

Swale Creek (Klickitat River Subbasin, Washington) Rapid Aquatic Habitat Assessment Stream Report



Confederated Tribes and Bands of the Yakama Nation
Yakama Nation Fisheries Program, Yakima/Klickitat Fisheries Project
Klickitat Sub-basin Research, Monitoring, and Evaluation Project
Klickitat Watershed Enhancement Project
Klickitat Field Office
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Klickitat, WA 98628



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Prepared by:

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Yakima Klickitat Fisheries Project-Klickitat Monitoring and Evaluation Project (KM&E) and Klickitat Watershed Enhancement Project (KWEP) - Rapid Aquatic Habitat Assessment Stream Report

Stream: Swale Creek

LLID: 1210956458254

Basin: Klickitat River

HUC Number: 17070106

Ecoregion: Columbia River Gorge

Watershed Area: 325.5 km²

Survey Dates: Reach 1 – May 14, 2014

Reach 2 – May 14 & 15, 2014

Reach 3- May 19-21, 23, 2014 & April 2, 2015

Survey Crew: Reach 1-Nicolas Romero, David Lindley, Jeremy Tekala, Dean Antone, and John Washines

Reach 2-Nicolas Romero, Dean Antone, and John Washines

Reach 3-Nicolas Romero, Dean Antone, and John Washines

Report Prepared By: Kory G. Kuhn and Nicolas Romero

Introduction:

The Rapid Aquatic Habitat Assessment Protocol (RAHAP) is designed to provide quantitative information on stream habitat and fish distribution at the watershed scale. Data collected from the stream inventory surveys are used to provide baseline information for fisheries biologists, hydrologists, and foresters to guide natural resources management and land use practices on Yakama Nation Southern Ceded lands. This protocol establishes hierarchical spatial context and fish habitat relationships at habitat unit, reach, and basin scales. The spatially continuous method is useful when the scale(s) necessary to detect pattern are unknown. This level of pattern detection is useful to managers for refining study designs; locating, identifying, and prioritizing projects; and establishing reference or control sites for project design. Existing stream inventory protocols were reviewed during the development of the RAHAP methodology. Upon review, two widely used Pacific Northwest stream classification systems, Washington Timber, Fish, and Wildlife (TFW) Monitoring Program and the Aquatic Inventory Project (AIP), were incorporated into the RAHAP methodology (Moore et al. 2010, Pleus et al. 1999, and Schuett-Hames et al. 1999).

RAHAP quantifies both the abiotic and biotic state of aquatic habitat. The abiotic components are: geomorphic reach segments, habitat units, bedrock features, wood pieces, wood jams, and streamflow. These physical parameters are coupled with a separate one-pass fish survey that ties fish abundance to habitat. The geomorphic reach and habitat unit level delineation methodology was derived primarily from AIP (Moore et al. 2010). The wood piece and wood jam inventories follow protocols established by

Schuett-Hames et al. 1999. Yakama Nation Fisheries personnel identified bedrock features as habitat of interest and subsequently developed survey methodologies. Refer to Romero and Lindley 2012 for the complete RAHAP protocol.

Stream Level Description:

The Swale Creek habitat survey began at the confluence with the Klickitat River (rkm 28.1) and extended upstream approximately 9.8 kilometers. Three reaches were delineated over the length of the habitat survey. A valley transition from wide to narrow delineated Reach 1 from Reach 2. A tributary junction delineated Reach 2 from Reach 3. A wide valley was the dominant valley form encountered. The stream channel was generally constrained by a road and fill from a decommissioned railroad on the south east bank.

Thirteen side channels were encountered on the survey. The primary channel stream gradient was 1.6%. The total wetted area for both primary and secondary channels combined was 62,376 m². The average wetted and bankfull widths were 5.1 and 13.1 meters, respectively. Boulders and cobble were the dominant substrate accounting for approximately 72% of the substrate area. Riffle was the most common geomorphic unit delineated, comprising 46% of the wetted area and 51% of the survey length. A total of 76 pools were quantified. The average residual pool depth was 0.67 meters. Approximately 20% of pools had a maximum depth ≥ 1 meter. The total number of pools/kilometer and pools ≥ 1 meter /kilometer was estimated at 6.9 and 1.4, respectively. Pool frequency was measured at 16.8 (bankfull widths/pool).

Ponderosa Pine, Oregon White Oak, and Douglas fir were the most common upslope trees. Red Alder and Scoulers Willow were the dominant and sub-dominant riparian vegetation, respectively. The canopy covered approximately 39% of the wetted area. A total of 421 pieces of large wood pieces were counted resulting in a frequency of 3.8 pieces/100 meters and a volume of 0.56 m³/100 meters. Deciduous tree species accounted for 419 of the 421 large wood pieces and approximately 99% of the wood volume. Logs accounted for 397 of the 421 pieces and 89% of the wood volume. Of the 421 large wood pieces, 77, 339, 109, and 77 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. The majority of the enumerated large wood pieces were stable (81%). Of the pieces exhibiting a level of stability, pinned, buried, and rooted stability forms were observed in 64%, 18%, and 3% of the pieces, respectively. Approximately one-fifth of pieces were unstable (19%). There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented parallel (37%) to the stream channel followed by perpendicular (26%), downstream (24%), and upstream (13%).

A total of 9 large wood jams were counted consisting of 133 total pieces and 189.6 m³ of wood. The average number of wood pieces per jam was 14.8. The average wood volume per jam was 21.1 m³. Jams occurred at a frequency of 105.1 bankfull widths/jam and 0.8 jams/kilometer. Jams were comprised completely of logs. Of the 133 total jam wood pieces quantified, small, medium, and large

logs comprised 35%, 51%, and 14% of the wood pieces and 2%, 10%, and 88% of the wood volume, respectively. Six of the jams were pool forming.

A total of 31 distinct bedrock features were quantified. The cumulative measured length was 1,215.4 meters. The dominant cross-sectional shape was slope, which accounted for 16 of 31 identified bedrock rock features. Bedrock ledge and cliff accounted for the remaining twelve and three bedrock features, respectively. Twenty five of the bedrock features projected into the wetted channel and seven features functioned as hydraulic surface control.

Reach Level Descriptions:

Reach 1 began at the confluence with the Klickitat River (rkm 28.1) and extended upstream 480 meters. A valley transition from a broad to a narrow valley delineated the end of Reach 1. The reach was characterized by an unconstrained wide alluvial fan valley. The reach gradient was 2.3%. Two side channels were encountered on the survey.

The total wetted area quantified for the primary and secondary channels was 2,699.1 m² and 112.3 m², respectively. The average wetted and bankfull widths for the primary channel were 4.7 and 16.1 meters, respectively. The average wetted width for the secondary channel was 2.3 meters. Cobble was the dominant reach substrate accounting for nearly half of the reach wetted area. Boulder, bedrock and gravel comprised an additional 30%, 12% and 10% of the quantified substrate, respectively. Riffles were the most common geomorphic unit delineated comprising 46% of the reach wetted area and 55% of the reach length. A total of 2 pools were quantified in the primary channel. The average primary channel residual pool depth was 0.80 meters. One of the pools had a maximum depth ≥ 1 meter. The number of primary channel pools/kilometer and pools ≥ 1 meter/kilometer was 4.2 and 2.1, respectively. Pool frequency for the primary channel was measured at 14.9 (bankfull widths/pool).

Oregon White Oak and Ponderosa Pine were the most common upslope and valley bottom trees. Cottonwood and Coyote Willow were the dominant and sub-dominant riparian vegetation in both the primary and secondary channel, respectively. The canopy covered approximately 16% of the primary channel wetted area and 49% of the secondary channel wetted area. A total of 3 large wood pieces were counted in the primary channel resulting in a frequency of 0.6 pieces/100 meters and a volume of 0.05 m³/100 meters. Of the 3 large wood pieces, 2, 3, 0, and 0 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Deciduous trees accounted for all 3 pieces and 100% of the wood volume. Logs accounted for 2 of the 3 pieces and 55% of the wood volume. All of the wood pieces were unstable. There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented parallel (67%) to the stream channel, followed by downstream (33%), perpendicular (0%), and upstream (0%). No large wood jams were counted.

One distinct right bank bedrock feature was quantified. The cumulative measured length was 51 meters. The encountered bedrock feature was a ledge and projected in to the wetted channel.

In addition to the primary channel, two side channels were encountered on the survey. The total wetted area quantified for the secondary channels was 112.3 m². The two side channels consisted of 6 habitat units and a combined length of 47.4 meters. There were no pools quantified for the secondary channel.

A total of 4 secondary channel wood pieces were counted resulting in a frequency of 8.4 pieces/100 meters and a volume of 1.6 m³/100 meters. Of the 4 large wood pieces, 0, 4, 2, and 0 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Deciduous logs accounted for all 4 pieces and 100% of the wood volume. Three of the wood pieces were unstable and 1 piece was pinned. There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented downstream (50%) to the stream channel, followed by upstream (25%), perpendicular (25%), and parallel (0%).

Reach 2 began 480 meters upstream from the confluence with the Klickitat River (rkm 28.1) and extended upstream 1,150.3 meters. A tributary junction delineated the end of Reach 2. The reach was characterized by a stream channel that was constrained by a road along the southeast bank. The reach gradient was 1.5%. Two side channels were encountered on the survey.

The total wetted area quantified for the primary channel was 6,790 m². The average wetted and bankfull widths for the primary channel were 5.3 and 18.1 meters, respectively. Boulders and cobble were the dominant substrate accounting for almost 71% of the substrate area. Gravel comprised an additional 18% of the quantified substrate. Riffles were the most common geomorphic unit delineated comprising 48% of the reach wetted area and 50% of the reach length. A total of 6 pools were quantified in the primary channel. The average primary channel residual pool depth was 0.56 meters. One of the pools had a maximum depth ≥ 1 meter. The number of pools/kilometer and pools ≥ 1 meter/kilometer in the primary channel was estimated at 5.2 and 0.9, respectively. Pool frequency for the primary channel was measured at 10.6 (bankfull widths/pool).

Ponderosa Pine and Oregon White Oak were the most common upslope trees. Red Alder was the dominant and sub-dominant riparian vegetation. The canopy covered approximately 60% of the primary channel wetted area and 61% of the secondary channel wetted area. A total of 46 large wood pieces were counted in the primary channel resulting in a frequency of 4.0 pieces/100 meters and a volume of 0.4 m³/100 meters. Of the 46 large wood pieces, 2, 38, 5, and 13 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Deciduous trees accounted for all 46 pieces and 100% of the wood volume. Logs accounted for 45 of the 46 pieces and approximately 91% of the wood volume. Of the pieces exhibiting a level of stability, pinned and buried stability forms were observed in 35% and 30% of the pieces, respectively. Approximately one-third of pieces were unstable (28%). There were no pieces that functioned as a pool forming agent. Large wood pieces were most commonly oriented perpendicular (37%) to the stream channel, followed by parallel (26%), downstream (20%), and upstream (17%). No large wood jams were counted in the primary channel.

A total of 4 distinct bedrock features were quantified for the primary channel. All for bedrock features were located on the right bank. The cumulative measured length was 141.4 meters. Three bedrock features were classified as a slope and one as a cliff. Three bedrock features projected into the wetted area.

In addition to the primary channel, two side channels were encountered on the survey. The total wetted area quantified for the secondary channels was 1,000 m². The two side channels consisted of 20 habitat units and extended upstream 388.9 meters. There were three pools quantified in the secondary channel. The number of pools/kilometer was 7.7 and the average residual pool depth was 0.55 meters. There were no pools ≥1 meter in depth encountered in the secondary channel.

A total of 30 secondary channel wood pieces were counted resulting in a frequency of 7.7 pieces/100 meters and a volume of 0.8 m³/100 meters. Of the 30 large wood pieces, 1, 25, 2, and 4 were located completely or partially in the wetted channel, within bankfull but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Deciduous logs accounted for 28 pieces and 76% of the wood volume. Of the pieces exhibiting a level of stability, buried and pinned stability forms were observed in 43% and 23% of the pieces, respectively. Approximately one-third of pieces were unstable. Large wood pieces were most commonly oriented parallel (50%) to the stream channel, followed by perpendicular (27%), downstream (20%), and upstream (4%). A total of 2 large wood jams were counted in the secondary channel consisting of 37 total pieces and 3.9 m³ of wood. One of the jams functioned as a pool forming agent.

