

Patterson Creek – RKM 6.3 – 6.5 - Accelerated Wood Recruitment Project - Phase II
Watershed and Treatment Site Characteristics

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A proposed treatment reach in Patterson Creek (RKM 6.3 – 6.5) with approximately 800 ft of main channel and a 400 ft side channel was analyzed to develop a concept for the second phase of the Patterson Creek Accelerated Wood Recruitment Project.

The watershed area and basin characteristics for the Patterson Creek – Accelerated Wood Recruitment Project - Phase II were generated in the USGS StreamStats application (<https://water.usgs.gov/osw/streamstats/>) (Map 1). The watershed area for the project site is approximately 11.8 sq miles with 24.6% of the basin above 6000 ft elevation. The mean annual precipitation for the basin is 42.3 inches.

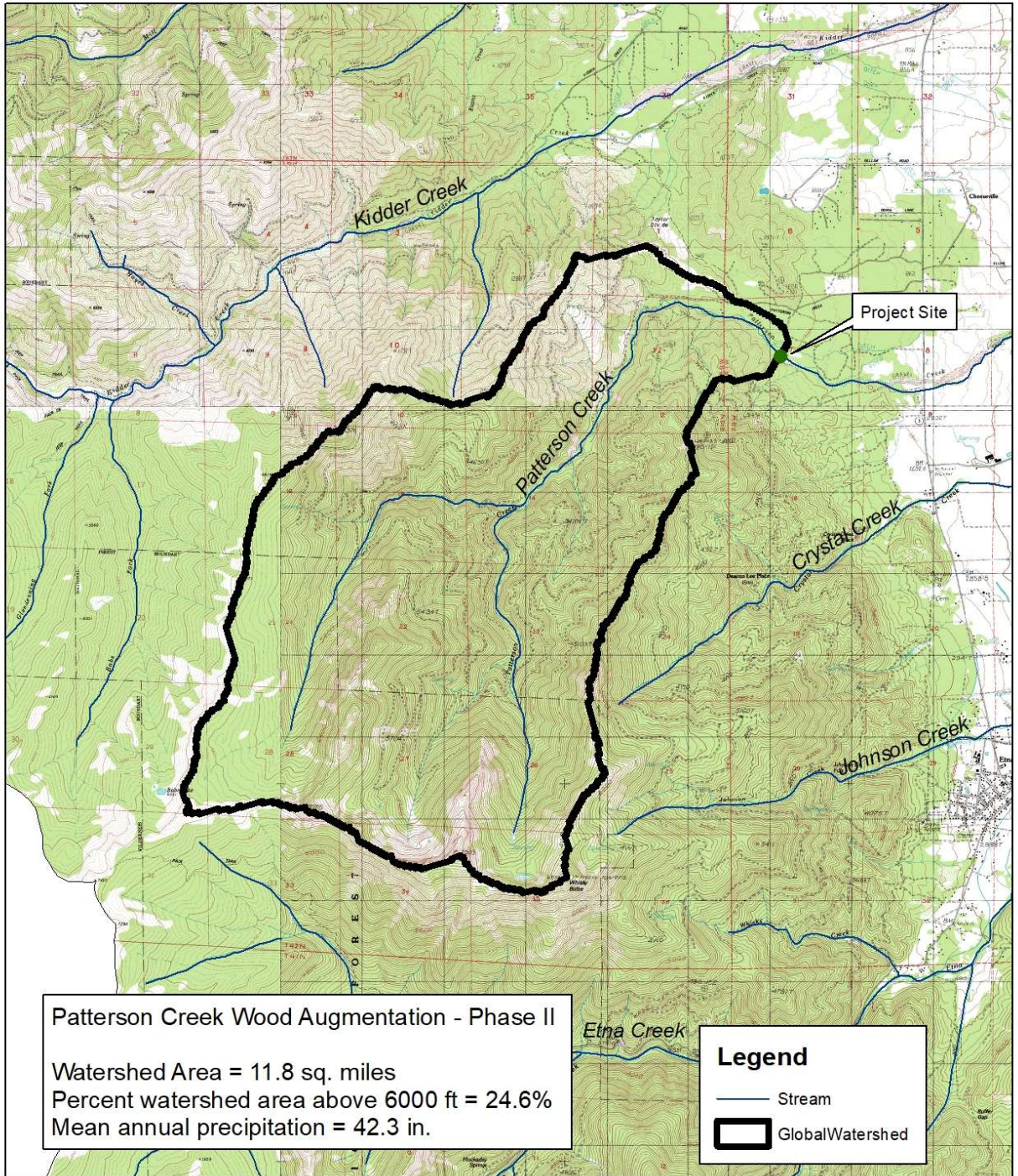
A peak-flow statistics flow report was generated in the StreamStats application for the basin (Gotvald et al., 2012). The estimated flow (cfs) for multiple recurrence intervals and the Prediction Interval lower (PIl), Prediction Interval upper (Plu) and Standard Error of prediction (SEp) are illustrated in Table 1.

Statistic	Value (cfs)	PIl (cfs)	Plu (cfs)	SEp
2 Yr	673	276	1640	58.6
5 Yr	1300	624	2730	47.4
10 Yr	1760	874	3540	44.2
25 Yr	2360	1210	4610	42.7
50 Yr	2820	1440	5520	42.7
100 Yr	3300	1650	6610	44.3
200 Yr	3750	1870	7530	44.4
500 Yr	4360	2120	8960	46

Table 1 – Peak-flow statistics flow report – USGS StreamStats (Gotvald et al., 2012)

A series of cross sections and longitudinal profiles of the main channel and side channel in the treatment reach were calculated from the 2010 lidar bare earth DEM in ArcGIS (Map 2). The longitudinal profiles for the main channel (Figure 1) and side channel (Figure 2) have a gradient of 2.2% and 2.8%, respectively. The seven cross sections illustrate the relative elevation of the stream beds in the main channel and side channel and the banks and terraces of Patterson Creek (Figures 3 – 9).

