SKAGIT RIVER GEOMORPHOLOGY BETWEEN GORGE DAM AND THE SAUK RIVER STUDY INTERIM REPORT

ATTACHMENT G

TRIBUTARY FISH PASSAGE ANALYSIS INVENTORY

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Results from the Tributary Fish Passage Analysis are presented by tributary in alphabetical order. For each tributary a general description of the lowest 500-foot (ft) section is provided as well as relative elevation and water depth profiles. Maps depicting the location of each tributary, excluding the Napoleon Side Channel and Sauk Side Channel 1, can be found in Figures G-64 and G-65.

Alma Creek

Alma Creek is characterized by a boulder cascade morphology with a predominantly cobble and boulder substrate (Figure G-1). The surveyed reach consisted predominantly of 3 percent grades with an average gradient of 5.25 percent and a wetted width of 5 ft. The average depth in the creek is 1.55 ft. The gradient is fairly consistent throughout the reach, with a series of pools between the boulder cascade sections (Figure G-2). The depth throughout the reach is also relatively consistent and there is no passage issue relative to water depth, although the gradient may be a challenge to some species (Figure G-3).

Figure G-1. Representative photo of Alma Creek habitat conditions.

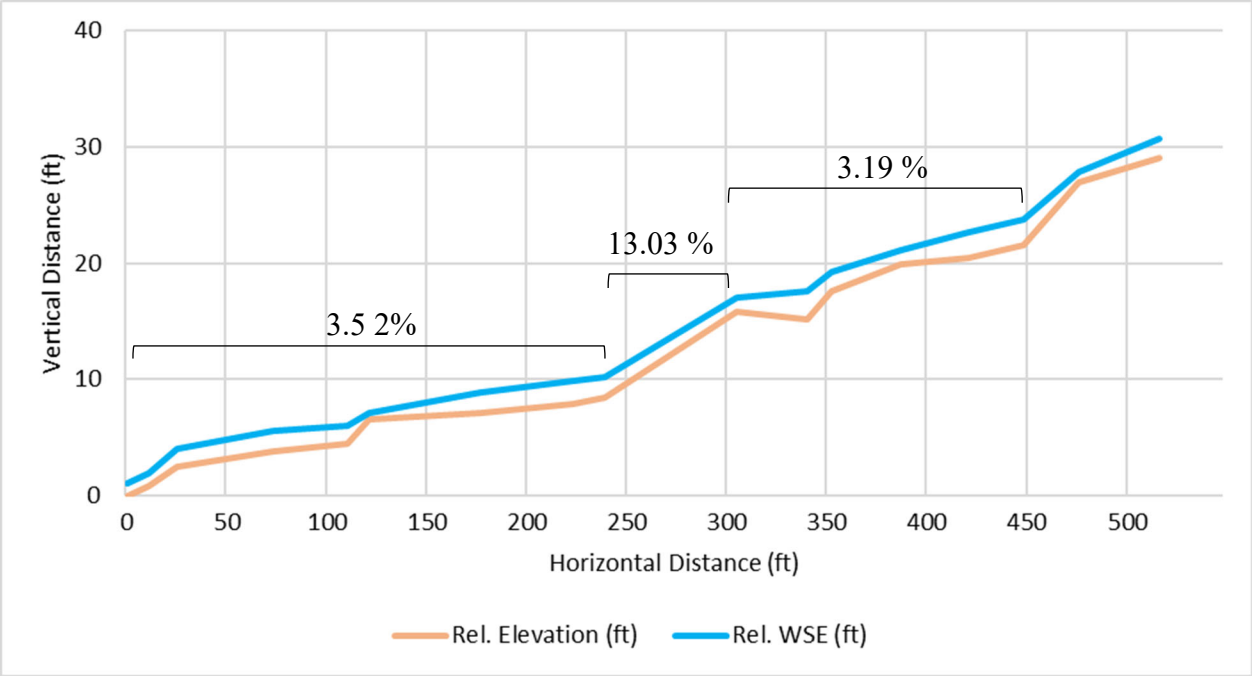


Figure G-2. **Relative bed elevation and water surface elevation for Alma Creek from mouth upstream 500 linear ft.**

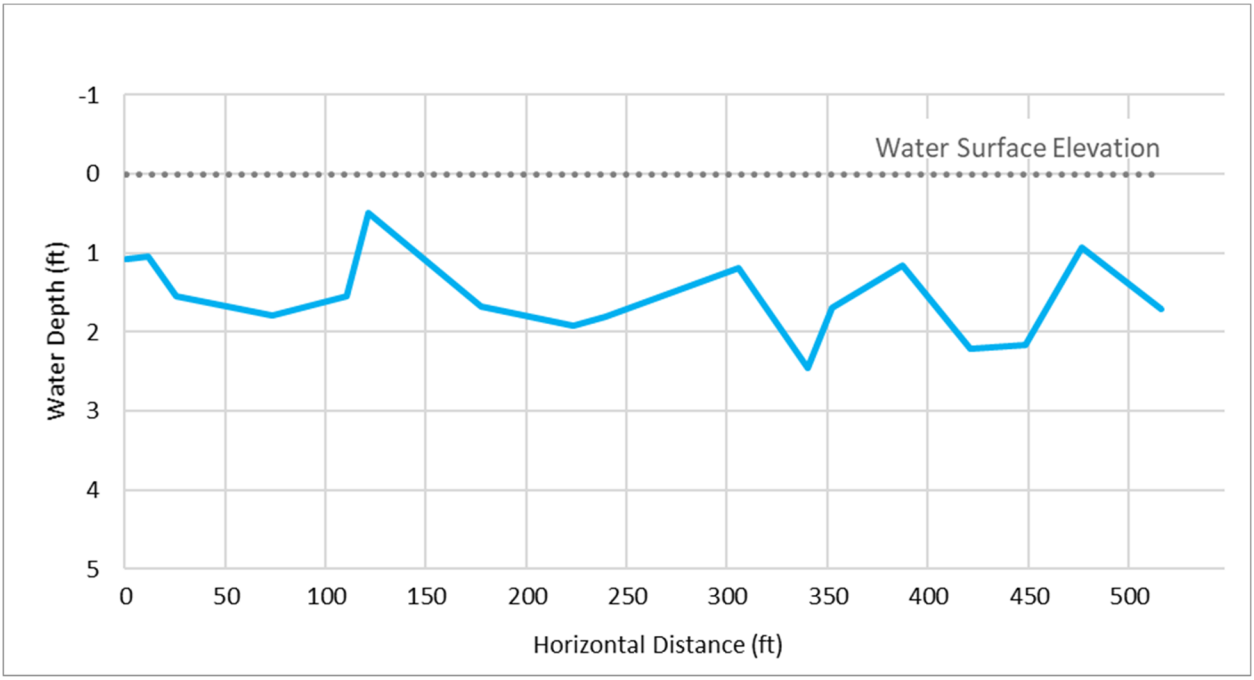


Figure G-3. **Water depth profile for Alma Creek on August 3, 2021 from the mouth upstream 500 linear ft.**

Babcock Creek

Babcock Creek flows through a culvert approximately 130 ft upstream of the creek mouth. Below the culvert, the creek bed consists of predominately sandy substrate, reflective of a depositional

zone and the very low gradient in the lower section of the creek (Figure G-4 (left)). Based on the water depth profile and site observations, the culvert is causing scour and a plunge pool at its outlet (Figures G-5 and G-6). Approximately 304 ft upstream of the creek mouth, the stream disappears subsurface. Reed canary grass and blackberry are very dense along the stream and throughout the channel itself, preventing the survey of the entire 500 ft (Figure G-4 (right)). There is little tree canopy upstream of the culvert and the channel appears to be incised on the upstream end of the culvert by more than two vertical ft. Much of the water present below the culvert is backwatered from the Skagit River contributing to sandy substrate and a negative overall gradient of -0.21 percent throughout the reach.

Figure G-4. **Babcock creek from channel center looking downstream near the mouth (left) and at survey end, approximately 300-ft upstream of the mouth (right).**

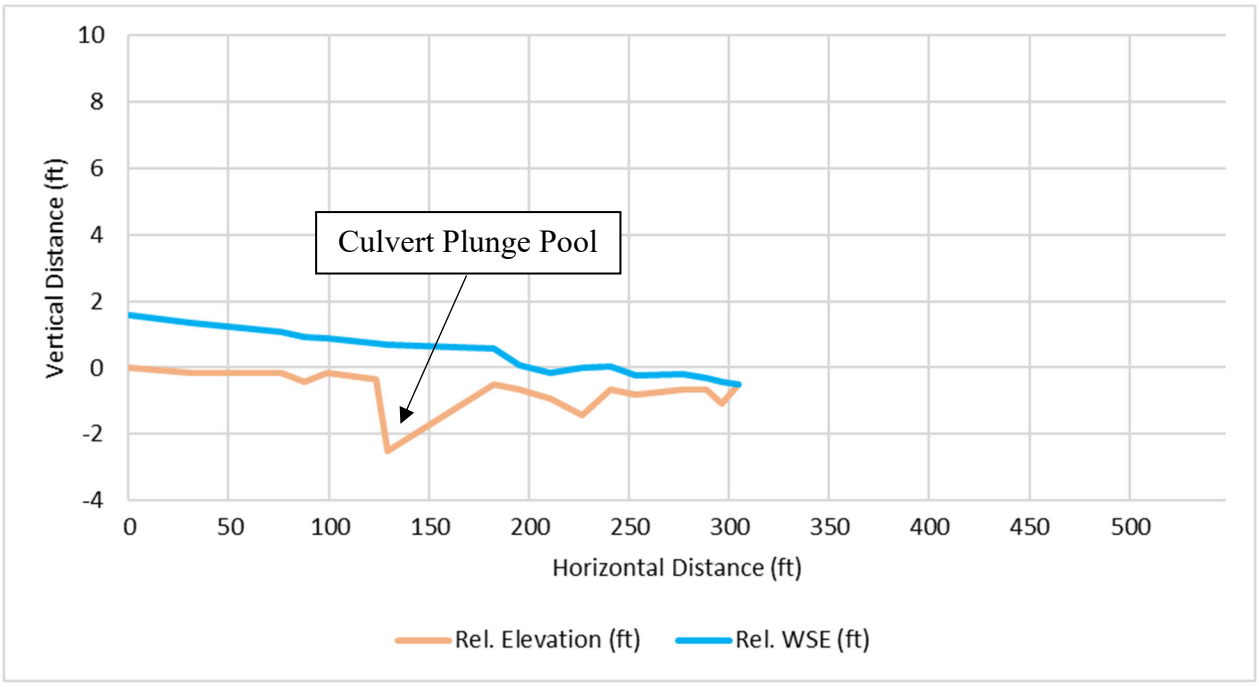


Figure G-5. **Relative bed elevation and water surface elevation for Babcock Creek from mouth upstream 500 linear ft.**

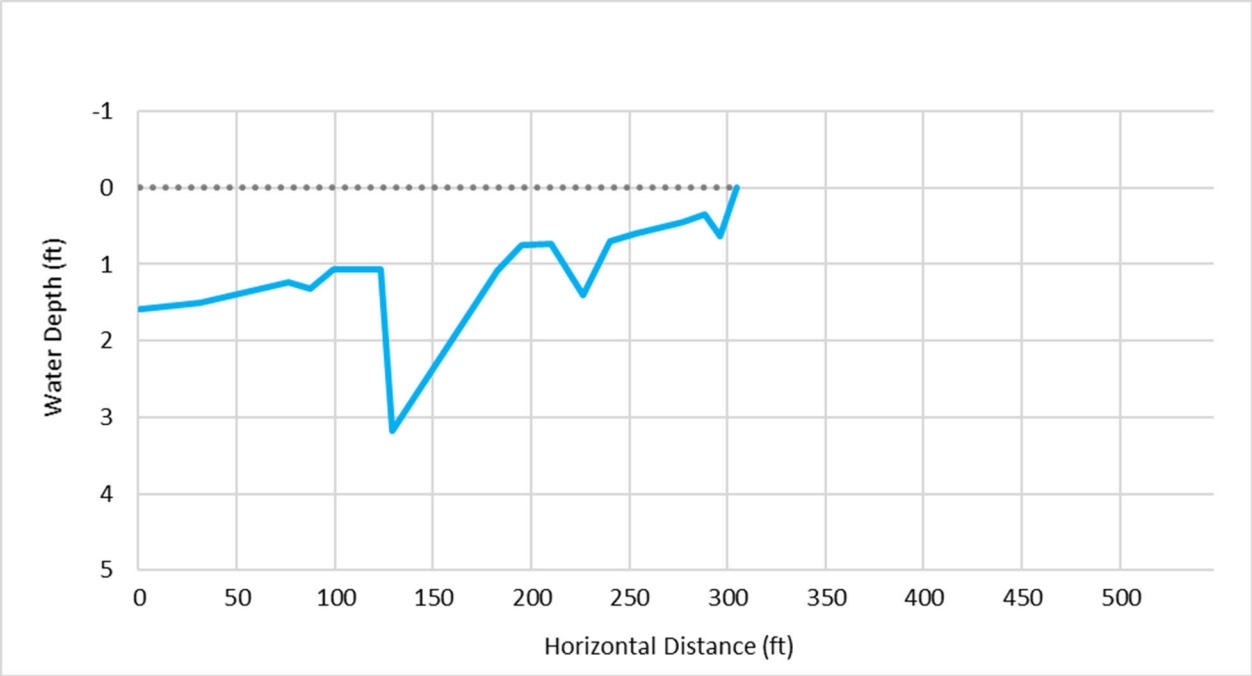


Figure G-6. **Water depth profile for Babcock Creek on August 6, 2021 from the mouth upstream 500 linear ft.**

Bacon Creek

The mouth of Bacon Creek is a low gradient river with plane bed morphology. The average gradient throughout the surveyed reach is 1.17 percent and the average wetted width is 54 ft (Figure G-8). At the time of survey, the thalweg was too deep and swift to access and water depths were taken along left bank, where there was an average water depth of 1.69 ft (Figure G-9). Gradient and water depth remained fairly consistent throughout the reach with no significant pools.

Figure G-7. **Looking upstream at the primary (left) and secondary (right) mouths of Bacon Creek.**

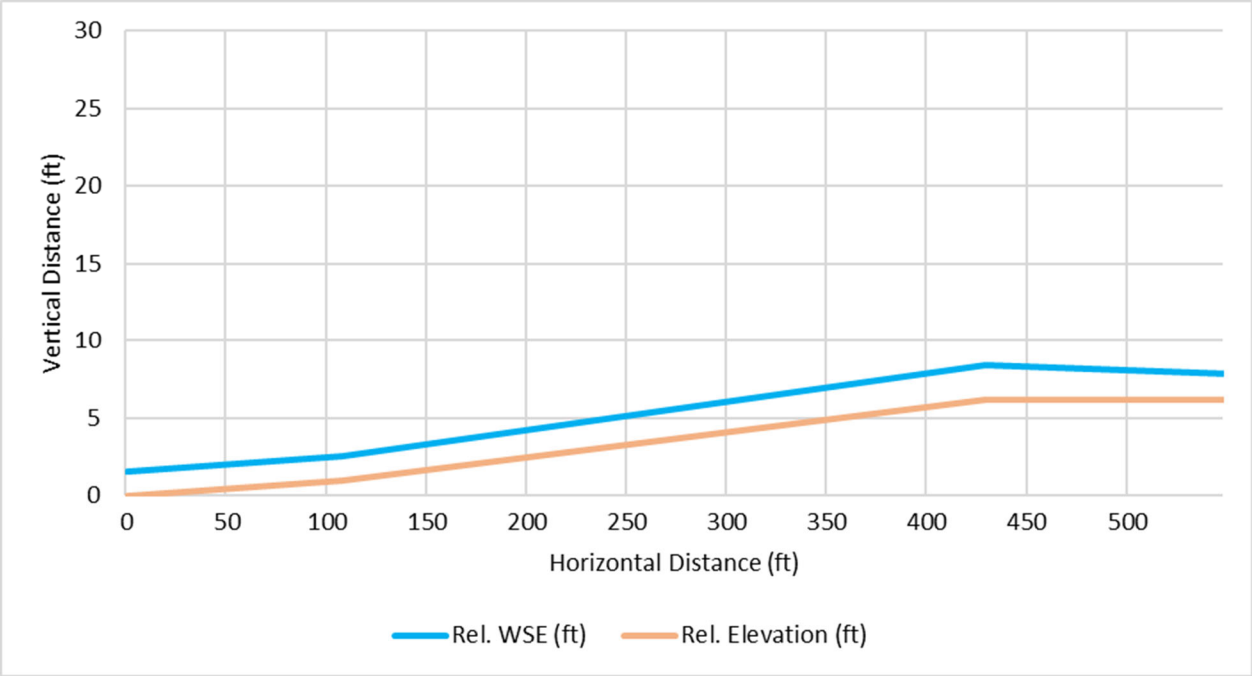


Figure G-8. **Relative bed elevation and water surface elevation for Bacon Creek from mouth upstream 500 linear ft.**

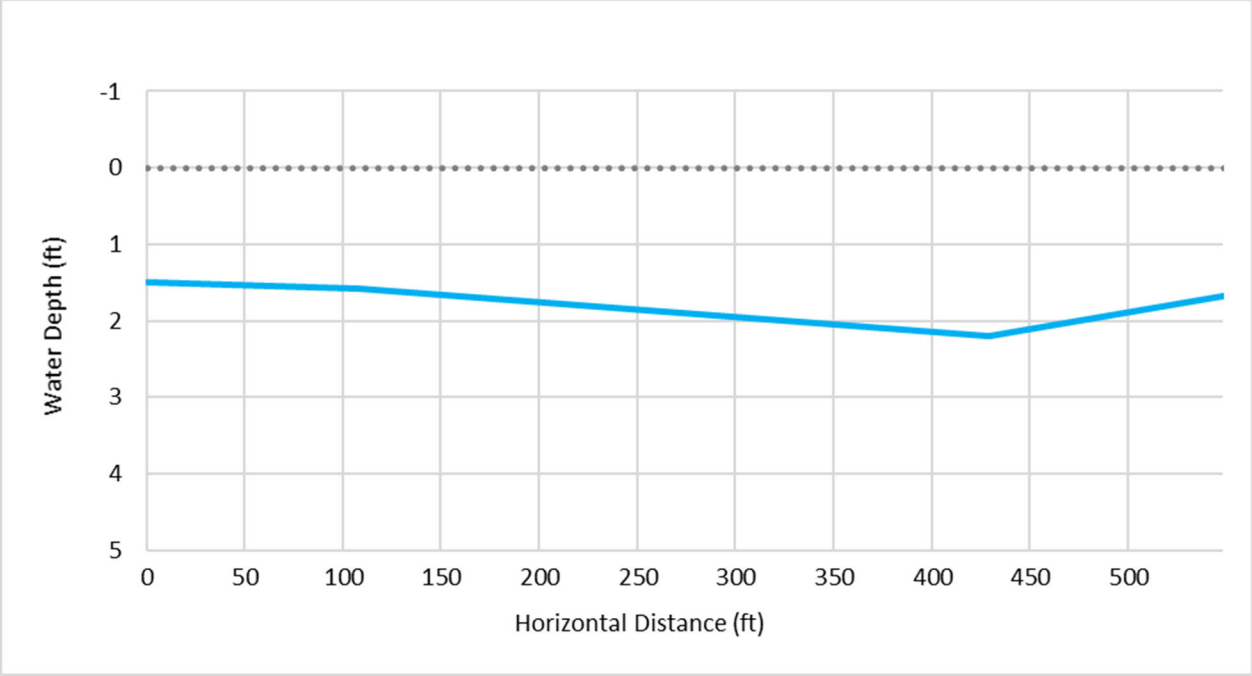


Figure G-9. **Water depth profile for Bacon Creek on August 4, 2021 from the mouth upstream 500 linear ft. (Water depth is taken from the bank and not representative of the true thalweg due to swift current).**

Barr Creek

Barr Creek is a forested, step-pool drainage with an average gradient of 4.25 percent and wetted

width of 15 ft throughout the survey reach (Figure G-10). There is a bridge across Barr Creek at 325 ft from the mouth (Figure G-11). The average water depth at time of field visit was 0.8 ft (Figures G-12 and G-13). The wetted width varied somewhat throughout the reach. Several small step pools occurred throughout the reach and in-stream complexity was present as forced by boulders and large woody material (Figure G-13).

Figure G-10. Looking downstream approximately 300 ft upstream of the mouth of Barr Creek.

Figure G-11. View of the bridge across Barr Creek.

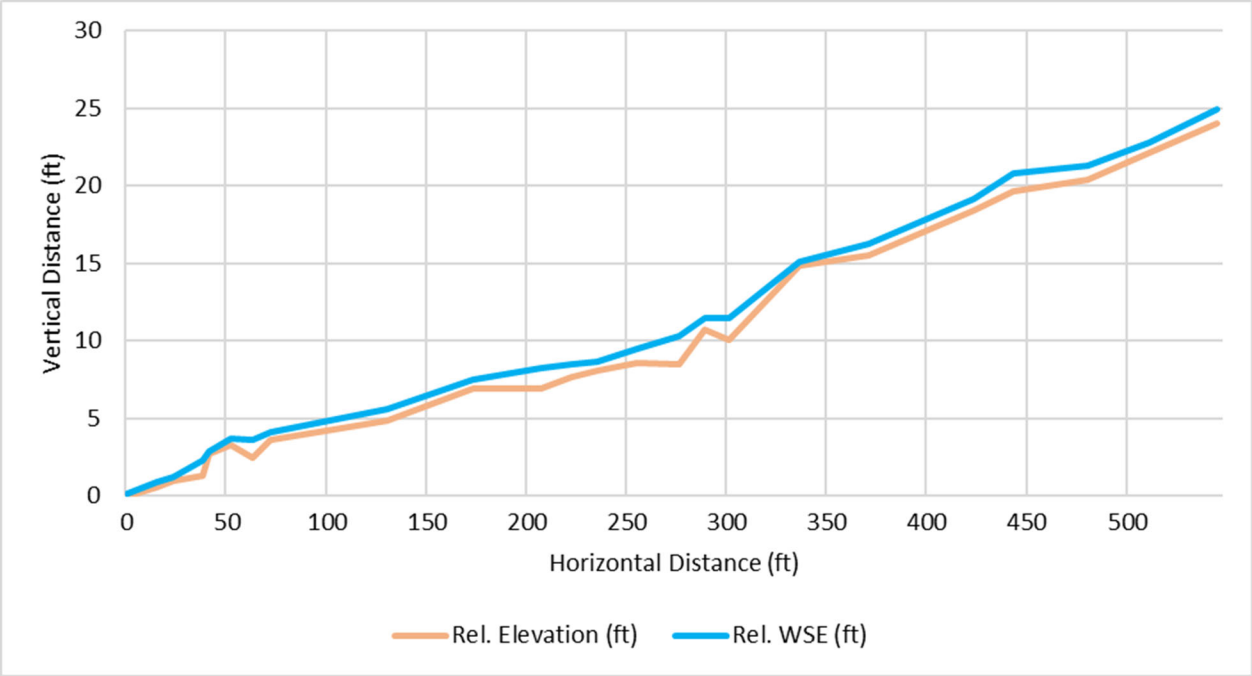


Figure G-12. **Relative bed elevation and water surface elevation for Barr Creek from mouth upstream 500 linear ft.**

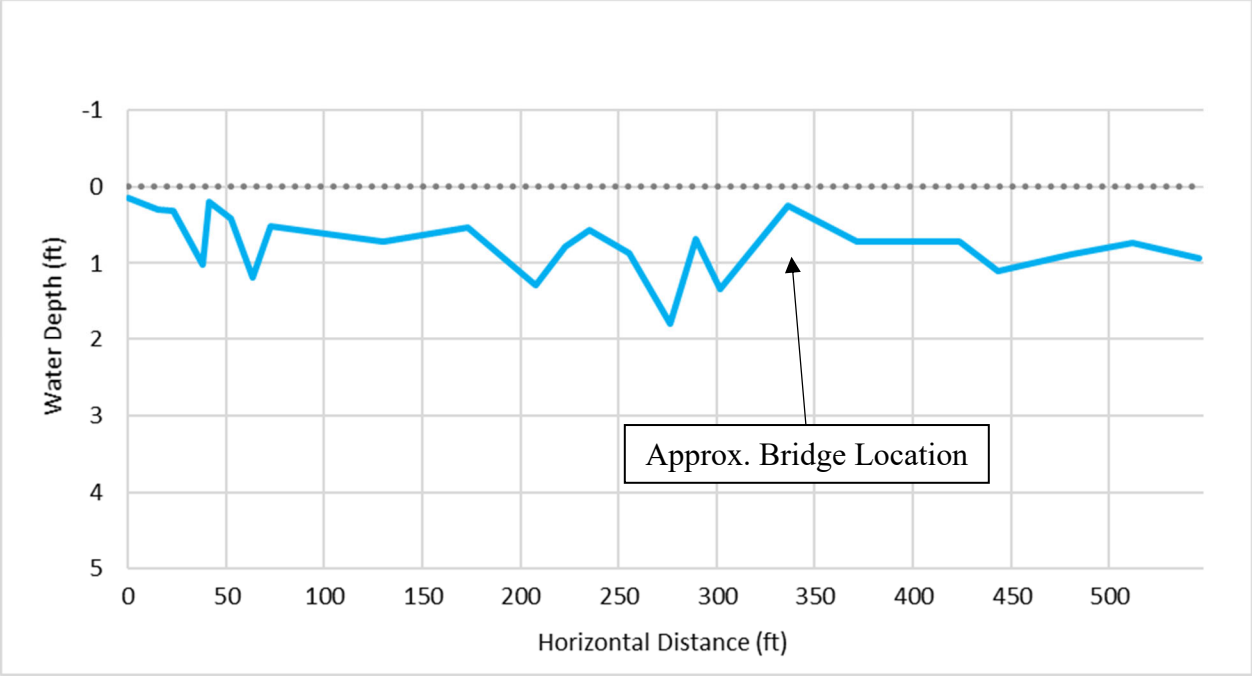


Figure G-13. **Water depth profile for Barr Creek on August 6, 2021 from the mouth upstream 500 linear ft.**

Copper Creek

The mouth of Copper Creek consists of a mix of boulder cascades and step-pool morphologies (Figures G-14 and G-15). The surveyed reach had an average gradient of 6.37 percent and an

average wetted width of 11 ft (Figure G-16). The average water depth at the time of field visit was 0.8 ft (Figure G-17). The grade and water depth remained consistent throughout much of the surveyed reach with a few small pools intermixed.

