Middle Entiat River Reach Assessment Update

Appendix A | Habitat Assessment

Entiat River (RM 15.6 – 26.7)

February 2026

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1 Introduction & Background

The Entiat River is located within the eastern foothills of the Central Cascade Mountains in central Washington. It is approximately 56.5 miles long from its headwaters to its confluence with the Columbia River. Flowing eastward into the Columbia River Basin, it joins the Columbia River approximately 483.6 river miles (RM) upstream of where the Columbia meets the Pacific Ocean, near the town of Entiat, WA.

The Yakama Nation identified an approximately 11-mile-long stretch of the Entiat River for assessment and identification of potential restoration actions to support Threatened and Endangered salmon and trout habitat within the Columbia River Basin. As part of the assessment process, Inter-Fluve conducted this salmonid habitat survey of the Entiat River between October 7 – 14, 2024 and August 4 – 8, 2025. The assessment area was expanded in 2025 to include an additional 3.6 miles (Reaches 9-12) from the original area surveyed during the 2024 field season. Habitat survey crews started at RM 15.6 (confluence with Potato Creek) and worked upstream to RM 26.7 (confluence with McCrea Creek). A flow rate of 43.7 cubic feet per second (cfs) was measured in the field on October 11, 2024 near RM 19.4 – approximately 150 feet upstream of the Stormy Creek tributary. The USGS river gage #12452800, located just downstream of the assessment near Ardenvoir (RM 11), measured 48.1 cfs on October 11, 2024. Streamflow was not measured as part of the 2025 survey, but the USGS river gage #12452800 measured 99.0 cfs on August 4, 2025. Insignificant precipitation was received over both 2024 and 2025 survey periods. Stream flow was not otherwise measured as part of this survey.

The objective of this Habitat Assessment is to characterize the habitat quantity and quality for salmonid species native to the Entiat River by quantifying in-channel morphologic features, characterizing riparian conditions, and identifying anthropogenic features influencing aquatic habitat. This information is used to inform potential restoration and conservation actions and will provide a baseline for evaluating future habitat trends and measuring the effectiveness of restoration efforts to improve the quantity and quality of available habitat within the assessment area.

2 Methods

The assessment was divided into 12 distinct geomorphic reaches. These 12 reach delineations are used for both the habitat assessment as well as the Reach-Based Ecosystem Indicators (Appendix B). River miles (RM) and reach extents used in this assessment were based on the Upper Columbia Salmon Recovery Board reaches in the Entiat River (UCSRB, 2021). Two of the UCSRB reaches were further partitioned for this assessment due to the long length of those reaches. The Potato 05 Reach was divided into three reaches (Reaches 2 – 4) and the Potato 06 Reach was divided into two reaches (Reach 5 – 6).

This habitat assessment employed the methods outlined in the US Forest Service (USFS) Stream Inventory Handbook: Level I & II, Pacific Northwest Region, Version 2.20 (USFS, 2020). The "Eastside Forest Option" protocol was used. All protocols were followed when safe and most of the suggested forest inventory options were applied in the survey. In some cases, adaptations to the USFS Eastside protocol were made for this survey. Those include:

- All reach and habitat unit lengths were measured in GIS from GPS data recorded in the field. Habitat units were delineated by survey points collected with a Juniper System GNS2 Geode unit (sub-foot accuracy).
- Floodprone width was calculated using LiDAR data and 2-Dimensional (2D) hydraulic modeling results produced in HEC-RAS
- Field data was collected digitally on an iPad using ESRI Field Maps software

At all channel units, surveyors performed an ocular estimate of wetted width and at nth units performed a measured wetted width using a laser rangefinder to calibrate their ocular estimate. A bankfull measurement was performed at the first three fast water channel units (riffle or glide) per reach when safe, and then at every nth unit after. The nth channel unit (riffle, pool, glide) measurement frequency applied in the field for data collected was 20%, or every 5th unit, for both fast- and slow-water channel unit types. If fewer than three fast-water units were encountered in a reach, bankfull measurements were collected at slow water units instead. The length of anthropogenically-induced unstable banks was recorded for both the left and right channel banks in all units. Water depths for all habitat units were measured using a graduated stadia rod carried by the surveyor or estimated if depths or velocities exceeded the wading ability of the observer. Water temperature and stream flow measurement were recorded for tributaries when safely accessible. Water temperature was taken for the tributary and in the main channel upstream of tributary influence and downstream of the tributary confluence.

For riparian vegetation measurements, the riparian corridor can be defined as either a single 100-ft wide zone or two adjacent riparian zones (inner and outer zones) totaling 100 feet in width (USFS, 2020). For this assessment, one single 100-ft wide riparian zone was designated for the Entiat River assessment area. Survey methods dictate defining a dominant size class of vegetation type within the riparian corridor (e.g. small trees, shrubs), then defining the dominant species observed in the overstory and understory. Survey protocol differed from the USFS protocol by collecting dominant overstory class and species, and a dominant understory species within the 100-feet wide riparian zone in addition to class size (USFS, 2020).

For this habitat survey, side channels were defined as naturally-wetted flow paths connected to the mainstem channel at their upstream and downstream ends at low flow. Side channel units were identified when the main channel split to form a stable island with soil or fine sediment accumulations and with established vegetation older than 2 to 3 years. Each side channel was determined to be predominately a fast-water or slow-water unit type. The average width of the side channel was estimated by the observer. Total length of the side channels was recorded using GPS following the same protocols used for main channel unit delineation. If the entire side channel was not wet at the time of survey, the length of the wetted portion of the side channel was estimated. This report provides data based on total side channel lengths, unless otherwise noted. Several off-channel features were categorized as "other" unit types, including alcoves or off-channel marshes that were connected to the mainstem of the Entiat River during the time of the survey.

Large woody material (LWM) was counted in the mainstem and side channels following the size class characterizations for "Eastside" forests (USFS, 2020). Tallies of small (> 6 in. diameter, >20 ft long), medium (>12 in. diameter, > 35 ft long) and large (>20 in. diameter, >35 ft long) pieces of LWM were completed for each unit. A log jam was classified as a group of three or more pieces meeting the size

requirements above in contact with one another and with at least one piece within bankfull. Both a within bankfull count (number of qualify LWM pieces within bankfull) and total count was performed (all qualifying LWM pieces within and outside of bankfull). The within bankfull count was used for this report. Geomorphic function of the jam, as well as whether the jam was of natural origin or constructed as a part of habitat enhancement efforts in the basin, was also noted. More information on the jams can be found in Section 2.9 of the main report.

3 Summary of Results

This section summarizes instream habitat conditions for all 12 reaches surveyed in the Entiat River from RM 15.6 - 26.7. Detailed reach summaries with reach-specific results are included in Section 4 of this appendix.

3.1 CHANNEL MORPHOLOGY

The Entiat River channel undergoes several distinct changes in morphology within the assessment area as it flows from McCrea Creek (RM 26.7) downstream to Potato Creek (RM15.6). A series of fans at tributary confluences throughout the assessment area provide local confinement and coarse sediment inputs to the channel, and create regions of relatively high gradient, high stream energy, and low sinuosity. These include fans at the mouths of Brennegan Creek in Reach 11, Preston Creek in Reach 10, Dill Creek in Reach 8, Stormy Creek and Shamel Creek both in Reach 4, as well as several additional unnamed tributaries. Between confined sections, the unconfined channel historically migrated across a wide valley bottom that is the remnant of late-Pleistocene glacial activity. Upstream of the Preston Creek alluvial fan the Entiat River channel is relatively steep and primarily single-thread in planform. As the valley bottom widens downstream of the Preston Creek fan, the slope generally becomes more gradual outside of fan confinements. In these wider regions, mid-channel bars create sections of split-flow within a channel that is otherwise primarily single-thread. As the Entiat River cuts through the Potato Moraine at the downstream end of the assessment area, the channel again narrows and steepens considerably through the end of the assessment area. See Table 1 below.

Table 1. Bankfull and floodprone width results for the entire Entiat River assessment area.

Bankfull Widths (feet)												
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**	**Reach 8**	**Reach 9**	**Reach 10**	**Reach 11**	**Reach 12**
Max	110	125	125	120	80	145	130	104	122	100	105	120
Min	75	100	70	80	50	105	90	70	80	80	85	90
Mean	95	115	93	95	63	119	118	85	101	88	93	103
St Dev	15	13	28	22	15	18	19	17	17	10	11	13
Floodprone Widths (feet)												
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**	**Reach 8**	**Reach 9**	**Reach 10**	**Reach 11**	**Reach 12**
Max	362	1152	532	420	965	1791	643	144	978	290	507	409
Min	74	387	322	287	563	655	174	92	150	122	371	158
Mean	160	704	431	368	749	1175	393	111	595	189	425	277
St Dev	136	399	105	71	203	535	212	29	336	89	72	117
Bankfull Depths (feet)												
	Reach 1	**Reach 2**	**Reach 3**	**Reach 4**	**Reach 5**	**Reach 6**	**Reach 7**	**Reach 8**	**Reach 9**	**Reach 10**	**Reach 11**	**Reach 12**
Max	4.7	5.7	5.3	4.3	5.9	4.1	4.6	5.4	5.3	5.1	5.7	5.3
Min	1.4	1.2	0.4	1.0	1.1	0.8	1.3	1.4	0.4	1.7	1.1	0.6
Mean	3.6	3.1	3.2	2.9	3.4	2.5	2.8	3.6	3.2	3.6	3.5	3.2
St Dev	3.6	1.1	1.1	0.9	1.2	0.8	0.9	1.0	1.0	1.0	1.3	1.0

3.2 HABITAT UNIT COMPOSITION

For the Entiat River assessment area overall, pool habitat comprised 41% of the total habitat area. Riffles consisted of 30% of the total area, and side channels 17%. Side channel habitat was found in Reaches 1, 3, 5, 7, 9 and Reaches 11-12. Glide units were 11% of the total habitat assessment area (Figure 1). There were five units recorded in the "other" unit type category (USFS, 2020): one off-channel marsh, one naturally-formed backwater alcove, and three constructed backwater alcoves. All of these "other" categories combined comprised 1% of the total assessment habitat area (Figure 1).

Pool habitat generally decreased moving upriver through the assessment area (Figure 2). Reach 2 and Reach 6 had the highest percentages of pool habitat, with 89% and 76% pool habitat recorded (respectively). Conversely, Reach 8 had no pool habitat and Reach 12 had only 3% pool habitat by area. The mean residual pool depth for the assessment area ranged from 2.6 feet in Reach 1 to 5.7 feet in Reach 11. Of the reaches with pools observed, Reach 2 had the lowest individual residual depth recorded, at 1.2 feet and Reach 11 also had the highest recorded residual depth at 10.6 feet, although it should be noted that the maximum depth in the pool was estimated. Mean residual depth across the 12 reaches was 4.0 feet (Figure 3). Pool frequency was the highest in Reach 4, with 13 pools per mile. Reaches 10 and Reach 12 had the lowest pool frequency, with only one and two pools per mile, respectively. Reach 8, with no pool habitat, was excluded from any pool metrics.

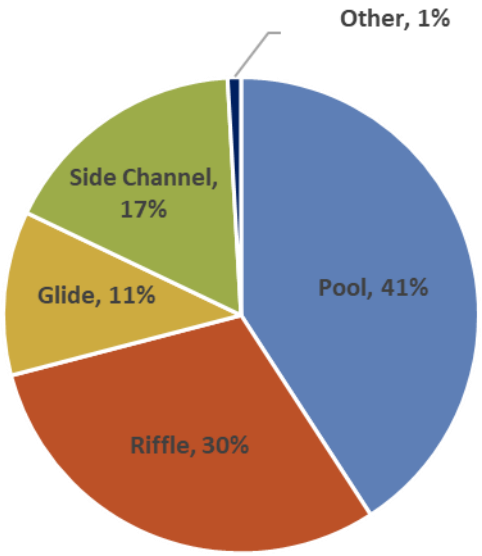

Figure 1. Habitat unit composition across the entire assessment area.

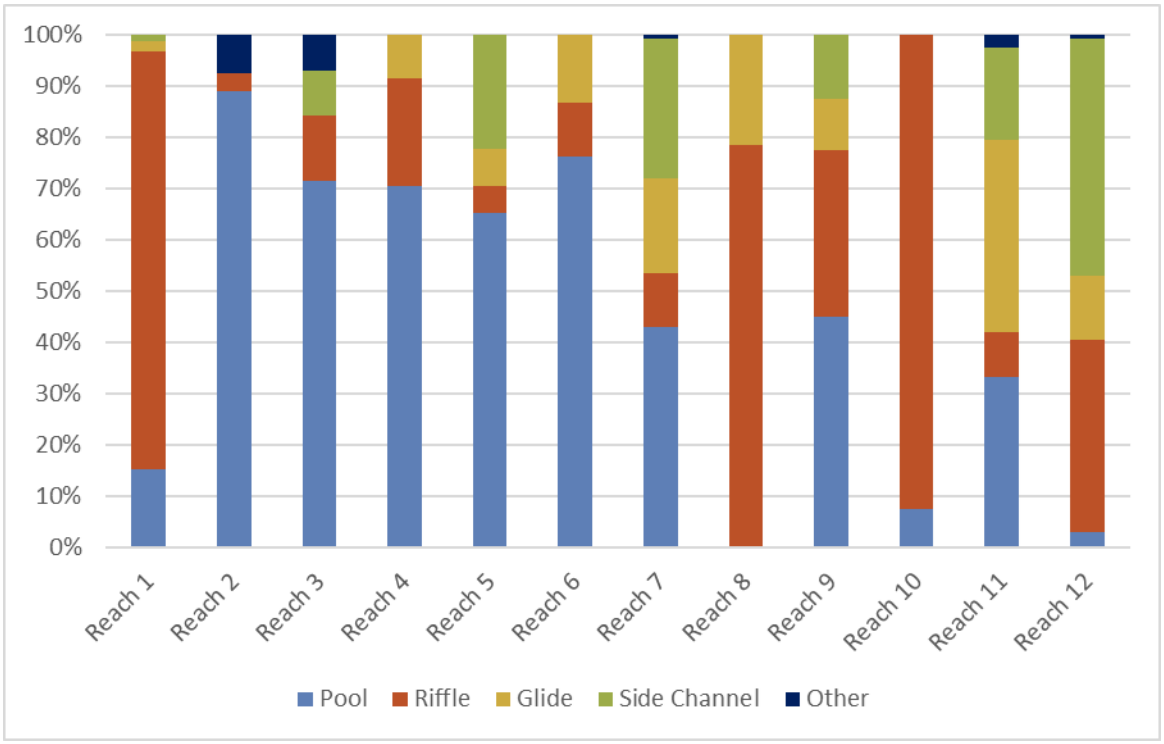

Figure 2. Habitat unit composition per reach (as a percent of total reach area) for each of the 12 surveyed reaches.

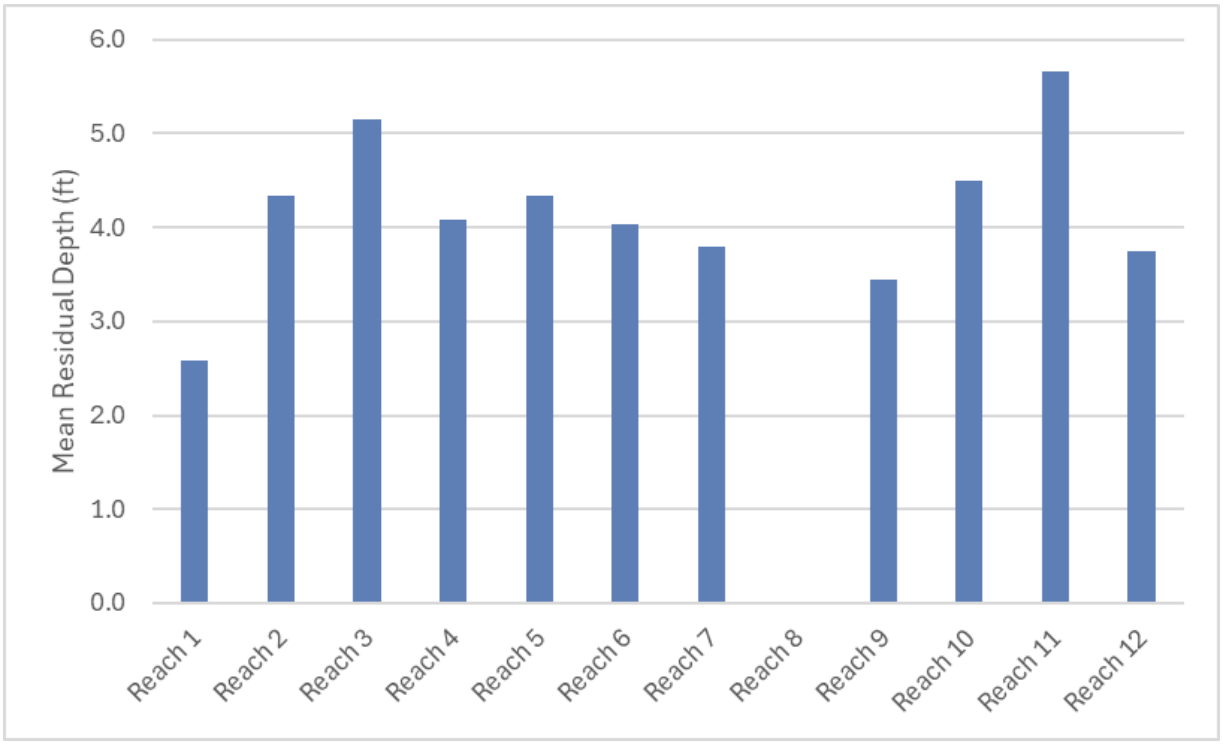

Figure 3. Average residual pool depth per reach.

3.3 SIDE CHANNEL HABITAT

There were 20 total side channels observed in the assessment area, accounting for 17% of the total habitat area. Five side channels were constructed through restoration efforts. Reach 12 had the most side channel by area of all the reaches, at 46% of the reach area, and Reach 7 had the highest quantity of side channels with six individual side channels observed. The longest side channel was observed in Reach 7, recorded as 2160 feet long. The shortest side channel was in Reach 11 at 96 feet long. All but one of the observed side channels were recorded as slow water (pool-type) habitats. The remaining side channel was primarily fast water (rifle-glide-type) habitat.

3.4 LARGE WOODY MATERIAL (LWM)

There were 4,381 pieces of LWM observed in the assessment area in total, which averages to 395 total pieces per mile and 206 M+L (M+L) pieces per mile. This count includes individual pieces tallied as well as the number of pieces estimated in jams. LWM was counted in three size classes: small (diameter >6 inches and length >20 feet), medium (diameter >12 inches and length >35 feet), and large (diameter >20 inches and length >35 feet). Small LWM pieces made up 48% of all wood recorded in the assessment area, while 33% was recorded as medium and 19% were classified as large. Reach 7 had the most LWM, both in the number of M+L pieces per mile (n=482) and in the total pieces per mile (n=882). There was a long, constructed side channel in Reach 7 in which 20 jams and 25% of the total wood in the reach were observed. Reach 8 and Reach 10 both had the lowest amount of LWM observed in the assessment area. In Reach 8, there were 60 pieces of LWM recorded, with only 13 M+L pieces per mile. In Reach 10 there were 57 pieces of LWM per mile observed, with 21 M+L per mile. These quantities include the wood found in jams, as well as individual pieces. See Figure 4 below. Most of the LWM observed in the assessment area was positioned in jams (75%), while 25% were recorded as individual pieces of LWM. A total of 216 jams (20 jams per mile) were counted in the assessment area and 141 of those were constructed.