Patterson Creek Accelerated Wood Recruitment Project - Phase II Watershed Area

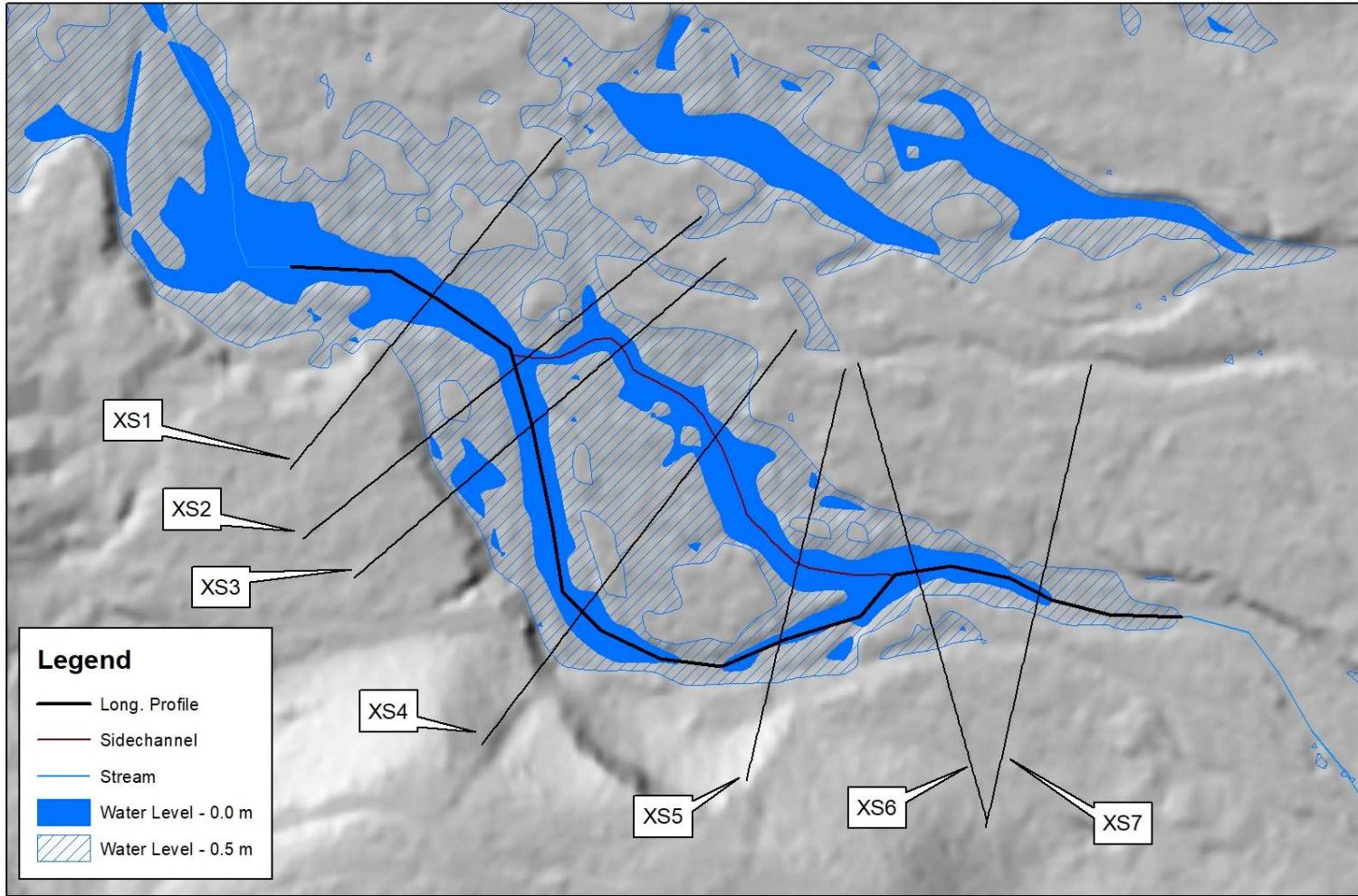


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Map 1 - Patterson Creek Wood Augmentation – Phase II – Watershed area and basin characteristics

Patterson Creek - RKM 6.3 - 6.5 Accelerated Wood Loading & Floodplain Enhancement Project



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Map 2 – Longitudinal Profiles and Cross Sections – Patterson Creek – RKM 6.3 – 6.5

