Subreach 2 - Realignment Preferred Option/Scenario 2D

Option 2D is a blend of options 2B and 2C, and is the preferred scenario. This alternative was developed based upon review of historic site conditions. It aims to restore the historic stream channel sinuosity present in this reach of Nason Creek. LIDAR review and the 1949 aerial photograph depict mainstem stream channel meanders near RM 13.3-13.65. Figure 44 depicts inundation modeling results from flows in Nason Creek, however, much of this floodplain area is already inundated during the 2 year event from tributary flows and the existing wetland. Therefore, the floodplain surface water connection will be even larger than depicted.

Option 2D would leave levees in place upstream of RM 13.65 and restore the stream channel similar to what is proposed in option 2B; rehabilitate stream channel cross-section and construct low amplitude meanders within the confines of the existing stream corridor. The lower 1,500 feet (between RM 13.3–13.65) would remove levees and reconstruct a new channel to the north of the existing channel similar to option 2C (see figure 41 on page 59). Option 2D could also include installation of new culverts under the railroad prism at RM 13.5 and 14.1, reconnecting and converting the historic stream channel into a side channel. Option 2D would involve the following actions: partial levee removal (RM 13.3–13.65), stream channel meander and floodplain reconstruction, off-channel wetland reconnection and creation, large wood restoration, riparian restoration. For a plan view of option 2D, see figure 47.