Figure G-14. Looking upstream approximately 300 ft upstream of creek mouth on Copper Creek.

Figure G-15. Looking upstream approximately 320 ft upstream of creek mouth on Copper Creek.

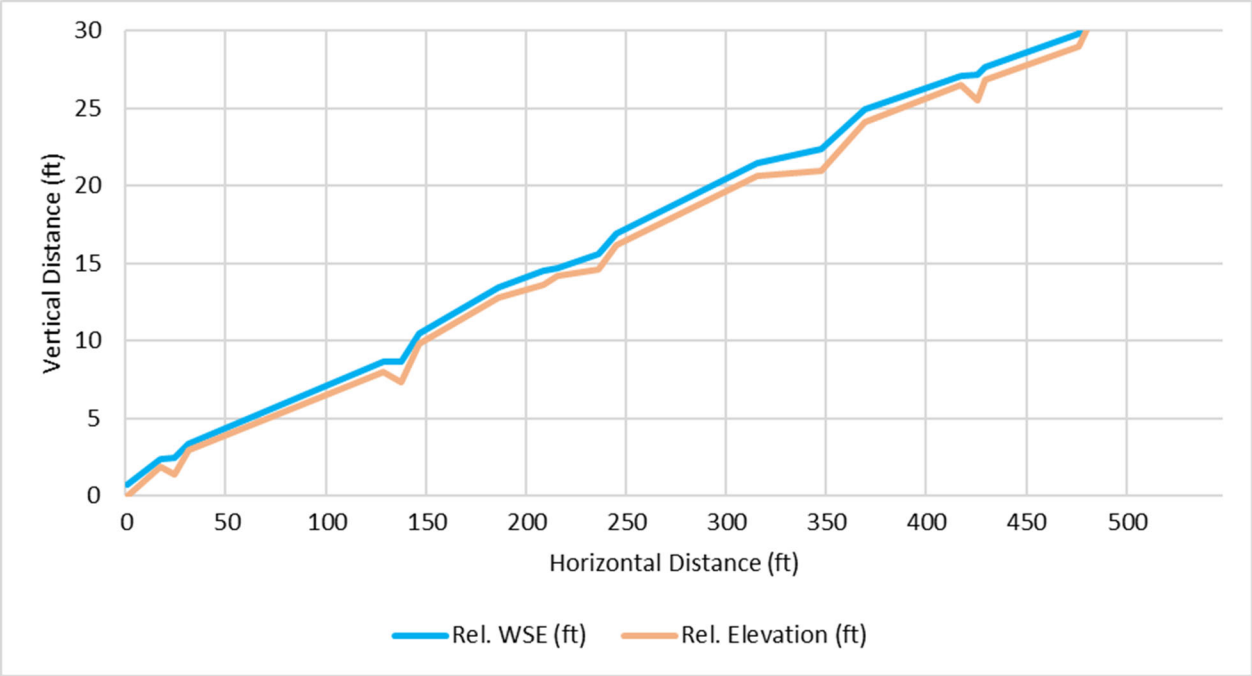


Figure G-16. Relative bed elevation and water surface elevation for Copper Creek from mouth upstream 500 linear ft.

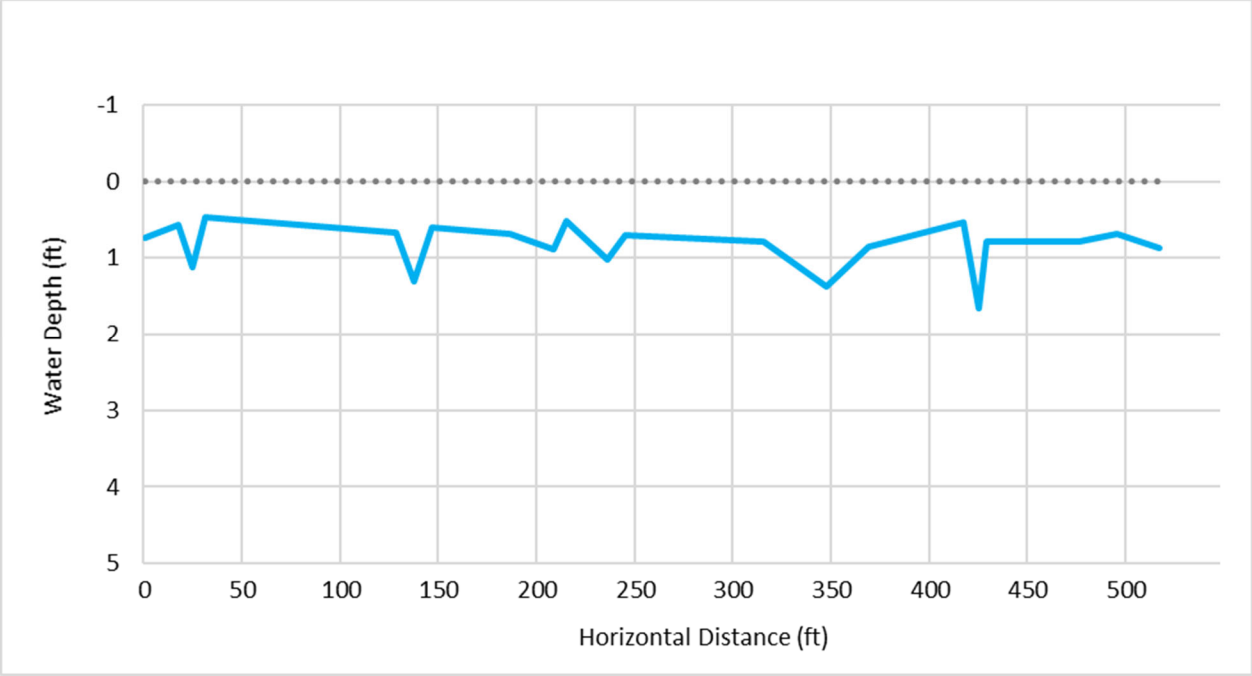


Figure G-17. Water depth profile for Copper Creek on August 4, 2021 from the mouth upstream 500 linear ft.

Corkindale Creek

Corkindale Creek was dry at the time of site visit (Figure G-18). The average bed gradient is 2.07 percent with a bankfull width (BFW) of approximately 16 ft (Figures G-19 and G-20). Channel

substrate consists predominantly of large cobbles. Both banks showed signs of incision with banks obscured by a dense layer of Himalayan blackberry.

Figure G-18. **Looking downstream approximately 280 ft upstream from the mouth of Corkindale Creek.**

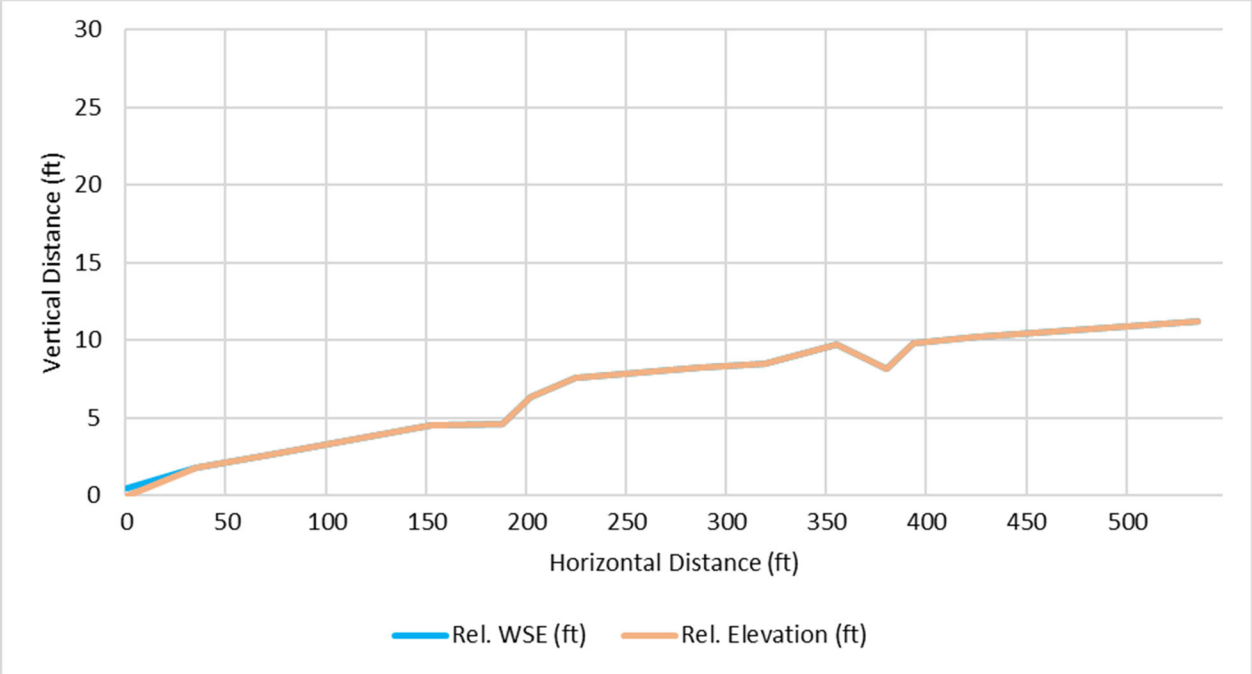


Figure G-19. **Relative bed elevation and water surface elevation for Corkindale Creek from mouth upstream 500 linear ft.**

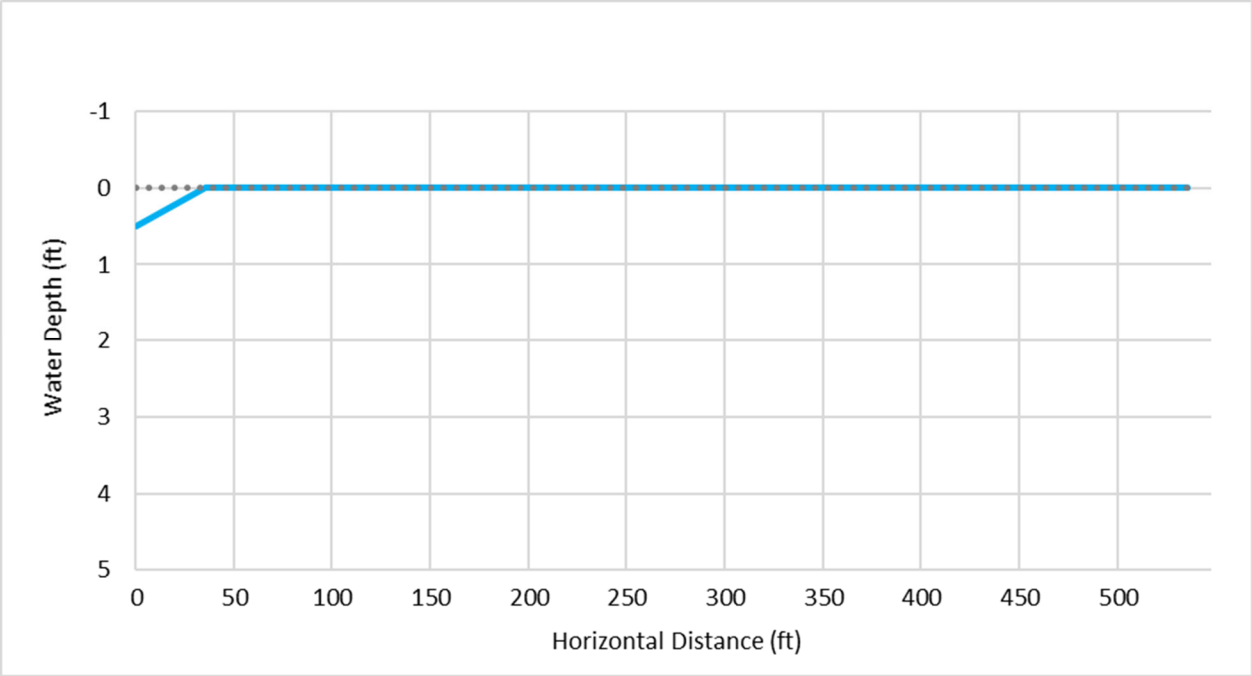


Figure G-20. Water depth profile for Corkindale Creek on August 5, 2021 from the mouth upstream 500 linear ft.

Damnation Creek

The mouth of Damnation Creek is characterized by a large, boulder dominated alluvial fan with several channels, many of which were dry at time of site visit (Figure G-21). The average gradient is 5.16 percent and the average wetted width is 20 ft throughout the survey reach (Figure G-22). The average water depth was 1.26 ft. Several boulder-forced pools exist throughout the reach (Figure G-23).

Figure G-21. Looking upstream from the mouth of Damnation Creek.

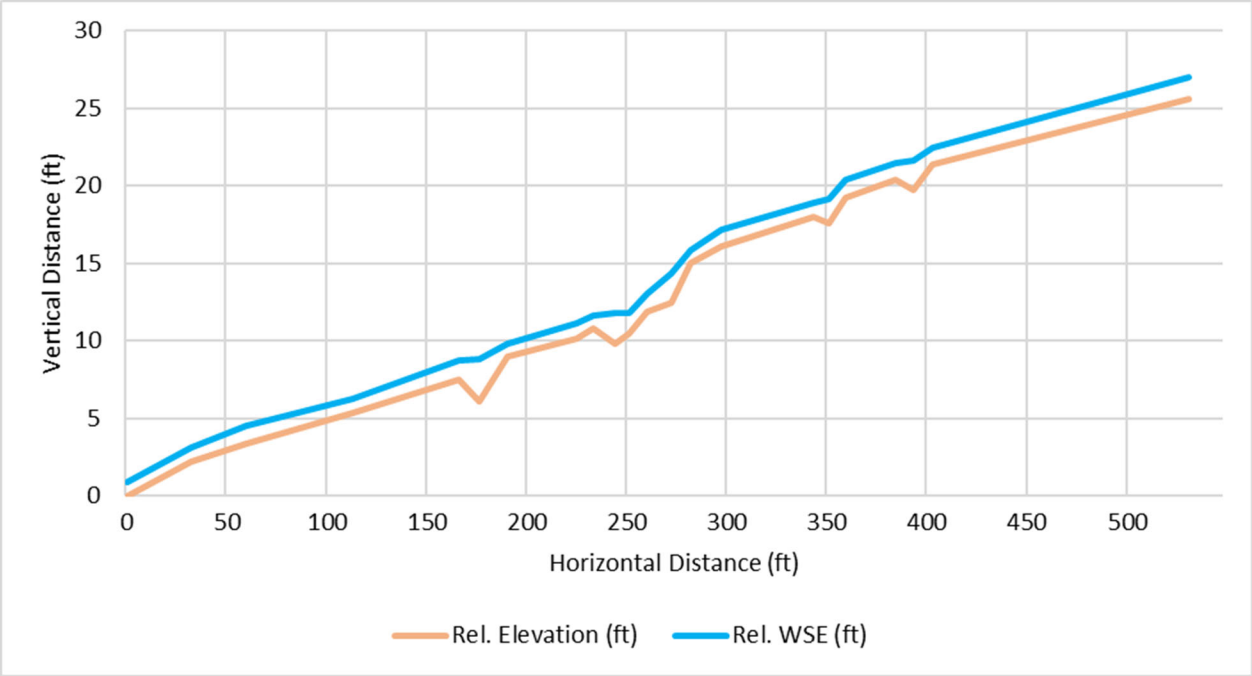


Figure G-22. **Relative bed elevation and water surface elevation for Damnation Creek from mouth upstream 500 linear ft.**

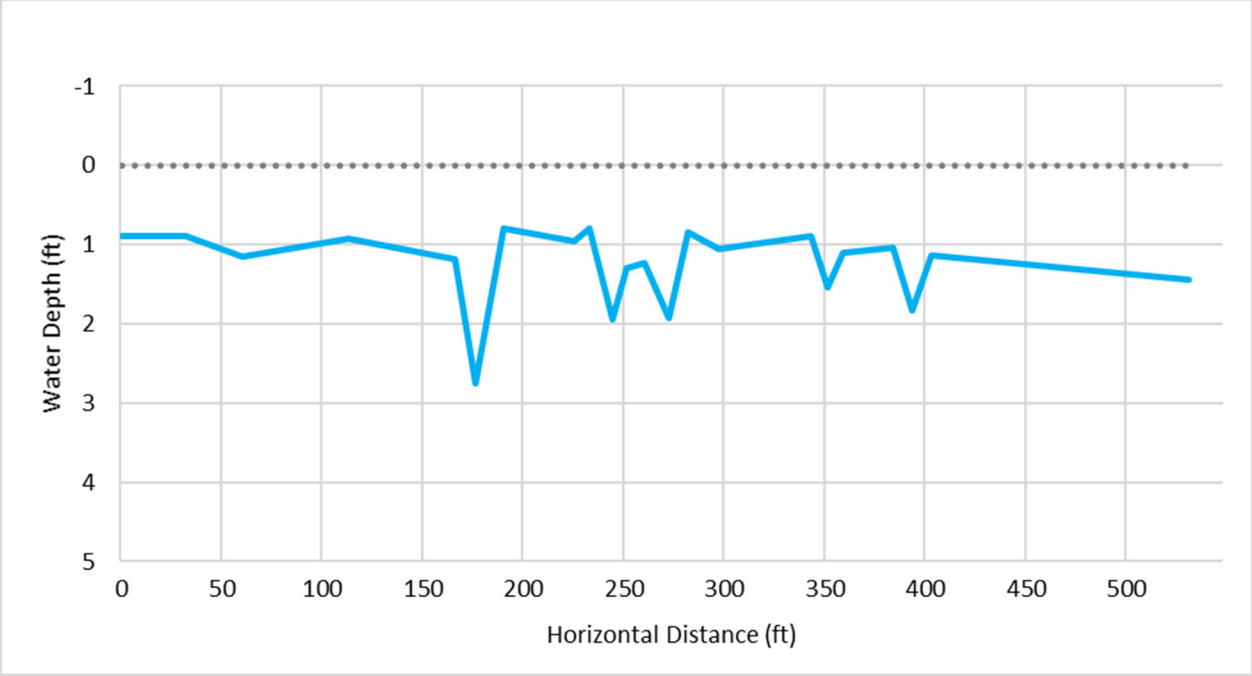


Figure G-23. **Water depth profile for Damnation Creek on August 3, 2021 from the mouth upstream 500 linear ft.**

Diobsud Creek

The mouth of Diobsud Creek is characterized by its low gradient, plane bed morphology with an average gradient of 0.14 percent (Figures G-24, G-25 and G-26). At time of field visit, the average

wetted width was 37 ft with an average water depth of 1.37 ft (Figure G-27). A long glide approximately 100 linear ft long with an approximate depth of 3.5 ft to 5 ft deep formed around several woody stems and their root wads along left bank (Figure G-25).

Figure G-24. **View of the plane bed morphology of Diobsud Creek.**

Figure G-25. **A surveyor stands just upstream of the upper end of the 100-foot-long glide along left bank.**

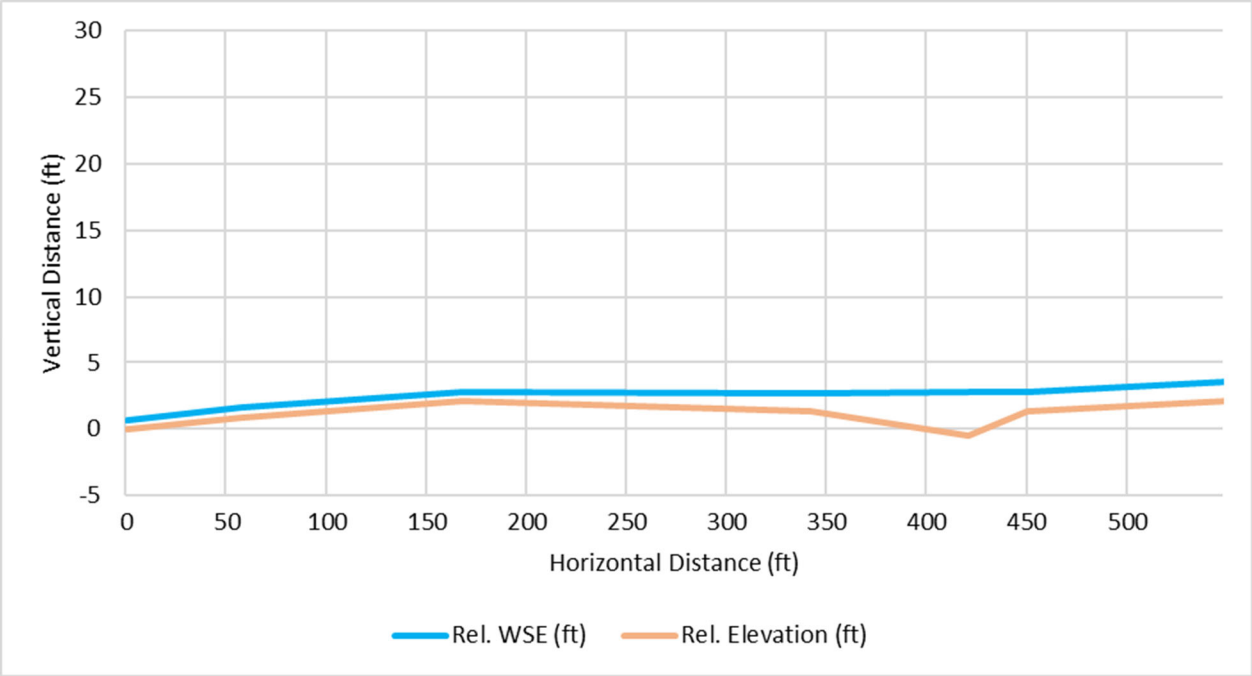


Figure G-26. Relative bed elevation and water surface elevation for Diobsud Creek from mouth upstream 500 linear ft.

