DOWNLOAD PDF NRCS 395 INSTREAM WOOD STRUCTURE DESIGN

Chapter 1 : The Roman Arch Concept | InStream Conservation

- Stream Habitat Improvement (Instream wood placement) - Page 1 of 2 FY - compiled 12/11/ USDA-Natural Resources Conservation Service North Carolina.

This stage of planning steps 5, 6, and 7 is an iterative phase of the process that must be accomplished with the client. The product of this stage is a plan for the CMU, listing the practices and their locations, types of structures and vegetation, and management requirements. Although more thorough information about certain practices design options, costs, materials is sometimes needed by the client to make informed decisions, preparing detailed or preliminary specifications or designs for any practice is not the intent of this phase of planning. A critical strategy in formulating an RMS for a stream corridor CMU is the interplay between candidate practices in achieving desired conditions. The scenario below illustrates two RMSs developed for a stream corridor-grazing situation. Note how the characteristics of plant materials affect RMS formulation. Streambank erosion control using an RMS that emphasizes management elements for the designed solution Givenbenchmarkconditions: A CMU at one edge of a farm has a third order stream with fairly wide overbank and transitional zones. Channel banks have accelerated erosion, and the overbank zone has periodic scour erosion; both can be controlled by vegetative means. Livestock cross the channel at many locations, causing soil compaction and additional bank erosion. Pasture and Hay Planting specifies the establishment of forage species with fibrous root systems in the overbank zone. Specifications for Prescribed Grazing identify certain plants in the overbank zone as key forage species that are closely monitored to maintain protection against flood scour erosion. Also, incidental use and trampling damage of bank zone vegetation is monitored, and the livestock are removed immediately when any degradation or loss of vigor is detected. A Stream Crossing in the form of a rock ford is installed to concentrate livestock movement across the channel livestock choose the ford because of ease of crossing. Livestock Use Exclusion is installed in the form of a Fence between the overbank and transitional zones on both sides of the channel. A gated and fenced Stream Crossing is installed to allow ready access to the far side of the CMU and periodic grazing of the bank and overbank zones. Livestock periodically graze the bank and overbank zones for short periods with close monitoring to maintain erosion control a requirement in the Prescribed Grazing specifications. Because access to water is variable, a Watering Facility is developed within the transitional zone on the far side of the channel. This also improves use of forage on both sides of the stream. Both RMSs meet quality criteria and client objectives for livestock grazing. RMS option B affords the greatest assurance that resource concerns and practice purposes will be met, but likely at a higher investment in installation costs and management time. Additional fencing in this option can impact certain types of wildlife and pose a periodic maintenance chore if fences are damaged by floods. RMS option A may require additional monitoring to maintain desired conditions. Obviously, those sites with little or no demands for crops, wood, forage, or recreation will have the fewest planning constraints and interplay between practices. However, streams and associated riparian areas are typically landscapes with favorable moisture and potential for exploitation. Intensive use of such landscapes will remain the rule, rather than the exception. Planners will need to think through each scenario using the process and techniques presented in this section to formulate sustainable RMSs. Consultation with specialists for complex situations is advised. Streambank erosion control using an RMS that emphasizes a combination of vegetation and structural design elements Givenbenchmarkconditions: Severe streambank erosion is attacking stream banks in a suburban area, with damage to utilities, loss of land, and degraded habitat. The stream is enlarged, excessive sediment yield, and loss of property and utility services are concerns. In some locations, sewer pipes and gas lines are in imminent danger of collapse. The site constraints are such that relocation of these utilities is not possible. The streambed appears to be stable with no active incision. Measures that are considered include Streambank and Shoreline protection and Channel Bank Vegetation It would be necessary to confirm that the bed is indeed stable. If it is not, some grade control may be necessary. The emphasis will be on protecting the streambank from future undercutting and collapse, so that the toe will be stabilized with rock riprap or gabions. The design will focus on the slope stability that can be achieved with the least impact on land backyards and easement areas and result in a stable bank condition. Soil bioengineering will be used to establish woody vegetation that will protect the bank from the erosion of flowing water and also knit together the bank with roots. Where riparian infrastructure is in imminent danger, harder structures such as gabions, sheetpile, and ACBs will be considered. Final design of the solution will depend on hydraulic analyses for the site.