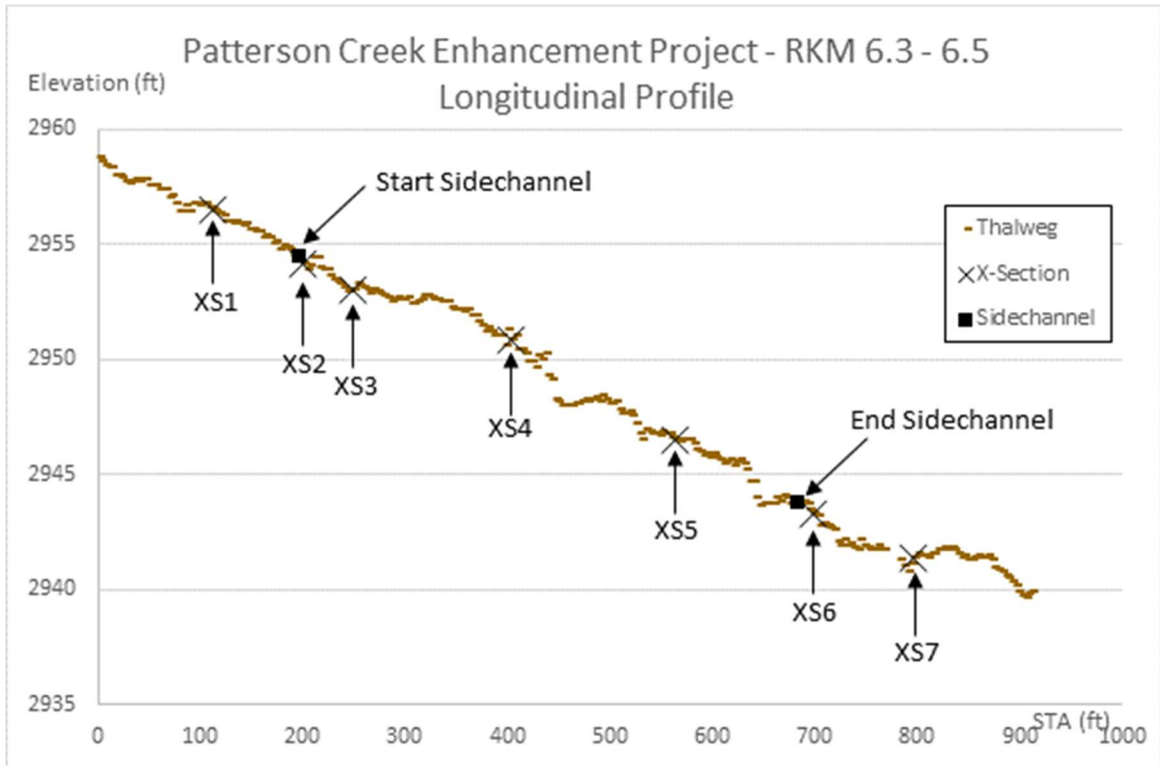


Figure 1 – Longitudinal Profile of Patterson Creek – Slope = 2.2%

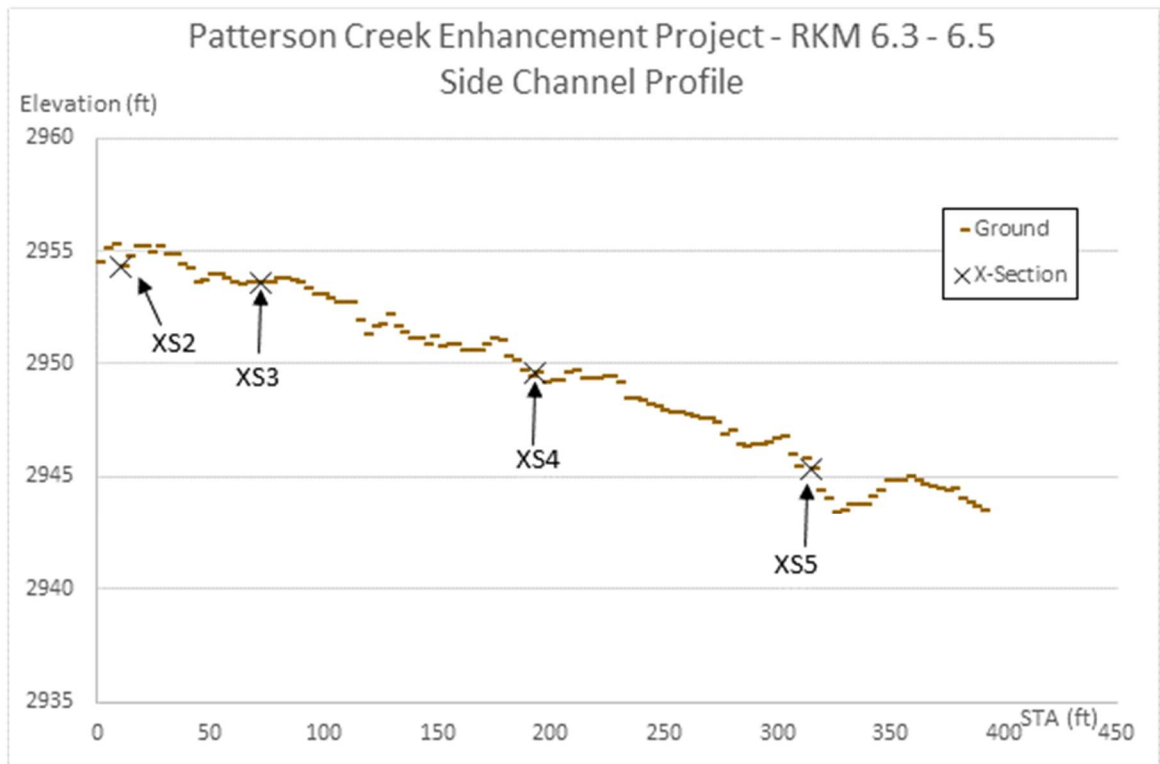


Figure 2 – Longitudinal Profile