

UPPER CHEHALIS BASIN LARGE WOOD LOADING INVENTORY

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Introduction

Anchor QEA conducted an inventory of the large wood load within the bankfull width of the mainstem Chehalis River between river mile (RM) 87 and RM 118, and in five upper Chehalis River tributaries on October 6 through 9 and November 4 through 6, 2015. Wood pieces meeting the minimum size criteria of Fox and Bolton (2007) were inventoried at each site with a handheld global positioning system (GPS) device. Fox and Bolton (2007) criteria are wood pieces at least 2 meters (6.5 feet) in length and at least 10 centimeters (cm; 4 inches) diameter. This survey focused on the geographic area of the upper Chehalis Basin.

Large wood plays an important role in creating and maintaining channel morphology and functional salmonid habitat, and is the foundation for most salmonid habitat restoration projects in the Pacific Northwest. Fox and Bolton (2007) conducted a study of the number and volume of large wood found in unmanaged streams and rivers in Washington and developed distributions (75th percentile, median, and 25th percentiles) for the number of pieces, volume, and number of key pieces per 100 meters (328 feet) of channel length based on bankfull widths of these unmodified watersheds. As part of their study, Fox and Bolton (2007) recommended large wood restoration targets (number of pieces, volumes, key pieces) meet the 75th percentile for degraded rivers and streams (defined as a system where the existing wood volume and numbers are below the median wood distribution for unmanaged streams). Based on the wood inventory results conducted by Anchor QEA, the Chehalis River and upper tributaries generally did not meet the 25th percentile for wood volume or number of pieces based on the Fox and Bolton (2007) distribution for unmanaged systems. It is recommended that the 75th percentile wood load be the interim target (for restoration wood placement) for the upper Chehalis River and tributaries until wood is able to meet the unmanaged wood-loading ranges.

Mainstem Chehalis River Large Wood Load

Large wood within the bankfull channel width was inventoried at ten sites along 31 miles of mainstem in the upper watershed. From October 6 through 9, 2015, the inventory was conducted during very low flows, where flows at the Doty gage (RM 101) ranged from approximately 24 to 27 cubic feet per second (cfs; USGS 2015). Conditions were mostly dry and air temperatures were approximately 55°F to 65°F during the October wood inventory. During this October inventory, mainstem Chehalis River sites between RM 87 and RM 105.5 were inventoried. A second wood survey was conducted on November 4 through 6, 2015, between RM 110 and RM 118 (confluence of the East and West Forks) and at one site on the West Fork Chehalis River. November flow conditions were higher than during the October inventory, with river flows at the Doty gage ranging from approximately 650 cfs at the start of the inventory (November 4) to 375 cfs at the end of the inventory (November 6).

Existing Wood Load Characteristics

The inventory included measuring the length and diameter of each wood piece meeting the minimum criteria that is located within the bankfull width. Based on the inventory results, the overall Chehalis River mainstem average wood length was 7.7 meters (25.3 feet) and diameter was 34.5 cm (13.6 inches). Based on the Chehalis River sites inventoried (including the West Fork), the site with the longest average length of 11.4 meters (37.3 feet) was measured at RM 93.5, and largest average diameter of 44.2 cm (17.4 inches) was measured at RM 101.5 (see Table 1). Both of these sites are located downstream of the town of Pe Ell and the managed forestlands in the upper watershed. However, these logs are small and do not meet the minimum criteria of a key log within a river that has a bankfull width the size of the Chehalis River. Key logs are large logs that are big enough to provide the stable foundation for the formation of a log jam.

Wood Load

The mainstem Chehalis River wood load is very low and is less than the large wood piece quantities or volumes for natural and unmanaged watersheds referenced by Fox and Bolton (2007). Fox and Bolton identify the 75th percentile as 208 pieces per 100 meters (328 feet) for a natural and unmanaged watershed in Western Washington that has a bankfull width between 30 and 100 meters (98 to 328 feet). For wood volume, Fox and Bolton (2007) identify the 75th percentile as 317 cubic meters (m³)/100 meters (11,193 cubic feet (ft³)/328 feet) for these unmanaged systems. The wood load results for the upper Chehalis River sites are summarized in Table 2.

