Project Description/Restoration Practices

The following is an overview of each practice to be used in connection with the **Restoring the Deer Creek Headwaters at Childs Meadows Project** that will restore hydrologic, geomorphic and biological conditions within the Childs Meadows complex. In addition to the practices themselves, construction and maintenance requirements are described as well. Importantly, in addition to the maintenance and motioning requirements described in this Initial Study/Mitigated Negative Declaration and **Appendix L Post Project Maintenance and Monitoring Plan for the Restoring the Deer Creek Headwaters at Childs Meadows Project** found in the Initial Study/Mitigated Negative Declaration (IS/MND), additional requirements may be established for project work in the future by regulatory and funding entities. **Figure 2. Overview of Childs Meadows Project Area with Specific Features Identified** of the IS/MND provides an overview of treatment locations. A visual description of proposed meadow treatments is shown in generalized schematic drawings found in **Appendix J.** of the IS/MND. General construction and implementation techniques for these meadow restoration practices follow those found in ***"Low-Tech Process-Based Restoration of Riverscapes: Design Manual. Version 1.0"*** shown among the references listed in the **References Cited** section of the Initial Study/Mitigated Negative Declaration. The Numbers adjacent to each practice described below refer to the Project areas described in the IS/MND.

Beaver Dam Analog (BDA) Areas 1,2 3, 4, 5, 8, 9, 10, 11, 12, 13, and 14

(See schematic drawings found Appendix J: and feature cross sections shown in Appendix K) of the IS/MND. BDA treatments will be used primarily in riparian meadow floodplain reaches. A summary of this treatment is found in **Table 2 Summary of Typical Hydraulic, Hydrologic and Geomorphic Effects of Beaver Dam Analogues (BDAs) and Post-Assisted Log Structures (PALS)** of the IS/MND. Backwater BDAs described below will also be used downstream of headcuts to reduce erosion. A total of between 48 and 91 BDAs will be developed throughout the overall **Restoring the Deer Creek Headwaters at Childs Meadows Project** area. BDA structures will be constructed using native materials and hand crews. As proposed, BDA structures will be a channel-spanning feature having a constant crest elevation. These structures will be constructed with a mixture of woody debris, rock, and soil to form a pond and mimic a natural beaver dam. The design and implementation of BDAs is non-destructive method to promote the depositional processes that are responsible for riparian floodplain habitat. BDAs will also be used to create immediate deep-water habitat to promote beaver colonization and to promote many of the same processes affected by natural beaver dams (e.g., increased channel-floodplain connectivity).

When channel incision is less than 1.21 meters, BDAs will serve to redirect flow from the channel over banks and onto the floodplain, at all flow rates including stream baseflows. These structures will be built greater than 100% and up to 300% of the bank-to-bank channel width. The crest elevations of BDAs will be up to .61 meters above the lowest bank height, but generally less than 1 foot. BDAs will be spaced such that the backwater from one dam reaches the next upstream dam so that the head differential from bank to pond is no greater than .46 meters at base flow. This will reduce the potential for scour below each dam, energy for end-run head cutting, and will allow beavers to travel safely throughout the complex with reduced risk of predation. When incision is greater than 1.21 meters, BDAs will serve as grade control to create a backwater effect that arrests headcuts within the channel or adjacent floodplain. BDAs structures will be built to 100% of the bank-to-bank channel width and up to 1.21 meters in height.

All BDAs will have a uniform crest elevation across their length. The structures will be straight or convex downstream (middle of the dam furthest downstream) so as to not concentrate flow in the center of the channel. BDAs will be constructed using native material sourced within the Project area including conifers, willow, sod, soil, forest duff, and rocks. Materials sourced for BDAs will follow the criteria in the material sourcing practices described below under the heading **Material Sourcing**. BDAs typically include posts

driven into the channel bed and banks, with extensive additions of interwoven trees, branches, and roots; BDAs may also be constructed without posts. Finer material will be packed into the structure to provide a water seal that will reduce flow through BDA structures, redirecting flow over the banks/floodplain and/or overtop the BDA. An extensive curtain of woody material will be interwoven on the downstream side of the BDA to reduce scour from overtopping streamflow. The approximate fill volume for a BDA of 16' × 4' × 4' dimensions (L × W × H) is 10 cubic yards (c.y.), including 3-5 c.y. of wood and branches and 5-7 c.y. of sod, soil, and forest duff. For post-assisted BDAs, untreated pine posts up to 3" diameter will be driven into the ground at least ¼ of the final post length, spaced about 18-30" apart. BDAs posts will be installed with a portable hydraulic post pounder, or sledge hammer and manual post pounder. The remaining assembly will be by hand.