Chapter 2 : Adding Wood Structures To Streams Promotes Fish Recovery, But Do They Have To Cost So

- Stream Habitat Improvement and Management (Instream wood placement) - Page 1 of 2 FY - compiled 11/7/ USDA-Natural Resources Conservation Service North Carolina.

This paper discusses the preliminary results of 38 log jam evaluations utilizing in-part or completely the engineered log jam technique and design criteria developed as part of a dissertation at the University of Washington. At a minimum, all of the log jams studied were installed with the two objectives stated on permits: Responses of these stream channel structural practices have ranged from successful habitat restoration to complete structural loss in attempts to incorporate wood. In the mid- s research on natural log jam characteristics, patterns, and benefits led to the technology that is currently referred to as engineered log jams. Due to complexities and site locations, this study was allocated into two stages: Stage 1 and Stage 2. Completion of Stage 2 will be determined based on budget, time frames, and availability of Stage 1 interdisciplinary team. This paper discusses the preliminary results of 38 log jam evaluations utilizing in-part or completely the Engineered Log Jam Technique and Design Criteria developed as part of a dissertation at the University of Washington. All of the log jams studied were installed with, minimally, the principle two objectives: It is an important technology that re-infuses wood components into stream corridors. Wood, an important fish aquatic habitat component, is lacking in many systems in the Pacific Northwest and other relevant geographic locations where it was once abundant and natural. It addresses a larger scale of both geomorphic and ecologic watershed restoration. Wood is a natural geomorphic component common to the Pacific Northwest in most riverine systems, particularly in the West Cascades Mountain Range. NRCS wants to know about the physical performance of these structures and did they meet the primary objectives of the stated project goals. ELJs have been implemented since the mids over 11 years: Are there significant design components that will help us adapt this technology in higher risk landscape settings, such as urban, urban fringe, agriculture, and transportation networks? A Request was generated from the Washington NRCS State Conservation Engineer and State Conservationist in December â€” To conduct an assessment to appropriately and confidently recommend this practice to address specific stream bank erosion concerns and associated salmonid habitat improvement. In February of , a technical interdisciplinary team was brought together to discuss a post project appraisal of engineered log jams implemented since to discuss concerns and primary goals and objectives. The following list includes the discussed topics: Definition of ELJs B. What do these ELJs cost? Do objectives compete with one another; e. How long should these structures last and how long are they lasting? Relevance of ELJs pertaining to fish, life cycles and other assemblages G. A variety of structures have been installed I. Flow convergence, high banks, wood buoyancy â€” wet dry cycle of wood and reduction of mass deterioration. Is ice a concern for wood structures? Sight conditions of failure: Response to high flow condition. Monitoring and criteria for judging mechanism of failure: Aerial photo comparison of sites before and after. Complete field reconnaissance of Washington Trout Study sites on North Fork of the Stillaquamish stream bank erosion data and protection M. How do you measure success? If the cycle of the King Salmon is four years and the ELJ is five years, how does that measure up to success? What happens to the wood after if it is mobilized? How does it provide for fish habitat in other places downstream? What has been the effect of wood on downstream bridges? How has it impacted operation and maintenance? Inability to get permits Q. ELJ implementation to socioeconomic setting R. How much will it cost relative to how long it will last? What should our expectation be? Develop ELJ field form to collect data relevant to analysis Due to the complex physical riverine conditions associated with ELJs, the team recognized the need to develop a methodology involving a two-stage study; this post-project appraisal is Stage 1. The stages are described as follows: Stage 1 â€” Assemble team, conduct initial assessment, gather information relative to projects, exam goals and objectives, and conduct reconnaissance of structures and field visits to identify physical strengths and weaknesses of structures relative to stream bank erosion and absence of structure or significant reduction in size of structure since time of installation. Examine stream bed, bank materials, scour depth, and aerial photos before and after installation, contact local entities, and examine peak flows since installation and on-site