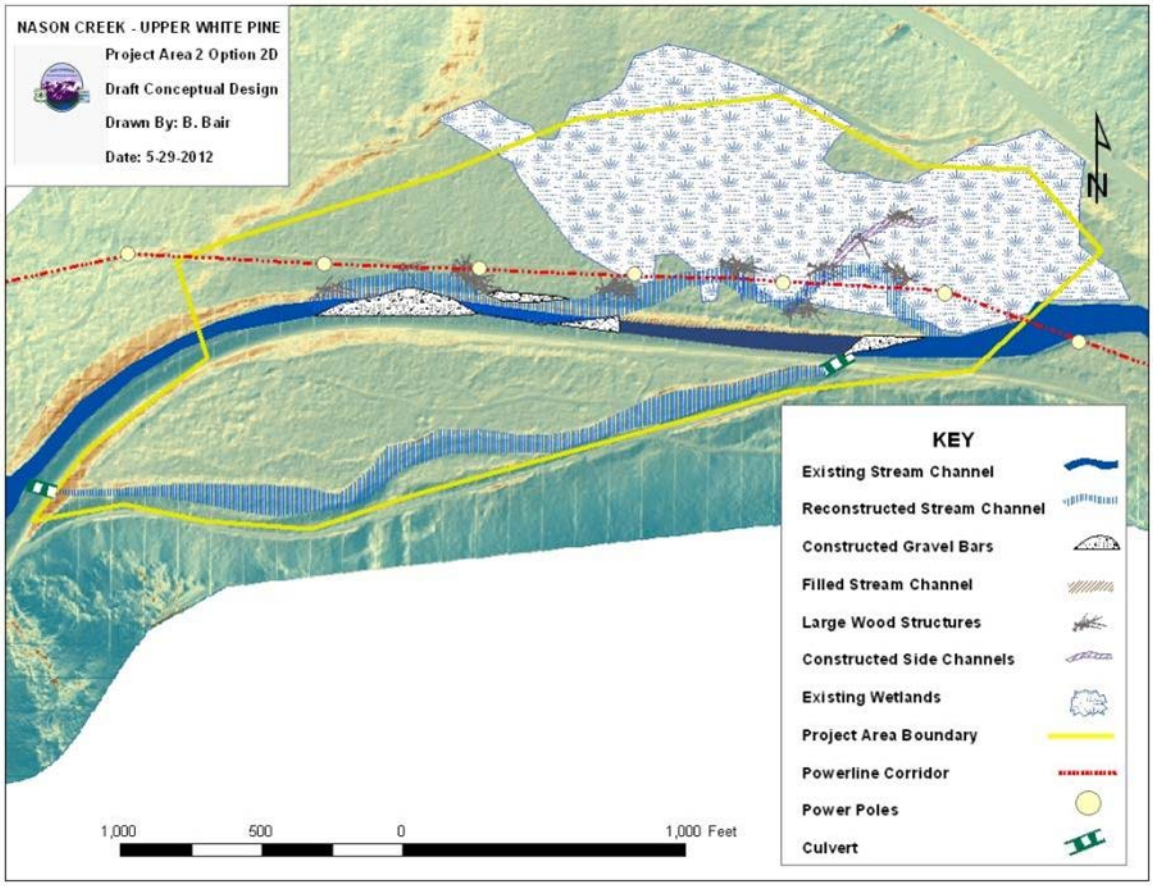

Figure 47. Conceptual design for option 2D (Nason Creek, RM 14.0 – 13.4)

Approximately 19,000 cubic yards of material would be excavated to remove the levee between RM 13.3 to 13.65. Depending on the level of floodplain connection, between 14,500 and 23,000 cubic yards of fill would be placed to fill the existing channel and to construct meanders and rehabilitate stream channel cross-section geometry within the existing stream corridor. Approximately 15,000 to 20,000 cubic yards of material would be excavated to construct the new stream channel.

Table 7. Changes to stream channel geometry, large woody material quantity, pool numbers and spawning volume after implementation of option 2D

Design Attributes	Existing Condition	Condition after Option 2D Implementation
Entrenchment Ratio	1.0	3 one year
Meander Beltwidth (ft.)	NA	150-600 one year
Meander Wavelength(ft.)	NA	500-1,000 one year
Sinuosity Range	1	1.1-1.2 one year
Thalweg Slope	1.1% Upper - 0.5% Lower*	1.0% Upper- 0.5% Lower* one year
Average Bankfull Width (ft.)	98	125 one year
Bankfull Average Depth (ft.)	2.6	3.4 one year
Average Bank Full Width/Depth Ratio	38	37 one year
Residual Maximum Pool/Scour Depth	4.4	5-6 one year
Average Low Flow Width (ft.)	56	38 one year
Average Low Flow Depth (ft.)	0.6	2.4 one year
Average Low Flow Width/Depth Ratio	93	16 one year
LWM (Key Pieces >36" in Diameter) pieces	0	12 one year
LWM (12"-35" in Diameter) pieces	4	29 one year
LWM (<12" in Diameter) cubic yards	198	711 one year
Pools	1	7 one year
Spawning Area (Square Yds.)	485	1,375 one year

Partial levee removal and stream channel reconstruction would restore the second greatest amount of flood prone area of all project area 2 options. Option 2D would increase the flood prone area from 6 acres to 28 acres at the Q2 discharge, 11 acres to 43 acres at the Q10 discharge, 21 acres to 49 acres at the Q50 discharge and 36 acres to 57acres at the Q100. Entrenchment ratios (flood prone width/bankfull width) from1.0 to 3, sinuosity would be increased from 1.0 to 1.2. Similar to option 2C, 1.8 acres of wetland habitat would be reconnected and an additional one acre of new wetlands would also be constructed.

Fish habitat would also be improved by increasing pools would be from 1 to 7, increasing spawning area from 485 square yards to 1,375 square yards and restoring large wood levels to greater than 50 trees per mile.

Without relocating the powerline corridor, riparian restoration would be limited in increasing the effective riparian area from 16 acres to 20 acres. Floodplain large wood levels would be restored to reference conditions that would also provide protection for pioneer and planted riparian vegetation during peak flow events.

The cost range for option 2D is $560,000 to $850,000 (cost estimates exclude installation of culverts). The estimated cost range does not include protection, removal or relocation of specific power poles. Option 2D is included in the preferred scenario description.