The construction of BDAs will require a light-duty truck or ATV to haul materials and equipment from the existing road network to BDA locations. All transportation equipment will be fitted with low pressure tires in order to prevent impacts to meadow vegetation and soil conditions. When transportation equipment is used, all cultural sites, areas with rare plants, fens and other sensitive areas of the Childs Meadows complex will be avoided.

BDA structures will be inspected and if necessary, maintained approximately every other month in the summers of years 1and 2 after installation. Maintenance will include adding material to seal leaks and pond water up to the bankfull or as-built height. Depending on the condition of the structures, maintenance will also include adding additional posts, weaving woody vegetation and/or patching small gaps using cobbles and sediment. Maintenance needs in years 3 through 5 will be determined through continued environmental monitoring conducted on an annual basis. Maintenance will be based on progress towards objectives identified in the monitoring plan developed for this project. Restoration efforts will utilize a process-based restoration approach and uses the dynamic hydrologic system within the Childs Meadows complex to alter the BDA structures. Consequently, intervention by Project proponents in order to maintain the restorative effects of Project work will be determined based on perturbation within the meadow system to effect achievement of Project objectives or significantly effecting timing of attaining those objectives. Substantial redundancies will be incorporated into Project work so that if some individual structures fail maintenance may not be necessary to achieve Project objectives. Maintenance and monitoring requirements will be formalized in a maintenance agreement established between the landowner and the RCD of Tehama County and as described in **Appendix L** of the IS/MND.

Post-Assisted Log Structure (PALS) Areas 1, 3, 4, 11, 14

This restoration practice will be utilized in riparian meadow transport reaches. A summary of this treatment is found in Table 2 of the IS/MND. Backwater BDAs described below will also be used downstream of headcuts to reduce erosion. Approximately 33-49 PALS will be constructed throughout the Project area utilizing native materials and hand crews. (**See schematic drawings found in Appendix J and cross sections in Appendix K to the Initial Study/Mitigated Negative Declaration)**. PALS structures are constructed using woody material of various sizes pinned together with untreated wooden posts driven into the stream bottom substrate and channel banks to mimic natural wood accumulations. These features are designed to influence hydraulic and geomorphic processes within stream channels. While PALS influence hydraulics at all flows, they are most likely to force geomorphic change during high flows when sediment is mobilized and as such require posts to provide temporary stability. Each PAL constructed will utilize a range of shapes and sizes based upon their location within the channel and desired function. In general, these features consist of larger diameter and longer length material than used in the construction of BDAs. PALS will be placed in reaches where incision is greater than 1.21 meters to accelerate the channel evolution processes of erosion and deposition and, in some cases, force overbank inundation during high flow. PALS will be built up to bank full 100% of the bank-to-bank channel width and up to 1.21 meters in height.

PALS are built with woody material and are intended to be porous. Construction materials will include trees, branches, and roots anchored using untreated pine posts up to 2.5" in diameter driven at least 2' into the channel bed and banks. Only those conifers meeting the criteria established for this material in the **Material Sourcing** section below will be felled and utilized in the construction of PALS. Posts will be installed with a sledge hammer, manual post-pounder, and portable hydraulic post pounder. The remaining PALS assembly is by hand. The approximate fill volume for a PALS of 12' × 4' × 3' dimensions is 5.5 c.y. of wood and branches.

The construction of PALS will require a light-duty truck or ATV to haul materials and equipment from the existing road network to PALS locations. All transportation equipment will be fitted with low pressure tires in order to prevent impacts to meadow vegetation and soil conditions. When transportation equipment is used, all cultural sites, areas with rare plants, fens, and other sensitive areas of the Childs Meadows complex will be avoided.