of Patterson Creek side channel – Slope = 2.8%

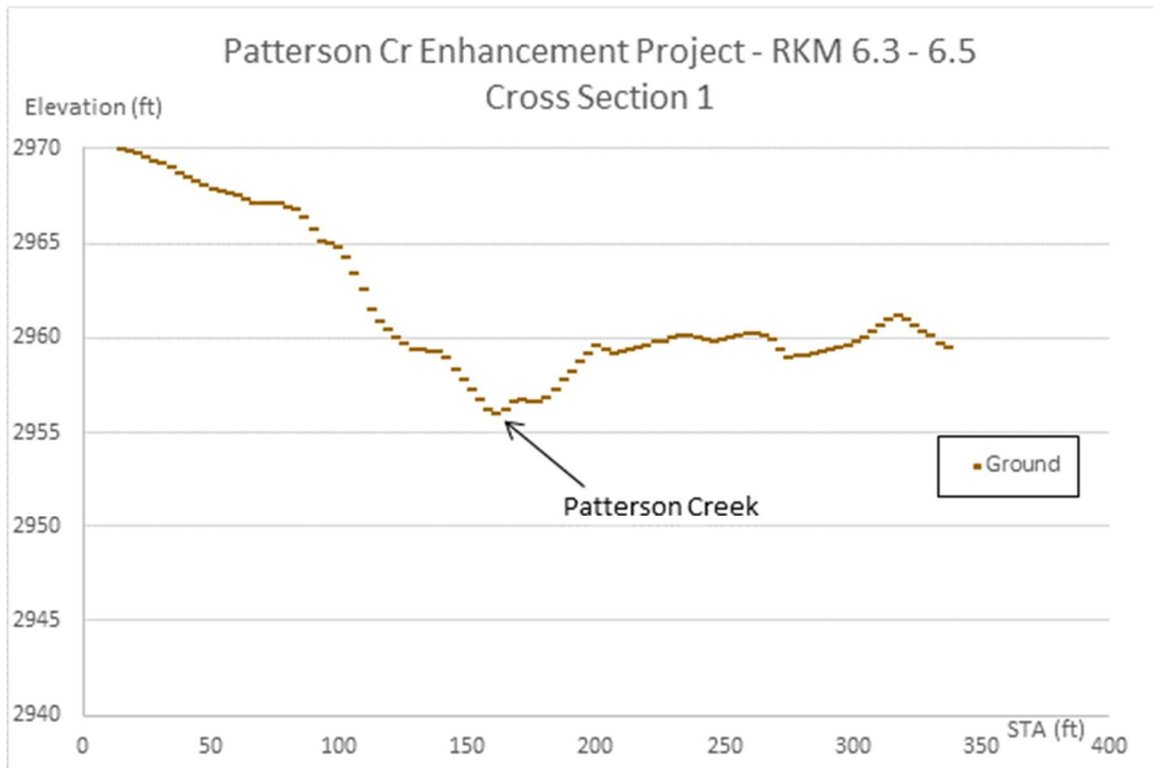


Figure 3 – Cross Section 1

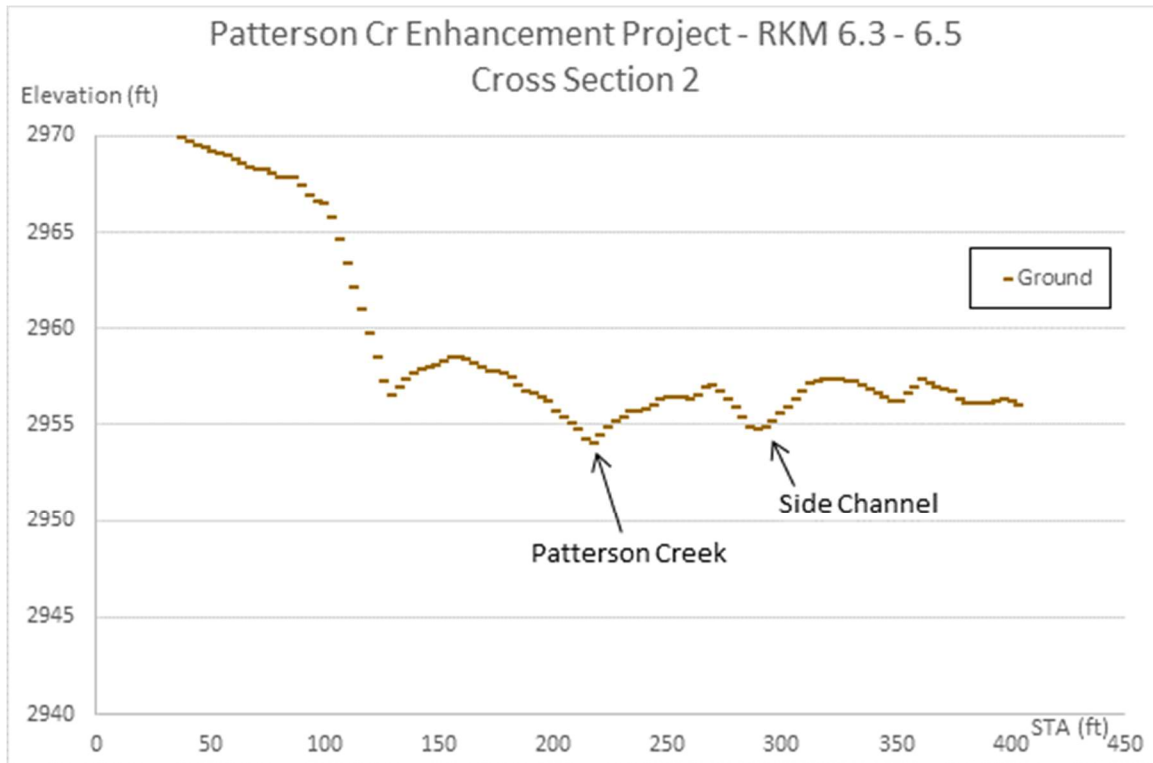


Figure 4 – Cross Section 2