Reach 3 began 1,630.3 meters upstream from the confluence with the Klickitat River (rkm 28.1) and extended upstream 8,155.9 meters. The end of Reach 3 was delineated by the upper extent of observed anadromous salmonid activity. The reach was characterized by a stream channel located in a wide valley that was intermittently constrained by a road and decommissioned railroad alternating between banks. The reach gradient was 1.6%. Nine side channels were encountered on the survey.

The total wetted area quantified for the primary channel was 49,652.3 m². The average wetted and bankfull widths for the primary channel were 5.4 and 12.6 meters, respectively. Cobble was the dominant reach substrate and compromised 43% of the wetted area. Boulder and gravel comprised an additional 30% and 17% of the quantified substrate, respectively. Riffles were the most common geomorphic unit delineated comprising 46% of the reach wetted area and 51% of the reach length. A total of 58 pools were quantified in the primary channel. The average primary channel residual pool depth was 0.67 meters. Eleven of the primary channel pools had a maximum depth ≥1 meter. The number of primary channel pools/kilometer and pools >1 meter/kilometer was estimated at 7.1 and 1.3, respectively. Pool frequency for the primary channel was measured at 11.1 (bankfull widths/pool).

Oregon White Oak and Ponderosa Pine were the most common upslope trees. Red Alder was the dominant vegetation for the primary channel. The canopy covered approximately 39% of the primary channel wetted area. A total of 322 pieces of large wood were counted in the primary channel resulting in a frequency 3.9 pieces/100 meters and a volume of 0.6 m³/100 meters. Of the 322 larger wood pieces, 71, 253, 100, and 60 were located completely or partially in the wetted channel, within bankfull

but outside of the wetted channel, above the bankfull channel, and flood plain/terrace, respectively. Deciduous trees accounted for 321 of the 322 primary channel pieces and 99.9% of the wood volume. Logs accounted for 301 of the 322 pieces and approximately 88% of the wood volume. Of the pieces exhibiting a level of stability, pinned, buried and rooted stability forms were observed in 76%, 12%, and 3% of the pieces, respectively. Approximately 15% of pieces were unstable. Large wood pieces were most commonly oriented parallel (39%) to the stream channel, followed by downstream (25%), perpendicular (24%) and upstream (13%).

A total of 7 large wood jams were counted that consisted of 96 total pieces and 185.7 m³ of wood. There were no jams located in the secondary channel. The average number of pieces per jam was 13.7. The average wood volume per jam was 26.5 m³. Jams occurred at a frequency of 92.3 bankfulls/jam and 0.9 jams/kilometer. Jams were comprised completely of logs. Of the 96 total jam wood pieces quantified, small, medium and large logs comprised 16%, 64%, and 20% of the wood pieces, respectively. Key pieces comprised approximately of 10% of the jam pieces. Five of the jams functioned as pool forming agents.

A total of 25 of distinct bedrock features were quantified in the primary channel and had a cumulative length of 976.6. Thirteen encountered bedrock features were slopes, 11 were ledge and 1 was a cliff. Twenty one features projected in to the wetted channel and seven features functioned as water surface control.

In addition to the primary channel, nine side channels were encountered on the survey. The total wetted area quantified for the secondary channel was 2,122.5 m². The side channel consisted of 33 habitat units and extended upstream 763.7 meters. There were seven pools quantified for the secondary channel and had an average residual pool depth of 0.81 meters. There were two pools >1 meter in depth encountered on the secondary channel. There were four dry channels that were located within four of the side channels. The total length of the dry channels was 193.1 meters.

References:

Moore, K. K. Jones, J. Dambacher, and C. Stein. 2010. Aquatic Inventories Project: Methods for Stream Habitat Surveys. Oregon Department of Fish and Wildlife, Aquatic Inventories Project, Conservation and Recovery Program, Corvallis, OR 97333.

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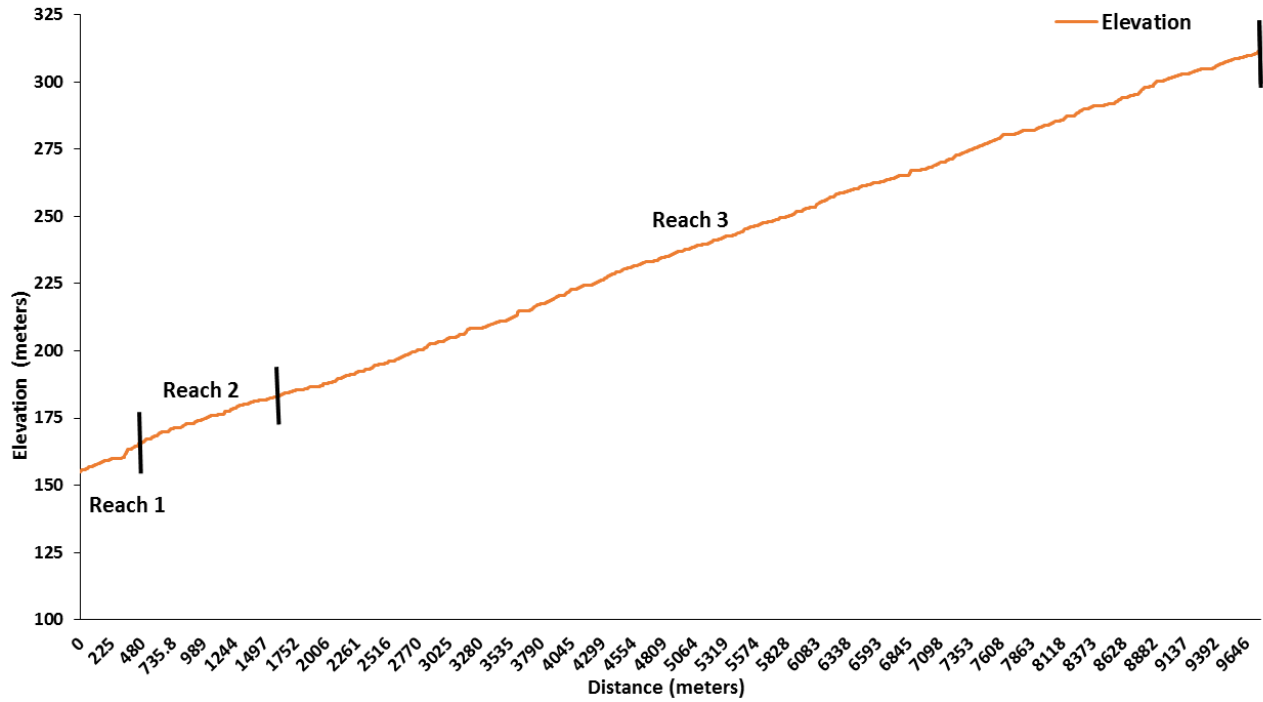
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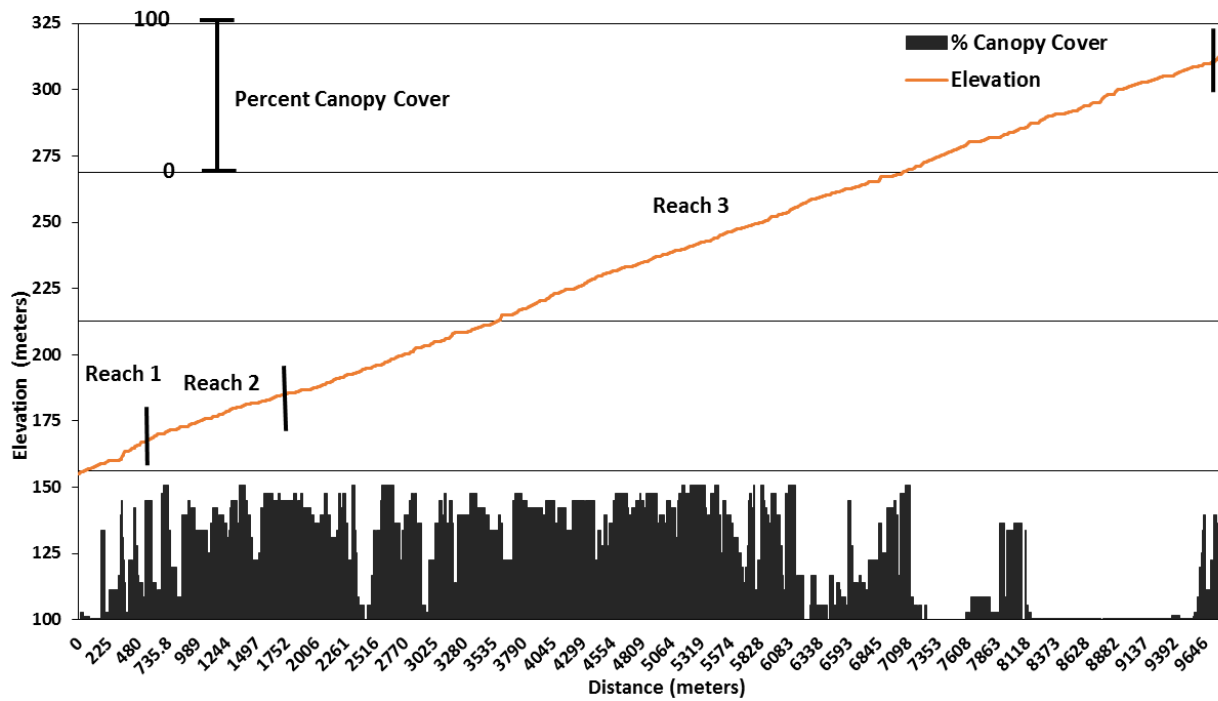
Schuett-Hames, D., A.E. Pleuse, and D. Smith. 1999. TFW Monitoring Program method manual for the salmonid spawning habitat availability survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish, and Wildlife Agreement. TFW-AM9-00-007. DNR #109. November.

Summary Figures:

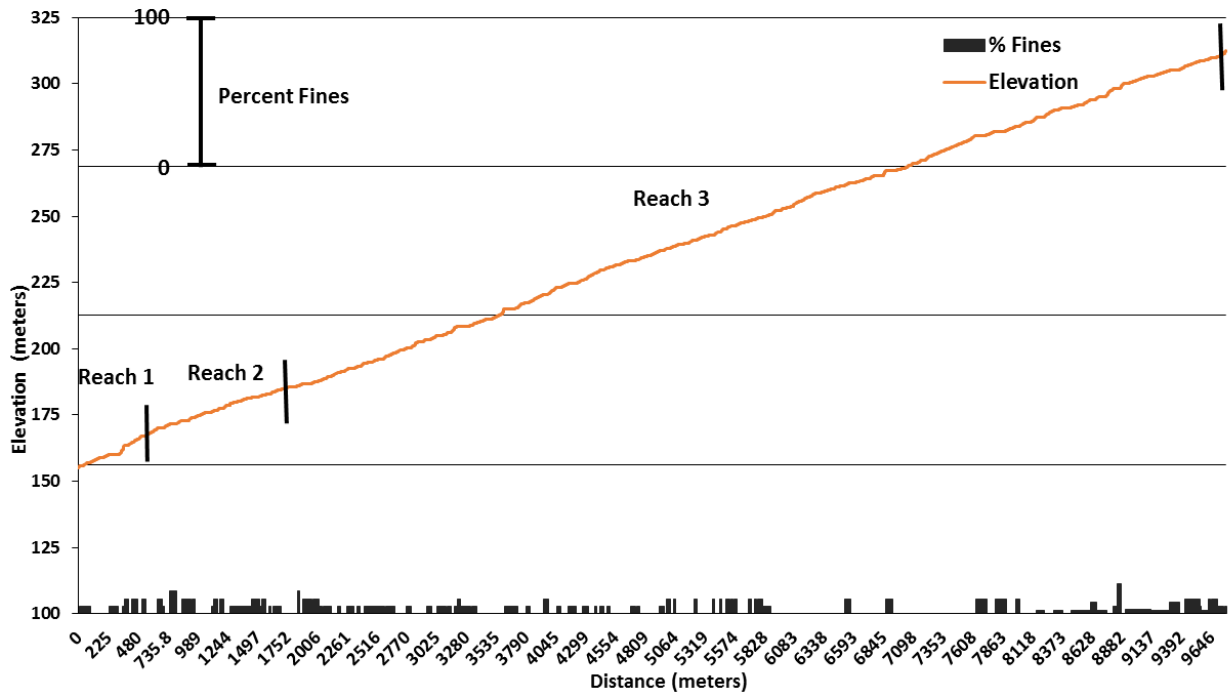
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Longitudinal Profile