The highest wood loads were found in the upstream extent of the Chehalis Basin (in the West Fork Chehalis River) and below the confluence of the East and West Forks (in the mainstem Chehalis River) near RM 118. A previous riparian analysis as part of the *The Upper Chehalis River Basin Watershed Analysis* (Beak Consultants 1994) also determined that the in-channel large wood was inadequate along the upper mainstem Chehalis River, as well as along the East Fork and West Fork.

The wood load (number of pieces or volume) in the Chehalis River mainstem is very low, and did not even meet the 25th percentile of levels found in unmanaged forests (Fox and Bolton 2007). In the mainstem Chehalis River (downstream of the confluence of the East and West Forks), the large wood load (volume) ranged from 1% to 5.6% of the Fox and Bolton (2007) recommended restoration target, and for the wood load (pieces) the count ranged from 0.6% to 7.5% of the recommended restoration target (see Table 2). However, the one site surveyed on the West Fork Chehalis did exceed the 25th percentile of the restoration target for wood pieces (see Table 2).

During the 2015 surveys, no logs were identified along the mainstem Chehalis River that met the referenced Fox and Bolton (2007) definition of a key log (minimum volume of 10.75 m³ [264.8 ft³]) for a channel of 50 to 100 meters (164 to 328 feet) bankfull width.

Chehalis River Tributary Large Wood Load

Anchor QEA conducted an inventory of the large wood load within the bankfull width of Lincoln Creek and the South Fork Chehalis, Newaukum, Skookumchuck, and Black rivers from October 7 to 9, 2015. Large wood within the bankfull channel was inventoried at several sites along each of these tributaries to the Chehalis River. Wood that met the minimum size criteria of Fox and Bolton (2007) were inventoried at each site with a handheld GPS device where pieces measured at least 2 meters (6.5 feet) in length and 10 cm (4 inches) diameter. During October the inventory was conducted during low flow conditions. Conditions were mostly dry and air temperatures were approximately 55°F to 70°F (12.8°C to 21.1°C) during the wood inventory.

Wood Characteristics

Based on inventory results, the average wood length ranged from 3.8 meters (12.6 feet; Lincoln Creek at RM 9.5) to 9.3 meters (30.5 feet; Skookumchuck River at RM 21). Average piece diameters ranged from 24.4 cm (9.6 inches; Skookumchuck River) to 63.5 cm (25 inches; Lincoln Creek at RM 1.0), although this was based on a single log measurement (see Table 3). The next largest diameter was measured at RM 18.5 in the South Fork Newaukum River (see Table 3). The majority of the wood inventoried did not have a rootwad.

Wood Load

The wood load in the tributaries is low and does not meet the large wood piece quantities or volume criteria for natural and unmanaged watersheds set by Fox and Bolton (2007). Fox and Bolton identify the 75th percentile as 63 pieces per 100 meters (328 feet) for an unmanaged system in Western Washington that has a bankfull width between 6 and 30 meters (19.7 and 98.4 feet), which is the average bankfull width of the tributaries surveyed (with the exception of the Skookumchuck River that had a greater bankfull width). For wood volume, Fox and Bolton (2007) identify the 75th percentile as 99 m³/100 meters (3,496 ft³/328 feet) for natural and unmanaged systems in Western Washington having a bankfull width up to 30 meters (98.4 feet).

The wood load results for the upper Chehalis River tributaries are summarized in Table 4. The lowest wood load volumes were found in the lower Skookumchuck River (RM 0.5 and RM 4.5) and in Lincoln Creek (RM 1 and RM 9.5). The highest wood load volumes were found in the South Fork Chehalis River (RM 11) and Skookumchuck River (RM 21), but still these volumes are very low and did not even meet the 25th percentile for unmanaged forests. The same is true for the number of pieces; the number of pieces per 100 meters of channel was very low and mostly did not meet the 25th percentile of unmanaged forests, with the exception of three sites—the South Fork Chehalis River (RM 11), Newaukum River (RM 0.1), and Skookumchuck River (RM 21; see Table 4).

In summary, the large wood load (volume) ranged from 0.4% to 20.0% of the Fox and Bolton (2007) restoration target, and the wood load (pieces) ranged from 1.3% to 42.8% of the restoration target (see Table 4). No tributary sites met the 75th percentile (recommended Fox and Bolton [2007] restoration target) for either wood volume or wood pieces.

