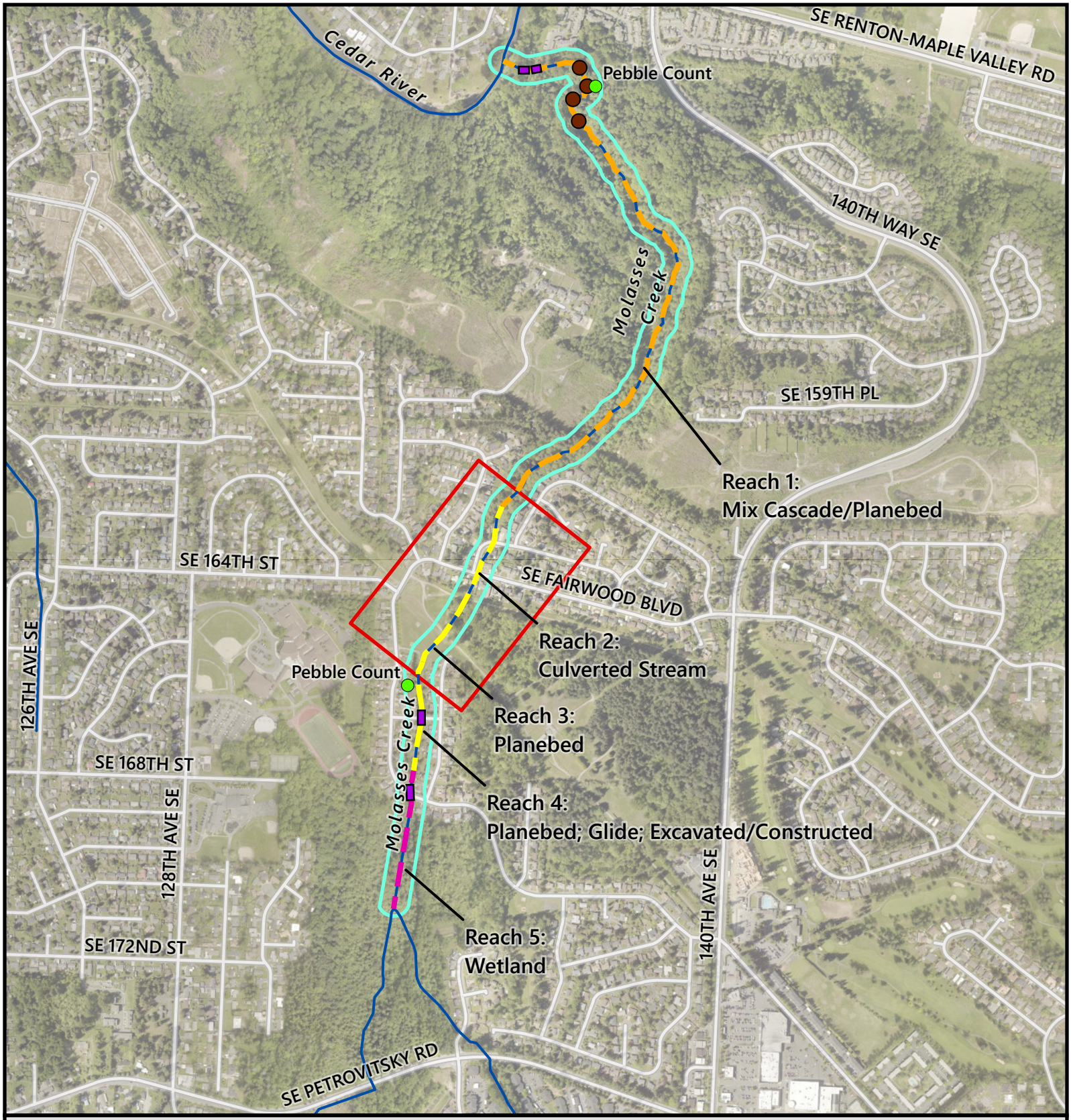
In Reach 2 where Molasses Creek flows beneath the SPU parcel, surface water ponding and flow emanating from uphill areas were observed in the forested area. Although the parcel is not identified as having a wetland by online databases (King County 2022a; USFWS 2022), the riparian vegetation (rush [*Junchus* spp.], reed canarygrass [*Phalaris arundinacea*], Himalayan blackberry) and surface water ponding may be indicative of wetland conditions.

### Floodplain Habitat

There is no mapped floodplain in the project area (Zone X; FEMA 2020); however, the mouth of Molasses Creek is within the Cedar River floodplain (Zone AE, FEMA flood insurance rate map panel 53033C0983G, effective August 19, 2020). The degree of floodplain connectivity varies widely between reaches of Molasses Creek observed during the field reconnaissance and is correlated with the amount of available wetland habitat and channel gradient. Floodplain connectivity is low in Reach 1 where channel gradient is high and in the restored channel section in Reach 3 where steep slopes and lack of wetland habitat prevent additional inundation. Floodplain connectivity is high in Reach 5 at the upstream end of the study area and in Reach 4 between private residences due to a lower gradient and low channel banks.

## *Stream Habitat Conditions*

Stream habitat observations during the site reconnaissance focused on physical habitat conditions and habitat complexity, streambed substrate suitability for salmonid spawning and rearing habitat, presence and hydraulic engagement of LWD, bank conditions, and potential fish habitat and access. These observations were supplemented by desktop analyses of water quality, fish passage, and fish and wildlife presence. The results of the field and desktop analyses are shown on Figure 12 and discussed below.




## Legend

- Study Area
- Project Area
- Streams
- Culvert
- Streets
- LWD
- Pebble Count Location

Channel Type

- Mix Cascasde/Planebed
- Planebed/Glide
- Wetland

**Figure 12.**
**Stream Habitat Conditions for the Molasses Creek Fish Passage Feasibility Study.**

N

0 500 1,000 2,000 Feet

HERRERA

King County Aerial

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## Habitat Complexity

Complex habitat conditions include variable channel units (pools, riffles, glides), heterogeneous channel geometry with the potential for multiple or sinuous flow paths (side channels, debris jams), and diverse microtopography (bars, floodplain benches), which together support a variety of habitats under varying flow conditions and are important for supporting spawning and/or rearing habitat for fish. Habitat complexity is rated as "poor/simple", "fair", "good", or "excellent/complex" based on qualitative features established in McBride (2001; Table 2).

**Table 2. Stream Complexity Classification Criteria (McBride 2001).**

| Classification Category | Description |
|---|---|
| Excellent/Complex | Diverse and complex structure |
| | Variety in channel units (pools, riffles, glides) |
| | Side channels and/or debris jams present |
| | Diverse microtopography |
| | Variable channel geometry |
| Good | Less diverse and complex structure |
| | Some variety in channel units |
| | Side channels and/or debris jams less frequent |
| | Some heterogeneity in microtopography and channel geometry |
| Fair | Little diversity or complexity in structure |
| | Little variety in channel units |
| | Very few side channels and/or debris jams |
| | Little heterogeneity in microtopography and channel geometry |
| Simple/Poor | Simple structure |
| | No variety in channel units |
| | No side channels or debris jams present |
| | Homogenous microtopography |
| | Very little variety in channel geometry |

Consistent with its riparian buffer, substrate material, and LWD presence (see description of functional LWD below), Reach 1 has "good" habitat complexity that decreases to "fair" through Reaches 3 and 4. Habitat complexity is likely "good" through Reach 5 based on what was observed at the downstream end of the reach, but much of Reach 5 was not visited during the site reconnaissance due to limited site access . The "good" to "fair" stream complexity ratings are characterized by good riparian buffers (greater than 50 feet vegetated width), with some presence and/or recruitment potential of LWD, unarmored channel bed and banks, and access to bedload sediment supply. As Reach 2 is confined to a system of pipes, it has no complexity or habitat features to support fish.

The type and amount of fish cover and human influence vary substantially between reaches. Fish cover in Reach 1 consists of overhanging vegetation, undercut banks, and boulders and instream wood. Human influences observed in Reach 1 were limited to the upstream and downstream limit and include drainage outfalls, culverts, an unpaved trail, and clearing

associated with residential development. The amount of human influence is greatest in Reaches 2, 3, and 4. Fish cover is absent in Reach 2, limited to placed instream wood in Reach 3 until plantings mature to provide vegetative cover, and minimal in Reach 4 with some undercut banks beneath reed canarygrass encroachment and limited overbank vegetation between landscaped yards and mowed lawns. Similar to Reach 1, human influence in Reach 5 is limited to the upstream and downstream limits and include culverts and clearings associated with residential housing. Fish cover is greatest through Reach 5 with overhanging vegetation, LWD, and wetland connectivity.