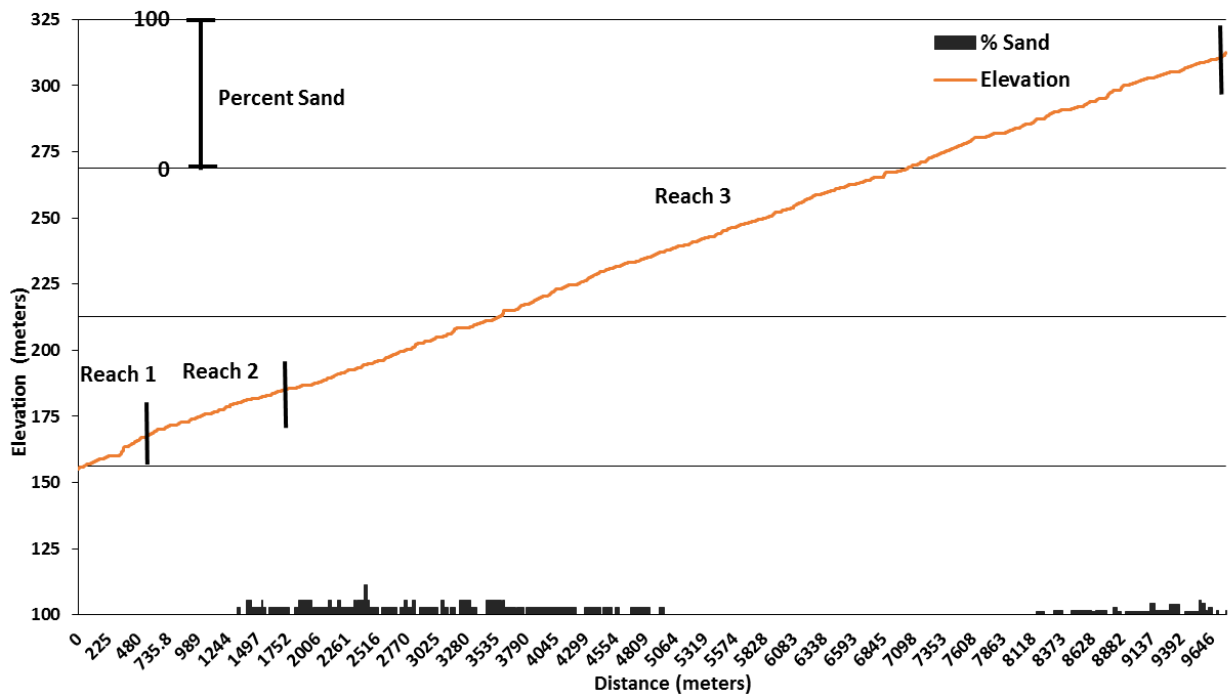
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Canopy Cover



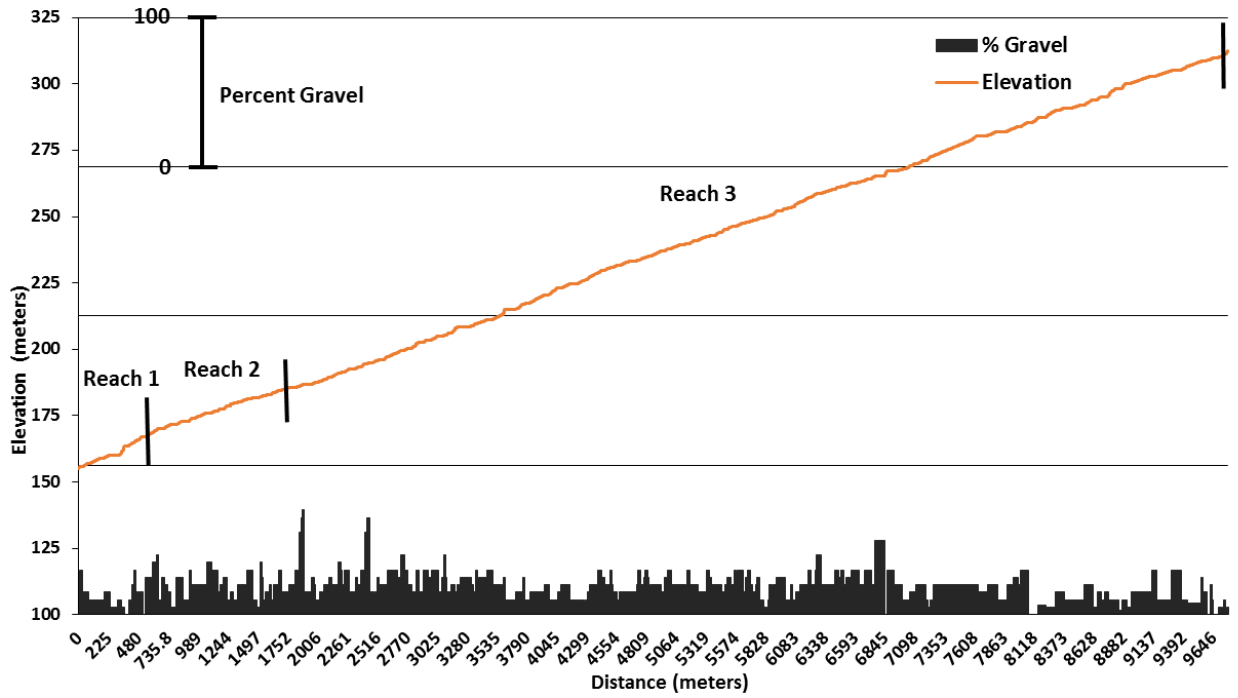
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Fines Substrate



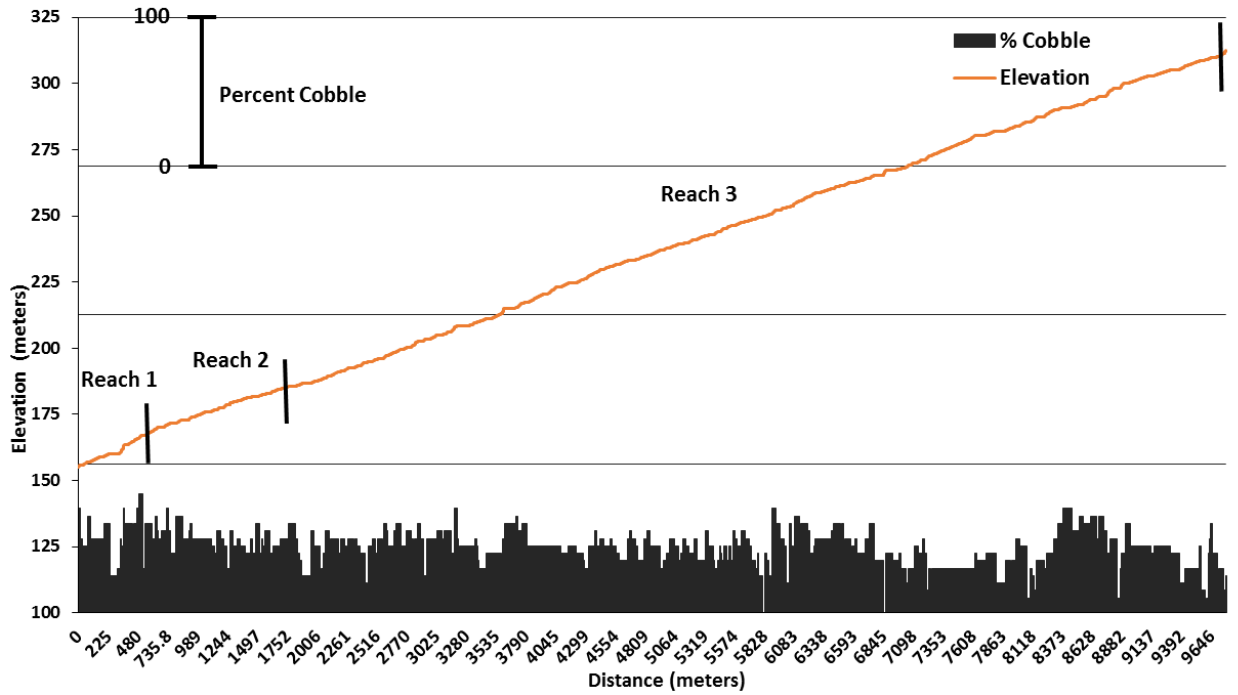
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Sand Substrate



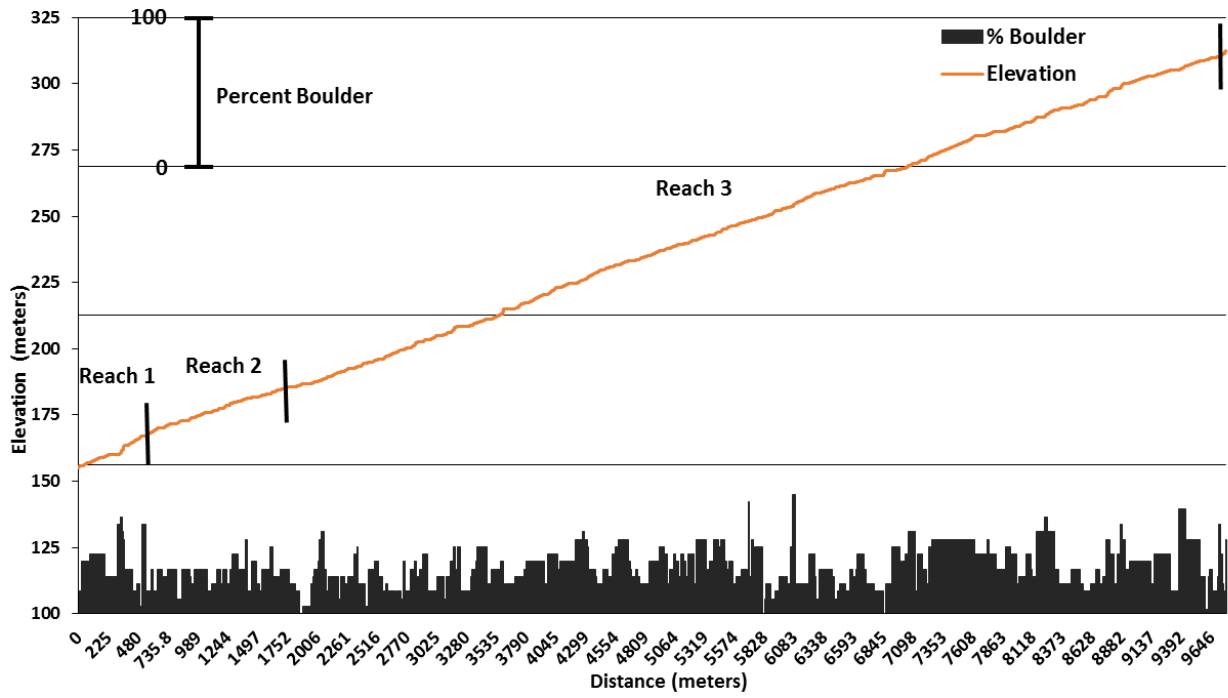
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Gravel Substrate



