UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
WASHINGTON STATE

DESIGN REPORT
(Re: National Engineering Manual Title 210, Par. 501.06.b)

PROJECT : *Mill Creek Fish Barrier Removal*
LOCATION : *Chelan County (SW1/4 SE1/4 SEC.6, T23N, R18E)*
PRACTICES: *NRCS-PS-396, Fish Passage*
NRCS-PS-582, Open Channel
NRCS-PS-560, Access Road
NRCS-PS-580, Streambank Protection
NRCS-PS-584, Channel Stabilization
JOB CLASS : *V*
DATE : *June 14, 2013*

INTRODUCTION:

This report presents a summary of the hydrology, hydraulic, geotechnical, and structural methodologies, computations, evaluations, and assumptions developed for the design of a 42 foot clear span bridge to replace a 5.2’ wide by 4.1’ high concrete box culvert that is 40 feet long.

United States Bureau of Reclamation (USBR) personnel performed a Culvert Barrier Assessment using Washington Department of Fish and Wildlife’s (WDFW’s) *Fish Passage Barrier and Surface Water Diversion Screening and Prioritization Manual Level A Method* and determined that the existing culvert is 33% passable (Appendix A).

This project will remove the fish passage barrier and will provide passage for ESA listed fish and other aquatic organisms to reconnect approximately 2.2 miles of perennial stream habitat.

The completion of this project will address Tier 4 habitat restoration as recommended in the Biological Strategy (UCRTT 2008) and Recovery Plan (UCSRB 2007) for Peshastin Creek.

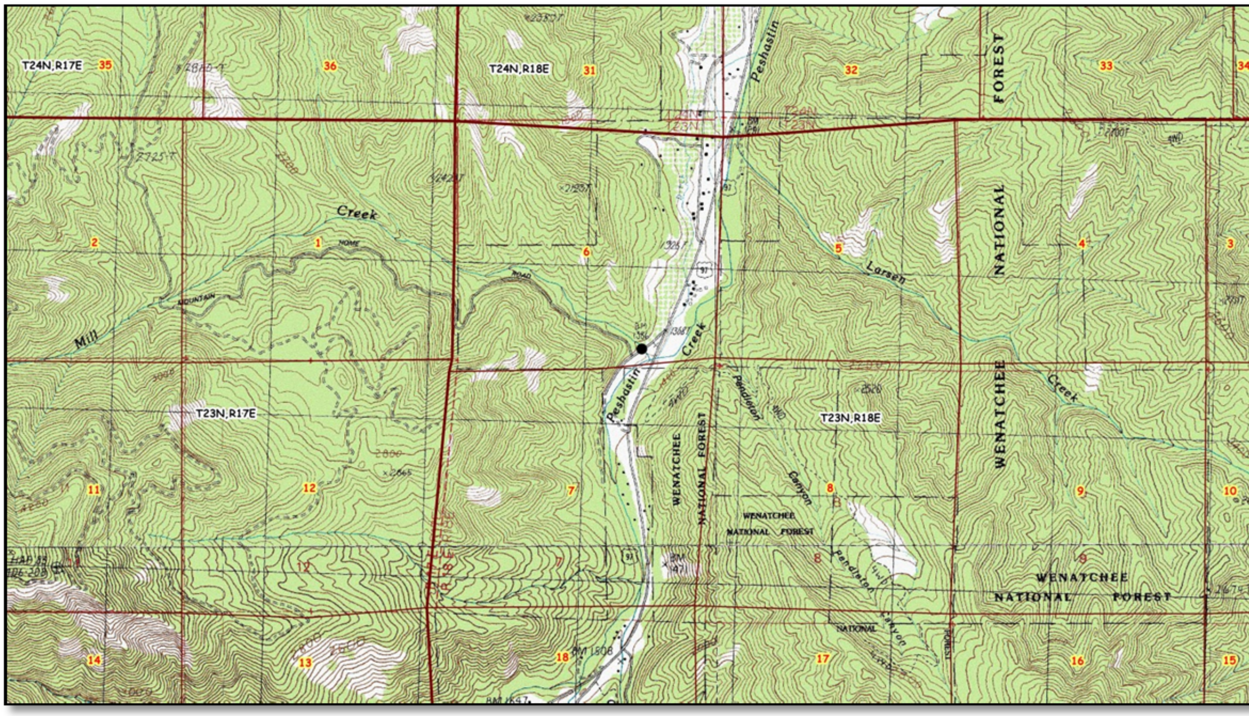
Chelan County has secured funding in the amount of $317,890 ($218,890 SRFB and $99,000 USFWS) for construction.

