Appendix B – Glossary

Term	Definition
Abiotic	Non-living. Climate is an abiotic component of ecosystems.
Active Nest	A nest with an adult pair present at least one year within a period of five consecutive years.
ADA	American with Disabilities Act
Affected environment	The natural environment that exists at the present time in an area being analyzed. The environment of the area to be affected or created by the alternatives under consideration.
Age class	An age grouping of trees of according to an interval of years, usually 20 years. A single age class would have trees that are within 20 years of the same age, such as 1–20 years or 21–40 years.
Air Quality	Refers to air standards for various classes of air as designated by the Clean Air Act, P.L. 88-206: Jan. 1978. Airshed Basic geographic units in which air quality is managed.
Airshed	A geographic area that shares the same air.
Alternative	A combination of management prescriptions applied in specific amounts and locations to achieve a desired management emphasis as expressed in goals and objectives. One of several policies, plans, or projects proposed for decision.
Alternative, No Action	An alternative that maintains current established trends or management direction.
Ammocoetes	The larval form (ammocoete) of Pacific lamprey. The ammocoete generally spends 4- 7 years burrowed in the stream substrate prior to undergoing a physiological process which prepares the juvenile (macrothalmia) for migration and adaptation to salt water.
Anadromous Fish	Fish that migrate from salt water seas up fresh water streams to reproduce.
Animal Unit Month (AUM)	The quantity of forage required by one mature cow and her calf (or the equivalent, in sheep or horses, for instance) for one month.
Apparent Naturalness	Roadless area characteristic defined as an indicator of whether an area appears natural to most people who are using the area. It is a measure of importance of visitors' perception of human impacts to the area. There may be some human impact, but it would not be obvious to the casual observer and the area would have the appearance of being affected only by the forces of nature.
AQMP	Air Quality Management Plan
AQRVs	Air Quality Related Values

Term	Definition
Aquatic Ecosystem	A stream channel, lake or estuary bed, the water itself, and the biotic communities that occur therein.
Aspect	The direction a slope faces. A hillside facing east has an eastern aspect.
ATV	All terrain vehicles such as motorcycles, 4-wheelers, and snowmobiles.
Authorized Officer	The Bureau of Land Management employee delegated Officer given the authority to perform a duty described in these rules. A Regional Forester, Forest Supervisor, District Ranger depending on the scope and level of the duty to be performed.
Avoided	Preventing a potential adverse effect from occurring to a cultural resource by the partial or complete redesign or relocation of a proposed land use.
Background Viewing Area	A landscape viewing area visible to a viewer from approximately three to five miles to infinity.
BACT	Best Available Control Technology
Bark beetle	An insect that bores through the bark of forest trees to eat the inner bark and lay its eggs. Bark beetles are important killers of forest trees.
Basal area (BA)	The area of the cross section of a tree trunk near its base, usually 4½ feet above the ground. Basal area is a way to measure how much of a site is occupied by trees. The term basal area is often used to describe the collective basal area of trees per acre.
Best Available Science	The Responsible Official has considered the best available science, also considering public input, competing use demands, budget projections, and other factors. Consideration of science has included: Surveying a wide range of available scientific information, including both published material, historical data, and agency surveys and reports to develop a comprehensive basis for analysis of important issues. Using best available data and models at appropriate scales, on the basis of internal review and consultation. Evaluating and disclosing limitations of data and models. Evaluating and disclosing substantial risks associated with project actions based on that science, and identifying the ecosystem components at risk. Considering and disclosing uncertainties and opposing viewpoints in scientific literature pertinent to project development and effects analysis. Independent peer review and other appropriate review to evaluate the application of science. These considerations are adapted from proposed Forest Planning Rule 219.11: Consideration of science in planning; Federal Register Volume 59, No. 126: Notice of interagency cooperative policy on information standards under the Endangered Species Act; Final ESA Consultation Handbook, March 1998, pages 1–6 on best available scientific and commercial data; and relevant court decisions. Each consideration is discussed in the individual resource analysis to the degree the issues merit.

Term	Definition
Best Management Practices (BMPs)	The set of management practices that, when applied during implementation of a project, ensures that water-related beneficial uses are protected and that state water quality standards are met.
Big Game	Those species of large mammals normally managed as a sport hunting resource.
Biodiversity	The variety of life in an area, including the variety of genes, species, plant, and animal communities, and ecosystems, as well as the interactions of these elements.
Biological Assessment (BA)	A stand alone document that reviews all BLM planned, funded, executed, or permitted programs and activities for possible effects on federally listed threatened, endangered, proposed, and candidate species as identified for the cumulative effects area in coordination with the USFWS. A Biological Assessment is used to satisfy consultation requirements with the USFWS for projects requiring an Environmental Impact Statement. (Reference: Sec. 7, ESA; 50 CFR, 402.12, 1508.7, 1508.25, and 1508.27.) The Biological Assessment displays the Determination of Effects for the DEIS or FEIS preferred alternative. The Determination of Effects (Salwasser, et al. Aug. 17, 1995) is limited to: (1) No Effect; (2) May effect–Not likely to adversely affect (NLAA); (3) *May effect–Likely to adversely affect (LAA); and (4) Beneficial effect. * = Considered a trigger for a significant action.
Biological Evaluation (BE)	Documentation on BLM sensitive species (animal and plant) contained within an EIS. Documentation includes a review of BLM sensitive species present, their habitat, and addresses and identifies the Determination of Effects on these species. The USFWS review of the biological evaluation is addressed through public scoping and conducted in conjunction with overall agency review of the DEIS. Reference FSM 2673.4 Biological Evaluations for Sensitive Species. Opinions in the determination of impacts to sensitive species (Salwasser, et al. Aug. 17,1995) are limited to: (1) NI = No impact; (2) MIIH = May impact individuals or habitat, but will not likely contribute to a trend towards federal listing, or cause a loss of viability to the population or species; (3) *WIFV = Will impact individuals or habitat with a consequence that the action may contribute to a trend towards federal listing or cause a loss of viability to the population of species; and (4) BI = Beneficial impact. * = Trigger for a significant action as defined in NEPA.
Biological Opinion	An official report by the US Fish and Wildlife Service (FWS) issued in response to a formal Forest Service request for consultation or conference. It states whether an action is likely to result in jeopardy to a species or adverse modification to its critical habitat.
Biomass	The total weight of all living organisms in a biological community.

Term	Definition
Biota	Living. Green plants and soil micro-organisms are biotic components of ecosystems
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
Board foot	A measurement term for lumber or timber. It is the amount of wood contained in an unfinished board 1-inch thick, 12 inches long, and 12 inches wide.
Broadcast burn	A prescribed fire that burns a designated area. These controlled fires can reduce wildfire hazards, improve forage for wildlife and livestock, or encourage successful regeneration of trees.
Buffer	A land area that is designated to block or absorb unwanted impacts to the area beyond the buffer. Buffer strips along a trail could block views that may be undesirable. Buffers may be set-aside next to wildlife habitat to reduce abrupt change to the habitat.
Bureau of Land Management (BLM)	The Department of Interior agency responsible for managing most federal government subsurface minerals.
CAA	Clean Air Act
Cable logging	Logging that involves the transport of logs from stump to collection points by means of suspended steel cables, a tower, and powered winch.
Canopy	The part of any stand of trees represented by the tree crowns. It usually refers to the uppermost layer of foliage, but it can be used to describe lower layers in a multi-storied forest.
Capability	The potential of an area of land to produce resources, supply goods and services, and allow resource uses under an assumed set of management practices and at a given level of management intensity. Capability depends upon current conditions and site conditions such as climate, slope, landform, soils, and geology, as well as the application of management practices, such as silviculture or protection from fire, insects, and disease.
Cavity	A hole in a tree often used by wildlife species, usually birds, for nesting, roosting, and reproduction.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Classified Road	Roads wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including state roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service.
Clean Water Act	The Clean Water Act is the primary federal law that protects our nation's waters, including lakes, rivers, aquifers, and coastal areas.

Term	Definition
Clear cut	A harvest in which all or almost all of the trees are removed in one cutting.
Climax	The culminating stage in plant succession for a given site. Climax vegetation is stable and self-reproducing.
Closure	The administrative order that does not allow specified users in designated areas or on BLM or Forest development roads or trails.
Code of Federal Regulation (CFR)	Regulations developed at the Department level for the specific implementation of a Public Law.
Commercial Thin	A cultural treatment made to reduce stand density of trees primarily to improve growth, enhance forest health, or to recover potential mortality, while removing a commercial product.
Composite Watershed	Watersheds that are not a single complete drainage. Current terminology refers to them as composite watersheds.
Composition	What an ecosystem is composed of. Composition could include water, minerals, trees, snags, wildlife, soil, micro-organisms, and certain plant species.
Conifer	A tree that produces cones, such as a pine, spruce, or fir tree
Connected Actions	A connected action is one type of action considered in determining the scope of the Proposed Action. Connected actions are actions that closely relate and therefore should be discussed in the same EIS (40 CFR 1508.29(i)(ii)(iii)). Actions are connected if they: (i) Automatically trigger other actions that may require environmental impact statements. (ii) Cannot or will not proceed unless other actions are taken previously or simultaneously. (iii) Are interdependent parts of larger actions and depend on the larger action for their justification.
Connectivity	Condition in which the spatial arrangements of land cover types allows organisms and ecological processes (such as disturbance) to move across the landscape. Connectivity is the opposite of fragmentation.
Connectivity (of habitats)	The linkage of similar but separated vegetation stands by patches, corridors, or “stepping stones” of like vegetation. This term can also refer to the degree to which similar habitats are linked.
Consumptive use	Use of resources that reduces the supply, such as logging and mining
Contour	A line drawn on a map connecting points of the same elevation.
Contrast	The effect of a striking difference in the form, line, color, or texture of an area being viewed.
Corridor	Elements of the landscape that connect similar areas. Streamside vegetation may create a corridor of willows and hardwoods between meadows were wildlife feed.

Term	Definition
Cost	The negative or adverse effects of expenditures resulting from an action. Costs may be monetary, social, physical, or environmental in nature.
Council on Environmental Quality (CEQ)	An advisory council to the President established by the National Environmental Policy Act of 1969. It reviews federal programs for their effect on the environment, conducts environmental studies, and advises the President on environmental matters.
County Road	A road under the jurisdiction of the county.
Cover	Any feature that conceals wildlife or fish. Cover may be dead or live vegetation, boulders, or undercut stream banks. Animals use cover to escape from predators rest, or feed.
Cover type (forest cover type)	Stands of particular vegetation types that are composed of similar species.
Created opening	An opening in the forest cover created by the application of even-aged silvicultural practices.
Critical Habitat	Specific areas within the geographical area occupied by the species on which are found those physical and biological features (1) essential to the conservation of the species, and (2) that may require special management considerations or protection. Critical habitat shall not include the entire geographic area that can be occupied by the threatened and/or endangered species.
Crown	The part of a tree or woody plant bearing live branches and foliage. Dominant–Trees with crowns extending above the general level of the main canopy of even-aged groups of trees, and receiving full light from above and partly from the sides. Co-dominant–Trees with crowns forming the general level of the main canopy in even-aged groups of trees, receiving full light from above and comparatively little from the sides. Intermediate–Trees with crowns extending into the lower portion of the main canopy of even-aged groups of trees, but shorter in height than the co-dominants. They receive little direct light from above and none from the sides. Overtopped (Suppressed)–Trees of varying levels of vigor that have their crowns completely covered by the crowns of one or more neighboring trees.
Cultural resource	A definite location of human activity, occupation, or use identifiable through field inventory, historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional cultural or religious importance to specified social and/or cultural groups.
Cumulative effects	Effects on the environment that result from separate, individual actions that, collectively, become significant over time.