### Functional LWD

Functional LWD, defined as woody material greater than 4 inches in diameter and 6 feet in length, is lacking throughout much of the study area. Although the ravine in Reach 1 has high recruitment potential with the mature mixed forest and wide riparian buffer, few LWD pieces were observed engaging with the stream channel to create hydraulic complexity. During the site reconnaissance in January 2022 along approximately 0.21 mile of Reach 1, only 12 functional LWD pieces were observed, of which nine were within the channel (Figure 12). There were no pieces of functional LWD observed in Reaches 2 or 4, and the 24 pieces of LWD observed in Reach 3 were placed. Observations in Reach 5 were limited to the downstream end adjacent to a residential house and no counts of LWD were documented in the wetland delineation report (Holcomb and Rigos 2016). The lack of LWD observed in Reaches 2 and 4 limits channel resiliency to watershed or localized changes, reduces instream habitat complexity, and limits the amount of cover and refuge for rearing salmonids.

### Substrate

Channel substrates throughout the study area are dominated by gravel, with cobble present in the lower, non-piped reaches (Reach 1 and Reach 3). The substrate type, as well as generally low levels of riffle cementation and embeddedness would support spawning and/or rearing habitat for fish in Reach 1, with suitable spawning and rearing substrate material decreasing further upstream. Riffle substrate embeddedness is low (0 to 25 percent) in Reaches 1 and 3, but increases in Reach 4. Riffle gravel cementation is rated as “good” in Reaches 1 and 3 where gravels are present and mostly loose, and “poor” in Reach 4 where the substrate is dominated by sands and fines.

## *Water Quality*

There is one water quality listing for Molasses Creek in the Washington State Department of Ecology’s database of degraded water bodies, the so-called Section 303(d) (of the federal Clean Water Act) list. Molasses Creek is listed for bioassessment because two or more benthic index of biotic integrity (B-IBI) data points among the most recent five data points indicate biological degradation (Ecology 2022). A B-IBI score below 27 indicates degraded biological integrity. Although Molasses Creek had three data points within the 5 years assessed that fell below a B-IBI score of 27 (24 in 2006; 24 in 2007; 26 in 2008), more recent results indicate the bioassessment scores have improved. From 2018 to 2021, B-IBI scores continued to improve

from 40.7 in 2019 to 55.5 in 2021, all rated as "good" to "fair" (King County 2022b), which likely indicates this creek is no longer qualified for listing as a Category 5 degraded water. There are no other listings in Molasses Creek to indicate issues or concerns with water quality.

## Fish and Wildlife Presence

Several salmonid species have access to and occur in Molasses Creek; however, anadromous fish use is limited to Reach 1 in the ravine (WDFW 2022a, b, c; Table 3). Within Reach 1, Molasses Creek flows through the Cedar River Valley Open Space Area (Soos Creek Park and Trail), which is designated as a biodiversity area and provides habitat for several avian and terrestrial wildlife species (WDFW 2022a; Figure 12). During the field investigation, several deer were observed foraging within the SPU parcel. The study area also provides habitat for birds, amphibians, mammals adapted to urban areas (e.g., coyote, deer, and mountain lion), and resident fish species. According to the eBird website, 88 species of birds have been observed in the adjacent Renton Natural Area above Maplewood (eBird 2022).

**Table 3. Anadromous Fish Presence in Study Area.**

| Species | Presence[a,b,c] | Habitat Use[b] | Federal Status | Critical Habitat |
|---|---|---|---|---|
| Chinook salmon *(Oncorhynchus tshawytscha)* | Gradient accessible | Non-natal rearing | Threatened (70 FR 52630, eff. 1/2/2006) | Not present in study area |
| Coho salmon (*O. kisutch*) | Documented | Spawning | Not listed | Not applicable |
| Sockeye salmon (*O. nerka*) | Documented | Spawning | Not listed | Not applicable |
| Steelhead (*O. mykiss*) | Gradient accessible | Non-natal rearing | Threatened (81 FR 9252, eff. 3/25/2016) | Present in lower reaches of study area |
| Resident rainbow trout (*O. mykiss*) | Documented | Non-natal rearing | Not listed | Not applicable |
| Resident cutthroat trout (*O. clarkii*) | Documented | Spawning | Not listed | Not applicable |

[a] WDFW 2022a

[b] WDFW 2022b

[c] WDFW 2022c

## Fish Passage

Molasses Creek flows through two culverts near its confluence with the Cedar River in Reach 1. The downstream-most culvert and an engineered fishway extending toward the river from it is a partial (33 percent) fish passage barrier due to excessive water surface drop (WDFW 2022c). During the field investigation, the culvert inlet (composed of two adjacent round, corrugated steel pipes) was blocked by woody and organic debris, likely increasing the barrier status. The upstream culvert is an 8-foot-diameter arch beneath the foot trail and is 100 percent fish passable (WDFW 2022c). The next culvert upstream of the creek mouth area is the recently

replaced culvert outlet in Fairwood West Community Park. The culvert was previously rated as a complete fish passage barrier due to slope (WDFW 2022c) but has not been assessed following the restoration; however, access upstream of the new culvert is restricted by a closed system consisting of nine culvert pipe sections connected by runoff collection boxes. The culvert inlet upstream in Fairwood Crest Community Park was similarly rated as a complete fish passage barrier due to slope prior to restoration actions and has not been reassessed.

The remaining culverts within the study area, under Southeast 166th Place and Southeast 168th Street, have not been assessed by the Washington Department of Fish and Wildlife (WDFW) for fish passability. Both of these culverts are round, 3-foot-diameter corrugated metal pipes that appear to be countersunk. These culverts were not rated in the field for passability, but the observed conditions associated with each culvert indicate possible slope or velocity barriers to fish passage.

## Utilities

Herrera conducted a site visit and performed desktop analysis to determine subsurface utilities, including storm drain pipes, wastewater sewer lines, water lines, and fiber optic cables, present in the project area that may be affected by project activities or present considerations for alternative construction planning (Figure 13; Appendix B). Highlights from the utilities investigation are as follows:

- There are four steel SPU water lines running southeast-northwest along the SPU waterline trail easement. The depth of these pipes is unknown.
- The Renton Fiber Project has fiber optic cables running underground east-to-west along the north end of the SPU parcel for a length of about 1,500 feet before shifting aboveground to run overhead on the power poles at the northwest edge of the forested wetland.
- Several storm drains and sewer lines are buried in the rights of way of surrounding streets.
- A Cedar River Water and Sewer District trunk sewer line parallels Molasses Creek along 132nd Place Southeast before crossing the creek on the SPU parcel and again near Fairwood Boulevard, continuing to the northwest and out of the study area. The depth of this sewer line is unknown.

## Hydrologic and Hydraulic Conditions

The existing hydrologic and hydraulic conditions represented in this section were extracted from the Fairwood West pipe removal for the Molasses Creek Fish Passage Feasibility Study. King County provided Herrera with the PCSWMM model summarized below and the full drainage report for that project (King County 2021).

## PCSWMM Model

PCSWMM software was used to model the 10-, 25-, 50- and 100-year recurrence interval flood events in Molasses Creek under existing conditions in the project area. The Fairwood West project model extended from south of (upstream of) the culvert under Southeast 168th Street to the downstream end at Fairwood West Community Park. The open channel sections between Southeast 168th Street/Southeast 166th Place and north of Southeast 166th Place (labeled as 'Cell1' and 'Cell2' in the model) were modeled as ponds due to their ponding function during high flow events. The area north of Southeast 166th Place was modeled as an open channel for lower flow analyses. The Molasses Creek culvert lengths, slopes, and diameters were among the model inputs.

The hydrologic inputs for the PCSWMM model were based on a combination of recurrence interval peak flows derived from hydrologic modeling done for the Cedar River Current and Future Conditions Report by King County (1993, Table 4) and the hydrograph shape from a peak storm event recorded at the mouth of Molasses Creek. In order to evaluate unsteady flow conditions with PCSWMM, the modeled future conditions recurrence interval peak flows for Madsen Creek at the project site (King County 1993) were scaled to the hydrograph of the largest storm event recorded at King County gage 31c at the mouth of Molasses Creek.