The USFWS/NRCS Habitat Restoration Team (HRT) will provide the design, permit review assistance, and construction observation. The Chelan County Natural Resources Department (CCNRD) will provide construction management. CNRD will direct the permitting process, pre-project implementation and effectiveness monitoring and general project management. Construction will take place sometime during the 2013 in-stream work window (July 15 – September 30). The Chelan County Public Works Department (CCPWD) will accept the bridge as part of the county transportation system.

PROJECT DESCRIPTION:

This project consists of replacing a concrete box culvert with a bridge where Mountain Home Road intersects Mill Creek.

The project is primarily on Chelan County Right of Way (Mountain Home Road) with a small portion of the temporary impacts being on the adjacent Smith property.



DESIGN OBJECTIVE:

The objective of this project is to provide passage for aquatic organisms in Mill Creek at the intersection of Mountain Home Road that complies with existing criteria established by the Chelan County Public Works Department and the Natural Resources Conservation Service.

The design utilizes the Stream Simulation design approach for fish passage at road/stream crossings as described by the WDFW (Washington State Department of Fish and Wildlife 2003), National Marine Fisheries Service (National Marine Fisheries Service July 2011), and the USDA Forest Service (USDA Forest Service 2008). Stream simulation is based on the principle that, if fish can migrate through the natural channel, they can also migrate through a man-made channel that simulates it (WDFW 2011).

THREATENED AND ENDANGERED SPECIES:

The reconnection of habitat as proposed by this project will benefit the following Threatened and Endangered listed species:

- Upper Columbia River spring Chinook salmon (Oncorhynchus tshawytscha)
- Upper Columbia River steelhead (Oncorhynchus mykiss)
- Columbia River bull trout (Salvelinus confluentus)

BASIS FOR DESIGN:

- AASHTO, 2002. “*Standard Specifications for Highway Bridges*”, 17th Edition.
- Chelan County Code, December 2012. “*Development Stanadards*”, Chapter 15.30. Chelan County, Washington.
- USDI Bureau of Reclamation, November 2006. Engineering Survey.
- GEO-SLOPE, November 2008. “*Stability Modeling with SLOPE/W*”, 2007 Version.
- National Marine Fisheries Service, July 2011. “*Anadromous Salmonid Passage Facility Design*”, Northwest Region, NMFS, Portland, Oregon.
- Puget Sound Lidar Consortium, 2009. “*2009 USGS Wenatchee LiDAR Project*”, Bare Earth – 3 ft raster resolution.
- Rosgen, Dave,. 1996. “*Applied River Morphology*,” Wildland Hydrology.
- Sumioka, S.S., D.L. Kresch and K.D. Kasnick, 1998. “*Magnitude and Frequency of Floods in Washington*” US Geological Survey, Water-Resources Investigation Report 97-4277.
- Upper Columbia Salmon Recovery Board, August 2007. “*Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan*”.
- Upper Columbia Regional Technical Team, 2008. “*A Biological Strategy to Protect and Restore Salmonid Habitat in the Upper Columbia Region*”.
- US Army Corps of Engineers, January 2010. “*HEC-RAS River Analysis System, User’s Manual, Version 4.1*”.
- US Army Corps of Engineers, January 2010. “*HEC-RAS River Analysis System, Hydraulic Reference Manual, Version 4.1*”.
- USDA Forest Service, National Technology and Development Program, August 2008. “*Stream Simulation: An Ecological Approach to Providing Passage for Aquatic Organisms at Road-Stream Crossings*”.
- USDA Natural Resources Conservation Service, August 2007. National Engineering Handbook Part 654, “*Stream Restoration Design Handbook*”.
- USDA Natural Resources Conservation Service, Web Soil Survey.
- USDOT Federal Highway Administration, September 2009. Hydraulic Engineering Circular No. 23, “*Bridge Scour and Stream Instability Countermeasures: Experience, Selection, and Design Guidance – Third Edition*”, Volumes 1 and 2.
- USGS Hazards Science Center, National Earthquake Hazards Reduction Program, “*2008 NSHMP PSHA Interactive Deaggregation (Beta)*”.
- Washington State Department of Fish and Wildlife, 2003. “*Design of Road Culverts for Fish Passage*”.
- Washington State Department of Fish and Wildlife, November 2011. “*Water Crossing Design Guidelines*”, 2nd Draft.
- Washington State Department of Transportation, August 2002. “*Culvert Design Flows for Fish Passage and Structural Safety in East Cascade and Blue Mountain Streams*”. Research Report WA-RD 545.2.
- Washington State Department of Transportation, 2012. “Standard Specifications for Road, Bridge, and Municipal Construction”.