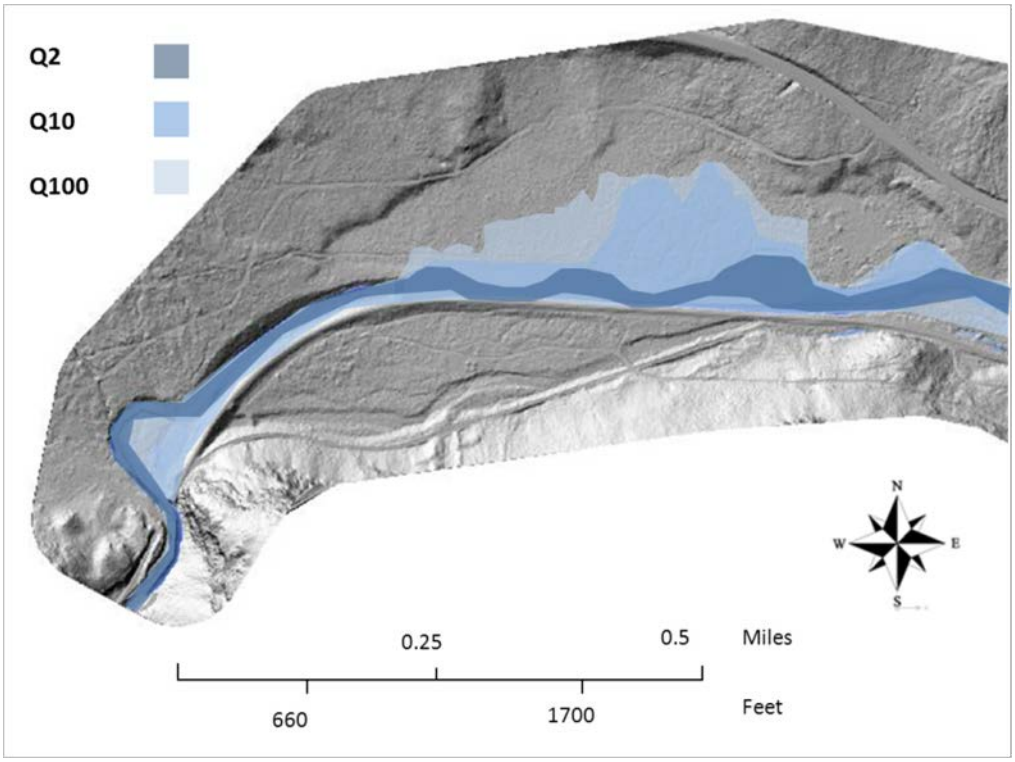

Figure 48. HEC RAS inundation mapping for the 2-, 10-, and 100-year flood events after stream channel cross-section rehabilitation and meander construction along the existing stream corridor in subreach 2

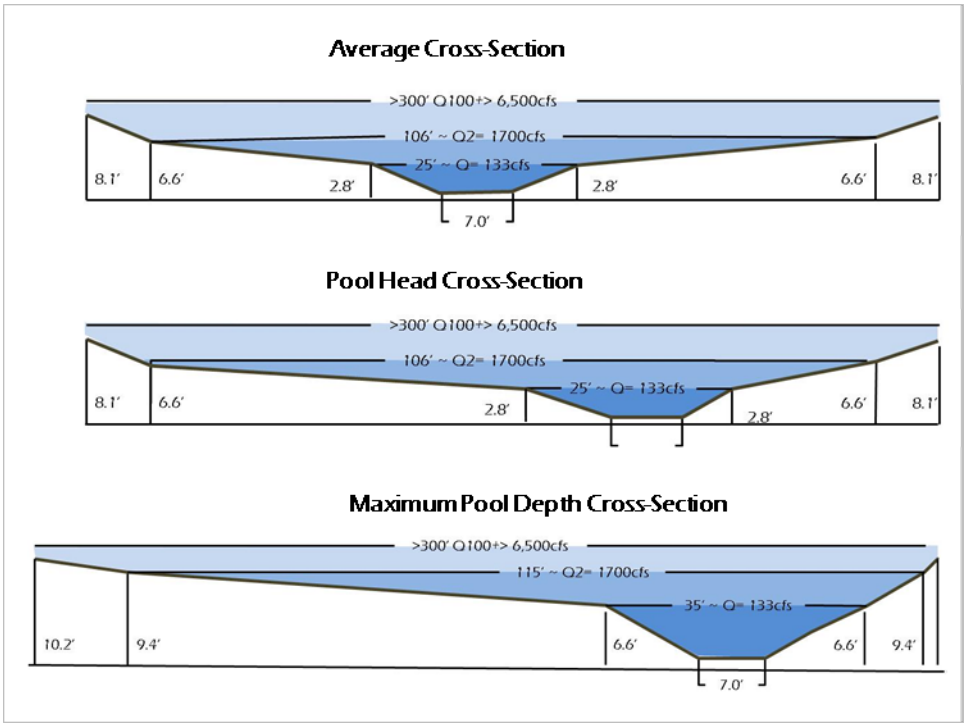

Figure 49. Average, pool head, and maximum pool depth cross section dimensions to be implemented for the stream channel and meander construction restoration action

