WSDOT Hydraulics Section	Hydraulics Field Report	Project Number: Y12463
	Project Name: Goodnough Creek SR 302 MP 16.15 (WDFW 105 K051518a)	Date: 3/26/2021 7/7/2021
	Project Office: TBD	Time of Arrival: 3/26/2021: 8:00am 7/7/2021: 9:00am
	Location: Goodnough Creek SR 16 MP 16.15	Time of Departure: 3/26/2021: 11:30am 7/7/2021: 10:45am
Purpose of Visit: Site Reconnaissance	Weather: 3/26/2021: Partly Sunny 7/7/2021: Mostly Cloudy	Prepared By: Joe Griffin

Meeting Location:
Goodnough Creek, Pierce County, SR 302 MP 16.15

Attendance List:

Name	Organization	Date	Role
Shaun Bevan	HDR	3/26/2021; 7/7/2021	Senior Water Resources Engineer
Ian Welch	HDR	3/26/2021; 7/7/2021	Biologist
Joe Griffin	HDR	3/26/2021; 7/7/2021	Water Resources Engineer
Cade Roler	WSDOT	7/7/2021	WSDOT Tribal Liaison
Inder Atwal	WSDOT	7/7/2021	Project Engineer
Heather Pittman	WSDOT	7/7/2021	HQ Hydraulics
David Molenaar	WSDOT	7/7/2021	Biology Program Manager
Damon Romero	WSDOT	7/7/2021	Fish Passage Coordinator
Gina Piazza	WDFW	7/7/2021	Habitat Biologist
Madeline Smith	WDFW	7/7/2021	Habitat Engineer

Bankfull Width:

Describe measurements, locations, known history, summarize on site discussion

HDR conducted an independent site visit on March 26th, 2021 to measure bankfull widths (BFW), collect pebble count data, and locate a reference reach. HDR walked the stream approximately 100 feet upstream of the 4-foot county culvert on Goodnough Drive, through the 4.5-foot circular concrete SR302 crossing, and up from the confluence with Henderson Bay. HDR took three BFW measurements, one upstream of the Goodnough Drive crossing and two BFWs upstream of the SR302 crossing. No BFW measurements were taken downstream of SR 302. See Figure 1 for measurement locations.

A second site visit with HDR, WSDOT, WDFW and the tribes was conducted on July 7th, 2021 to gain concurrence on bankfull widths and other design considerations. One additional BFW measurement was taken upstream of SR302 during the second site visit and another measurement was revised slightly. Table 1 summarizes bankfull measurements taken during the March 26th and July 7th site visits, which were used to determine the design bankfull width. The measured bankfull widths resulted in a **design average bankfull width of 12.6 feet.**

See last page of this field report for further notes on discussions of concurrence and decisions made that help to inform the design.

Table 1: Bankfull width measurements

BFW #	Location	Width (ft)	Included in Design Average	Concurrence notes
1	Upstream of Goodnough DR	10.1	No	
2	Upstream of SR302	12.5	Yes	Increased slightly
3	Upstream of SR302	12.3	Yes	No revisions
4	Upstream of SR302	13.0	Yes	New measurement
Design Average	**-**	**12.6**		