Term	Definition
Cumulative Effects Analysis	An analysis of the effects of the environment that results from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or nonfederal), or person undertakes such other actions.
Cumulative Impact	The impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
CWA	Clean Water Act
CWE	Cumulative Watershed Effects
dbh	Diameter at Breast Height: The diameter of a tree 4½ feet above the ground on the uphill side of the tree.
DEIS	Draft Environmental Impact Statement–The draft version of the Environmental Impact Statement that is released to the public and other agencies for review and comment.
Desired future condition	Land or resource conditions that are expected to result if goals and objectives are fully achieved.
Developed Recreation	Recreation that occurs where improvements have been added to enhance recreation opportunities and accommodate intensive recreation activities in a defined area.
Diameter of Breast Height	The standard method for measuring tree diameter at 4½ feet from the ground. Also known as dbh.
Direct Effects	Effects on the environment that occur at the same time and place as the initial cause or action.
Dispersed recreation	Recreation that does not occur in a developed recreation site, such as hunting, backpacking, and scenic driving.
Displacement	As applied to wildlife, forced shifts in the patterns of wildlife use, either in location or timing of use.
Disturbance	Any event, such as forest fire or insect infestations that alter the structure, composition, or functions of an ecosystem.
Diversity	(1) The relative abundance of wildlife species, plant species, communities, habitats, or habitat features per unit of area. (2) The distribution and abundance of different plant and animal communities and species within the area covered by a Land and Resource Management Plan.
Draft Environmental Impact Statement	(DEIS) A detailed written statement as required by Sec. 102 (2)(C) of the National Environmental Policy Act (NEPA).

Term	Definition
Duration	The length of time management activity and its impacts will be taking place.
EA	Environmental Assessment
EC	Existing Conditions
ECA	Equivalent Clearcut Area
Ecology	The interrelationships of living things to one another and to their environment, or the study of these interrelationships.
Ecosystem	An arrangement of living and non-living things and the forces that move among them. Living things include plants and animals. Non-living parts of ecosystems may be rocks and minerals. Weather and wildfire are tow of the forces that act within ecosystems.
Ecosystem management	An ecological approach to natural resource management to assure productive, healthy ecosystems by blending social, economic, physical, and biological needs and values.
Ecosystem Structure	The physical arrangement of the various components. In addition, trophic (nourishing) structure; measured in standing crop or energy fixed per unit area per unit time. May be pyramids of numbers, biomass, or energy flows.
Edge	The margin where two or more vegetation patches meet, such as a meadow opening next to a mature forest stand, or a ponderosa pine stand next to an aspen stand.
Effects *(also see Impacts)*	Physical, biological, social, and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect, and cumulative and may be either beneficial or detrimental. (See *Impacts*)
EIS	Environmental Impact Statement (under NEPA)
Endangered species	A plant or animal that is in danger of extinction throughout all or a significant portion of its range. Endangered species are identified by the Secretary of the Interior in accordance with the Endangered Species Act of 1973.
Endemic	Restricted to a specified region or locality.
Endemic plant/organism	A plant or animal that occurs naturally in a certain region and whose distribution is relatively limited geographically.
Enhancement	A short-term visual resource management objective aimed at increasing positive visual variety where little variety now exists.
Environmental Analysis	An analysis of alternatives actions and their predictable short- and long-term environmental effects, which include physical, biological, economic, social, and environmental design factors and their interactions. Completion of this level of analysis may result in a Decision Notice (DN) and Finding of No Significant Impact (FONSI).

Term	Definition
Environmental Assessment (EA)	A concise public document prepared to provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact. It includes a brief discussion of the need for the proposal, alternatives considered, environmental impact of the proposed action and alternatives, and a list of agencies and individuals consulted.
Environmental Impact Statement (EIS)	A formal public document prepared to analyze and disclose the impacts on the environment of the proposed project or action and alternatives.
Environmental Justice	When environmental effects do not disproportionately affect minority or low-income communities.
EO	Executive Order
EPA	U.S. Environmental Protection Agency
Ephemeral Stream	A stream that flows only in direct response to precipitation and whose channel is at all times above the water table.
Equivalent Clearcut Area	The total area in a watershed that does or would exist in a clearcut condition.
Erosion	(1) The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep. (2) Detachment and movement of soil or rock fragments by water, wind, ice, or gravity.
Erosion Hazard	The probability of soil loss resulting from complete removal of vegetation and litter. It is an interpretation based on potential soil loss in relation to tolerance values.
ESA	Endangered Species Act
Even-aged	A stand of trees that originated at a single point in time, so that the individual trees are approximately the same age or a regeneration system designed to produce such a stand.
Even-aged management	Timber management actions that result in the creation of stands of trees in which the trees are essentially the same age.
Executive Orders 11990 and 11988	The purpose of these executive orders is to avoid to the extent possible the long- and short-term adverse impacts associated with the destruction or modification of wetlands and floodplains.
Existing Old Growth	Individual stands on a national forest currently recognized as meeting the parameters of the old-growth operational definitions.
Exotic	Foreign, not native.
Fauna	The animal life of an area.
FEIS	Final Environmental Impact Statement
FEIS Database	See *Fire Effects Information System*

Term	Definition
Felling	Cutting down trees.
Final cut	The removal of the last seed bearers or shelter trees after regeneration of new trees has been established in a stand being managed under the shelterwood or seedtree system of silviculture.
Final Environmental Impact Statement (FEIS)	The final version of the public document required by NEPA.
Fire Effects Information System (FEIS)	FEIS provides up-to-date information about fire effects on plants and animals. It was developed at the United States Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory in Missoula, Montana. The FEIS database contains literature reviews, taken from current English-language literature of almost 900 plant species, about 100 animal species, and 16 Kuchler plant communities found on the North American continent. The emphasis of each review is fire and how it affects each species. Background information on taxonomy, distribution, basic biology, and ecology of each species is also included. Reviews are thoroughly documented, and each contains a complete bibliography. Managers from several land management agencies (United States Department of Agriculture, Forest Service, and United States Department of Interior, Bureau of Indian Affairs, Bureau of Land Management, Fish and Wildlife Service, and National Park Service) identified the species to be included in the database. Those agencies funded the original work and continue to support maintenance and updating of the database. FEIS staff accessions current English-language literature for FEIS literature reviews by searching scientific abstracts including Agricola, Current Contents, Current Titles in Wildland Fire, Ecodisc, Ecological Abstracts, Forestry Abstracts, Georef, and Water Resources Abstracts. Tables of Content from reefed scientific journals and government publication lists are also regularly searched for pertinent literature.
Fire Intensity	A fire's characteristics, or fire intensity, include flame length, rate of spread, amount and location of torching, distance a fire spots, and energy produced. This is the result of the interaction of the physical setting (composed of aspect, slope, drainage location and direction, and topographic position), weather, as well as vegetative structure, which can include homes.
Fire regime	The characteristics of fire in a given ecosystem, such as the frequency, predictability, intensity, and seasonality of fire.
Fire severity ratings	Low Fire Severity: Low soil heating, or light ground char, occurs where litter is scorched, charred, or consumed, but the duff is left largely intact, although it can be charred on the surface. Woody debris accumulation are partially consumed or charred. Mineral soil is not changed. Fire severity

Term	Definition
	in forest ecosystems is low if the litter and duff layers are scorched or not altered over the entire depth. The surface is mostly black in a shrubland or grassland ecosystem, although gray ash can be present for a short time. Soil temperatures at 1 cm are less than 50 C. Lethal temperatures for soil organisms occur down to depths of about 1 cm. Moderate Fire Severity: Moderate soil heating, or moderate ground char, occurs where the litter on forest sites is consumed and the duff is deeply charred or consumed, but the underlying mineral soil surface is not visibly altered. Light colored ash is present. Woody debris is mostly consumed, except for logs, which are deeply charred. On shrubland or grassland sites, gray or white ash is present and char can be visible in the upper 1 cm of mineral soil, but the soil is not altered. Soil temperatures at the 1 cm depth can reach 100 to 200 C. Lethal temperatures for soil organisms occur down to depths of 3–5 cm. High Fire Severity: High soil heating, or deep ground char, occurs, where the duff is completely consumed and the top of the mineral soils is visibly reddish or orange on severely burned sites. Color of the soil below 1 cm is darker or charred form organic material. The char layer can extend to a depth of 10 cm or more. Logs can be consumed or deeply charred, and deep ground char can occur under slash concentrations or burned out logs. Soil texture in the surface layers is changed and fusion evidenced by clinkers can be observed locally. All shrub stems are consumed and only the charred remains of large stubs may be visible. Soil temperatures at 1 cm are greater than 250 C. Lethal temperatures for soil organisms occur down to depths of 9–16 cm. (Debano et al., 1998)
FISHSED	Guide for Predicting Salmonid Response to Sediment Yields, commonly referred as FISHSED model.
Fisheries	Resident and anadromous fish species.
Fisheries habitat	Streams, lakes, and reservoirs that support fish, or have the potential to support fish.
Flood plain	Lowland adjoining a watercourse. At a minimum, the area is subject to a 1% or greater chance of flooding in a given year.
Flora	The plant life of an area.
Forage	All browse and non-woody plants that are eaten by wildlife and livestock.
Forb	A broadleaf plant that has little or no woody material in it.
Foreground	One of the distance zones of a landscape being viewed. A distance that details can be perceived, normally within one quarter to one-half mile of the viewer. Must be determined on a case-by-case basis.
Forest	An area of trees with overlapping crowns (generally forming a 60 to 100 percent cover).
Forest cover type	See *Cover type*.