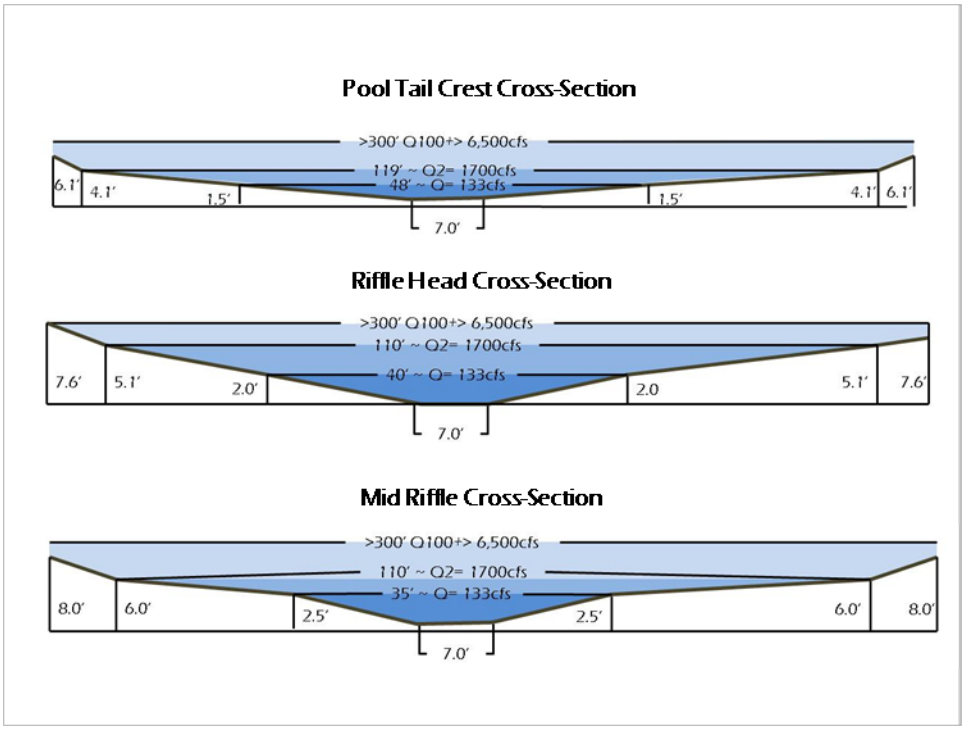

Figure 50. Pool tail crest, riffle head, and mid riffle cross section dimensions to be implemented for the stream channel and meander construction restoration action