Fox and Bolton (Fox & Bolton, 2007) conducted instream large wood surveys in unmanaged streams across Washington state to help understand natural wood loading conditions. As part of their study, they compared their data to the National Marine Fisheries Service (NMFS) properly functioning conditions threshold (1996) that are based on sizes exceeding the "medium" size class used by the USFS in the Level 2 survey protocols (2020; ≥12 in diameter and at least 35 ft long). The Fox and Bolton (2007) 75th percentile of wood loading was 67.45 pieces per mile for unmanaged streams in eastside forests. For this Entiat River reach assessment, we chose the 75th percentile value to use as a comparison to observed conditions in Entiat River, since this is believed to be a reasonable target for restoration of natural wood loading ranges across the landscape by Fox and Bolton (2007). Therefore, the "adequate" threshold for LWM in the Entiat River is > 67.45 pieces per mile of M+L size class wood, with additional woody debris available for long-term recruitment. Reaches 2-7, Reach 9, and Reach 12 all met the criteria for number of M+L per mile, however, none of them met the criteria for LWM recruitment. The remaining reaches met neither the M+L criteria per mile nor the recruitment potential.

The LWM reported in this habitat assessment is based on USFS criteria (2020). Additional information on LWM, including LWM that doesn't meet USFS criteria (2020) but provides geomorphic function to the Entiat River, is discussed in Section 6 of the main report.

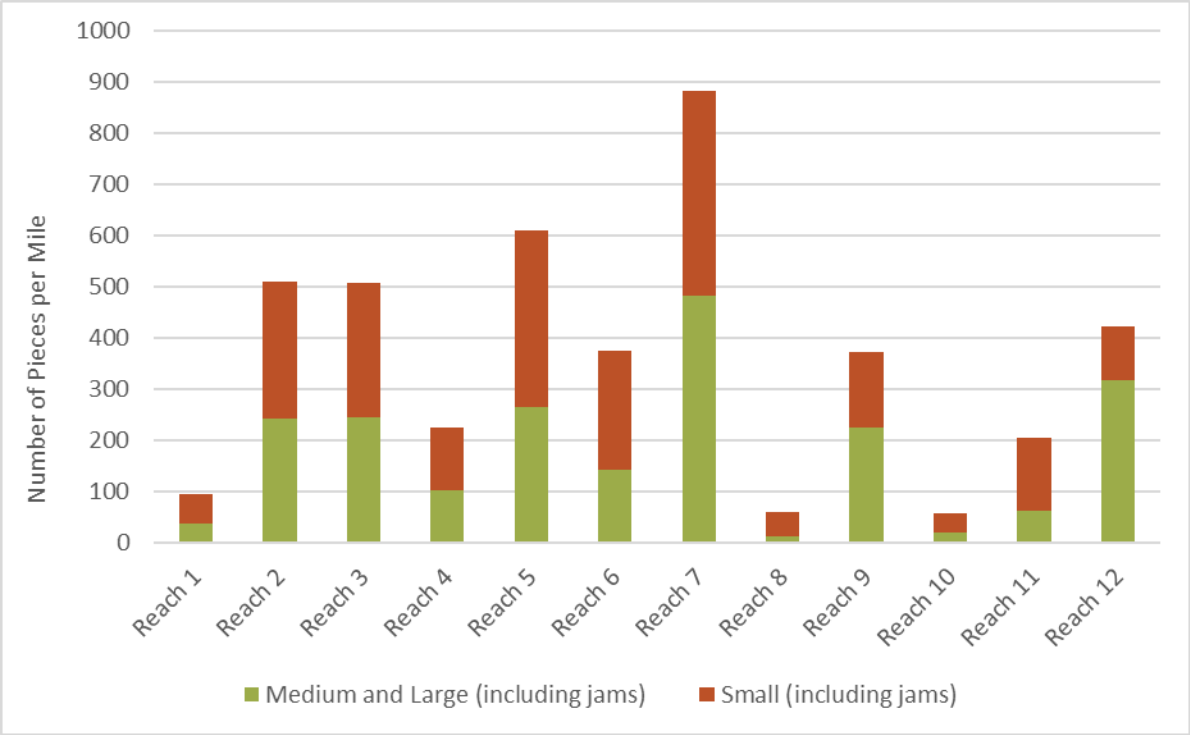

Figure 4. Number of LWM pieces per mile for each reach, classified by small size class and M+L size class.

3.5 BANK INSTABILITY

Human-induced bank instability was infrequently observed in the assessment area, totaling only 1% of the total bank length. The total bank length throughout the assessment area was calculated by doubling the length of the reach to account for unstable banks on both river left and river right. Anthropogenically-induced bank instability was most often observed near roads and private properties or underneath bridges.

Reach 3 had the highest percentage of unstable banks, with 4% of the total bank length (i.e., both sides) in the reach recorded as unstable. The Entiat River Road was directly adjacent on the river left side of Reach 3 in two distinct sections and riprap was prevalent. There was also a bridge crossing for a privately owned driveway in Reach 3 with riprap present on both river right and left of the bridge.

3.6 FISH PASSAGE BARRIERS

No full fish passage barriers were observed in the mainstem of the Entiat River within the assessment area. There were two channel-spanning rock weirs near the McKenzie Diversion, an irrigation diversion equipped with fish screens, at the upstream end of Reach 1 (Figure 13). The thalweg depths at the rock weirs at the time of survey were deep, 2.1 feet at the downstream weir and 3.3 feet at the upstream weir, and adult salmon were witnessed in the pool upstream of the weirs. The rock weirs may act as

impediments to fish passage depending on the flow or condition of the weir. There were no other fish passage impediments or barriers observed in the assessment area.

3.7 RIPARIAN CORRIDOR

Riparian conditions within 100 feet of the channel on both banks were recorded at a subset of channel units, including n^{th} units or where surveyors noticed dramatic shifts in riparian conditions. Of the 60 units where vegetation conditions were recorded, most (53%) of the overstory riparian vegetation size was large trees (21.0-31.9-inch diameter at breast height [dbh]). Small trees (9.0-20.9-inch dbh) were the second most frequent overstory size class in the assessment area (42%). Shrub/Seedling (1-4.9-inch dbh), grassland/forb, and "other" size classes were each 2% of the recorded overstory size classes in the assessment area (Figure 5). The "other" size class was recorded in Reach 1 where the overstory consisted of burned snags, from the 2018 Cougar Creek Fire or the 1994 Tyee Fire (Washington State Department of Natural Resources, n.d.). Overstory species observed included cottonwood in 50% of surveyed units and Ponderosa pine in 27% of surveyed units. Alder (8%), Douglas fir (7%), other/unknown species (3%), cedar (3%), and birch (2%) were also reported as overstory species in the assessment area (Figure 6). The other/unknown overstory species included a unit with burnt snags from the Tyee and Cougar Creek fires and a unit with no overstory in Reach 1.

A majority of understory in the assessment area was recorded as the shrub/seedling (1.0 -4.9-inch dbh) size class (87%). Sapling/pole (5-8.9-inch dbh) was the second most prevalent class (10%), followed by grassland/forb (3%; Figure 7). Willow and alder were the most frequently observed understory species, recorded in 40% and 35% of surveyed units, respectively. Additional understory species observed include dogwood (20%), other/unknown species (3%), and cottonwood (2%; Figure 8). The other/unknown species were grasses that could not be typed out in the field.

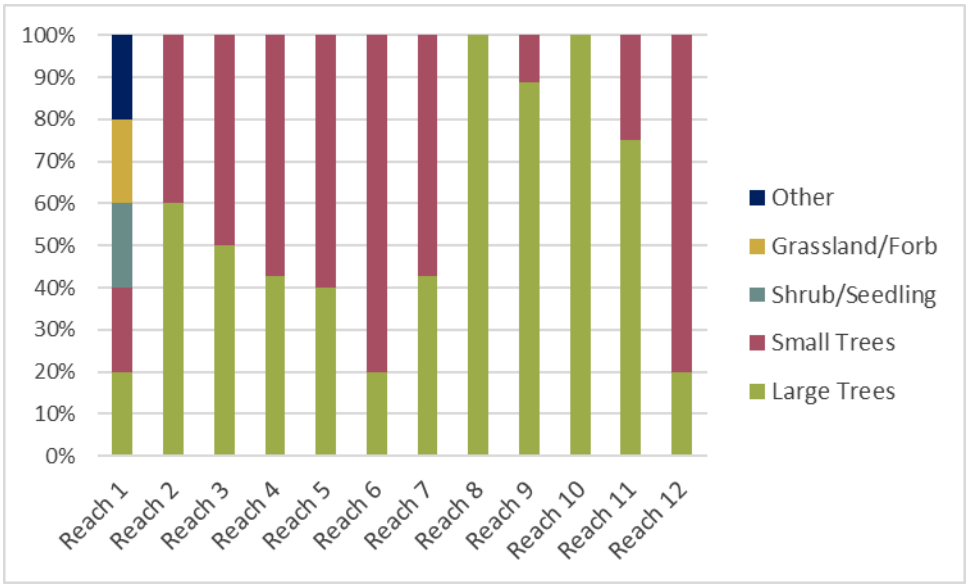

Figure 5. Percent composition of the dominant overstory size class for all units in which vegetation surveys were performed.

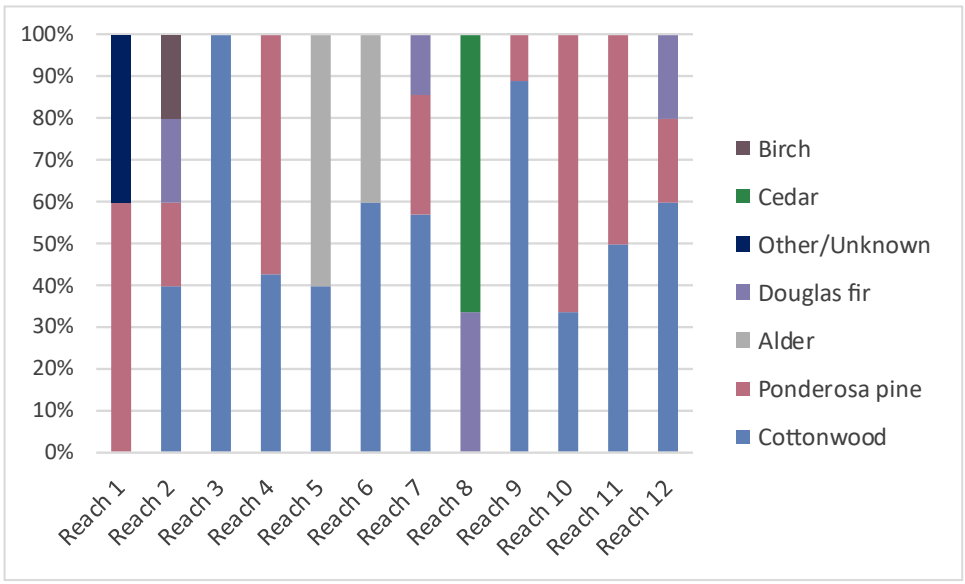

Figure 6. Percent composition of the dominant overstory species for all units in which vegetation surveys were performed.

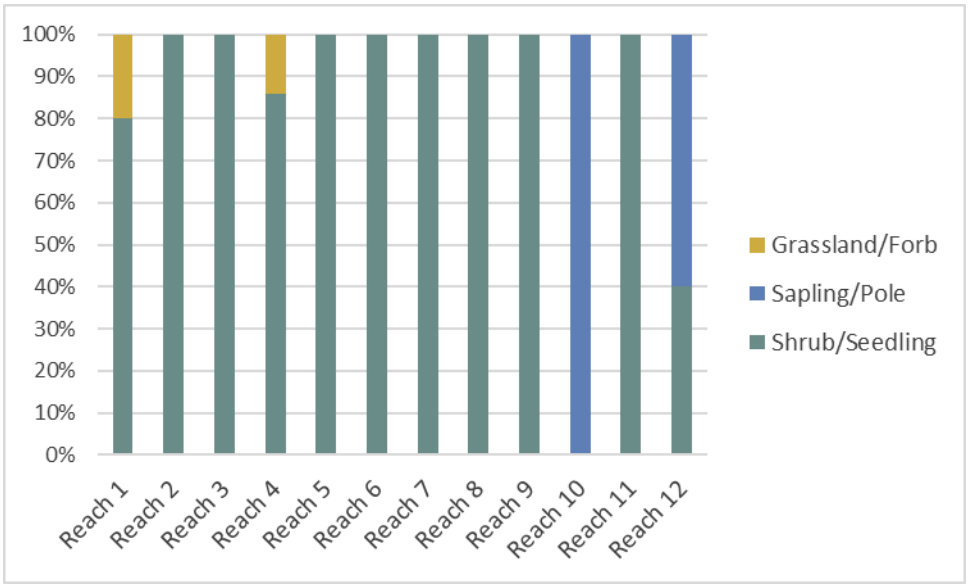

Figure 7. Percent composition of the dominant understory size class for all units in which vegetation surveys were performed.

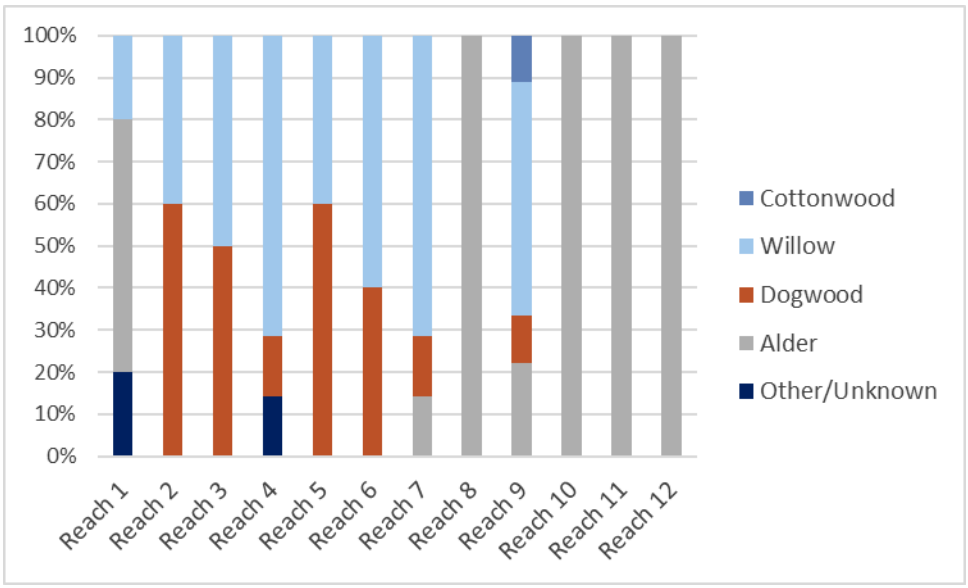

Figure 8. Percent composition of the dominant understory species for all units in which vegetation surveys were performed.

4 Comparison To Past Reach Assessments

Four reach assessments covering a portion of this Entiat River assessment area (RM 15.6 – 26.7) have been previously conducted, and include:

- Gray Reach Assessment (USBR, 2013), RM 16.6 – 18.7
- Stormy Reach Assessment (USBR, 2009b), RM 19.0 – 22.1
- Preston Reach Assessment (USBR, 2009a), RM 22.45 – 24.55, and
- Reach 0 of the Upper Stillwaters Reach Assessment (Inter-Fluve, 2013), RM 24.8 – 25.6

Data from these four previous assessments on the Entiat are compared to the data collected in the equivalent stretch of the Entiat River from this 2024/25 assessment (Table 2 - Table 5). A subset of metrics that were recorded in all previous assessments were selected for this comparison to the 2024/2025 assessment, including: habitat unit composition, number of side- or off- channel features, and pieces of LWM per mile. These key metrics were selected for comparison due to the likelihood of change as a result of restoration actions.

The Stormy and Preston Reach Assessments generally followed USFS Level II Stream Inventory Handbook protocols (2007), with minor modifications as follows:

- Habitat units were counted even if the unit wetted width exceeded the unit length. Habitat units in the 2024/2025 assessment were counted only if the unit length exceeded the unit wetted width.
- Standing trees within bankfull were counted separately from in-channel wood, whereas the 2024/2025 assessment included standing trees within bankfull in the LWM counts.

The Stormy and Preston Reach Assessments used LWM size criteria that were consistent with the criteria used in the 2024/2025 surveys and are therefore directly comparable.

The Upper Stillwaters Reach Assessment used protocols from the USFS Level II Stream Inventory Handbook (2010). No major modifications were described and therefore the results are assumed to be comparable to the 2024/2025 assessment data.

The Gray Reach Assessment summarized habitat data from readily available sources and/or habitat data provided by the Integrated Status and Trend Monitoring Program (Burgoon 2012). Key differences between the Gray Assessment and this 2024/2025 assessment include:

- LWM Size Criteria: In the Gray Reach Assessment, LWM was recorded in the following categories: small (>20ft long and 4-6-inch diameter), medium (>20ft long and 6-12-inch diameter), and large (>20 and >12 inch diameter). These categories are generally smaller than those recorded following the USFS (2020) habitat inventory protocols. LWM numbers are therefore, not directly comparable among the Gray Reach Assessment and the 2024/2025 assessment. However, the total LWM pieces per mile recorded in the Gray Reach Assessment are reported below and compared to the total LWM pieces per mile documented in the 2024/2025 assessment for reference (Table 2).

- Habitat Units: The Gray Reach Assessment did not include a habitat assessment or field delineation of habitat units. For this reason, a habitat unit composition comparison to the 2024/2025 assessment is not feasible.
- Side Channel Units: Side channels recorded in the Gray Reach Assessment appear to have included both perennial or seasonal/ephemeral channels. The 2024/25 assessment only included perennial side or off-channel features.

LWM metrics show an increase in the 2024/2025 dataset compared to previous reach assessments. In a comparison of M+L sized LWM per mile, the 2024/2025 dataset shows an increase of 62% compared to the 2013 Upper Stillwaters Assessment and over 1300% compared to the 2009 Preston Reach Assessment data. This is presumably related to the 10 restoration projects (with 141 constructed jams) implemented in the Entiat over the past decade and a half. Side channel metrics suggest that certain portions of the Entiat River have increased availability of side- and off-channel habitats, but a majority of the project area has not changed substantially. The Entiat River from RM 19.0 – 22.1 had two side channels reported in the 2009 Stormy Reach Assessment, compared to 10 side channels recorded in the 2024/2025 surveys, many of which were constructed restoration features. The Gray, Preston, and Upper Stillwaters Reach Assessments recorded similar numbers of side- and off-channel features as found in the 2024/2025 surveys, showing little change over the last decade or more in those portions of the project area. Similarly, habitat unit composition documented in the current 2024/2025 assessment was not substantially different compared to any of the previous assessments. Where there were differences, increased pool and side- or off-channel habitat area were the most frequent shifts in habitat composition, largely related to constructed LWM and side channel or alcove habitats. Comparisons of the current 2024/2025 assessment to previous assessments are provided in Table 2 - Table 5 below.

Table 2. Key metrics compared for the Entiat River between RM 16.6 – 18.7, as reported in the Gray Reach Assessment (USBR, 2013) and the 2024/2025 surveys. It should be noted that the Gray Reach Assessment used different size criteria for LWM, recording pieces as small (>20ft long and 4-6-inch diameter), medium (>20ft long and 6-12-inch diameter), and large (>20 and >12 inch diameter) and only measured pool habitat units.

Metrics	2010/2011 Gray Reach Assessment	2024/2025 Assessment
Number of Side Channels	2	2
Number of Off-channel Units	"several"	2
LWM (all sizes) per mile	46.5	201

Table 3. Key metrics compared for the Entiat River between RM 19.0 – 22.1, as reported in the Stormy Reach Assessment (USBR, 2009b) and the 2024/2025 surveys. Both assessments used the same USFS Level II survey protocols, including LWM size criteria.