Term	Definition
Forest health	A measure of the robustness of forest ecosystems. Aspects of forest health include biological diversity; soil, air, and water productivity; natural disturbances; and the capacity of the rest to provide a sustaining flow of goods and services for people.
Forest land	Land at least 10 percent occupied by forest trees of any size or formerly having had such tree cover and not currently developed for non-forest use. Lands developed for non-forest use include areas for crops, improved pasture, residential, or administrative areas, improved roads of any width, and adjoining road clearing and powerline clearing of any width.
Forest Plan	A comprehensive management plan prepared under the National Forest Management Act of 1976 that provides standards and guidelines for management activities on the Forest.
Forest Service (FS)	The agency of the United States Department of Agriculture responsible for managing National Forests and Grasslands.
Forest Supervisor	The official responsible for administering National Forest lands on an administrative unit, usually one or more National Forests. The Forest Supervisor reports to the Regional Forester.
Form	The mass of an object or objects that appears visually unified.
Formation	A body of rock identified by lithic (stone) characteristics and stratigraphic (rock strata) position; it is prevailingly, but not necessarily tabular, and is mapable at the earth's surface or traceable in the subsurface.
FP	Forest Plan
Fragmentation	The splitting or isolating of patches of similar habitat, typically forest cover, but including other types of habitat. Habitat can be fragmented naturally or from forest management activities, such as clearcut logging.
Fuel Model	Fuel models are sets of parameters that describe physical fuel properties, including fuel loading, fuel bed depth, and moisture of extinction. Each fuel model is typically used to represent a range of conditions in which fire behavior may be expected to respond similarly to changes in fuel moisture, wind, and slope. Fuel models are used as input in fire behavior prediction models.
Fuelbreak	A linear corridor in which vegetation is modified to prevent fires from easily crossing.
Fuels	Plants and woody vegetation, both living and dead, that are capable of burning.
Fuels management	The treatment of fuels that would otherwise interfere with effective fire management or control. For instance, prescribed fire can reduce the amount of fuels that accumulate on the forest floor before the fuels become so heavy that a natural wildlife in the area would be explosive and impossible to control.
Fuelwood	Wood cut into short lengths for burning.

Term	Definition
Function	All the processes within an ecosystem through which the elements interact, such as succession, the food chain, fire, weather, and the hydrologic cycle.
FWS	U.S. Fish & Wildlife Service
Game species	Any species of wildlife or fish for which seasons and bag limits have been prescribed under state or federal laws, codes, and regulations, and that are normally harvested by hunting, trapping, and fishing.
Geology	The study of the planet Earth. It is concerned with the origin of the planet, the material and morphology of the Earth, and its history and the processes that acted (and act) upon it to affect its historic and present forms.
Geomorphic processes	Processes that change the form of the earth, such as volcanic activity, running water, and glacial action.
GIS (geographic information systems)	GIS is both a database designed to handle geographic data as well as a set of computer operations that can be used to analyze the data. In a sense, GIS can be thought of as a higher order map.
Goal	A concise statement that describes a desired condition to be achieved sometime in the future. It is normally expressed in broad, general terms and is timeless in that it has no specific date by which it is to be completed. Goal statements form the principal basis from which objectives are developed.
Ground fire	A fire that burns along the forest floor and does not affect trees with thick bark or high crowns.
Ground water	The supply of fresh water under the earth's surface in an aquifer or in the soil.
Group selection	A method of tree harvest in which trees are removed periodically in small groups. This silvicultural treatment results in small openings that form mosaics of age class groups in the forest.
Guilds	A group of organisms that share a common food resource.
Habitat	The physical and biological environment for a plant or animal in which all the essentials for its development, existence, and reproduction are present.
Habitat capability	The ability of a land area or plant community to support a given species of wildlife.
Habitat Management Plan	A BLM activity plan (HMP) for wildlife, fisheries, or ecological resources. The plan identifies purpose and need, objectives, management actions, and monitoring strategy.
Habitat type	A way to classify land area. A habitat type can support certain climax vegetation, both tree and undergrowth species. The habitat type can indicate the biological potential of a site.

Term	Definition
Habitat Type Group	An aggregation of habitat types with similar interpretative properties.
Heterogeneity	Dissimilar elements and non-uniform.
Hiding cover	Vegetation capable of hiding 90 percent of an adult elk or deer from human view at a distance of 200 feet or less.
High fire severity	See *Fire severity ratings*
HUC	Hydrologic Unit Code. See Hydrologic Unit
Human Environment	The factors that include, but are not limited to biological, physical, social, economic, cultural, and aesthetic factors that interrelate to form the environment.
Hydrologic Unit	A hierarchical coding system developed by the U.S. Geological Service to map geographic boundaries of watersheds of different sizes.
Hydrology	The science dealing with the study of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere.
ID	Interdisciplinary
Impact (also see *Effects*)	Physical, biological, social, and economic results (expected or experienced) resulting from achievement of outputs. Effects can be direct, indirect, and cumulative and may be either beneficial or detrimental.
IMPLAN Pro	An economic input / output model.
Indicator Species	A species of animal or plant whose presence is a fairly certain indication of a particular set of environmental conditions. Indicator species serve to show the effects of development actions on the environment.
Indirect Effects	Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
Instream flow	The quantity of water necessary to meet seasonal stream flow requirements to accomplish the purposes of the National Forests, including, but not limited to fisheries, visual quality, and recreational opportunities.
Integrated pest management	A process for selecting strategies to regulate forest pests in which all aspects of a pest-host system are studied and weighed. The information considered in selecting appropriate strategies includes the impact of the unregulated pest population on various resources values, alternative regulatory tactics and strategies, and benefit/cost estimates for these alternative strategies. Regulatory strategies are based on sound silvicultural practices and ecology of the pest-host system and consist of a combination of tactics such as timber stand improvement plus selective

Term	Definition
	use of pesticides. A basic principle in the choice of strategy is that it be ecologically compatible or acceptable.
Interdisciplinary team	A team of individuals with skills from different disciplines that focuses on the same task or project.
Intermittent stream	A stream that flows only at certain times of the year when it receives water from streams or from some surface source, such as melting snow.
Inventoried Roadless Area (IRA)	Unroaded areas typically 5000 acres or more that meet criteria for wilderness consideration under the Wilderness Act and that were inventoried during the Forest Service's Roadless Area and Review and Evaluation (RARE II) process, subsequent assessments, or forest planning.
Invertebrate	An animal lacking a spinal column.
IRA	Inventoried Roadless Area
Irregular Shelterwood	An irregular shelterwood system consists of individual leave-trees or small groups distributed throughout the stand, interspersed with small openings such that the adjacent trees provide shelter for various resource needs. The key characteristic of the irregular shelterwood is that, although prompt regeneration is an objective, residual trees are left for long periods beyond the regeneration phase (e.g., from 20% of the rotation to several rotations). Residual trees initiate new age classes of regeneration, accumulate wood volume increment and, if desired, achieve non-timber stand objectives.
Irretrievable	One of the categories of impacts mentioned in the National Environmental Policy Act to be included in statements of environmental impacts. An irretrievable effect applies to losses of production or commitment of renewable natural resources.
Irretrievable Effect	An irretrievable effect is one that is sustained for a certain period of time but is reversible.
Irreversible	A category of impacts mentioned in statements of environmental impacts that applies to nonrenewable resources, such as minerals and archaeological sites. Irreversible effects can also refer to effects of actions that can be renewed only after a very long period of time, such as the loss of soil productivity.
Irreversible Effects	An irreversible effect is one that cannot be reversed.
Issue	A public or agency concern or controversy about a specific action or area that is addressed in the NEPA process.
km	Kilometer
Ladder fuels	Vegetation located below the crown level of forest trees that can carry fire from the forest floor to tree crowns. Ladder fuels may be low growing tree branches, shrubs, or smaller trees.

Term	Definition
Landing	Any place where cut timber is assembled for further transport from the timber sale area.
Late Seral (successional) Stage	The stage of forest development during which the age of trees is usually greater than 80 years depending on the composition of tree species. Small gaps become more common as some trees die allowing full sunlight to reach the mid- and under stories. This stage contains the largest trees within a forest and provides the highest capability for large snags, large live cavities, and den tree production. The presence of large, downed, woody material is highest during this period. Old-growth forests occur during the later periods of the seral stage.
Litter (forest litter)	The freshly fallen or only slightly decomposed plant material on the forest floor. This layer in includes foliage, bark fragments, twigs, flowers, and fruit.
Logging slash	The residue left on the ground after timber cutting. It includes unutilized logs, uprooted stumps, broken branches, bark, and leaves. Certain amounts of slash provide important ecosystem roles, such as soil protection, nutrient cycling, and wildlife habitat.
Low fire severity	See *Fire severity ratings*
LRMP	Land & Resource Management Plan
M	Thousand. Five thousand board feet of timber can be expressed as 5M board feet.
Management action	Any activity undertaken as part of the administration of BLM land
Management Area	An aggregation of capability areas that have common management direction under the MFP and may be noncontiguous in BLM land. Consists of a grouping of capability areas selected through evaluation procedures and used to locate decisions and resolve issues and concerns.
Management Direction	A statement of multiple-use and other goals and objectives, the associated management practices identified by the BLM in the planning process.
Management practice	A specific activity, measure, course of action, or treatment.
Mass movement/wasting	The down-slope movement of large masses of earth material by the force of gravity. Also called a landslide.
Matrix	The least fragmented, most continuous pattern element of a landscape; the vegetation type that is most continuous over a landscape.
Mature timber	Trees that have attained full development, especially height, and are in full seed production.
MBF	Thousand Board Feet
MCF	thousand cubic feet
Mesic	Pertaining to or adapted to an area that has a balanced supply of water; neither wet nor dry.

Term	Definition
MFP	Management Framework Plan–this document guides the management of a particular BLM administrative area and establishes management standards and guidelines for all lands of that area.
Microclimate	The climate of a small site. It may differ from the climate at large of the area due to aspect, tree cover (or the absence of tree cover), or exposure to winds.
Mid Seral (successional) Stage	The stage of forest development during which distinct over story, mid story, and under story canopies are present. The age of trees range from about 20 years to about 90 years depending on the composition of tree species. The trees are usually greater than 10 inches in dbh. This stage provides capability for hard mast production, large standing snags, and live cavities. During this period, tree species reach economic maturity.
Mineral soil	Soil that consists mainly of inorganic material, such as weathered rock, rather than organic matter.
Mitigation	Actions taken to avoid, minimize, or rectify the impact of a land management practice.
MM	Million
MMBF	Million Board Feet
Moderate fire severity	See *Fire severity ratings*
Modification	Fundamental change to the provisions of a lease stipulation, either temporarily or for the term of the lease. Therefore, a modification may include an exemption from or alteration to a stipulated requirement. Depending on the specific modification, the stipulation may or may not apply to all other sites within the leasehold to which the restrictive criteria apply.
Monitoring	To watch, observe, or check, especially for a specific purpose, such as to keep track of, regulate, or control (Webster's dictionary).
Monitoring and evaluation	The periodic evaluation of forest management activities to determine how well objectives were met and how management practices should be adjusted.
Montane	Relating to the zone of relatively moist, cool, upland slopes characterized by the presence of large evergreen trees as a dominant life form.
Mortality	Trees that were merchantable and have died within a specified period of time. The term mortality can also refer to the rate of death of a species in a given population or community.
Mosaic	Areas with a variety of plant communities over a landscape, such as areas with trees and areas without trees occurring over a landscape.
MOU	Memorandum of Understanding

Term	Definition
Mountain pine beetle	A tiny black insect, ranging from 1/8 to ¾ inch in size, which bores through a pine tree's bark. It stops the tree's intake and transport of the food and nutrients it must have to stay alive, thus killing the tree.
NAAQS	National Ambient Air Quality Standards
National Environmental Policy Act of 1969 (NEPA)	An act which encourages productive and enjoyable harmony between man and his environments; promotes efforts to prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; enriches the understanding of the ecological systems and natural resources important to the Nation; and establishes a Council on Environmental Quality.
National Forest Management Act (NFMA)	A law passed in 1976 as amendments to the Forest and Rangeland Renewable Resources Planning Act that requires the preparation of Regional and Forest plans and the preparation of regulations to guide that development.
National Forest System (NFS)	All National Forest System lands reserved or withdrawn from the public domain of the United States; all National Forest System lands acquired through purchase, exchange, donation, or other means, and other lands, waters, or interests therein which are administered by the Forest Service or are designated for administration through the Forest Service as a part of the system (16 U.S.C. 1609).
National Forest System Road (NFSR)	A Forest road under jurisdiction of the Forest Service.
National Park Service	The agency of the U.S. Department of the Interior responsible for the administration of national Parks, Monuments, and Historic Sites. It is distinct form the USDA Forest Service both administratively and by mission.
National Register of Historic Places (NRHP)	The National Register lists cultural properties found to qualify for inclusion because of their local, state, or national significance. The National Register of Historic Places is maintained by the Secretary of the Interior.
Native Species	All animal and plant species originally occurring in the area.
Natural disturbance	See *Disturbance*.
Natural Integrity	Roadless area characteristic defined as the extent to which long-term ecological processes are intact and operating. Impacts to natural integrity are measured by the presence and magnitude of human-induced change to an area. This change includes physical developments as well as activity in the area.
Natural range of variability	See *Range of variability*.