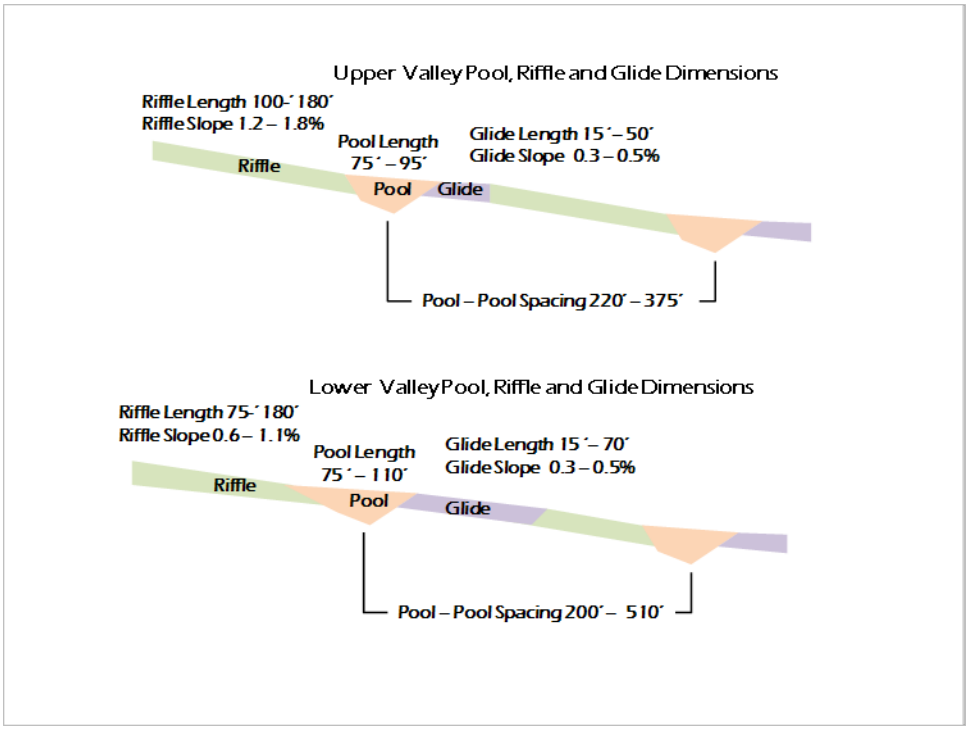

Figure 51. Proposed riffle, pool, and glide dimension for the stream channel reconstruction restoration action proposed in subreach 2

Subreach 3 Realignment

This project element involves two realignment options within subreach 3 that would shift the channel away from the armored banks along U.S. Highway 2. Realignment option 1 would involve a slight shift of the channel just enough to remove the influence of the armored banks. Realignment option 2 is a more aggressive approach that would shift the channel further from the highway. These are described below.

Subreach 3 - Realignment Option 1

This action includes moving the channel away from the highway embankment in subreach 3 (figure 52). The channel currently abuts the highway at two locations at the northern extents of the two meanders near RM 12.8 and 13. This action would shift the channel to the south approximately 50 feet at both locations in order to: (1) move the channel off of the existing riprap banks at these locations, (2) create a forested riparian and floodplain buffer (long term), and (3) enhance margin habitat complexity through placement of meander bend logjams. These actions would be expected to enhance cover for rearing juvenile salmon and steelhead on 500 lineal feet of channel and to enhance long-term riparian functions including wood recruitment, shade, and bank stability. The new channel would approximate the location of the early 1980s alignment as observed in the aerial photo record. The channel would be moved just enough to establish an adequate riparian buffer (~50 feet) but would retain existing high quality habitat that now exists within these meander bends, including pool-riffle habitat and a large meander bend logjam along the river-left bank near RM 12.95.

The new floodplain surface would be set at an elevation to overtop between a 1 and 2-year return interval flood event and would be planted with native riparian vegetation including deciduous and coniferous species. The existing riprap would remain in place and would not be altered other than