**Table 4. Recurrence interval peak flows from the Cedar River and Future Conditions Report (King County 1993).**

| Flow Frequency (years) | Inflow (cfs) |
|---|---|
| 10 | 126 |
| 25 | 152 |
| 50 | 172 |
| 100 | 192 |

Table 5 lists the peak outflows simulated with the County's PCSWMM model at the downstream end of the project area. The results for the model show that the existing culverts under Southeast 168th Street and Southwest 166th Place surcharge in the 10-, 25-, 50-, and 100-year recurrence peak flow conditions. The 440-foot-long reverse grade pipe under the wetland is always full of water. The County's model results indicate that the 48-inch-diameter concrete pipe between Fairwood Boulevard and Southeast 163rd Street surcharges in the 100-year flow event. All other pipes along Molasses Creek do not have any capacity issues.

**Table 5. Outflow from PCSWMM Model.**

| Flow Frequency (years) | Outflow (cfs) |
|---|---|
| 10 | 116 |
| 25 | 138 |
| 50 | 152 |
| 100 | 166 |


**HERRERA**

# MOLASSES CREEK
EXISTING CONDITIONS

DATE: DATE

DRAWING:

SHEET: 1 OF 2



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RENTON FIBER OPTICS OVERHEAD

UNKNOWN POWELINE

RENTON FIBER OPTICS CONDUIT

SPU WATER LINES

CEDAR RIVER WATER AND SEWER DISTRICT SEWER LINE

MOLASSES CREEK 48-IN CMP

134TH AVE SE

135TH AVE SE

FAIRWOOD BLVD

SE 163RD ST

40 0 40 80

1"=40'

# MOLASSES CREEK

EXISTING CONDITIONS

DATE: DATE

DRAWING:

SHEET: 2 OF 2

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# SUMMARY AND RECOMMENDATIONS

A potentially significant barrier to fish passage in Molasses Creek is the approximately 1,250 feet of stream length that is confined to a series of 48-inch-diameter culverts through Reach 2. Other potential fish passage barriers include the culverts at the confluence with the Cedar River, and the culvert crossings of Southeast 166th Place and Southeast 168th Street, both of which have not been assessed by the Washington Department of Fish and Wildlife for potential barrier status.

An extension of the recent Fairwood West Community Park Restoration project onto the SPU parcel could daylight approximately 500 feet of stream length, with necessary culverts to maintain road access and protect utilities. The SPU parcel also provides potential for enhanced wetland and floodplain connectivity through the center of the parcel, where surface runoff is collected and routed into the long Molasses Creek culvert system. Additional stream channel daylighting possibilities downstream of the SPU parcel would require acquiring private properties, which could be done in phases as owners are willing to sell to King County or properties become available on the market. Because the long culverted section of Molasses Creek in Reach 2 is 13 to 15 feet below existing ground, all daylighting options in this reach will need to consider the amount of regrading necessary in proximity to residences and infrastructure. Daylighting of an open channel could yield additional flood storage benefits that address some of the storm drainage system capacity issues described above. Potential daylighting of Molasses Creek through Fairwood West Community Park would eliminate much of the limited space available for recreation and thus would require engagement with and approval by the community. The opportunities for daylighting Molasses Creek through Reach 2 do not overlap with steep slopes; however, geologic hazards should be considered and a geotechnical investigation should be included in all alternative assessments to assess slope stability, ensure project design and construction provide for adequate erosion control, and evaluate potential negative impacts to adjacent slopes and buffer areas.

Habitat conditions in Reach 3 were improved through the recent Fairwood Crest daylighting project that included acquiring a property for grading a more gradual slope, installing LWD throughout the daylighted channel length, and planting the banks with native vegetation. Habitat conditions will improve as the channel adjusts and establishes a new quasi-equilibrium grade, and as riparian vegetation grows and matures. However, supplementing plants with conifers and other perennial vegetation will help reestablish a healthy riparian buffer and canopy cover, as well as enhance the aesthetic for the neighborhood residents and park visitors. Improvements to habitat conditions in Reach 4 may be limited by property owner willingness. Outreach activities, such as educational material that describes the benefits of native vegetation for enhancing streambank stability, as well as information on grants or rebates for natural landscaping may enable improving riparian and channel conditions along the stream in this area.

# REFERENCES


Beechie, T.J. and T.H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126:217-229.

eBird. 2022. eBird: An online database of bird distribution and abundance [web application]. eBird, Ithaca, New York. Accessed 16 February 2022. <http://www.ebird.org>.

Ecology. 2022. Washington State Water Quality Assessment 303(d)/305(b) List: Listing ID 70078. Washington State Department of Ecology. Accessed 12 January 2022. <https://apps.ecology.wa.gov/approvedwqa/approvedpages/viewapprovedlisting.aspx?LISTING_ID=70078>.

FEMA. 2020. FIRMette 53033C0983G, effective 8/19/2020. Federal Emergency Management Agency Flood Map Service Center. Accessed 12 January 2022. <https://msc.fema.gov/portal/home>.

Fox, M. and S. Bolton. 2007. A Regional and Geomorphic Reference for Quantities and Volumes of Instream Wood in Unmanaged Forested Basins of Washington State. North American Journal of Fisheries Management 27:342–359.

Holcomb, C. and M. Rigos. 2016. Wetland delineation and stream report for the Ann Marie Linn Development. Prepared for Ann Marine Linn, LLC by Red Wing Environmental. February 1, 2016.

King County. 1993. Cedar River Current and Future Conditions Report. King County Department of Public Works Surface Water Management Division. April 1993.

King County 2013. Fairwood 11 Culvert Replacement 2: Project #117559. Prepared by King County Road Services Division, April 18, 2013.

King County. 2014. Fairwood 4 Stormwater Improvement Project: Geotechnical Investigation Report. Prepared by King County Department of Transportation, April 2014.

King County. 2021. WLSWC Fairwood 11 Pipe Phase 2. Full Drainage Review. Prepared by King County Road Services Division, January 2021.

King County. 2022a. King County iMap. King County. Accessed 12 January 2022. <https://gismaps.kingcounty.gov/iMap/?mapset=wria>.

King County. 2022b. Puget Sound Stream Benthos. Accessed 12 January 2022. <https://pugetsoundstreambenthos.org/Default.aspx>.

McBride, M. 2001. Spatial effects of urbanization on physical conditions in Puget Sound lowland streams. Water Resources Services, Technical Report No. 177, Department of Civil and Environmental Engineering, University of Washington, Seattle, Washington.

Montgomery, D.R. and J.M. Buffington. 1997. Channel-reach morphology in mountain drainage basins. GSA Bulletin 109(5):596 611.

NMFS. 1996. Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale. National Marine Fisheries Service, Environmental and Technical Services Division, Habitat Conservation Branch: <http://www.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/Biology/NMFS_Matrix.pdf>.

NRCS. 2022. Web Soil Survey. USDA Natural Resources Conservation Service. Accessed 12 January 2022. <https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>.

Ralph, S.C., G.C. Poole, L.L. Conquest, and R.J. Naiman. 1994. Stream channel morphology and woody debris in logged and unlogged basins of western Washington. Canadian Journal of Fisheries and Aquatic Science 51:37-51.

USFWS. 2022. National Wetlands Inventory. U.S. Fish and Wildlife Service. Accessed 12 January 2022. <https://www.fws.gov/wetlands/Data/Mapper.html>.

WDFW. 2022a. Priority Habitats and Species on the Web. Washington Department of Fish and Wildlife. Accessed 12 January 2022. <https://geodataservices.wdfw.wa.gov/hp/phs/>.

WDFW. 2022b. SalmonScape. Washington Department of Fish and Wildlife. Accessed 12 January 2022. <http://apps.wdfw.wa.gov/salmonscape/map.html>.

WDFW. 2022c. Washington State Fish Passage. Washington Department of Fish and Wildlife. Accessed 12 January 2022. https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html>.