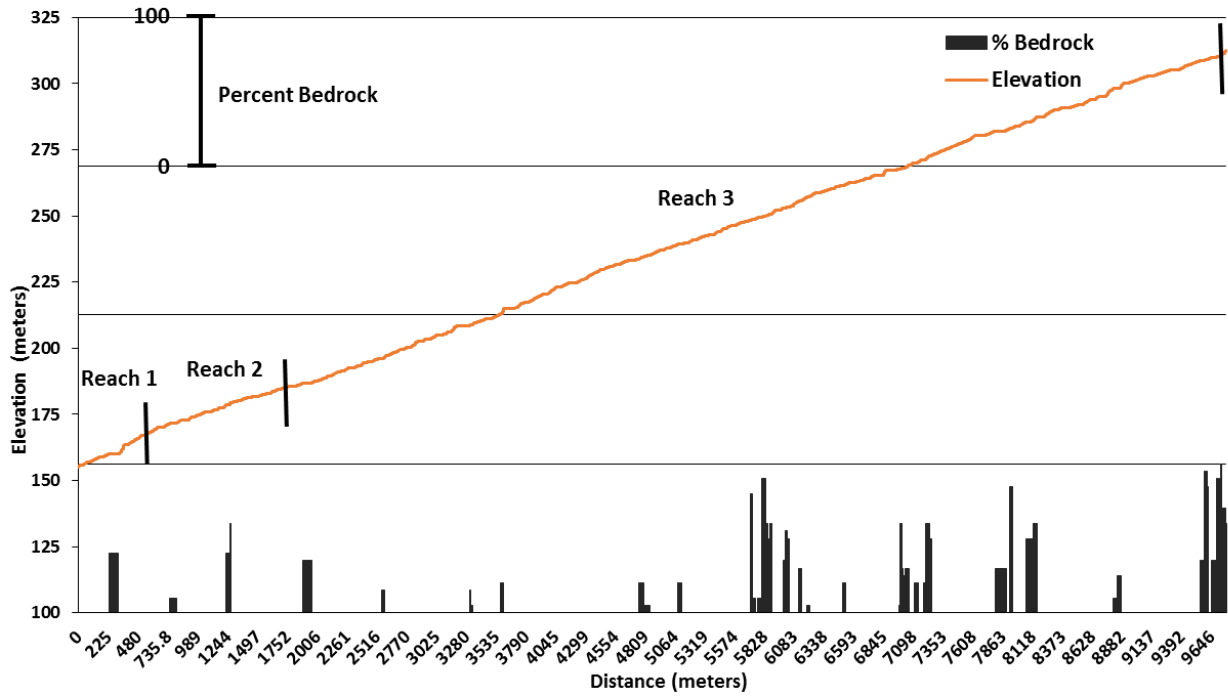
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Cobble Substrate



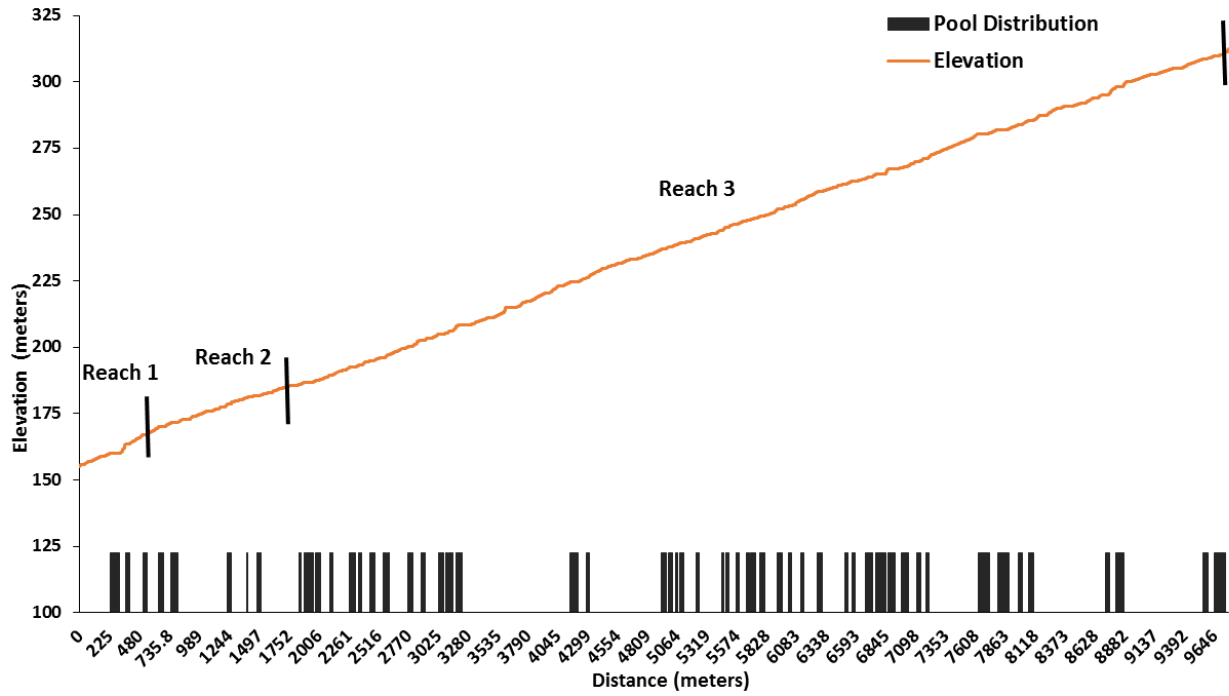
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Boulder Substrate



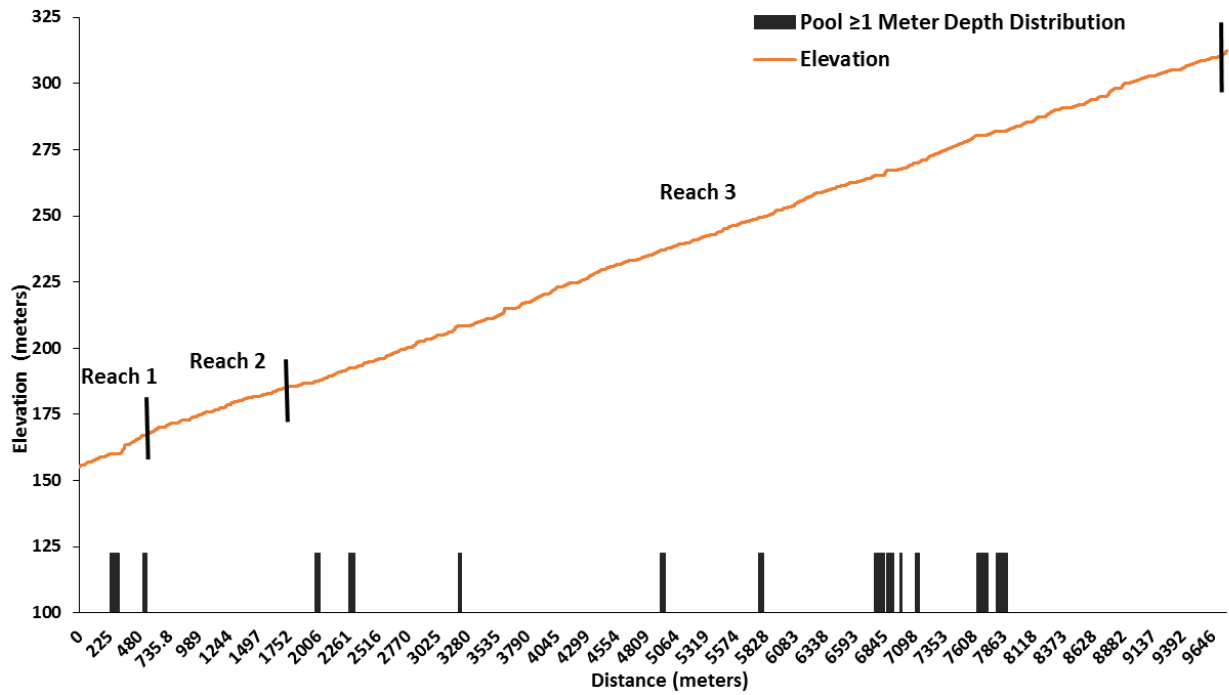
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Percent Bedrock Substrate



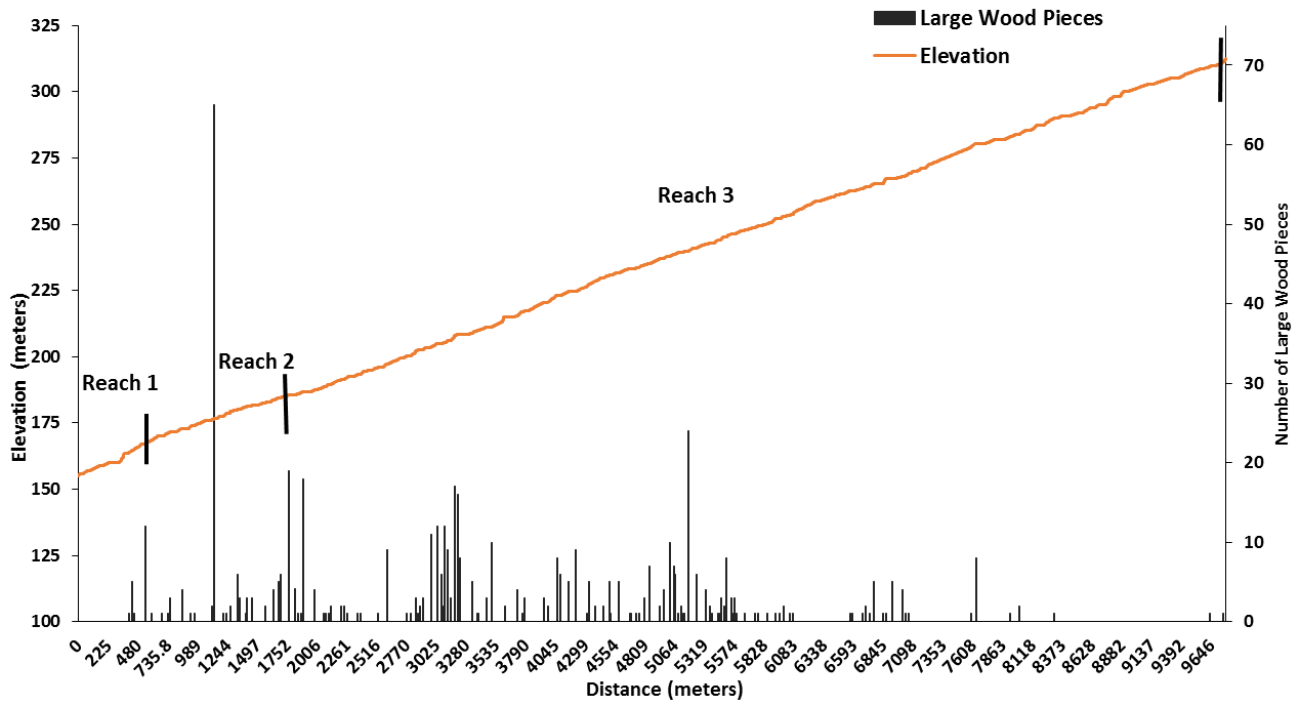
Swale Creek (Klickitat River Basin) 2014/2015 Spring - Pool Distribution



Swale Creek (Klickitat River Basin) 2014/2015 Spring - Pool ≥ 1 Meter Depth Distribution

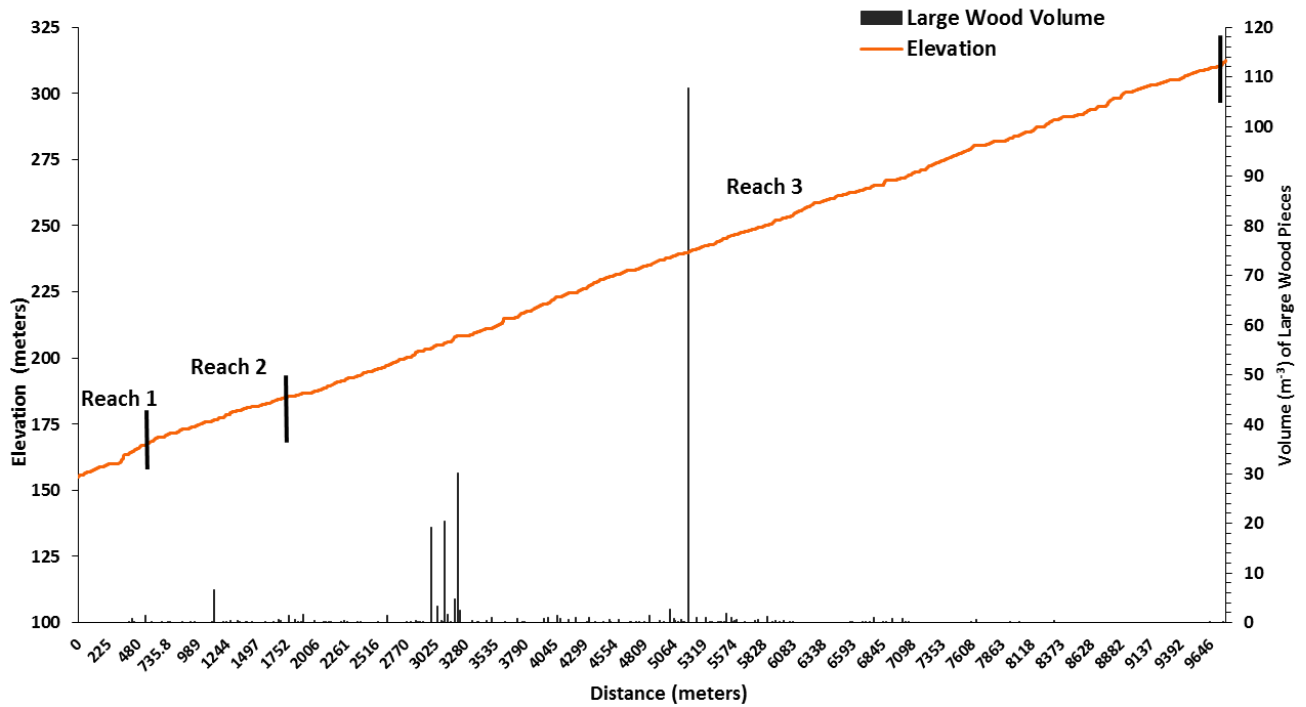


Swale Creek (Klickitat River Basin) 2014/2015 Spring - Large Wood Piece Distribution