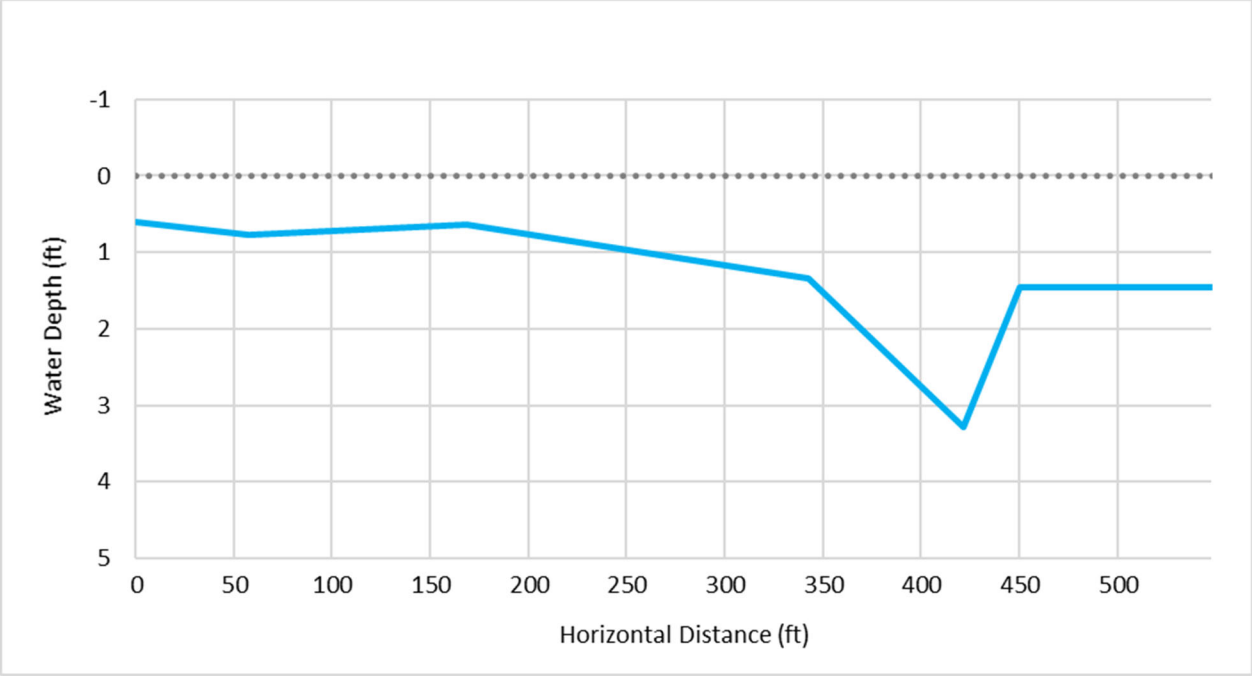


Figure G-27. Water depth profile for Diobsud Creek on August 4, 2021 from the mouth upstream 500 linear ft.

Goodell Creek

The mouth of Goodell Creek is characterized by high flows and swift current with boulder and large cobble. At time of field visit, waters were deep and swift with limited access to the river

mouth due to a highly erosive, steep right bank preventing a water depth profile from being conducted. Approximately 500 ft upstream of the mouth by the bridge crossing, waters slowed but were consistently too deep to wade for survey. Water depth was approximated to be 3 to 5 ft deep throughout reach, with deeper slower waters further upstream near the bridge (Figure G-28). A visual inspection concluded that fish passage was not a problem at the mouth of Goodell Creek.

Figure G-28. View of Goodell Creek from the bank.

Illabot Creek

Illabot Creek flows into the larger Illabot Creek side channel complex before entering the Skagit River. The habitat in the creek includes a high level of complexity with multiple pool and riffle sequences and substantial large wood (Figure G-29). The average gradient is 2.93 percent (Figure G-30). The average wetted width was 17 ft and average water depth was 1.73 ft at time of survey with several large pools noted in the survey profile (Figure G-31).

Figure G-29. View of Illabot Creek from the bank.

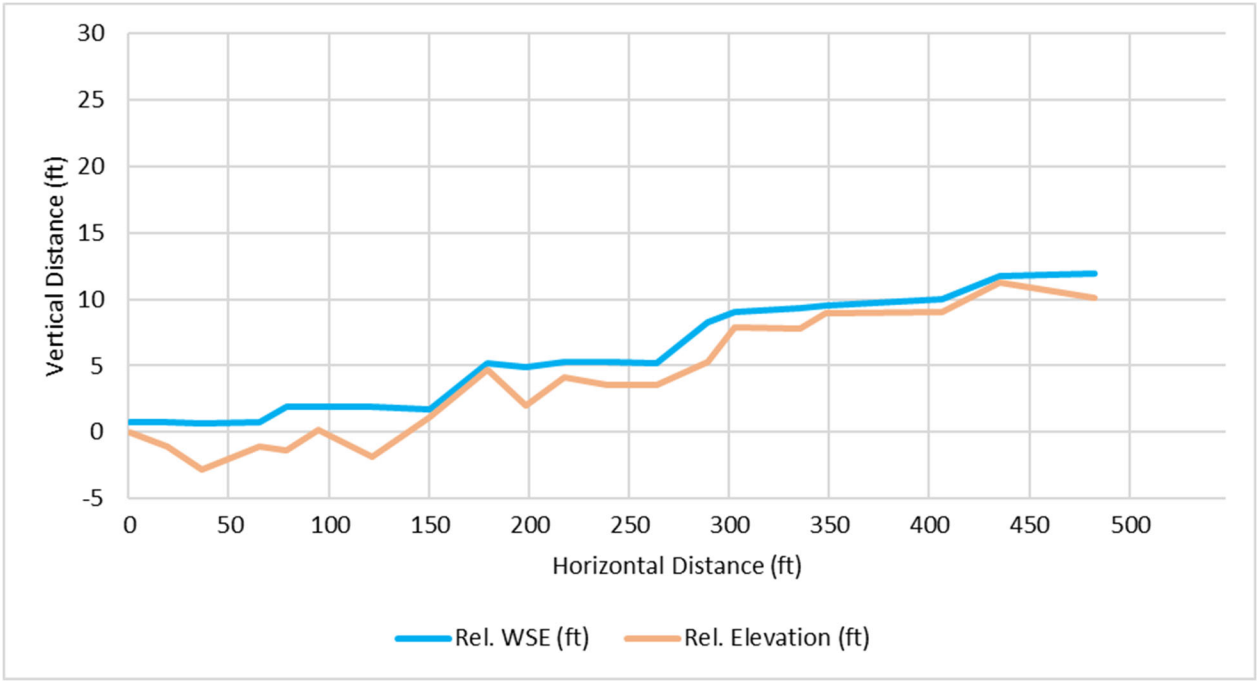


Figure G-30. Relative bed elevation and water surface elevation for Illabot Creek from mouth at the Illabot alluvial fan (above the side channel complex) upstream 500 linear ft.

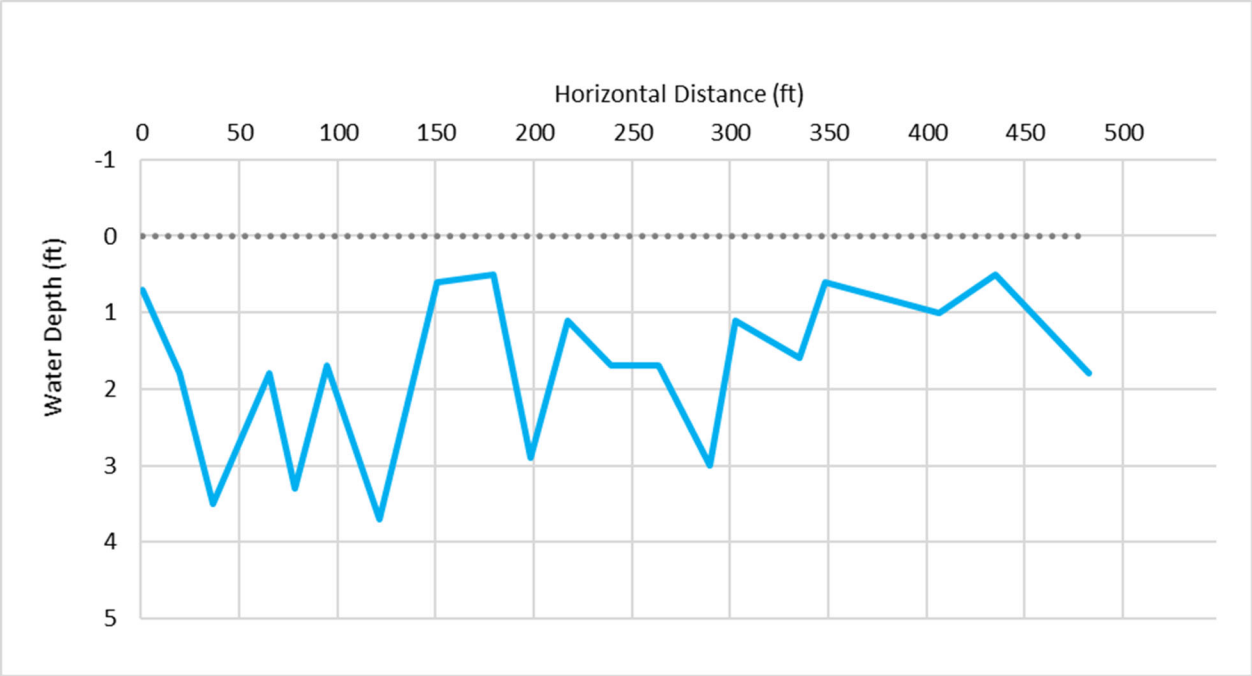


Figure G-31. Water depth profile for Illabot Creek on August 26, 2021 from the mouth upstream 500 linear ft.

Ladder Creek

The mouth of Ladder Creek is comprised predominantly of large boulders with cobble substrate (Figure G-32). A series of cascades occur beginning approximately 300 ft upstream of the mouth with the first of several large, fish blocking waterfalls (over 3.7 meters according to Washington Department of Fish and Wildlife [WDFW] 2019) occurring approximately 50 ft further upstream. A large plunge pool exists at the base of the falls. Downstream of the falls, the average slope is 2.68 percent where surveyable. The thalweg of the river was too deep and swift to survey at time of field visit, so an elevation profile was conducted along right bank. The water depth along right bank averaged 2.27 ft deep and wetted width was approximated at 16 to 20 ft wide.

Figure G-32. A surveyor stands on the right bank at the mouth of Ladder Creek.

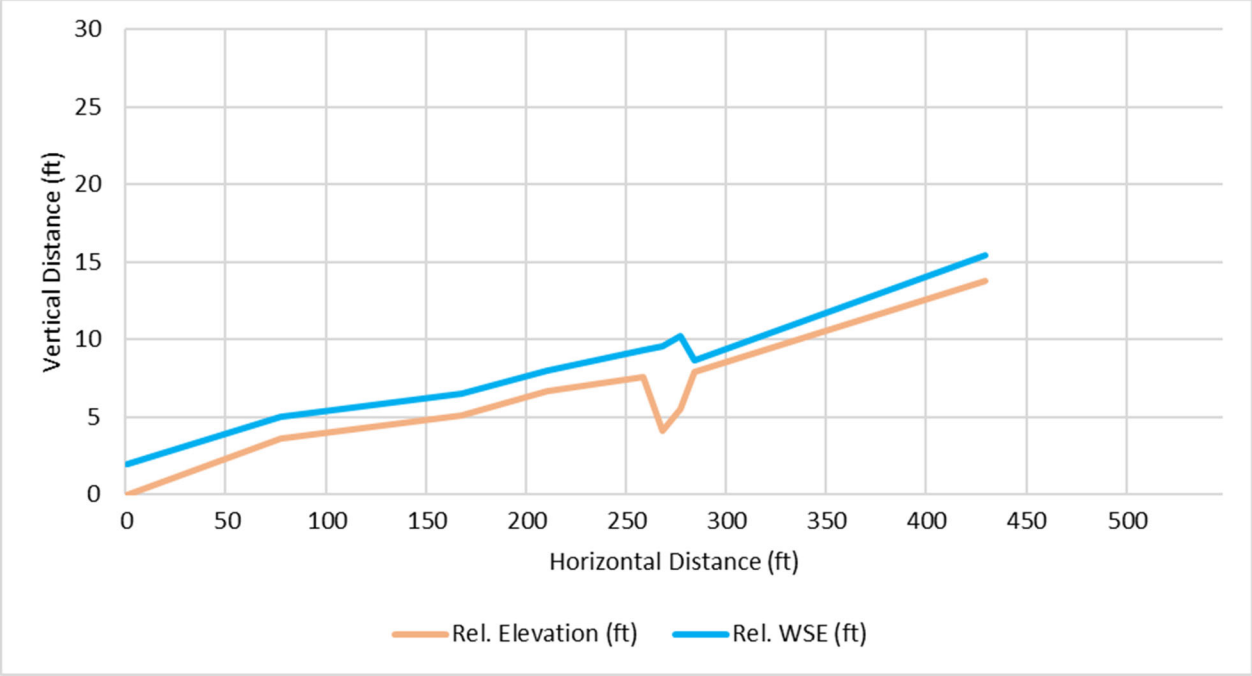


Figure G-33. Relative bed elevation and water surface elevation for Ladder Creek from mouth upstream more than 400 linear ft.

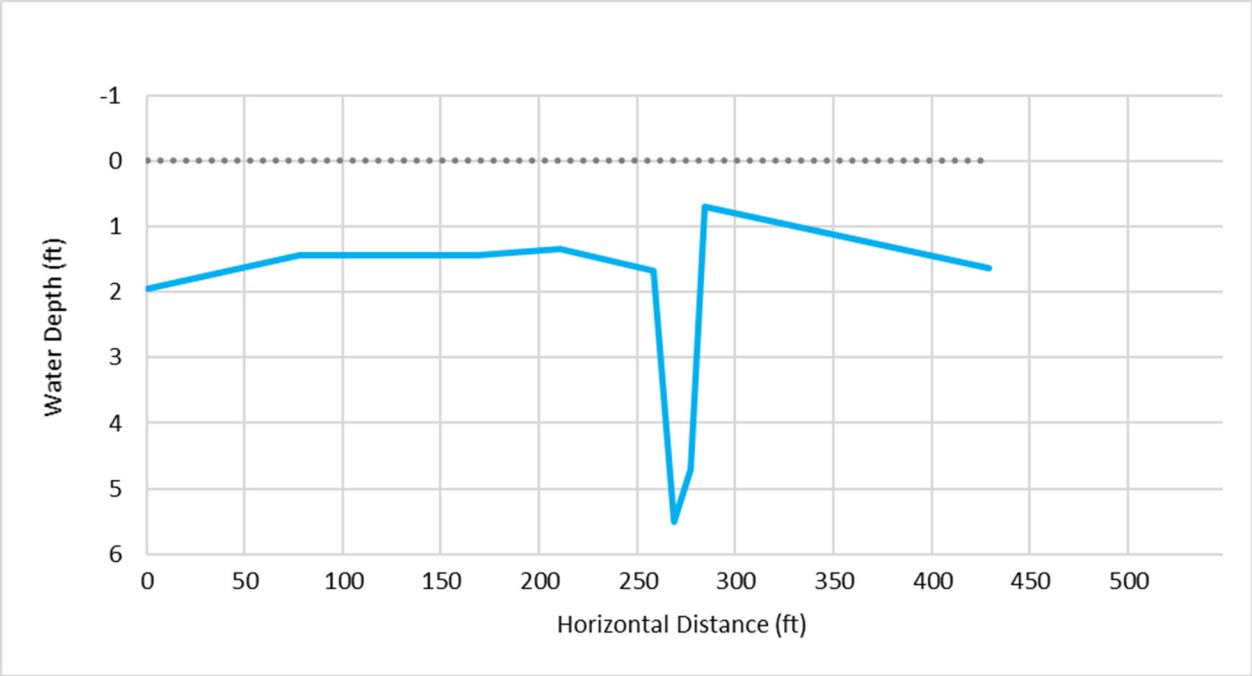


Figure G-34. **Water depth profile for Ladder Creek on August 5, 2021 from the mouth upstream 500 linear ft.**

Martin Creek

The mouth of Martin Creek is a low gradient drainage with predominantly sandy substrate in a dune-ripple morphology partially formed by the backwatering effect on the tributary as it meets the mainstem Skagit at the bend of a prominent meander (Figure G-35). The creek quickly transitions into a gravel-dominated channel bed of pool-riffle morphology, retaining a low gradient profile with an average slope of 0.86 percent (Figure G-36). At the time of field visit, the average wetted width was 9 ft and average water depth was 0.53 ft (Figure G-37).

Figure G-35. **Looking upstream at creek center at the mouth of Martin Creek.**

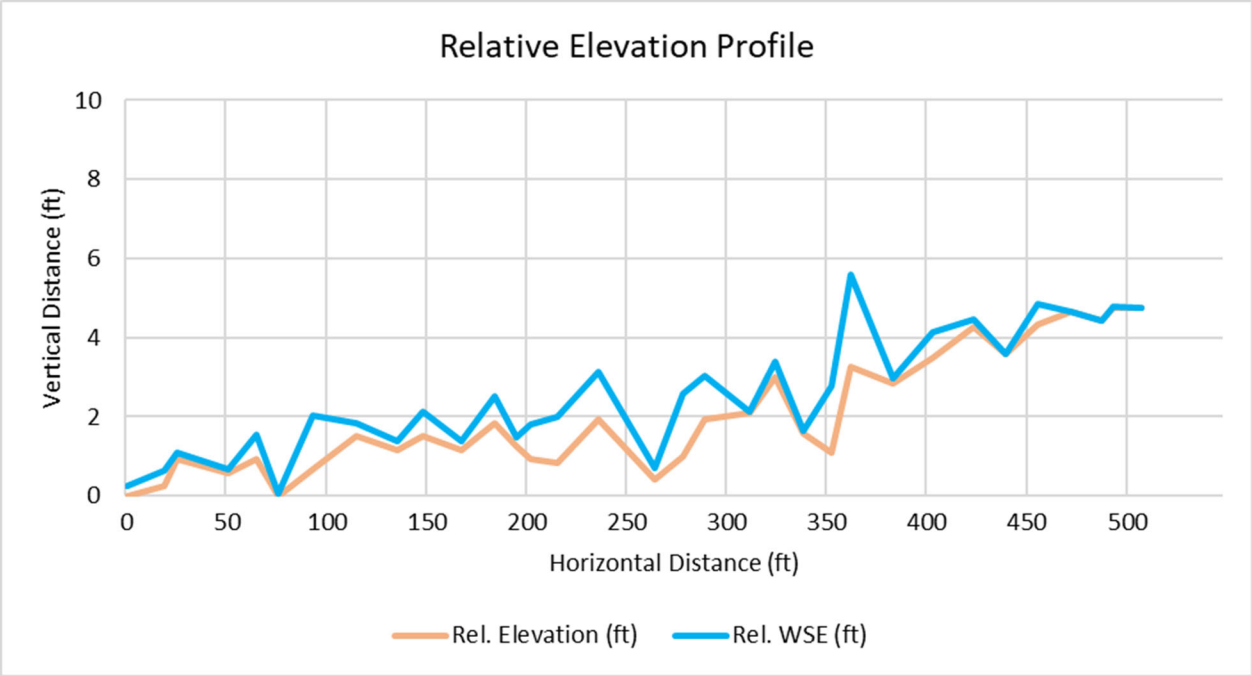


Figure G-36. **Relative bed elevation and water surface elevation for Ladder Creek from mouth upstream 500 linear ft.**

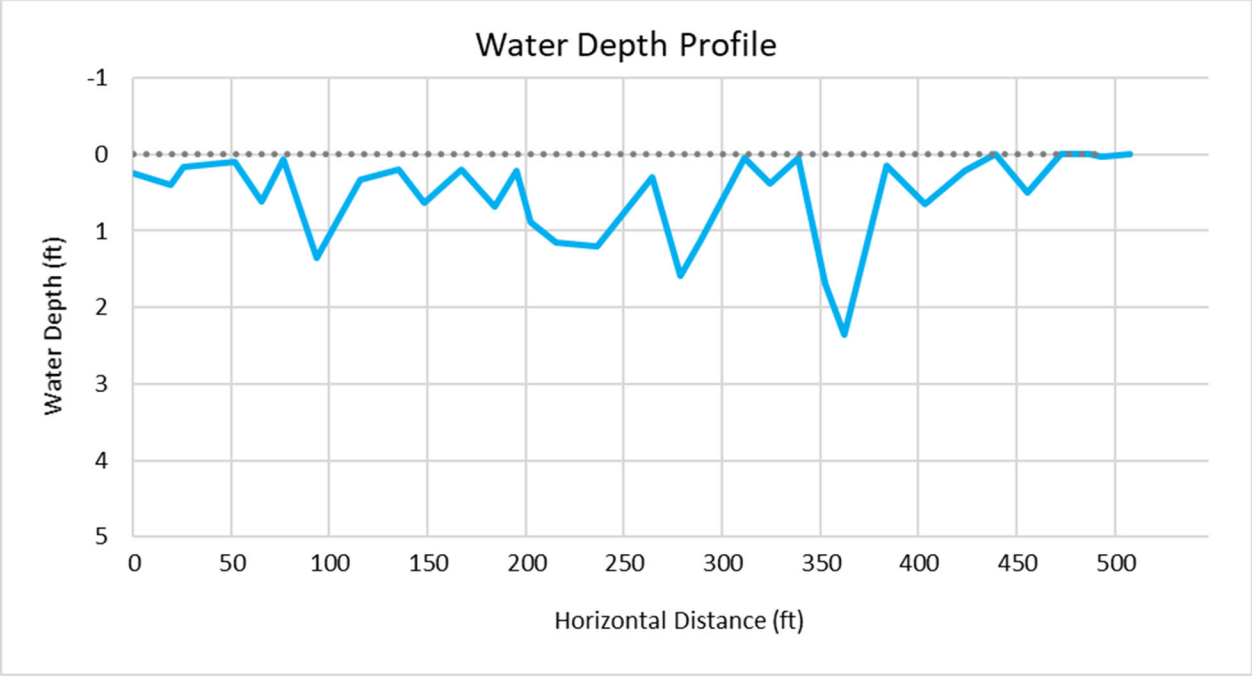


Figure G-37. **Water depth profile for Martin Creek on August 3, 2021 from the mouth upstream 500 linear ft.**

Napoleon Side Channel

The Napoleon Side Channel is a low gradient channel that predominantly moves water from the Sauk River, not the Skagit, before funneling into the mainstem Skagit River (Figure G-38).