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# APPENDIX A

## Photo Log

# Molasses Creek at RM 0-1.8: Photographic Log

| Photo Number | Photo Description |
|---|---|
| 1 | Looking upstream to fish way in Reach 1 at confluence with Cedar River. |
| 2 | Looking downstream to fish way in Reach 1 at confluence with Cedar River. |
| 3 | Looking downstream at the downstream portion of Reach 1, with a planebed channel type and predominantly deciduous riparian vegetation. |
| 4 | Looking upstream to some Large woody debris (LWD) and a gravel bar in Reach 1. |
| 5 | Looking upstream to cascade habitat within Reach 1. |
| 6 | Upstream end of Reach 1 ravine with cascade and planebed morphology. |
| 7 | Downstream edge of Reach 2, showing the recently restored 8-foot box culvert with roughened streambed. This culvert extends for approximately 100 feet before entering a 48-inch piped system. |
| 8 | North end of forested wetland area on SPU Property situated above the culverted Molasses Creek, showing catch basin in lower left corner that directs surface flow into the culverted Molasses Creek. |
| 9 | View west on SPU Property in Reach 2; yellow posts show outside extents of SPU pipeline. |
| 10 | View south (upstream) on SPU Property in Reach 2 toward Reach 3, where the recently daylighted and restored portion of Molasses Creek lies beyond orange fencing. |
| 11 | Downstream end of daylighted portion of Molasses Creek in Fairwood Crest Community Park (Reach 3). |
| 12 | View south (upstream) in Reach 3 along daylighted portion of Molasses Creek in Fairwood Crest Community Park. |
| 13 | Rock placed to stabilize right bank in Reach 3. |
| 14 | View north (downstream) in Reach 3 showing wood angles and placement. |
| 15 | View south (upstream) in Reach 4 showing glide/planebed stream type between single-family residential homes. |
| 16 | Looking upstream to the first culvert in Reach 4, at Southeast 166th Place. |
| 17 | View south (upstream) in Reach 4 upstream of the culvert beneath Southeast 166th Place. |
| 18 | Reed canarygrass encroachment on stream at upstream end of Reach 4. |
| 19 | Culvert outlet at Southeast 168th Place, at the boundary between Reach 4 and 5. |
| 20 | View west of wetland habitat in Reach 5 where channel is defined along right bank as it borders single-family home. |
| 21 | View south (upstream) along wetland habitat in Reach 5 showing less defined channel edges and heavy riparian vegetation cover. |


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# APPENDIX B

## Table of Known Utilities

| Molasses Creek – Table of Known Utilities<br>Stand-Alone Table for King County Review | | | | | |
|---|---|---|---|---|---|
| **Utility Type** | **Pipe Size (diameter)** | **Material** | **Owner** | **Approximate Location** | **Source** |
| Water | 72" | Steel | Seattle Public Utilities (SPU) | Running Southeast-Northwest along the SPU water easement | City of Renton online GIS & King County design plans for Fairwood Division 11 sinkhole emergency project |
| Water | 60" | Steel | SPU | Running Southeast-Northwest along the SPU water easement | City of Renton online GIS & King County design plans for Fairwood Division 11 sinkhole emergency project |
| Water | 66" | Steel | SPU | Running Southeast-Northwest along the SPU water easement | City of Renton online GIS & King County design plans for Fairwood Division 11 sinkhole emergency project |
| Water | 66" | Steel | SPU | Running Southeast-Northwest along the SPU water easement | City of Renton online GIS & King County design plans for Fairwood Division 11 sinkhole emergency project |
| Drain | 42" | Steel | SPU | Running Southeast-Northwest along the SPU water easement | King County design plans for Fairwood Division 11 sinkhole emergency project |
| Sewer | Unknown | Unknown | Cedar River Water and Sewer District | Running North-South along 133rd Pl SE and 135th Ave SE | City of Renton GIS |
| Overhead powerline | N/A | Power cable | City of Renton | Running overhead Southeast-Northwest along the north side of the SPU property | City of Renton GIS/Site visit and street view |
| Overhead powerline | N/A | Power cable | Unknown | Running overhead Southeast-Northwest along the north side of the SPU property | Site visit and street view |

# Appendix B

## Equity and Social Justice Plan

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King County
Department of Local Services
Road Services Division

# Project-Specific ESJ Plan

**Sustainable Infrastructure Scorecard – ESJ Credit 1**

**Project Name: Molasses Creek Fish Passage Feasibility Study (CIP 1140988)**

**July 2023**

| **Credit Description**<br>How to achieve the credit | **Credit Achievement**<br>Check one (✓) | | | **Notes**<br>Explain how the project will achieve the credit. If the project is taking "No" or "N/A," explain why. |
|---|---|---|---|---|
| | **Yes** | **No** | **N/A** | |
| **Credit 1. Develop a project-specific ESJ plan**<br>✓ **Part 1:** Compete the Equity Determinants Review form to identify how the project impacts the King County Determinants of Equity<br>✓ **Part 2:** Complete this worksheet to identify how the project will address the Sustainability Scorecard ESJ credits | ✓ | | | *This document serves as the project's ESJ Plan; it will be reviewed and revised as the project progresses.*<br><br>*This project evaluated the feasibility of fish passage improvements (daylighting) to Molasses Creek and compared 2 daylighting alternatives with a status quo alternative.*<br><br>*The community most affected by this project are Fairwood residents associated with census tracts 025702 and 031907. Residents in this area are characterized as having median household incomes of $80-$100K and are predominantly white with smaller percent of Asian, Latino or mixed race and with just over 10% of population with limited English language ability (Appendix A).* |

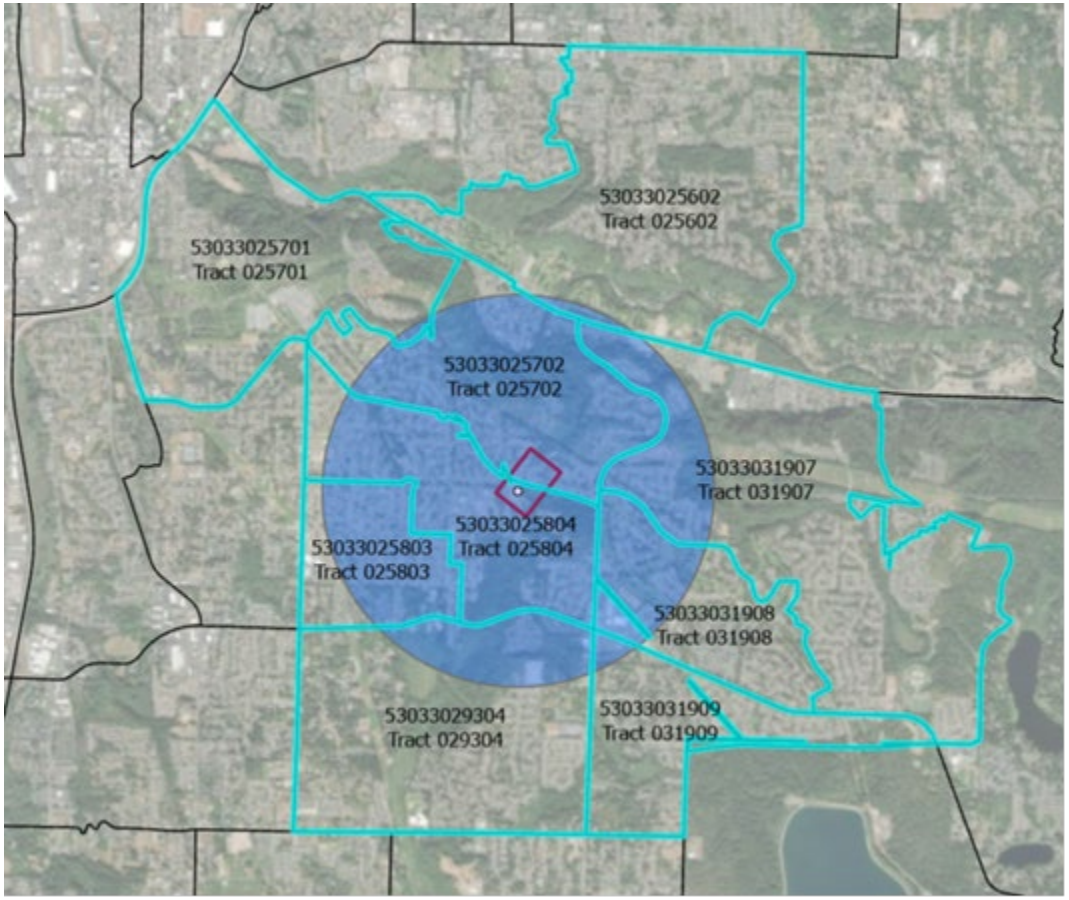
| **Credit Description**<br>How to achieve the credit | **Credit Achievement**<br>Check one (✓) | | | **Notes**<br>Explain how the project will achieve the credit. If the project is taking "No" or "N/A," explain why. |
|---|---|---|---|---|
| | **Yes** | **No** | **N/A** | |
| **Credit 2. Stakeholder Partnering and Collaboration**<br>✓ Identify key stakeholder groups, including community organizations<br>✓ Conduct outreach to stakeholder groups to understand community's voices, perspectives, and interests as they relate to the project<br>✓ Credit has two parts:<br>**2.1.** Project practices engagement at "County informs," "County consults, and "County engages in dialogue" levels.<br>**2.2.** Project practices engagement at "County and Community work together" and "Community directs action" level. | ✓ | | | *The project will meet this credit at the "County Informs" and "County and Community Work Together" levels – meeting the intent of credits 2.1 and 2.2.*<br><br>***2.1. County Informs:***<br>• *Project team will utilize standard WLRD outreach mechanisms for local residents (e.g., mailers)*<br>• *For the HOA outreach meetings, Herrera's team was prepared to provide translation services, but this was not necessary as the attendees were primarily English-speaking and translation services were not requested.*<br>***2.2. County and Community Work Together:***<br>• *Project team engaged the community via participation in HOA meeting to share information about the project and the property needs (acquisition) that would be required. The project team provided opportunities for interested property owners to contact County staff to discuss the potential to sell their homes.* |
| **Credit 3. Assemble exemplary diversity in project and design teams**<br>✓ Build capacity among priority populations, consultants, and in-house staff<br>✓ Demonstrate that consultants and in-house team members involved in the design and development processes represent gender, racial, and other diversity<br>✓ Credit has two parts:<br>**3.1.** Include ESJ expertise or partnership on project team<br>**3.2.** Allow ESJ stakeholder(s) to have decision making role in project development | ✓ | | | ***3.1. Diversity/Expertise on Project Team:*** *King County project team represents diversity. Project team also integrates ESJ planning throughout project planning and conceptual design.*<br><br>***3.2. Decision Making:*** *Project team represents diversity in PM and design leadership positions.*<br><br>*Property owners had a role in decision making as the County indicated that any property acquisition would be voluntary.* |