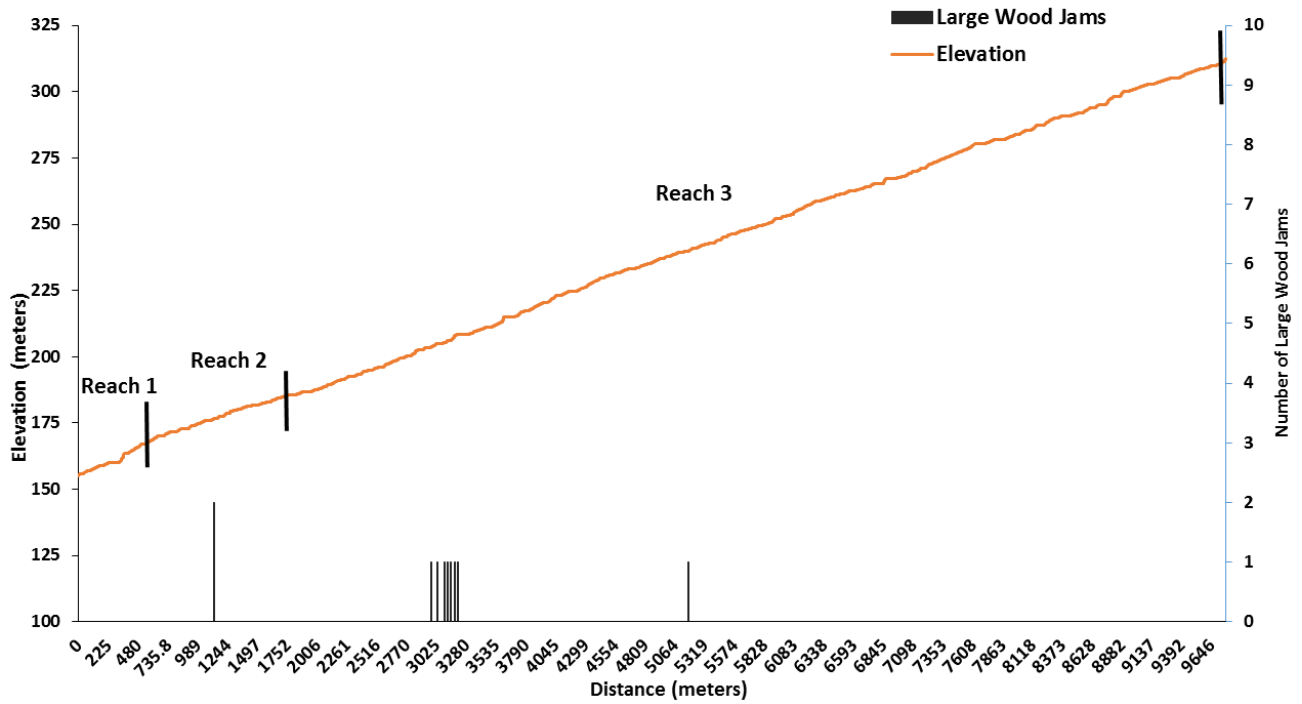
¹Large wood piece tally distribution Includes enumerated pieces from jams

Swale Creek (Klickitat River Basin) 2014/2015 Spring - Large Wood Volume (m³) Distribution

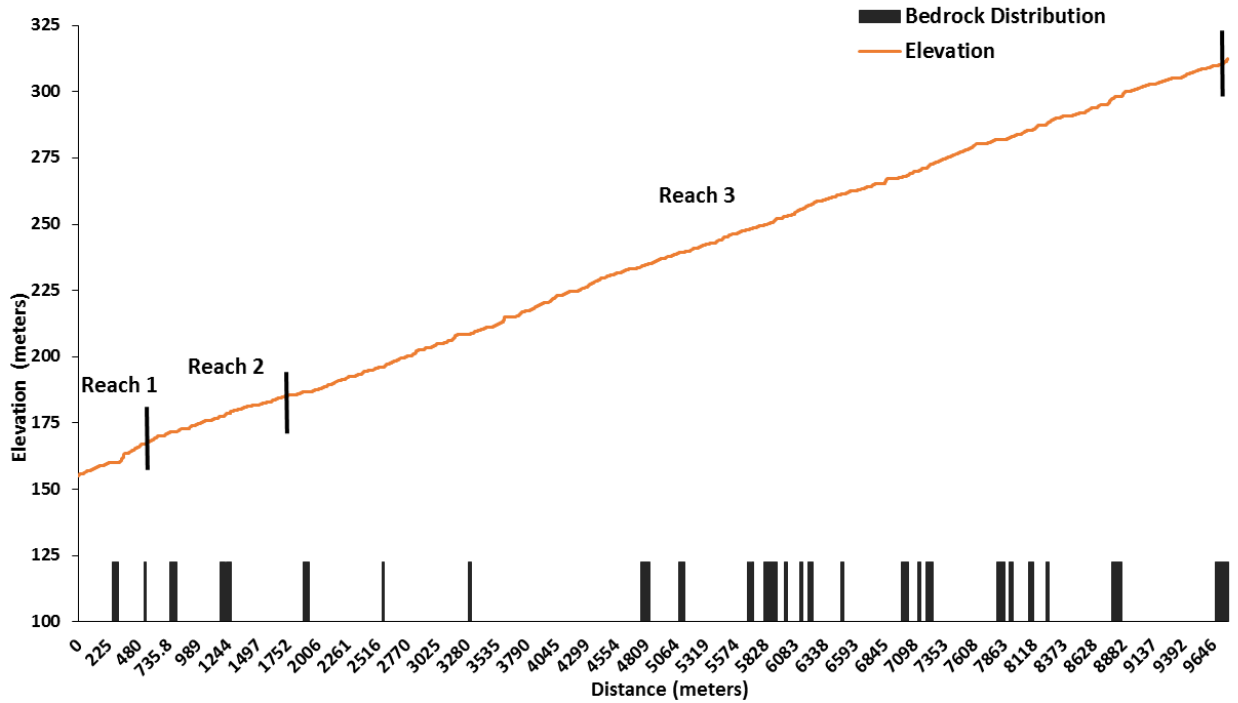


¹Large wood volume distribution Includes volume totals from jams

Swale Creek (Klickitat River Basin) 2014/2015 Spring - Large Wood Jam Distribution



Swale Creek (Klickitat River Basin) 2014/2015 Spring - Bedrock Distribution



Summary Tables:

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 1
Report Date: 07/09/2020	Survey Date: 05/14/2014
Start Location: 45.82516, -121.09767	End Location: 45.82212, -121.09464
Start Elevation: 155.0 m	End Elevation: 166.0 m
Reach Forming Agent: Confluence	Reach Ending Agent: Valley Transition

CHANNEL SUMMARY

Channel Characteristics (m)

<u>Type</u>	<u>No. Units</u>	<u>Length (m)</u>	<u>Area (m²)</u>	<u>Gradient (%)</u>	<u>Dry Units</u>
Primary	20	480.0	2,699.1	2.3	0
Secondary	6	47.4	112.3	-	0

Channel Dimensions (m)

<u>Type</u>	<u>Avg. Length</u>	<u>Avg. Wetted Width</u>	<u>Avg. Bankfull Width</u>	<u>LB Undercut Bank Length</u>	<u>RB Undercut Bank Length</u>
Primary	24.0	4.7	16.1	0	0
Secondary	7.9	2.3	-	0	0

Substrate Summary

<u>Hab Type</u>	<u>Substrate Percent Wetted Area</u>						<u>Substrate Wetted Area</u>					
	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>
Pools	6.0	0.0	4.0	31.8	26.0	32.3	58.5	0.0	39.6	311.6	254.8	316.8
Glides	5.5	0.0	16.8	53.9	23.8	0.0	27.1	0.0	83.3	267.6	118.1	0.0
Runs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	2.2	0.0	12.5	51.2	34.0	0.0	28.1	1.4	160.4	659.3	437.3	0.0
Rapids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	0.0	0.0	5.1	30.0	65.0	0.0	0.0	0.0	2.4	14.2	30.8	0.0
Steps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iso Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culverts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	4.0	0.0	10.2	44.6	29.9	11.7	113.7	1.4	285.7	1,252.7	841.0	316.8

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 2

Report Date: 07/09/2020

Survey Date: 05/14-5/15/14

Start Location: 45.82212, -121.094608

End Location: 45.81502, -121.08773

Start Elevation: 166.0 m

End Elevation: 183.5 m

Reach Forming Agent: Valley Transition

Reach Ending Agent: Tributary Junction

CHANNEL SUMMARY

Channel Characteristics (m)

<u>Type</u>	<u>No. Units</u>	<u>Length (m)</u>	<u>Area (m²)</u>	<u>Gradient (%)</u>	<u>Dry Units</u>
Primary	45	1,150.3	6,790.0	1.5	0
Secondary	20	388.9	1,000.0	-	0

Channel Dimensions (m)

<u>Type</u>	<u>Avg. Length</u>	<u>Avg. Wetted Width</u>	<u>Avg. Bankfull Width</u>	<u>LB Undercut Bank Length</u>	<u>RB Undercut Bank Length</u>
Primary	25.6	5.3	18.1	0	0
Secondary	19.4	2.7	-	0	0

Substrate Summary

<u>Hab Type</u>	<u>Substrate Percent Wetted Area</u>						<u>Substrate Wetted Area</u>					
	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>
Pools	23.3	2.9	5.8	34.7	26.5	6.7	267.0	32.7	66.7	397.3	302.8	77.2
Glides	7.9	1.7	20.8	46.1	22.1	1.4	236.4	51.9	620.7	1,374.4	658.5	41.0
Runs	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Riffles	4.1	0.7	19.5	50.5	25.2	0.0	148.7	25.5	712.0	1,841.1	917.0	0.0
Rapids	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cascades	0.0	0.0	0.0	10.0	29.9	60.2	0.0	0.0	0.0	1.9	5.7	11.5
Steps	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Backwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Alcoves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Iso Pools	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Obscured	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Culverts	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	8.4	1.4	18.0	46.4	24.2	1.7	652.1	110.0	1,399.5	3,614.8	1,884.0	129.7

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 3

Report Date: 07/09/2020

Survey Date: 05/19-05/23/14, 04/02/15

Start Location: 45.81506, -121.08748

End Location: 45.76229, -121.07103

Start Elevation: 183.5 m

End Elevation: 312.5 m

Reach Forming Agent: Tributary Junction

Reach Ending Agent: Valley Transition

CHANNEL SUMMARY

Channel Characteristics (m)

<u>Type</u>	<u>No. Units</u>	<u>Length (m)</u>	<u>Area (m²)</u>	<u>Gradient (%)</u>	<u>Dry Units</u>
Primary	295	8,155.9	49,652.3	1.6	0
Secondary	33	763.7	2,122.5	-	4

Channel Dimensions (m)

<u>Type</u>	<u>Avg. Length</u>	<u>Avg. Wetted Width</u>	<u>Avg. Bankfull Width</u>	<u>LB Undercut Bank Length</u>	<u>RB Undercut Bank Length</u>
Primary	27.6	5.4	12.6	0	14.0
Secondary	23.1	3.2	8.6	0	0