stream velocity at point of flow convergence. Examine accomplishments of primary objectives stated on permits. Stage 2 â€” Examine stream morphometry, including dimension, pattern, and profile, and examine more in-depth the bank and bed stratigraphy, velocity distribution, hydraulic geometry, bed load competence incipient motion , and particle size distribution. Interview designers-installers and study project costs. Compare short to medium term impacts on the targeted salmonid habitat more in-depth. Stage 2 study is contingent based on budget, time frames, and availability of the Stage 1 interdisciplinary team. The team developed the following criteria for the post project appraisal: Projects had to be five years or older and exposed to floods above bank full Q channel formative flow 3. Projects had to be identified as engineered log jams either on permit or design. Projects had to include stream bank protection and salmon habitat as primary goals. The anchor systems described below were used as one of the defining points of the ballast system for the 38 ELJs: No anchorsâ€"where wood is supplied to the stream and allowed to be naturally stable or, as conditions develop, moved by the flow. Passive anchorsâ€"where the weight and shape of the structure is the anchor, and movement at some flow level is acceptable includes ballast. Flexible anchorsâ€"such as tethering the structure so there is some degree of movement flexibility with varying flows. Rigid anchorsâ€"holding the logs permanently in place with no movement allowed. Although not part of the sampled sites, 7. In the mids, research on natural log jams characteristics, patterns, and benefits lead to the technology that is currently referred to as engineered log jams. Six sites are briefly described as follows. These ELJs were designed to treat stream bank erosion and instability and provide salmonids habitat along meters located on private property. The three ELJs installed are no longer there. The drainage area is mi2. Three ELJs were constructed with logs with a passive type of anchoring. The primary objectives were stream bank protection and the creation of deep pools at each ELJ with associated environmental benefits. Previous to installation, rapid lateral recession into private property occurred due to damages from the fourth highest flood of record: The Site 1 received post construction flood flows. The floods Qs between and ranged from 15,cfs 1. Two of the three ELJs were lost in The third ELJ was gone by with the exception of a few large wood members. The landowner estimated a loss of 7 acres with feet of lateral recession since construction in Figure 3 shows the right bank of the Cowlitz several hundred feet behind the stream bank. Figure 4 is a view from the right stream bank. Bedload transport and aggradation remain as concerns at Site 1. The stream bank stratigraphy is composed of lateral accretion with fine textured soil over vertical accretion-course gravel texture. Sand-sized matrix material and finer layers were washed out of gravel strata causing that unit to slough off, which undermines the overlying finer textured unit. The overlying finer-textured material has more shear strength. There is a difference in the shear strength of the finer-textured materials near the top of the bank. See the stream bank in Figure 3 behind the blue and white global probe velocity meter. Previous to installation, stream bank erosion and lack of salmonid habitat were primary concerns for the USFS. Sites B and C were constructed in and Site A was constructed in Engineered log jam A2 is partially gone. Between and , Site 2 received four post project floods from cfs 2. There are 12 ELJs composed of logs that were constructed in and All ELJs were located on the right bank of the Cispus. These ELJs were the passive anchor type with no pylons or cable used. The four ELJs at site C are not connected to the main channel at lower flows. Scours and flanking in the vicinity of the stream bank and keys were present at Sites A and B as shown in Figure 7 and Figure 8. Site 3 North Fork of the Stillaquamish: Three left bank ELJs, 6 through 8, were constructed upstream from the first five on river mile 22 in ELJs 6â€" 8 were constructed with cable only at the front of the key log members next to the sill log. The ELJs on the North Fork of the Stillaquamish were implemented with the passive anchor approach with a minimal amount of cable for maintenance. One of the primary objectives for ELJ 1 was to trap wood that was continuously piling up at the C-Post bridge, which is located immediately downstream. There was a large pool located just beneath the C-Post bridge where poaching was a concern. Shortly after installation in , ELJ 1, located on the left bank immediately above the C Post Bridge, had one of the deepest pools with one of the highest populations of salmon on the North Fork of the Stillaguamish. The pool was measured to be 4â€"5 meters deep.