PALS will be maintained annually during baseflow conditions in years 1 through 3 after restoration. Maintenance includes adding and anchoring woody material up to the as-built height and up to the full channel width. Maintenance in years 3 through 5 will be determined by monitoring and is expected to be light and semi-annual. Maintenance will be based on progress towards objectives identified in the monitoring plan for this Project. Using a processed based approach, it is anticipated that the dynamic hydrologic system within the meadow complex will alter the BDA and PALS structures and thus intervention will be determined based upon the potential for any perturbation to effect achievement of Project objectives or to significantly effect timing in the attainment of those objectives. Redundancies will be built into the implementation of Project work so that if a portion of the individual structures fail, maintenance may not be necessary to achieve Project objectives. Maintenance and monitoring requirements will be formalized in a maintenance agreement established between and the RCD of Tehama County and shown in **Appendix L** of the IS/MND.

Mechanical Fill of Large Channels Areas 4 and 6.

Mechanical Fill treatments will be utilized in fens. Within treatment areas 4 and 6 incised and degraded channels at least .61 meters wide and .61 meters deep are located within and adjacent to fens. Due to the large fill volume required, mechanical equipment will be used to generate, transport, and place a mix of locally-sourced wood chips and mineral soil in large incised channels (up to 50% of fill will be wood chips). These locations are mapped as "Mechanical Channel Fill" and "Mechanical Borrow Area" in the plan view figures throughout the Initial Study/Mitigated Negative Declaration. The total eroded gully volume recommended for mechanical fill treatments is approximately 947 c.y.. The estimated total fill volume is 1,420 cubic yards of compacted material: approximately 710 cubic yards each of wood chips and mineral soil. Heavy-duty and light-duty equipment will access each restoration site from the existing road network and will not be operated on any meadow soils or plants. The mineral soil component excavated from the borrow areas will fill the gaps between the wood chips and shreds in the fill, helping anchor the saturated soil and preventing rapid subsurface flow. On all steep slopes, periodic permeable fill retainers such as organic erosion fabric or coir logs with interlaced wooden stakes hammered into beds and banks will be installed to reduce the risk of the saturated fill flowing down the channel before plant roots have a chance to grow, anchoring this material.

Earthen material will be excavated from hillslopes adjacent to the meadow as shown in plan views throughout the IS/MND. Multiple borrow locations have been identified from which fill material will be obtained. Most borrow areas will be located adjacent to the meadows and slightly higher in elevation than flood prone sites. In a number of instances, a portion of the borrow area may be located within the

floodplain. These sites however will be utilized so that the invert elevation (i.e., difference between upslope and downslope edge) remains flat or less than .15 meters in height. A total of 1,966 c.y. of potential fill has been identified in the mechanical borrow areas however, no more than 1,420 c.y. (if no wood chips are used in fill mix), and as little as 710 c.y. (if 50% woodchips are used in fill mix), of this material will be needed to fill the large meadow gullies.

Prior to filling the channel, all sod and topsoil from within the channel will be removed and placed adjacent to the channel. After fill material is transported and placed in the channel, sod and topsoil will be replaced, and covered with natural-fiber (e.g., coir or jute) erosion fabric anchored into the adjacent fen surface. Disturbed areas not covered by replaced sod will then be planted with seeds and plugs of native fen sedges, whose roots and rhizomes anchor fen soil. No maintenance is expected to be necessary for this practice, however annual monitoring will be in place for up to 5 years to determine any need. If substantial erosion occurs, additional material (erosion control fabric, and revegetation) will be required. Maintenance requirements will be formalized in a maintenance agreement between the landowner and the RCD of Tehama County **(See Appendix L)** of the IS/MND. The finished grade elevation for channel fill will be set to a similar elevation as the adjacent banks/floodplain. All fill surfaces that receive overland flow will be covered with staked erosion fabric suitable for transplanting into and allowing plant growth and establishment (e.g., Rolanka BioD-Mat).