Term	Definition
Natural resource	A feature of the natural environment that is of value in serving human needs.
NEPA	National Environmental Policy Act
New Road Construction	Investment in construction of a road to provide access that adds new miles of road to the transportation system.
NEZSED	A predictive computerized model that estimates cumulative sediment production from road construction, fire, and timber harvest activities in forested watersheds.
NFMA	National Forest Management Act–this law was passed in 1976 and requires the preparation of Regional Guides and Forest Plans.
NFMP	National Forest Management Plan
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NNL	National Natural Landmark
No Action Alternative	The management direction, activities, outputs, and effects that are likely to exist in the future if the current trends and management would continue unchanged. Under NEPA, it means following the current approved MFP management direction and guidance.
No Adverse Effect	Undertaking is modified, conditions are imposed, or data recovered such that the characteristics of a cultural property that may qualify it for the National Register of Historic Places are preserved.
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
Nongame	Wildlife species that are not hunted for sport.
Notice of intent	A notice in the Federal Register of intent to prepare an environmental impact statement on a proposed action.
Noxious Weed	According to the Federal Noxious Weed Act (PL 93-629), a weed that causes disease or has other adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.
NPNF	Nez Perce National Forest
NRCS	Natural Resources Conservation Service
Objective	A concise time-specific statement of measurable planned results that respond to pre-established goals. An objective forms the basis for further planning, to defining the precise steps to be taken and the resources to be used in achieving identified goals.
Off Highway Vehicle	Any motorized vehicle designed for and/or capable of travel off roads.
OHV	Off-highway vehicle

Term	Definition
Old growth	Old forests often containing several canopy layers, variety in trees sizes and species, decadent old trees, and standing and dead woody material.
Old Growth Forests	An ecosystem distinguished by old trees and related structural attributes. Old growth encompasses the later stages in a variety of characteristics including tree size, accumulation of large dead woody material, number of canopy layers, species composition, and ecosystem function. Old growth is not necessarily virgin or primeval. It can develop over time following human disturbances, just as it does following natural disturbances. Old growth encompasses both older forests dominated by early seral species and forests in later successional stages dominated by shade tolerant species.
ORV	Off-road vehicles, such as motorcycles, 4-wheel drive vehicles, and 4-wheelers
Overstory	The upper canopy layer; the plants below comprise the understory.
Ozone	Ozone, the major constituent of smog, is formed through a complex series of chemical reactions and transformations in the presence of sunlight. Ozone is a strong irritant, which attacks the respiratory system, leading to lung tissue damage. Ozone also affects materials such as surface coatings, fabrics, and rubber.
Parent materials	The mineral or organic matter from which the upper layers of soil are formed.
Partial retention	A visual quality objective, which, in general, means man's activities, may be evident but must remain subordinate to the characteristic landscape.
Particulates	Small particles suspended in the air and generally considered pollutants.
Patch	An area of homogeneous vegetation, in structure and composition.
Perennial Stream	A stream that flows continuously year round.
Personal use	The use of a forest product, such as firewood, for home use and not for commercial use.
Planning area	The BLM administrative area covered by a regional guide or MFP.
Plant Community	A group of individual plants of one or more species growing in a specific area in association with one another and with a complex of other plants and animals.
PNV	See *Present net value*.
Policy	A guiding principle upon which is based a specific decision or set of decisions.
Population	A group of individuals with common ancestry that are much more likely to mate with one another than with individuals from another such group.
ppm	part per million

Term	Definition
Precommercial thinning	Removing some of the trees from a stand that are too small to be sold for lumber or house logs, so the remaining trees will grow faster.
Predator	An animal the lives by preying on other animals. Predators are at or near the tops of food chains.
Prescribed fire	Fire set intentionally in wildland fuels under prescribed conditions and circumstances. Prescribed fire can reduce fuels, rejuvenate forage for livestock and wildlife or prepare sites for regeneration of trees.
Prescription	Management practices selected to accomplish specific land and resource management objectives.
Prescription Watershed	At the time of the BLM Management Framework Plan and Fishery/Water Quality Objective supplements (1981 and 1985), watersheds were referred to as prescription watersheds. Current nomenclature refers to those as subwatersheds.
Present net value	PNV—also called present net worth—the measure of the economic value of a project when costs and revenues occur in different time periods. Future revenues and costs are "discounted" to the present by an interest rate that reflects the changing value of a dollar over time. The assumption is that dollars today are more valuable than dollars in the future. PNV is used to compare alternatives that have different cost and revenue flows.
Prevention of Significant Deterioration (PSD)	A classification established to preserve, protect, and enhance the air quality in National Wilderness Preservation System areas in existence prior to August 1977 and other areas of National significance, while ensuring economic growth can occur in a manner consistent with the preservation of existing clean air resources. Specific emission limitations and other measures, by class, are detailed in the Clean Air Act. (42 U.S.C. 1875 et seq.)
Primitive (P)	Those recreation activities that occur in areas characterized by an essentially unmodified natural environment of fairly large size.
Productive	The ability of an area to provide goods and services and to sustain ecological values.
Project Area	Area of specific analysis for BLM Eastside Project. proposed leasing on Sioux Ranger District of the Custer National Forest.
Proposed Action	In terms of National Environmental Policy Act, the project, activity, or action that a federal agency intends to implement or undertake and which is the subject of an environmental analysis.
PSD	Prevention of Significant Deterioration of Air Quality
psi	pounds per square inch
Public domain	The territory ceded to the Federal government by the original thirteen states, plus additions by treaty, cession, and purchase.

Term	Definition
Public involvement	The use of appropriate procedures to inform the public, obtain early and continuing public participating, and consider the views of interested parties in planning and decision making.
Public issue	A subject or question of widespread public interest relating to management of the National Forest System.
Range	Land on which the principle natural plant cover is composed of native grasses, forbs, and shrubs that are valuable as forage for livestock and big game.
Range of Alternatives	The NEPA requires the proposed action, a no action alternative, and a reasonable range of alternatives to the proposed action be addressed in an EIS.
Range of variability	Also called the historic range of variability or natural range of variation. The components of healthy ecosystems fluctuate over time. The range of sustainable conditions in an ecosystem is determined by time, processes (such as fire), native species, and the land itself. For instance, ecosystems that have a 10-year fire cycle have narrower range of variation than ecosystems with 200–300 year fire cycles. Past management has placed some ecosystems outside their range of variability. Future management should move such ecosystems back toward their natural, sustainable range of variation.
Raptor	Birds of prey, such as owls, hawks, and eagles.
RARE II	Roadless Area Review and Evaluation. The national inventory of roadless and undeveloped areas within the National Forests and Grasslands.
Reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This normally involves regrading, replacement of topsoil, revegetation, and other work such as fertilization and fencing necessary to restore it for use.
Record of Decision (ROD)	A document separate from, but associated with, an environmental impact statement, that publicly and officially discloses the responsible official's decision on the proposed action.
Recreation Opportunities	The combination of recreation settings, activities, and experiences provided by an area.
Recreation Opportunity Spectrum (ROS)	A system for planning and managing recreation resources that recognizes recreation activity opportunities, recreation settings, and recreation experiences along a spectrum or continuum of settings as follows: Primitive–Characterized by essentially unmodified natural environment of fairly large size. Interaction between users is very low and evidence of other users is minimal. The area is managed to be essentially free from evidence of human-induced restrictions and controls. Motorized use is not permitted. Semi-Primitive Non-Motorized–Characterized by predominately natural or natural appearing environment of a moderate to large size.

Term	Definition
	Concentration of users is low, but there is often evidence of other area users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but these are subtle. Motorized use is not permitted. Semi-Primitive Motorized–Characterized by a predominantly natural or natural appearing environment of moderate-to-large size. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but these are subtle. Motorized use is permitted. Roaded Natural–Characterized by predominantly natural appearing environment with moderate evidence of the sights and sounds of man. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate, but with the evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Motorized use is permitted. Rural–Characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Urban–Characterized by a substantially urbanized environment, although the background may have natural appearing elements. Vegetative cover is often exotic and manicured. Sights and sounds of humans on-site are predominant.
Reforestation	The restocking of an area with forest trees, by either natural or artificial means, such as planting.
Regeneration	The renewal of a tree crop by either natural or artificial means. The term is also used to refer to the young crop itself.
Regional Forester	The official of the USDA Forest Service responsible for administering an entire region of the Forest Service.
Rehabilitation	A short-term visual resource management objective used to restore landscapes containing undesirable visual or other resource impacts to the desired visual or other acceptable quality level.
Remoteness	A characteristic of an area defined as the perceived condition of being secluded, inaccessible, and "out of the way.” Topography, vegetative screening, distance from human impacts, distance from sights and sounds of man, and difficulty of travel all contribute to remoteness.
Removal cut	The removal of the last seed bearers or shelter trees after regeneration is established.
Residual stand	The trees remaining standing after an event such as selection cutting.

Term	Definition
Resilience	The ability of an ecosystem to maintain diversity, integrity, and ecological processes following a disturbance.
Responsible line officer	The Forest Service Bureau of Land Management employee who has the authority to select and/or carry out a specific planning action.
Responsible official	The Forest Service Bureau of Land Management employee who has been delegated the authority to carry out a specific planning action.
Restoration (of ecosystems)	Actions taken to modify an ecosystem to achieve a desired, healthy, and functioning condition.
Restore	To bring back to a former or original condition or appearance.
Revegetation	The reestablishment and development of self-sustaining plant cover. On disturbed sites, this normally requires human assistance such as seedbed preparation, reseeding, and mulching.
Riparian	Riparian areas consist of terrestrial and aquatic ecosystems, those lands in a position to directly influence water quality and water resources, whether or not free water is available. This would include all lands in the active flood channel and lands immediately upslope of stream banks. These areas may be associated with lakes, reservoirs, marshes, streams, bogs, wet meadows, and intermittent or permanent streams where free and unbound water is available.
Riparian Area	The area along a watercourse or around a lake or pond.
Riparian Areas	Geographically delineable areas with distinctive resource values and characteristics that comprise the riparian ecosystems.
Riparian Ecosystem	a) Ecosystems transitional between terrestrial and aquatic ecosystems. Also streams, lakes, wet areas, and adjacent vegetation communities and their associated soils that have free water at or near the surface. b) Those assemblages of plants, animals, and aquatic communities whose presence can either be directly or indirectly attributed to factors that are water influenced or related. c) Interacting system between aquatic and terrestrial situations, identified by soil characteristics and distinctive vegetation that requires or tolerates free or unbound water.
Riparian Zone	An area of vegetation adjacent to an aquatic ecosystem. It has a high water table, certain soil characteristics, and some vegetation that requires free (unbound chemically) water or conditions that are more moist than normal. This zone is transitional between aquatic and upland zones.
RN	Roaded Natural
Road	A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be permanent, or temporary.
Road Decommissioning	Activities that result in the stabilization and restoration of unneeded roads to a more natural state.