Therefore, it was treated as a tributary for the purpose of this analysis rather than a side channel. The Napoleon Side Channel has an overall negative slope across the surveyed reach with an average gradient of -0.11 percent (Figure G-39). At the time of field visit, the average wetted width was 51 ft while the average water depth was 2.08 ft (G-40).

Figure G-38. Looking upstream at creek center at the mouth of Napoleon Side Channel.

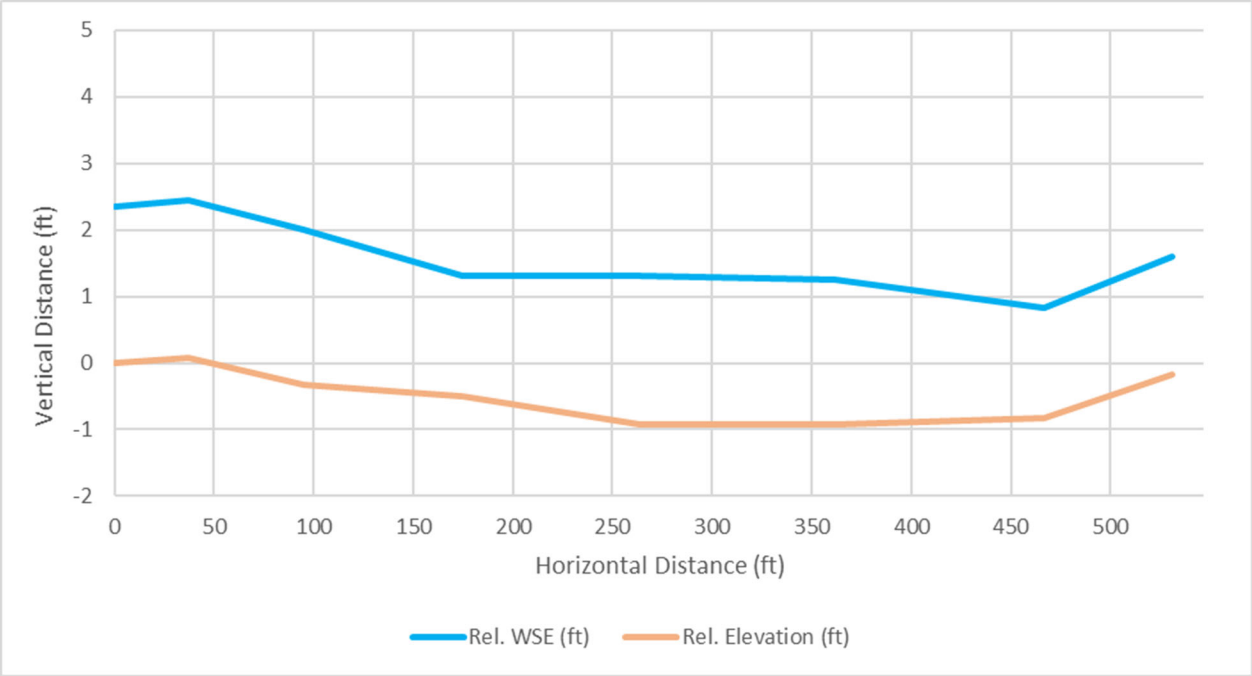


Figure G-39. Relative bed elevation and water surface elevation for Napoleon Side Channel from mouth upstream 500 linear ft.

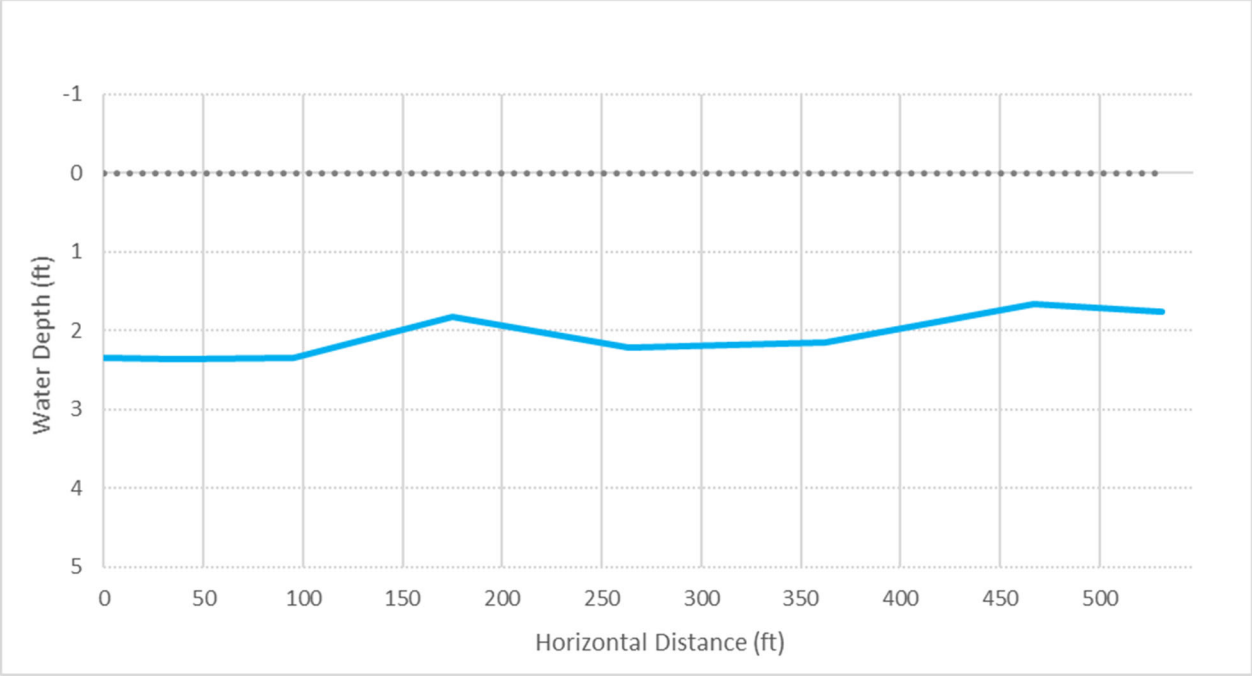


Figure G-40. Water depth profile for Napoleon Side Channel on August 5, 2021 from the mouth upstream 500 linear ft.

Newhalem Creek

Newhalem Creek is characterized by cobble and boulder dominated substrate with two channel mouths (Figure G-41). Both channels were flowing with approximate water depths of 1.5 ft during

the site visit. The dominant mouth, along left bank, was surveyed, but was too deep and swift to cross or obtain a water depth profile of the thalweg. Therefore, a depth profile was taken along the left bank (Figure G-43). The average gradient is 2.90 percent (Figure G-42) while the average wetted width was approximately 30 ft. Average water depth at time of visit was 2.12 ft.

Figure G-41. Looking upstream at the mouth of Newhalem Creek.

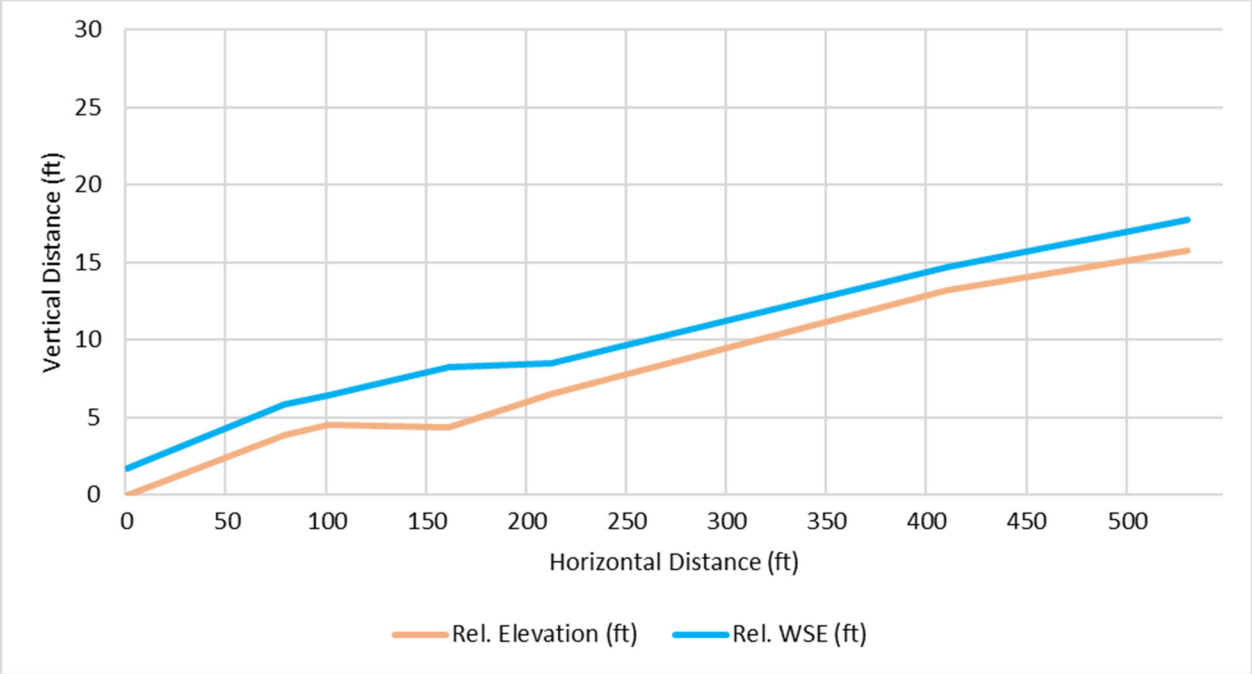


Figure G-42. Relative bed elevation and water surface elevation for Newhalem Creek from mouth upstream 500 linear ft.

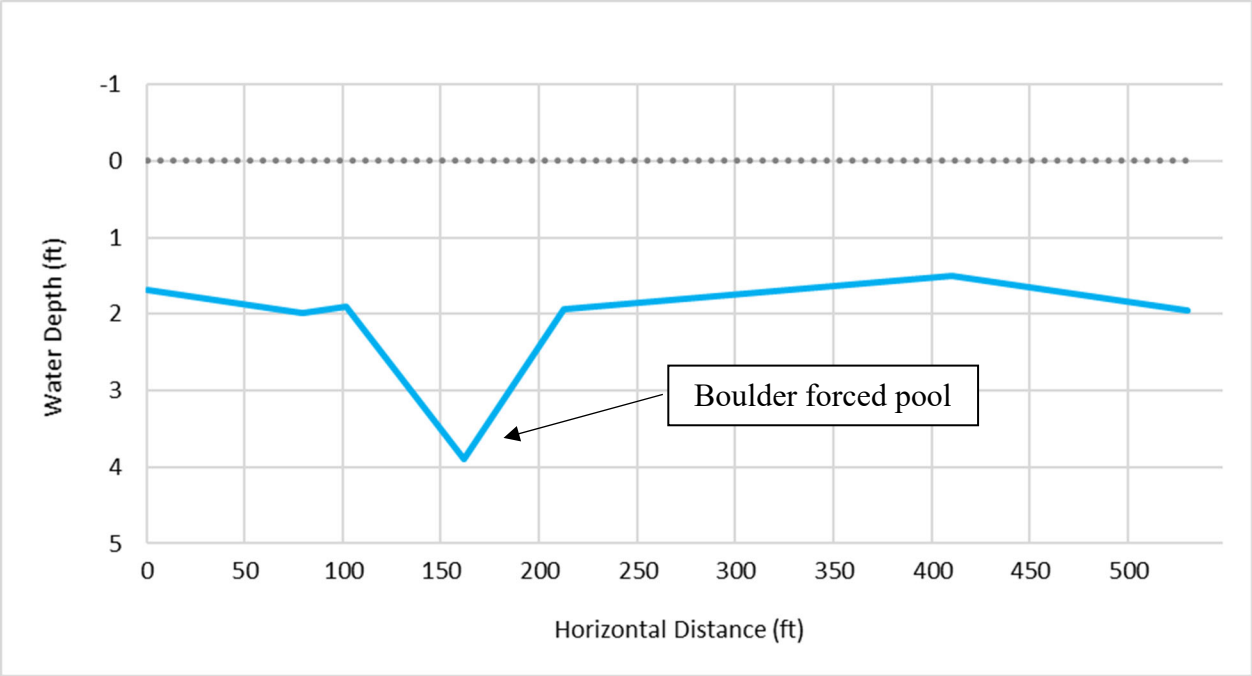


Figure G-43. Water depth profile for Newhalem Creek on August 5, 2021 from the mouth upstream 500 linear ft.

Olsen Creek

Olsen Creek was dry at the time of site visit, except for two isolated pools within shallow depressions (Figure G-44). Approximately 300 ft upstream from the creek mouth, Olsen Creek runs through a squashed corrugated metal pipe (CMP) beneath State Rt. 20 that is documented as a total fish barrier (0 percent passable) due to having a slope over 3 percent according to the WDFW Fish Passage Inventory (WDFW 2021). Upstream of the culvert, the channel is constricted by failing gabion basket walls approximately 8 ft tall that are contributing angular aggregate to the streambed and confining the creek within a width of 13 ft. The gabion basket walls continue until about 500 ft upstream of the channel's mouth, at which point, the channel widens again. The riparian zone throughout the surveyed reach is heavily impacted and dominated by Himalayan blackberry. The average bed gradient throughout the surveyed reach is 1.67 percent (Figure G-45) and the BFW is 39 ft downstream of the road crossing (Figure G-46).

Figure G-44. **Standing at mouth of Olsen Creek looking upstream (left). A surveyor stands at the downstream end of the squashed CMP beneath State Rt. 20 (right).**

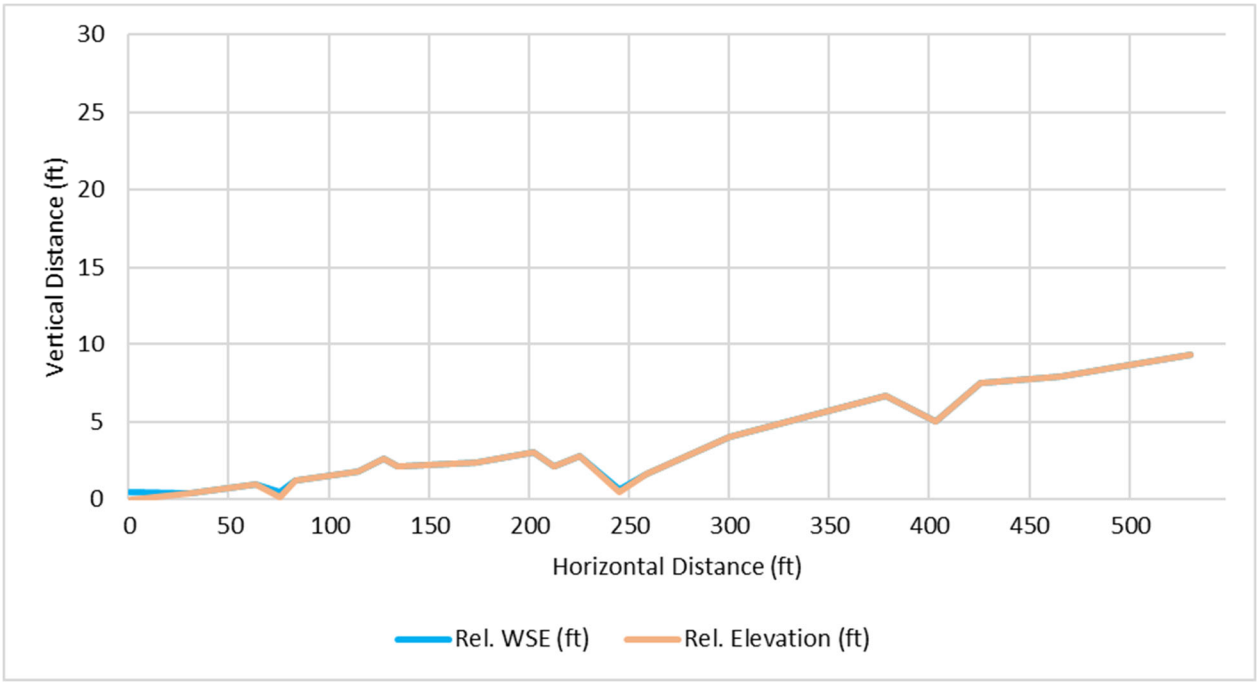


Figure G-45. **Relative bed elevation and water surface elevation for Olsen Creek from mouth upstream 500 linear ft.**

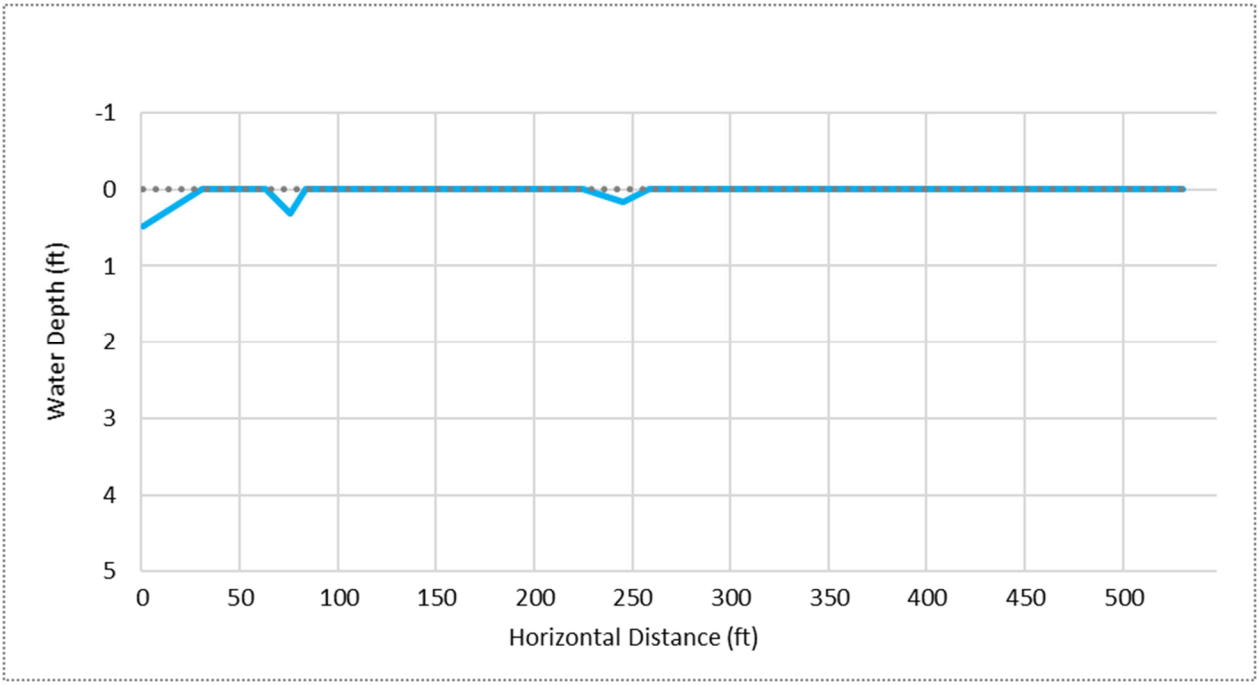


Figure G-46. **Water depth profile for Olsen Creek on August 5, 2021 from the mouth upstream 500 linear ft.**

Rocky Creek

The mouth of Rocky Creek is characterized by a boulder dominated substrate (Figure G-47). The average slope is 2.83 percent, with the dominant grade being between 1.5 and 2.0 percent for the majority of the reach (Figure G-48). At the time of the field visit, the average wetted width was 19 ft and the average water depth was 0.75 ft (Figure G-49). Conditions remained consistent throughout the entire surveyed reach, with a small pool of about 1.3 ft deep occurring at about 300 ft upstream from the mouth.

Figure G-47. **Stream center looking downstream in Rocky Creek.**

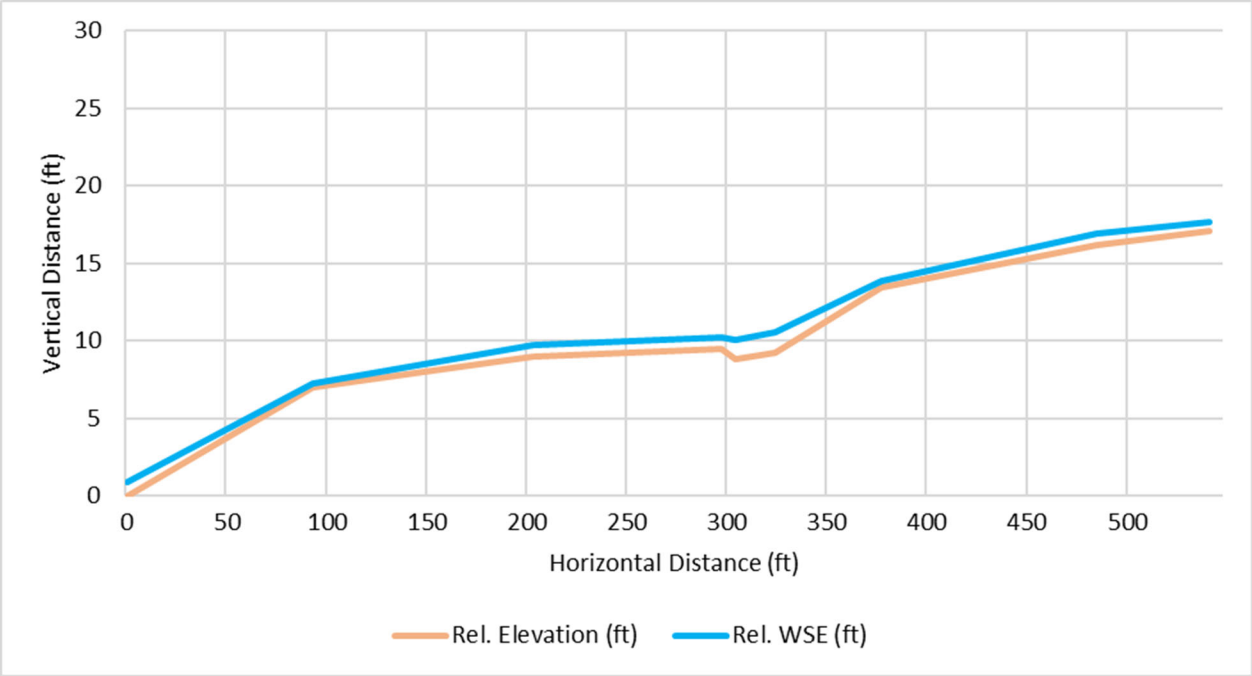


Figure G-48. **Relative bed elevation and water surface elevation for Rocky Creek from mouth upstream 500 linear ft.**

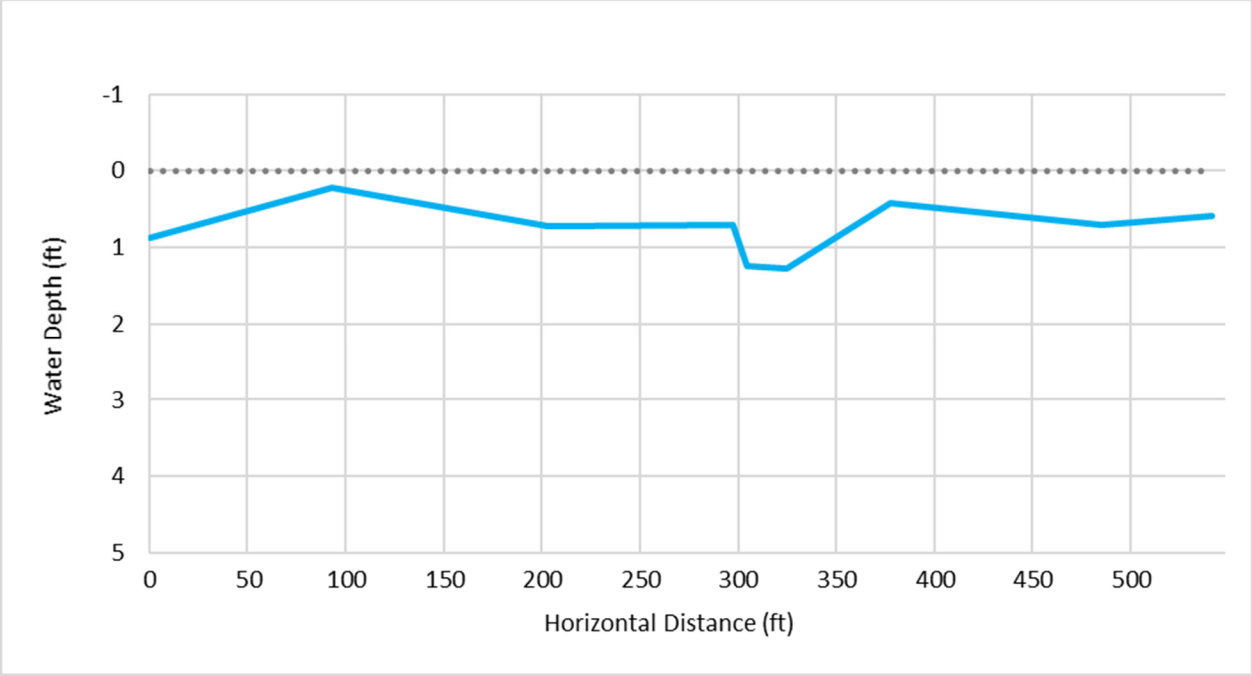


Figure G-49. **Water depth profile for Rocky Creek on August 5, 2021 from the mouth upstream 500 linear ft.**

Sauk Side Channel 1

Sauk Side Channel 1 is a low gradient channel that predominantly moves water from the Sauk River, not the Skagit, before funneling into the mainstem Skagit River (Figure G-50). Therefore,

it was treated as a tributary for the purpose of this analysis rather than a side channel. Sauk Side Channel 1 had an overall negative slope with an average gradient of -0.32 percent (Figure G-51). The substrate is predominantly characterized by sand and fines. At the time of field visit, the average wetted width was 35 ft while the average water depth was 1.69 ft (Figure G-52).