GENERAL BASIC DATA:

The project site is located within the Wenatchee River Watershed (WRIA 45) at RM 0.1 on Mill Creek. The mouth of Mill Creek is at RM 5.2 on Peshastin Creek. The site has a drainage area of 5.4 square miles. The site is located at an elevation of approximately 1400 feet with a mean annual precipitation of 26.9 inches.

PROJECT LAYOUT:

The existing 5.2' wide by 4.1' high concrete box culvert is 40 feet long. There is an approximate 2.5 foot vertical drop at the outlet of the existing culvert.

Existing Culvert Inlet (9/26/2012)

Existing Culvert Outlet (9/26/2012)

Mountain Home Road looking southwest (9/26/2012)

A two-step design approach is used to develop a road crossing of the stream at this site that will meet fish passage criteria utilizing the Stream Simulation design approach.

- The first step consists of designing a re-graded stream channel (assuming the removal of the existing road and culvert). This re-graded channel is designed using the streambed simulation design method based on channel geometry and channel bed material in the adjacent reference reach.

- The second step consists of designing a new road crossing over the re-graded stream channel that maintains streambed simulation design method elements.

ENGINEERING SURVEY:

An engineering survey, including longitudinal profile and cross sections, was completed by the USBR in November 2006. The longitudinal profile was 840 feet long and surveyed the existing stream thalweg. This profile extends 610 feet upstream of the inlet to the existing culvert and 190 feet downstream from the outlet of the existing culvert. Cross sections of the channel (30 each) were surveyed along the stream channel profile. The survey points were imported into AutoCAD Civil3D and a surface model of the stream channel was created. Another surface model of the project area was created using LiDAR data from the 2009 USGS Wenatchee LiDAR Project. A composite surface model for design was created from the stream channel and LiDAR surface models.

HYDROLOGY:

Two design discharge frequency values were used.

- The stream channel geometry was based on the estimated bankfull discharge. The bankfull discharge is assumed to be at the 1.5-year frequency.
- The structural integrity and debris passage were evaluated based on the estimated 100-year frequency peak discharge.

Peak flow discharges for the 2-year frequency, 25-year frequency, and the 100-year frequency were estimated using the USGS Regression Equation (Sumioka 1998) and the WSDOT Regression Equation (Washington State Department of Transportation 2002). A regression analysis Excel spreadsheet was used to estimate the peak discharge at the 1.5-year frequency. Calculated peak flow values are presented in Table 1.

Table 1		
	Regression Equation	
Frequency (Yr)	WSDOT (cfs)	USGS (cfs)
1.5	32	18
2	34	30
10	-	69
25	94	91
50	-	109
100	137	128

There is no historic flow data for Mill Creek however the CCNRD has been monitoring stream flows in Mill Creek since July 2011 (Peshastin Tributary Monitoring, M. Shales, CCNRD, January 6th, 2012). A 2012 peak flow measurement of 25.8 cfs was measured on 4/24/2012. There was a slightly higher than normal snowpack for the 2011-2012 water year.

Both methods used to estimate peak flows are regression based. There is a greater level of confidence with the WSDOT method since the standard error for this equation is between 5% and 16% compared to 82% to 92% with the USGS method. The water surface elevations modeled using 32 cfs as the bankfull discharge also corresponds to bankfull indicators observed in the field. The results based on the WSDOT regression equation will be used for design since 1) it has a much lower standard error, 2) it is comparable to the measure 2012 peak flow, and 3) it corresponds to bankfull indicators observed in the field. The selected design peak flow values for the site are shown in Table 2.

Table 2	
Frequency (Yr)	Flow (cfs)
1.5	32
100	137

GEOMORPHOLOGY:

Two different sites were selected having “Reference Reach” conditions; Stations 14+75 and 17+52. The average hydraulic geometry values of the reference reach cross sections at bankfull discharge were calculated and are shown in Table 3.

Table 3		
Item	Value	Unit
Bankfull Area	5.9	sq.ft.
Bankfull Width	7.7	ft.
Mean Depth	0.8	ft.
Width to Depth Ratio	9.6	
Maximum Depth	1.2	ft.
Dmax/Dave	1.4	
Entrenchment Ratio	1.4	

A Wolman pebble count was conducted at Station 14+75. A total of 103 particles were measured with an average size (D50) of 33.5 mm. The results are shown in Table 4 and Figure 1.