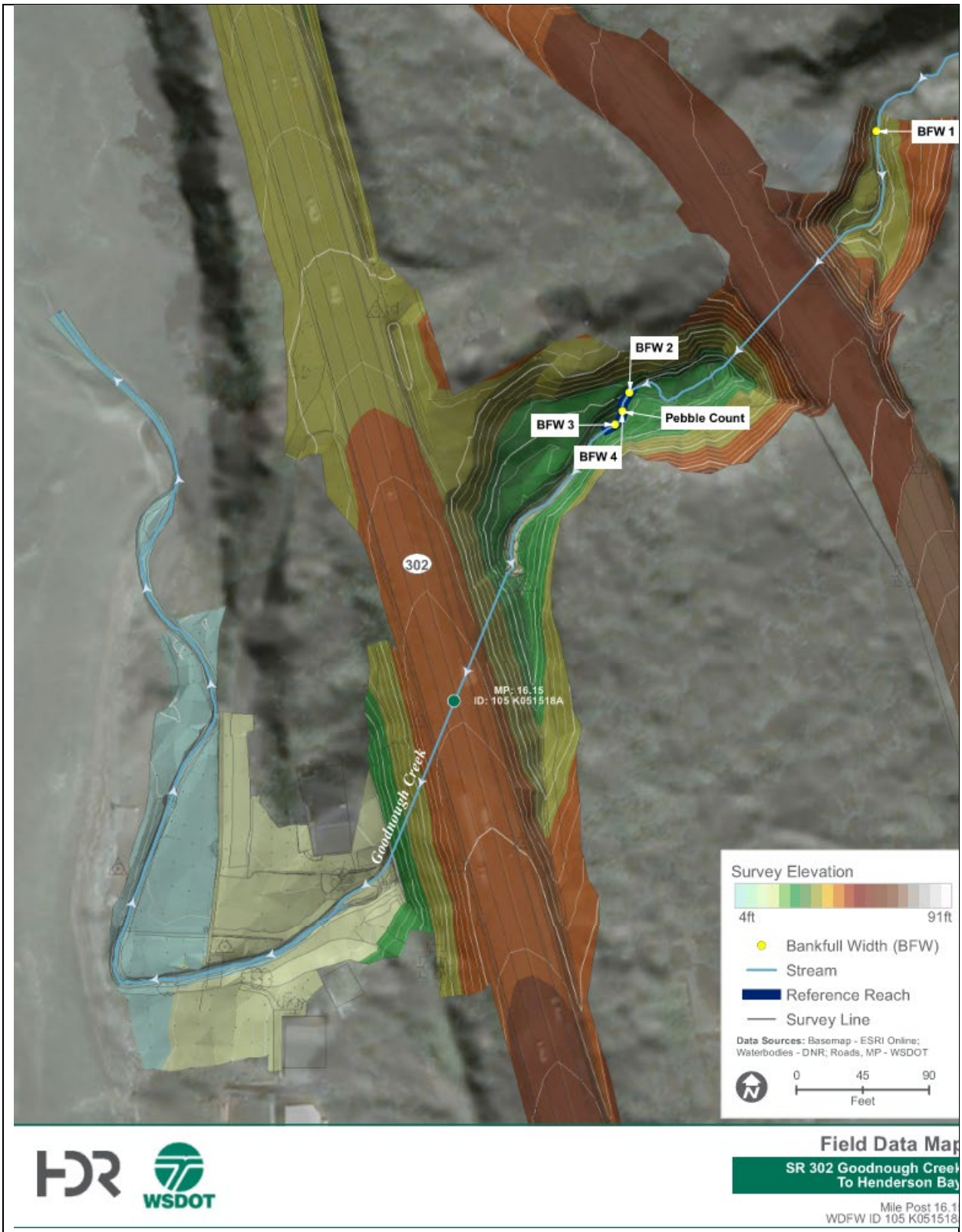

Figure 1: Reference reach, bankfull width, and pebble count locations

Reference Reach:

Describe location, known history, summarize on site discussion, appropriateness, bankfull measurement

The reference reach is located approximately 150 feet upstream of the SR302 culvert, shown in Figure 1 above. The reference reach is downstream of the Goodnough drive culvert influence and upstream of the more confined channel with incised banks that occur downstream of the reference reach. Cross section geometry in the reference reach will be used to inform the channel design. Bankfull widths 2, 3, and 4 were taken within the reference reach and a pebble count was conducted. During the second site visit with WSDOT, WDFW, and the tribes agreed with the reference reach appropriateness. Site conditions of the reference reach where the three bankfull width measurements were taken can be viewed in Figure 12 and Figure 14.

Data Collection:

Describe who was involved, extents collection occurred within

HDR conducted an independent site visit on March 26th, 2021. HDR walked the stream approximately 100 feet upstream of the Goodnough Drive crossing to the downstream end of Goodnough Creek where it enters Henderson Bay. HDR took three bankfull width measurements: one upstream of Goodnough Drive and two upstream of SR302. A pebble count was conducted upstream of the SR302 culvert crossing.

Observations:

Describe site conditions, channel geomorphology, habitat type and location, flow splits, LWM location and quantity, etc.