Figure G-50. Standing at the mouth of Sauk Side Channel 1, along left bank, looking upstream.

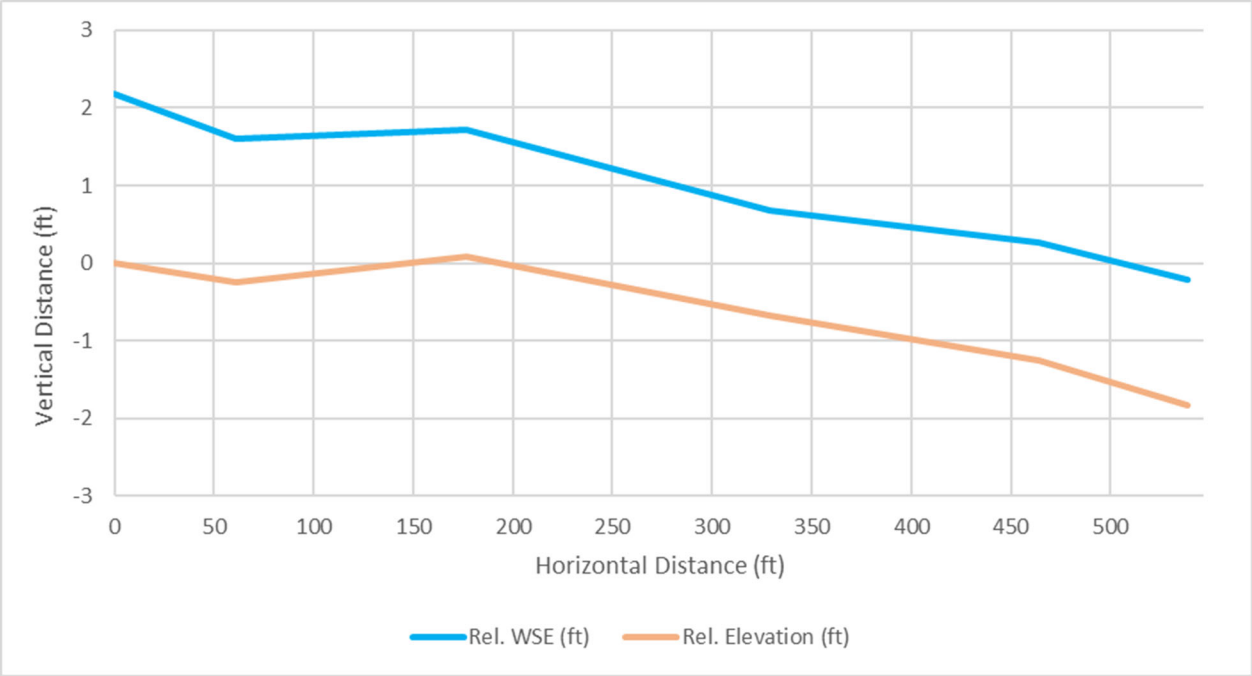


Figure G-51. **Relative bed elevation and water surface elevation for Sauk Side Channel 1 from mouth upstream 500 linear ft.**

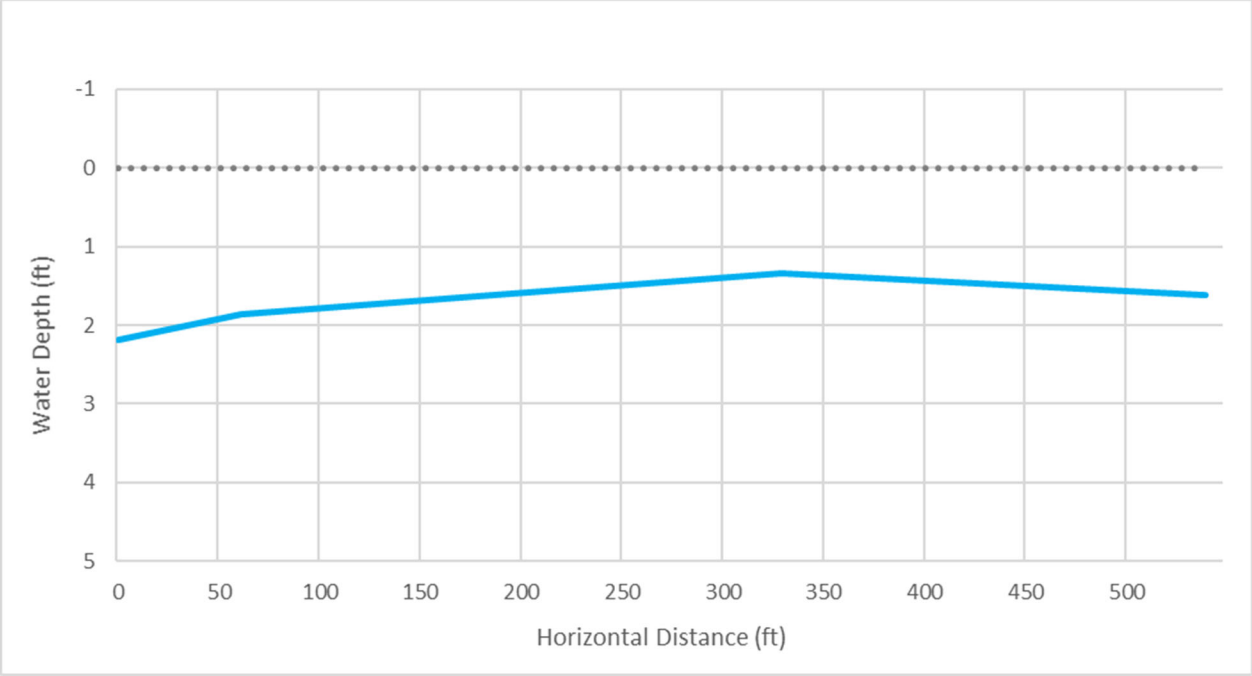


Figure G-52. **Water depth profile for Sauk Side Channel 1 on August 5, 2021 from the mouth upstream 500 linear ft.**

Sky Creek

Sky Creek is a steep, boulder dominated channel with multiple vertical hydraulic drops that act as natural fish barriers (Figure G-53). At 110 ft upstream of the channel mouth, the first hydraulic

drop occurred at 2.9 ft tall. Drop heights increased and grade steepened until the survey was concluded at a hydraulic drop of 13.5 ft at 275 linear ft upstream from the mouth of the creek (Figure G-54). This drop meets the criteria for a total fish barrier (WDFW 2019). Leading up to this point, minimal pool habitat exists between drops, which precludes a fish's ability to orient its body sufficiently to prepare for a leap or give it opportunity for rest. Therefore, fish use likely concludes approximately 200 ft downstream (Figure G-55). An average width was not measured at this location but was estimated to be 9-ft. Average water depth was 0.90 ft at time of survey (Figure G-56).

Figure G-53. Looking upstream at the mouth of Sky Creek.

Figure G-54. **Looking upstream at hydraulic drop, which constituted a total fish barrier at 275 ft upstream of mouth.**

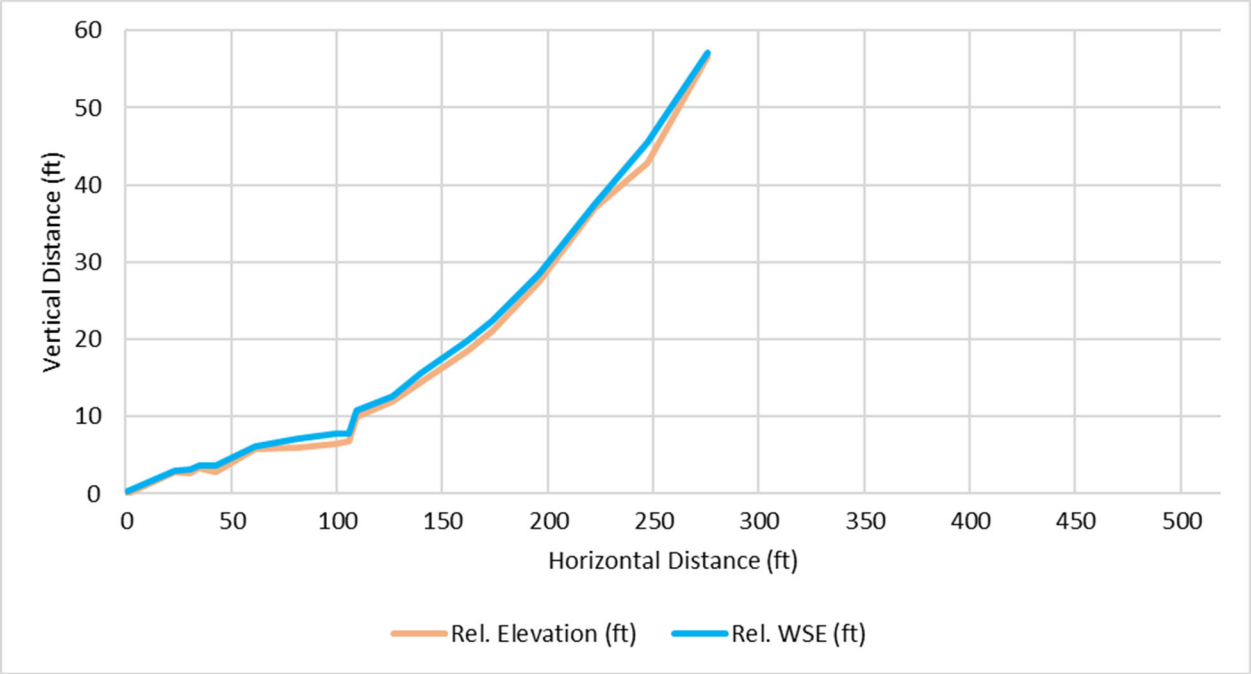


Figure G-55. **Relative bed elevation and water surface elevation for Sky Creek from mouth upstream 275 linear ft.**

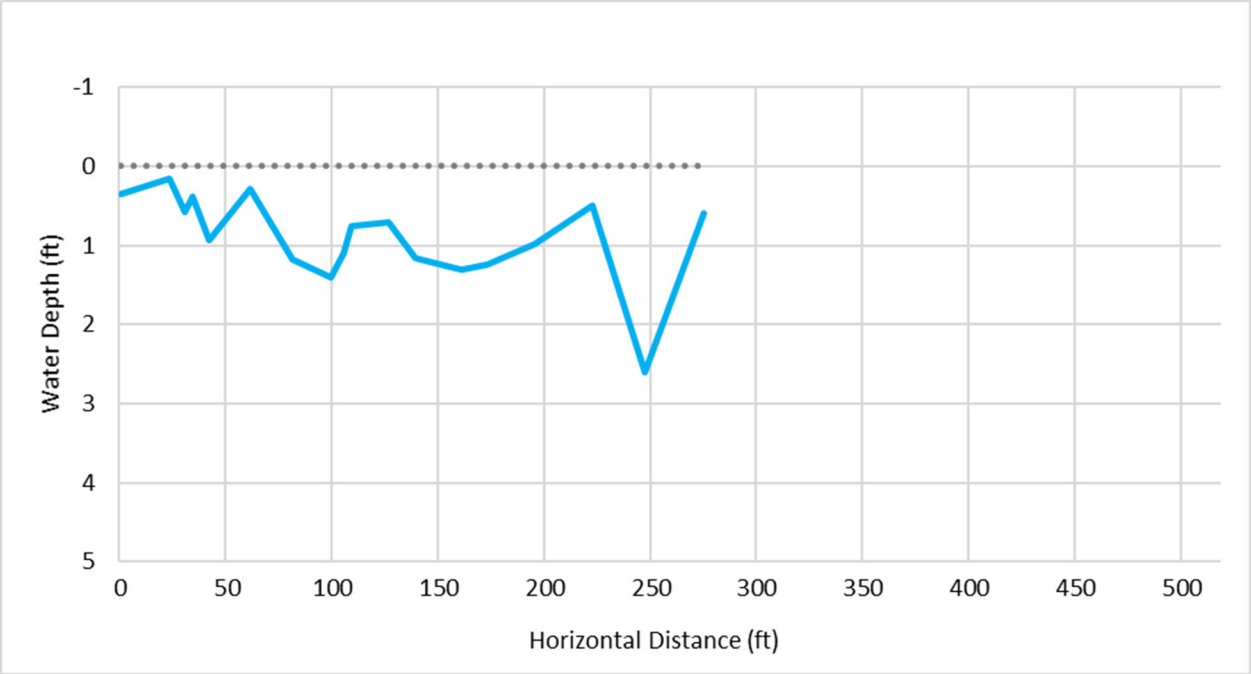


Figure G-56. Water depth profile for Sky Creek on August 3, 2021 from the mouth upstream 275 linear ft.

Sutter Creek

Sutter Creek was dry at the time of the field visit. The mouth of Sutter Creek occurs at a popular boat launch, which has contributed to widening of the stream channel, erosion, and a lack of riparian vegetation. Approximately 80-ft upstream of the mouth, a 5-foot diameter plain cement concrete (PCC) culvert occurs at the crossing with State Rt. 20 (Figure G-57). This culvert is identified as a total fish barrier (0 percent passability) by the WDFW Fish Passage Inventory (WDFW 2021). Downstream of the culvert, substrate consists predominantly of gravel, while upstream of the culvert substrate becomes coarser (Figure G-58). The average slope of the surveyed reach was 4.3 percent while the average BFW was 17 ft (Figures G-59 and G-60).

Figure G-57. **Looking upstream at the outlet of the PCC culvert beneath State Rt. 20 that acts as a total fish barrier (WDFW 2021) on Sutter Creek.**

Figure G-58. **Standing in channel center looking upstream, approximately 500-ft upstream of channel mouth.**

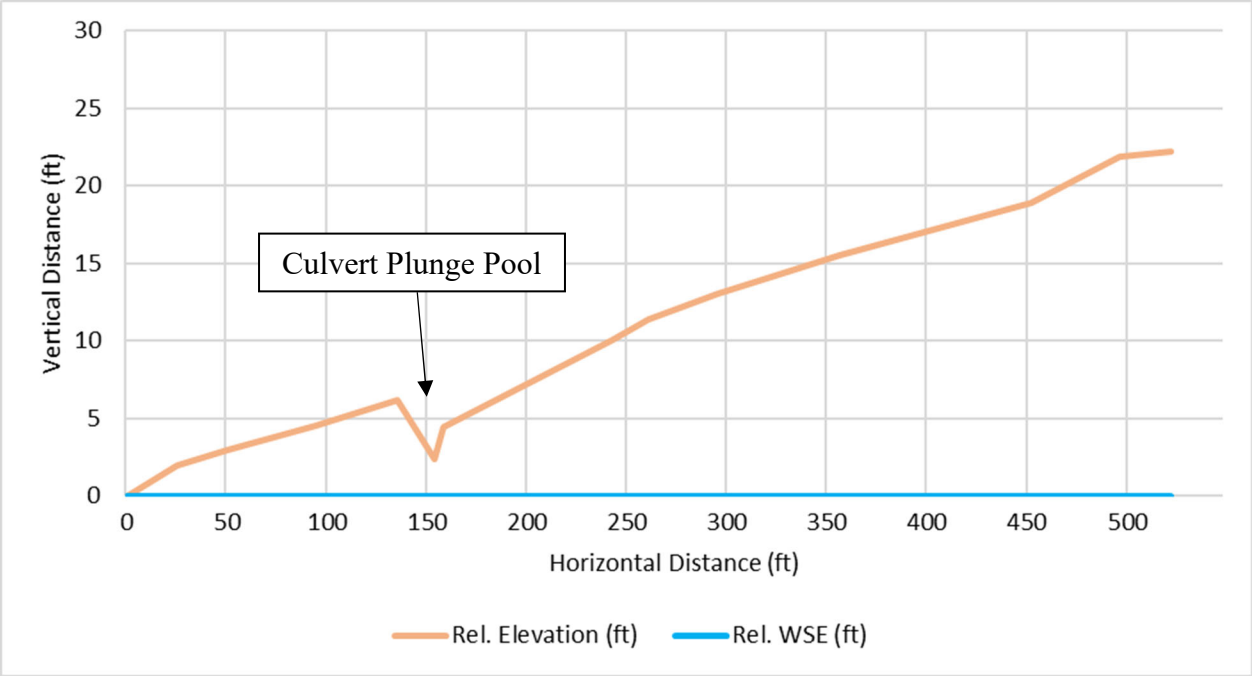


Figure G-59. **Relative bed elevation and water surface elevation for Sutter Creek from mouth upstream 500 linear ft.**

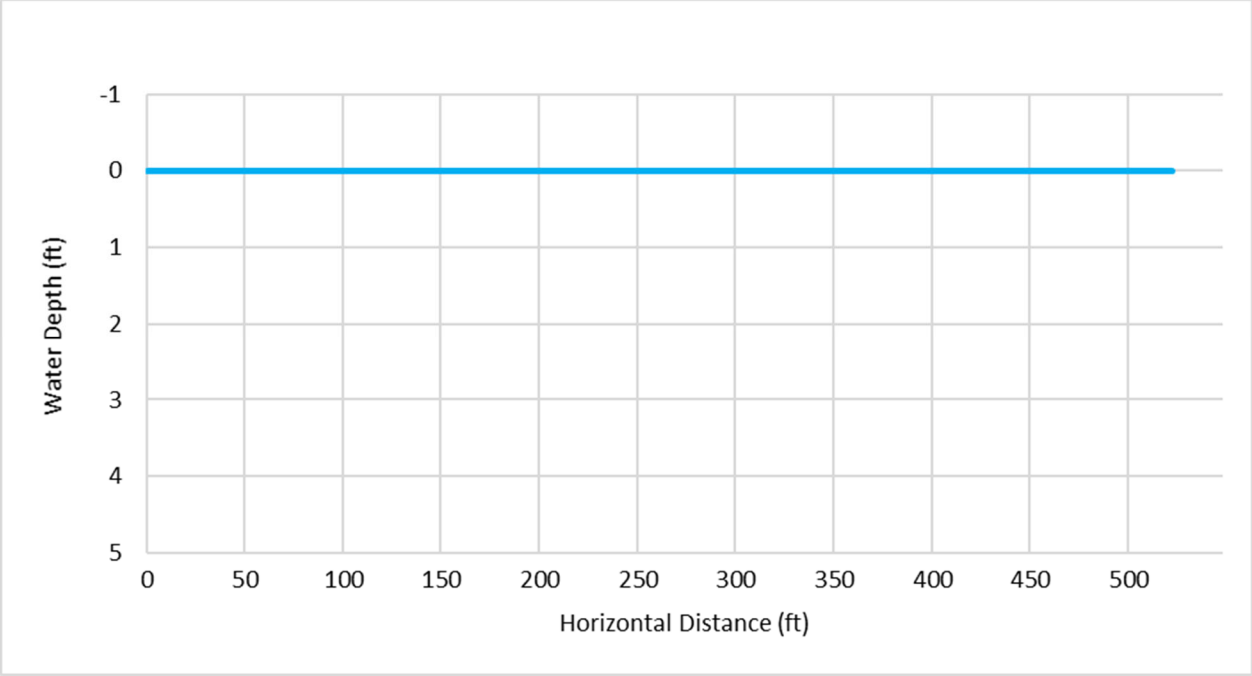


Figure G-60. **Water depth profile for Sutter Creek on August 6, 2021 from the mouth upstream 500 linear ft.**

Thornton Creek

Thornton Creek has multiple channels throughout the alluvial fan at its mouth, though only the main channel had flowing water at the time of field survey. The channel bed substrate was cobble-

boulder dominated (Figure G-61). At approximately 150 ft upstream from the mouth, the stream crossed beneath a bridge under State Rt. 20. Shortly upstream of the bridge, the channel splits around a small island and then rejoins about 100 ft later. The right bank split appeared to be the primary flow path and was the reach that was surveyed. The average stream gradient was fairly consistent at 2.67 percent throughout the surveyed reach (Figure G-62). At time of field visit, the average channel width was 33 ft and the average water depth was 1.31 ft (Figure G-63).

Figure G-61. Standing in channel center looking upstream approximately 400 ft upstream from channel mouth on Thornton Creek.