Substrate Summary

<u>Hab Type</u>	<u>Substrate Percent Wetted Area</u>						<u>Substrate Wetted Area</u>					
	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>	<u>Fin</u>	<u>Snd</u>	<u>Grv</u>	<u>Cbl</u>	<u>Bld</u>	<u>Bdrk</u>
Pools	6.4	3.1	17.8	36.5	25.7	10.4	772.0	371.2	2,133.7	4,377.2	3,082.9	1,245.3
Glides	3.3	3.8	17.7	48.5	23.8	3.0	445.3	521.9	2,412.8	6,614.1	3,241.0	408.9
Runs	0	0	0	0	0	0	0	0	0	0	0	0
Riffles	1.5	2.3	17.8	44.0	33.3	1.1	352.7	550.3	4,214.5	10,443.4	7,892.8	265.9
Rapids	0	0	0	0	0	0	0	0	0	0	0	0
Cascades	0.6	0.3	10.5	26.3	47.4	14.9	15.1	6.9	243.9	611.8	1,101.8	345.6
Steps	0	0	0	0	0	0	0	0	0	0	0	0
Backwater	0	0	0	0	0	0	0	0	0	0	0	0
Alcoves	0	0	0	0	0	0	0	0	0	0	0	0
Iso Pools	0	0	0	0	0	0	0	0	0	0	0	0
Obscured	0	0	0	0	0	0	0	0	0	0	0	0
Dry	0	0	0	0	0	0	0	0	0	0	0	0
Culverts	0	0	0	0	0	0	0	0	0	0	0	0
Total	3.1	2.8	17.4	42.7	29.6	4.4	1,585.0	1,450.2	9,004.8	22,046.6	15,318.5	2,265.7

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 1

Report Date: 07/09/2020

Survey Date: 05/14/2014

Start Location: 45.82516, -121.09767

End Location: 45.82212, -121.09464

Start Elevation: 155.0 m

End Elevation: 166.0 m

Reach Forming Agent: Confluence

Reach Ending Agent: Valley Transition

HABITAT SUMMARY

Geomorphic Habitat Type Summary

Habitat Type	Primary Channel (PC)					Secondary Channel (SC)				
	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)
Pools	2	111.0	7.9	981.3	36.4	0	0.0	0.0	0.0	0.0
Glides	7	109.2	4.2	473.1	17.5	2	9.8	2.3	23.0	20.5
Runs	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Riffles	10	251.9	4.3	1,197.3	44.4	4	37.6	2.3	89.3	79.5
Rapids	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Cascades	1	7.9	6.0	47.4	1.8	0	0.0	0.0	0.0	0.0
Steps	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Isolated Pools	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Total	20	480.0	5.0	2,699.1	100.0	6	47.4	2.3	112.3	100.0

Pool Summary

Variable	Total Pool #	PC Pool #	SC Pool #	# Pools/KM	# PC Pools/KM	# SC Pools/KM
All Pools	2	2	0	3.8	4.2	0
Pools ≥1m	1	1	0	1.9	2.1	0
Pool frequency (channel widths/pool)	16.4	14.9	0	-	-	-
Residual pool depth (avg)	0.80	0.80	-	-	-	-

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 2

Report Date: 07/09/2020

Survey Date: 05/14-5/15/14

Start Location: 45.82212, -121.094608

End Location: 45.81502, -121.08773

Start Elevation: 166.0 m

End Elevation: 183.5 m

Reach Forming Agent: Valley Transition

Reach Ending Agent: Tributary Junction

HABITAT SUMMARY

Geomorphic Habitat Type Summary

Habitat Type	Primary Channel (PC)					Secondary Channel (SC)				
	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)
Pools	6	178.4	4.7	863.7	12.7	3	66.7	4.3	279.9	28.0
Glides	18	398.1	5.7	2,653.2	39.1	7	118.8	3.0	329.7	33.0
Runs	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Riffles	20	565.3	5.2	3,254.0	47.9	9	203.4	2.0	390.4	39.0
Rapids	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Cascades	1	8.5	2.3	19.1	0.3	0	0.0	0.0	0.0	0.0
Steps	0	0.0	0.0	0.0	0.0	1	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Isolated Pools	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Total	45	1,150.3	5.3	6,790.0	100.0	20	389	2.7	1,000.0	100.0

Pool Summary

Variable	Total Pool #	PC Pool #	SC Pool #	# Pools/KM	# PC Pools/KM	# SC Pools/KM
All Pools	9	6	3	5.8	5.2	7.7
Pools ≥1m	1	1	0	0.6	0.9	0
Pool frequency (channel widths/pool)	9.4	10.6	-	-	-	-
Residual pool depth (avg)	0.56	0.56	0.55	-	-	-

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 3

Report Date: 07/09/2020

Survey Date: 05/19-05/23/14, 04/02/15

Start Location: 45.81506, -121.08748

End Location: 45.76229, -121.07103

Start Elevation: 183.5 m

End Elevation: 312.5 m

Reach Forming Agent: Tributary Junction

Reach Ending Agent: Valley Transition

HABITAT SUMMARY

Geomorphic Habitat Type Summary

Habitat Type	Primary Channel (PC)					Secondary Channel (SC)				
	No.	Length	Avg. Width	Wetted Area	% Wetted	No.	Length	Avg. Width	Wetted Area	% Wetted
<u>Habitat Type</u>	<u>Units</u>	<u>(m)</u>	<u>(m)</u>	<u>(m²)</u>	<u>Area (m²)</u>	<u>Units</u>	<u>(m)</u>	<u>(m)</u>	<u>(m²)</u>	<u>Area (m²)</u>
Pools	58	1,613.1	5.9	11,358.1	22.9	7	123.6	4.1	624.1	29.4
Glides	88	1,929.8	5.8	13,372.0	26.9	4	55.1	3.5	271.9	12.8
Runs	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Riffles	118	4,215.3	5.0	2,2765.7	45.9	15	344.2	2.9	1057.9	49.8
Rapids	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Cascades	17	398.7	5.0	2,156.5	4.3	2	47.7	3.5	168.6	7.9
Steps	14	0.0	0.0	0.0	0.0	1	0.0	0.0	0.0	0.0
Backwater	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Alcoves	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Iso. Pools	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Obscured	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Dry Channel	0	0.0	0.0	0.0	0.0	4	193.1	0.0	0.0	0.0
Culvert	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0.0	0.0
Total	295	8155.9	5.4	49,652.3	100.0	33	764	3.2	2,122.5	100.0

Pool Summary

Variable	Total	PC	SC	#	# PC	# SC
	<u>Pool #</u>	<u>Pool #</u>	<u>Pool #</u>	<u>Pools/KM</u>	<u>Pools/KM</u>	<u>Pools/KM</u>
All Pools	65	58	7	7.3	7.1	9.2
Pools ≥1m	13	11	2	1.5	1.3	2.6
Pool frequency (channel widths/pool)	10.9	11.1	12.7	-	-	-
Residual pool depth (avg)	0.69	0.67	0.81	-	-	-

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 1-3

Report Date: 07/09/2020

Survey Date: 05/14-05/23/14, 04/02/15

Start Location: 45.82516, -121.09767

End Location: 45.76229, -121.07103

Start Elevation: 155.0 m

End Elevation: 312.5 m

Reach Forming Agent: Confluence

Reach Ending Agent: Tributary Junction

STREAM CHANNEL AND HABITAT SUMMARY

Channel Summary

Channel Type	No. Units	Total Length (m)	Wetted Area (m ²)	Avg Width (m)	Avg Bankfull Width (m)	% Gradient	Bankfull					
							% Fin	% Snd	% Grv	% Cbl	% Bldr	% Bdrk
PC	360	9,786.2	59,141.3	5.4	13.3	1.6	3.1	2.3	17.1	43.4	29.5	4.5
SC	59	1,200.0	3,234.8	3.0	8.6	-	15.3	6.4	18.2	39	19.4	1.8

Geomorphic Habitat Type Summary

Habitat Type	Primary Channel (PC)					Secondary Channel (SC)				
	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)	No. Units	Length (m)	Avg. Width (m)	Wetted Area (m ²)	% Wetted Area (m ²)
Pools	66	1,902.5	5.8	13,203.1	22.3	10	190.3	4.2	904.0	27.9
Glides	113	2,436.1	5.7	16,498.3	27.9	13	183.7	3.1	624.6	19.3
Runs	0	0	0	0	0	0	0	0	0	0
Riffles	148	5,032.5	5.0	27,217.0	46.0	28	585.2	2.5	1537.6	47.5
Rapids	0	0	0	0	0	0	0	0	0	0
Cascades	19	415.1	4.9	2,223.0	3.8	2	47.7	3.5	168.6	5.2
Steps	14	0	0	0	0	2	0	0	0	0
Backwater	0	0	0	0	0	0	0	0	0	0
Alcoves	0	0	0	0	0	0	0	0	0	0
Isolated Pools	0	0	0	0	0	0	0	0	0	0
Obscured	0	0	0	0	0	0	0	0	0	0
Dry Channel	0	0	0	0	0	4	193.1	0	0	0
Culvert	0	0	0	0	0	0	0	0	0	0
Total	360	9,786.2	5.4	59,141.3	100.0	59	1,200.0	2.95	3235	100.0

Pool Summary

Variable	Total	PC	SC	#	# PC	# SC
	Pool #	Pool #	Pool #	Pools/KM	Pools/KM	Pools/KM
All Pools	76	66	10	6.9	6.7	8.3
Pools ≥1m	15	13	2	1.4	1.3	1.7
Pool frequency (channel widths/pool)	16.8	11.1	14.0	-	-	-
Residual pool depth (avg)	0.67	0.66	0.73	-	-	-

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 1
Report Date: 07/09/2020	Survey Date: 05/14/2014
Start Location: 45.82516, -121.09767	End Location: 45.82212, -121.09464
Start Elevation: 155.0 m	End Elevation: 166.0 m
Reach Forming Agent: Confluence	Reach Ending Agent: Valley Transition

RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

<u>Type</u>	<u>Total Canopy Cover Area (m²)</u>	<u>Total % Canopy Cover</u>	<u>Unit Avg. % Canopy Cover</u>	<u>Dom Canopy Species</u>	<u>Sub-dom Canopy Species</u>
Primary	438.1	16.2	33.2	Cottonwood	Coyote Willow
Secondary	55.2	49.2	49.2	Cottonwood	Coyote Willow

Large Wood Piece Inventory Summary

<u>Channel Type</u>	<u>Primary Channel</u>	<u>#Pieces</u>	<u>Volume (m³)</u>	<u>Pieces/100 m</u>	<u>Volume (m³)/100 m</u>
Primary	All Pieces ¹	3	0.2	0.6	0.05
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	2	0.1	0.4	0.03
	Rootwads	1	0.1	0.2	0.02
	Conifer	0	0.0	0.0	0.0
Secondary	Deciduous	3	0.2	0.6	0.05
	All Pieces ¹	4	0.8	8.4	1.6
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	4	0.8	8.4	1.6
	Rootwads	0	0.0	0.0	0.0
	Conifer	0	0.0	0.0	0.0
	Deciduous	4	0.8	8.4	1.6

¹Large Wood Piece (≥2 m x ≥0.10 m dia.); ² Minimum Qualifying Key Pieces (≥9.0 m³)

Large Wood Piece Zone Location Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Zone 1 (%)</u>	<u># Zone 2 (%)</u>	<u># Zone 3 (%)</u>	<u># Zone 4 (%)</u>
Primary	3	2 (66.7)	3 (100)	0 (0.0)	0 (0.0)
Secondary	4	0 (0.0)	4 (100)	2 (50.0)	0 (0.0)

*Pieces may span multiple zones

*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Rooted (%)</u>	<u># Buried (%)</u>	<u># Pinned (%)</u>	<u># Unstable (%)</u>	<u># Pool Forming (%)</u>
Primary	3	0 (0.0)	0 (0.0)	0 (0.0)	3 (100)	0 (0.0)
Secondary	4	0 (0.0)	0 (0.0)	1 (25.0)	3 (75.0)	0 (0.0)