Metrics	2009 Stormy Reach Assessment	2024/2025 Assessment
Habitat Composition (percent of total area)		
Pool	59%	58%
Riffle	22%	11%
Glide	15%	16%
Side/Off-Channel	4%	15%
Number of Side Channels	2	10
Number of Off-channel Units	2	1
LWM (M+L) per mile	25	315

Table 4. Key metrics compared for the Entiat River between RM 22.45 – 24.55, as reported in the Preston Reach Assessment (USBR, 2009a) and the 2024/2025 surveys. Both assessments used the same USFS Level II survey protocols, including LWM size criteria.

Metrics	2009 Preston Reach Assessment	2024/2025 Assessment
Habitat Composition (percent of total area)		
Pool	29%	37%
Riffle	53%	45%
Glide	15%	3%
Side/Off-Channel	3%	10%
Number of Side Channels	1	2
Number of Off-channel Units	1	0
LWM (M+L) per mile	28.4	403

Table 5. Key metrics compared for the Entiat River between RM 24.8 – 25.6, as reported in the Upper Stillwaters Reach Assessment (data for Reach 0 only; Inter-Fluve, 2013) and the 2024/2025 surveys. Both assessments used the same USFS Level II survey protocols, including LWM size criteria.

Metrics	2012 Upper Stillwaters Reach Assessment (Reach 0)	2024/2025 Assessment
Habitat Composition (percent of total area)		
Pool	21%	33%
Riffle	36%	9%
Glide	29%	38%
Side/Off-Channel	14%	18%
Number of Side Channels	3	4
Number of Off-channel Units	0	1
LWM (M+L) per mile	39	63

5 Stream Habitat Reach Reports

5.1 REACH 1

Location: River mile 15.6 – 16.7
Total length: 1.1 miles
Survey date: October 7th-8th, 2024

Figure 9. Representative photo of Reach 1. Habitat units were dominated by riffles.

5.1.1 Habitat Unit Composition

Reach 1 is 1.1 miles long and dominated by long riffle habitats. A few short pools and glides were interspersed among the long riffles in this reach (Figure 11). At the upstream end of the reach is the McKenzie Ditch Irrigation Diversion, an irrigation diversion equipped with fish screens and with two rock weirs creating pools in the mainstem (Figure 12 and Figure 13). The downstream end of the reach is at the confluence of Potato Creek, although the tributary was dry at the time of survey. The channel in Reach 1 is confined between steep hillslopes on river right and a high terrace on river left which has resulted in a relatively straight corridor with limited riparian vegetation. Channel gradient in this reach is 0.92%.

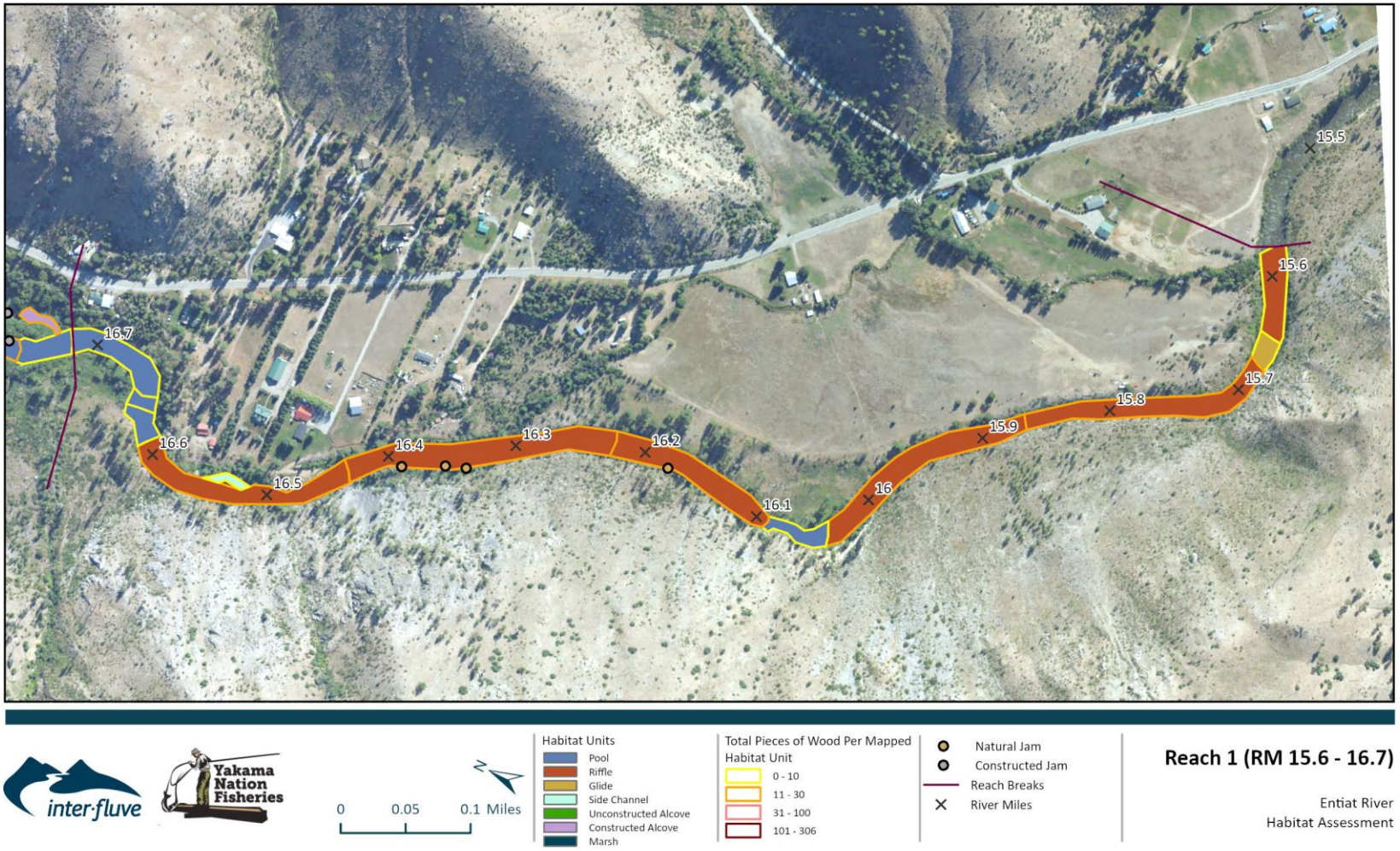

Figure 10. Map of the habitat unit composition and LWM in Reach 1 of the Entiat River. LWM count includes pieces in jams.

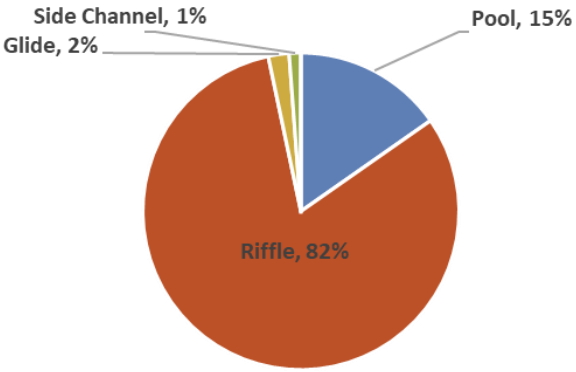

Figure 11. Stream habitat unit area composition of Reach 1.

Figure 12. Photo shows the McKenzie Ditch Irrigation Diversion near RM 16.65, equipped with a fish screen as determined by (NW Power and Conservation Council, 2022).

Figure 13. Photo shows the channel spanning rock weirs, adjacent to the McKenzie Ditch Irrigation Diversion near RM 16.65, forming pool habitat.

5.1.2 Pools

Four pools were recorded in Reach 1. Mean pool spacing was four pools per mile, markedly lower than the assessment area average of eight pools per mile. Most (75%) of the pools were relatively shallow, with less than 3.0 feet of residual depth. The average residual depth for Reach 1 was 2.6 feet, with a minimum of 1.7 feet and a maximum of 3.7 feet. The mean residual depth for the whole assessment area was 4.0 feet.

5.1.3 Side Channel Habitat

One side channel was observed in Reach 1. The side channel was 151 feet long and predominantly slow water habitat. No LWM was observed in the side channel. See Table 6 below.

Table 6. Summary of the side channel habitat observed in Reach 1.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 1	151	Side Slow	0	0	0

5.1.4 Large Woody Material

Reach 1 had one of the lowest quantities of LWM observed, with a combined total (jams and individual pieces) of 105 pieces – corresponding to 95 pieces per mile. There were 37 (39%) M+L size class pieces per mile and 58 small pieces per mile. Four jams were observed in Reach 1, consisting of 17% (n = 18) of the LWM in the reach (Table 7).

Table 7. Large woody material quantities in Reach 1.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	56	26	5	87
Number of individual pieces per mile	51	28		79
Number of pieces per mile (including pieces in jams)	58	37		95
Number of jams	4			
Number of jams per mile	4			
Estimated wood count in jams	18			

5.1.5 Riparian Corridor

Riparian vegetation in Reach 1 was influenced by the Tyee fire in 1994 and the Cougar Creek fire in 2018 (Washington State Department of Natural Resources,1973-2023). Five observations of riparian vegetation condition were conducted in Reach 1, two of which were in the burned area. Steep bedrock or tallus/scree slopes with little vegetation along the banks, or cleared agricultural fields were also common in Reach 1; one unit had no overstory and riparian vegetation only consisted of grasses, while another consisted of burned snags and small Ponderosa pine regrowth. The remainder of the surveyed units recorded Ponderosa pine trees in the large, small, and shrub/seedling size classes (Figure 14). Most of the understory observations were alders or willows in the shrub/seedling size class (Figure 15).

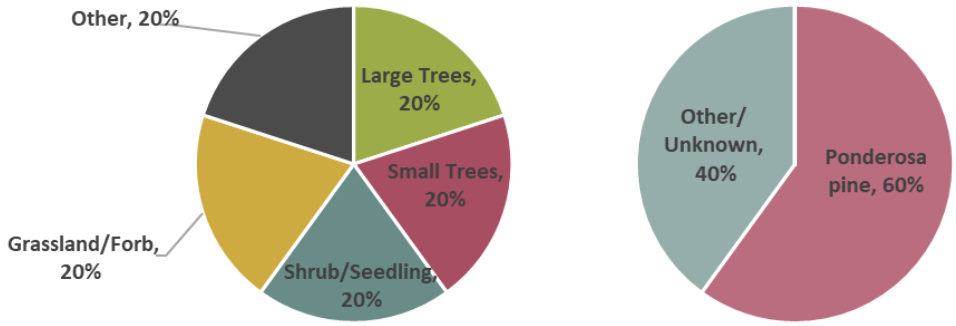

Figure 14. Dominant overstory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

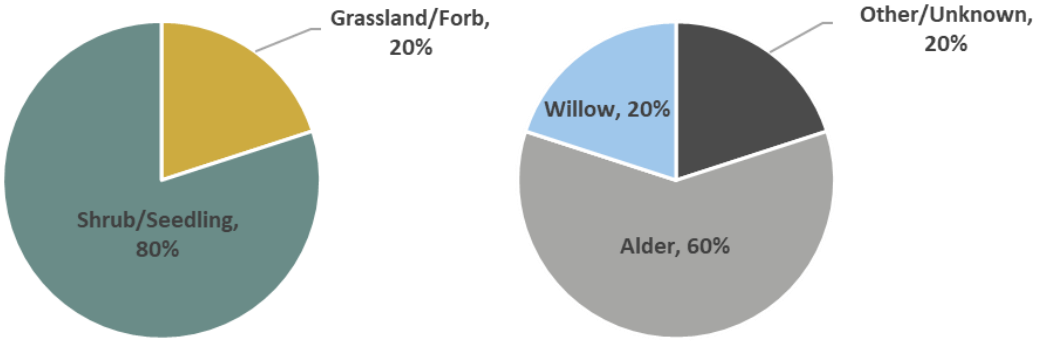

Figure 15. Dominant understory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.2 REACH 2

Location: River mile 16.7-17.7
Total length: 1.0 miles
Survey Date: October 9th, 2024

Figure 16. Representative photo of Reach 2. Habitat units were dominated by pools.

5.2.1 Habitat Unit Composition

Reach 2 is one mile long and was primarily classified as pool habitats (89%), with small riffles and off-channel habitats interspersed between the pools (Figure 18). Reach 2 has the lowest channel gradient of all the reaches at 0.12% and is more sinuous than Reach 1. Two constructed alcoves were recorded as "other" habitat units in this reach. Riparian vegetation was more prevalent in Reach 2, with larger trees observed in the riparian zone. The channel through Reach 2 is generally unconfined, with localized confinement from the Gray Creek alluvial fan and rip rap protecting the road and properties on river left.

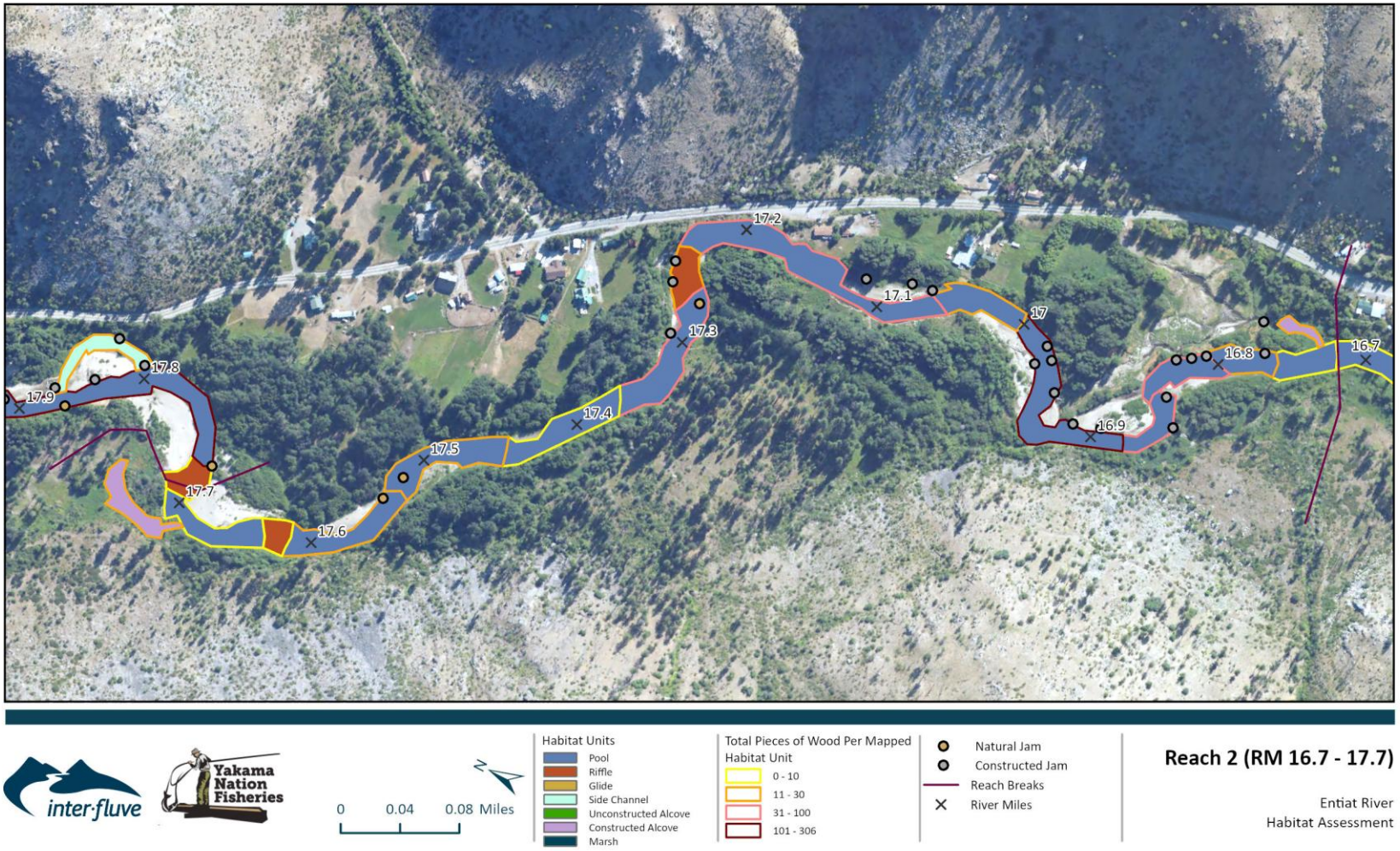

Figure 17. Map of the habitat unit composition and LWM in Reach 2 of the Entiat River. LWM count includes pieces in jams.

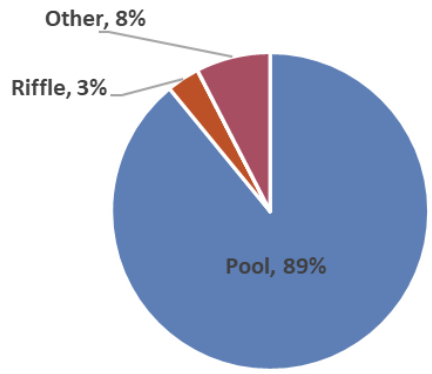

Figure 18. Stream habitat unit area composition of Reach 2.

5.2.2 Pools

A total of 12 pools were observed in Reach 2, for a frequency of 12 pools per mile (the reach was one mile long). This was higher than the average of eight pools per mile across the entire assessment area. Pools in Reach 2 were relatively deep; 17% of pools had a residual depth greater or equal to 6.0 feet, 58% had a residual depth between 3.0 and 6.0 feet, and 25% had less than 3.0 feet of residual depth. The average residual depth for Reach 2 was 4.3 feet, with a range of residual depths between 1.2 and 7.5 feet. The mean residual depth for the entire assessment area was 4.0 feet.

5.2.3 Side Channel Habitat

There were no actively flowing side channels in Reach 2 at the time of the survey, but two constructed alcoves were recorded. One alcove was observed on river-left at the downstream end of the reach, near RM 16.75 (Figure 19). At the time of survey, the surface water connection only spanned about 200 feet, but likely functions as a flow-through side channel at higher discharge events in the Entiat River. Constructed jams and LWM were present throughout the wetted alcove and dry high-flow channel inlet. Only the jams and LWM found in the portion of the alcove connected via surface water at the time of survey were included in this habitat assessment. The second alcove feature was present on river-right at the upstream end of the reach, near RM 17.70, and was wide and ponded with a narrow, deep channel connecting it to the Entiat. The alcove had placed wood in the wide, ponded area (Figure 20). Additionally, there was a third, large, constructed side channel feature on river-right near RM 16.5. The constructed side channel had intermittent pools and a number of wood jams, but it was not connected at the time of survey, and therefore not included in this habitat assessment.

Figure 19. Upstream end of the alcove near RM 16.75.

Figure 20. Alcove near RM 17.70, with placed LWM.

5.2.4 Large Woody Material

Reach 2 had a combined (jams and individual pieces) total of 510 pieces of LWM, for a frequency of 510 pieces per mile. There were 242 (48%) M+L sizes pieces per mile. Twenty-two jams were observed in Reach 2, containing 77% (n = 690) of the LWM in the reach. See Table 8 below.

Table 8. Large woody material quantities in Reach 1.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	86	30	4	120
Number of individual pieces per mile	86	34		120
Number of pieces per mile (including pieces in jams)	268	242		510
Number of jams	22			
Number of jams per mile	22			
Estimated wood count in jams	390			

5.2.5 Riparian Corridor

The riparian corridor in Reach 2 was more established than Reach 1 but had some localized impacts from residential property development between RM 17.0-15.5 on river-left. Five observations of riparian vegetation were recorded in this reach. Large and small trees comprised the overstory, with the primary species being cottonwood, Douglas fir, Ponderosa pine, and birch (Figure 21).The understory was dominated by dogwood or willow in the shrub/seedling size class in all five surveyed units (Figure 22).