Term	Definition
Roaded Natural	A recreation opportunity classification term for describing a land area that has predominately a natural appearing environment with moderate evidence of sights and sounds of humans. Concentration of users is moderate to low. Roads of better than primitive class are usually within 0.5 mile. A broad range of motorized and non-motorized activity opportunities is available. Management activities are present and harmonize with the natural environment.
Roadless	Refers to the absence of roads that have been constructed and maintained by mechanical means to ensure regular and continuous use.
ROD	Record of Decision
ROS	Recreation Opportunity Spectrum
Rotation	The number of years required to establish and grow timber crops to a specific condition of maturity.
Run-off	The portion of precipitation that flows over the land surface or in open channels.
Sapling	A loose term for a young tree more than a few feet tall and an inch or so in diameter that is typically growing vigorously.
Scale	In ecosystem management, it refers to the degree of resolution at which ecosystems are observed and measured.
Scoping/Scoping Process	An early and open public involvement process for determining the scope of issues to be addressed and for identifying the significant issues related to the proposed action. Identifying the significant environmental issues deserving of study and de-emphasizing insignificant issues, narrowing the scope of the Environmental Impact Statement accordingly. (Ref. CEQ Regulations, 40 CFR 1501.7.)
Sediment	Solid mineral or organic material that is transported by air, water, gravity, or ice.
Seedtree	A *seed tree system* is defined as a silvicultural system in which selected trees or tree groups are left standing after the initial harvest, to provide a seed source for natural regeneration. After natural regeneration is achieved, the seed trees may or may not be removed.
Semi-primitive	A recreation opportunity classification term for describing land areas that have very few management controls lying between 0.5 mile and 3 miles from the nearest point of motor vehicle access, excepting four-wheel drive roads and trails, with mostly natural landscapes and some evidence of other people.
Semi-Primitive Motorized (SPM)	A land area classified as semi-primitive that may have primitive roads present and where motorized use is permitted. Settings, activities, and opportunities are affected accordingly though there is still a moderate probability of experiencing isolation from sights and sounds of humans.

Term	Definition
Semi-Primitive Non-Motorized (SPNM)	A land area classified as semi-primitive that has a natural environment and motorized use is not permitted. Non-motorized status increases the probability of experiencing isolation, independence, and closeness to nature. Challenge and risk are generally high. Resource management may be present; however, natural appearance is still maintained.
Sensitive Species	Plant or animal species susceptible or vulnerable to activity impacts or habitat alterations. Species that have appeared in the Federal Register as proposed for classification or are under consideration for official listing as endangered or threatened species. The sensitive species designation is normally used for species that occur on Bureau administered lands for which BLM has the capability to significantly affect the conservation status of the species through management. The State Director may designate additional categories of special status species as appropriate and applicable to his or her state's needs.
Seral	The stage of succession of a plant or animal community that is transitional. If left alone, the seral stage will give way to another plant or animal community that represents a further stage of succession.
Shelterwood	A cutting method used in a more or less mature stand, designed to establish a new crop under the protection of the old.
Significant Impact/Effect	An impact or effect is significant when it is projected to meet or exceed threshold standards, while considering how substantial the impact or effect is, considering its context and intensity.
Silviculture	The art science that promotes the growth of single trees and the forest as a biological unit.
Size class	One of the three intervals of three stem diameters used to classify timber in the Forest Plan database. The size classes are: Seedling/Sapling (less than 5 inches in diameter); Pole timber (5–7 inches in diameter); Saw timber (greater than 7 inches in diameter).
Skidding	Hauling logs by sliding, not on wheels, from stump to a collection point.
Skyline logging	A logging system used to remove timber from steep slopes. Logs are brought up-slope on a suspended cable, or skyline. Since the weight of the log is completely or partially supported by the cable, there is little disturbance to soil or other vegetation.
Slash	The residue left on the ground after timber cutting or left after a storm, fire, or other event. Slash includes logs, uprooted stumps, broken or uprooted stems, branches, bark, etc.
Slash filter windrow	Woody debris (slash) placed along a slope to trap and hold sediment coming off a hill or road above.
Slope	The amount or degree of deviation from the horizontal or vertical. Concerning visual or scenic resources, as slope increases, views into a site and the size of the disturbance increase. Generally, the steeper slopes are more visible due to their location in the landscape.

Term	Definition
Slump	A landslide where the underlying rock masses tilt back as they slide from a cliff or escarpment.
Snag	A standing dead tree. Snags are important as habitat for a variety of wildlife species and their prey.
Soil compaction	The reduction of soil volume. For instance, the weight of heavy equipment on soils can compact the soil and thereby change it in some ways, such as in its ability to absorb water.
Soil productivity	The capacity of a soil to produce a specific crop. Productivity depends on adequate moisture and soil nutrients, as well as favorable climate.
Solitude	A personal, subjective value and roadless area characteristic defined as isolation from the sights, sounds, presence of others, and the developments of man. A primitive recreation experience includes the opportunity to experience solitude, a sense of remoteness, closeness to nature, serenity, and spirit of adventure.
Special Features	Unique geological, biological, ecological, cultural, or scenic features located in a roadless area. Unique fish and animal species, unique plants or plant communities, potential Research Natural Areas, outstanding landscape features such as unique rock formations, and significant cultural resource sites are some of the items that should be considered when analyzing this element.
Stand	A group of trees that occupies a specific area and is similar in species, age, and condition.
Standards and guidelines	Requirements found in a forest plan which impose limits on natural resource management activities, generally for environmental protection.
Stewardship	Caring for the land and its resources to pass healthy ecosystems to future generations.
Stewardship Contracting	The primary objective of a stewardship project is to achieve one or more of the land management goals that meet local and rural community needs. These goals, as identified in the authorizing legislation (Section 323 of Public Law 108-7), may include but are not limited to: • Road and trail maintenance or obliteration for improved water quality; • Soil productivity, habitat for wildlife and fisheries, or other resource values; • Setting of prescribed fires to improve composition, structure, condition, and health of stands or to improve wildlife habitat; • Removing vegetation or other activities to promote healthy forest stands, reduce fire hazards or achieve other land management objectives; • Watershed restoration and maintenance; • Restoration and maintenance of wildlife and fish habitat; and

Term	Definition
	• Control of noxious and exotic weeds and reestablishing native plant species. Stewardship contracting projects are defined as those activities used to accomplish one or more of the goals noted above and where the BLM would enter into contract or agreement for services to achieve land management goals as well as meet local and rural community needs. In addition, a source for performance under a contract must be selected on a best value basis. The legislation authorizes trading goods for services, and multi-year contract authority greater than five years but not to exceed ten years.
Stocking level	The number of trees in an area as compared to the desirable number of trees for best results, such as maximum wood production.
Stream order	A numbering system used to classify streams by their position relative to other streams. The Strahler system is the most commonly used. First order streams are the smallest unbranched tributaries. Second order streams are formed at the confluence of two first order streams. Third order streams are formed at the confluence of two second order streams. This pattern continues downstream until a stream enters an ocean or other sink. [Adapted from: American Geological Institute. 1962. Dictionary of Geological Terms.]
Stringer	A strip of vegetation different form surrounding vegetation, such as a stringer of aspen in an area of spruce.
Structure	How the parts of ecosystems are arranged, both horizontally and vertically. Structure might reveal a patter, or mosaic, or total randomness of vegetation.
Subwatershed	A subdivision within a watershed.
Succession	The natural replacement, in time, of one plant community with another. Conditions of the prior plant community (or successional stage) create conditions that are favorable for the establishment of the next stage.
Successional stage	A stage of development of a plant community as it moves from bare ground to climax. The grass-form stage of succession precedes the woody shrub stage.
Suitability	The appropriateness of certain resource management to an area of land. Suitability can be determined by environmental and economic analysis of management practices.
Sustainability	The ability of an ecosystem to maintain ecological processes and functions, biological diversity, and productivity over time.
Sustainable	The yield of a natural resource that can be produced continually at a given intensity of management is said to be sustainable.

Term	Definition
Sustained yield	The yield that a renewable resource can produce continuously at a given intensity of management.
Target	The BLM's annual goals for accomplishment for natural resource programs. Targets represent the commitment the BLM has with Congress to accomplish the work Congress has funded, and are often used as a measure of the agency's performance.
Temporary Road	Roads authorized by contract, permit, lease, other written authorization, or emergency operation, not intended to be part of the transportation system and not necessary for long-term resource management.
Terrestrial	Living or growing in or on the land.
TES	Threatened, Endangered and Sensitive (Species)
Texture	Detail of landscape that varies with distance.
Thinning	A cutting made in an immature stand of trees to accelerate growth of the remaining trees or to improve the form of the remaining trees.
Threatened Species	Any species likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and that has been designated in the Federal Register by the Secretary of the Interior as a threatened species.
Tiering	Refers to the elimination of repetitive discussions of the same issue by incorporating by reference the general discussion in an environmental impact statement of broader scope. For example, a project environmental assessment could be tiered to the Forest Plan EIS.
Timber production	The purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. For purposes of this subpart, the term "timber production" does not include production of fuelwood.
Tractor logging	A logging method that uses tractors to carry or drag lots from the stump to a collection point.
Treatment area	The site-specific location of a resource improvement activity.
TSI	Timber Stand Improvement–Actions to improve growing conditions for trees in a stand, such as thinning, pruning, prescribed fire, or release cutting.
Unclassified Road	Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travel-ways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon termination of the authorization.
Underburn	A burn by a surface fire that can consume ground vegetation and "ladder" fuels.