| **Credit Description**<br>How to achieve the credit | **Credit Achievement**<br>Check one (✓) | | | **Notes**<br>Explain how the project will achieve the credit. If the project is taking "No" or "N/A," explain why. |
|---|---|---|---|---|
| | **Yes** | **No** | **N/A** | |
| **Credit 4. Conduct equity impact review process**<br>✓ Use the Equity Determinants Review table from Credit 1 (Part 1)<br>✓ <u>If the Credit 1 review showed opportunity to impact equity determinants</u>, complete these three steps:<br>1. Identify who will be affected;<br>2. Identify how the project siting, design, and/or construction approaches will impact these groups; and<br>3. Use this information to make pro-equity project decisions.<br>✓ <u>If the Credit 1 review showed no opportunity to impact equity determinants</u>, this credit is considered "Not Applicable" | | | ✓ | *The project does not affect equity determinants for local residents or park-users as the status quo option is the only option remaining as there are no property owners willing to sell their property to the County. The status quo option identifies risks to the community as time goes on because of the pipe system's age and increasing regulatory requirements. The status quo option does have negative impacts to Native American Tribes with Treaty rights to fish as the fish passage barrier will not be corrected at this time.* |
| **Credit 5. Site, design, and construct to counter known disparities in conditions**<br><br>Document how project planning, siting, design, and/or construction occurred via an approach that countered, remediated, and/or corrected inequities in community conditions, health outcomes, or other related determinants. | | | ✓ | *Not applicable as the Status Quo option will remain in effect until suitable properties are found.* |

| **Credit Description**<br>How to achieve the credit | **Credit Achievement**<br>Check one (✓) | | | **Notes**<br>Explain how the project will achieve the credit. If the project is taking "No" or "N/A," explain why. |
|---|---|---|---|---|
| | **Yes** | **No** | **N/A** | |
| **Credit 6. Realize priority elements of ESJ plan**<br><br>Document at least ESJ objectives that the project will accomplish from the ESJ Plan in Credit 1 that are not accounted for in any other credits. (This credit is designed as a 'catch all' for ESJ activities that are not documented in other credits.) | | | ✓ | *Not applicable. ESJ activities associated with the project are sufficiently captured in other credits.* |
| **Credit 7. Advance Economic Justice**<br><br>Advance economic justice via Priority Hire, Project Labor Agreement, SCS, SOAW, apprenticeships, and selecting contracts to advance socially just enterprises, and partner with companies and community organizations that advance economic justice.<br><br>Credit has scale based on % -<br><br>✓ 7.1. Achieves apprenticeship and SCS requirements for planning, design, and construction contracting through priority contracted hires and apprentices (by cost per phase).<br>✓ 7.2. For sourcing 1-3% above requirements for planning, design, and construction contracting through priority contracted hires and apprentices (by cost per phase).<br>✓ 7.3. For sourcing 4-6% above requirements for planning, design, and construction contracting through priority contracted hires and apprentices (by cost per phase). | | | ✓ | *Not applicable as the Status Quo option will remain in effect until suitable properties are found.* |

| **Credit Description**<br>How to achieve the credit | **Credit Achievement**<br>Check one (✓) | | | **Notes**<br>Explain how the project will achieve the credit. If the project is taking "No" or "N/A," explain why. |
|---|---|---|---|---|
| | **Yes** | **No** | **N/A** | |
| **Credit 8. Pro-Equity Sourcing**<br><br>Select site and building materials, equipment, and systems which have pro-equity upstream and supply chain effects (e.g., local suppliers).<br><br>Based on % beyond requirements -<br><br>✓ 8.1. – For sourcing 10% of project materials or equip/systems (by cost) through exemplary pro-equity suppliers<br>✓ 8.2. For sourcing-11-20% of project materials or equip/systems (by cost), through exemplary pro-equity suppliers.<br>✓ 8.3. For sourcing more than 20% of project materials or equip/systems (by cost), through exemplary pro-equity suppliers | | | ✓ | *Not applicable as the Status Quo option will remain in effect until suitable properties are found.* |
| **Credit 9. Innovation Credits**<br><br>Exemplary practices, processes, or outcomes at any phase of the capital project lifecycle. | | | ✓ | *Not applicable. Project will follow standard WRLD practices and processes.* |

## Appendix A: Demographic Data for Fairwood




# SOURCES

Table 1: "Consolidated Demographics Index for King County Census Tracts / demographic index area" dataset, from King County's Open Data portal.

- Data on all focus census tracts present within 1 mile radius.

Tables 2-4: King County Census Viewer

- Data for Tracts 025701 and 031907 missing

# TABLES

**Table 1. Summary Data**

*Source: Consolidated Demographics Index dataset*

| GEO_ID_TRT | TRACT_LBL | Population | NumberofESL | PercentESL | MedianHouseholdIncome | NumberofPOC | PercentPOC |
|---|---|---|---|---|---|---|---|
| 53033025602 | Tract 025602 | 6479 | 764 | 11.791943 | $131,509 | 3520 | 54.329372 |
| 53033025701 | Tract 025701 | 6004 | 845 | 14.073951 | $60,440 | 2937 | 48.917388 |
| 53033025702 | Tract 025702 | 3203 | 72 | 2.247893 | $100,347 | 1256 | 39.213238 |
| 53033025803 | Tract 025803 | 4518 | 176 | 3.895529 | $69,916 | 2597 | 57.481186 |
| 53033025804 | Tract 025804 | 3479 | 94 | 2.701926 | $80,101 | 1192 | 34.262719 |
| 53033029304 | Tract 029304 | 4892 | 148 | 3.025348 | $93,750 | 2395 | 48.957482 |
| 53033031907 | Tract 031907 | 7787 | 737 | 9.464492 | $96,826 | 3432 | 44.073456 |
| 53033031908 | Tract 031908 | 4347 | 175 | 4.025765 | $82,331 | 1872 | 43.064182 |
| 53033031909 | Tract 031909 | 3191 | 170 | 5.327484 | $100,372 | 1436 | 45.001567 |

**Table 2. Median Household Income**

*Source: King County Census Viewer*

| Census Tract | Median Household Income in past 12 months (inflation-adjusted dollars to last 5-year range) | Total Households | Households with any self-employment income in past 12 months | Percent of households with any self-employment income | Households with no self-employment income in past 12 months |
|---|---|---|---|---|---|
| 53033025602 | 158,224 | 2,173 | 221 | 10.2 | 1,952 |
| 53033025701 | | | | | |
| 53033025702 | 110,000 | 1,168 | 107 | 9.2 | 1,061 |
| 53033025803 | 77,074 | 1,643 | 246 | 15 | 1,397 |
| 53033025804 | 84,739 | 1,280 | 136 | 10.6 | 1,144 |
| 53033029304 | 101,083 | 1,862 | 205 | 11 | 1,657 |
| 53033031907 | | | | | |
| 53033031908 | 88,616 | 1,739 | 151 | 8.7 | 1,588 |
| 53033031909 | 95,500 | 1,250 | 104 | 8.3 | 1,146 |