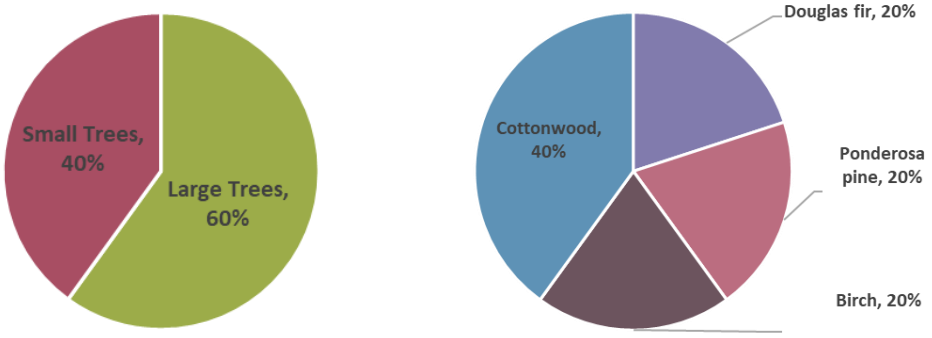

Figure 21. Dominant overstory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

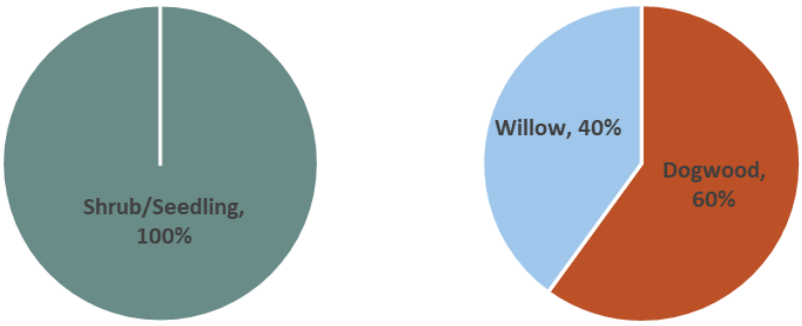

Figure 22. Dominant understory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.3 REACH 3

Location: River mile 17.7 – 18.4
Total length: 0.7 miles
Survey Date: October 10th, 2024

Figure 23. Representative photo of Reach 3. Habitat units were dominated by pools.

5.3.1 Habitat Unit Composition

Reach 3 is 0.7 miles long. The channel gradient in Reach 3 is 0.13%, very similar to Reach 2 downstream. Correspondingly, Reach 3 was also dominated by pool habitats, followed by riffle habitat. Roughly equal amounts of side channel and "other" habitat made up the rest of the reach by area (Figure 25). The "other" unit in this reach was a constructed feature functioning as an off-channel alcove. The reach is locally confined by the Entiat River Road on the river left side, as well as a bridge for a private driveway near RM 18.1.

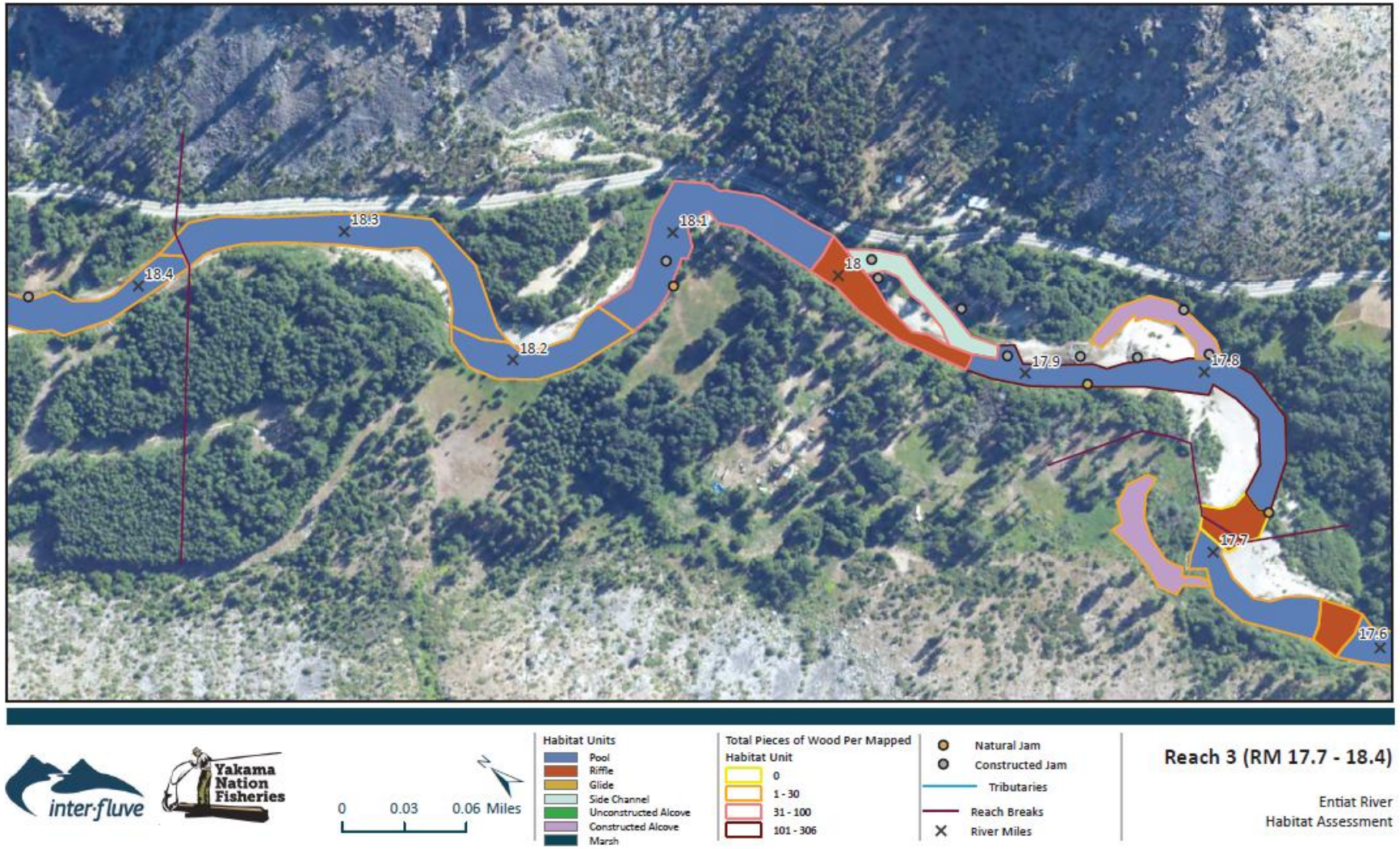

Figure 24. Map of the habitat unit composition and LWM in Reach 3 of the Entiat River. LWM count includes pieces in jams.

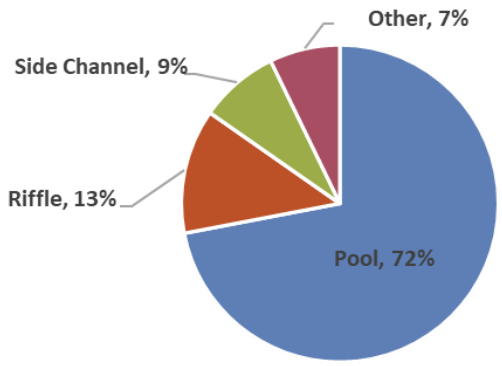

Figure 25. Stream habitat unit area composition of Reach 3.

5.3.2 Pools

Four pools were observed in Reach 3, corresponding to six pools per mile. This was lower than the eight pools per mile average across the entire assessment area. The pools were deep in Reach 3, with residual depths for all pools exceeding 3.0 feet and 50% of those pools with residual depths greater than 6.0 feet. Residual pool depths ranged from 3.7 to 6.7 feet deep, with a reach average of 5.2 feet. The mean residual depth for the whole assessment area was 4.0 feet.

5.3.3 Side Channel Habitat

One side channel was observed in Reach 3, with a total length of 416 feet. It was predominantly slow water (pool-type habitat) at the time of the survey. A total of 74 pieces of LWM were observed in the side channel. A constructed, off-channel alcove feature was also observed. This feature appears to have originally been constructed as a flow-through side channel. At the time of survey, the inlet appeared to have filled in with sediment. See Table 9 and Figure 26 below.

Table 9. Summary of the side channel habitat observed in Reach 3.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 2	416	Side Slow	3	2	74

Figure 26. Photo shows the dry inlet of the former constructed side channel, filled in with sediment. Surveyors recorded it as an alcove.

5.3.4 Large Woody Material

Reach 3 had a combined (jams and individual pieces) total of 355 pieces of LWM, or 507 pieces per mile. Of the 507 pieces per mile, 244 (48%) pieces per mile were M+L sized. Eighty-two percent (n = 291) of the wood was observed in the 12 jams in Reach 3 (Table 10).

Table 10. Large woody material quantities in Reach 3.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	43	17	4	64
Number of individual pieces per mile	61	30		91
Number of pieces per mile (including pieces in jams)	263	244		507
Number of jams	12			
Number of jams per mile	17			
Estimated wood count in jams	291			

5.3.5 Riparian Corridor

Only two vegetation surveys were performed in Reach 3. Riparian vegetation clearing was observed on river-left, likely related to road maintenance and residential development. However, the overstory trees immediately adjacent to the river were, for the most part, preserved. The overstory in both units was

entirely cottonwood, split between large and small tree size classes (Figure 27). The understory was dominated by shrub/seedling sized vegetation, split between dogwood and willow species (Figure 28).

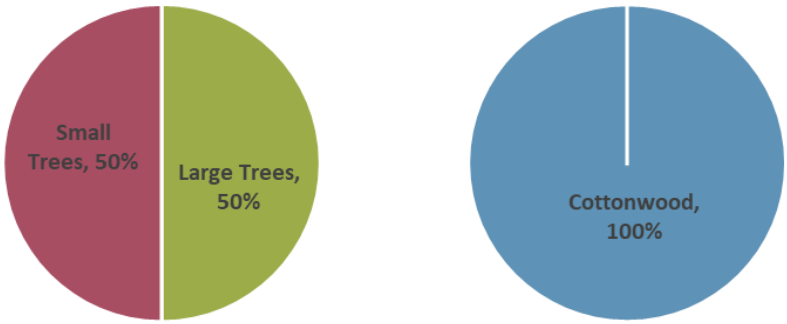

Figure 27. Dominant overstory riparian vegetation class and species, from two units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 28. Dominant understory riparian vegetation class and species, from two units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.4 REACH 4

Location: River mile 18.4 – 19.3
Total length: 0.9 miles
Survey Date: October 11th, 2024

Figure 29. Representative photo of Reach 4. Habitat units were dominated by pools.

5.4.1 Habitat Unit Composition

Reach 4 is 0.9 miles long and mostly pool habitat (70%; Figure 30). Riffle and glide habitats made up the remaining third of the reach by area (Figure 31). There is a bridge crossing the Entiat River near RM 18.9 and residential development on river-left in Reach 4, impacting understory riparian vegetation in those areas. The reach is naturally confined between the Stormy Creek alluvial fan on river-left and the hillslopes/small fan across on river-right, which naturally limits the availability of side or off-channel habitat in the reach. The Stormy Creek channel confluence was dry at the time of the survey (Figure 32). Reach 4 is relatively sinuous and the channel gradient is 0.19%.

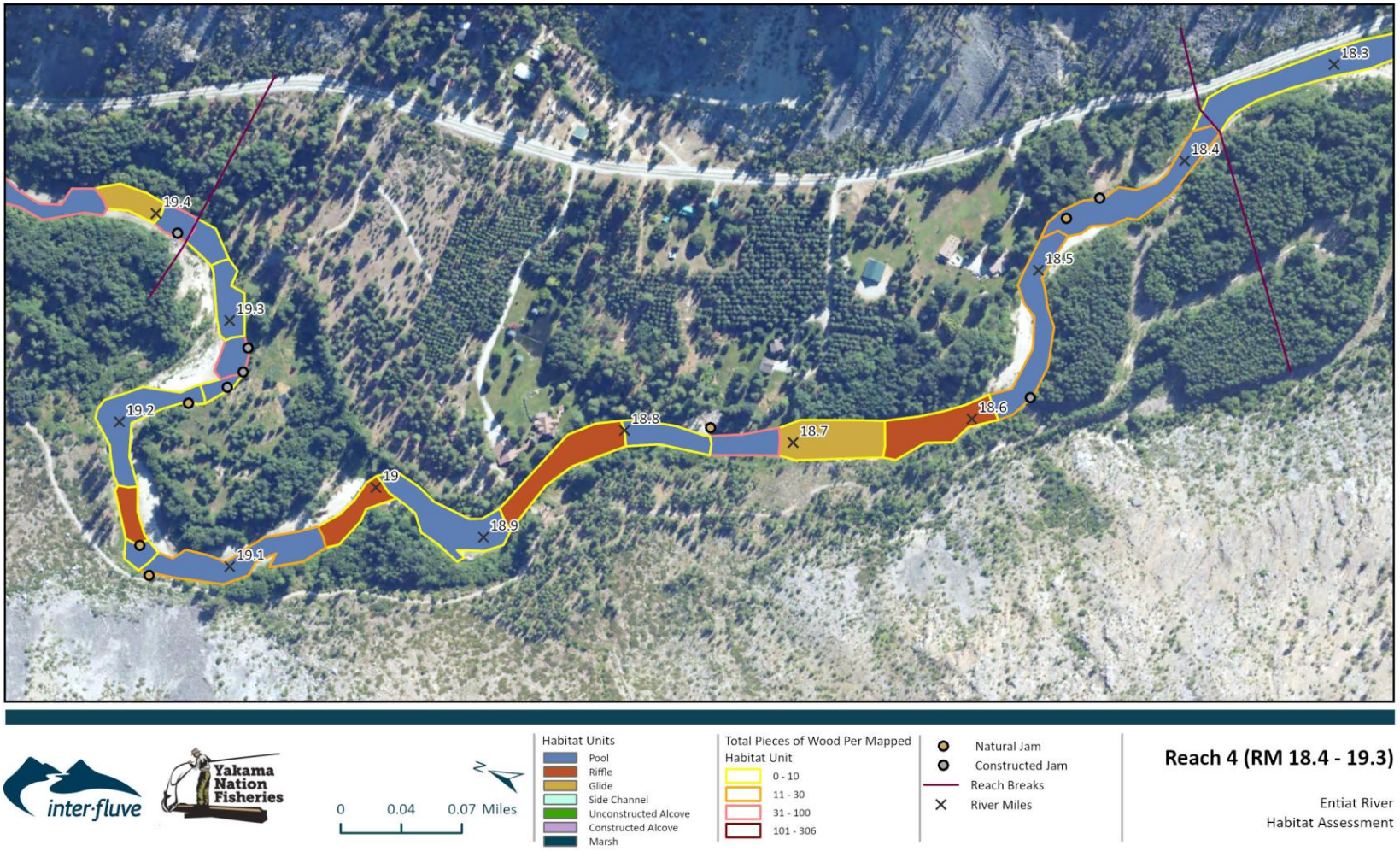

Figure 30. Map of the habitat unit composition and LWM in Reach 4 of the Entiat River. LWM count includes pieces in jams.

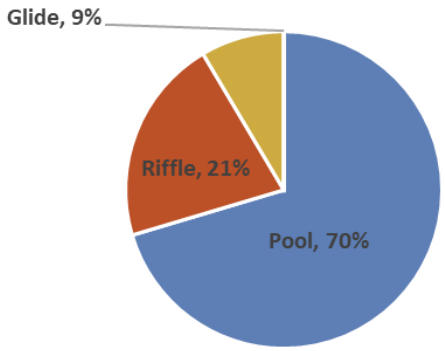

Figure 31. Stream habitat unit area composition of Reach 4.

Figure 32. Photo shows the Stormy Creek tributary, dry at the confluence with the Entiat at the time of the survey.

5.4.2 Pools

There were 12 pools recorded in Reach 4, corresponding to the highest number of pools per mile of any reach, at 13 pools per mile. A majority (75%) of the pools had a residual depth between 3.0 and 6.0 feet, while 17% had a residual depth less than 3.0 feet deep. One of the pools had a residual depth of 6.0 feet. The average residual pool depth for Reach 4 was 4.1 feet, with a range of residual pool depths between 2.5 and 6.0 feet. The mean residual depth for the whole assessment area is 4.0 feet.

5.4.3 Side Channel Habitat

There were no actively flowing side channels observed in Reach 4 at the time of the survey.

5.4.4 Large Woody Material

In Reach 4, there were 202 total pieces of LWM, corresponding to 224 pieces of LWM per mile (including individual LWM pieces and wood found in jams). About half (54%) of the LWM was recorded in the small size class (122 pieces per mile) and half (45% or 102 pieces) recorded in the M+L size class. Ten jams, containing 73% (n = 148) of the LWM, were observed throughout the reach (Table 11).

Table 11. Large woody material quantities in Reach 4.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	43	8	3	54
Number of individual pieces per mile	48	12		60
Number of pieces per mile (including pieces in jams)	122	102		224
Number of jams	10			
Number of jams per mile	11			
Estimated wood count in jams	148			

5.4.5 Riparian Corridor

Seven observations of riparian were conducted in this reach. The riparian corridor in Reach 4 was cleared for residential development on river left between RM 18.5-18.9. Small tree sized cottonwoods or Ponderosa pine trees were the dominant overstory in most of the units surveyed, and large tree sized Ponderosa pines were found in the remainder (Figure 33). The understory primarily consisted of willow and dogwood in the shrub/seedling size class. A landscaped yard with an unknown species of ornamental grass was observed in the understory of one of the units (recorded as "other" in Figure 34).

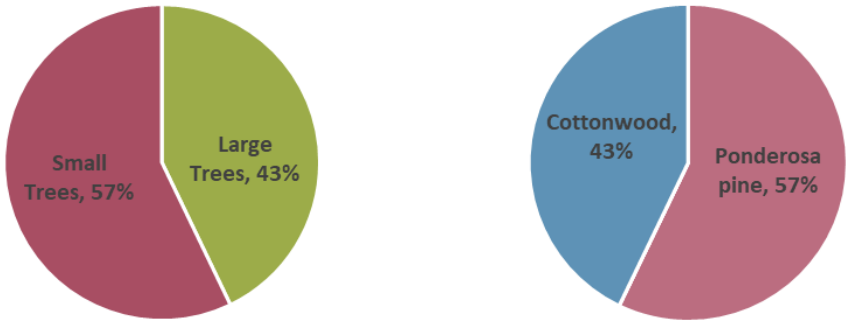

Figure 33. Dominant overstory riparian vegetation class and species, from seven units surveyed, within 100 feet of the Entiat River by ocular estimate.

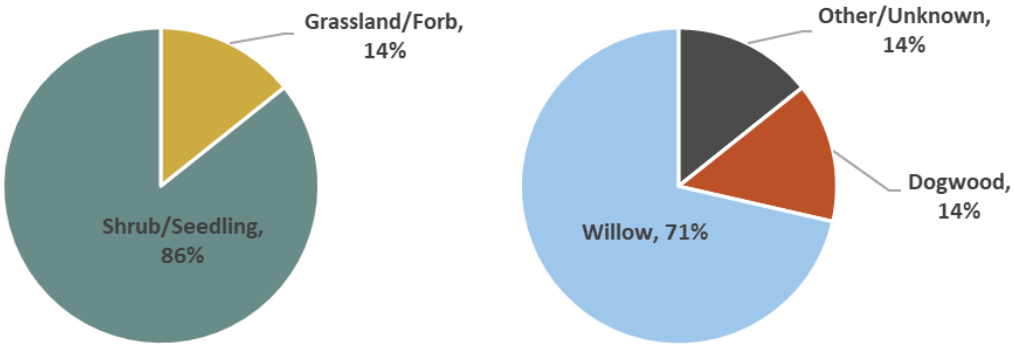

Figure 34. Dominant understory riparian vegetation class and species, from seven units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.5 REACH 5

Location: River mile 19.3 – 20.1
Total length: 0.8 miles
Survey Date: October 11th, 2024

Figure 35. Representative photo of Reach 5. Habitat units were dominated by pools.