Table 4							
Percent Less Than (mm)	% Type	Material	Size Range (mm) low	Size Range (mm) high	Total #	Item %	% Cumulative
	0%	Silt/Clay	0	0.062		0%	0%
D16: 1.292	18% Sand	Very Fine	0.062	0.125		0%	0%
		Fine	0.125	0.25	12	12%	12%
D35: 12.9		Medium	0.25	0.50		0%	12%
		Coarse	0.50	1.0	3	3%	15%
D50: 33.5		Very Coarse	1.0	2	4	4%	18%
	47% Gravel	Very Fine	2	4		0%	18%
D84: 160		Fine	4	5.7	5	5%	23%
		Fine	5.7	8	3	3%	26%
D95: 448		Medium	8	11.3	6	6%	32%
		Medium	11.3	16	8	8%	40%
		Coarse	16	22.6		0%	40%
		Coarse	22.6	32	9	9%	49%
		Very Coarse	32	45	11	11%	59%
		Very Coarse	45	64	6	6%	65%
	25% Cobble	Small	64	90	8	8%	73%
		Small	90	128	7	7%	80%
		Large	128	180	7	7%	86%
		Large	180	256	4	4%	90%
	9% Boulder	Small	256	362	3	3%	93%
		Small	362	512	3	3%	96%
		Medium	512	1024	2	2%	95%
		Large-Very Large	1024	2048	1	1%	96%
	1%	Bedrock	2048	3000	1	1%	97%
				Total Particle Count:	103		

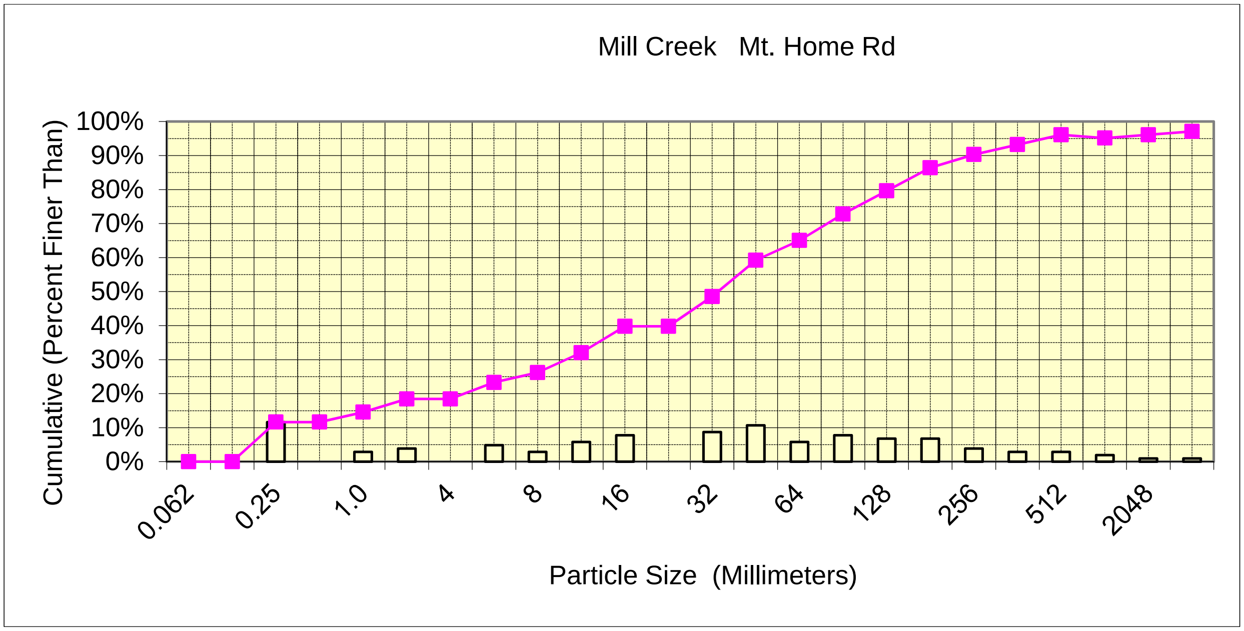


Figure 1

The channel is a B4a (Rosgen) stream class based on the hydraulic geometry, gradient and particle distribution. B4 stream types "*normally develop in stable alluvial fans, colluvial deposits, and structurally controlled drainage ways. The channel bed morphology is dominated by gravel material and characterized as a series of rapids with irregular spaced scour pools*" (Rosgen, 1996). The B4a stream type has the characteristics of a B4 channel except that the gradient exceeds 4%.

Reference Reach – STA 17+52

HYDRAULICS:

HEC-RAS was used to evaluate the surveyed longitudinal stream profile with the existing conditions (box culvert and road prism; Figure 2) and with the proposed conditions (proposed channel re-grade and bridge; Figure 3). (Appendix C).