Term	Definition
Understory	The trees and other woody species that grow under a more or less continuous cover of branches and foliage formed collectively by the upper portion of adjacent trees and other woody growth.
Uneven-aged	A stand of trees in which the individual trees originated over a long period of time and, thus, differ widely in age; a regeneration system designed to produce such a stand.
USDA	U.S. Department of Agriculture
USDI	U.S. Department of Interior
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
Vegetation management	Activities designed primarily to promote the health of forest vegetation for multiple-use purposes.
Vegetation Response Unit (VRU)	Ecological land units that have unique patterns of habitat types groups (potential vegetation), terrain, and historic fire regimes.
Vegetation type	A plant community with distinguishable characteristics.
Viability	The likelihood of continued existence in an area for some specified period of time.
Viable population	The number of individuals of a species sufficient to ensure the long-term existence of the species in natural, self-sustaining populations that are adequately distributed throughout their range.
Viewshed	A total landscape as seen from a particular viewpoint.
Visual (or Scenic) Resource	The composite of basic terrain, geologic features, water features, vegetative patterns, and land use effects that typify a land unit and influence the visual appeal of the unit.
Visual Resource Management (VRM)	A classification that establishes the "visual landscape" as a basic resource, treated as an essential part of the land. The visual resource management classification provides a framework to inventory the visual resource and provides measurable standards for its management.
VRM	Visual Resource Management
Water table	The upper surface of groundwater. Below it, the soil is saturated with water.
Water yield	The runoff from a watershed, including groundwater outflow.
Watershed	The entire region drained by a waterway (or into a lake or reservoir. More specifically, a watershed is an area of land above a given point on a stream that contributes water to the streamflow at that point.
WEPP	The Water Erosion Prediction Project (WEPP) model is a process-based, distributed parameter, continuous simulation, erosion prediction model.
Wetlands	Areas that are permanently wet or are intermittently covered with water.

Term	Definition
Wilderness	An area of undeveloped federal land designated Wilderness by Congress, retaining its primeval character and influence, without permanent improvements or human habitation, protected and managed to preserve its natural conditions and that (1) generally appears to have been affected primarily by the forces of nature with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or primitive and unconfined recreation, (3) has at least 5,000 acres or is of sufficient size to make practical its preservation and use in an unimpaired condition, and (4) also may contain features that are of ecological, geological, scientific, educational, scenic, or historical value. These characteristics were identified by Congress in the Wilderness Act of 1964.
Wildfire	Any wildland fire that is not a prescribed fire.
Wildland Urban Interface	An area within or adjacent to an at-risk community identified within recommendations to the Secretary of Agriculture in a Community Wildfire Protection Plan, OR In the case of any area for which a Community Wildfire Protection Plan is not in effect: An area extending ½ mile from the boundary of an at-risk community; An area with 1½ miles from the boundary of an at risk community, including land that 1) Has a sustained steep slope that creates the potential for wildland fire behavior endangering the at-risk community, 2) Has a geographic feature that aids in creating an effective firebreak, such as a road or ridgetop.
Wildlife	Mammals, birds, reptiles, amphibians, and invertebrates.
Windthrow	Trees uprooted by wind.
Woodlands	An open stand of trees with crowns not usually touching (generally forming a 25 to 60 percent cover).
WUI	See *Wildland Urban Interface.*
Yarding	Moving the cut trees form where they fell to a centralized place (landing) for hauling away from the stand.

Appendix C – References

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Appendix D – Treatments by Alternative

The following tables represent the units for the project area. The unit is the number assigned to the stand being treated. The T Code is the prescription type. The codes are:

Table D.1

T Code	Treatment
4113	Clearcut
4114	Clearcut with reserves
4131	Shelterwood Cut
4133	Irregular shelterwood
4134	Seed tree cut with reserves
4220	Thinning
4230	Sanitation (Salvage)
4260	Human caused fire

Table D.2

Abbreviation	Fuels Treatment
Ex. Pile	Excavator piling of fuels throughout unit in preparation for burning
Underburn	A light broadcast burn under existing forest canopy, with limited damage to existing trees
Broadcast	A prescribed burn with no piling, wind rowing and limited concern for existing vegetation
Hand Pile	Hand piling of fuels throughout unit in preparation for burning

The percent (%) stands for canopy cover removed that was used for ECA and NEZSED modeling. Type = the logging system. Biomass utilization may occur in excavator pile units, lessoning the amount of excavator piling needed. The alternatives are the associated actions that will be treated and the acres column is the size of the unit. If there is a blank in the Unit row under the alternative, this means that unit will not be treated under that alternative.

Table D.3

Alternative B					
Unit	T Code	Type	%	Fuels	Acres
1	4131	Helicopter	80	Hand Pile	11
2	4220	Ground	70	Ex. Pile	14
3	4131	Cable	80	Underburn	10
4	4134	Ground	80	Underburn	4
5	4134	Cable	80	Underburn	5
6	4220	Ground	70	Ex. Pile	16
7	4131	Cable	80	Underburn	8
8	4134	Cable	80	Underburn	11
9	4134	Ground	90	Ex. Pile	61
10	4131	Cable	80	Underburn	23
11	4134	Ground	80	Underburn	27
12	4134	Cable	80	Underburn	16
13	4230	Ground	50	Ex. Pile	32
14	4230	Ground	50	Ex. Pile	68
15	4230	Ground	50	Ex. Pile	9
16	4220	Ground	70	Ex. Pile	45
18	4131	Ground	90	Ex. Pile	60
19	4133	Cable	90	Underburn	28

Alternative C				
Unit	T Code	Type	Fuels	Acres
1	4131	Helicopter	Hand Pile	11
2	4220	Ground	Ex. Pile	14
3	4131	Cable	Underburn	10
4	4134	Ground	Underburn	4
5	4134	Cable	Underburn	5
6	4220	Ground	Ex. Pile	16
7	4131	Cable	Underburn	8
8	4134	Cable	Underburn	11
9	4134	Ground	Ex. Pile	61
10	4131	Cable	Underburn	23
11	4134	Ground	Underburn	27
12	4134	Cable	Underburn	16
13	4230	Ground	Ex. Pile	32
14	4230	Ground	Ex. Pile	68
16	4220	Ground	Ex. Pile	45
18	4131	Ground	Ex. Pile	60
19	4133	Helicopter	Underburn	28

Alternative D				
Unit	T Code	Type	Fuels	Acres
9	4134	Ground	Ex. Pile	61
10	4131	Cable	Underburn	23
11	4134	Ground	Underburn	27
12	4134	Cable	Underburn	16
13	4230	Ground	Ex. Pile	32
14	4230	Ground	Ex. Pile	68
16	4220	Ground	Ex. Pile	45
18	4131	Ground	Ex. Pile	60
19	4133	Helicopter	Underburn	28

Alternative B					
Unit	T Code	Type	%	Fuels	Acres
20	4133	Cable	90	Underburn	26
21	4220	Helicopter	70	Hand Pile	24
22	4220	Ground	70	Ex. Pile	24
23	4133	Ground	90	Ex. Pile	18
24	4133	Cable	90	Underburn	40
25	4133	Cable	90	Underburn	10
26	4133	Ground	90	Ex. Pile	6
27	4134	Helicopter	80	Hand Pile	19
28	4133	Cable	90	Underburn	25
29	4134	Ground	80	Ex. Pile	9
30	4133	Ground	90	Ex. Pile	21
31	4134	Cable	80	Underburn	8
32	4133	Cable	90	Underburn	7
33	4133	Ground	90	Ex. Pile	41
34	4131	Ground	80	Ex. Pile	57
35	4131	Ground	80	Ex. Pile	3
36	4260		90	Broadcast	6
37	4260		90	Broadcast	25
38	4260		90	Broadcast	57
39	4134	Ground	80	Ex. Pile	35
40	4133	Ground	100	Ex. Pile	14
41	4131	Ground	80	Ex. Pile	60
42	4131	Cable	80	Underburn	40

Alternative C				
Unit	T Code	Type	Fuels	Acres
20	4133	Helicopter	Underburn	26
21	4220	Helicopter	Hand Pile	24
22	4220	Ground	Ex. Pile	24
23	4133	Ground	Ex. Pile	18
24	4133	Helicopter	Underburn	40
25	4133	Helicopter	Underburn	10
26	4133	Ground	Ex. Pile	6
27	4134	Helicopter	Hand Pile	19
28	4133	Cable	Underburn	25
29	4134	Ground	Ex. Pile	9
30	4133	Ground	Ex. Pile	21
31	4134	Cable	Underburn	8
32	4133	Cable	Underburn	7
33	4133	Ground	Ex. Pile	41
34	4131	Ground	Ex. Pile	57
35	4131	Ground	Ex. Pile	3
36	4133	Helicopter	Broadcast	6
37	4133	Helicopter	Broadcast	25
38	4133	Helicopter	Broadcast	57
39	4134	Ground	Ex. Pile	35
40	4133	Ground	Ex. Pile	14
41	4131	Ground	Ex. Pile	60
42	4131	Cable	Underburn	40

Alternative D				
Unit	T Code	Type	Fuels	Acres
20	4133	Helicopter	Underburn	26
21	4220	Helicopter	Hand Pile	24
22	4220	Ground	Ex. Pile	24
23	4133	Ground	Ex. Pile	18
24	4133	Helicopter	Underburn	40
25	4133	Helicopter	Underburn	10
26	4133	Ground	Ex. Pile	6
27	4134	Helicopter	Hand Pile	19
29	4134	Ground	Ex. Pile	9
30	4133	Ground	Ex. Pile	21
31	4134	Cable	Underburn	8
32	4133	Cable	Underburn	7
33	4133	Ground	Ex. Pile	41
34	4131	Ground	Ex. Pile	57
37	4133	Helicopter	Broadcast	25
38	4133	Helicopter	Broadcast	57
39	4134	Ground	Ex. Pile	35
40	4133	Ground	Ex. Pile	14
41	4131	Ground	Ex. Pile	60
42	4131	Cable	Underburn	40

Alternative B					
Unit	**T Code**	**Type**	**%**	**Fuels**	**Acres**
43	4131	Cable	80	Underburn	12
44	4134	Ground	80	Ex. Pile	49
45	4133	Ground	100	Ex. Pile	28
46	4134	Cable	80	Underburn	18
47	4133	Ground	90	Ex. Pile	59
48	4133	Cable	90	Underburn	11
49	4134	Ground	80	Ex. Pile	24
50	4133	Ground	90	Ex. Pile	17
51	4260		90	Broadcast	52
Eastside Total Acres					**1293**

Alternative C				
Unit	**T Code**	**Type**	**Fuels**	**Acres**
43	4131	Cable	Underburn	12
44	4134	Ground	Ex. Pile	49
45	4133	Ground	Ex. Pile	28
46	4134	Cable	Underburn	18
47	4133	Ground	Ex. Pile	59
48	4133	Cable	Underburn	11
49	4134	Ground	Ex. Pile	24
50	4133	Ground	Ex. Pile	17
51	4133	Helicopter	Broadcast	52
Eastside Total Acres				**1284**

Alternative D				
Unit	**T Code**	**Type**	**Fuels**	**Acres**
43	4131	Cable	Underburn	12
44	4134	Ground	Ex. Pile	49
45	4133	Ground	Ex. Pile	28
46	4134	Cable	Underburn	18
47	4133	Ground	Ex. Pile	59
48	4133	Cable	Underburn	11
49	4134	Ground	Ex. Pile	24
50	4133	Ground	Ex. Pile	17
51	4133	Helicopter	Broadcast	52
Eastside Total Acres				**1171**

Table D.4

Totals by T Code				
		Alt B	**Alt C**	**Alt D**
4113	Clearcut			
4114	Clearcut with reserves			
4131	Shelterwood Cut	284	284	252
4133	Irregular shelterwood	351	491	460
4134	Seed tree cut with reserves	286	286	266
4220	Thinning	123	123	93
4230	Sanitation (Salvage)	109	100	100
4260	Man caused fire	140		

Appendix E – Monitoring Plan _____

Regeneration and Survival Success Monitoring _____

Program: Forest Management

Monitoring Item: Artificial regeneration

Objective: To assess the survival and stocking rates following tree planting in regeneration units.