Upstream of Goodnough Drive

Upstream of the County owned culvert at Goodnough Drive the channel is in a small ravine with accessible floodplains on each bank. The right bank floodplain was developed by the property owner and cleared of most brush with some small bushes and ivy present. The left bank floodplain contained some smaller trees and bushes but was clear of most foliage. A single bankfull width measurement was taken approximately 85 feet upstream of the County culvert to provide a greater insight into the extended Goodnough creek reach (Figure 3). Ultimately, this BFW was not included in the design as it was outside the reference reach and smaller than the two measurements within the reference reach. The slope upstream of the county culvert is approximately 2.5% and the channel flow depth observed at the first bankfull measurement was approximately 17" during the site visit (Figure 4). Further downstream of the first bankfull measurement a small, natural log weir has created a shallow water surface drop. The log weir consists of two logs, one spanning the channel and the other along the left bank (Figure 5**).** Near the entrance of the county culvert on the right bank in the floodplain is a small man-made concrete pond with unknown purpose (FIGURE). The streambed sediment through the upstream reach is a mix of sands, gravels, and a few cobbles(Figure 6 and Figure 7)**.** The county culvert is a 4-foot smooth circular concrete pipe. Roughly five feet into the broken back culvert is an approximate 10-foot elevation drop (Figure 8**).**

Upstream of SR302

Downstream of the county culvert, the creek meanders within a narrow ravine containing trees and light brush (Figure 9). A 4 to 5-foot water surface drop from the exit of the County culvert (Figure 10**)** that has created a large scour pool. The scour pool extends from toe to toe of the ravine. Downstream of the culvert outlet the channel has moderate sinuosity and is single threaded with small accessible floodplains within the confined ravine with a pool riffle morphology (Figure 11).

Above the banks in the floodplain are larger trees and dense brush. Approximately 160 feet upstream of the SR302 culvert, a second bankfull width was taken before a bend in the channel. This bankfull width marks the upstream end of the reference reach (Figure 12**).**

The bankfull channel depth throughout the reference reach is approximately 14 to 24 inches and the slope developed from the long profile from survey data was 1.9 percent. A pebble count consisting of approximately 250 particles was conducted between BFW measurements 2 and 3 (Figure 13**)** and was uniformly graded mix of gravels with some sand and a few cobbles. The largest material observed in the pebble count was roughly 4 inches in diameter. Bankfull width 3 taken 130 feet upstream of the SR302 crossing was collected near the downstream end of the reference reach (Figure 14)**.** The right bank was slightly incised, and the floodplains contained small brush such as ferns with a scattering of large trees.

Downstream of the reference reach the channel becomes more confined and the stream narrows with much less accessible floodplains (Figure 15). Approximately 40 feet upstream of the SR 302 culvert entrance, a large, 2-foot diameter tree with rootwad has fallen and is partially blocking flow along the right bank of the channel(Figure 16). The tree partially broke after hitting another on the left bank and headwall of the culvert entrance (Figure 17). During the second site visit WDFW and WSDOT indicated that the fallen tree should be restored in channel by the contractor after construction. The channel turns left approximately 5 feet downstream of the root ball towards the entrance of the culvert. Before the start of the concrete headwall, rip rap was observed on the right bank protecting the road embankment toe from the channel erosion (Figure 18). The culvert headwall is 5 feet tall on the left side, the right side is parallel to the channel and tapers down from 5 to 2 feet. The culvert is a 4.5-foot smooth, circular concrete pipe (Figure 19). A small baffle on the inside bottom right of the culvert entrance was observed.

Downstream of SR302 and Confluence with Henderson Bay

The downstream outlet of the culvert is partially filled with fine sediment material. Immediately downstream of the culvert is a crib wall retaining the road embankment on the left bank. On the right bank is a small shed that stores the property owner's boat (Figure 20**)** that encroaches on the existing culvert. Further downstream of the culvert the channel material is comprised primarily of gravels. The downstream channel is a well maintained, landscaped, 7-foot-wide stream (Figure 21). The channel is plane bed with a uniform depth and width throughout the two downstream properties until reaching the beach. 150 feet downstream of the culvert exit is a small wooden pedestrian bridge with a 13-inch chord depth (Figure 22). Approximately 60 feet downstream of the pedestrian bridge is a reinforced 90 degree bend right in the channel that prevents the creek from flowing straight into Henderson Bay but through the northern properties lawn (Figure 23). The channel floodplains are grass as it flows through the property owner's lawn for approximately 200 feet (Figure 24). Further downstream, the channel spreads out onto the beach (Figure 25) and finally into Henderson Bay (Figure 26)**.** The downstream reach is tidally influenced but the tidal affect does not extend up to the inlet of the SR302 culvert. The downstream outlet invert of the SR302 culvert is at 13.6-feet and the max king tide elevation observed at the nearest gauge in the same datum was 12.1-feet. At the time of the site visit on March 26th the tide was receding and about to change into flood.