Chapter 3 : Performance of Engineered Log Jams in WA | InStream Conservation

- 1 NRCS, NHCP September Conservation practice standards are reviewed periodically and updated if needed. To obtain the current version of this standard, contact your Natural Resources Conservation Service.

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Chapter 4 : TU, SRF host first-ever Large Wood Field School | Trout Unlimited - Conserving coldwater fishe

helping people help the land technical notes. usda natural resources conservation service colorado. engineering - no april guidance for stream.

Bibliography Background About KRIS Instream Structures Fisheries scientists in the s began to recognize that stream habitat had been simplified by past land use activities Hassler, Northwestern California streams, particularly those that had intensively logged watersheds, were dominated by riffles with low pool frequency and little habitat complexity Kier Associates, ; Pacific Watershed Associates, Throughout the s and s, millions of dollars of state and federal money were spent to increase habitat complexity through direct manipulation of streams. Gabions, inexpensive wire baskets filled with rocks, were used in initial efforts but were found to have a very short life. Boulders and log structures were then used extensively throughout northwestern California to accelerate recovery of fish habitat. Olsen showed that juvenile salmonid rearing densities increased around instream structures in Klamath National Forest streams. He showed that large wood and rock structures added habitat diversity and that coho and chinook salmon juveniles were found during post-project surveys while only steelhead were present before POPUP resteval2. Kier Associates found that the instream structure failure rate was lower in Six Rivers National Forest where watershed conditions were less disturbed. Large wood structures, such as this one in Elk Creek, Klamath National Forest, were extensively used by juvenile salmonids. Shifting bedload in Elk Creek during the January, storm destroyed many instream structures. The Elk Creek watershed was extensively salvage-logged after the fire and road densities in the watershed became very high. No logging has taken place in the Red Cap Creek watershed for the last decade, and road densities are not high. These two boulder weirs withstood the storm. Bluff Creek, within the Six Rivers National Forest, has been allowed a period of rest and no new roads have been built during the last decade. Photos courtesy of Six Rivers N. F Fish Creek, a tributary of the Clackamas River in Oregon, had hundreds of instream structures installed in the s to help improve fish habitat complexity. In February storm event, almost all the structures were lost, seventeen miles of stream channel were scoured and landslides occurred, many triggered by road failures Hickman, In response, the U. Forest Service has gone to a primarily upland erosion control strategy for fish restoration in this basin and road crossings removed and miles of road obliterated. Similar high failure rates of instream structures have also been noted in other areas of the Pacific Northwest. They concluded that "commonly prescribed structural modifications often are inappropriate and counterproductive in streams with high or elevated sediment loads, high peak flows or highly erodible bank materials. With regard to southwest Oregon they found that: The purpose of the inventory was to partially assess the success of CDFG in-stream restoration activities. Some new streams, and a sub-set of previously visited sites were surveyed in , after higher flows had occurred. Overall success rate scores for structures throughout northwestern California were higher in than in see chart of results. No significant storm events occurred between and , while January and March saw two large storms. This study should provide useful information on channel conditions for north coast watershed assessment. Success and failure of restoration projects can be analyzed with respect to watershed disturbance, sediment yield, road densities and other factors. References De la Fuente, J. Effects of the Floods on the Klamath National Forest. North American Journal of Fisheries Management Department of Agriculture, Forest Service. Pacific Northwest Research Station. Annual Report for Interagency Agreement Action plan for the restoration of the South Fork Trinity River watershed and its fisheries.

Chapter 5 : 10 Literature Cited | Hydropower Reform Coalition

X^^ Stream Habitat Improvement Rock and wood structures X^^ only available in EQIP Forestry and Wildlife Pool X^^ Stream Habitat Improvement Constructed Log.