5.5.1 Habitat Unit Composition

The 0.8-mile-long Reach 5 was predominantly classified as pool habitats (65%), though a relatively large portion of the total habitat area was recorded as side channel habitat (22%). There were small amounts of glide and riffle habitat observed as well (Figure 37). A large avulsion occurred recently at the upstream end of Reach 5. The historical channel was wetted at the time of the survey and was classified as side channel habitat. The channel gradient for this reach is 0.22%.

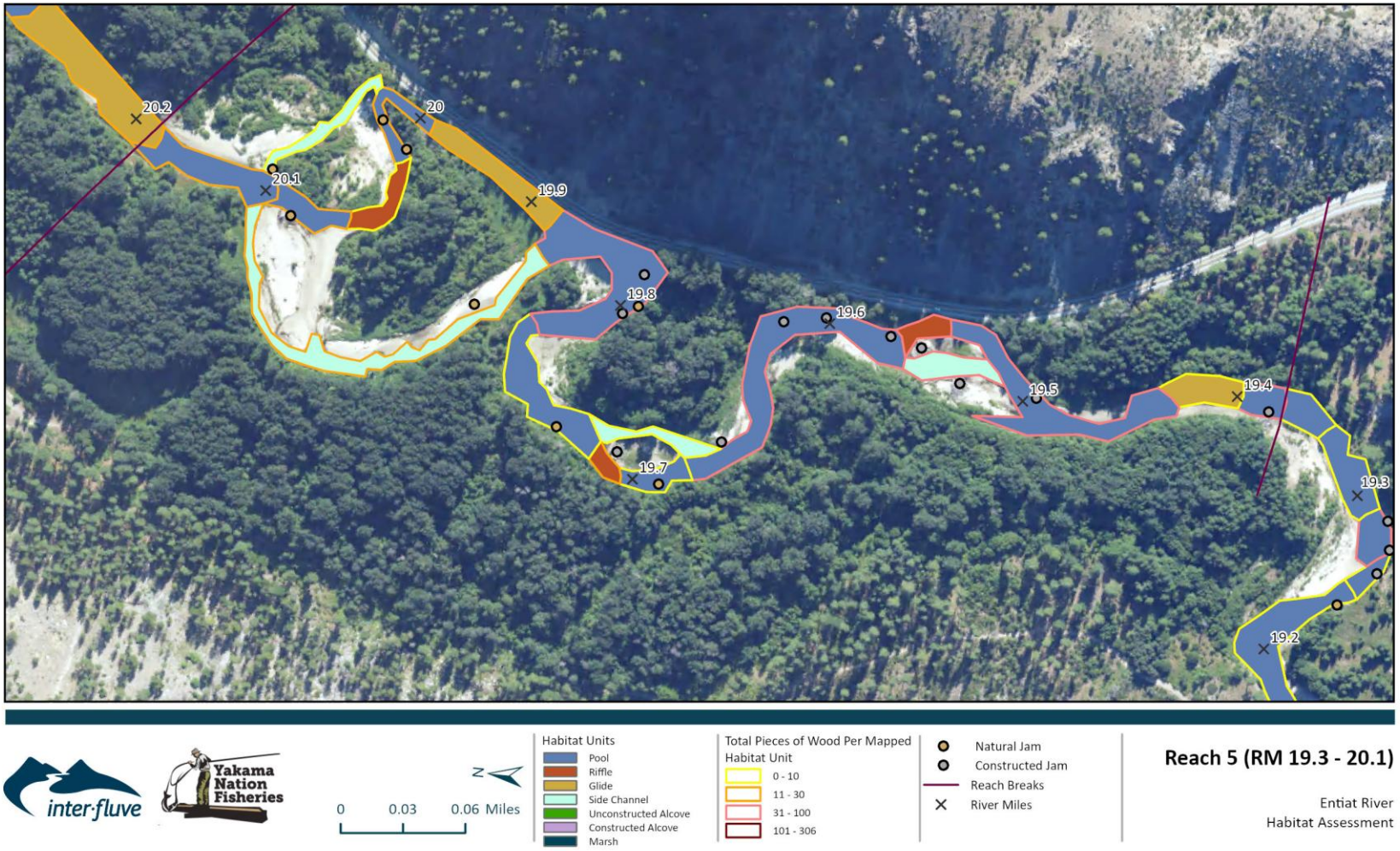

Figure 36. Map of the habitat unit composition and LWM in Reach 5 of the Entiat River. LWM count includes pieces in jams.

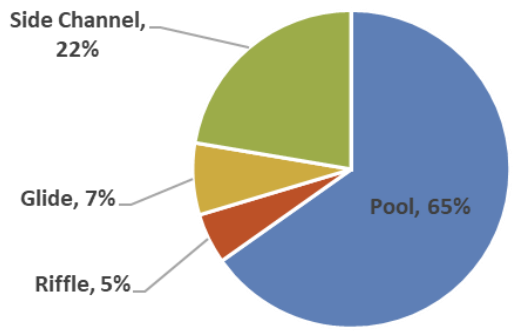

Figure 37. Stream habitat unit area composition of Reach 5.

5.5.2 Pools

Reach 5 had nine pools total and 11 pools per mile. This was higher than the eight pools per mile average across the entire assessment area. None of the pools had a residual depth over 6.0 feet, but 89% had a residual depth between 3.0 and 6.0 feet. Only a small proportion (11%) of the pools were shallower than 3.0 feet. The residual pool depths ranged from 2.7 to 5.6 feet deep. The mean residual pool depth for the reach was 4.3, compared to the whole assessment area average of 4.0 feet.

5.5.3 Side Channel Habitat

Four side channels were observed in Reach 5, with a total length of 2,313 feet. All four side channels were primarily slow water (pool-type habitat) at the time of the survey. A total of 76 pieces of LWM were observed in the two side channels (Table 12). The longest side channel, Side 5, was the former main channel. Subsurface flow was observed at the inlet for approximately five feet, but transitioned to surface water for the remainder of the side channel alignment. A couple large, constructed jams were observed in Side 3. Approximately 65 feet (16% of the total length) in the middle of Side 6 was dry (or flow went subsurface).

Table 12. Summary of the side channel habitat observed in Reach 5.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 3	233	Side Slow	2	1	48
Side 4	523	Side Slow	2	0	0
Side 5	1,160	Side Slow	14	1	4
Side 6	397	Side Slow	6	0	0
Total	*2,313*		*24*	*2*	*52*

5.5.4 Large Woody Material

Reach 5 had a combined total of 488 pieces of LWM (jams and individual pieces)– corresponding to 610 pieces of LWM per mile. There were 265 (54%) M+L sized pieces per mile. Most of the LWM (77% or 377 pieces) was observed within the 19 jams in the reach (Table 13).

Table 13. Large woody material quantities in Reach 5.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	75	29	7	111
Number of individual pieces per mile	94	45		139
Number of pieces per mile (including pieces in jams)	345	265		610
Number of jams	19			
Number of jams per mile	24			
Estimated wood count in jams	377			

5.5.5 Riparian Corridor

The riparian corridor in Reach 5 was relatively undisturbed compared to previous reaches. Five units were surveyed for vegetation in this reach, all of which were at regular nth unit intervals. Alders in the small size class were most frequently observed in the overstory, followed by large tree sized cottonwoods (Figure 38). The understory was dominated by dogwood or willow in the shrub/seedling size class in all five surveyed units (Figure 39).

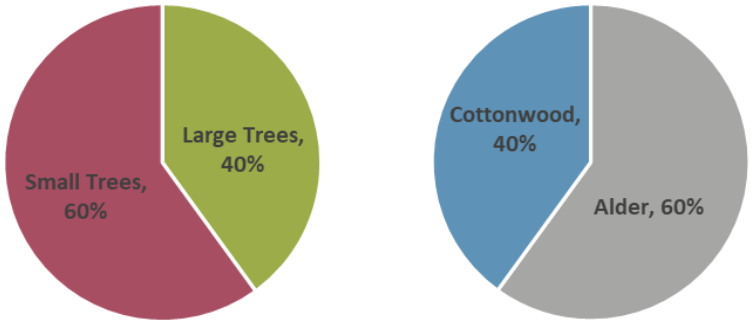

Figure 38. Dominant overstory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

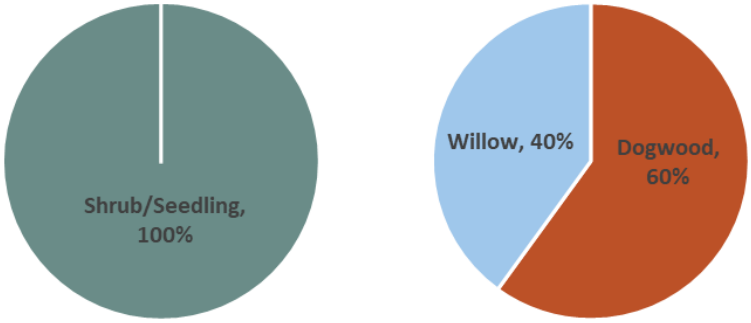

Figure 39. Dominant understory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.6 REACH 6

Location: River mile 20.1 – 20.8
Total length: 0.7 miles
Survey Date: October 12th, 2024

Figure 40. Representative photo of Reach 6. Habitat units were dominated by pools.

5.6.1 Habitat Unit Composition

Reach 6 is 0.7 miles long, with mostly pool habitat followed by roughly equal amount of glide and riffle habitat (Figure 42). The reach is low gradient and unconfined, resulting in high amounts of pool habitat with minimal side channel development. The channel gradient in this reach is 0.23% and it is less sinuous than other reaches.

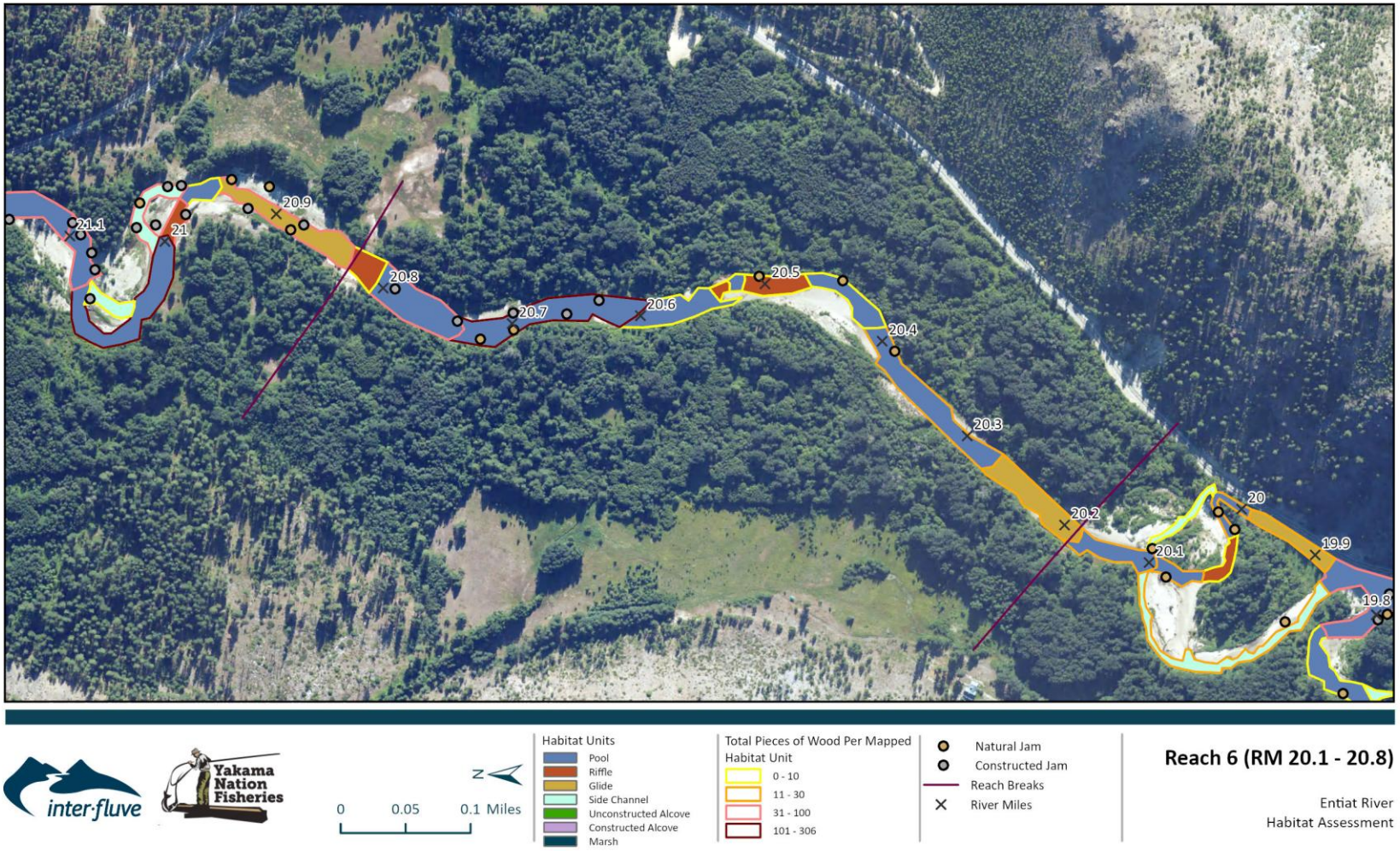

Figure 41. Map of the habitat unit composition and LWM in Reach 6 of the Entiat River. LWM count includes pieces in jams.

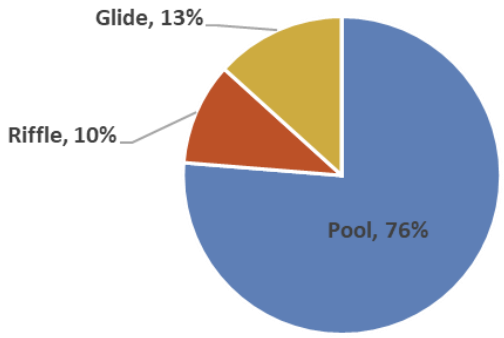

Figure 42. Stream habitat unit area composition of Reach 6.

5.6.2 Pools

Six pools total were observed in Reach 6. This corresponds to nine pools per mile, similar to the eight pools per mile average across the entire assessment area. Two-thirds (67%) of the pools had residual depths greater than 3.0 feet; one of those pools (17%) had a residual depth of 6.0 feet. The average residual depth for the reach was 4.0 feet, the same as the assessment area average of 4.0 feet. The residual depths ranged from 2.6 to 6.0 feet deep.

5.6.3 Side Channel Habitat

There were no actively flowing side channels observed in Reach 6 at the time of the survey.

5.6.4 Large Woody Material

There was a combined total (jams and individual pieces) of 262 pieces of LWM in Reach 6, corresponding to 374 pieces of LWM per mile. M+L sized pieces accounted for 143 pieces per mile (55%). Ten jams were observed in Reach 6, containing 79% (n = 208) of the LWM in Reach 6 (Table 14).

Table 14. Large woody material quantities in Reach 6.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	40	11	3	54
Number of individual pieces per mile	57	20		77
Number of pieces per mile (including pieces in jams)	231	143		374
Number of jams	10			
Number of jams per mile	14			
Estimated wood count in jams	208			

5.6.5 Riparian Corridor

The riparian corridor in Reach 6 had minimal clearing in recent history compared to other reaches. Though there was minimal recent clearing, the overstory was primarily composed of small trees, likely a result of the widespread logging history in the basin. In one of the five observations made, large trees were the dominant overstory size class. Most of the units were recorded as cottonwood trees, including

the unit with large trees, while alder was found in the remainder of overstory species (Figure 43). The understory was dominated by willow or dogwood in the shrub/seedling size class in all five surveyed units (Figure 44).

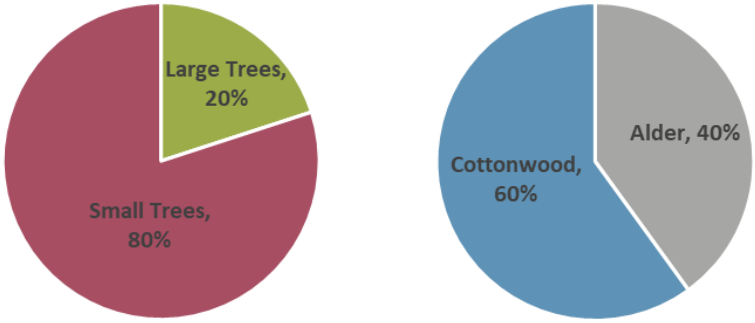

Figure 43. Dominant overstory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 44. Dominant understory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.7 REACH 7

Location: River mile 20.8 – 22.1
Total length: 1.3 miles
Survey Date: October 12th-13th, 2024

Figure 45. Representative photo of Reach 7. Habitat units were dominated by pools and side channels.

5.7.1 Habitat Unit Composition

Reach 7 is 1.3 miles long. It was primarily pool habitat and side channel habitat. The rest of the reach consisted of glide and riffle habitat (Figure 47). There was a long, constructed side channel with placed jams that contributed to the large amount of side channel habitat found in the reach. The Entiat River Road runs along river-left for part of the reach. The reach is relatively sinuous and the channel gradient in Reach 7 is 0.24%.

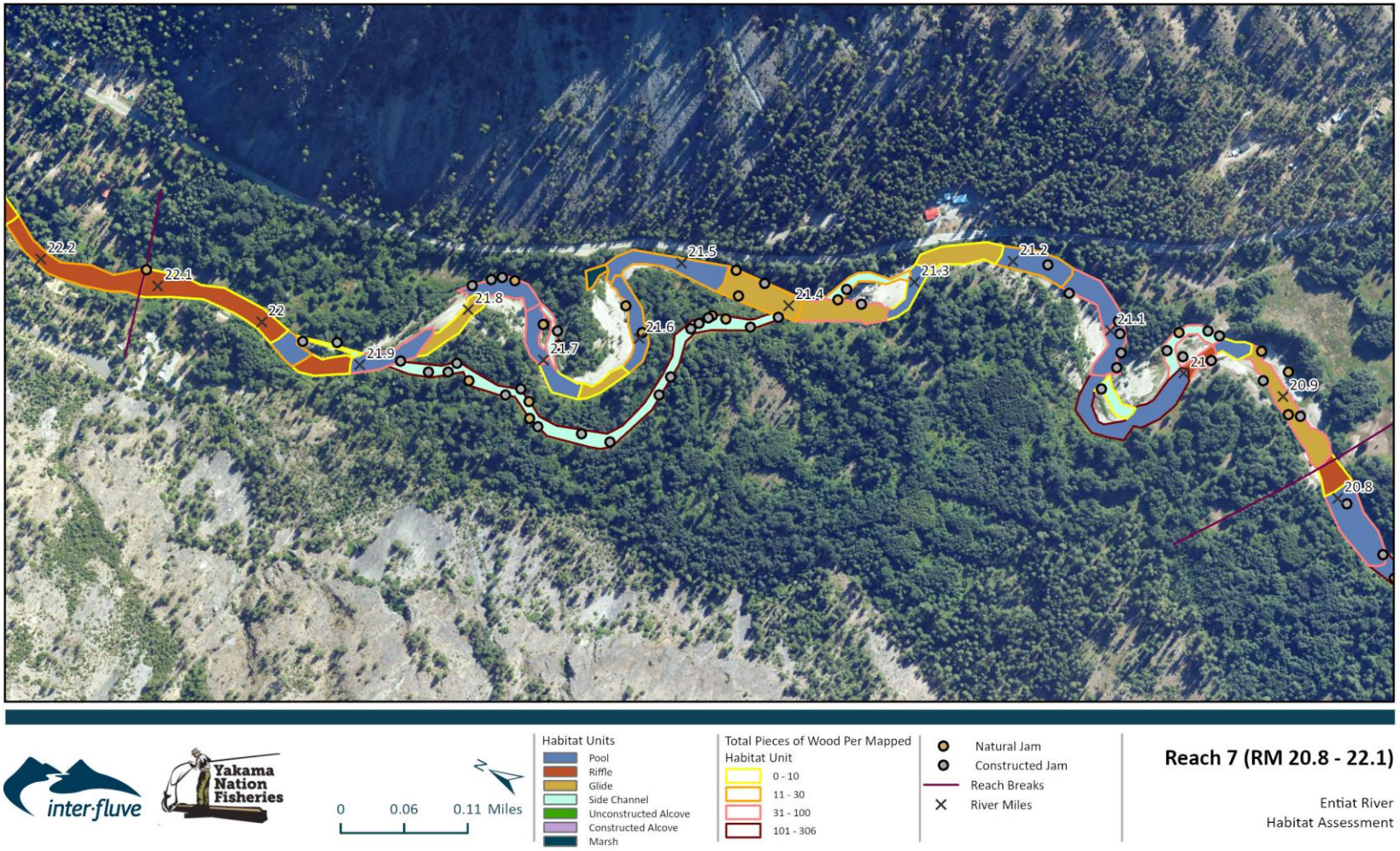

Figure 46. Map of the habitat unit composition and LWM in Reach 7 of the Entiat River. LWM count includes pieces in jams.