Parameters: Regeneration establishment and survival checks.

Methodology: Install and measure 1/100 acre plots per standard protocols.

Frequency/Duration: First, third, and fifth year following planting

Data Storage: Field office files

Analysis/Report: Silvicultural and reforestation reports

Priority: High

Personnel: Forestry staff

Cost: Average $30/acre times the number of acres planted

Fuel Condition _____

Program: Fuels Management

Monitoring Item: Fuel condition; burn unit design; biomass utilization

Objective: To assess the implementation of fuel reduction objectives, keeping prescribed fire within designated unit boundaries, and reducing excavator piling resulting from biomass utilization.

Parameters: Post treatment fuel model; burned area survey; acres excavator-piled

Methodology: Install and measure fuel inventory plots per standard protocols, patrol unit firelines, and observe and map actual burned area, evaluate biomass opportunities.

Frequency/Duration: 30 days following treatment

Data Storage: Field office files

Analysis/Report: Fuel reduction accomplishments (NFPORS)

Priority: High

Personnel: Fuels Staff

Cost: Average $30/acre times the number of acres planted

Vegetation _____

Program: Noxious Weeds

Monitoring Item: Inventory activity areas for weed occurrence

Objective: To survey and document new and spreading populations of noxious weeds in the treatment area.

Parameters: Weed occurrence

Methodology: Visual survey of disturbed areas for weed occurrence

Frequency/Duration: Two years following treatment

Data Storage: Field Office Files

Analysis/Report:

Priority: High

Personnel: All field staff

Cost: Average $30/acre times the number of acres planted

Water Quality _____

Program: Water Quality

Monitoring Item: Implementation of BMPs, project design features and mitigation

Objective: To determine if stated measures were implemented and if they were effective as designed.

Parameters: Were the BMPs, PDFs, and mitigation implemented and effective feedback information to IDTs for future project design?

Methodology: Site visit, pre- and post-monitoring of site conditions

Frequency/Duration: Before, during, and post implementation. Post implementation should continue for up to five years to track effectiveness.

Data Storage: Field Office Files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design.

Priority: High

Personnel: Hydrologist, Biologist

Water Quality _____

Program: Water Quality

Monitoring Item: Temperature; turbidity; active erosion/sediment

Objective: To determine change in condition over time.

Parameters: Use standard DEQ protocol for monitoring turbidity at mixing zone.

Methodology: Regularly record temperatures and prepare trend analysis for riparian restoration projects. During project implementation that involves actions below mean high water or instream activities that may affect turbidity, monitor during project implementation, and pre- and post-project turbidity levels. Monitor activities within riparian habitats where project related soil/vegetation disturbance has potential to reach water. Monitor implementation and effectiveness of erosion control design features. Continue monitoring existing permanent monitoring stations; install temporary monitoring stations for periodic evaluation. Document erosion control implementation and effectiveness.

Frequency/Duration: Temperature is recorded daily and data retrieved monthly (summer months). Monitoring should continue for foreseeable future to discern trends. Turbidity monitoring conducted during, pre-, and post-project construction periods. Erosions control implementation and effectiveness monitoring conducted during project implementation and post-project monitoring as needed until appropriate site stabilization is achieved.

Data Storage: Field office files

Analysis/Report: Provide summary reports to track changes resulting and trend for project design and compliance with water quality standards.

Priority: High

Personnel: Fisheries Biologist

Roads

Program: Restoration

Monitoring Item: Decommissioned roads and fish habitat

Objective: To ensure decommissioned roads are removed to designed standards and are, in fact, no longer passable, and to assess changes to fish habitat conditions and document trend.

Parameters: Percent woody material on former surface, depth of decompaction, recontouring percent complete (if applicable)

Methodology: On-site measurements and visual observation

Frequency/Duration: Post implementation

Data Storage: Field office files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design. Provide feedback to regulatory agencies on effectiveness of treatments.

Priority: High

Personnel: Contract Administrator

Cultural _____

Program: Cultural Resource Protection

Monitoring Item: Installation of protective measures at ditch crossings, recording features prior to implementation

Objective: To protect documented resources.

Parameters: Parameters are provided in the design feature table.

Methodology: Visual observation

Frequency/Duration: During and post implementation

Data Storage: Field office files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design. Provide feedback to regulatory agencies on effectiveness of treatments.

Priority: High

Personnel: Archeologist, Contract Administrator

Fish Habitat

Program: Fish Habitat

Monitoring Item: Fish habitat features: cobble embeddedness; LWD; pool:riffle; surface fines; width:depth

Objective: To assess changes to fish habitat conditions and document trend.

Parameters: Parameters are identified for each feature in the *Matrix and Pathways of Indicators.*

Methodology: Use standard protocols for each monitoring type.

Frequency/Duration: Before, during and post implementation. Post implementation should continue for up to five years to track effectiveness.

Data Storage: Field office files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design. Provide feedback to regulatory agencies on effectiveness of treatments.

Priority: High

Personnel: Fisheries Biologist

Fish Habitat _____

Program: Fish Habitat

Monitoring Item: Stream channel morphology, stream bank condition, and riparian re-vegetation attributes following crossing replacement or ford decommissioning and restoration

Objective: To assess changes to fish habitat conditions and document trend.

Parameters: Parameters are identified for each feature in the *Matrix and Pathways of Indicators.*

Methodology: Use standard protocols for each monitoring type.

Frequency/Duration: Post implementation. Monitoring should continue periodically for up to ten years to track effectiveness.

Data Storage: Field Office Files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design. Provide feedback to regulatory agencies on effectiveness of treatments.

Priority: High

Personnel: Fisheries Biologist

Fisheries

Program: Fish Genetics

Monitoring Item: Genetic testing of isolated/semi-isolated Westslope cutthroat trout populations

Objective: To assess the genetic composition and any changes that occur through following reconnection of the Queen creek channel to American River.

Parameters: Parameters are identified for collection of genetic material.

Methodology: Use standard protocols for each monitoring type.

Frequency/Duration: Pre- and post-implementation. Post-implementation should continue periodically to assess changes over time.

Data Storage: Field office files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design. Provide feedback to regulatory agencies on documented impacts.

Priority: Moderate

Personnel: Fisheries Biologist

Wildlife Habitat_____

Program: Wildlife Habitat

Monitoring Item: Green tree, snag replacement, snags and down woody retention guidelines

Objective: To assess changes to forest structure and assure conformance with developed guidelines.

Parameters: Green tree retention parameters vary by treatment unit and would be derived from the silvicultural prescription. Snags guidelines are included in the MFP. Down woody material is based on recommendations in the Soils Section.

Methodology: Use standard protocols for each monitoring type.

Frequency/Duration: Post implementation

Data Storage: Field office files

Analysis/Report: Provide summary reports and recommendations to IDTs developing future projects to ensure continually improving project design.

Priority: High

Personnel: Forester

Wildlife Habitat_____

Program: Wildlife Habitat

Monitoring Item: Road restrictions for temporary roads

Objective: To ensure gates, signs, and closures are effective to restrict public vehicle use or other non-authorized uses of temporary roads during the duration of the contract.

Parameters: Document that gates are installed immediately after temporary roads are constructed. Monitor road closure facilities (gates, signs) are in place and functional during project duration.

Methodology: Documentation of gate installation and effectiveness in project inspector's field notes/diary.

Frequency/Duration: Project implementation

Data Storage: Field office files

Analysis/Report: Provide summary reports of gate/closure construction and periodic monitoring.

Priority: High

Personnel: Forester, Biologist

TES Plants

Program: Threatened and Endangered Species

Monitoring Item: Retention of live lodgepole pine near candystick populations

Objective: To ensure habitat components are retained.

Parameters: Green lodgepole pine retention should be implemented near documented populations or any newly discovered populations.

Methodology: Visual observation

Frequency/Duration: During and post implementation

Data Storage: Field office files

Analysis/Report: Monitoring report to FWS

Priority: High

Personnel: Forester, Botanist/Ecologist

Appendix F – Descriptions of Fuel Models_____

Fuel Model descriptions taken from Aids to Determining Fuel Models for Estimating Fire Behavior by Hal E. Anderson, 1982. Each fuel model is typically used to represent a range of fuel conditions in which fire behavior may be expected to respond similarly to changes in fuel moisture, wind, and slope.

Fuel Model 1: Fire spread is governed by the fine herbaceous fuels that have cured or are nearly cured. Fires move rapidly through cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Fuel Model 2: Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and down-down stemwood from timber overstory contributes to the fire intensity. Such stands may include clumps of fuels that generate higher intensities and that may produce firebrands.

Fuel Model 3: Fires in this fuel are the most intense of the grass group and display high rates of spread under the influence of wind. The fire may be driven into the upper heights of the grass stand by the wind and cross standing water. Stands are tall, averaging about 3 ft., but may vary considerably. Approximately one-third or more of the stand is considered dead or cured, and maintains the fire.

Fuel Model 4: Fire intensity and fast-spreading fires involves the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory. Besides flammable foliage, dead woody material in the stands significantly contributes to the fore intensity.

Fuel Model 5: Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs, and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Shrubs are generally not tall, but have nearly total coverage of the area.

Fuel Model 8: Slow-burning ground fires with low flame heights are the rule, although the fire may encounter an occasional “jackpot” or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures, low humidities, and high winds do the fuels pose fire hazards. Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and some twigs since little undergrowth is present in the stand.

Fuel Model 10: The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead down fuels include greater quantities of 3-inch or larger limbwood resulting from overmaturity or natural events that create a large load of dead materiel on the forest floor. Crowning out, spotting, and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties. Any forest type may be considered if heavy down material is present; for example insect or disease ridden stands, wind-thrown stands, overmature stands with deadfall, and aged slash from light thinning or partial cutting.

Fuel Model 12: The visual impression is dominated by slash and much of it is less than 3 inches in diameter. Fires are rapidly spreading with high intensities capable of generating firebrands. When a fire starts, it is generally sustained until a fuel break of change in fuels is encountered.

Appendix G – Modeling Assumptions _____

Site-specific activities can readily be evaluated using the Forest Vegetation Simulator (FVS) and the Fuel and Fire Effects extension (FFE) of FVS to quantify vegetation and fuel succession following fire or fuels treatments.

The following excerpt has been adapted from the Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity (Graham, McCaffrey and Jain 2004). It gives a good description of the predictive strengths and weaknesses associated with Modeling. These are applicable to the use of the FFE-FVS modeling done on the Eastside Project.