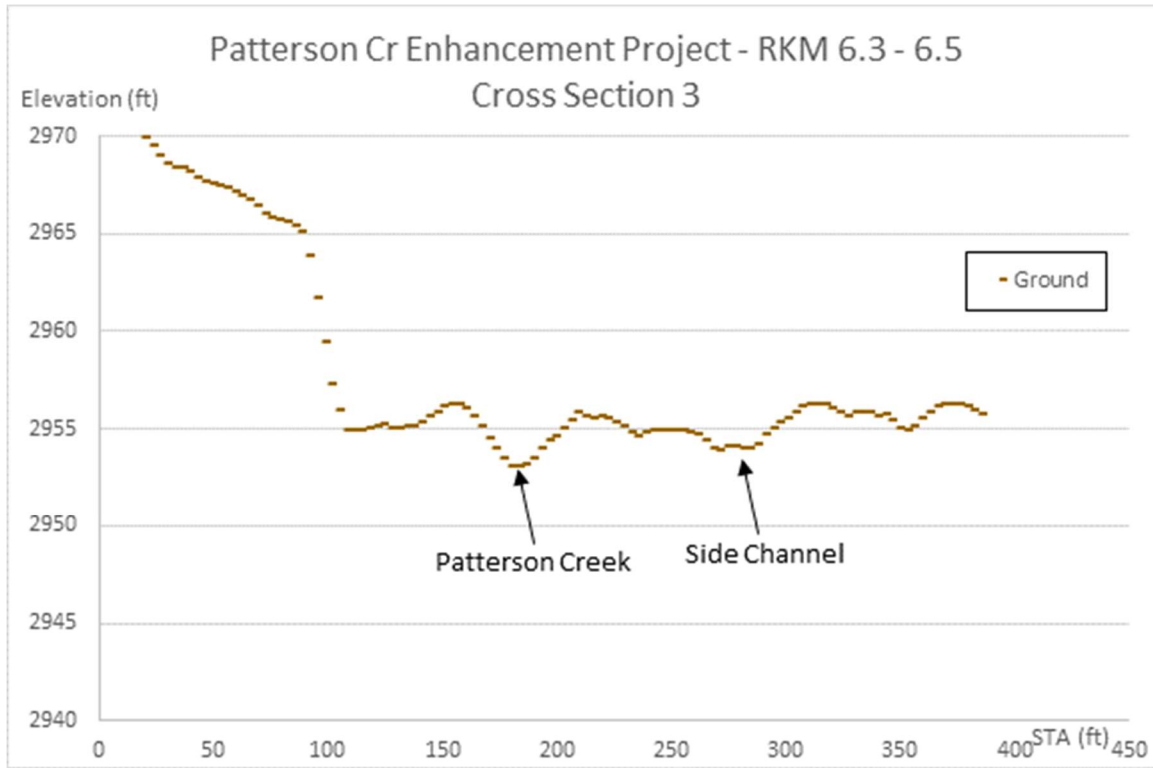


Figure 5 – Cross Section 3

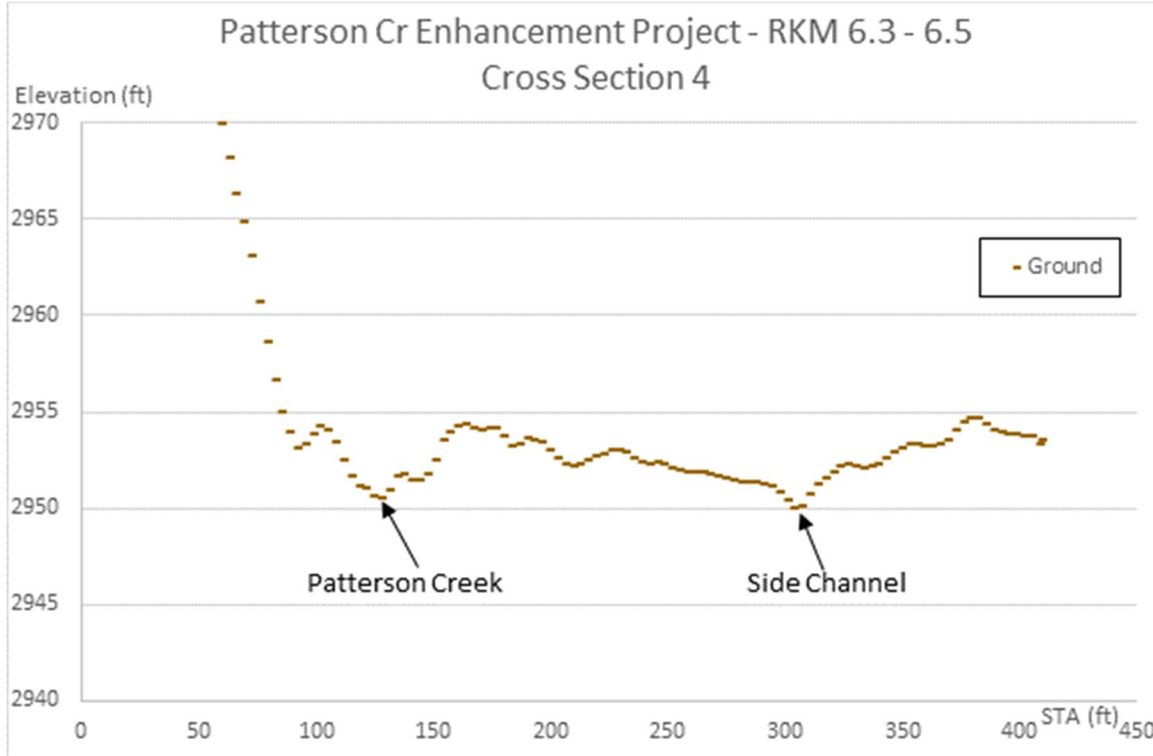


Figure 6 – Cross Section 4

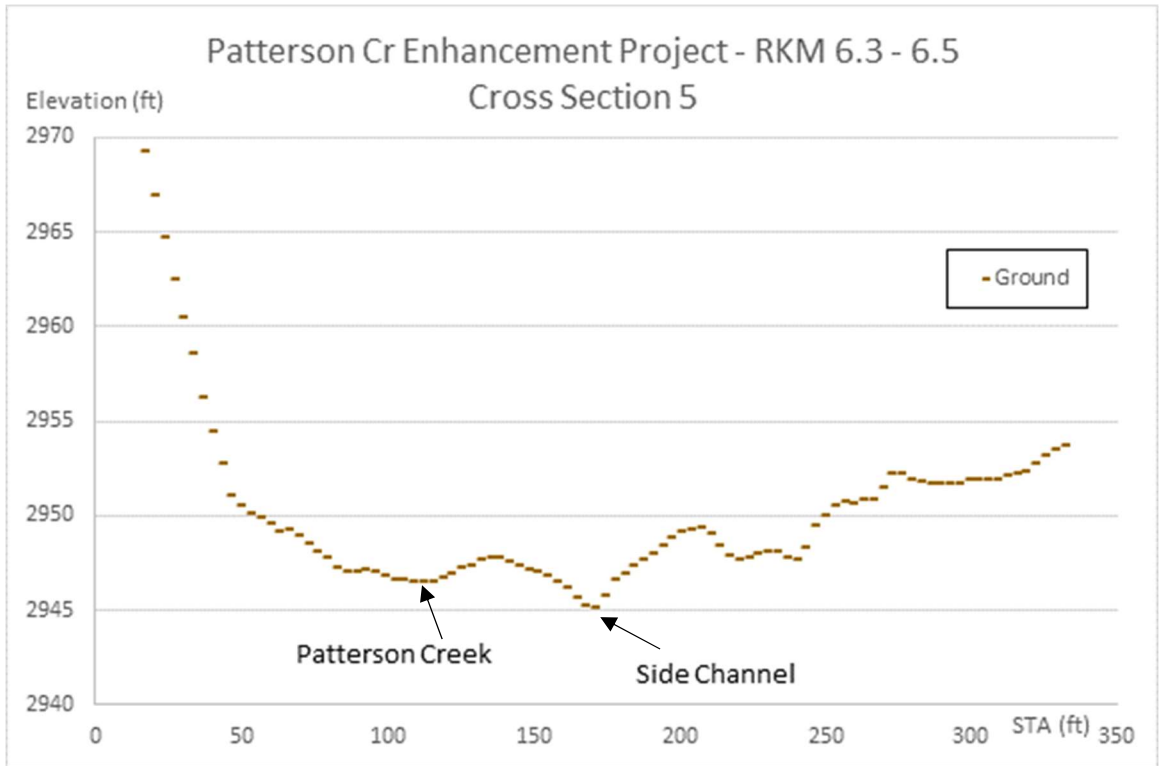