Pebble Counts/Sediment Sampling:

Describe location of sediment sampling and pebble counts if available

A pebble count was conducted to provide an accurate assessment of the streambed sediment distribution throughout the reference reach. The pebble count was conducted in the reference reach and consisted of approximately 250 particles. The sediment size distribution can be seen in Figure 2 and a summary of the particle diameters is provided in Table 2. Figure 13 shows a typical photo of the material found throughout the reference reach. The entire reach investigated during the site assessment had very similar size to the reference reach, with the reach just downstream of the SR 302 similar but lacking the few small cobbles observed upstream. The largest particle observed was approximately 4-inches in diameter within the reference reach and recorded in the pebble count.

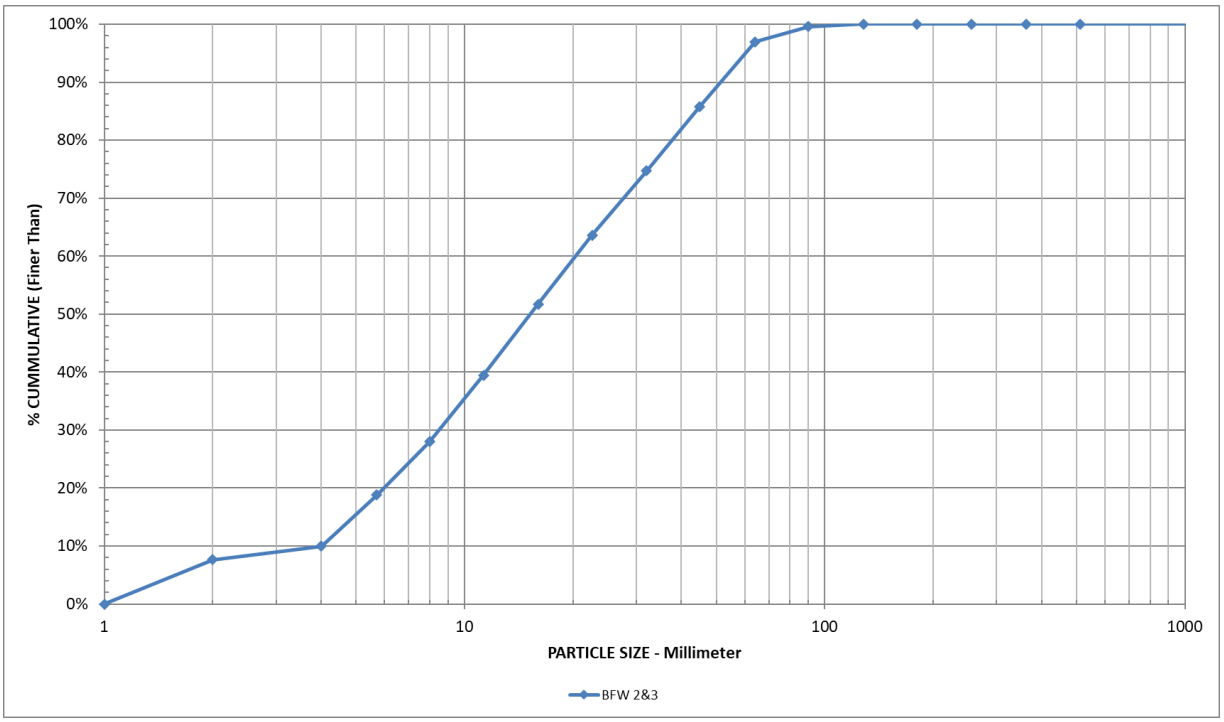

Figure 2: Reference reach sediment size distribution

Table 2: Sediment properties upstream of project crossing

	Reference Reach	
Particle	Diameter (in)	Diameter (mm)
$\mathbf{D_{15}}$	0.2	4.9
$\mathbf{D_{50}}$	0.6	15.2
$\mathbf{D_{84}}$	1.7	42.6
$\mathbf{D_{95}}$	2.4	60.2
$\mathbf{D_{100}}$	5.0	128.0