Within sites having slopes >4%, coir logs will be placed and staked in a herringbone pattern over erosion-fabric-covered fill to prevent overland flow downslope. Permeable coir logs of about 1.82 to 2.44 meters in length will be used rather than natural trees or wood structures. The permeability and short length of the coir logs will better reduce the flow concentration along impermeable and long flow barriers. In addition, coir logs will decompose under wetland conditions after approximately 5 years, by which time dense wetland vegetation will be established and resistant to erosion. Sod plugs of the desired meadow type (e.g., fens and meadows) will be hand dug and transplanted into the fill areas. Locally collected seed of native wetland sedges will be grown at a nursery and the seedlings transplanted back into the fill. All identified rare plant occurrences will be avoided as borrow areas for plugs. Sparsely vegetated remnant meadow surfaces (not sites containing fill material) that will be receiving dispersed overland flow as part of a restoration treatment will be evaluated for erosion fabric protection. If sufficient surface stability, root cohesion and early spring plant growth exists, no additional fabric will be required. If not, erosion fabric and transplants will be added to these rewetted but not filled areas.

Hand Fill of Ditches and Small Channels 4, 6, 16, and 17

This restoration practice will be utilized within fen and discharge slope meadows. In select small channels and ditches less than approximately 2’ deep and 2’ wide, hand crews will backfill steep sloping locations or place plugs in shallow sloping locations. This practice is referred to as “Hand Fill Chanel,” “Hand Fill Ditch,” and “Hand Borrow Area” in the legends of plan view figures displayed throughout this IS/MND. Two types of fill material will be used as appropriate, either a 50:50 mix of native alluvium and wood chips, or densely woven coconut coir logs. In both instances, hand crews will place the material within the channel. Coir logs will be staked in place. The alluvium and wood chips mix will fill gaps between the bed, banks, and the coir logs, helping to prevent piping and rapid subsurface flow.

The total ditch and small channel fill volume recommended for hand fill treatments is approximately 740 c.y. Roughly 370 c.y. each of wood chips and mineral soil will be required if coir logs are not use. 693 c.y. of potential fill has been identified in hand fill borrow areas. Using hand tools, any remaining sod within small channels will be salvaged and stockpile adjacent to the channel. Alluvium will be excavated from borrow areas using a combination of mechanical and hand tools. This material along with wood chips will be transported using whenever feasible, non-mechanized equipment. Transport routes will be established

in areas that will not result in damage to meadow soils and vegetation resources. The salvaged sod will then be replanted with fill material packed to the required elevation. Jute fabric will be placed and staked in a manner similar to the mechanical treatment criteria described above if the area is at high risk of flood flows and erosion. No maintenance is expected to be necessary for channels and ditches filled by hand crews and annual monitoring will be in place for 3 years to determine any needs. If substantial erosion occurs, additional material, erosion control fabric, and revegetation will be required. Monitoring and Maintenance requirements will be formalized in a maintenance agreement between the landowner and RCD of Tehama County as described in Appendix I of the IS/MND.

Revegetation Areas 3, 5, 10, 11, 12, 13, 14

Revegetation practices described in this section will be used in and adjacent to riparian meadow floodplain and transport reaches. Riparian deciduous shrubs and trees will be planted in and adjacent to stream channels. These plantings are intended to accelerate the creation and enhancement of habitat for terrestrial and aquatic vertebrates. All plants will be locally sourced (collected locally and grown at a nursery). Willow cuttings will be sourced from within the Childs Meadows complex according to the criteria in the willow material sourcing practices described under **Material Sourcing** below. Revegetation will occur by hand within two years of hydrologic restoration activities. The Sierra Meadow Planting Palette tool developed by Point Blue Conservation Sciences (PBC) will be utilized to identify appropriate plant species in order to actively revegetate meadow sites within the Project area. Temporary protection (e.g., fencing, tubes) of plantings may be required to reduce impacts from cattle, deer, and other plant predators. If substantial loss of desired plant species occurs, additional planting (and protection) to maintain the desired species composition will be required. No maintenance is expected to be necessary for this practice, but occasional post-project monitoring will occur for up to 20 years to determine success and need for supplemental planting. Monitoring during the duration of the grant will occur as outlined in the monitoring plan shown in **Appendix L** of the IS/MND.