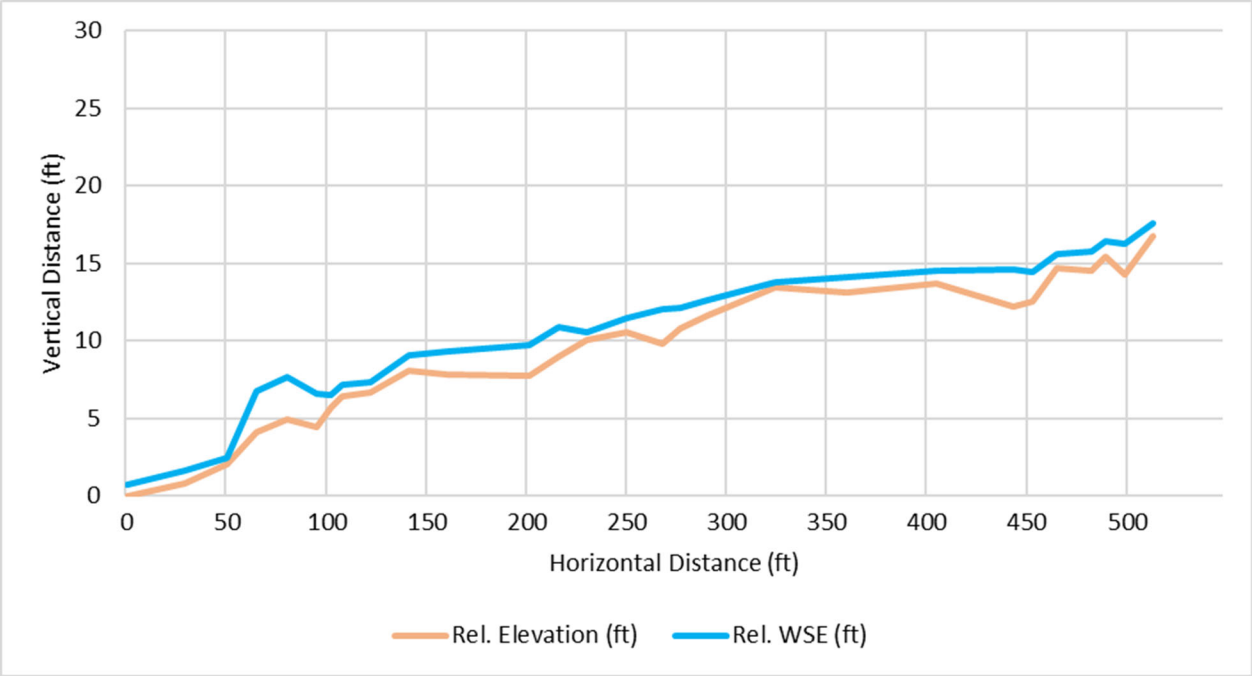


Figure G-62. Relative bed elevation and water surface elevation for Thornton Creek from mouth upstream 500 linear ft.

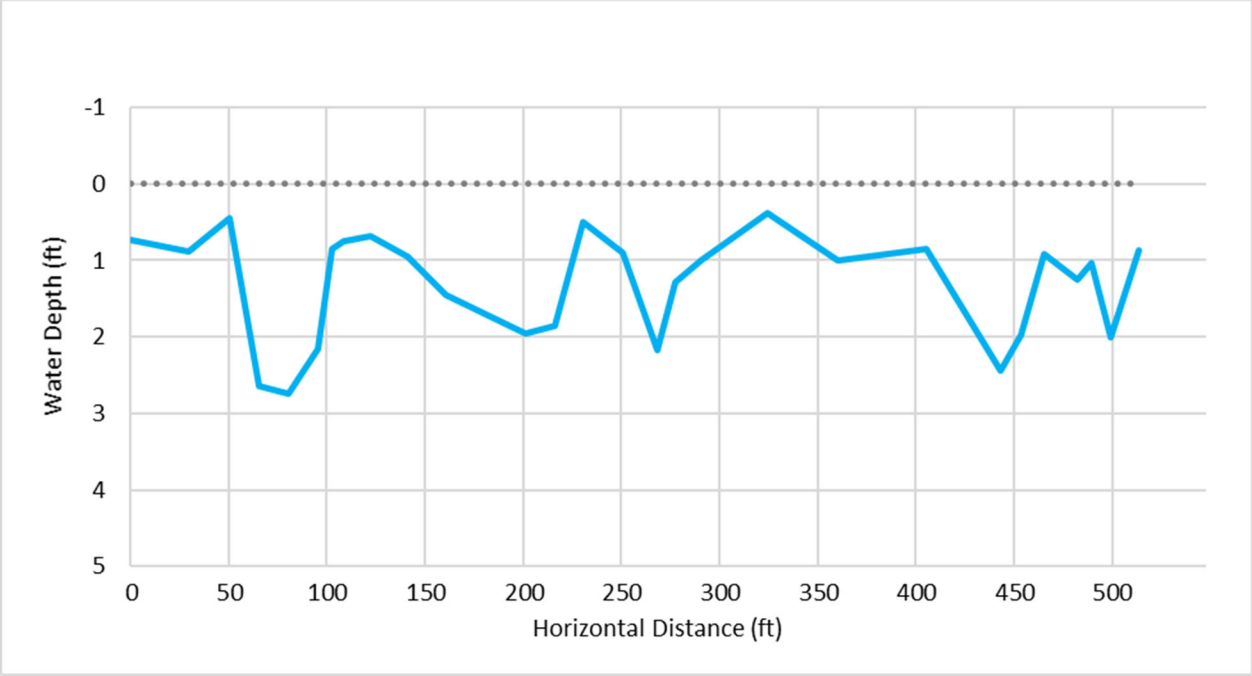


Figure G-63. Water depth profile for Thornton Creek on August 3, 2021 from the mouth upstream 500 linear ft.

Location of Tributaries Within Study Area

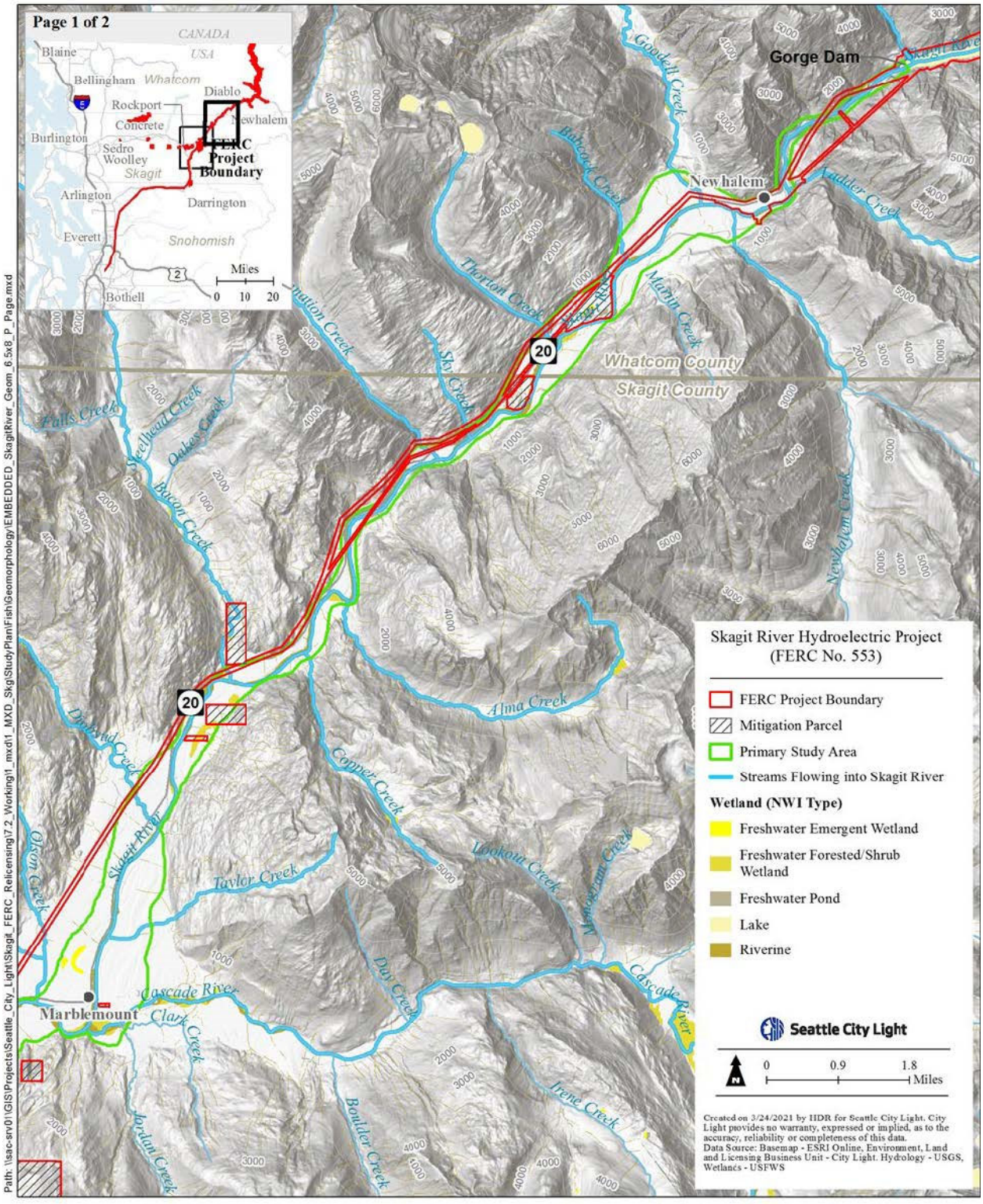


Figure G-64. Tributaries entering northern portion of study area (City Light 2021).

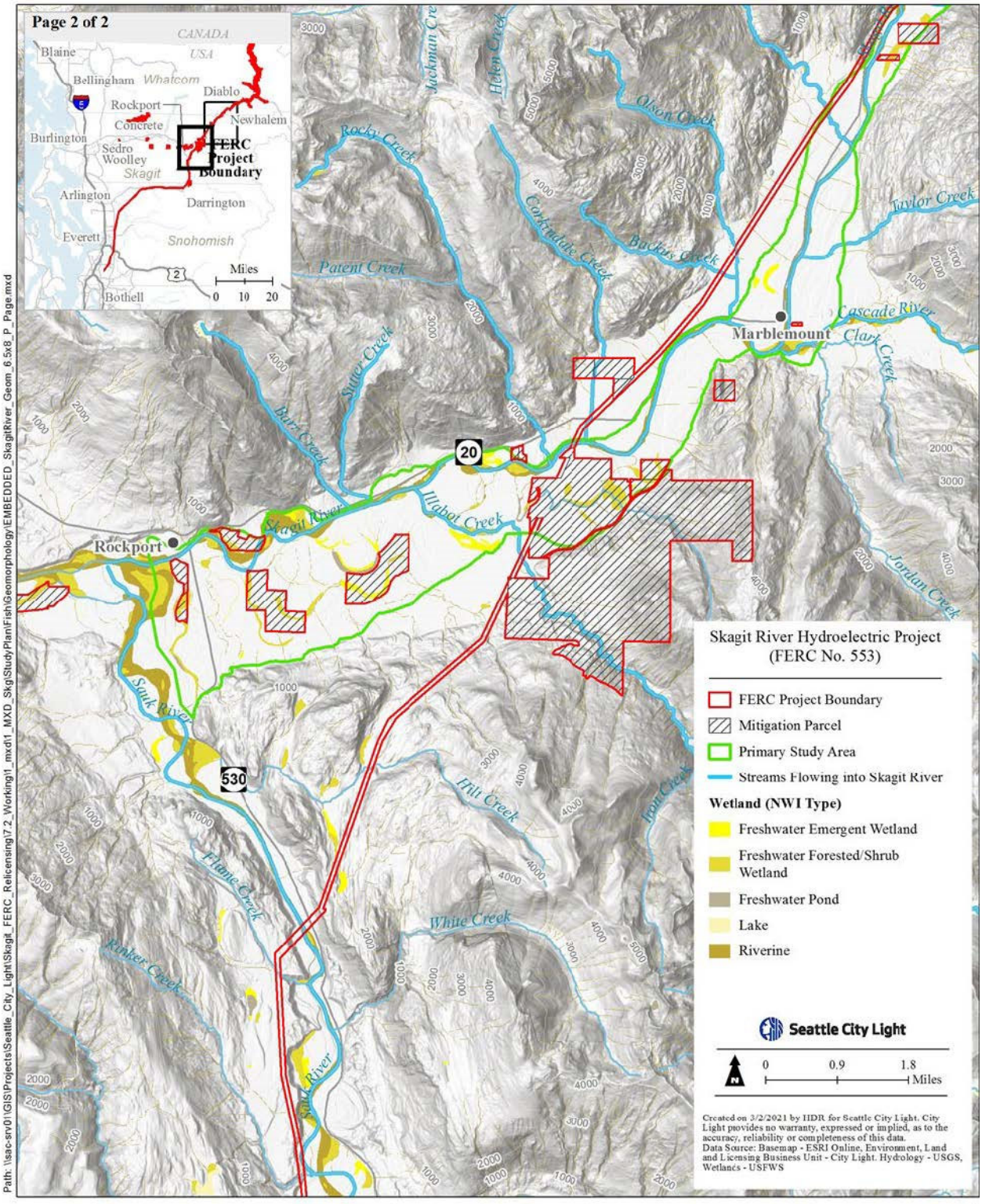


Figure G-65. Tributaries entering southern portion of study area (City Light 2021).

References

Seattle City Light (City Light). 2021. Revised Study Plan (RSP) for the Skagit River Hydroelectric Project, FERC Project No. 553. April 2021.

Washington Department of Fish and Wildlife (WDFW). 2019. Fish passage and surface water diversion screening assessment and prioritization manual. Olympia, Washington.

_____ 2021. Fish passage and diversion screening inventory (FPDSI), 2021. [Online] URL: https://geodataservices.wdfw.wa.gov/hp/fishpassage/index.html. Accessed in August 2021.

SKAGIT RIVER GEOMORPHOLOGY BETWEEN GORGE DAM AND THE SAUK RIVER STUDY INTERIM REPORT

ATTACHMENT H

SIDE CHANNEL INVENTORY NARRATIVE BY GEOMORPHIC REACH

SIDE CHANNEL INVENTORY NARRATIVE BY GEOMORPHIC REACH

Reach 2B

Beginning at the upstream end, the first side channel in Reach 2B is at Project River Mile (PRM) 92.8 on the left bank. The channel flows around a stable forested island and is dry at typical river flows as evidenced by observations of vegetation colonizing the surface with some seedlings several years old including 10-15 feet (ft) tall cottonwoods. The inlet is semi-vegetated indicating infrequent activation. The outlet was dry with a sandy bed, suggesting flood flows backwater into the outlet channel and deposit fine suspended sediment.

Two side channels are found at PRM 91.7, one on the left bank and one on the right bank. The left bank channel is a small, mostly abandoned channel along the inside of a meander bend. The channel forms a 50 ft long wetted backwater at low flow and transitions to a vegetated floodplain swale within 150 ft of the outlet. The outlet also has a large deposit of sand and the inlet is fully vegetated with mature trees. The right bank channel is a flow through channel that is seasonally connected. The channel is formed by a narrow forested island with a log jam at the head of the island. The inlet was not connected at the time of the August 2021 survey, but several isolated pools 1-2 ft deep were found. The gradient of the channel is 1 percent with coarse substrate dominated by cobble and coarse gravel.

Moving downstream, the next side channel is Park Slough at PRM 91.5 on the left bank. Park Slough is a blind constructed Chum spawning channel created in the 1990s. It is groundwater fed due to a subsurface inlet in the floodplain and was noticeably colder to the touch than the mainstem during the August 2021 survey. The outlet was connected but filled with sand from river backwatering. Upstream of the outlet the channel is a series of constructed pools and riffles with placed spawning gravel and several beaver dams. In pools upstream of the beaver dams the channel is filled with silt so spawning habitat is reduced. Park Slough provides rearing habitat due to slow velocities, cold groundwater inputs, and cover from large wood and overhanging vegetation. Juvenile salmonids were seen throughout the channel.

The Agg Ponds are a series of constructed side channels and off channel ponds at PRM 91 on the right bank. The ponds were originally dug for mining aggregate for hydroelectric infrastructure, but now function as large wetland ponds, and the side channels connecting to the ponds were created in the 1990s as Chum spawning channels. The ponds have aquatic vegetation around the shoreline and open deep water in the center. The constructed channels provide rearing habitat via perennial depth, and fish cover from large wood and overhanging vegetation cover. During the August 2021 survey depths were approximately 0.5 ft in the riffles and 1.5-3 ft in pools within the lower channel. The lower channel connecting the larger pond to the Skagit has patches of spawning gravel that appear to still be functioning, but the upper channels above the ponds are filled with aquatic vegetation and a veneer of fine sediment.

Directly downstream from the outlet of the Agg Ponds and adjacent to the confluence of Thornton Creek is a small blind seasonal side channel at PRM 90.5 on the right bank. The channel was dry during the August 2021 survey, but had an unvegetated bed indicating seasonal inundation. The channel probably backwaters from the Skagit and/or Thornton Creek and may also receive runoff from the highway since it runs directly along the road for a portion of its length.

Across the river from the Agg Ponds is the Thornton Side Channel. This is a series of side channels along the left bank. There are multiple inlets to the Thornton Side Channel that flow into a larger channel which runs parallel to the mainstem and eventually forms a braid with the mainstem Skagit. The upstream most inlet appears to be the least active, vegetated along the upper half of the channel, and only appears to activate at high flows. The second upstream most inlet was also dry but appears to be more frequently activated, had a large log jam at the entrance, and became wetted from hyporheic flow before joining the larger channel. Downstream of the second inlet junction the side channel becomes wide and continuously wetted. The third and fourth inlets are perennial with strong connection to the river and the third inlet has a large log jam. The channel gets progressively deeper and wider from the second junction down to a large inlet where it forms a nearly even a split flow with the mainstem river. Downstream of the second junction the channel has long sections of coarse gravel and small cobble substrate suitable for spawning. The larger channel is a long glide a with minimal wood but has some rearing areas along the left bank where vegetation and brush create edge habitat.

Branching off of the Thornton Side Channel is a secondary side channel at PRM 90.25. The channel is perennial and contains juvenile salmonid rearing habitat elements including shelter from mainstem flows, large wood and vegetation cover, and large wood formed pools, along with stretches of spawning gravels (Figure H-1). The channel is low gradient with an average slope of 0.25 percent and has two notable log jams. The first log jam is at the meander just downstream from the inlet and forms a pool >4 ft deep. The other log jam is channel spanning forms a pool >4 ft deep has accumulated large amounts of smaller wood that form a continuous rack of woody cover above the channel.

Figure H-1. Notable log jams creating deep pools with cover within the smaller side channel at PRM 90.25 that splits off of the Thornton Side Channel.

Across the river from the Thornton Side Channel Outlet is a short side channel on the right bank at PRM 90.1. The channel has a perennial connection to the river but has a 0.5 percent gradient with turbulent water even at low flow conditions and is devoid of cover.

The downstream most side channel in Reach 2B is the County Line Ponds on the right bank at PRM 89.5. The County Line Ponds are a series of side channels and old aggregate mining pits that have become ponds (Figure H-2). Within the County Line Ponds there are three side channels and

two ponds that are perennially connected to the river, and a series of ponds that are less connected. The largest side channel, near the upstream end of the County Line Ponds, begins where the river eroded through a bank separating one of the ponds from the river. The channel splits with a portion of the flow going through a large pond and out into a side channel downstream of the pond. The other portion of the side channel flows parallel to the pond and around an island before rejoining the Skagit. This channel is wide and lacks complexity or woody debris, aside from a few wood pieces in the upper portion of the channel. At the downstream end of the pond with the side channel flowing through it a large floating mat of woody debris has formed, and the outlet forms a deep and fast side channel that is widening as indicated by significant bank erosion. The widening is likely due to an increased amount of flow coming into the pond and outlet channel from the river in recent years. Near the downstream end of the outlet channel is a constructed side channel that connects one of the large ponds to the outlet channel. The constructed channel was dry during the August 2021 survey, but appears to be seasonally inundated, although the frequency of connection to the pond is currently unknown.

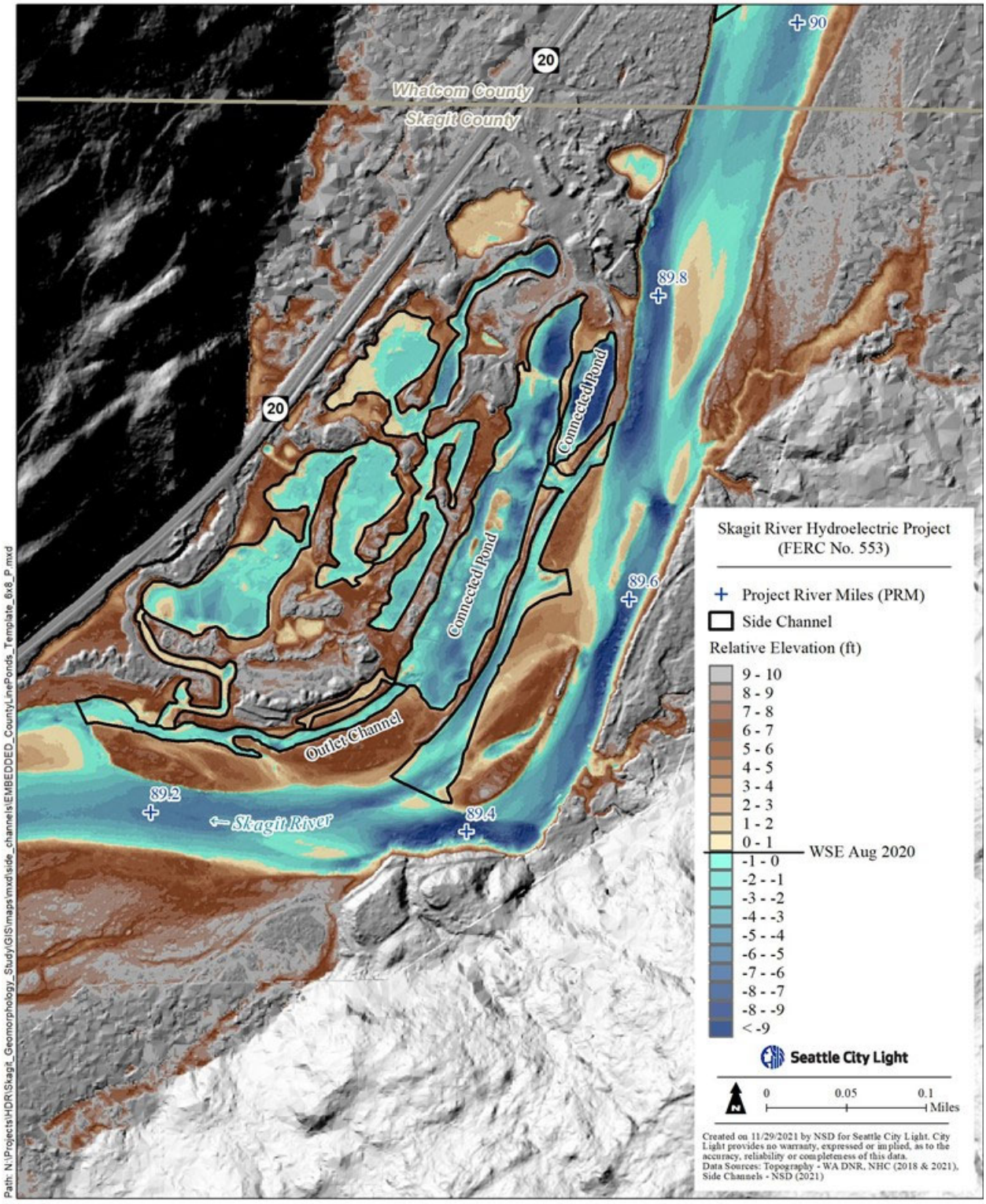


Figure H-2. **County Line Ponds in Reach 2B relative elevation model (REM) showing side channels.**

Reach 3A

Reach 3A contains two side channels. The first side channel is on the right bank at PRM 88.8. This is a small channel flowing along the road prism. The channel is only connected at the outlet and dry during low flow. It backwaters from the river at higher flows. The inlet is not active and vegetated with a bank 3-5 ft above the active channel.