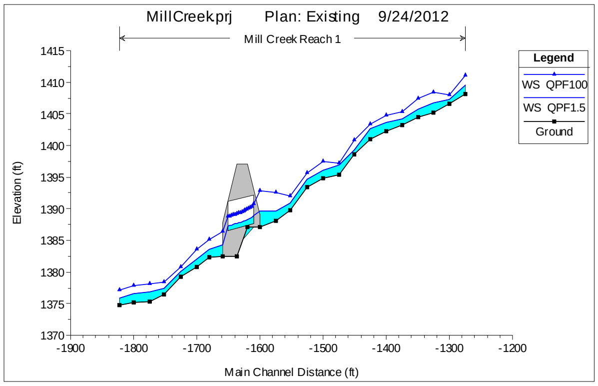


Figure 2

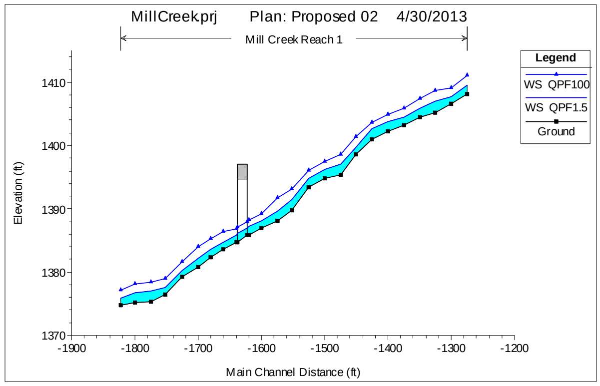


Figure 3

Manning's "n" value for the channel was calculated by the Relative Roughness (d/D_{84}) method which is used in the Steam Simulation Excel spreadsheet developed by Dean Renner (based on Rosgen, 1996). A Manning's "n" value of 0.063 was calculated for the channel. A Manning's "n" value of 0.080 was estimated for the overbank regions that are well vegetated with trees and shrubs.

Velocity and shear stress values calculated in the proposed channel re-grade with the proposed bridge installed are within the range of values calculated in the reference reaches.

CHANNEL DESIGN:

The channel design is evaluated in three components which include stream channel geometry, the streambed material, and the rock riprap on the bridge abutment slopes.

The proposed channel re-grade reach profile length and grade was determined from the surveyed longitudinal profile. The proposed slope is 0.055 ft/ft and the length is 100 feet (Station 15+75 to 16+75). The proposed slope is what is assumed to have been the original channel slope prior to the installation of the culvert. There is a very slight adjustment to the channel alignment in the re-grade reach.

The average hydraulic geometry values from the reference reach, and the morphological description of a Rosgen stream class B4a channel were used to determine the following constructed cross section for the channel re-grade reach. The "Bed Width" is the minimum culvert bed width for stream simulation criteria, or the sum of the bankfull width plus a bankfull bench on each side of the channel for an open channel or bridge opening. The Stream Simulation Excel spreadsheet developed by Dean Renner was used for these computations. The selected channel geometry is shown in Table 4. The design bankfull width (8.5') is slightly greater than the measured reference reach average bankfull width (7.7'). The increased design width results from using a design width/depth ratio of 12 rather than the reference width/depth ratio of 9.6. A width/depth ratio of 12 is at the lower range for a typical B4a stream type.

Table 4		
Item	Value	Unit
Bankfull Width	8.5	ft
Bottom Width	2.8	ft
Maximum Depth	1.1	ft
Side Slopes	3:1	
Bankfull Area	6.0	sq ft
Mean Depth	0.7	ft
Width to Depth Ratio	12	
Dmax/Dave	1.5	
Bed Width	11.2	ft
Flood Prone Width	11.9	ft
Entrenchment Ratio	1.4	

HEC-RAS was used to evaluate the surveyed longitudinal stream profile with the proposed channel re-grade and with the existing culvert and road removed. For the bankfull discharge the channel velocity and the channel shear stress in the reference reach were compared with the proposed re-graded reach as shown in Table 5.

Table 5			
Location	Profile Station	Bankfull	
		Channel Velocity	Channel Shear Stress
	ft	fps	psf
Reference Reaches	14+75	3.2	1.1
	17+52	5.0	3.2
New Channel	16+00	4.8	2.8
	16+30 US	4.3	2.3
	16+30 DS	3.1	1.1
	16+60	4.6	2.5

HEC-RAS was used to evaluate the surveyed longitudinal stream profile with the proposed channel re-grade and with a proposed bridge for the road crossing of the stream. The proposed bridge has a 42 foot clear-span between the abutment footings and a 2:1 (H:V) slope on the abutments. The abutment footings are set back 3 feet from the edge of the slope. For the bankfull discharge and the 100-year discharge the channel velocity and the channel shear stress in the reference reaches were compared with the proposed re-graded reach with the bridge as shown in Table 6.