Page 85 Share Suggested Citation: The National Academies Press. In-stream structures can be classified in two fundamental categories: Sills are structures that span the entire channel width, while single-arm structures extend from one bank into the channel without reaching the opposite bank. Single-arm structures can be further subdivided into deflector, redirec- tive, and retard types, depending on the function of each structure configuration NRCS, Proper structure design and placement are necessary to avoid channel aggradation, local bed scour, and bank erosion, all of which can result in structure failure and cause signifi- cant harm to the stream and nearby property. Furthermore, failure of these structures will accelerate the adverse effects they were initially installed to prevent, such as lateral migra- tion and infrastructure endangerment see Table F Design approaches need to incorporate the unsteady, 3-D character of the flow in the vicinity of structures and the complex inter- actions of turbulence in the water column with streambed sediments. The design guidelines in the following sections were developed with the multi-pronged approach described in Chapter 2, combining information from a comprehensive literature review Appendix A , practitioner survey Appen- dix B , field case studies Appendix C , physical experiments Appendix D , and numerical simulations Appendix E and Chapter 3. Figure F-2 lays out the general flowchart for using the following design guidelines. Structure type is selected based on project goals and channel characteristics Tables F-2 and F An appropriate angle of orientation is selected based on the site characteristics. A vector analysis is used to map out optimum structure location. Ideally, 2-D or 3-D modeling approaches, such as VSL3D, will be used to fur- ther refine the design of the structure layout and evaluate its performance for the specific site under consideration. One- dimensional models will not provide adequate information to evaluate structure layout and, therefore, are not suggested as a tool for in-stream structure design. Three major categories of structure failure mechanism were identified: The practitioner survey Appendix B also reported winnowing or scour between rocks as a significant failure mode. This failure mechanism, however, was not explicitly evaluated in NCHRP Project , although the effects of this process were likely in the field case studies Appendix C. Table F-3 compiles the evaluation of the susceptibility of each structure type to these failure mechanisms. These struc- tures gradually slope from the bank to the bed such that, even at low-flow conditions, the tip of the structure remains submerged Radspinner et al. Rock vanes are installed with an upstream angle to minimize erosive flow patterns near the bank by diverting high-velocity flow away from the bank Maryland Department of the Environment, ; Johnson et al. Reasons and modes of failure reported in the practitioner survey published in Radspinner et al. Illustrations of typical single-arm deflector structure and typical sill rock structure from Radspinner et al. A series of vanes installed for bank protection is intended to move scour to the middle of the channel and enhance deposition along the bank e. Rock vanes and other in-stream rock structures can reduce or eliminate the need for bank armoring on unstable banks and can improve the effec- tiveness of other erosion protection measures such as vegeta- tion restoration McCullah and Gray, Current guidelines for placement and spacing of rock vanes, however, are based primarily on practitioner experience e. Design flow process for the design and layout of in-stream flow control structures. Recommendations for in-stream flow control structure selection based on site characteristics and project goals. Evaluation of susceptibility to failure mechanisms for in-stream flow control structures. Extent of protection required at a channel bend for three different channels: Blue and red zones are associated to the regions with significant scour and deposition, respectively. Included in this document is a summary of the uses of these structures in common restoration and stabilization practices. Within this summary, applications for which rock vanes are well suited e. It is also important to note that the stream bank opposite the rock vane structures should be monitored closely after installation for any increase in erosion occurring due to the presence of the rock vane and its ability to direct flow away from the outer bank, towards the center of the channel, and, on occasion, negatively affecting the opposite bank. Several structures use the rock vane as the key component and modify it for various situations. All structures from the rock vane family can be subjected to failure by lateral cir- cumvention, winnowing, local scour, aggradation, and dis- placement Johnson et al. Typical rock vane installation after Rosgen, and Radspinner et al. The following section builds on existing rock vane guidance with input from the comprehensive physical and numerical experi- ments described in previous sections. In general, longer, flatter vanes will offer greater lengths of bank protection. Vane Location and Spacing Rock vanes should be installed in series of at least two struc- tures to protect the entire region of the outer bank subject to scour Johnson et al. Specific guidelines on vane spac- ing and vane placement are sparse. The Maryland Department of the Environment guidelines suggest spacing of one or more channel widths for habitat considerations, depending on the pattern of scour pools, in reference reaches, or five to seven bankfull widths if the restoration goal is to initiate meandering. For smaller radius of curvature channels, the final structure array should be shifted upstream by approximately one channel width to provide adequate bank protection and minimize the risk of structure failure due to excessive local scour or flanking. Typically, footer rocks are one to two large rocks underneath the top rock. Footer rocks should be downstream of the top rock to minimize structure failure by rocks falling into a downstream scour hole Doll et al. Footer rock size should be at least three times the protrusion height of the vane. This depth should be doubled for sand-bed streams NRCS, Based on the numerical results from NCHRP Project , footer rocks should be installed at an elevation that is 1 to 1. Rock Size Rock vanes are typically constructed from rock much larger than the rock size for other redirective flow training structures such as bendway weirs or stream barbs. Rocks in bendway weirs and stream barbs are commonly sized using riprap sizing equations with a factor of safety i. The rock used to construct rock vanes is typically much larger than riprap equations suggest as the rocks are not interlocking. One method for sizing individual boulders is based on a balance of the forces on an individual rock Fischenich and Seal, ; however, these equations also