Large Wood Piece Orientation Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Parallel (%)</u>	<u># Perpendicular (%)</u>	<u># Downstream (%)</u>	<u># Upstream (%)</u>
Primary	3	2 (66.7)	0 (0.0)	1 (33.3)	0 (0.0)
Secondary	4	0 (0.0)	1 (25.0)	2 (50.0)	1 (25.0)

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 2
Report Date: 07/09/2020	Survey Date: 05/14-5/15/14
Start Location: 45.82212, -121.094608	End Location: 45.81502, -121.08773
Start Elevation: 166.0 m	End Elevation: 183.5 m
Reach Forming Agent: Valley Transition	Reach Ending Agent: Tributary Junction

RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

<u>Type</u>	<u>Total Canopy Cover Area (m²)</u>	<u>Total % Canopy Cover</u>	<u>Unit Avg. % Canopy Cover</u>	<u>Dom Canopy Species</u>	<u>Sub-dom Canopy Species</u>
Primary	4,050.7	59.7	58.5	Red Alder	Red Alder
Secondary	606.4	60.6	57.4	Red Alder	Red Alder

Large Wood Piece Inventory Summary

<u>Channel Type</u>	<u>Primary Channel</u>	<u>#Pieces</u>	<u>Volume (m³)</u>	<u>Pieces/100 m</u>	<u>Volume (m³)/100 m</u>
Primary	All Pieces ¹	46	4.4	4.0	0.4
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	45	4.0	3.9	0.3
	Rootwads	1	0.4	0.1	0.0
	Conifer	0	0.0	0.0	0.0
Secondary	Deciduous	46	4.4	4.0	0.4
	All Pieces ¹	30	3.0	7.7	0.8
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	29	2.8	7.5	0.7
	Rootwads	1	0.2	0.3	0.0
	Conifer	1	0.5	0.3	0.1
	Deciduous	29	2.4	7.5	0.6

¹Large Wood Piece (≥2 m x ≥0.10 m dia.); ² Minimum Qualifying Key Pieces (≥9.0 m³)

Large Wood Piece Zone Location Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Zone 1 (%)</u>	<u># Zone 2 (%)</u>	<u># Zone 3 (%)</u>	<u># Zone 4 (%)</u>
Primary	46	2 (4.3)	38 (82.6)	5 (10.9)	13 (28.3)
Secondary	30	1 (3.3)	25 (83.3)	2 (6.7)	4 (13.3)

*Pieces may span multiple zones

*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Rooted (%)</u>	<u># Buried (%)</u>	<u># Pinned (%)</u>	<u># Unstable (%)</u>	<u># Pool Forming (%)</u>
Primary	46	0 (0.0)	14 (30.4)	16 (34.8)	13 (28.3)	0 (0.0)
Secondary	30	0 (0.0)	13 (43.3)	7 (23.3)	10 (33.3)	0 (0.0)

Large Wood Piece Orientation Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Parallel (%)</u>	<u># Perpendicular (%)</u>	<u># Downstream (%)</u>	<u># Upstream (%)</u>
Primary	46	12 (26.1)	17 (37.0)	9 (19.6)	8 (17.4)
Secondary	30	15 (50.0)	8 (26.7)	6 (20.0)	1 (3.3)

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 3
Report Date: 07/09/2020	Survey Date: 05/19-05/21/14, 05/23/14, 04/02/15
Start Location: 45.81506, -121.08748	End Location: 45.76229, -121.07103
Start Elevation: 183.5 m	End Elevation: 312.5 m
Reach Forming Agent: Tributary Junction	Reach Ending Agent: Valley Transition

RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

<u>Type</u>	<u>Total Canopy Cover Area (m²)</u>	<u>Total % Canopy Cover</u>	<u>Unit Avg. % Canopy Cover</u>	<u>Dom Canopy Species</u>	<u>Sub-dom Canopy Species</u>
Primary	19,195.4	38.7	52.7	Red Alder	Red Alder
Secondary	281.1	13.2	29.0	Scoulers Willow	Scoulers Willow

Large Wood Piece Inventory Summary

<u>Channel Type</u>	<u>Primary Channel</u>	<u>#Pieces</u>	<u>Volume (m³)</u>	<u>Pieces/100 m</u>	<u>Volume (m³)/100 m</u>
Primary	All Pieces ¹	322	51.3	3.9	0.6
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	301	45.1	3.7	0.6
	Rootwads	21	6.2	0.3	0.1
	Conifer	1	<0.1	<0.1	<0.1
Secondary	Deciduous	321	51.3	3.9	0.6
	All Pieces ¹	16	1.4	2.1	0.2
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	16	1.4	2.1	0.2
	Rootwads	0	0.0	0.0	0.0
	Conifer	0	0.0	0.0	0.0
	Deciduous	16	1.4	2.1	0.2

¹Large Wood Piece (≥2 m x ≥0.10 m dia.); ² Minimum Qualifying Key Pieces (≥6.0 m³)

Large Wood Piece Zone Location Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Zone 1 (%)</u>	<u># Zone 2 (%)</u>	<u># Zone 3 (%)</u>	<u># Zone 4 (%)</u>
Primary	322	71 (22.0)	253 (78.6)	100 (31.1)	60 (18.6)
Secondary	16	1 (6.3)	16 (100)	0 (0.0)	0 (0.0)

*Pieces may span multiple zones

*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Rooted (%)</u>	<u># Buried (%)</u>	<u># Pinned (%)</u>	<u># Unstable (%)</u>	<u># Pool Forming (%)</u>
Primary	322	11 (3.4)	40 (12.4)	244 (75.8)	47 (14.6)	0 (0.0)
Secondary	16	0 (0.0)	10 (62.5)	1 (6.3)	5 (31.3)	0 (0.0)

Large Wood Piece Orientation Summary

<u>Channel Type</u>	<u>Total Pieces</u>	<u># Parallel (%)</u>	<u># Perpendicular (%)</u>	<u># Downstream (%)</u>	<u># Upstream (%)</u>
Primary	322	124 (38.5)	76 (23.6)	81 (25.2)	41 (12.7)
Secondary	16	2 (12.5)	7 (43.8)	3 (18.8)	4 (25.0)

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 1-3

Report Date: 07/09/2020

Survey Date: 05/14-05/23/14, 04/02/15

Start Location: 45.82516, -121.09767

End Location: 45.76229, -121.07103

Start Elevation: 155.0 m

End Elevation: 312.5 m

Reach Forming Agent: Confluence

Reach Ending Agent: Valley Transition

STREAM RIPARIAN AND LARGE WOOD PIECES SUMMARY

Riparian Characteristics

Type	Total Canopy Cover Area (m ²)	Total % Canopy Cover	Unit Avg. % Canopy Cover	Dom Canopy Species	Sub-dom Canopy Species
Primary	23,684.2	40.0	52.4	Red Alder	Red Alder
Secondary	942.7	29.1	41.2	Red Alder	Scoulers Willow

Large Wood Piece Inventory Summary

Channel Type	Primary Channel	#Pieces	Volume (m ³)	Pieces/100 m	Volume (m ³)/100 m
Primary	All Pieces ¹	371	56.0	3.8	0.6
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	348	49.2	3.6	0.5
	Rootwads	23	6.7	0.2	0.1
	Conifer	1	<0.1	<0.1	<0.1
Secondary	Deciduous	370	55.9	3.8	0.6
	All Pieces ¹	50	5.1	4.2	0.4
	Key Pieces ²	0	0.0	0.0	0.0
	Logs	49	5.0	4.1	0.4
	Rootwads	1	0.2	0.1	<0.1
	Conifer	1	0.5	0.1	<0.1
	Deciduous	49	4.6	4.1	0.4

¹Large Wood Piece (≥2 m x ≥0.10 m dia.); ² Minimum Qualifying Key Pieces (≥6.0 and 9.0 m³)

Large Wood Piece Zone Location Summary

Channel Type	Total Pieces	# Zone 1 (%)	# Zone 2 (%)	# Zone 3 (%)	# Zone 4 (%)
Primary	371	75 (20.2)	294 (79.2)	105 (28.3)	73 (19.7)
Secondary	50	2 (4.0)	45 (90.0)	4 (8.0)	4 (8.0)

*Pieces may span multiple zones

*Zone 1 (wetted channel); Zone 2 (within bankfull); Zone 3 (above bankfull); Zone 4 (flood plain/terrace/hillslope)

Large Wood Piece Stability and Pool Forming Summary

Channel Type	Total Pieces	# Rooted (%)	# Buried (%)	# Pinned (%)	# Unstable (%)	# Pool Forming (%)
Primary	371	11 (3.0)	54 (14.6)	260 (70.1)	63 (17.0)	0 (0.0)
Secondary	50	0 (0.0)	23 (46.0)	9 (18.0)	18 (36.0)	0 (0.0)

Large Wood Piece Orientation Summary

Channel Type	Total Pieces	# Parallel (%)	# Perpendicular (%)	# Downstream (%)	# Upstream (%)
Primary	371	138 (37.2)	93 (25.1)	91 (24.5)	49 (13.2)
Secondary	50	17 (34.0)	16 (32.0)	11 (22.0)	6 (12.0)

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 1
Report Date: 07/09/2020	Survey Date: 05/14/2014
Start Location: 45.82516, -121.09767	End Location: 45.82212, -121.09464
Start Elevation: 155.0 m	End Elevation: 166.0 m
Reach Forming Agent: Confluence	Reach Ending Agent: Valley Transition

LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u># Pieces</u>	<u>Avg # Pieces</u>	<u>Jam Frequency¹</u>	<u># Jams/KM</u>
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

¹Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Total Pieces</u>	<u>Large Wood Piece Size</u>				<u>#Rtwd Key Pieces</u>	<u>#Log Key Pieces</u>
			<u>#Rootwad (Dia≥20cm)</u>	<u>#Log (Dia≥10>20cm)</u>	<u>#Log (Dia20<50cm)</u>	<u>#Log (Dia≥50cm)</u>		
Primary	0	-	-	-	-	-	-	-
Secondary	0	-	-	-	-	-	-	-

Large Wood Piece Zone Location and Pool Forming Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Wetted Channel Area (%)</u>	<u>Bankfull Channel Area (%)</u>	<u>Flood plain/Terrace Area (%)</u>	<u>Pool Forming (%)</u>
Primary	0	-	-	-	-
Secondary	0	-	-	-	-

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 2
Report Date: 07/09/2020	Survey Date: 05/14-5/15/14
Start Location: 45.82212, -121.094608	End Location: 45.81502, -121.08773
Start Elevation: 166 m	End Elevation: 183.5 m
Reach Forming Agent: Valley Transition	Reach Ending Agent: Tributary Junction

LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u># Pieces</u>	<u>Avg # Pieces</u>	<u>Jam Frequency¹</u>	<u># Jams/KM</u>
Primary	0	0	-	-	0
Secondary	2	37	18.5	-	5.1

¹Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Total Pieces</u>	<u>Large Wood Piece Size</u>				<u>#Rtwd Key Pieces</u>	<u>#Log Key Pieces</u>
			<u>#Rootwad (Dia≥20cm)</u>	<u>#Log (Dia≥10>20cm)</u>	<u>#Log (Dia20<50cm)</u>	<u>#Log (Dia≥50cm)</u>		
Primary	0	0	0	0	0	0	0	0
Secondary	2	37	0	30	7	0	0	0

Large Wood Piece Zone Location and Pool Forming Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Wetted Channel Area (%)</u>	<u>Bankfull Channel Area (%)</u>	<u>Flood plain/Terrace Area (%)</u>	<u>Pool Forming (%)</u>
Primary	0	-	-	-	-
Secondary	2	2 (100.0)	-	-	1 (50.0)

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 3

Report Date: 07/09/2020

Survey Date: 05/19-05/23/14, 04/02/15

Start Location: 45.81506, -121.08748

End Location: 45.76229, -121.07103

Start Elevation: 183.5 m

End Elevation: 312.5 m

Reach Forming Agent: Tributary Junction

Reach Ending Agent: Valley Transition

RIPARIAN AND LARGE LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u># Pieces</u>	<u>Avg # Pieces</u>	<u>Jam Frequency</u> ¹	<u># Jams/KM</u>
Primary	7	96	13.7	92.3	0.9
Secondary	0	0	0	0	0