**Table 3. English Proficiency**

*Source: King County Census Viewer*

| Census Tract | Population 18 years and over in limited English Households | Population 18 years and over in limited English Households who speak Spanish | Population 18 years and over in limited English Households who speak Other Indo-European languages | Population 18 years and over in limited English Households who speak Asian and Pacific languages | Population 18 years and over in limited English Households who speak Other languages | Population 5 years and over in limited English households | Total population 5 years and over | Percents of adults 18 years and over who have limited English ability |
|---|---|---|---|---|---|---|---|---|
| 53033025602 | 551 | 157 | 46 | 348 | 0 | 678 | 6,419 | 21.3 |
| 53033025701 | | | | | | | | |
| 53033025702 | 82 | 0 | 0 | 82 | 0 | 94 | 3,264 | 10.6 |
| 53033025803 | 179 | 8 | 79 | 92 | 0 | 209 | 4,194 | 16 |
| 53033025804 | 84 | 11 | 34 | 39 | 0 | 91 | 3,443 | 11.6 |
| 53033029304 | 151 | 89 | 0 | 62 | 0 | 158 | 4,868 | 15.5 |
| 53033031907 | | | | | | | | |
| 53033031908 | 164 | 49 | 0 | 115 | 0 | 286 | 3,798 | 6.9 |
| 53033031909 | 168 | 0 | 75 | 93 | 0 | 168 | 2,934 | 13.9 |

**Table 4. Race Demographics**

*Source: King County Census Viewer*

| Census Tract | Total Population | Percent White (non-Hispanic) | Percent Black (non-Hispanic) | Percent American Indian and Alaska Native (non-Hispanic) | Percent Asian (non-Hispanic) | Percent Native Hawaiian and Other Pacific Islander (non-Hispanic) | Percent Some Other Race (non-Hispanic) | Percent 2 or more races (non-Hispanic) | Percent Hispanic or Latino |
|---|---|---|---|---|---|---|---|---|---|
| 53033025602 | 6,829 | 47.9 | 1.1 | 0 | 34.9 | 0 | 0.6 | 7.8 | 7.7 |
| 53033025701 | | | | | | | | | |
| 53033025702 | 3,585 | 57.2 | 8.2 | 0 | 19.6 | 1.3 | 0.4 | 3.5 | 9.9 |
| 53033025803 | 4,427 | 37.2 | 12.4 | 0.7 | 12.7 | 1.1 | 0.2 | 10 | 25.7 |
| 53033025804 | 3,577 | 67.9 | 2.3 | 0 | 10.6 | 0 | 0 | 9.1 | 10 |
| 53033029304 | 5,143 | 48.9 | 7.4 | 0.9 | 24 | 0.3 | 0.4 | 4.4 | 13.7 |
| 53033031907 | | | | | | | | | |
| 53033031908 | 4,150 | 54.3 | 16 | 0 | 8.9 | 2.4 | 0.6 | 8.1 | 9.7 |
| 53033031909 | 3,129 | 45.1 | 16.4 | 0 | 25.8 | 0.7 | 0 | 6.3 | 5.8 |

# Appendix C

## Potential Alternative Property Acquisition Needs and Costs

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| Table C-1. Molasses Creek Potential Property Acquisition Needs by Alternative. | | | |
|---|---|---|---|
| **Alternative** | **Property** | **King County Assessed Value** | **Zillow Market Estimate** |
| 2 | Property A | $576,000 | $635,800 |
| 2 | Property B | $570,000 | $573,400 |
| 2 | Property C | $594,000 | $601,900 |
| 2 | Property D | $565,000 | $612,900 |
| | **Alternative 2 Total** | **$2,305,000** | **$2,424,000** |
| 3 | Property A | $576,000 | $635,800 |
| 3 | Property E | $597,000 | $691,900 |
| 3 | Property F | $597,000 | $635,000 |
| 3 | Property G | $579,000 | $626,400 |
| 3 | Property H | $699,000 | $734,900 |
| 3 | Property I | $497,000 | $485,200 |
| | **Alternative 3 Total** | **$3,545,000** | **$3,809,200** |

# Appendix D

## Conceptual Alternative Layouts

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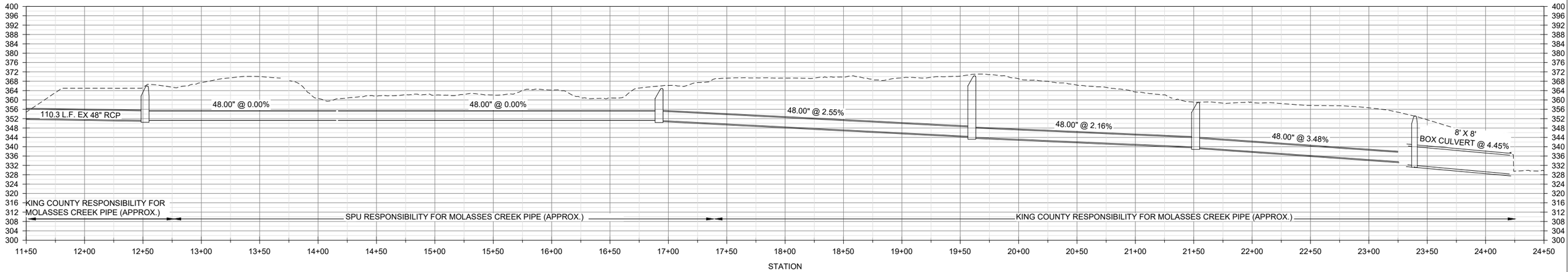
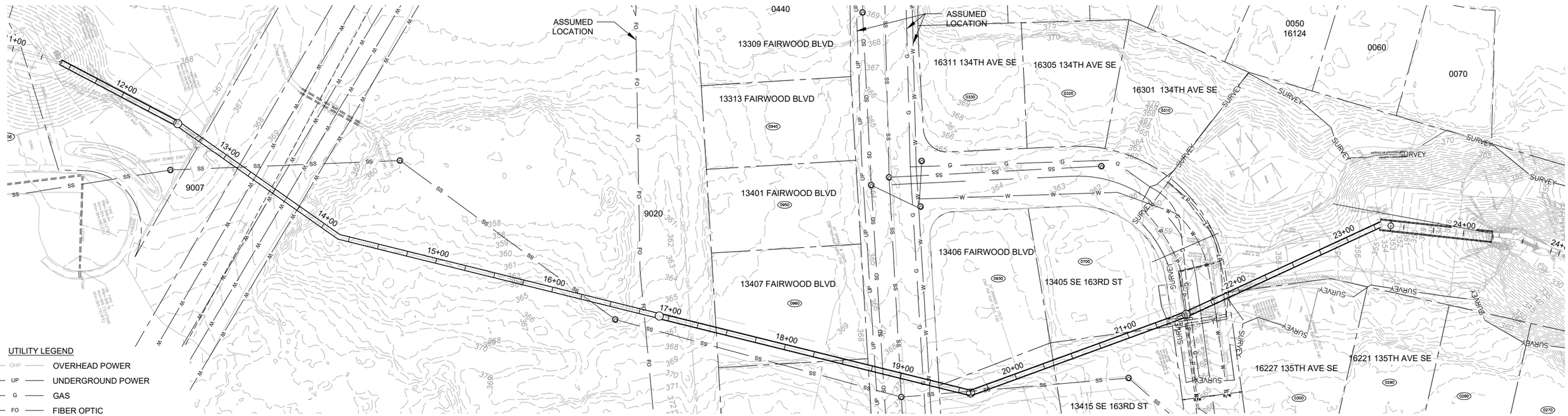
# Appendix D-1.
# Alternative 1 – Status Quo.