Material Sourcing

The following describes the requirements, procedures and standards for sourcing materials to be used in connection with the **Restoring the Deer Creek Headwaters at Childs Meadows Project**

Conifers

Approximately 3,890 non-merchantable live and recently fire-killed conifers will be required in order to implement proposed restoration practices: approximately 2,300 trees to generate 1,080 CY of woodchips for mechanical and hand fill treatments; up to 1,350 for wood structures (assuming 10 trees per BDA and PALS); and up to 235 for the conifer jackstraw treatments. These calculations assume an average tree size of 8” DBH. Live non-merchantable lodgepole pine, white fir, incense cedar, along with fire-killed non-merchantable conifers of any species, up to 12” DBH sourced from (1) within the boundaries of delineated wetlands outside of treed fens, and (2) within non-wetland habitat to 100 ft of the mapped wetland boundary of Childs Meadows will be utilized. The second sourcing area is within Collins Almanor Forest’s Childs Meadows THP boundary. These sites are displayed in **Figure 1: Restoring the Deer Creek Headwaters at Childs Meadows Project Location Map** of the IS/MND. All cultural resource and rare plant sites will be avoided when sourcing conifers. When woody material is needed, all suitable trees required for a particular activity will be felled and immediately transported to restoration areas using pick-up trucks and

ATVs with trailers. Limbs and other unused material will be lopped and scattered in the areas from which they were sourced. Exact areas where conifers are sourced will be determined during construction and thus are not shown in the plan view figures.

Beaver Dam Analogs

Beaver Dam analogs will be constructed using native material sourced onsite, including conifers, willow, sod, soil, forest duff, and rocks. Conifers and willows will be sourced as described in their respective material sourcing sections described in the IS/MND. Approximately five c.y. of non-woody material (sod, soil, forest duff, and rocks) will be needed for each BDA structure. Soil, forest duff, and rocks will be sourced with hand tools from upland sites within 30 m of mapped Childs Meadows wetland boundaries, outside of all cultural resource areas. These sites are identified as "BDA Uplands Material Source" in plan view figures throughout this IS/MND. A total of 19.6 acres of potential BDA material locations have been mapped however, only 2% of this area will be disturbed in order to yield no more than 550 c.y. of upland soil, duff, and rock. The disturbance footprint created in obtaining this material will occur in patches no larger than 4 m^2, digging 30 cm (12 inches) deep, and no more than 4 m^2 will be disturbed from any 20 m^2 area. Sod for BDAs will be obtained from existing wetland surfaces, excluding fens and dewatered wetlands. Patches of sourced sod will be no larger than 1 m^2 and 30 cm deep, and no more than 2 m^2 will be taken from any 20 m^2 area of non-fen existing wetland surface. Up to 500 m^2 of sod (up to 200 CY of sod material) will be used throughout the entire Project area. Sod source sites have not been mapped in plan view figures but will exclude rare plants and cultural sites.

Willows

Willow cuttings are required for the construction of BDAs and for revegetation plantings. Most of the willow cuttings will be sourced from individuals found within the Project area. When willows are not available within 100 yards of a planned BDA structure or revegetation area, cuttings will be sourced from the lower extent of the Project area, within Area 14, or further downstream on CAF land where willows are abundant. Only branches less than 2" in diameter at the cutpoint will be used. No more than 20% of stems from an individual willow plant will be removed. No willow cuttings will be removed within existing Willow Flycatcher territories as described in the Biological Resources section of this IS/MND.

Cattle Grazing

Current and historical grazing is a key problem related to the degradation of Childs Meadows. There are 395 acres of wetlands on CAF property managed under the conservation easement now held by Collins Almanor Forest of which 243 acres is currently available for "full-season" grazing. Currently, where grazing within the Childs Meadows complex is conducted, the grazing strategy is incompatible with achieving long-term restoration objectives. In order for grazing to continue within the **Project Area** while at the same time ensuring its compatibility with desired Project outcomes, modifications will be made to the current grazing regime within the Project area. To continue this land use activity once Project work is completed will require improved grazing management by the landowner and lessee as well as an increased use of fencing and natural barriers (e.g., downed trees) to exclude grazing from sensitive areas of the meadow such as fens, stream channels, and large unfilled headcuts **(See Figure 23: Map Showing Approximate Locations of Proposed New Fencing and Extent of Childs Meadows Wetland Area on Collins Almanor Forest Land With Easement Held by TNC Available for "Full-Season" Grazing and Table 3: Length of Fencing to be Installed Within the Restoring the Deer Creek Headwaters at Childs Meadows Project)** of the IS/MND.