¹Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Total Pieces</u>	<u>Large Wood Piece Size</u>				<u>#Rtwd Key Pieces</u>	<u>#Log Key Pieces</u>
			<u>#Rootwad (Dia≥20cm)</u>	<u>#Log (Dia≥10>20cm)</u>	<u>#Log (Dia20<50cm)</u>	<u>#Log (Dia≥50cm)</u>		
Primary	7	96	0	16	61	19	0	10
Secondary	0	0	0	0	0	0	0	0

Large Wood Piece Zone Location and Pool Forming Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Wetted Channel Area (%)</u>	<u>Bankfull Channel Area (%)</u>	<u>Flood plain/Terrace Area (%)</u>	<u>Pool Forming (%)</u>
Primary	7	7 (100.0)	-	-	5 (71.4)
Secondary	0	-	-	-	-

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 1-3

Report Date: 07/09/2020

Survey Date: 05/14-05/23/14,
05/02/15

Start Location: 45.82516, -121.09767

End Location: 45.76229, -121.07103

Start Elevation: 155 m

End Elevation: 312.5 m

Reach Forming Agent: Confluence

Reach Ending Agent: Valley Transition

STREAM LARGE WOOD JAM SUMMARY

Large Wood Jam Inventory Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u># Pieces</u>	<u>Avg # Pieces</u>	<u>Jam Frequency</u> ¹	<u># Jams/KM</u>
Primary	7	96	13.71	105.11	0.72
Secondary	2	37	18.5	-	5.14

¹Jam frequency (total bankfull channel widths/jam)

Large Wood Jam Composition Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Total Pieces</u>	<u>Large Wood Piece Size</u>				<u>#Rtwd Key Pieces</u>	<u>#Log Key Pieces</u>
			<u>#Rootwad (Dia≥20cm)</u>	<u>#Log (Dia≥10>20cm)</u>	<u>#Log (Dia20<50cm)</u>	<u>#Log (Dia≥50cm)</u>		
Primary	7	96	0	16	61	19	0	10
Secondary	2	37	0	30	7	0	0	0

Large Wood Piece Zone Location and Pool Forming Summary

<u>Channel Type</u>	<u>Total Jams</u>	<u>Wetted Channel Area (%)</u>	<u>Bankfull Channel Area (%)</u>	<u>Flood plain/Terrace Area (%)</u>	<u>Pool Forming (%)</u>
Primary	7	7 (100.0)	0	0	5 (71.4)
Secondary	2	2 (100.0)	0	0	1 (50.0)

*A jam was assigned to wetted or bankfull zone if a LWD piece extended 0.1 meters into a zone

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 1
Report Date: 07/09/2020	Survey Date: 05/14/2014
Start Location: 45.82516, -121.09767	End Location: 45.82212, -121.09464
Start Elevation: 155.0 m	End Elevation: 166.0 m
Reach Forming Agent: Confluence	Reach Ending Agent: Valley Transition

BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

<u>Channel Type</u>	<u>Total #</u>	<u># LB Loc</u>	<u># RB Loc</u>	<u>#CB Loc</u>	<u># Channel Span</u>	<u>Total Length</u>
Primary	1	0	1	1	0	51.0
Secondary	0	-	-	-	-	-

Bedrock Feature Characteristic Summary

<u>Channel Type</u>	<u># Ledge</u>	<u># Slope</u>	<u># Cliff</u>	<u># Projecting</u>	<u># Non- projecting</u>	<u># Surface Control</u>
Primary	1	0	0	1	0	0
Secondary	0	0	0	0	0	0

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 2
Report Date: 07/09/2020	Survey Date: 05/14-5/15/14
Start Location: 45.82212, -121.094608	End Location: 45.81502, -121.08773
Start Elevation: 166.0 m	End Elevation: 183.5 m
Reach Forming Agent: Valley Transition	Reach Ending Agent: Tributary Junction

BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

<u>Channel Type</u>	<u>Total #</u>	<u># LB Loc</u>	<u># RB Loc</u>	<u>#CB Loc</u>	<u># Channel Span</u>	<u>Total Length</u>
Primary	4	0	4	0	0	141.4
Secondary	0	-	-	-	-	-

Bedrock Feature Characteristic Summary

<u>Channel Type</u>	<u># Ledge</u>	<u># Slope</u>	<u># Cliff</u>	<u># Projecting</u>	<u># Non-projecting</u>	<u># Surface Control</u>
Primary	0	3	1	3	1	0
Secondary	0	0	0	0	0	0

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek	Reach: 3
Report Date: 07/09/2020	Survey Date: 05/19-05/23/14, 04/02/15
Start Location: 45.81506, -121.08748	End Location: 45.76229, -121.07103
Start Elevation: 183.5 m	End Elevation: 312.5 m
Reach Forming Agent: Tributary Junction	Reach Ending Agent: Valley Transition

RIPARIAN AND LARGE BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

<u>Channel Type</u>	<u>Total #</u>	<u># LB Loc</u>	<u># RB Loc</u>	<u>#CB Loc</u>	<u># Channel Span</u>	<u>Total Length</u>
Primary	25	9	9	8	0	976.6
Secondary	1	0	1	0	0	46.4

Bedrock Feature Characteristic Summary

<u>Channel Type</u>	<u># Ledge</u>	<u># Slope</u>	<u># Cliff</u>	<u># Projecting</u>	<u># Non- projecting</u>	<u># Surface Control</u>
Primary	11	13	1	21	4	7
Secondary	1	0	1	0	1	0

Klickitat Monitoring and Evaluation Project Rapid Aquatic Habitat Inventory

Survey Stream: Swale Creek

Reach: 1-3

Report Date: 07/09/2020

Survey Date: May 14, 15, 19-21, 23, 2014,
April 2, 2015

Start Location: 45.82516, -121.09767

End Location: 45.76229, -121.07103

Start Elevation: 155.0 m

End Elevation: 312.5 m

Reach Forming Agent: Confluence

Reach Ending Agent: Valley Transition

BEDROCK FEATURE SUMMARY

Bedrock Feature Inventory Summary

<u>Channel Type</u>	<u>Total #</u>	<u># LB Loc</u>	<u># RB Loc</u>	<u>#CB Loc</u>	<u># Channel Span</u>	<u>Total Length</u>
Primary	30	9	14	9	0	1,169.0
Secondary	1	0	1	0	0	46.4

Bedrock Feature Characteristic Summary

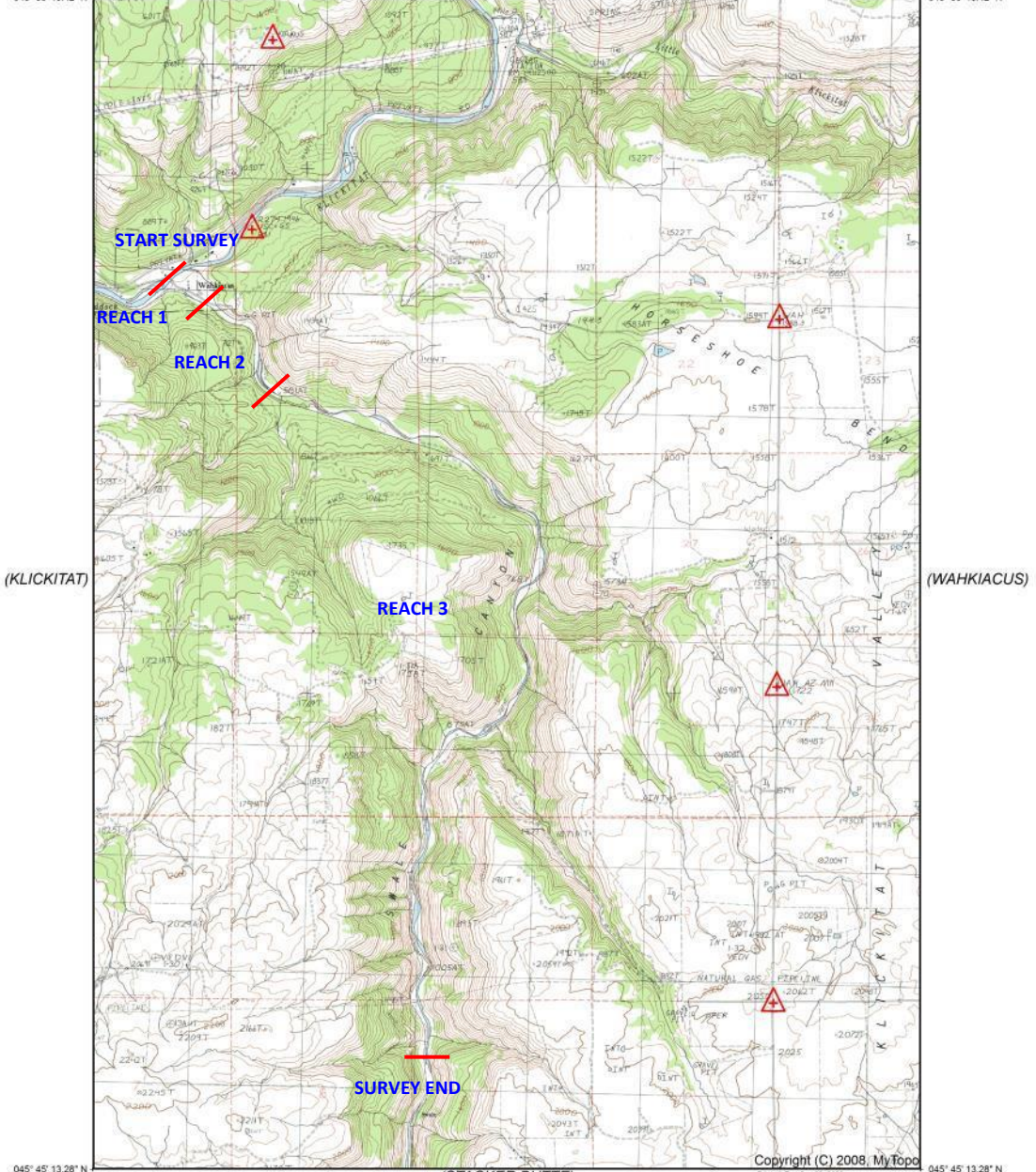
<u>Channel Type</u>	<u># Ledge</u>	<u># Slope</u>	<u># Cliff</u>	<u># Projecting</u>	<u># Non-projecting</u>	<u># Surface Control</u>
Primary	12	16	2	25	5	7
Secondary	0	0	1	0	1	0

(DEAD CANYON)



WAHKIACUS QUADRANGLE
WESTPORT/MT. ST. HELENS/MT.
ADAMS/COLUMBIA RIVER (GRAYBACK MT)
TOPOGRAPHIC SERIES

121° 06' 32.40" W 045° 50' 48.42" N (GRAYBACK MT) 121° 00' 53.07" W 045° 50' 48.42" N



(THE DALLES NORTH)

Produced by MyTopo Terrain Navigator
Topography based on USGS 1:24,000
Maps

North American 1983 Datum (NAD83)
Lambert Conformal Conic Projection

To place on the predicted North American
1927 move the projection lines 17M S and
92M W



CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM 1929

WAHKIACUS, WA
1983

(STACKER BUTTE)

Swale Creek 2014 Habitat Survey – Reach 1 Photos



Unit 1 – Upstream view of confluence riffle



Unit 3 – Upstream view of riffle



Unit 4 – Upstream view of PIT tag array



Unit 8 – Upstream view of bedrock scour pool



Unit 10 – Upstream view of glide



Unit 15 – Upstream view of pool

Swale Creek 2019 Habitat Survey – Reach 2 Photos



Unit 1 – Upstream view of glide



Unit 14 – Upstream view of pool



Unit 21 – Upstream view of riffle



Unit 24.11 – Upstream view of side channel wood jam



Unit 24.14 – Downstream view of side channel glide



Unit 29 – Upstream view of cascade

Swale Creek 2019 Habitat Survey – Reach 3 Photos



Unit 10 – Upstream view of pool



Unit 21 – Upstream view of riffle



Unit 60 – Upstream view of pool



Unit 100 – Upstream view of cascade



Unit 114 – Upstream view glide



Units 200.2– Upstream view of side channel pool

Swale Creek 2019 Habitat Survey – Reach 3 Photos



Unit 213 – Downstream view of beaver dam pool



Unit 223 – Upstream view of cascade



Unit 230 – Upstream view of train trestle



Unit 235– Upstream view of riffle



Unit 240 – Upstream view bedrock scour pool



Unit 295– Upstream view of end of survey cascade