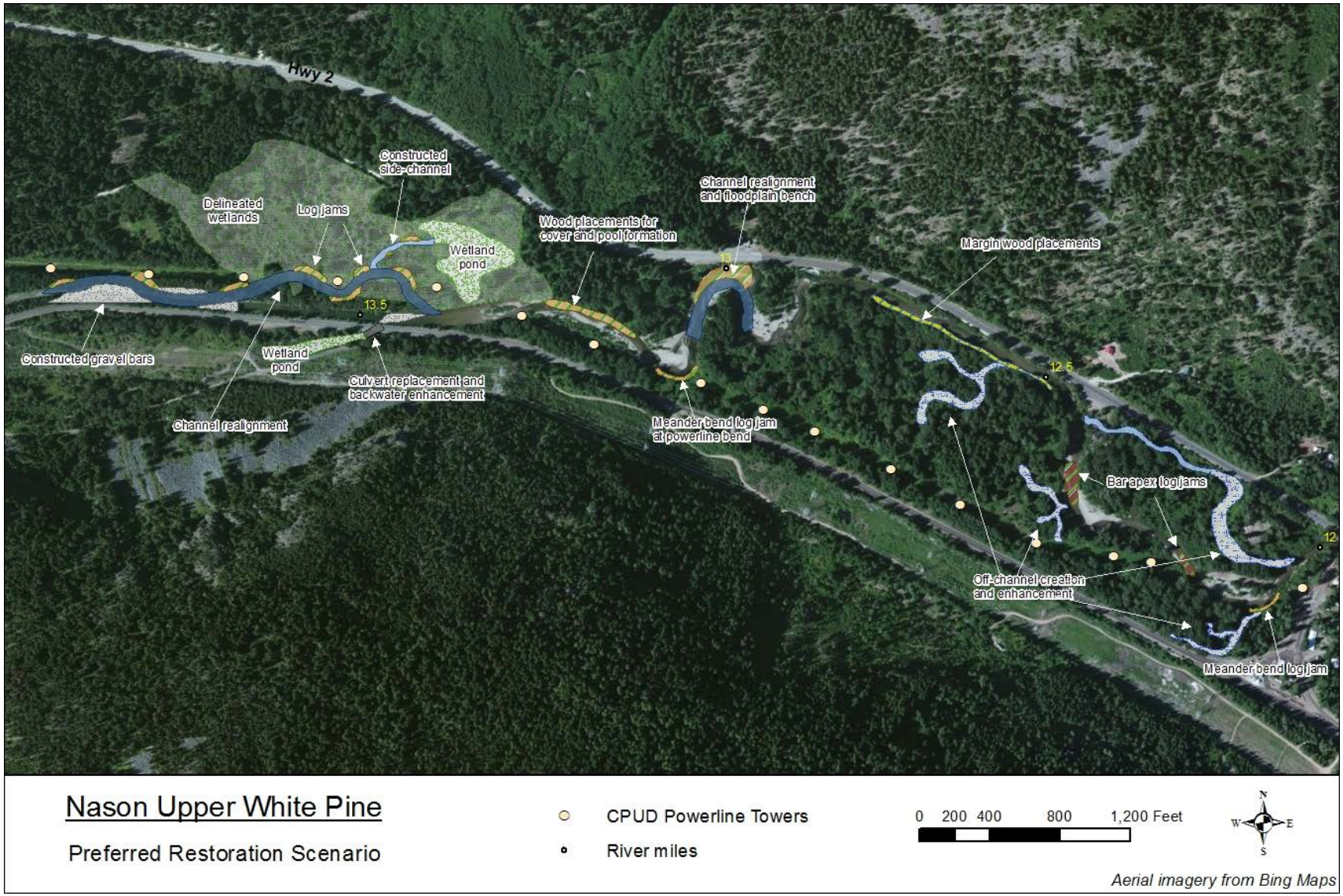

Figure 58. Preferred restoration scenario for the Upper White Pine Reach. Note: wetlands have not been delineated for subreaches 3-5.

Table 9. Elements included within the preferred scenario, including scenario options,* by subreach

Scenario	Subreach				
	1	2	3	4	5
Preferred Scenario (Subreach 2 Option D)	None	• Channel raise and rehabilitation of cross-sections and pool-riffle-glide sequences (RM 13.85-13.65) – leave levee • Levee removal (13.65-13.3) and channel realignment (includes powerline reconfiguration) • Modify or install new culvert for off-channel enhancement at RM 13.5 (right bank)	• Wood placements RM 13.2 - 13.3 • Meander bend logjam at CPUD powerlines (RM 13.15) • Channel realign option 1 (except only at RM 13 bend)	• Margin wood placement • Off-channel habitat creation and enhancement	• Bar apex and meander bend logjams • Off-channel habitat creation and enhancement
Subreach 1 Option A	Instream enhancement via LWD placement				
Subreach 2 Option A		Levee breach near RM 13.6			
Subreach 2 Option B		Levee removal (13.85-13.3) with channel raise and rehabilitation of cross-sections and pool-riffle-glide sequences (no realignment - channel remains in existing corridor); and full relocation of powerlines.			
Subreach 2 Option C		Levee removal (13.85-13.3) with full stream channel realignment; full relocation of powerlines.			
Subreach 2 Option E		Instream enhancement via LWD and boulder placement			
Subreach 3 Option A			Channel realign at RM 12.8 meander bend		
Subreach 3 Option B			Channel realign option 2 (to 1949 location)		
Subreach 4 Option A				Lateral structures along U.S. Highway 2	

*Option 2C was dropped from further consideration