undersize the rock. The rock size needs to be large enough to withstand local scour around the base of the structure. Many other guidelines suggest large rock sizes regardless of local stream-channel characteristics i. Rosgen provides a general reference for mini- mum rock size based on a limited number of rivers. This relationship results in a much larger rock size than other rock-sizing methods. Rock shape depends on local availability but typically should be flat to allow interlocking, and vane rocks should be touching Doll et al. Large rocks and boulders can be placed on the downstream side of the structure to enhance stability Maryland Department of the Environment, For rock vanes, rocks placed at the tip of the structure are subject to forces that are approximately 1. This is compounded by the fact that the deepest scour occurs near the structure tip. Therefore, rocks placed at the tip of the structure need to be large enough to account for the forces exerted by the turbulent flow. Sills Bank Key Sills consisting of two to three large rocks built into the stream bank can help mitigate erosion behind rock vanes, especially on new channels Maryland Department of the Environment, ; NRCS, Experimental and numerical results from 72 NCHRP Project indicated that a large amount of sedi- ment was transported and stored upstream of rock vanes. This additional sediment may lead to bank overtopping and flank- ing of the structure as sediment deposition becomes vegetated under low flows, increasing local roughness and redirecting flow around and behind the structure. The following suggestions are included based on the results from NCHRP Project for monitoring and maintenance of rock vanes. Over time, vegetation can begin to grow on this deposited material, shifting flow around the outside of the structure. Similar to the rock vane, the vane portion of these structures gradually slopes from the bank to the bed such that, even at low-flow Figure F Typical J-hook vane installation after Rosgen, J-hook vanes are also installed with an upstream angle to minimize erosive flow patterns near the bank by diverting high-velocity flow away from the bank Maryland Department of the Environment, ; Johnson et al. Often, rock vanes and other in-stream rock struc- tures are installed with a secondary goal of improving aquatic habitat by creating flow diversity through the formation of scour pools Rosgen, , and J-hook vanes are expected to provide additional in-stream habitat enhancement in the form of a mid-channel scour pool Maryland Department of the Environment, Current guidelines for placement and spacing of J-hook vanes are similar to those developed for rock vanes, based primarily on practitioner experience e. Applications for J-hook vanes are similar to those for rock vanes, with the exception that J-hook vanes are expected to provide better in-stream habitat in the form of a deep scour hole Maryland Department of the Environment, Limitations of J-hook vanes are similar to those of rock vanes. With any flow-redirection structure, the stream bank opposite the structures should be monitored closely after installation for any increase in erosion occurring due to the presence of the structure. All structures from the rock vane family can be subjected to failure by lateral circum- vention, winnowing, local scour, aggradation, and displace- ment Johnson et al. The following section builds on existing J-hook vane guidance with input from the comprehensive physical and numerical experiments from NCHRP Project Vane Location and Spacing When used for meander bend protection, J-hook vanes should be installed in series of at least two structures to protect the entire region of the outer bank subject to scour Mooney et al. Specific guidelines on vane spacing and vane placement are sparse. Similar to rock vanes, the Maryland Department of the Environment guidelines suggest spacing of one or more channel widths for habitat consider- ations, depending on the pattern of scour pools, in reference reaches, or 5 to 7 bankfull widths if the restoration goal is to initiate meandering. For smaller radius of curvature chan- nels, the final structure array should be shifted upstream by approximately one channel width to provide adequate bank protection and minimize the risk of structure failure due to excessive local scour or flanking. Footer rock size should be at least three times the protrusion height, and this depth should be doubled for sand-bed streams NRCS, Rock Size J-hook vanes are typically constructed from rock much larger than the rock used for other redirective flow training structures such as bendway weirs or stream barbs see the Rock Size subsection in Section F. Excessive gaps between rocks can lead to winnowing and subsequent failure of the structure. Alternatively, grouting structures can help them survive high-flow events. NCHRP Project evaluated structures where gaps between rocks were limited to the tip of the hook portion of the vane. Gaps in the hook were found to significantly alter sediment transport through the structure. For J-hook vanes, rocks placed at the tip of the structure are subject to forces that are approximately 4 to 5 times the force on rocks closer to the stream bank. Sills Bank Key Sills consisting of two to three large rocks built into the stream bank can help mitigate erosion behind rock vanes, especially in new channels Maryland Department of the Environment, ; NRCS, Experimental and numer- ical results from NCHRP Project indicated that a moderate amount of sediment was transported and stored upstream of J-hook vanes. This additional sediment may lead to bank overtopping and flanking of the structure as sediment deposition becomes vegetated under low flows, increasing local roughness and redirecting flow around the structure. Large hydrodynamic forces could combine with undermining of the footer rock to shift rocks at the structure tip or displace the rocks that form the hook part of the structure. Several state agen- cies have published technical notes and case studies for bend- way weir use under a variety of stream characteristics e. Stream barbs are designed to protect the bank by disrupting velocity gradients in the near-bed regions, deflecting currents toward the tip of the weirs Matsuura and Townsend, The trans- verse slope along the centerline should be no steeper than 1V: The flat weir section normally transitions into 75 the bank on a slope of 1V: The height of the weir should meet the following criteria Lagasse et al. NCHRP Proj- ect found that the optimum angle should be selected by evaluating the combined effect of multiple structures and longer vane length. Based on numerical simulations from NCHRP Project , placing the first bendway weir at the meander apex sufficiently protected the toe of the bank on the outer bank of the meander. Typical bendway weir spac- ing should range from 5 to 10 times the effective struc- ture length, and ideally 4 to 5 times the effective length NRCS, ; Lagasse et al.