Figure 7 – Cross Section 5

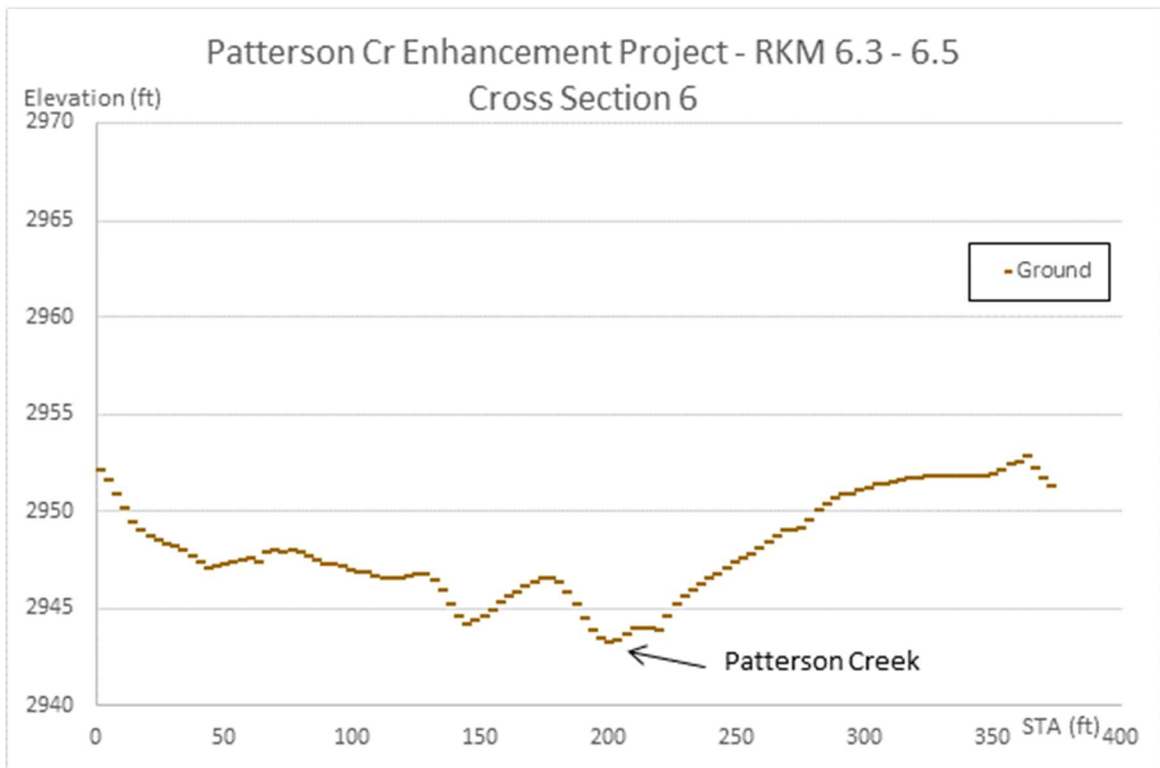


Figure 8 – Cross Section 6

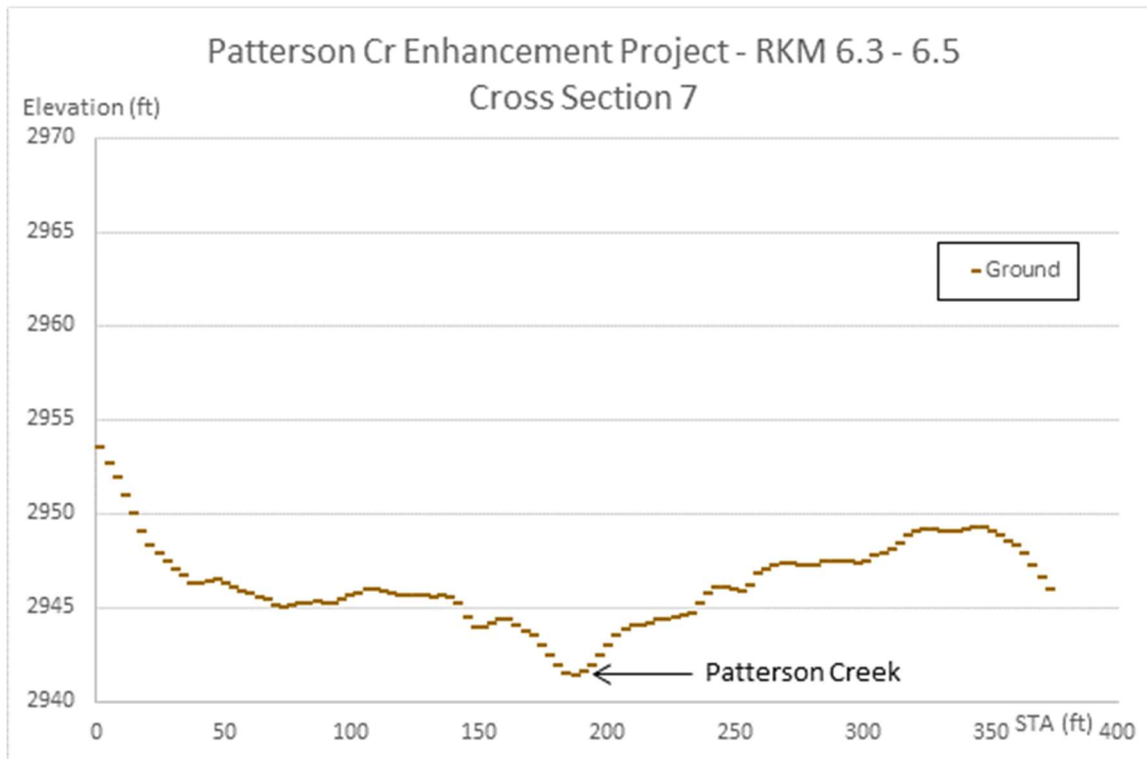
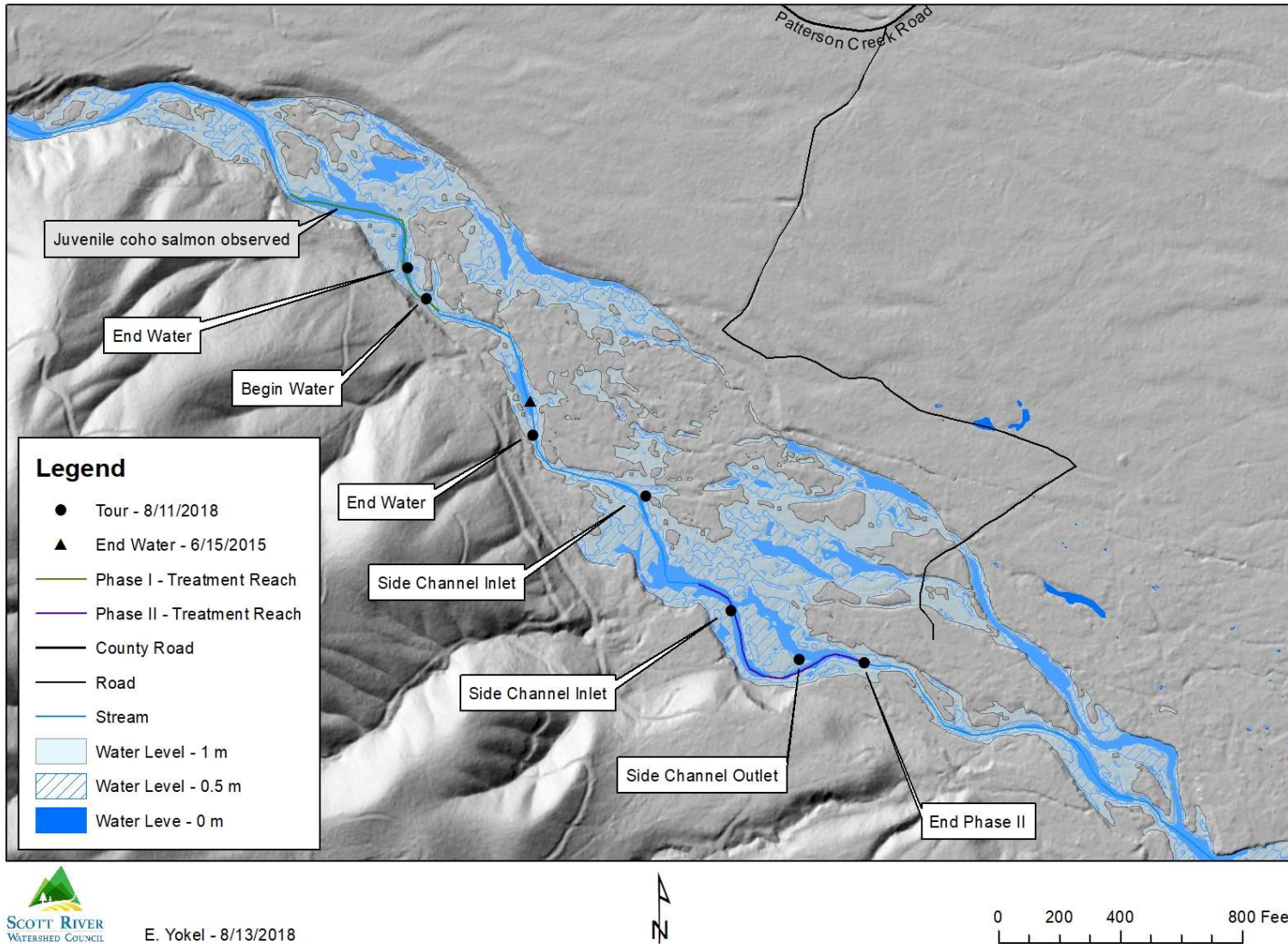