Photos:

Any relevant photographs listed above

Figure 3: BFW 1 upstream Goodnough Drive at survey extents

Figure 4: Upstream channel looking towards Goodnough Drive

Figure 5: Small drop from log weir and small concrete pond (left side)

Figure 6: Streambed material upstream of Goodnough Drive

Figure 7: Goodnough Drive culvert entrance

Figure 8: Elevation drop midway through Goodnough Drive Culvert

Figure 9: Downstream of Goodnough Drive culvert outlet

Figure 10: Goodnough Drive perched culvert outlet and existing scour hole

Figure 11: Channel sinuosity downstream of culvert

Figure 12: BFW 2

Figure 13: Pebble count substrate

Figure 14: BFW 3 and reference reach

Figure 15: Confined channel downstream of reference reach

Figure 16: LWM in channel

Figure 17: LWM above channel and culvert

Figure 18: Looking upstream at SR302 culvert entrance

Figure 19: SR302 Culvert entrance and headwalls

Figure 20: Downstream SR302 culvert exit

Figure 21: Downstream maintained channel reach

Figure 22: Wooden pedestrian bridge

Figure 23: Reinforced channel bend

Figure 24: Downstream channel through maintained landscaping

Figure 25: Typical channel on beach

Figure 26: Confluence with Henderson Bay

Samples:	
Work within the wetted perimeter may only occur during the time periods authorized in the APP ID 21036 entitled "Allowable Freshwater Work Times May 2018". Work outside of the wetted perimeter may occur year-round. APPS website: https://www.govonlinesaas.com/WA/WDFW/Public/Client/WA_WDFW/Shared/Pages/Main/Login.aspx	
Were any sample(s) collected from below the OHWM?	*No ☒ If no, then stop here.*
	Yes ☐ If yes, then fill out the proceeding section for each sample.

Sample #:	Work Start:	Work End:	Latitude:	Longitude:

Summary/description of location:

Summarize/describe the sample location.

Description of work below the OHWL:

Describe the work below the OHWL, including equipment used and quantity of sediment sampled.

Description of problems encountered:

Describe any problems encountered, such as provision violations, notification, corrective action, and impacts to fish life and water quality from problems that arose.

Bankfull Width Concurrence Meeting:

Describe date and time of BFW concurrence meeting, attendees, any measurements, concurrence or decisions made that help to inform the design. You may have follow up information from this meeting and any follow up may be documented here as well.

A second site visit with HDR, WSDOT, and WDFW was conducted on July 7th, 2021 to gain concurrence on BFWs and other design considerations for Goodnough Creek at SR 302. Squaxin Island Tribe was invited to the site visit but was unable to attend. During the site visit WDFW and WSDOT slightly increased the measurement at BFW 2, agreed with BFW 3, and then added a new measurement at BFW 4. The design average is presented in Table 1. The largest BFW observed during the site visit was 13 feet. One additional BFW was recorded during the site visit in the reference reach. WDFW concurred on pebble count classification and the decision to only take one pebble count between the two crossings.

HDR raised the concern with not being able to meet the slope ratio with the proposed design due to the constraint with the upstream county culvert. The natural channel slope may be closer to the 3.6% upstream of Goodnough Drive shown in the long profile but the best available reference reach within the accessible project site is 2.0% between the WSDOT culvert and upstream County culvert. It was discussed that extending the grading limits all the way to the outlet of the County's Goodnough drive culvert would have minimal changes the design slope. It was discussed in the field that if that was the case the preference would be to shorten the grading limits to decrease impacts to the existing riparian corridor. WDFW agreed with the approach and acknowledged the slope ratio issues and constraints with the county culvert.

The downstream crib wall and property was discussed during the site visit with WSDOT and WDFW. Any structure that replaces the existing culvert will likely have impacts to the downstream property owner and those will be coordinated as the project progresses.

The large tree that fell and broke on top of the existing SR302 culvert inlet should be replaced in the channel when construction is complete.