Chapter 6 : Instream Structures

triggered efforts to design structures that emulated the USDA NRCS a). Accordingly, wood structures are Use of Large Woody Material for Habitat and Bank.

Posted on Friday, November 07, PST Wood structures added to mid-sized streams to create pools for juvenile fish help in recovery efforts for salmon and steelhead, but wood structures could be added to streams at a faster pace if the cost was lower, according to studies published in October. One study that evaluated the effectiveness of adding well-placed wood into the Entiat River in Washington found that pools created by the wood structures attract juvenile chinook salmon and steelhead. However, by September of each year of the study, there was no difference between restored and unrestored reaches of the stream in the presence of juvenile fish. That, according to Jennifer Carah, ecologist in The Nature Conservancy California water program, offers the opportunity to do more restoration in streams at a faster pace and with less money. The method of installing wood to create pools, cover, shading and slow areas that was studied by Polivka in the Entiat River were engineered and used hardware to anchor the wood structures in place. So, the increased occupancy in restored sections of the stream actually represented an increase in total stream capacity rather than just a redistribution of fish, but it required extensive sampling in unrestored areas to prove this, he said. Regardless of location in restored or unrestored sections of the Entiat River, pool size, depth and velocity of the current had the most impact on juvenile fish occupancy, according to the report. However, the finding of increased occupancy in restored sections of the river was not consistent within a season. The reason for the seasonal change was a drop in pool size and depth as stream flows declined over the summer, according to the report. By September chinook salmon occupied both restored and unrestored pools. Steelhead tended to occupy unrestored habitat anyway, as well as reaches of streams with faster currents. His study occurred after the restoration structures had already been placed within the river, so there was no pre-treatment monitoring, Polivka said. The study installed the low-cost wood structures in six watersheds and 72 kilometers about 45 miles of streams, concentrating all the installations into small to medium streams. Carah said there is growing enthusiasm for using accelerated recruitment wood loading techniques in Northern California and believes the technique could also be used for other salmon species in other areas, such as the Columbia River basin, but only following the technique guidelines and only in smaller streams. The report says that there may even be advantages for going the less expensive and more natural route: With imperiled coho, Carah, along with her study authors, is mostly looking to get more improvements within streams at a faster pace, and hoping for a quicker recovery for fish. Wood length must be 1. No hard anchoring is used. The treated areas resulted in an increase in the number of pools and pool area, wood cover and wood volume. Retention of the added wood was fairly high, ranging from 73 percent to percent the mean is 92 percent across the two to six years of the study, according to the report. Exceptions would be large rivers, or rivers with a lot of downstream infrastructure. An earlier study of 91 restoration projects that also used unanchored wood in coastal and Columbia Basin streams, found that after six years most of the projects had increased overwintering rearing capacity for salmon and biologists saw an overall increase in the surface area of pools along with an increase in gravel. After six years of monitoring, the amount of large wood added to the stream had declined by almost 75 percent, but still had not fallen back to pre-treatment levels.

Chapter 7 : Toewood Design and Siting for Stream Restoration â€” The Webinar Portal

Practices under the broad categories of revetments, hydraulic structures and soil bioengineering utilize pieces of wood to provide stability, changes in instream hydraulics and provide habitat for aquatic species.

Chapter 8 : Large Wood Technical Field School | Salmonid Restoration Federation

Responses of these stream channel structural practices have ranged from successful habitat restoration to complete *structural loss in attempts to incorporate wood. In the mid- s research on natural log jam characteristics, patterns, and benefits led to the technology that is currently referred to as engineered log jams.*

Chapter 9 : Read Chapter Stream Restoration Design Process

The weight of the structure pressing down, or pressure of flowing water, forces each building block of the structure to support and reinforce the rest of the structure, thus allowing river structures to be built with a minimum of materials and blend into the natural environment.