Velocities and shear stress values calculated in the proposed channel re-grade with the proposed bridge installed are within the range of velocities and shear stress values calculated in the reference reaches.

Table 6						
Location	Profile Station	Bankfull		100-Year		
		Channel Velocity	Channel Shear Stress	Channel Velocity	Channel Shear Stress
	ft	fps	psf	fps	psf
Reference Reaches	14+75	3.2	1.1	5.5	2.6
	17+52	5.0	3.2	7.8	5.9
New Channel	16+00	4.8	2.8	7.3	4.9
	16+30 US	4.3	2.3	5.5	2.9
	16+30 DS	3.1	1.1	4.5	1.8
	16+60	4.6	2.5	5.1	2.2

The existing streambed is hardened with large boulders and appears to be very stable (excluding immediately upstream and downstream of the culvert). The streambed in the re-graded channel reach is proposed to be the in-place material following the channel excavation. Stability will be increased by adding large boulders found during excavation to act as key pieces to add stability to the stream bed. It is assumed from the longitudinal stream profile that the culvert was installed on top of the old streambed and that much of the old streambed material still exists below the existing culvert. The measured D_{84} particle size from the Wolman pebble count at the reference reach was 160 mm (6.3 in.). The proposed streambed material will be similar in size and distribution with the existing reference reach streambed material and is shown in Table 7. The gradation was determined using the distribution relationship shown in "Design of Road Culverts for Fish Passage" (WDFW, 2011) and is based as a function of D_{84}. Approximately 15 boulders within the size range of 16" to 36" will also be included in the streambed material to simulate the boulder erratic's of the existing streambed. These boulders will be placed as directed in the field by the engineer and/or the USFWS personnel.

Streambed material size was also calculated by the following three methods; Critical Shear Stress, Unit-Discharge Bed Deisign, and Paleohydraulic Analysis (WDFW "*Design of Road Culverts for Fish Passage*"). The "Stream Bed Design" Excel spreadsheet developed by Dean Renner was used for these computations. All three methods produced wide range of D_{84} particle sizes from a low of 102 mm (4 in.) to a high of 591 mm (23.3 in). None of these calculated methods were used due to the large variability.

Table 7	
Streambed Gradation	
Percent Passing	Diameter
D_{10}	#200
D_{16}	0.75"
D_{50}	2.5"
D_{84}	6.3"
D_{100}	15.8"

The riprap for the bridge abutment was sized according to "*HEC No. 23, Design Guideline 14, Rock Riprap at Bridge Abutments*" (USDOT Federal Highway Administration 2009). The riprap section thickness was determined to be 24 inches and the gradation is Class III and is shown in Table 8.

Table 8		
Riprap Gradation		
Percent Passing	Lower (in.)	Upper (in.)
D_{15}	7.3	10.5
D_{50}	11.5	14
D_{85}	15.5	18.5
D_{100}		24

BRIDGE SCOUR:

Scour was analyzed using HEC RAS modeling results based on FHWA No. 18 methods. Only the 100-year discharge was analyzed to predict maximum scour. Total scour potential consists of general aggradation/degradation, contraction, and abutment scour with this bridge design (no pier scour). In this reach Mill Creek is very stable and no severe aggradation/degradation is observed and general scour is assumed to be minimal. Flows from the 100-year discharge do not reach the elevation at which the abutments are located; therefore there is no scour due to the abutments. Potential scour at this site is assumed to be limited to only contraction scour. A D_{50} of 33.5 mm was utilized to predict whether live bed or clear water scour conditions exist. The predicted total (contraction) scour depth at this site is 0.25 feet.

SOIL MECHANICS:

The USDA Web Soil Survey indicates that the site is located on the Burnscreek stony sandy loam soil series which has a Unified Class of SM and GM. The parent material for this soil series is described as Alluvium and the landform is described as Terraces and Alluvial fans.

A geotechnical exploration utilizing the NRCS mobile drill rig was planned for this site. However upon reviewing the conditions at the site the NRCS geologist determined that a geotechnical exploration was not warranted due to the stable boulder/sand/silt complex of the in-situ soils, streambank, and channel.