The second side channel is on the left bank at PRM 88.7. Light Detection and Ranging (LiDAR) show channels intersecting the valley hillslope indicating a ground water and hillslope fed channel that provides juvenile salmonid rearing habitat via a series of channels, with several pools, large wood and jams, beaver dams, and cover from woody shrubs. During the August 21 survey the channel went dry in spots, but pools were still full of water with juvenile fish observed in them. It has an active outlet that also flows into a notable backwater pool on the mainstem, but an inactive inlet that is vegetated with mature alders and is 3+ ft above the active channel. At the confluence of Damnation Creek near PRM 88 there is an abandoned side channel that has not been active for decades. A more detailed discussion of the abandoned channel near Damnation Creek is presented in the geomorphic change section of this report.

Reach 4

Reach 4 contains three side channels. The first channel is located at PRM 85.5 on the right bank. This channel is cut through a meander, is mostly inactive, does not flow through, and has a vegetated inlet. At higher flows the channel backwaters from the river at the outlet but is otherwise not engaged as evidenced by field visits during winter 2020, the March 2021 REM, a lack of vegetation, and exposed sand and gravels. The next side channel at PRM 85.3 on the left bank is not active. The channel appears to not be frequently inundated and has mature woody shrubs growing in the channel. The outlet does not even seem to backwater at high flows due to woody vegetation growing immediately in the outlet above the mainstem Skagit active channel. The third side channel in Reach 4 is at PRM 84.5 on the left bank. The channel is perennial and has spawning gravel throughout it. During low flow the channel is < 0.5 ft deep but is <1 percent slope so it provides some side channel rearing habitat. Both the inlet and outlet were well connected with water depths of 0.5-0.6 ft during the August 2021 survey.

Reach 3B

Reach 3B contains three side channels. The first side channel is located at PRM 82.9 on the left bank. This side channel is a former mainstem flow path and in current condition consists of a shallow outlet channel connected to a ponded off channel area. The inlet is inactive and vegetated with willows. The outlet is only seasonally active and the connection to the river is impaired by a large sand deposit. The pond is deep and contains abundant aquatic vegetation and some large wood and provides juvenile salmonid rearing habitat with slow water and fish cover when connected to the river. Juvenile salmonids were seen in the pond during the August 2021 survey, and must have migrated in during higher flows.

Across the river is Moses Slough on the right bank at PRM 82.8. Moses Slough is a side channel that flows around a forested island with large mature conifers and along the State Route (SR) 20 road prism. At the head of the island and the inlet to the channel is a large log jam. During low flow the connection to the river is subsurface at the inlet and the river backwaters into the outlet. The channel upstream of the river backwater is shallow during low flow and goes dry in a few

spots and contains beaver dams. During higher flow the channel likely provides juvenile salmonid rearing habitat due to the low gradient with an average 0.35 percent slope, beaver dam formed pools, and cover from woody debris and overhanging vegetation. The lower section of the side channel appears to be a perennially connected backwater with depths between 0.5 and 2 ft during the August 2021 survey and has spawning gravels.

Downstream from the outlet of Moses Slough is the third side channel in Reach 3B at PRM 82.5 on the left bank. This side channel is perennial has several large pools 3-6 ft ft deep at low flow formed by large wood which provide good rearing habitat, and the remainder of the was a 2 ft deep glide during the August 2021 survey. A log jam is present at the inlet which appears to somewhat protect the channel and may reduce velocities during higher flows. The channel also provides spawning habitat via coarse gravel and cobble found throughout and steelhead and Chum have been observed spawning at the inlet (Lowery 2021).

Reach 5A

Reach 5A contains three side channels. Two of the side channels are located on the upstream and downstream sides of Diobsud Creek on the right bank. The upstream channel, Diobsud Slough, is located at PRM 81.4. Diobsud Slough was historically a flow through channel, but the inlet is inactive and is now limited to a perennial pool backwatered from the river and a shallow beaver ponded wetland above the backwater. The channel used to also be a Chum spawning area but has silted in during recent years (Lowery 2021). The side channel on the downstream side of Diobsud Creek is at PRM 80.6. This channel appears to be inactive at typical river flows due to both the inlet and outlet being vegetated. The lower portion of the channel may backwater from the river at flood flows, but the frequency of engagement is not currently known.

The final channel in Reach 5A is the Taylor Side Channel at PRM 80. The Taylor Side Channel is a blind spawning channel constructed in the 1990s. The channel is perennial and ground water fed as evidenced by a subsurface inlet and is a cold water refugia in the summer. During the August 2021 survey the channel was noticeably colder to the touch than the mainstem. The lower section of Taylor also has several log jams and two beaver dams creating 2+ ft deep pools, and the upper section was consistently 1.5-3 ft deep during August. The cold water refuge, protected slow water, and fish cover provide juvenile salmonid rearing habitat (Figure H-5). Spawning habitat in Taylor is still functional in some locations. In the lower section of the channel contains a large section of spawning sized gravels near the outlet and the upper half of the channel likely still functions for spawning to some degree. There is deposition of a veneer of fine sediment of placed spawning gravels, but patches with clean gravels are still present.

Figure H-5. **Taylor Side Channel. Left photo (facing upstream) is in the lower section of the channel showing cover from wood and overhanging vegetation. Right photo is the upper section (facing downstream) as viewed from the foot bridge.**

Reach 5B

Reach 5B contains seven side channels. The first side channel is the Cascade River Distributary Channels at PRM 78.3. The Cascade River splits into a network of large, mostly perennial distributary channels that all have similar characteristics. The distributary channels are geomorphically active pool-riffle channels full of large wood and substantial log jams. Many of the log jams occupy a majority of the channel and create pools 3-6+ ft deep, providing juvenile salmonid rearing habitat. Sections of spawning sized gravels are found throughout the distributary network.

Across the river from the Cascade River Distributary Channels is Marblemount Slough on the right bank at PRM 78.1. Marblemount Slough is a plane bed channel with minimal hydraulic complexity and large wood, aside from one large log jam forming an island near the inlet. The inlet is connected at most flows, but dry at summer base flows, and the lower half the channel is perennially connected with the outlet forming a large backwater with the river. Substrate is coarse gravel and cobble dominated, but the gravels and cobble are surrounded by fines and therefore highly embedded throughout the majority of the channel. The Pressentin Side Channel, a constructed side channel, shares an inlet with Marblemount Slough, and was under construction during the August 2021 survey. Pressentin Side Channel was excavated through the floodplain in 2021, so it does not appear on the REM based on 2017/2018 LiDAR.

Directly across the river from Marblemount Slough is a high flow side channel on the left bank at PRM 77.6. This large side channel is approximately half the width of the mainstem Skagit River. Dry at low flows, the majority of the channel is wide and open, however, the channel has a large log jam at the inlet and on the bar near the outlet.

Along the same meander as the high flow side channel is another side channel, Marblegate Slough, on the left bank at PRM 77. Marblegate Slough is a partially relict side channel that in present day is only active in the downstream portion of the channel. The active portion consists of a series of large pools with gravel beds overlain with fines (Figure H6). During the August 2021 survey the pools were isolated and not connected to river. Water appears to backwater from the river at higher

flows. Upstream of the pools the channel transitions to a vegetated slough that appears to be not recently inundated.

Figure H-6. Isolated pool (looking upstream) in lower section of Marblegate Slough, Reach 5B.

At PRM 76.6, just downstream and across the river from Marblegate Slough is another side channel on the right bank. This side channel is perennial, but high gradient with slope ranging from 0.5-1 percent and plane bed with minimal large wood. Due to the high gradient and lack of hydraulic complexity the channel does not appear to provide quality spawning or juvenile salmonid rearing habitat.

The next side channel is Clarks Cabin Side Channel at PRM 75.5 on the right bank. Clarks Cabin Side Channel is on private property so it was not surveyed during August 2021. Analysis from REMs and aerial photography indicate a side channel with an inactive inlet and a seasonally connected outlet.

The downstream most side channel in Reach 5B is an unnamed channel at PRM 74.6 on the right bank. The side channel is a backwater at the lower end, then transitions to a beaver dammed relict feature with an inactive inlet. The backwater is sometimes used for Chum and steelhead spawning, and particularly for teelhead when water is flowing over the point bar (Lowery 2021). Behind the beaver dam the channel is mostly dry and disconnected at low flow.

At PRM 75 is an old meander cut-off channel scar that currently forms an off channel wetland. The wetland is only connected to surface water flow in the river by a narrow channel during high flows. The extent of connectivity is not currently known, but hydraulic modeling results once they are available will help assess what flows engage the wetland. The feature was not visited during August 2021, but the TR-02 Wetland Assessment (City Light 2022) and topography from the REMs provide some information. The wetland is 38.9 acre depressional wetland with areas of permanent inundation and a shallow intermittently flowing channel running through a portion of it.

Reach 6

Reach 6 contains 18 side channels and six off channel areas. The upstream most side channel in Reach 6 is the Powerline Pond at PRM 73.9 on the left bank. Powerline Pond is another constructed spawning channel created in the 1990s. The feature is an excavated pond connected to the river by a low gradientoutlet channel with slope <0.1 percent. Shortly after construction the river flooded into the pond and outlet channel filling them with fine sediment. Beavers have also colonized the pond and outlet channel, causing even more deposition of fine sediment. Currently the feature is not functional for spawning due to the high amount fine sediment. However the pond and outlet channel provide good juvenile salmonid rearing habitat due to the outlet channel being full of large wood and aquatic vegetation that provide good cover, and the pond providing cover due to aquatic vegetation During the August 2021 surveys the water was 1.5-3 ft deep in the outlet channel and >3 ft deep in the pond.

Downstream at PRM 73.6, also on the left bank, is another constructed blind spawning channel. The spawning channel is similar to other constructed spawning channels, with a groundwater fed inlet and deep slow water throughout it. Similar to other spawning channels, it has sections of clean spawning gravel, but also areas of extensive deposition of fine sediments, particularly near the inlets and outlet. The outlet of the spawning channel connects to a large wetland in the Illabot Side Channel Complex.

The Illabot Side Channel Complex is a series of side channels and wetlands flowing through a network of channels formed by the Skagit River. The network of channels in the side channel complex are mainly gravel bedded pool riffle channels. The side channels provide good juvenile salmonid rearing and spawning habitat due to abundant spawning sized gravels, substantial large wood and log jams, beaver dams, and riparian cover.

There are four main sections to the side channel network: southern channels, northern channels, western channels, and eastern wetland (Figure H-7). The southern channel is the outlet of the complex, and Illabot Creek also flows into the southern channel. The northern channel flows out of the eastern wetland and contains large wood and several channel-spanning log jams. The western channels contain one main perennial channel and several seasonal channels. The western channel has significant ground water input as evidenced by active areas of groundwater upwelling and water noticeably colder to the touch than the other areas in the Illabot Complex. The eastern wetland is a large off channel wetland. The wetland is a series of open water areas of full of aquatic vegetation and depths were 2+ ft deep in the center during the August 2021 survey.

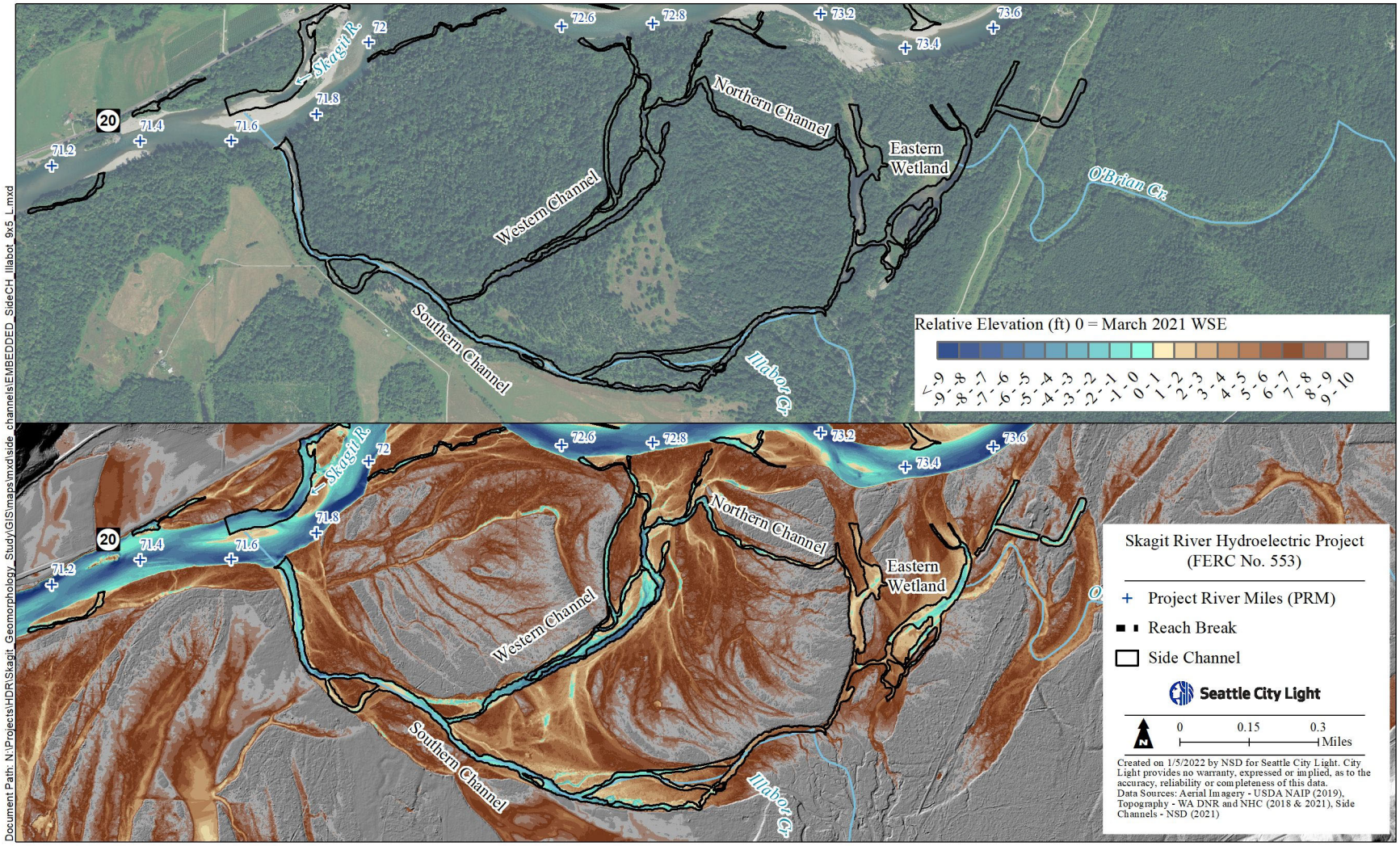


Figure H-7. Illabot Side Channel Complex.

At PRM 73.2 on the right bank is Buller's Side Channel. Buller's Side Channel is a relict mainstem channel that currently forms a blind side channel consisting of a backwater and three beaver dammed ponds. At the outlet the channel backwaters up to the first of three beaver dams. The lower two ponds are smaller ponds that are 2-3 ft deep and primarily gravel bedded. The upper pond is the several times larger than the lower ponds and water was 4+ ft deep in the middle with fines covering most of the bed. Buller's Side Channel has substantial ground water inputs. Active areas of groundwater upwelling were seen during the August 2021 survey and the water was noticeably colder to the touch than the mainstem.

Across the river from Buller's Side Channel is an unnamed side channel at PRM 73 on the left bank. The side channel is inactive aside from two shallow ponded depressions that backwater from the outlet at higher flows. The channel is otherwise dry and vegetated with willows and alders.

Downstream from Buller's Side Channel on the right bank are two side channels at PRM 72.5 and 72.3 in the mainstem backwater where the river begins to flow along SR 20. The side channel at PRM 72.5 is dry at low flow aside from a small backwater at the outlet. The channel is filled with a series of beaver dams and willows. The bed is covered by silt, indicating a lack of flow coming through the channel in recent years. The side channel at PRM 72.3 is called Hoopers Slough and consists of a series of off channel features separated by earthen beaver dams that were originally created by the Washington Department of Fish and Wildlife (WDFW). They are filled with aquatic vegetation and substrate is all sand and fines. Depths were 0.5-2 ft deep during the August 2021 survey.

At PRM 72.2 a side channel cuts through the inside of the meander bend. The side channel provides good juvenile salmonid rearing habitat due to abundant small and large wood and a mature riparian forest containing a grove of large cedars. High juvenile usage was observed during the August 2021 survey. During low flow, conditions alternate between shallow glides 0.3 ft deep and sections with large wood and jams forming pools up to 4 ft deep. The channel was connected and has log jams at both the inlet and outlet, but a section in the middle of the channel was dry during the August 2021 survey.

At PRM 71.9 on the right bank is the Timber Dolo Side Channel. The upper portion of the side channel is a bank protection project with concrete dolos and large wood installed along the SR 20 road prism, along with two large log jams created on the island, separating the side channel from the mainstem. The upper portion of the channel alternates between riffles and deep pools with the dolo revetment providing fish cover. Downstream of the dolo revetment channel width greatly increases and the channel forms long, wide open glides and pools before a large backwater where the channel re-enters the mainstem. Fish cover, wood, and complexity are much lower downstream of the dolo revetment.

Directly downstream from the Timber Dolo Side Channel are two smaller side channels on the right bank. The first side channel is at PRM 71.5. This side channel is a mostly inactive channel that currently forms an off channel wetland. The inlet is completely vegetated with mature alders and cottonwoods and disconnected from the river. The channel forms along the road prism and is a series of disconnected depressions during low flow. During the August 2021 survey, at the outlet a short series of beaver dammed pools flowed into a small 0.1 ft deep trickle of water connecting the side channel to another side channel at PRM 71.4. The second side channel at PRM 71.4 is a

perennial channel that also flows along the road prism. The channel has wood and overhanging vegetation cover, with a diversity of depths and pools in the upper section. The lower half is a riprap lined series of pools that were 2-3 ft deep during the August 2021 survey. The channel also appears to have previous enhancement actions, which are indicated by log weirs and wood secured to the bed.

At PRM 71.2 on the left bank is a seasonal side channel that flows around a narrow, forested island. The channel appears to be in the process of being cut off from the river. During the August 2021 survey flow both the inlet and outlet were dry, and the inlet is colonized by willows and alders. The channel was a series of isolated pools with no surface water connection to the river and cobble and gravel substrate overlain with a thin layer of fines. Juvenile salmonids were seen in the isolated pools, indicating the channel still inundates during higher flows.

At the confluence of Barr Creek and the Skagit River a side channel flows around a developing island at PRM 70.8. The Barr Creek Side Channel is a perennial side channel. The channel is fast and dominated by riffles with little fish cover, aside from one spot in the middle of the channel where a log jam and small island create a 3-4 ft deep pool at low flow. Near the outlet Barr Creek flows into the side channel and a small backwater is formed at the mainstem river.

The Barnaby Outlet is an off channel wetland formed in a series of old Skagit River channel scars. As the name implies, the Barnaby Outlet was the historical outlet of the large oxbow wetland known as Barnaby Slough (Figure H-8). A dike was constructed during the 1960s at the outlet of Barnaby Slough to separate it from the river as part of a larger project to convert Barnaby Slough and the adjacent Harrison Slough into fish rearing ponds. The present day wetland downstream of the slough, referred to as Barnaby Outlet, is an off channel wetland still perennially connected to the river. Barnaby Outlet is full of aquatic vegetation, has beavers, and was 1-3 ft deep during the August 2021 survey. During summer and fall 2021 Barnaby Slough was undergoing a restoration project to remove old infrastructure and reconnect it to the river, but at the time of survey was still separated by a dike.

Lucas Slough branches off of Barnaby Slough and is a long flowing side channel (Figure H-8). Lucas Slough was also separated from Barnaby Slough by fish rearing facility infrastructure, but was fed by water from Barnaby Slough and Harrison Slough. As part of the Barnaby Restoration Project, the infrastructure separating Lucas Slough from Barnaby Slough was in the process of being removed during summer and fall 2021. Lucas Slough is a low gradient channel with slope <0.1 percent, forming a slow glide 2+ ft deep with aquatic vegetation and fine sediments throughout most of its length. The outlet of Lucas Slough flows into another larger side channel at PRM 69.5.

Within the Barnaby area floodplain is another large off channel wetland oxbow—False Lucas Slough (Figure H-8). False Lucas Slough was not visited during August 2021 surveys, but information from aerial imagery, the TR-02 Wetland Assessment, and REM provide some information. False Lucas Slough is more shallow and vegetated than Barnaby Slough or Harrison Slough. False Lucas Slough is not perennially connected to the Skagit River. The March 2021 REM show the outlet several feet higher than the mainstem water surface, and hydraulic modeling performed for the Barnaby Restoration Project show it connected at a 2-year flow via a perched outlet at PRM 69.

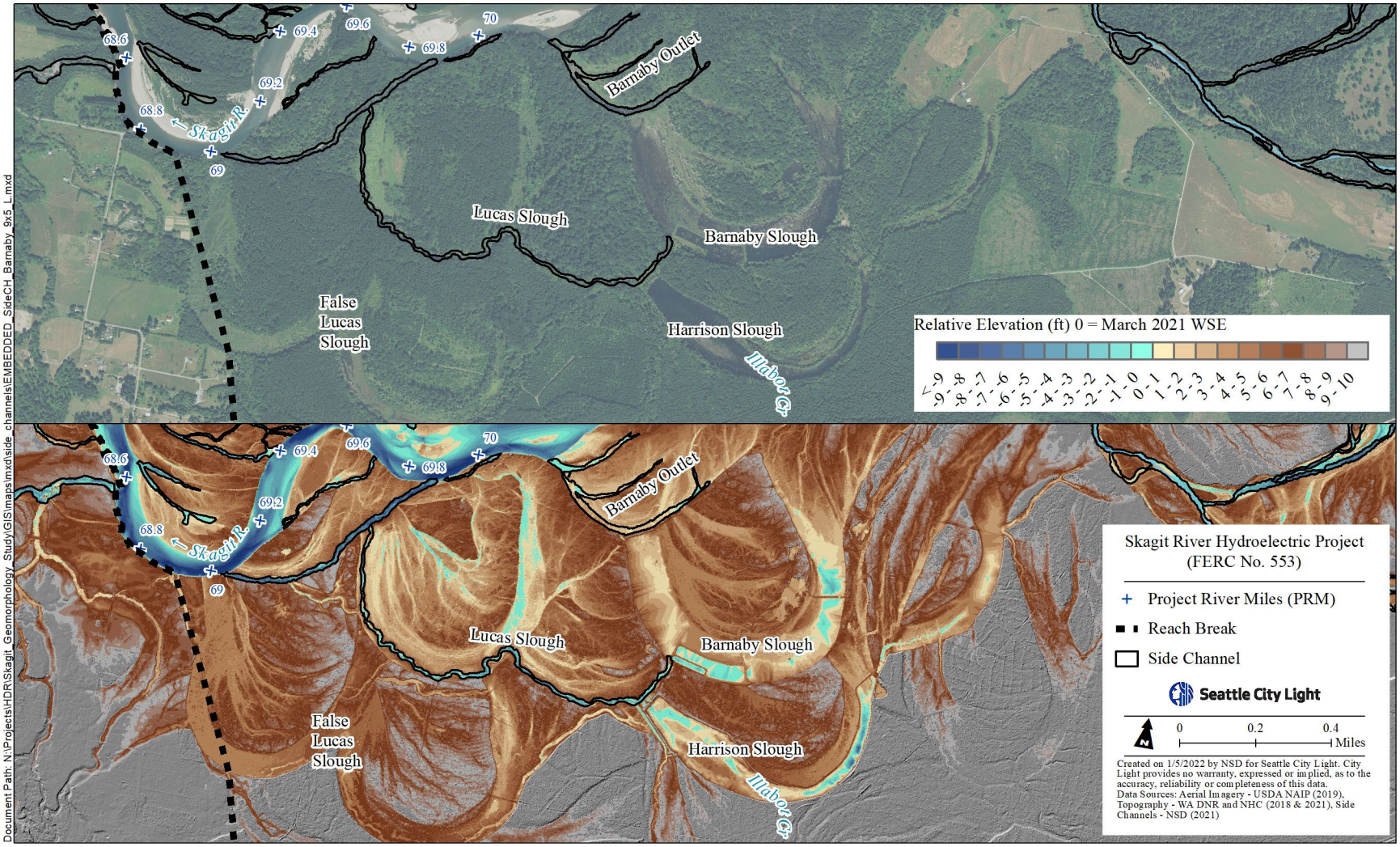


Figure H-8. Barnaby area.