Data Limitations

The large wood data collected as part of this inventory represents only a snapshot of the wood load in the upper Chehalis River and major tributaries during fall 2015. The wood load counts in the Chehalis River and tributaries are not based on a comprehensive inventory of the entire river or tributary extents. The wood load counts in the upper Chehalis Basin (within the boundaries of the Weyerhaeuser Timberlands) are based on an inventory that was conducted approximately every 2 RMs. Along the tributaries, the wood count was conducted in the lower extents of the river where land use is mostly agriculture, and was conducted at locations where public river access was available. The tributary wood load counts did not include upper watershed areas where the majority of the lands are in timber production; therefore, the overall wood load for the tributaries may represent lower wood loads than what is actually present throughout the entire tributary watersheds.

Log jams were noted at a few locations along the mainstem Chehalis River; however, they were located outside of the large wood load inventory sites. The presence of log jams within a survey reach would alter the wood load numbers in the counts represented. However, the number of log jams in the mainstem Chehalis River is low, and the overall wood load numbers for the mainstem would not increase significantly with the addition of this woody material.

Table 1
Mainstem Chehalis River Large Wood Survey Length and Diameter

RIVER MILE	COUNT/100 METERS (N) ¹	LENGTH METERS (FEET)	DIAMETER CENTIMETERS (INCHES)
West Fork Chehalis (RM 1)	20.7	6.8 (22.8)	33.8 (13.3)
118	15.7	7.1 (23.2)	35.1 (13.8)
116	6.7	5.9 (19.4)	27.2 (10.7)
115	4.7	5.3 (17.4)	28.7 (11.3)
112	6	8.1 (26.6)	29.5 (11.6)
110	3	8.1 (26.6)	29.5 (11.6)
105.5	10	10.8 (35.4)	33.0 (13.0)
101.5	3.3	7.9 (25.8)	44.2 (17.4)
93.5	1.3	11.4 (37.3)	42.7 (16.8)
92.3	9.7	7.4 (24.2)	39.4 (15.5)
87	8.7	5.0 (16.4)	27.2 (10.7)

Note:

1. Per 100 meters of channel length.

Table 2
Upper Mainstem Chehalis River Existing Wood Load Summary

RIVER MILE	WOOD LOAD (VOLUME) ^A M ³ /100 METERS (FT ³ /328 FEET) ^B	RESTORATION TARGET ^C M ³ (FT ³)	PERCENT OF RESTORATION TARGET ^C	WOOD LOAD (COUNT) PIECES/100 METERS (328 FEET) ^B	RESTORATION TARGET ^C PIECES/100 METERS (328 FEET) ^B	PERCENT OF RESTORATION TARGET ^C
West Fork (RM 1)	22 (776.8)	99 (3,496)	22.2	21.3	63	33.8
118	17.9 (632)	317 (11,193)	5.6	15.7	208	7.5
116	3.1 (109.5)	317 (11,193)	1.0	6.7	208	3.2
115	4.2 (148.3)	317 (11,193)	1.3	4.7	208	2.3
112	4.2 (148.3)	317 (11,193)	1.3	6.0	208	2.9
110	2.8 (98.9)	317 (11,193)	0.9	3.0	208	1.4
105.5	13.7 (483.7)	317 (11,193)	4.3	10.0	208	4.8
101.5	4.2 (148.3)	317 (11,193)	1.3	3.3	208	1.6
93.5	2.8 (98.9)	317 (11,193)	0.9	1.3	208	0.6
92.3	11 (388.41)	317 (11,193)	3.5	9.7	208	4.7
87	10 (353.1)	317 (11,193)	3.2	8.7	208	4.2

Notes:

a. Wood data were collected October 6 through 9, 2015, and November 4 through 6, 2015, by Anchor QEA.

b. Per 100 meters of channel length.

c. Restoration targets were obtained from Fox and Bolton (2007). These targets are the 75th percentile distribution of wood inventory, are based on bankfull width, and are presented in Table 4 (Fox and Bolton 2007).