Slope stability was initially analyzed using GEO-SLOPE SLOPE/W 2007 stability modeling software. However after consultation with an NRCS Soil Mechanics Engineer (Fort Worth, TX) the Meyerhof method (NRCS NEH Part 654, Technical Supplement 14Q, "*Abutment Design for Small Bridges*") was selected for design. This is because SLOPE/W assumes that the entire uniform load will be transferred to the slope side. In actuality only half of the load is transferred to the slope side while the other half of the load is transferred to the non-slope side. The Meyerhof method accounts for the true distribution of loads. The SLOPE/W method may be used however it will yield results approximately one-half to that calculated by the Meyerhof method.

Soil bearing capacity was analyzed using the procedure contained in "Technical Supplement 14Q, *Abutment Design for Small Bridges*" (NRCS, 2007). The Meyerhof method was used for the analysis. The same in-situ soil was used as in the slope stability analysis. This boulder/sand/silt complex soil is assumed to have properties somewhere between rock riprap and silty gravel (GM). This cohesionless material is assumed to have a dry unit weight of 140 pcf and an angle of internal friction of 40 degrees. The footing is placed on grade (zero depth), has a width of 3 feet, and is set back 3 feet from the edge of the slope. The ultimate bearing capacity is calculated to be 9,744 psf. The allowable bearing capacity is 3,248 psf with a factor of safety of 3. The actual total load (live and dead loads) from the bridge is calculated to be 3,072 psf. The actual load is less than the allowable therefore the design is okay with respect to soil bearing.

According to the 2008 seismic hazard mapping by the USGS National Earthquake Hazards Reduction Program (NEHRP) the site has a 10% probability in 50 years of experiencing peak ground acceleration (pga) of 0.32 g assuming an average shear-wave velocity in the top 30 meters of 270 meters per second, NEHRP Site Class D (Figure 4).

Figure 4 shows an image of NEHRP peak ground acceleration estimate based on 2008 deaggregation model for 10% PE in 50 years and a shear-wave velocity in the upper 30 meters of 270 meters per second.

The site has a low potential for failure by liquefaction due to the firm to compact relative density of the boulder/sand/silt complex soil and moderate depth to water table. Failure would most likely occur through differential settlement of the foundation and/or rotational /slump failure of the abutment slope.

A note has been added to the O&M Plan recommending inspection of the structure following earthquakes greater than magnitude 5.0.

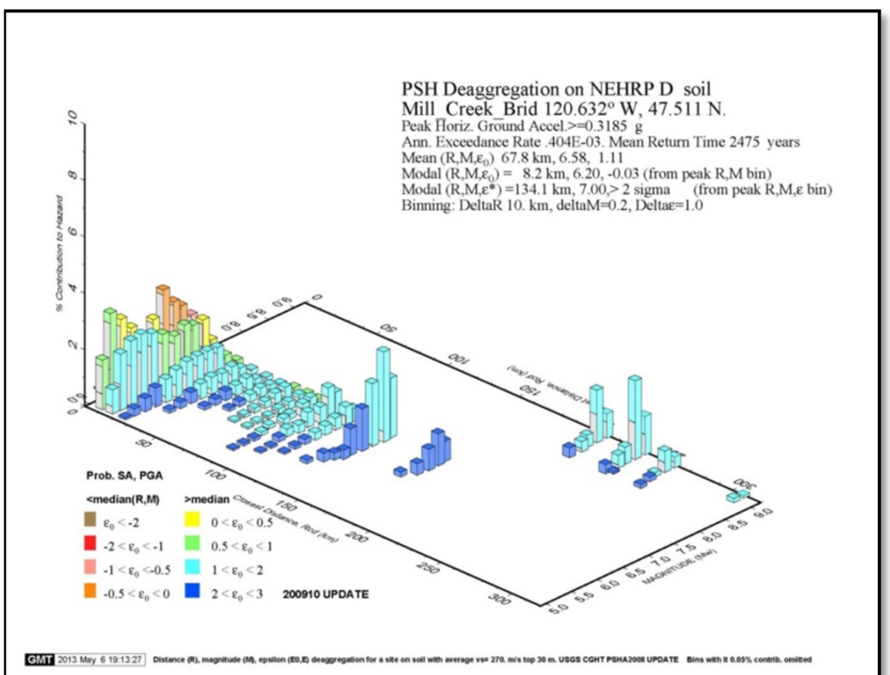


Figure 4

BRIDGE STRUCTURAL DESIGN:

The contracted bridge manufacturer shall be responsible for designing, supplying, and installing a bridge structure and abutment footings meeting the dimension requirements identified in the plans and specifications. The contracted bridge manufacturer shall submit to the contracting agency (CCNRD) and the engineer, documentation demonstrating that the bridge deck and abutment footings are designed to withstand AASHTO HL-93 loading and meet the requirements of the Chelan County Design Standards. The documentation shall be provided to the contracting agency and the engineer at least 35 days prior to installation of the bridge at the project site and shall include drawings of the bridge deck and abutment footings, supporting computations for designed loading, and maximum total end reactions at the abutment footings. All of which shall be stamped by a structural engineer licensed in the state of Washington.