Figure 9 – Cross Section 7

Gotvald, A.J., Barth, N.A., Veilleux, A.G., and Parrett, Charles, 2012, Methods for determining magnitude and frequency of floods in California, based on data through water year 2006: U.S. Geological Survey Scientific Investigations Report 2012-5113, 38 p., 1 pl., available online only at <http://pubs.usgs.gov/sir/2012/5113/>

Patterson Creek Accelerated Wood Recruitment Project Field Tour - 8/11/2018



Map 3 - Patterson Creek Accelerated Wood Recruitment Project Field Tour observations – August 11, 2018

A field tour of the Patterson Creek Accelerated Wood Recruitment Project reach was performed on August 11, 2018 to document current condition and verify the existence of key features identified in the model (Map 3). The field tour was started upstream of the Phase I Treatment Reach and ended at the downstream extent of the proposed Phase II Treatment Reach. A significant thunderstorm driven runoff event occurred in Patterson Creek on July 15th, 2018. Fine sediment (silt) deposits from the runoff event were observed throughout the reach during the field visit (Picture 13).

The condition of an actively eroding stream bank on river right upstream of the Phase I reach was documented (Picture 1). A lateral scour pool at the upstream end of the Phase I Treatment Reach was observed to have fine sediment deposits covering the stream bed (Picture 2). Juvenile coho salmon were observed rearing in the pool on August 11th. Surface water was connected through the Phase I Treatment Reach with the exception of a 100-foot riffle at the downstream end of the reach that was disconnected (Map 3). Surface water was present from the end of the disconnected riffle to a point approximately 650 feet downstream (Picture 3). Surface water was absent throughout the rest of the surveyed stream.

A large complex of coarse woody debris was observed at the inlet to a side channel above the Phase II Treatment Reach (Picture 4). This wood accumulation at the side channel inlet is a potential model for treatment in the Phase II reach. The inlet to the side channel in the Phase II Treatment Reach identified in the GIS model was located directly upstream from a large alder tree on the river left bank (Picture 5). There is currently a small berm between the main channel of Patterson Creek and the side channel inlet (Picture 6). Several large conifers were observed in the area of the side channel inlet that could be used in conjunction with the large alder to create a log jam downstream of the side channel inlet to direct additional flow into the side channel.

The side channel is significantly narrower than the main channel of Patterson Creek (Picture 7). Several large conifers were observed along the bank or near the bank of the side channel. The side channel outlet is wider potentially due to the backwater effect at the confluence (Picture 8). Large conifers were observed on the steep river right bank of Patterson Creek (Picture 9). These conifers could be utilized to create a log jam at in Patterson Creek downstream of the side channel outlet to potential create a backwater habitat at the outlet's confluence. Downstream of the outlet approximately 200 feet the treatment reach is ended due to a more limited availability of large conifers in near vicinity to the stream.

On the mainstem of Patterson Creek between the side channel inlet and outlet there is a significant actively eroding cut bank on the river right (Picture 10 & 11). There are large conifers on the top of the bank (Picture 10) and several large conifers with root wads on the face of the bank (Picture 11). The toe of the bank has some willow brush but is largely unprotected with vegetation. There is a significant amount of willow in the stream bed and banks throughout the surveyed reach of Patterson Creek that could be utilized for cuttings to plant and protect the toe of the eroding bank.



Picture 1 – Actively eroding stream bank upstream of Phase I Treatment Reach



Picture 2 – Pool with documented rearing juvenile coho salmon in Phase I Treatment Reach



Picture 3 – End of surface water – Patterson Creek – August 11th, 2018



Picture 4 – Large woody debris deposit at side channel inlet upstream of Phase II Treatment Reach



Picture 5 – Scour hole from large alder tree directly downstream of side channel inlet in Phase II reach



Picture 6 – Inlet to side channel (bottom left) in Phase II reach



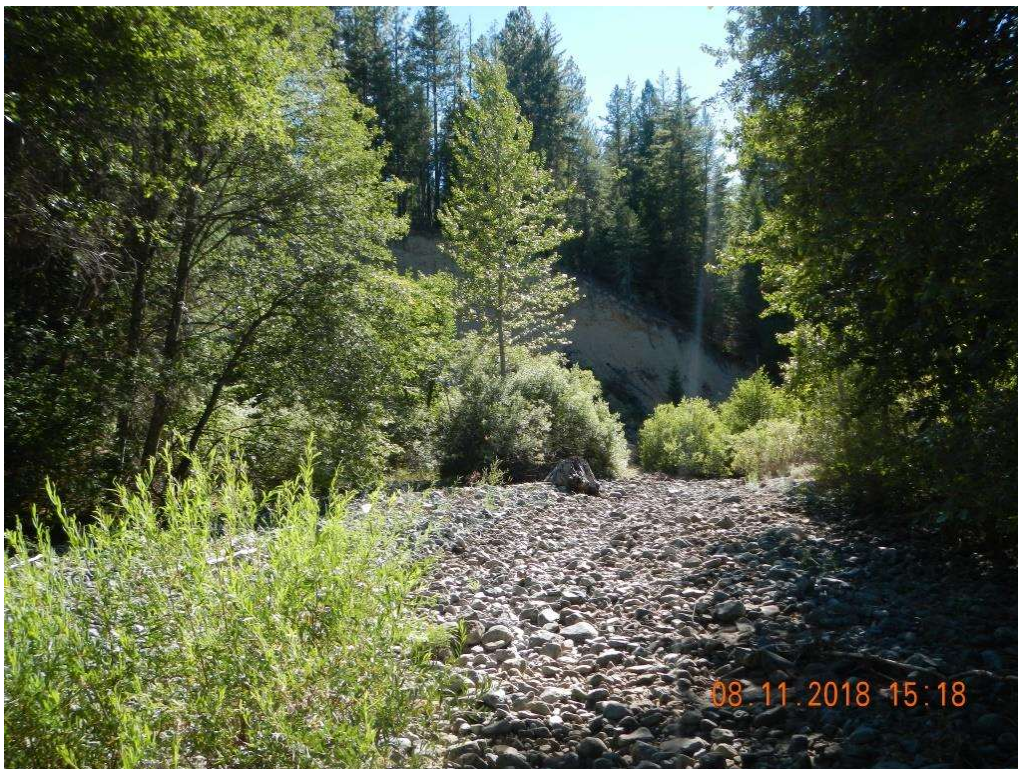
Picture 7 – Side channel in Phase II reach



Picture 8 – Outlet of side channel (from Patterson Creek) in Phase II Reach



Picture 9 – Patterson Creek – looking upstream from side channel outlet in Phase II reach