As proposed, approximately 5% (12 of 243 acres) of the area within that portion of the meadow complex managed under CAF's conservation easement will be removed from all grazing activity. 231 acres of these wetlands will remain available for "full-season" grazing which would once again be allowed in the year immediately following completion of restoration work. Continuation of grazing will require diligence by the grazer and/or landowner to ensure that cows stay out of sensitive restored sites and that fences are repaired in a timely manner. Improved cattle grazing operations will require installing approximately 1 mile of new fencing **(See Table 3 of the IS/MND)**. Additional grazing mitigation practices would be needed within the most sensitive areas to ensure minimal damage to soils and resources when fences are breached or circumvented by cattle. Achieving necessary levels of protection will require a substantial initial cost for fencing and other Mitigation Measures, a maintenance budget for fence upkeep and regular diligence to ensure fence integrity especially in the late season when cows are inclined to enter wetter, more productive areas. These measures will be pared with a reduction in cattle number to attain AUMs approximately 20% lower than currently exists. A reduction in AUMs would be achieved through a combination of reducing the number of animals or the duration with which they are present. Exact AUMs will be adapted annually based on water year/available forage and results from monitoring the effects of previous year's grazing impacts on restoration goals. Development of a rigorous grazing management plan will occur as part of this Project's implementation funding to detail and codify these concepts.

Grazing Management - Exclusion Fencing

Exclusion fencing will be used in and adjacent to fens in Areas 4 and 6 to exclude or discourage cattle from entering these sensitive sites thus meeting restoration objectives. The fence type will be split rail utilizing cedar sourced within upland forest stands within the Project area on adjacent Collins Almanor Forest lands or wildlife friendly barbed wire. The fencing material to be used will vary depending on local conditions . No digging will be necessary, though posts will be driven into the ground. Mapped fence locations are approximate and may change based on field conditions **(See Figure 23: Map Showing Approximate Locations of Proposed New Fencing and Extent of Childs Meadows Wetland Area of the IS/MND)**. Cattle exclusion fencing will be maintained for the first 3 years by RCD of Tehama County and CAF using grant funding. Following the initial 3-year maintenance period, fence maintenance will become the responsibility of the landowner, which at the present time is Collins Pine. Cost associated with fence maintenance will be offset from funds generated in connection with Project area grazing leases.

Grazing Management - Conifer Jackstraw

Jackstrawing of small conifers will be used in fens and discharge slope meadows in Areas 4, 6, 16, 17, and 18. In these areas, fens were identified that had significant hoof puncture impacts created by cattle and are at high risk of further degradation. Where these fens remain unfenced or have partial fencing, small diameter whole trees will be felled and placed across the meadow and meadow edge in a crisscross (jackstraw) patten in order to discourage overuse by cattle. This material will be placed at a density of 100 trees per hectare over an area of 2.34 acres. Approximately 234 trees will be used for this purpose. All trees will be sourced according to the conifer material sourcing practice described in the IS/MND. All areas containing rare plants whose development is incompatible with this action will be avoided. The conifer jackstraw treatment will be maintained for the first 3 years by RCD and CAF personnel through implementation grant funds. Following the 3-year implementation period, maintenance will be the responsibility of the landowner

Grazing under new management requirements would be allowed in the year immediately following restoration. Monitoring of modified grazing areas would be required of the grazer and CAF to ensure

livestock is excluded from sensitive areas. CAF has stated a commitment to regularly assess the compatibility of the selected grazing regime with restoration objectives through long-term monitoring, adaptively managing grazing in the interest of meadow health and re-evaluating the grazing lease annually with the possibility of complete cessation of grazing within the meadow in the future.