The sales engineer at Central Premix Prestress (Spokane, WA) stated that the maximum total end reactions from AASHTO HS25-44 loading is approximately the same as the maximum total end reactions from AASHTO HL-93 loading. For design planning purposes, the abutment footing design is based on the AASHTO HS25-44 loading. These calculations will then be checked with anticipated AASHTO HL-93 loading that will be supplied by the bridge manufacturer. If necessary, the abutment footing area will be increased if the AASHTO HL-93 loadings produce a q_{actual} greater than the $q_{allowable}$.

BRIDGE SAFETY:

The bridge will have impact rated guard rails (T-101 or equivalent) to provide safety to vehicular traffic. There will be 37.5 feet of Type 4 guardrail (WSDOT Standard Plan C-1 and C-3a) which includes 25 feet of non-flared terminal (WSDOT Standard Plan C-4e) on the traffic approach side of the bridge. There will be 18.75 feet of Type 4 guardrail (WSDOT Standard Plan C3a) which includes 6.25 feet of Type 1 anchor (WSDOT Standard Plan C-6). The guardrail installation and material will be in accordance to WSDOT Standard Specification 9-16 “Fence and Guardrail”. All guardrail beams will have a “weathered” finish.

Flexible guideposts will be installed on the guardrail mount at all four corners of the bridge deck (WSDOT Standard Plan M-40.10.02). The flexible guideposts will be installed in accordance to WSDOT Standard Specification 8-10 “Guide Posts” and will meet the material requirements of WSDOT Standard Specification 9-17 “Flexible Guide Posts”.

PEMANENT ROAD DESIGN:

The Chelan County Development Standards Standard Plan PW-9 (Rural Local Access Class 2) is used as the road section design for Mountain Home Road. Crushed surfacing base course will be placed to final grade in accordance to WSDOT Standard Specification 4-04 in the reconstructed section of road. The base course material will meet the material quality requirements of WSDOT Standard Specification 9-03.9(3). Hot mix asphalt will be installed sometime after construction is complete on this project by the Chelan County Public Works road crew.

TEMPORARY DETOUR ROAD DESIGN:

The temporary detour road will have a 10 foot wide single-lane driving width. The road material is composed of a minimum of 6” of WSDOT Base Course which is placed on a non-woven geotextile. The Contractor will be responsible for designing, supplying, installing and removing a bridge structure and abutment footings meeting the dimension requirements identified in the plans and specifications. The Contractor will submit to the contracting agency (CCNRD) and the engineer, documentation demonstrating that the bridge deck and abutment footings are designed to withstand 75% of AASHTO HL-93 loading and meet the requirements of the Chelan County Design Standards. The documentation shall be provided to the contracting agency and the engineer at least 35 days prior to installation of the bridge at the project site and shall include drawings of the bridge deck and abutment footings, supporting computations for designed loading, and maximum total end reactions at the abutment footings. All of which shall be stamped by a structural engineer licensed in the state of Washington.

ENVIRONMENTAL CONSIDERATIONS:

The following is a list of some of the permits that may be required:

- SEPA (Chelan County)
- Shoreline Permit (Chelan County)
- Cultural Resources (SHPO)
- JARPA (WDFW, DOE, COE)
- ESA Consultation (NOAA Fisheries, USFWS)

ENGINEER’S COST ESTIMATE:

An engineer’s cost estimate has been prepared for this project (Appendix E).

CONSTRUCTION DRAWINGS:

Site specific construction drawings have been prepared using AutoCAD Civil 3D 2012 (Appendix F).

CONSTRUCTION AND MATERIAL SPECIFICATIONS:

The NRCS Standard Construction and Material Specifications are used for this design and installation (Appendix G).

INSPECTION PLAN:

An Inspection Plan has been prepared for this installation. The plan assigns the inspector, and identifies construction items where inspection is required (Appendix H).

OPERATION AND MAINTENANCE PLAN:

A site specific Operation and Maintenance plan has been prepared for this structure and appurtenances (Appendix I).

AUTHORITY:

Prepared by:__________________________________Date: 7-11-13________
Joseph M. Lange, CE

Reviewed by______Kelly Scott,________________________Date: 7-2013________
Design Engineer, Spokane SO

LAWRENCE JOHNSON

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Approved by:_______________________________________Date:____________
Lawrence A Johnson, SCE