Picture 10 – Downstream extent of actively eroding river right stream bank



Picture 11 – Actively eroding stream bank in Phase II Reach – looking downstream

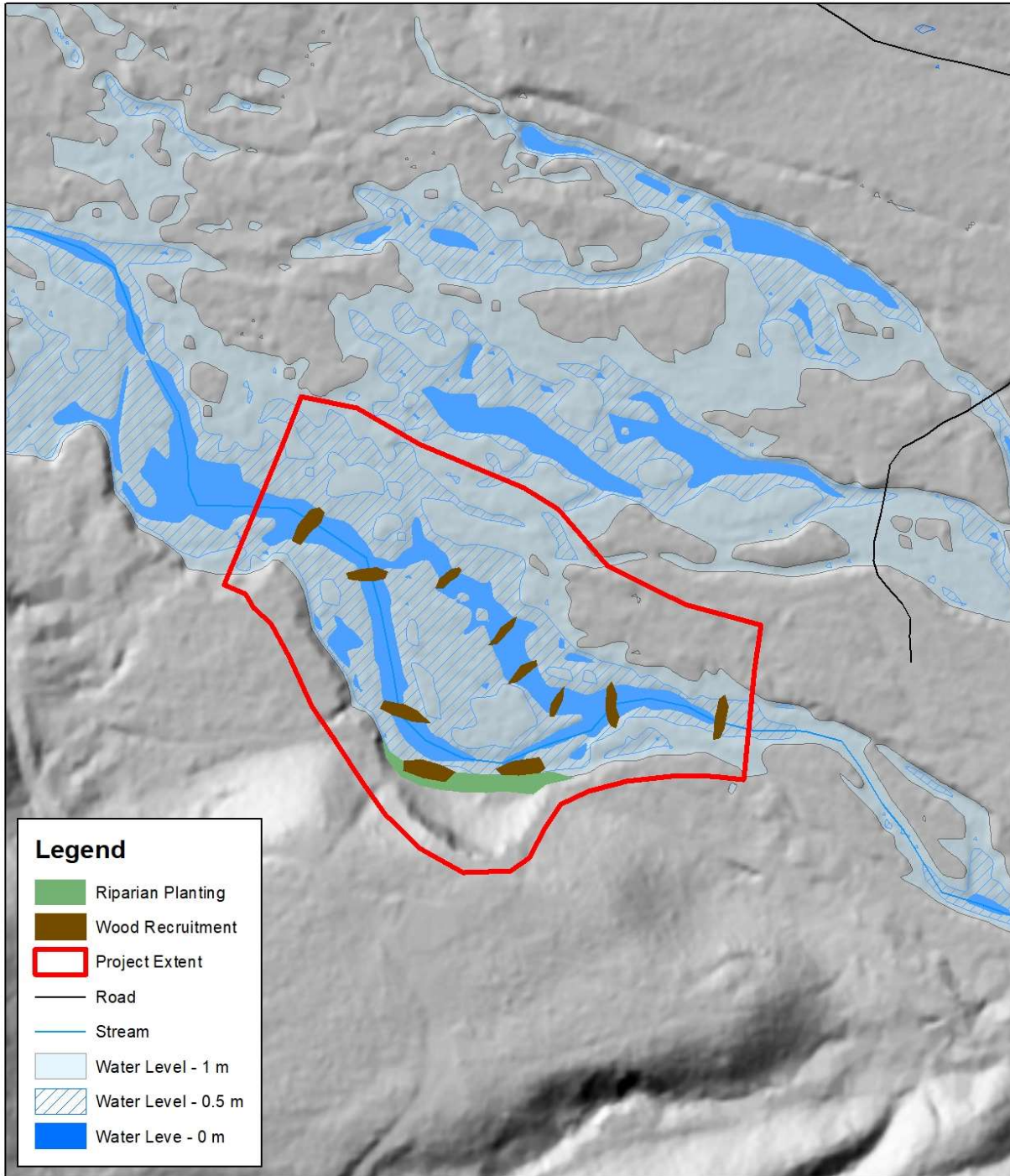


Picture 12 – Terrace on river right upstream of the eroding stream bank



Picture 13 – Deposit of fine sediment (silt) from July 15th, 2018 thunderstorm runoff event

Patterson Creek Accelerated Wood Recruitment Project - Phase II Wood Recruitment and Riparian Planting Concept



E. Yokel - 8/17/2018



Map 4 – Concept design for accelerated wood recruitment and riparian planting locations

The objectives of the project are:

Utilize unanchored large woody debris structures to

- 1) Increase stream channel complexity and promote sediment storage and sorting
- 2) Activate at a higher recurrence interval and enhance the existing side channel
- 3) Protect and enhance an actively eroding stream bank

The approach to achieve the objectives is:

- 1) Introduce large wood for habitat complexity/ promotion of aggradation and capture of wood
- 2) Introduce wood downstream of side channel inlet to encourage split flows into side channel and downstream of side channel outlet to encourage backwatering of outlet and potential creation of alcove like habitat
- 3) Introduce wood in main stem above river right eroding bank to deflect flows from actively eroding toe
- 4) Introduce wood in conjunction with riparian plantings (willow cuttings) on toe of actively eroding bank to promote toe stability and fine sediment storage and arrest erosion.

The proposed treatment method for the Patterson Creek RKM 6.3 – 6.5 reach is accelerated wood recruitment through the directional dropping of existing large conifers and repositioning the dropped conifers into channel spanning structures that are anchored by existing trees on the stream bank. The tree falling will be performed by a licensed sawyer. The repositioning will be performed by the California Conservation Corps utilizing mechanical hand tools (e.g. grip hoist with blocking) under engineer and/or project coordinator supervision. Final placement of logs and structure locations will be field fit by the engineer and project coordinator.

Logs will be channel spanning in most locations. A 20 – 40 ft long log will span the channel through the main stem stream. A 10 – 20 ft long log is required to span the side channel. The larger conifer trees utilized for the logs can be cut into multiple logs that will span the main stem and side channels.

The concept design has the first large wood structure spanning Patterson Creek upstream of the side channel inlet to promote stream habitat complexity, capture and store coarse woody debris and potentially alter sediment transport processes. Each structure should consist of 4-6 pieces of large woody debris (logs). A structure will be installed directly downstream of the side channel utilizing the existing large alder tree on river left to split the flow into the side channel and provide habitat complexity in the main channel. At least four structures will be placed in the side channel to significantly increase the roughness and reduce the potential risk of down cutting in the higher gradient channel.

A structure placed in the main channel downstream of the side channel outlet will potentially backwater the confluence of the side channel and main channel creating a slow water backwater habitat. A final structure downstream defines the end of the treatment reach.

A structure downstream of the side channel inlet will be installed in a position with the river left downstream of the river right to direct the flow away from the upstream toe of the actively eroding bank. Placed wood structures along the toe of the eroding bank in conjunction with riparian plantings (willow cuttings) will protect the bank while promoting fine sediment deposition and long term bank stability and stream shade.