Table 3
Chehalis River Tributary Large Wood Length and Diameter

TRIBUTARY RIVER MILE	COUNT/100 METERS	LENGTH METERS (FEET)	DIAMETER CENTIMETERS (INCHES)
SOUTH FORK CHEHALIS			
RM 1	13.0	6.7 (22.1)	19.6 (7.7)
RM 5.5	4.0	8.8 (28.8)	43.2 (17.0)
RM 11	27.0	4.8 (15.7)	31.2 (12.3)
NEWAUKUM¹			
RM 0.1	16.0	5.0 (16.4)	27.2 (10.7)
RM 1.5	11.7	8.9 (29.1)	31.0 (12.2)
RM 18.5	2.0	9.1 (29.8)	50.8 (20)
SKOOKUMCHUCK			
RM 0.5	2.7	8.2 (26.8)	32.0 (12.6)
RM 4.5	2.7	8.8 (28.8)	24.4 (9.6)
RM 10.5	5.3	6.2 (20.3)	26.9 (10.6)
RM 21.0	22.0	9.3 (30.5)	29.2 (11.5)
BLACK²			
RM 14.5	10.0	8.0 (26.2)	26.7 (10.5)
RM 17.5	0	NA	NA
LINCOLN			
RM 1	1.0	6.1 (20)	63.5 (25.0)
RM 9.5	5.0	3.8 (12.6)	27.9 (11.0)

Note:

1. RM 18.5 is located on the South Fork Newaukum River.
2. No wood was found at the Black River at the RM 17.5 monitoring site.

Table 4
Upper Chehalis Basin Tributary Existing Wood Load Summary

TRIBUTARY/ LOCATION	WOOD LOAD (VOLUME) M ³ /100 METERS ^A (FT ³ /328 FEET)	RESTORATION TARGET ^B M ³ (FT ³)	PERCENT OF RESTORATION TARGET ^B	WOOD LOAD (COUNT) PIECES/100 METERS ^A (328 FEET)	RESTORATION TARGET ^B PIECES/100 METERS ^A (328 FEET)	PERCENT OF RESTORATION TARGET ^B
SOUTH FORK CHEHALIS						
RM 1	2.6 (90.2)	99 (3,496)	2.6	13.0	63	20.6
RM 5.5	9.3 (328.1)	99 (3,496)	9.4	4.0	63	6.3
RM 11	14.3 (504.7)	99 (3,496)	14.4	27.0	63	42.8
NEWAUKUM^C						
RM 0.1	5.3 (187.0)	99 (3,496)	5.4	16.0	63	25.4
RM 1.5	11.3 (397.2)	317 (11,193)	3.6	11.7	63	18.6
RM 18.5	3.6 (124.5)	99 (3,496)	3.6	2.0	63	3.2
SKOOKUMCHUCK						
RM 0.5	3.8 (133.4)	317 (11,193)	1.2	2.7	207	1.3
RM 4.5	1.4 (50.1)	317 (11,193)	0.4	2.7	207	1.3
RM 10.5	2.8 (99.6)	99 (3,496)	2.8	5.3	63	8.4
RM 21.0	19.8 (698.4)	99 (3,496)	20.0	22.0	63	34.9
BLACK						
RM 14.5	6.3 (223.7)	99 (3,496)	6.4	10.0	63	15.9
LINCOLN						
RM 1	1.9 (68.2)	99 (3,496)	1.9	1.0	63	1.6
RM 9.5	1.8 (65.0)	99 (3,496)	1.8	5.0	63	7.9

Notes:

- a. Per 100 meters of channel length.
- b. Source: Fox and Bolton 2007
- c. RM 18.5 is located on the South Fork Newaukum River.

References

- Beak Consultants, 1994. *The Upper Chehalis River Watershed Analysis: Riparian Module Upper Chehalis Watershed Analysis*. Prepared for Weyerhaeuser Company. Kirkland, Washington.
- Fox, M., and S. Bolton, 2007. A regional and geomorphic reference for quantities and volumes of instream wood in unmanaged forested basins of Washington State. *North American Journal of Fisheries Management* 27:342-359.
- USGS (U.S. Geological Survey), 2015. National Water Information System Web Interface: USGS Gage 12020000 Chehalis River near Doty, Washington. Available from: http://waterdata.usgs.gov/usa/nwis/uv?site_no=12020000.