UTILITY LEGEND

- OHP — OVERHEAD POWER
- UP — UNDERGROUND POWER
- G — GAS
- FO — FIBER OPTIC
- SS — SANITARY SEWER
- W — WATER
- SD — STORM DRAIN
- STREAM
- T — UNDERGROUND TELECOMMUNICATIONS

UTILITY LOCATIONS ARE APPROXIMATE AND BASED ON VARIOUS SOURCES

HORIZONTAL SCALE IN FEET
40 0 40 80
20 0 20 40
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION X 2





NOTE: OTHER UNMAPPED UTILITIES ARE PRESENT IN PROJECT VICINITY. ONLY UTILITIES READILY AVAILABLE FROM PUBLICLY AVAILABLE GIS SOURCES ARE SHOWN

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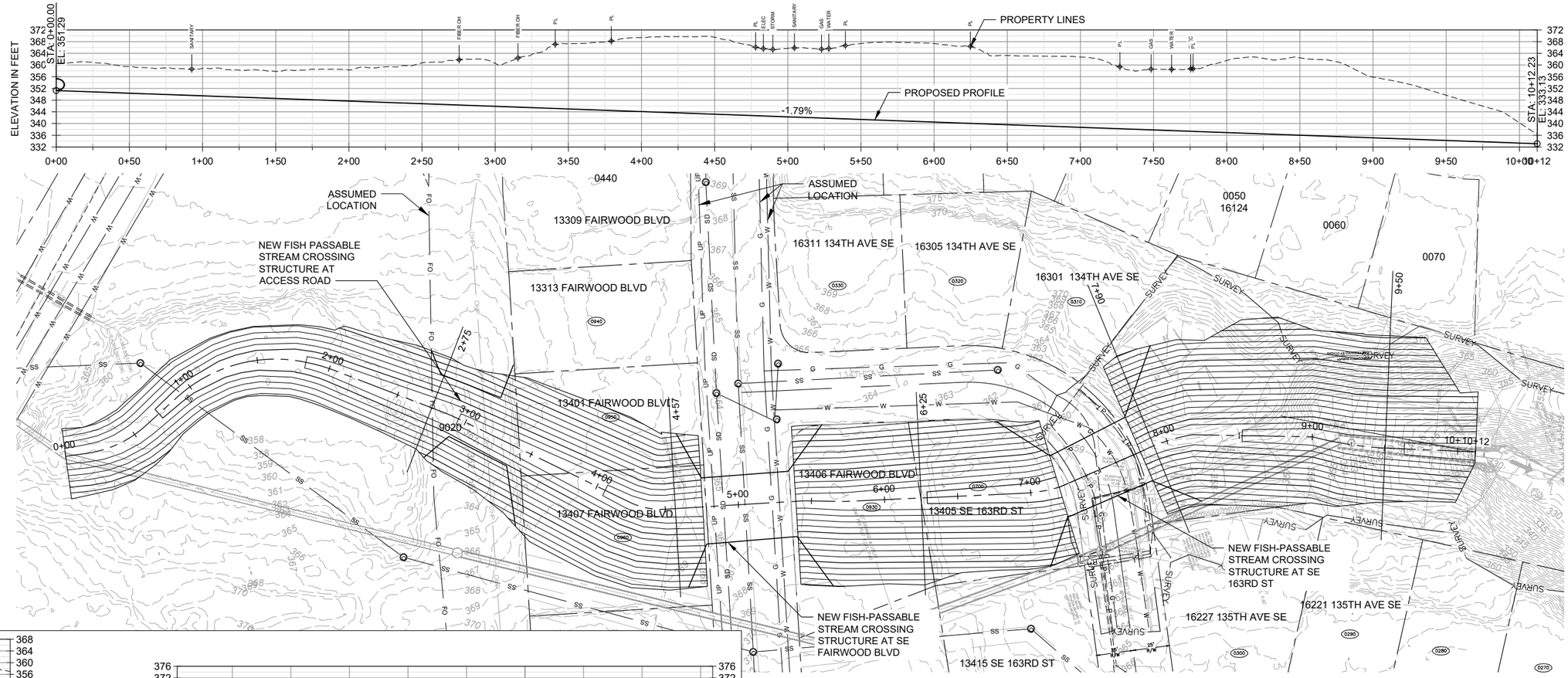
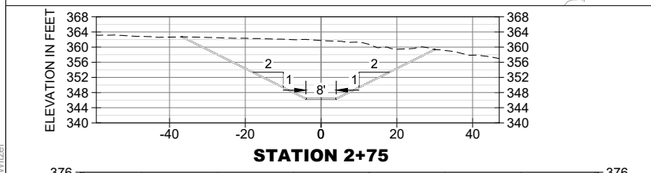
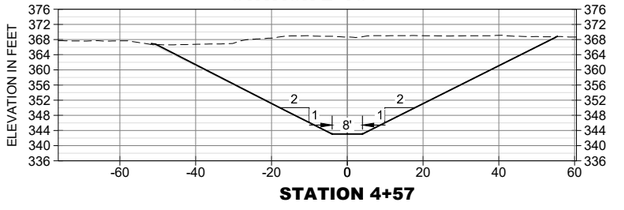
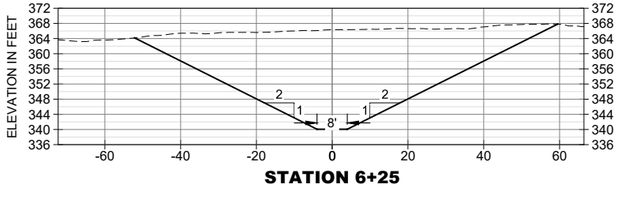
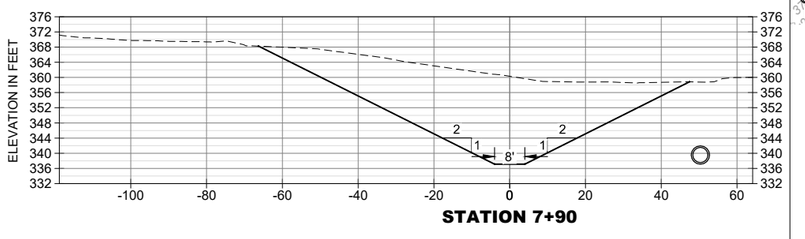
# Appendix D-2.
# Alternative 2 – Current Alignment Daylighting.

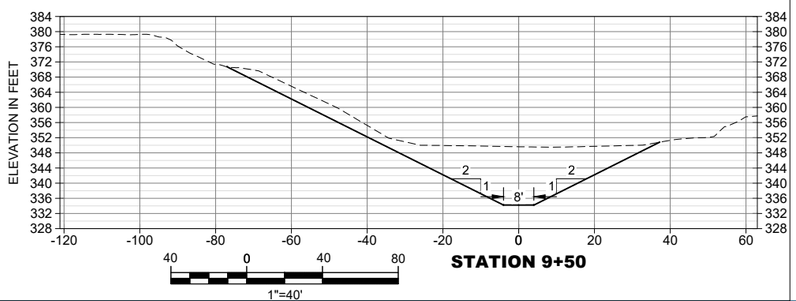



UTILITY LEGEND

| | |
|---|---|
| OHP | OVERHEAD POWER |
| UP | UNDERGROUND POWER |
| G | GAS |
| FO | FIBER OPTIC |
| SS | SANITARY SEWER |
| W | WATER |
| SD | STORM DRAIN |
| | STREAM |
| T | UNDERGROUND TELECOMMUNICATIONS |

UTILITY LOCATIONS ARE APPROXIMATE AND BASED ON VARIOUS SOURCES

HORIZONTAL SCALE IN FEET
40 0 40 80
20 0 20 40
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION X 2





NOTE: OTHER UNMAPPED UTILITIES ARE PRESENT IN PROJECT VICINITY. ONLY UTILITIES READILY AVAILABLE FROM PUBLICLY AVAILABLE GIS SOURCES ARE SHOWN