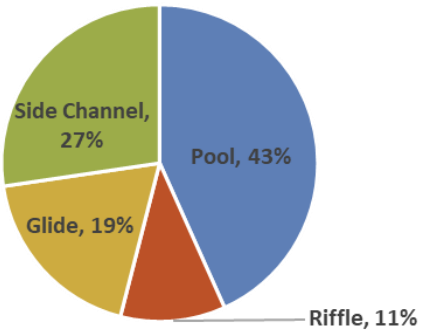

Figure 47. Stream habitat unit area composition of Reach 7.

5.7.2 Pools

Reach 7 had 13 pools total, for a frequency of 10 pools per mile. This was higher than the eight pools per mile average across the entire assessment area. The average residual depth for the reach was 3.8 feet, compared to the assessment area of 4.0 feet. Residual pool depths in Reach 7 ranged from 2.4 to 5.2 feet deep. A majority of the pools (77%) had residual depths between 3.0 and 6.0 feet and the remaining 23% had less than 3.0 feet of residual depth. There were no pools with residual depths over 6.0 feet.

5.7.3 Side Channel Habitat

Reach 7 had six side channels totaling 3,736 feet, the longest amount of side channel of any reach. All six side channels were predominantly slow water (pool-type habitat) at the time of the survey, though Side 7 and Side 10 did have some riffle and glide habitats interspersed throughout the side channels. Side 11 and Side 12 were wetted for a majority of their length, but had small, intermitted sections where flows went subsurface. A total of 329 pieces of LWM were observed in the side channels, primarily in jams. Side 10, the longest side channel, was constructed and included constructed jams along the entire length. See Table 15 below.

Table 15. Summary of the side channel habitat observed in Reach 6.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 7	390	Side Slow	0	4	61
Side 8	205	Side Slow	0	0	0
Side 9	405	Side Slow	1	7	1
Side 10	2,160	Side Slow	3	20	237
Side 11	282	Side Slow	0	2	20
Side 12	294	Side Slow	0	1	6
Total	*3,736*		*4*	*34*	*325*

5.7.4 Large Woody Material

Reach 7 had the highest quantity of LWM of all the reaches. The combined total for LWM (jams and individual pieces) was 1,147 pieces – corresponding to 882 pieces of LWM per mile. There were 482 pieces per mile (55%) in the M+L size class. There were 57 jams observed throughout the reach, containing 87% (n = 998) of the LWM (Table 16).

Table 16. Large woody material quantities in Reach 7.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	91	39	19	149
Number of individual pieces per mile	70	45		115
Number of pieces per mile (including pieces in jams)	400	482		882
Number of jams	57			
Number of jams per mile	44			
Estimated wood count in jams	998			

5.7.5 Riparian Corridor

Seven units included vegetation surveys in Reach 7. Small trees, primarily cottonwoods or Ponderosa pine, were the most common overstory species and size class composition, though some units were recorded with Douglas fir or Ponderosa pine in the overstory (Figure 48). There was a small about of riparian clearing in this reach related to Entiat River Road on river left. Legacy impacts to the riparian canopy, as a result of historical timber harvest, has limited the size and distribution of large trees in the overstory. Thick, woody-stemmed riparian species such as willow, dogwood and alder dominated the understory. In all the units surveyed, shrub/seedling was the understory size class (Figure 49).

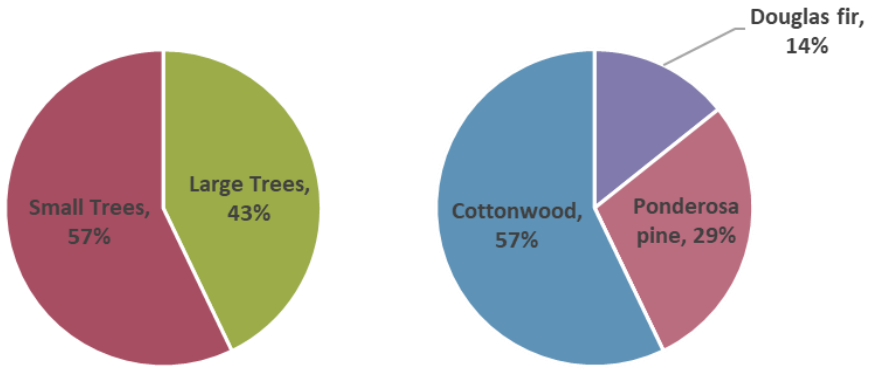

Figure 48. Dominant overstory riparian vegetation class and species, from seven units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 49. Dominant understory riparian vegetation class and species, from seven units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.8 REACH 8

Location: River mile 22.1 – 22.5
Total length: 0.4 miles
Survey Date: October 13th, 2024

Figure 50. Representative photo of Reach 8. Habitat units were dominated by riffles.

5.8.1 Habitat Unit Composition

Reach 8 is the shortest reach in the assessment area, spanning only 0.4 miles long with a steeper channel gradient than downstream reaches at 0.47%. Accordingly, Reach 8 habitat was entirely comprised of long fast-water riffle or glide units (Figure 52). There is natural confinement by steep valley walls on both river-right and -left. Private property with residential structures were also prevalent throughout the riparian zone. The upstream end of the reach is demarcated by the Coyote Falls Road bridge crossing the Entiat River.

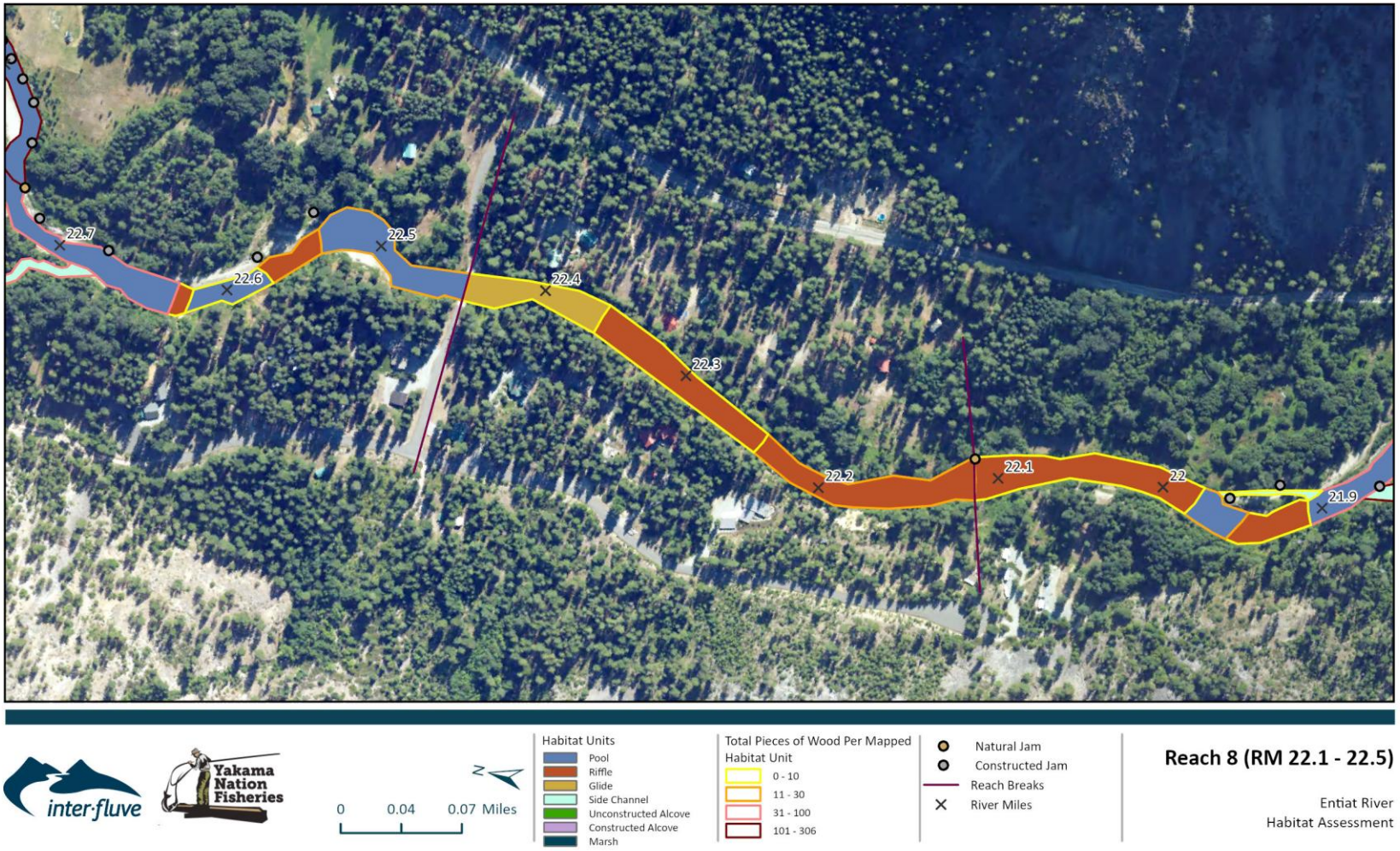

Figure 51. Map of the habitat unit composition and LWM in Reach 8 of the Entiat River. LWM count includes pieces in jams.

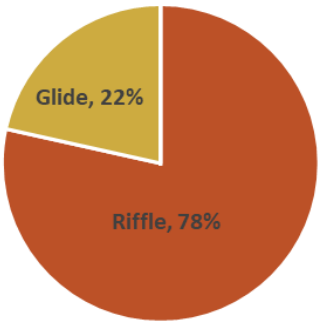

Figure 52. Stream habitat unit area composition of Reach 8.

5.8.2 Pools

There were no pools observed in Reach 8 during the time of the survey.

5.8.3 Side Channel Habitat

There were no actively flowing side channels observed in Reach 8 at the time of the survey.

5.8.4 Large Woody Material

Very little LWM was observed in Reach 8, with a combined total (jams and individual pieces) of 24 pieces of LWM – corresponding to 60 pieces per mile. There were 13 M+L (combined) size class pieces per mile. No jams were observed in Reach 8 (Table 17).

Table 17. Large woody material quantities in Reach 8.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	19	2	3	24
Number of individual pieces per mile	48	13		60
Number of pieces per mile (including pieces in jams)	48	13		60
Number of jams	0			
Number of jams per mile	0			
Estimated wood count in jams	0			

5.8.5 Riparian Corridor

All three units in Reach 8 included vegetation surveys. There were multiple private residences alongside both sides of the river throughout the reach, although the riparian corridor was still relatively intact. In all the units, large trees, either cedar or Douglas fir, were observed in the overstory (Figure 53). The understory was dominated by alder in the shrub/seedling size class (Figure 54).

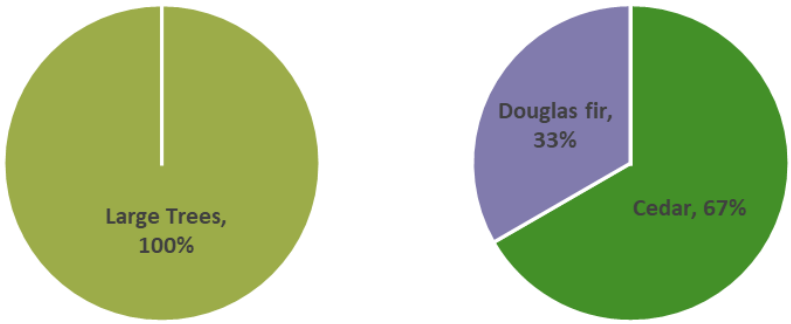

Figure 53. Dominant overstory riparian vegetation class and species, from three units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 54. Dominant overstory riparian vegetation class and species, from three units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.9 REACH 9

Location: River mile 22.5 – 24.2
Total length: 1.7 miles
Survey Date: October 8th and 13th, 2024 and August 4th-5th, 2025

Figure 55. Representative photo of Reach 9. Habitat units were dominated by pools.

5.9.1 Habitat Unit Composition

Reach 9 was the longest reach in the assessment area, spanning 1.7 miles. Habitat in Reach 9 was 45% pool habitat, followed by 32% riffle habitat (Figure 57). Roughly equal amounts of glide and side channel habitat formed the remaining reach habitat area. The reach is sinuous, with a channel gradient of 0.30%. Dispersed residential properties throughout the reach, on river right and left, have resulted in riparian clearing. A levee on river left near RM 23.7 limits the amount of side channel habitat that exists in Reach 9.

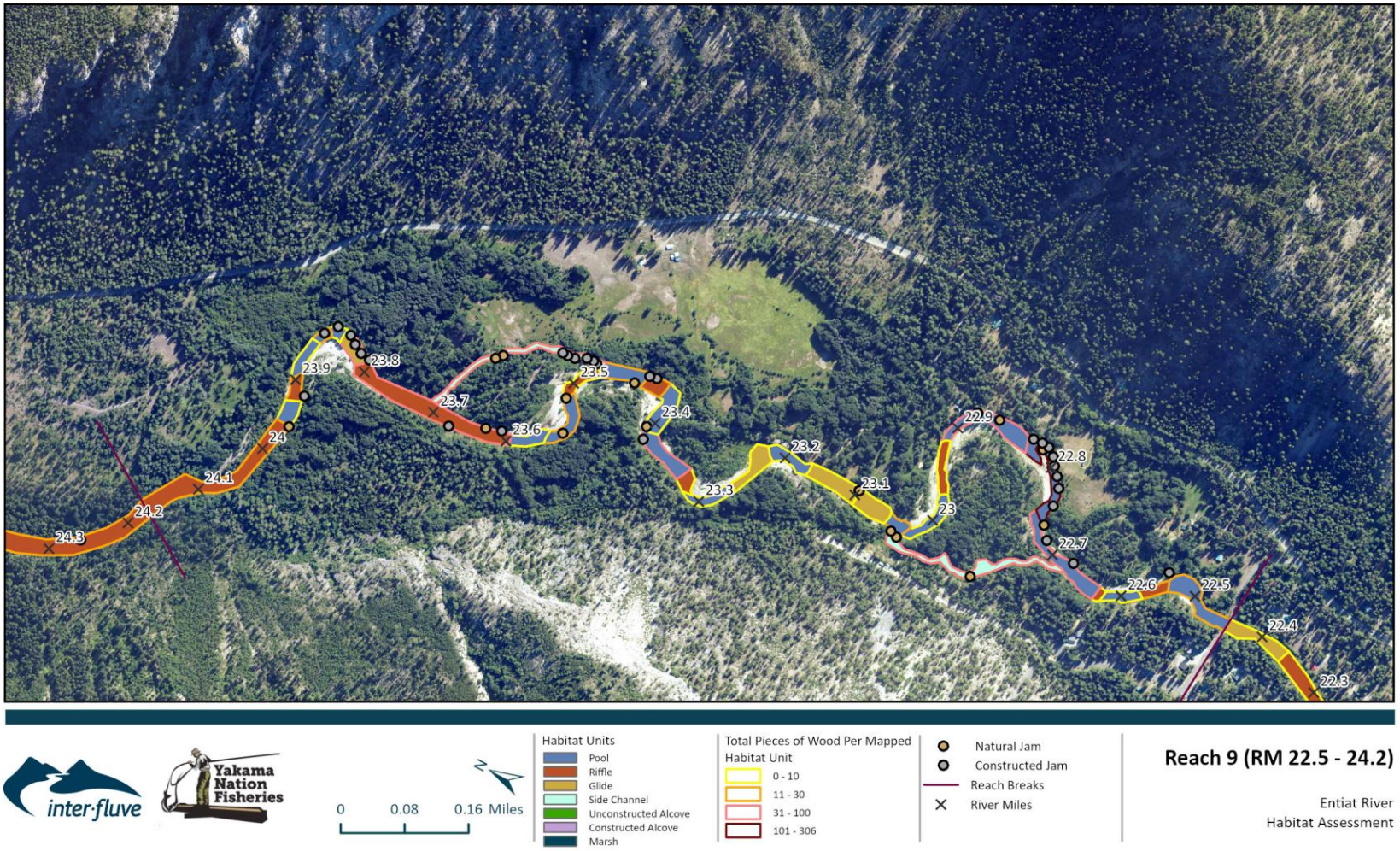

Figure 56. Map of the habitat unit composition and LWM in Reach 9 of the Entiat River. LWM count includes pieces in jams.

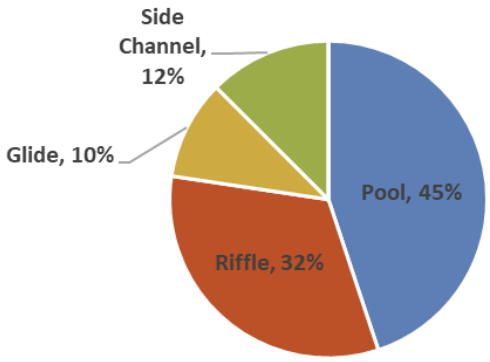

Figure 57. Stream habitat unit area composition of Reach 9.

5.9.2 Pools

Reach 9 had 18 pools total, corresponding to a frequency of 11 pools per mile. This was higher than the eight pools per mile average across the entire assessment area. The average residual pool depth for Reach 9 was 3.5 feet, compared to the assessment area average of 4.0 feet. Residual pool depths ranged from 1.7 to 7.6 feet deep. Only one pool (6%) had a residual depth greater than 6.0 feet. Fifty percent had a residual depth between 3.0 and 6.0 feet and the remaining 44% had less than 3.0 feet of residual depth.

5.9.3 Side Channel Habitat

There were two actively flowing side channels at the time of the survey. The total combined length of the two side channels was 2,577 feet long and both were primarily slow water (pool-type) habitat. There were 105 pieces of LWM total, roughly half recorded as individual pieces and half as LWM contained in the 11 recorded jams. Side 14 was constructed. See Table 18 below.

Table 18. Summary of the side channel habitat observed in Reach 9.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 13	1,295	Side Slow	33	3	12
Side 14	1,282	Side Slow	18	8	42
Total	*2,577*		*51*	*11*	*54*

5.9.4 Large Woody Material

Reach 9 had 635 total pieces of LWM, including individual pieces and wood counted in jams, which corresponds to 374 pieces of LWM per mile. There were 226 pieces (36%) of M+L wood (combined) per mile. Forty-six jams were counted, containing 69% (n = 435) of the total number of LWM pieces observed in the reach (Table 19).