Directly downstream from the Barnaby Outlet is a perennial side channel at PRM 70 also on the left bank. This side channel flows around a narrow island that is actively being eroded by the river and the side channel may soon be lost due to the river completely eroding through the island. The side channel is almost all pool and glide habitat at low flow. Abundant large wood is found throughout the channel that all appears to be eroded from the adjacent banks.

Along the same portion of the left bank are two more side channels. The first is a smaller side channel that cuts through the meander at PRM 69.5. This side channel is perennial and comprised of pools 1-4 ft deep at low flow and short shallow riffles. At low flow the channel is nearly stagnant. The channel has nearly devoid of large wood or other cover aside from vegetation along the bank edges. During the August 2021 survey the inlet was dry and formed a 10 ft long dry patch, but the channel was otherwise continuously wetted. The second side channel is a larger side channel centered at PRM 69.4. This side channel cuts directly from one meander apex to the next on the mainstem and the river is beginning to migrate into it. The channel is deep and fast and was not wadeable during the August 2021 survey when depths were 3+ ft throughout the channel. The channel has actively eroding banks along both sides almost most of the side channel, indicating the side channel is widening. A log jam is formed at the inlet and the actively eroding banks have recruited numerous trees into the channel.

Across the river from the left bank side channels is a large backwater pool on the right bank where two side channels enter the mainstem river. The first and smaller of the two is a perennial channel at PRM 69.7 formed by a vegetated bar. The channel is a wide shallow plane bed with little cover from large wood or vegetation. Several shallow unstable channels that flow around gravel bars are also present adjacent to this side channel. The larger side channel is an off channel wetland formed in an oxbow called Washington Eddy at PRM 69.6. Washington Eddy is a large wetland and open water feature perennially connected to the mainstem backwater. Beavers and beaver dams are present throughout the entire area along with snags, fallen large wood, and aquatic vegetation. The lower portion of Washington Eddy has a bed of fine sediment and depths vary between 1-6+ ft. The channel bed in the upper section is still dominated by fines but has more gravel and sand, and is shallower with depths generally 1-4 ft. The upper section also has strong inputs from ground water, as evidenced by active spots of upwelling observed during the August 2021 survey, making it much colder than the lower portion. The channel eventually transitions from aquatic to terrestrial near the upstream end, and the inlet is inactive and fully vegetated with mature trees.

At PRM 68.6 on the right bank is a perennial side channel that forms a backwater with the river at the outlet and transitions to a beaver ponded area. The ponded area has a fine bed and extensive aquatic vegetation. The inlet is inactive and vegetated with willow and alders.

Downstream at PRM 68.5 also on the right bank is the Johnson Side Channel. Johnson Side Channel is a prominent perennial side channel that contains multiple threads. The channel contains large wood and log jams, overhanging vegetation, beaver dams, and pools throughout the entire network of channels all of which provide good juvenile salmonid rearing habitat. The channel has multiple inlets feeding four separate channels and a large log jam spanning the main inlet. Channels converge and split throughout the network forming high complexity and engagement at a variety of flows depending on the stage of the river. The outlet is well connected to the river with a 5 ft deep channel flowing into the Skagit.

Adjacent to Johnson Side Channel is a large side channel that flows around a forested island called the Rockport Side Channel at PRM 68.3. Rockport Side Channel is wide, deep, and open with little cover aside from vegetated bank edges, and the hydraulic conditions are more similar to the mainstem Skagit than many of the other side channels surveyed. Branching off Rockport Side Channel is a small seasonally connected side channel at PRM 68.2. The channel consists of sand and fines and does not contain large wood but has overhanging vegetation cover. During low flow the small side channel is dry.

Reach 7

Reach 7 contains four side channels. The first side channel is a seasonally connected channel on the left bank at PRM 68.3. During the August 2021 survey the inlet and outlet were dry but isolated pools without a surface water connection to the river were observed. The channel is vegetated with a dense canopy of young alder and willow, is well used by beavers, and contained several dams and wood forced pools. Along the same bank is Bohs Slough, a larger side channel at PRM 68.1. Bohs Slough is a perennial side channel consisting of glides and pools. The channel provides juvenile salmonid rearing habitat due to pools created by large wood and log jams. Two channel spanning log jams with dozens of large wood pieces are present—one at the inlet and other about 800 ft downstream from the inlet. The lower portion of Bohs Slough flows underneath a bridge for SR 530 and has lower amounts of large wood and hydraulic complexity compared to above the bridge.

Below Bohs Slough is another perennial side channel on the right bank at PRM 67.3, Howard Miller Side Channel. Howard Miller Side Channel flows around a narrow island along the Howard Miller Steelhead Park Property. The majority of the channel is a wide plane bed channel with low hydraulic complexity and cover, but the outlet forms a deep backwater and large log jam with the river.

The final side channel in Reach 7A is the Sauk Waterfall at PRM 67.1 on the left bank. As the name implies, the Sauk Waterfall is a network of distributary channels from the Sauk River. The Sauk Waterfall is dry at low flow, but isolated pools of water were found in the western most channel. The channels have dense riparian canopy of woody shrubs and small wood and brush provides some fish cover. At higher flows the network is likely wetted from the Sauk River and provides high flow refugia.

References

Seattle City Light (City Light). 2022. TR-02 Wetland Assessment, Draft Report for the Skagit River Hydroelectric Project, FERC Project No. 553. Prepared by Environmental Science Associates. March 2022.

Lowery, Erin. 2021. Personal communication between Erin Lowery (Seattle City Light) and Colin Riordan (Natural Systems Design). August 2021.

SKAGIT RIVER GEOMORPHOLOGY BETWEEN GORGE DAM AND THE SAUK RIVER STUDY INTERIM REPORT

ATTACHMENT I

LARGE WOOD AUGUST 2021 INVENTORY MAPBOOK

GE-04 GEOMORPHOLOGY STUDY

Large Wood August 2021
Field Inventory

- FERC Project Boundary
- Mitigation Parcel
- National Park / National Recreation Area Boundary
- Project River Miles (PRM)
- Geomorphic Reach
- Large Wood Detailed
- Log Jam
- Individual Log

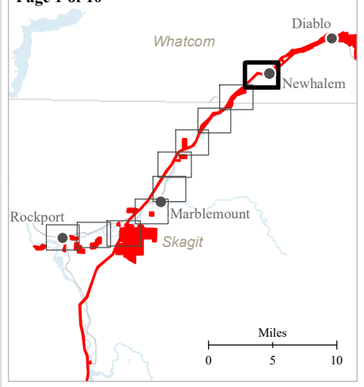
Tallied Large Wood

PieceCount

- 1 - 2
- 3 - 5
- 6 - 10

N

0 500 1,000 Feet



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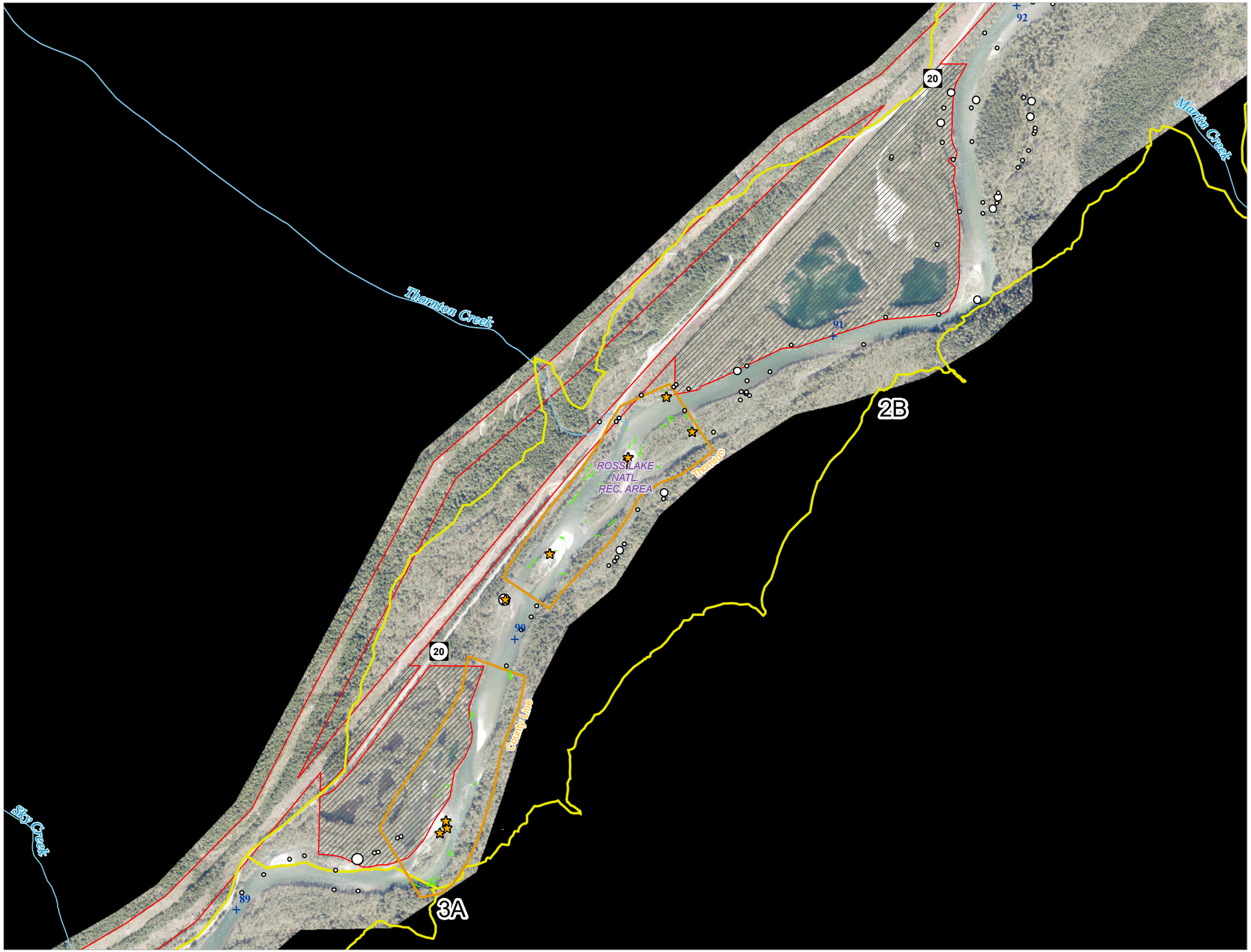

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- Log Jam
- Individual Log

Tallied Large Wood

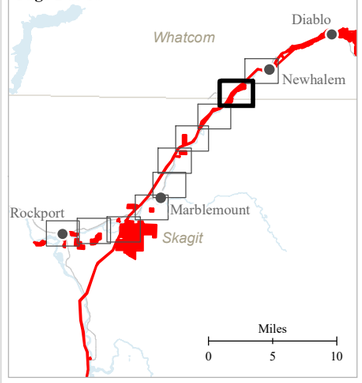
PieceCount

- 1 - 2
- 3 - 5
- 6 - 10

N

0 500 1,000 Feet

Page 2 of 10



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- Log Jam
- Individual Log

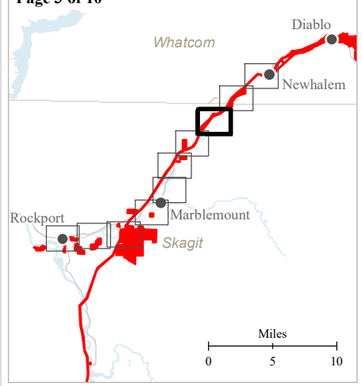
Tallied Large Wood

PieceCount

- 1 - 2
- 3 - 5
- 11+

N

0 500 1,000 Feet



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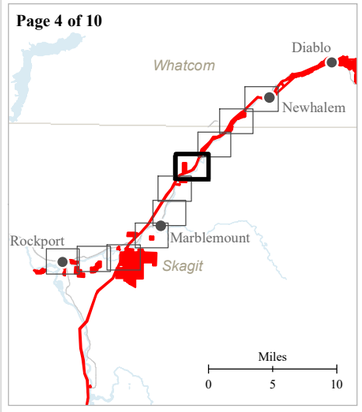
PieceCount

- 1 - 2
- 3 - 5
- 6 - 10

N

0 500 1,000 Feet



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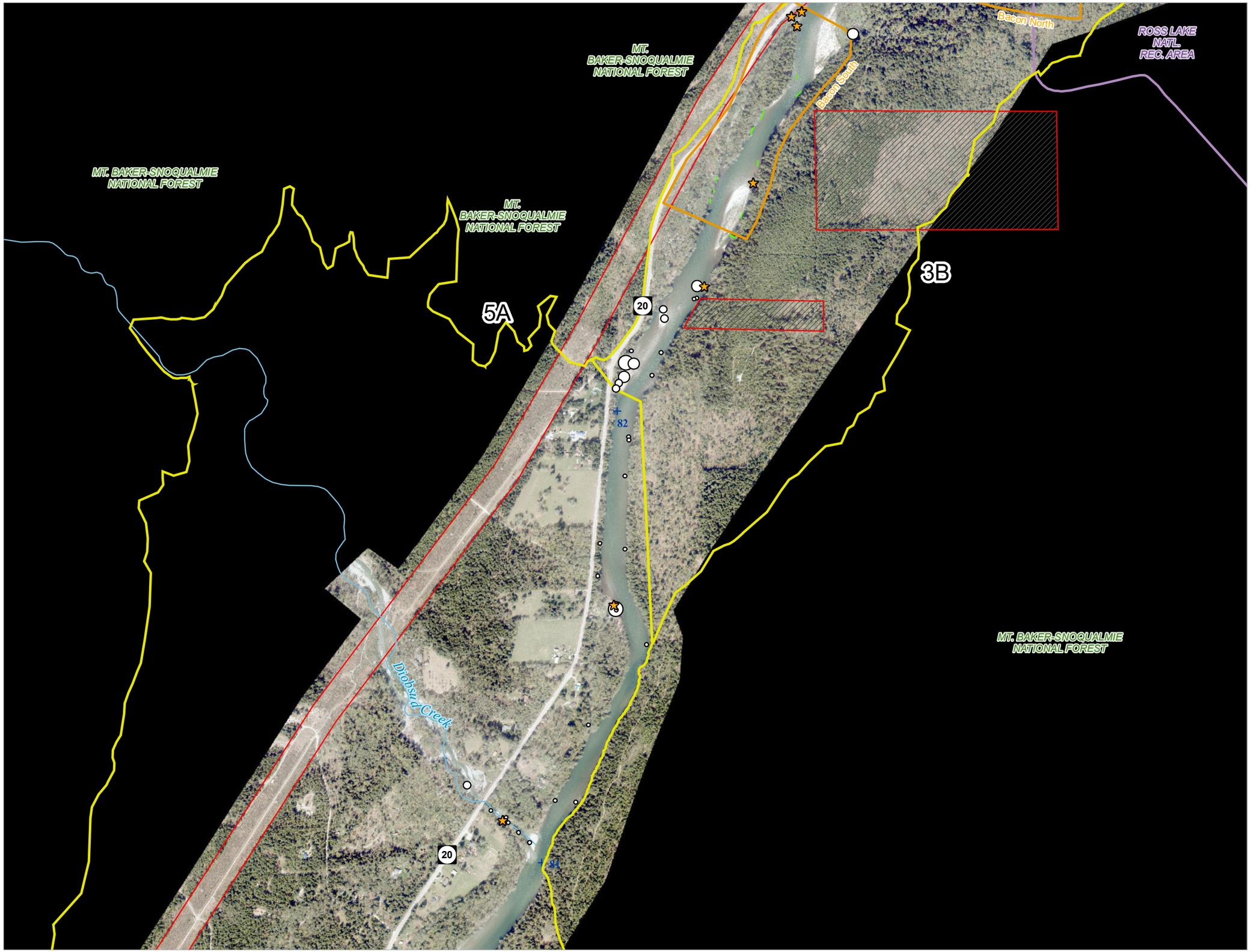

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PieceCount

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- 3 - 5
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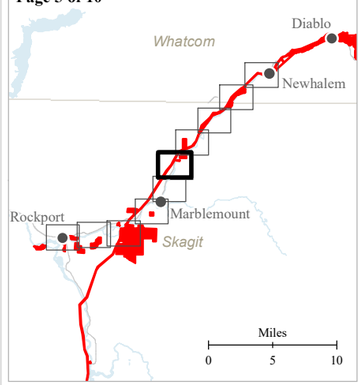
- 11+

N

0 500 1,000 Feet

Page 5 of 10



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PieceCount

- 1 - 2
- 3 - 5

MT. BAKER-SNOQUALMIE NATIONAL FOREST

MT. BAKER-SNOQUALMIE NATIONAL FOREST

5A

5B

20

80

79

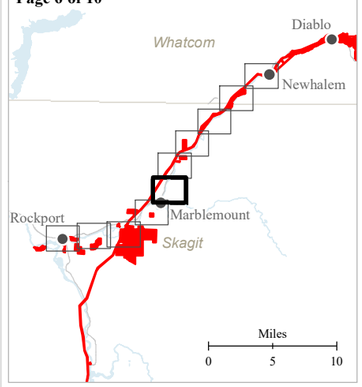
20

Taylor Creek

Olson Creek

N

0 500 1,000 Feet



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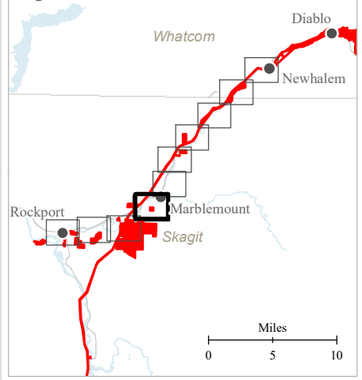

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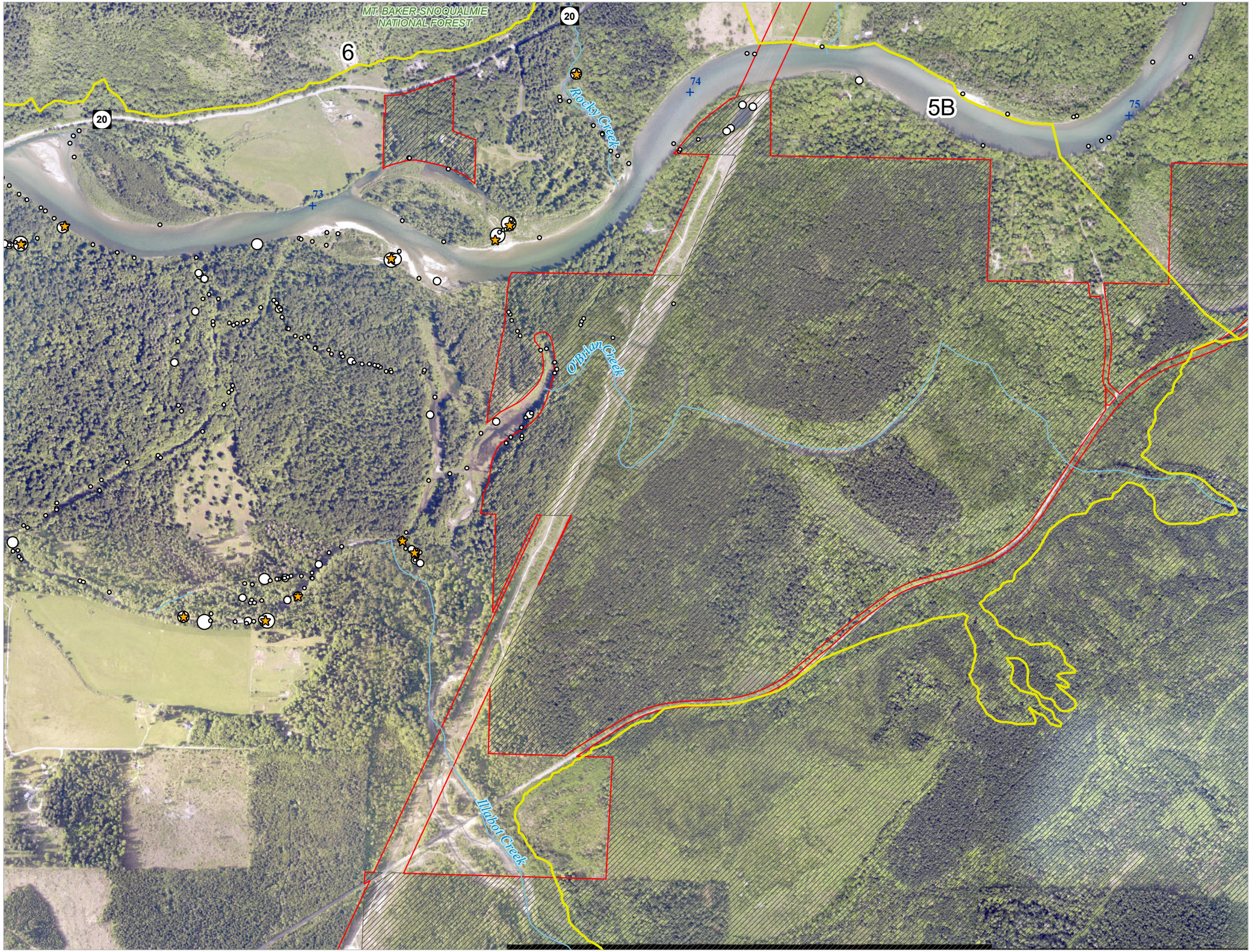

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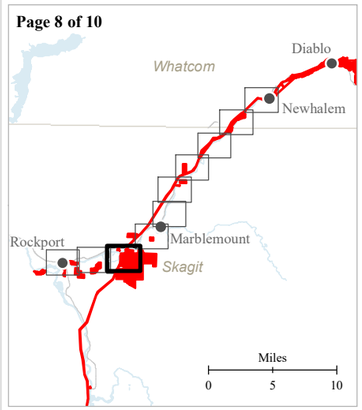

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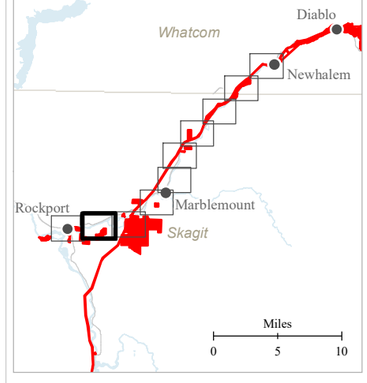

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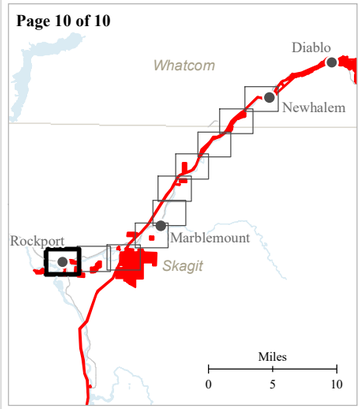

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