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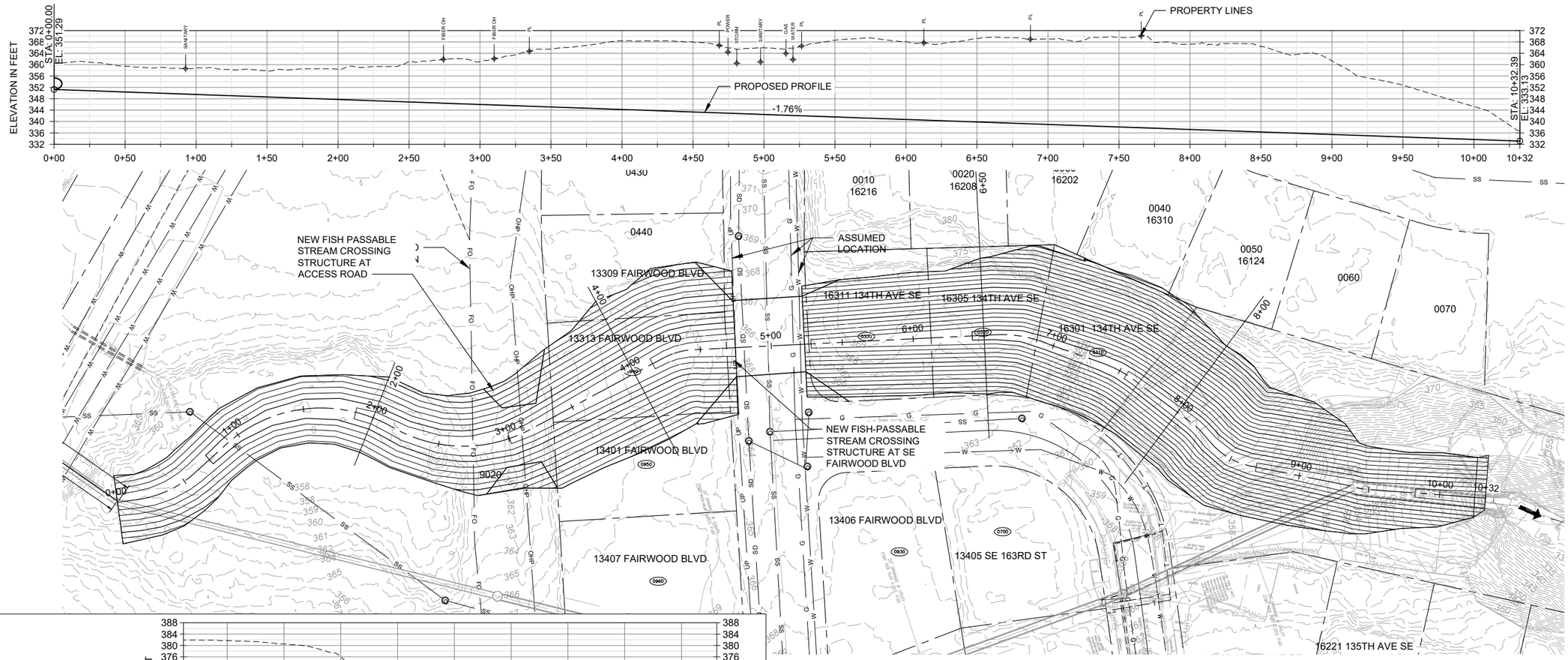
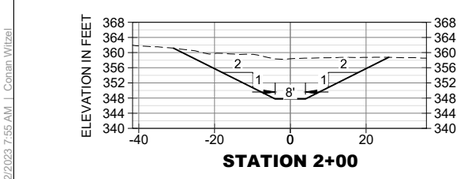
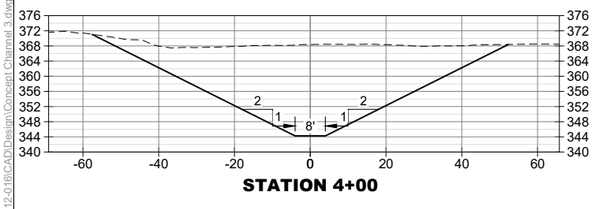
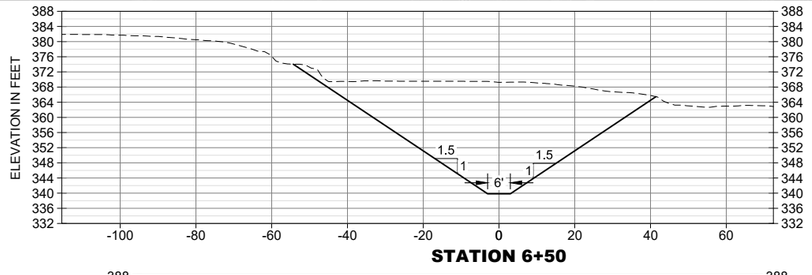
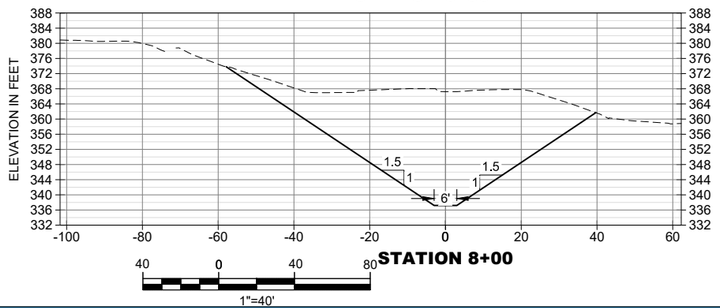
# Appendix D-3.
# Alternative 3 – Historical Alignment Daylighting.

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20 0 20 40
VERTICAL SCALE IN FEET
VERTICAL EXAGGERATION X 2





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# Appendix E

## Alternative Comparison Matrix

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# Alternative Comparison Matrix

| ALTERNATIVE COMPARISON | | | |
|---|---|---|---|
| **Criteria** | **Alternative 1: Status Quo** | **Alternative 2: Current Alignment Daylighting** | **Alternative 3: Historical Alignment Daylighting** |
| **Operations and Maintenance** | • Unsustainable maintenance—not able to obtain permits for future maintenance<br>• Eventual "run to failure" mode | • Reduced maintenance needs—creek channel design to be self-sustainable<br>• Some adaptive management may be needed | • Reduced maintenance needs—creek channel design to be self-sustainable<br>• Some adaptive management may be needed |
| **Property Needs[a]** | • No acquisition or easements needed | • Minimum four properties to be acquired<br>• $2.4.M costs | • Minimum six properties to be acquired<br>• $3.8M costs |
| **Construction Cost[a]** | • $0 | • $7.1M | • $6.3M |
| **Total Cost** | • Near Term/Construction Subtotal: $0<br>• Total Lifecycle estimate: $25.6M to $27.0M (+ inflation and escalation) | • Near Term/Construction Subtotal: $22.5M<br>• Total Lifecycle estimate: $22.5M + adaptive management if needed | • Near Term/Construction Subtotal: $22.1M<br>• Total Lifecycle estimate: $22.1M + adaptive management if needed |
| **Project Pros/Cons** | • Perpetuates fish passage barrier<br>• No impacts or benefits to wetland, floodplain, riparian or instream habitat<br>• No change in hydrologic or geomorphic conditions | • Eliminates 1,250-foot fish passage barrier<br>• 1,032 feet new fish access<br>• 1,032 feet new/improved riparian, instream and floodplain habitat<br>• Possible impacts to existing wetlands or mature vegetation<br>• Improved hydrologic and geomorphic conditions<br>• Requires three new roadway crossings | • Eliminates 1,250-foot fish passage barrier.<br>• 1,032 feet of new fish access<br>• 1,032 feet new/improved riparian, instream and floodplain habitat<br>• Possible impacts to existing wetlands or mature vegetation<br>• Construction impacts in critical areas—steep slopes<br>• Improved hydrologic and geomorphic conditions<br>• Requires two new roadway crossings |

| ALTERNATIVE COMPARISON | | | |
|---|---|---|---|
| **Criteria** | **Alternative 1: Status Quo** | **Alternative 2: Current Alignment Daylighting** | **Alternative 3: Historical Alignment Daylighting** |
| **Risk** | • Likely future culvert or pipe malfunction and liability for damage to private property, roadways and utilities | • Liability risks reduced by daylighting<br>• Risk of increased costs due to limited geotechnical and survey data | • Liability risks reduced by daylighting<br>• Risk of increased costs due to limited geotechnical and survey data<br>• Requires steeper slopes and possible retaining structures<br>• Risks due to construction in steep slopes, and potential impacts to upslope properties |
| **Permits Required** | • No immediate permits needed<br>• High risk of not being able to obtain permits for future maintenance and repairs | • Moderate permit complexity<br>• Multiple (>10) local, state and federal permits required | • Moderate permit complexity<br>• Multiple (>10) local, state and federal permits required |
| **Geotechnical Issues** | • None | • None known but additional geotechnical work recommended | • Steep slope area—retaining structures may be required; additional geotechnical work recommended |
| **Constructability** | • None | • Would require three new roadway crossings | • Would require two new roadway crossings<br>• May require additional retaining structures |
| **Equity and Social Justice** | • No immediate negative impacts on community<br>• Increased future risk to property owners/residents<br>• Negative impacts to Tribes—fish passage continues to be blocked | • Negative impacts to property owners/residents whose homes need to be acquired<br>• Changed use of Fairwood West Community Park from active recreation to passive nature viewing<br>• Reduces risks to residents from culvert or pipe malfunctions and impacts to roads, utilities, or property<br>• Supports Tribal Treaty rights to fish<br>• Schools | • Negative impacts to property owners/residents whose homes need to be acquired<br>• Changed use of Fairwood West Community Park from active recreation to passive nature viewing<br>• Reduces risks to residents from culvert or pipe malfunctions and impacts to roads, utilities, or property<br>• Supports Tribal Treaty rights to fish |

[a] Acquisition and Construction costs listed in these rows do not include contingency. Contingency costs are included in total project cost estimates.