Table 19. Large woody material quantities in Reach 9.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	115	59	26	200
Number of individual pieces per mile	68	50		118
Number of pieces per mile (including pieces in jams)	148	226		374
Number of jams	46			
Number of jams per mile	27			
Estimated wood count in jams	435			

5.9.5 Riparian Corridor

Nine units were surveyed for vegetation in Reach 9. Though residential development was present in the reach, riparian vegetation immediately adjacent to the channel remained, for the most part, intact. Large trees, primarily cottonwoods or Ponderosa pine, were the dominant overstory. Willow, alder and dogwood were observed in the understory. In all the units surveyed, shrub/seedling was the dominant understory size class. See Figure 58 and Figure 59 below.

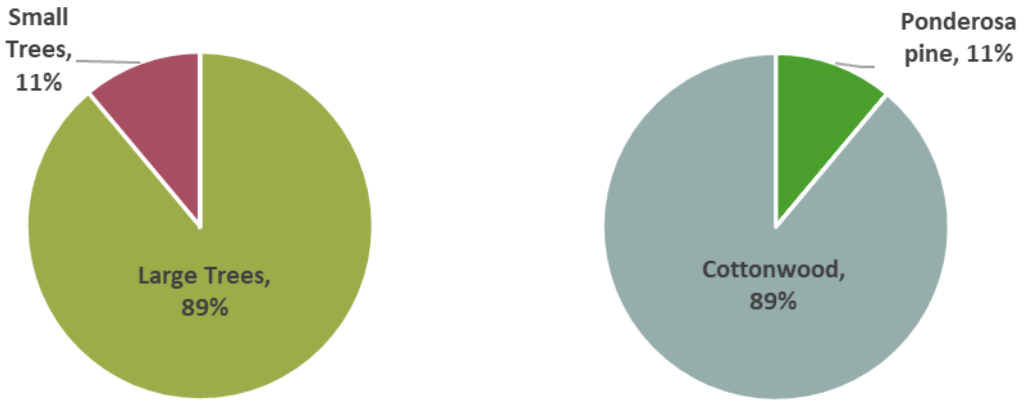

Figure 58. Dominant overstory riparian vegetation class and species, from nine units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 59. Dominant understory riparian vegetation class and species, from nine units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.10 REACH 10

Location: River mile 24.2 – 24.9
Total length: 0.7 miles
Survey Date: August 5th, 2025

Figure 60. Representative photo of Reach 10. Habitat units were dominated by riffles.

5.10.1 Habitat Unit Composition

Reach 10 is 0.7 miles long and has a relatively steep channel gradient of 0.58%. Habitat in the reach was dominated by riffle habitat (92%), with only a single pool, formed by a sharp bend in the channel, observed near the upstream end of the reach (Figure 62). Residential development along the river left side of the reach, along with two alluvial fans entering the reach along both sides of the river, results in a relatively confined, straight channel with high amounts of riffle habitat.

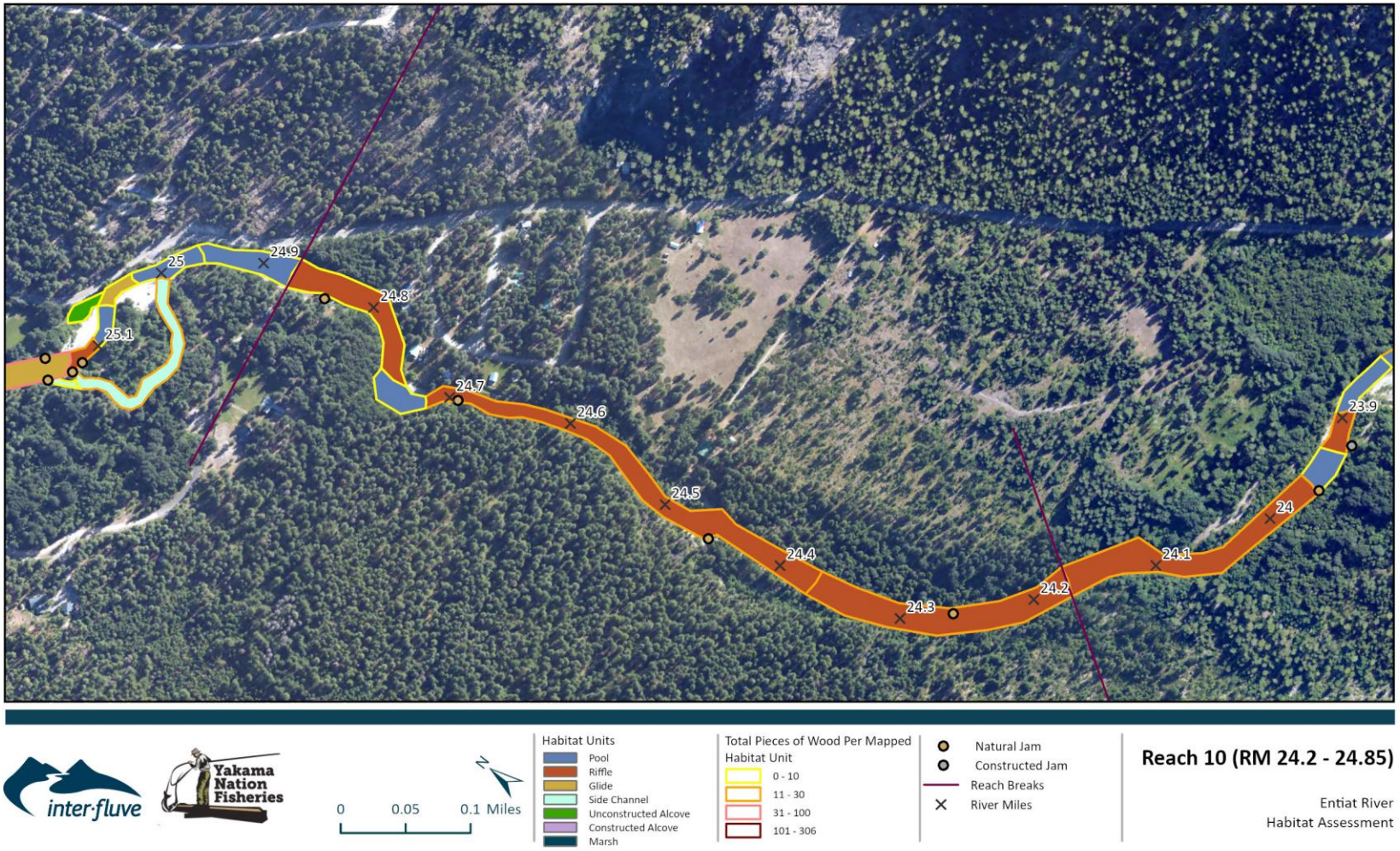

Figure 61. Map of the habitat unit composition and LWM in Reach 10 of the Entiat River. LWM count includes pieces in jams.

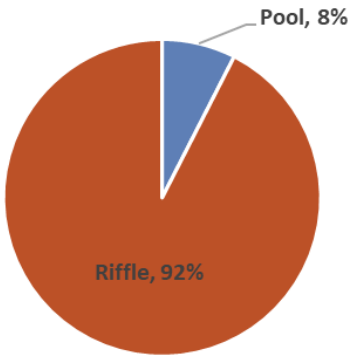

Figure 62. Stream habitat unit area composition of Reach 10.

5.10.2 Pools

There was only one pool in Reach 10, which corresponds to roughly one pool per mile. This was much lower than the eight pools per mile average across the entire assessment area. The pool had 4.5 feet of residual depth, slightly higher than average residual depth for the entire assessment area of 4.0 feet. Aside from Reach 8, in which no pools were observed, Reach 10 had the least amount of pool habitat in the assessment area.

5.10.3 Side Channel Habitat

There were no actively flowing side channels in Reach 10 at the time of the survey.

5.10.4 Large Woody Material

Reach 10 had the lowest quantity of LWM of any reach. There was a total of 40 pieces of LWM observed (individual pieces and wood in jams), corresponding to 57 pieces per mile. Of those 57 pieces, 37% (n=21) were M+L (combined) size. There were four jams in the reach, containing 16 pieces (40% of the total) of LWM. See Table 20 below.

Table 20. Large woody material quantities in Reach 10.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	14	5	5	24
Number of individual pieces per mile	20	14		34
Number of pieces per mile (including pieces in jams)	36	21		57
Number of jams	4			
Number of jams per mile	6			
Estimate wood count in jams	16			

5.10.5 Riparian Corridor

Three units in Reach 10 included vegetation surveys. The overstory was dominated by large trees, typically Ponderosa pine or cottonwood (Figure 63). In all three units surveyed the understory consisted

of alder in the sapling/pole size class (Figure 64). There were multiple residential properties alongside the river in Reach 10 where riparian vegetation clearing was observed.

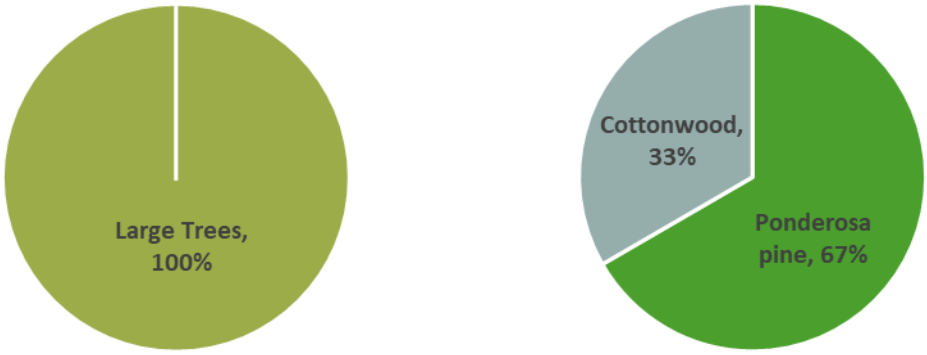

Figure 63. Dominant overstory riparian vegetation class and species, from three units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 64. Dominant understory riparian vegetation class and species, from three units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.11 REACH 11

Location: River mile 24.9 – 25.6
Total length: 0.7 miles
Survey Date: August 6th, 2025

Figure 65. Representative photo of Reach 11. Habitat units were varied, but glide habitat was the most prevalent by area.

5.11.1 Habitat Unit Composition

Reach 11 is 0.7 miles long and has a gradient of 0.93%, the steepest of any reach. Most of the reach was recorded as glide (38%) or pool habitat (33%). See Figure 67 below. The remaining area consisted of side channel habitat, riffle habitat, and a small amount of "other" habitat, which in this case was an alcove at the downstream end of the reach. The alcove was naturally-formed and connected to the mainstem. Subsurface flow also appeared to be contributing at the upstream end of alcove. There are multiple residences on river-left in this reach, contributing to substantial swaths of cleared riparian vegetation, as well as a private driveway bridge crossing the channel at the downstream end of the reach.

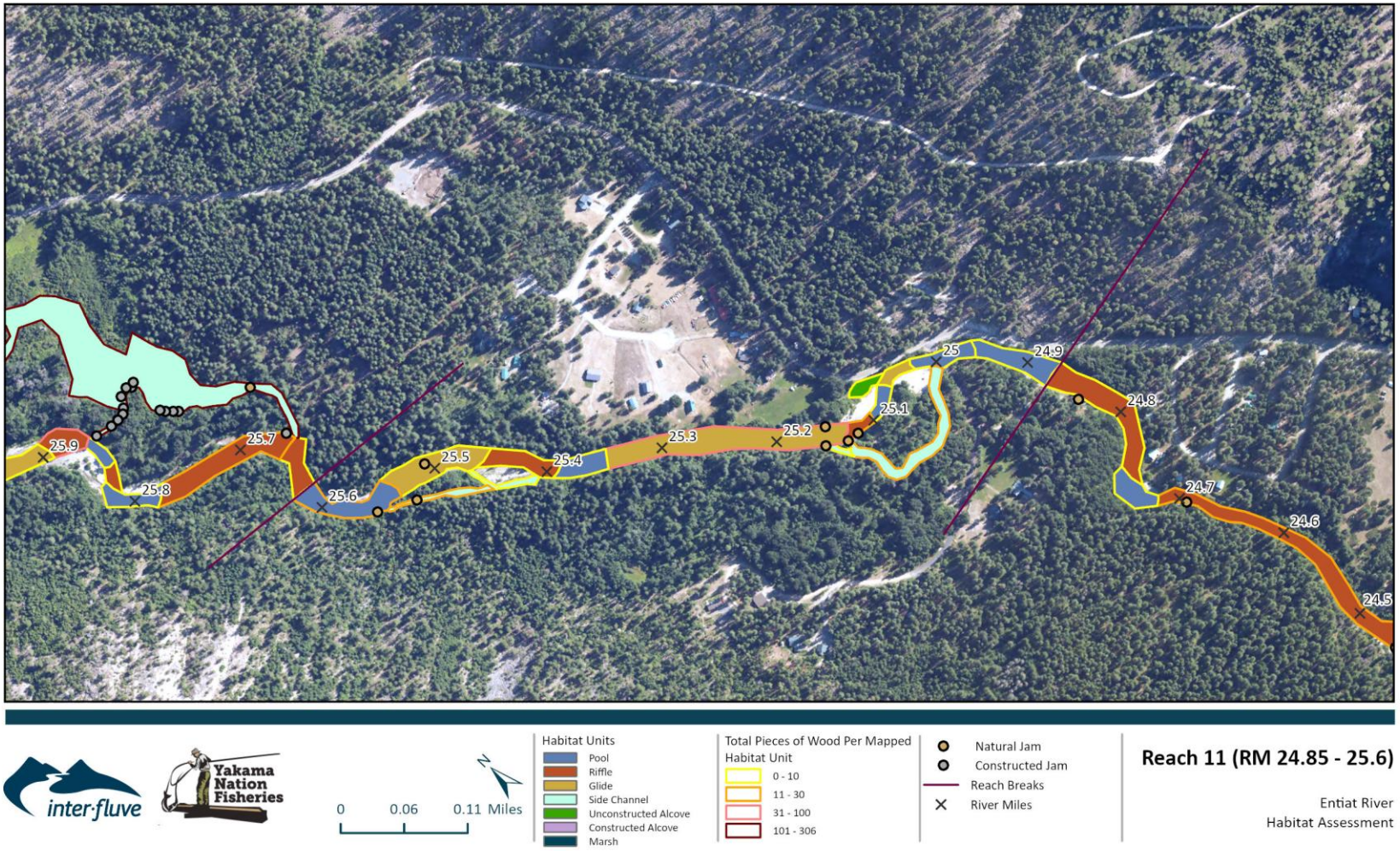

Figure 66. Map of the habitat unit composition and LWM in Reach 11 of the Entiat River. LWM count includes pieces in jams.

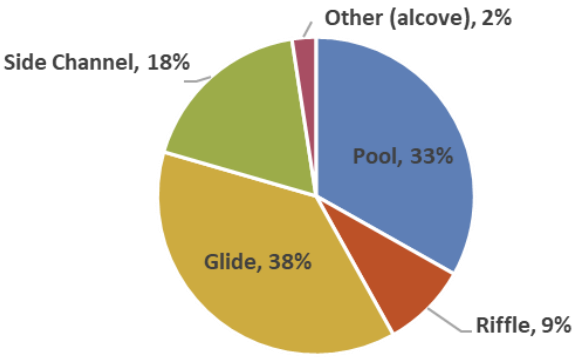

Figure 67. Stream habitat unit area composition of Reach 11.

5.11.2 Pools

Reach 11 had five pools total, corresponding to a frequency of seven pools per mile, which was slightly less than the eight pools per mile average across the entire assessment area. The average residual depth for the reach was 5.7 feet, ranging from 3.5 to 10.6 feet deep. All the pools had residual depths over 3.0 feet, with one very deep pool (20%) with a residual depth estimated at 10.6 feet. The mean residual depth for the entire assessment area was 4.0 feet.

5.11.3 Side Channel Habitat

There were four actively flowing side channels at the time of the survey. The total combined length of the side channels was 1,802 feet long and all were primarily slow water (pool-type) habitat. There was a total of 43 pieces of LWM observed in the side channels. None of the side channels in Reach 11 were constructed. See Table 21 below.

Table 21. Summary of the side channel habitat observed in Reach 11.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 15	883	Side Slow	12	0	0
Side 16	95	Side Slow	5	0	0
Side 17	345	Side Slow	7	0	0
Side 18	479	Side Slow	11	1	8
Total	*1,802*		*35*	*1*	*8*

5.11.4 Large Woody Material

There was a combined total (jams and individual pieces) of 143 pieces of LWM, corresponding to 204 pieces of LWM per mile in Reach 11. M+L sized pieces accounted for 63 pieces (31%) of LWM per mile. Roughly half (49%) of the LWM was in the seven jams found in the reach (Table 22).

Table 22. Large woody material quantities in Reach 11.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	54	14	5	73
Number of individual pieces per mile	77	27		104
Number of pieces per mile (including pieces in jams)	141	63		204
Number of jams	7			
Number of jams per mile	10			
Estimate wood count in jams	70			

5.11.5 Riparian Corridor

There were four vegetation surveys performed in Reach 11. The overstory was split between cottonwood and Ponderosa pine trees. A majority of the overstory was classified as large trees, with small trees present in one of the units. Alder trees, in the shrub/seedling size class, were the dominant understory in this reach. Despite multiple residential properties present in the reach, riparian vegetation immediately adjacent to the river was relatively intact. See Figure 68 and Figure 69 below.

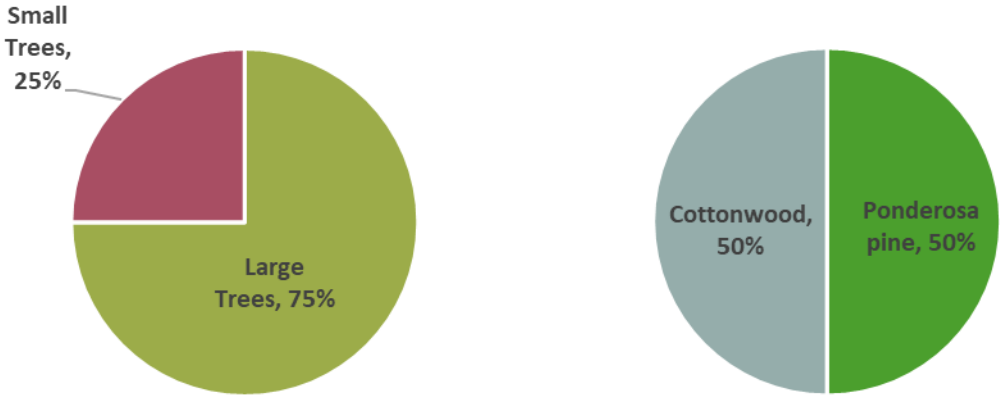

Figure 68. Dominant overstory riparian vegetation class and species, from four units surveyed, within 100 feet of the Entiat River by ocular estimate.

Figure 69. Dominant understory riparian vegetation class and species, from four units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.12 REACH 12

Location: River mile 25.6 – 26.7
Total length: 1.1 miles
Survey Date: August 7th, 2025

Figure 70. Representative photo of Reach 12. Riffle habitat dominated the mainstem of the Entiat in Reach 12.

5.12.1 Habitat Unit Composition

Reach 12 is 1.1 miles long. The reach had the highest percentage of side channel by area than any other reach. Riffle habitat was prevalent in this reach, followed by a small amount of glide habitat, pool habitat, and alcove habitat, classified as "other" in Figure 72. The "other" habitat type in this reach was a constructed alcove with placed wood throughout the unit. The high percentage of side channel habitat was primarily from one side channel, Side 19, located at the downstream end of the reach on river left. This was a constructed side channel, with placed wood, where beavers had moved in and built a series of

dams that slowed down and spread water across a wider section of the floodplain. Reach 12 is sinuous, with minimal natural confinement and a channel gradient of 0.31%. There is some residential development along river left at the upstream end of the reach, resulting in localized riparian clearing and inhibiting lateral migration.

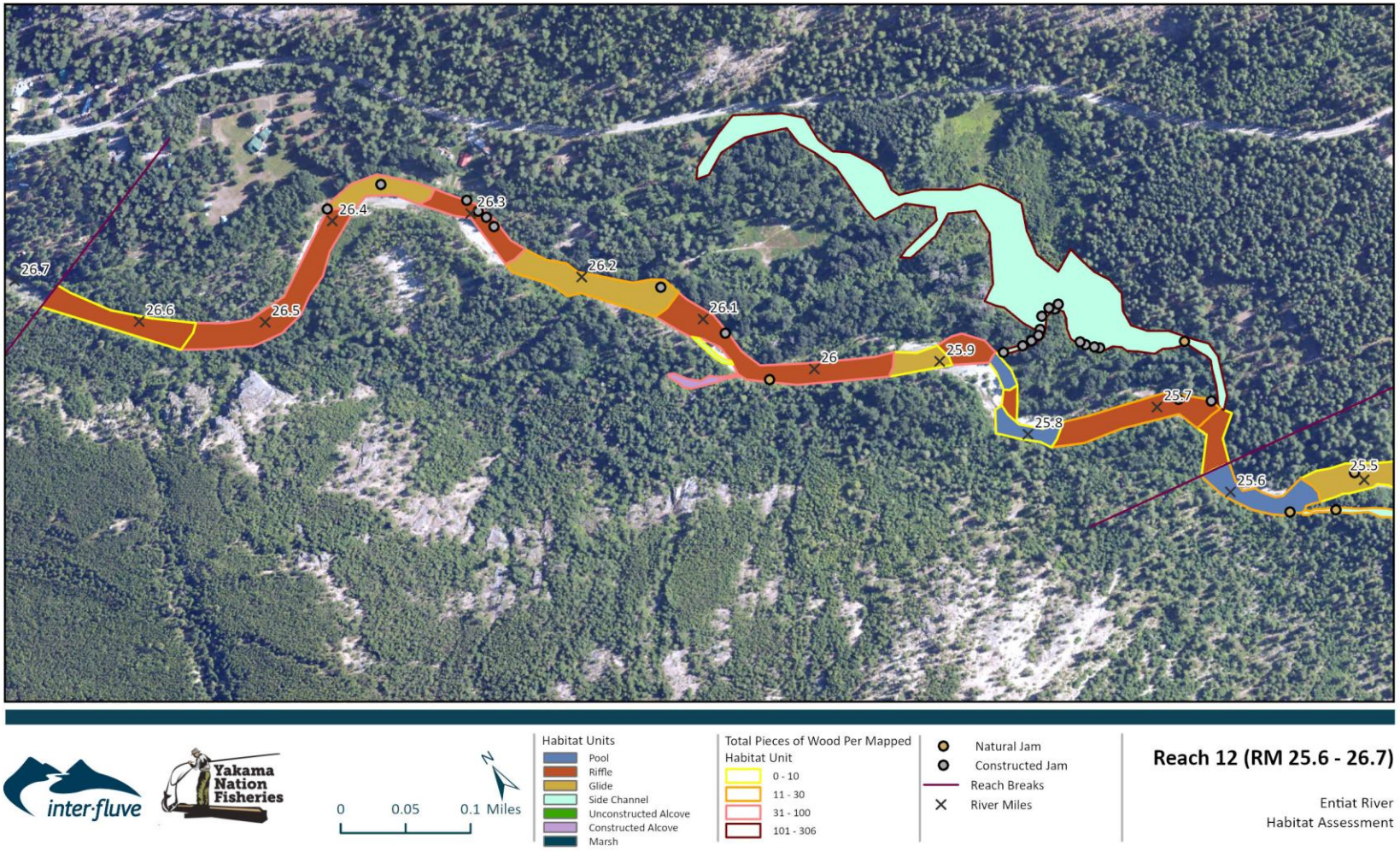

Figure 71. Map of the habitat unit composition and LWM in Reach 12 of the Entiat River. LWM count includes pieces in jams.

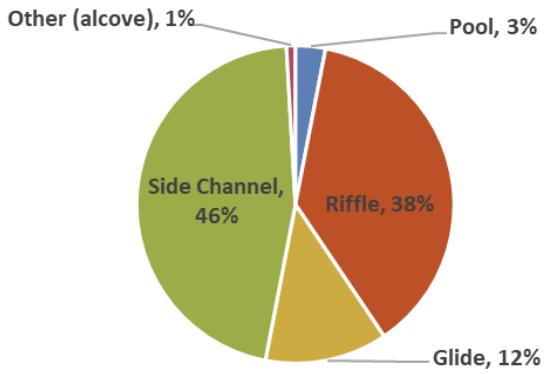

Figure 72. Stream habitat unit area composition of Reach 12.

5.12.2 Pools

There were two pools recorded in Reach 12, which corresponds to roughly two pools per mile. This was substantially lower than the eight pools per mile average across the entire assessment area. The residual depths of the two pools was relatively similar, recorded as 3.6 and 3.9 feet deep (and averaging 3.8 feet deep). The mean residual pool depth for the entire assessment area was 4.0 feet.

5.12.3 Side Channel Habitat

There were two side channels documented in Reach 12, however, side channel habitat made up 46% of the total reach habitat area. This large percentage of side channel habitat was primarily due to Side 19 which was a constructed side channel where beaver had moved in and built a series of dams. The total combined length of the side channels in Reach 12 was 1,507 feet. Side 19 was primarily slow water (pool-type) habitat as a result of the beaver activity and Side 20 was primarily fast water (riffle-type) habitat. There were an estimated 70 individual pieces of LWM and 39 pieces of LWM in 13 jams, all of which were observed in Side 19. See Table 23 and Figure 73 below.

In addition to the side channels, there was a constructed alcove unit on river right near RM 26.05 (Figure 74) that was connected at low flows. Placed large wood was observed in the alcove. There were two other constructed alcove features in the reach on river right between RM 26.20 - 26.25 that were not connected at low flows and were therefore excluded from the assessment.

Table 23. Summary of the side channel habitat observed in Reach 12.

Location	Length (ft)	Dominant unit type	Wood count	Jam Count	Wood Count in Jams
Side 19	1,324	Side slow	70	13	39
Side 20	183	Side fast	0	0	0
Total	*1,507*		*70*	*13*	*39*

Figure 73. Photo shows beaver dam in a constructed side channel in Reach 12. Beaver had moved in and created a large marsh in the side channel.

Figure 74. Photo shows the constructed alcove in Reach 12. This one was connected via surface flow to the mainstem of the Entiat at the time of survey and included in the habitat assessment.

Figure 75. Photo shows another constructed alcove in Reach 12; however, this one was not connected via surface flow to the mainstem of the Entiat at the time of the survey and therefore not included in the habitat assessment.

5.12.4 Large Woody Material

Reach 12 had 466 total pieces of LWM, including individual pieces of LWM and LWM counted in jams, which corresponds to 424 pieces of LWM per mile. There were 319 (75%) pieces of M+L wood (combined) per mile. Twenty-five jams were counted in Reach 12, containing 66% (n = 309) of the total number of LWM pieces observed in the reach (Table 24).

Table 24. Large woody material quantities in Reach 12.

	Small (6 in x 20 ft)	Medium (12 in x 35 ft)	Large (20 in x 35 ft)	Total
Number of individual pieces	72	56	29	157
Number of individual pieces per mile	65	77		143
Number of pieces per mile (including pieces in jams)	105	319		424
Number of jams	25			
Number of jams per mile	23			
Estimate wood count in jams	309			

5.12.5 Riparian Corridor

There were five vegetation surveys performed in Reach 12. Most of the overstory consisted of small cottonwood or Ponderosa pine, though some Douglas fir in the large tree size category were recorded in one of the units (Figure 76). The understory was dominated by alder in the sapling/pole and shrub/seedling size classes (Figure 77). The riparian vegetation was relatively undisturbed in Reach 11, except for some localized clearing of the riparian area on river left between RM 26.1 - 26.4, related to residential development roadways.

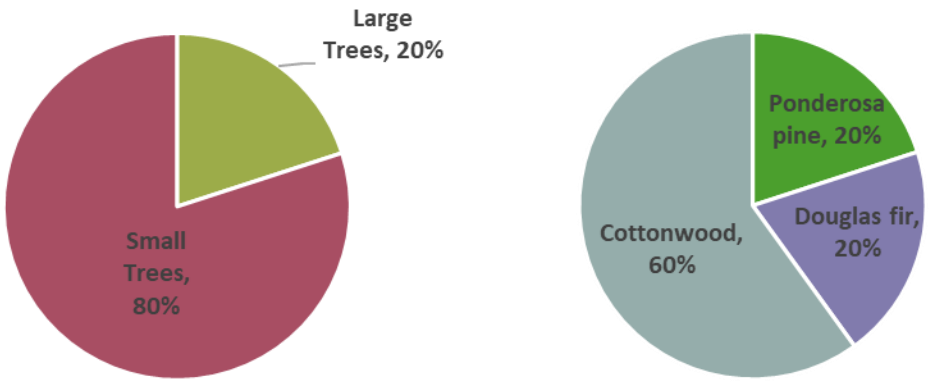

Figure 76. Dominant overstory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

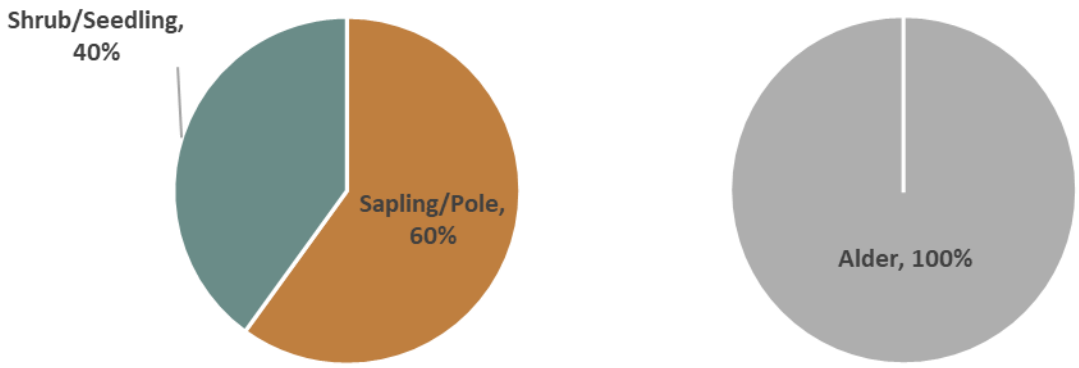

Figure 77. Dominant understory riparian vegetation class and species, from five units surveyed, within 100 feet of the Entiat River by ocular estimate.

5.13 SUMMARY DATA

Table 25. Summary of all the data collected for the 2024-2025 Habitat Assessment on the Entiat River.

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
River Miles Surveyed	1.10	1.00	0.70	0.90	0.80	0.70	1.30	0.40	1.70	0.7	0.70	1.10	11.10
Stream Gradient	0.92%	0.12%	0.13%	0.19%	0.22%	0.23%	0.24%	0.47%	0.30%	0.58%	0.93%	0.49%	0.31%
Average Wetted Width (ft)													
Pool													
Mean	69	60	63	52	54	59	58	0	55	85	67	55	58
Median	68	60	58	53	50	63	60	0	50	85	70	55	58
St. Dev.	17	9	12	6	10	7	8	0	12	n=1	14	7	11
Riffle													
Mean	64	55	65	48	35	42	57	65	58	57	60	64	57
Median	67.5	55	65	47.5	35	45	65	65	60	55	60	65	55
St. Dev.	12	21	21	3	5	10	19	0	21	8	7	13	15
Glide													
Mean	70	0	0	75	40	60	48	55	64	0	63	68	58
Median	70	0	0	75	40	60	45	55	58	0	65	60	55
St. Dev.	n=1	0	0	n=1	0	n=1	13	n=1	18	0	18	19	16
Side Channel													
Mean	15	0	20	0	20	0	24	0	20	0	12	13	18
Median	15	0	20	0	23	0	23	0	25	0	11	13	20
St. Dev.	n=1	0	n=1	0	11	0	14	0	7	0	6	10	10

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
Water Depth (ft)													
Pool Maximum Depth													
Mean	4.9	5.1	5.8	4.9	5.4	4.9	4.7	0.0	4.6	6.0	7.0	5.8	5.1
Median	4.9	5.0	5.8	4.7	5.3	4.7	5.0	0.0	4.5	6.0	6.5	5.8	5.0
St. Dev.	0.6	1.5	1.7	1.1	1.1	1.3	0.8	0.0	1.1	n=1	2.9	0.4	1.4
Pool Residual Depth													
Mean	2.6	4.3	5.2	4.1	4.3	4.0	3.8	0.0	3.5	4.5	5.7	3.8	4.0
Median	2.5	4.3	5.1	3.9	4.3	4.0	4.0	0.0	3.3	4.5	5.3	3.8	4.0
St. Dev.	0.8	1.7	1.7	1.1	0.8	1.3	0.8	0.0	1.3	n=1	2.9	0.2	1.4
Riffle/Glide Average Depth													
Mean	1.5	0.8	1.2	1.4	1.9	1.1	1.1	1.7	1.3	1.3	1.5	1.3	1.4
Median	1.5	0.75	1.2	1.3	1.4	1.05	1	1.8	1.1	1.2	1.5	1.2	1.2
St. Dev.	0.3	0.2	0.8	0.4	0.9	0.3	0.2	0.5	0.7	0.4	0.5	0.5	0.5
Bankfull Characteristics													
Width (ft)													
Mean	95	115	93	95	63	119	118	85	101	88	93	103	99
Median	97.5	120	85	85	60	112.5	125	80	100	85	88	75	100
St. Dev.	15	13	28	22	15	18	19	17	17	10	11	13	21
Depth (ft)													
Maximum Depth (ft)	4.7	5.7	5.3	4.3	5.9	4.1	4.6	5.4	5.3	5.1	5.7	5.3	5.9
Minimum Depth (ft)	1.4	1.2	0.4	1.0	1.1	0.8	1.3	1.4	0.4	1.7	1.1	0.6	0.4
Mean Depth (ft)	3.6	3.1	3.2	2.9	3.4	2.5	2.8	3.6	3.2	3.6	3.5	3.2	3.2
Median	3.7	3.1	3.4	3.2	3.4	2.6	2.7	3.8	3.5	3.6	3.5	3.4	3.2

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
St. Dev.	3.6	1.1	1.1	0.9	1.2	0.8	0.9	1.0	1.0	1.0	1.3	1.0	1.1
Width:Depth Ratio													
Mean	26.15	37.22	29.00	32.50	18.44	47.36	42.68	23.57	31.39	24.84	26.43	31.56	30.73
Floodprone Width													
Mean	160	704	431	368	749	1175	393	111	595	189	425	277	474
Median	102	574	439	398	719	1126	378	97	675	154	397	270	392
St. Dev.	136	399	105	71	203	535	212	29	336	89	72	117	372
Habitat Area (%)													
Pool	15%	89%	72%	70%	65%	76%	43%	0%	45%	8%	33%	3%	89%
Riffle	81%	3%	13%	21%	5%	10%	11%	78%	32%	92%	9%	38%	3%
Glide	2%	0%	0%	9%	7%	13%	18%	22%	10%	0%	38%	12%	0%
Side Channel	1%	0%	9%	0%	22%	0%	27%	0%	12%	0%	18%	46%	0%
Other (alcove)	0%	8%	7%	0%	0%	0%	0%	0%	0%	0%	2%	1%	8%
Other (marsh)	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	0%
Pools													
Pools per Mile	4	12	6	13	11	9	10	0	11	1	7	2	8
Residual Depth (% of Pools)													
% of Pools D<3ft	75%	25%	0%	17%	11%	33%	23%	0%	44%	0%	0%	0%	9%
% of Pools 6>D>=3 ft	25%	58%	50%	75%	89%	50%	77%	0%	50%	100%	80%	100%	26%
% of Pools D>=6	0%	17%	50%	8%	0%	17%	0%	0%	6%	0%	20%	0%	65%
Riffle: Pool Ratio	1.50	0.17	0.50	0.33	0.33	0.50	0.23	n=0 (no pools)	0.50	3.00	0.40	4.00	0.55

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
Mean Pool Spacing (bankfull channel widths per pool)	15	4	13	4	7	5	4	n=0 (no pools)	5	42	8	28	7
Wood													
Total Number of Pieces (not including pieces in jams)													
Small	56	86	43	43	75	40	91	19	115	14	54	72	708
Medium	26	30	17	8	29	11	39	2	59	5	14	56	296
Large	5	4	4	3	7	3	19	3	26	5	5	29	113
M+L (combined)	31	34	21	11	36	14	58	5	85	10	19	85	409
Total	87	120	64	54	111	54	149	24	200	24	73	157	1117
Number of Pieces/Mile (not including pieces in jams)													
Small	51	86	61	48	94	57	70	48	68	20	77	65	64
Medium	24	30	24	9	36	16	30	5	35	7	20	51	27
Large	5	4	6	3	9	4	15	8	15	7	7	26	10
M+L	28	34	30	12	45	20	45	13	50	14	27	77	37
Total	79	120	91	60	139	77	115	60	118	34	104	143	101
Jams													
Total Jams	4	22	12	10	19	10	57	0	46	4	7	25	218
Jams Per Mile	4	22	17	11	24	14	44	0	27	6	10	23	20
Small in Jams	8	182	141	67	201	122	429	0	136	11	45	43	1389
Medium in Jams	6	129	101	51	111	56	322	0	174	4	18	176	1148
BF Large in Jams	4	79	49	30	65	30	247	0	125	1	7	90	727
Total Wood in Jams	18	390	291	148	377	208	998	0	435	16	70	309	3264

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
Unstable Banks													
Percent Reach Length (both banks)	0%	1%	4%	1%	2%	0%	1%	0%	2%	0%	3%	1%	1%
Vegetation - Percent of System													
Dominant Overstory Size Class													
Large Tree	20%	60%	50%	43%	40%	20%	43%	100%	89%	100%	75%	20%	53%
Small Tree	20%	40%	50%	57%	60%	80%	57%	0%	11%	0%	25%	80%	42%
Shrub/Seedling	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Grassland/Forb	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Other	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Dominant Overstory Species Composition													
Cedar	0%	0%	0%	0%	0%	0%	0%	67%	0%	0%	0%	0%	3%
Douglas fir	0%	20%	0%	0%	0%	0%	14%	33%	0%	0%	0%	20%	7%
Ponderosa pine	60%	20%	0%	57%	0%	0%	29%	0%	11%	67%	50%	20%	27%
Alder	0%	0%	0%	0%	60%	40%	0%	0%	0%	0%	0%	0%	8%
Cottonwood	0%	40%	100%	43%	40%	60%	57%	0%	89%	33%	50%	60%	50%
Other/Unknown	40%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%
Birch	0%	20%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	2%
Dominant Understory Size Class													
Sapling/Pole	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	60%	10%
Shrub/Seedling	80%	100%	100%	86%	100%	100%	100%	100%	100%	0%	100%	40%	87%
Grassland/Forb	20%	0%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%	3%

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Reach 7	Reach 8	Reach 9	Reach 10	Reach 11	Reach 12	All Reaches
Dominant Understory Species Composition													
Alder	60%	0%	0%	0%	0%	0%	14%	100%	22%	100%	100%	100%	35%
Cottonwood	0%	0%	0%	0%	0%	0%	0%	0%	11%	0%	0%	0%	2%
Dogwood	0%	60%	50%	14%	60%	40%	14%	0%	11%	0%	0%	0%	20%
Willow	20%	40%	50%	71%	40%	60%	71%	0%	56%	0%	0%	0%	40%
Other/Unknown	20%	0%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%	3%

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