Uncertainties in Predicting Fire Behavior

While we have a good general understanding of the factors that govern fire behavior, the interactions among these factors and the way in which fire behaves on the landscape are highly complex. As a result, fire behavior and severity can be understood and predicted in general terms, but exact predictions are not possible. Different models have been developed that are widely used and useful to assist in managing fires and developing fuel treatment plans. However, there are key uncertainties in how the simplifying assumptions of models affect their accuracy and as well as uncertainties that result from difficulties of providing adequate input data to operate the models. The limitations to predictions using models can be categorized as:

- **Model assumptions and limitations.** Because all models are abstractions of reality and not reality itself, there are many limitations to the predictions resulting from the models. By necessity, models simplify much of what really happens in order to facilitate the user's understanding of the process. In addition, many models are developed to reflect weather conditions that are "normal" and not extreme; therefore, their predictions do not reflect these types of events (Albini 1976, Van Wagner 1977, Rothermel 1983, Andrews 1986).
- **Unknowable fire environment at the time wildfires encounter treatments.** Even if models were nearly perfect, we would never be able to predict the exact conditions of a wildfire that would encounter a fuel treatment and serve as the performance measure. For example, the weather and wind conditions at a particular time, the attendant ignition location and direction of fire movement through the treatment, the degree of variability in the treatment conditions at the time of the fire—all these determine the performance of a fuel treatment in terms of the changes to fire behavior and effects.
- **Coarse data descriptions of fuels and environmental conditions.** The data for model input for the Eastside Project came from stand exam data which is better than most fuels maps. Even so this scale is still too coarse to reflect variability within some of the area, such as heavy fuel concentrations or thickets of trees. Such fine-scale variability could be important and may have important consequences to fire growth over landscapes, but it is unknowable for fire modeling. Our fuel data today tend to smooth out variation in order to represent the "average" condition. However, the average fuel condition does not produce the average fire behavior response because fire behavior responds nonlinearly to changes in fuels and weather.

A key area of uncertainty is in how to determine thresholds of treatment for different fuels when they are encountered by wildfire. Even though models cannot predict how a given structure created by a fuel treatment will fare when a wildfire encounters it, they can predict a range of conditions under which fuel conditions will modify fire behavior and/or severity. In general, models are effective in showing the contributions to the fire hazard made by the different fuel strata—that is, the surface fuels, ladder fuels, and crown fuels. However, each stratum affects fire behavior differently and there is uncertainty about how much treatment is needed in each stratum to achieve desired results.

Appendix H – Support Information for the Watershed and Fisheries Analysis

Introduction

The following support information for the watershed and fisheries analysis includes information specific to the Eastside Project and where appropriate support documentation from the American and Crooked River Project (USDA-FS 2005).

Fisheries/Water Quality Objectives

The Chief Joseph Management Framework Plan (USDI-BLM, 1981) and supplement guidance (USDI-BLM, 1985, 1989a, and 1989b) identifies fisheries/water quality objectives by prescription watersheds for the Cottonwood Field Office management area. Figure H.1 below, and the following Table H.1 identifies eight prescription watersheds that would be affected by the proposed actions. The Elk Creek prescription watershed (17060305-05-17) is primarily private lands and did not meet criteria for a BLM prescription watershed (USDI-BLM, 1989a), however, it does occur in the composite watershed for Lower American River (see Figure H.1), which will be assessed for cumulative affects.

Fish/water quality objectives displayed on the following page provide management direction in terms of maximum sediment yield over baseline conditions that can be approached or equaled for a specified number of years per decade, ranging from one to three times. Watersheds with fish/water objectives of 80 or 90 percent are allowed one entry per decade and those with 70 percent are allowed three entries per decade. All objectives are relative to full habitat potential of 100 percent.

Since 1992 additional standards and guidelines have been developed, primarily as a result of the various listing of anadromous and resident fish. NFMS (1996) has developed a matrix of pathways and indicators of watershed conditions that have been modified and locally adapted by the Central Idaho Level 1 team for chinook salmon, steelhead trout, and bull trout (USDA-FS and USDI-BLM, 1998)

Table H.1 Fisheries and Water Quality Objectives for Prescription Subwatersheds within the Eastside Project Analysis Area

Prescription Watershed	Prescription Watershed Name	Beneficial Use[1]	Current Fishery Habitat Condition (%)	Fishery/ Water Quality Objective (% Habitat Potential)[3]	Sediment Yield Guideline (% Over Baseline)	Entry Frequency Guideline (Per Decade)
17060305-05-06	Middle American R.	A	65%[2]	80%	30%[4]	1
17060305-05-16	Lower American R.	A	60%[2]	80%	30%[4]	1
17060305-05-10	E. Fk. American R.	A	80%[2]	90%	30%[4]	1
17060305-05-12	Whitaker Creek	R	70%	70%	60%	3
17060305-05-13	Queen Creek	R	70%	70%	60%	3
17060305-05-15	Box Sing Creek	A	65%[2]	70%	60%	3
17060305-05-11	Kirks Fork	A	75%[2]	80%	30%	1
17060305-05-05	Little Elk Creek	A	60%[2]	80%	30%	1

[1] A = Anadromous Fishery; R = Resident Fishery; MW = Municipal Watershed

[2] These streams are below carrying capacity because of a lack of diversity and/or instream cover. This problem may be attributed to dredge mining, livestock grazing, and or excessive sediment from roads, timber harvest, or development. Timber management and other land uses can occur in these drainages, concurrent with habitat improvement efforts, as long as habitat improvement efforts show a positive upward trend.
Within the project area, legacy effects from some land uses, such as historic dredge mining and roading have resulted in adverse impacts to stream channels, riparian habitats, and floodplains. Recovery is often slow and long term, and in some cases will require significant habitat improvement efforts. The BLM has been implementing a variety of land management and restoration actions to support improving trends within the American River drainage. BLM past, present, and actions identified for the foreseeable future have included instream restoration, riparian restoration, culvert replacements, road restoration, improved livestock management.

[3] All objectives are relative to full biological potential of 100 percent in reference to pristine conditions.

[4] These prescription watersheds, unlike most, are not true watersheds. By definition, a true watershed includes all the lands draining through a stream reach. These footnoted watersheds drain only part of such a hydraulic unit and generally contain the downstream reaches of relatively large streams. For sediment yield analysis on these downstream reaches, all upstream prescription watersheds are combined into a true watershed. Sediment yield guidelines (Column 6) apply only to true watersheds. Entry frequency guidelines (Column 7) apply to prescription watersheds regardless of whether they are true watersheds.

The watershed numbering and nomenclature system has evolved over the past twenty years. At the time of the BLM Management Framework Plan and Fishery/Water Quality Objective supplements (1981 and 1985), the Hydrologic Unit Code (HUC) system was nationally coordinated to the 4th code HUC (e.g. South Fork Clearwater River subbasin = 17060305). Efforts are currently underway to nationally coordinate HUCs to the 6th code level. This analysis relies on the older codes.

At the time of the BLM Management Framework Plan and Fishery/Water Quality Objective supplements (1981 and 1985), watersheds were referred to as prescription watersheds. Current nomenclature refers to those as subwatersheds.

Prescription watersheds such as Lower American River and Middle American River pose a unique situation in that they are not a single complete drainage (see footnote above). Current terminology refers to them as composite watersheds. The maps below show how composite and pure watersheds are related in the project area.

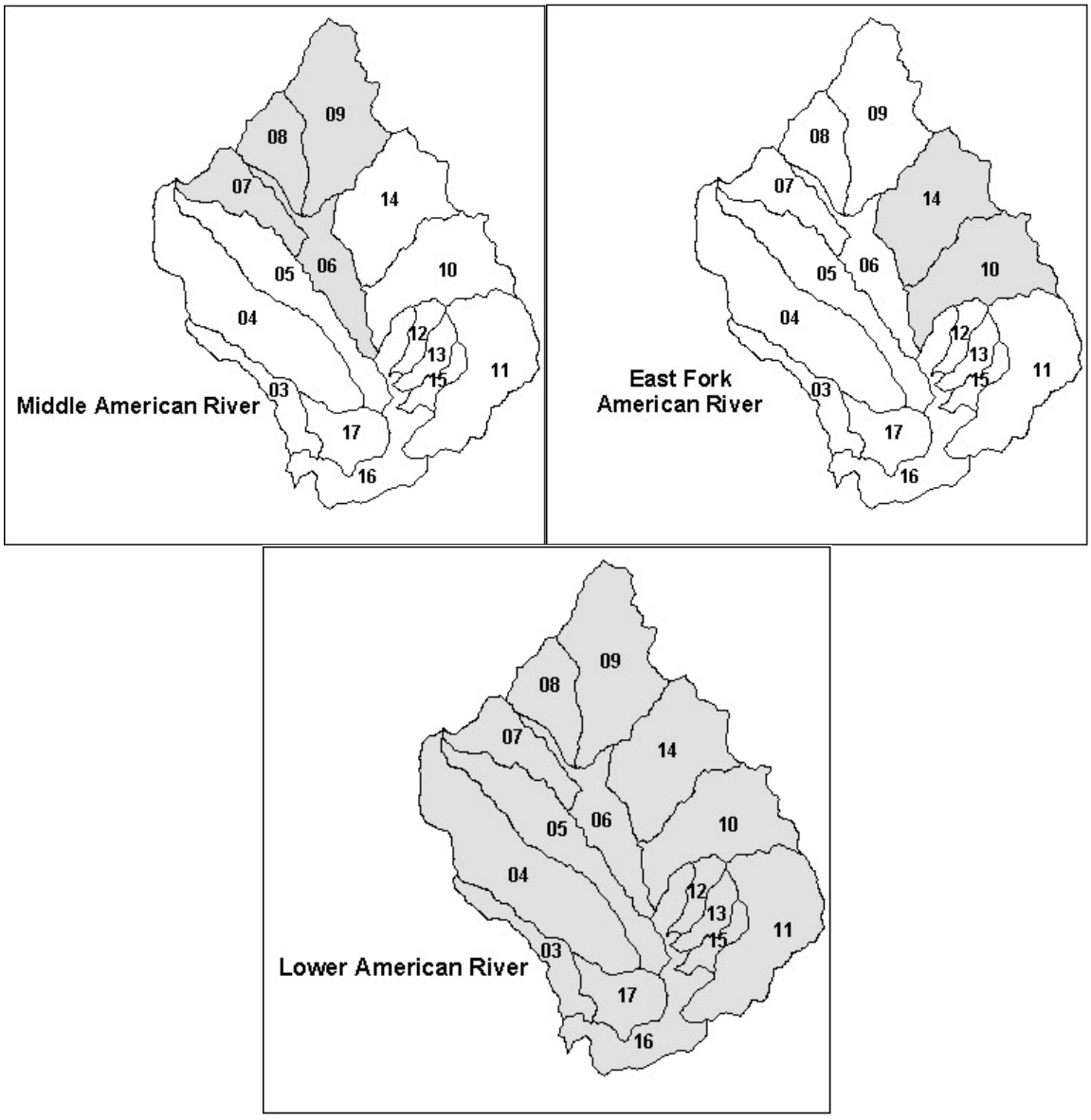

Figure H.1 Composite v, Pure Watersheds – American River

For purposes of water yield (ECA) and sediment yield (NEZSED) analysis, composite watersheds are compiled into larger pure watersheds. This is done in order to maintain integrity with the assumptions used to develop the ECA and NEZSED procedures. Both of these models assume the water yield and sediment yield reflect the conditions in the entire pure watershed above the analysis point (also known as pour point).

Each of the maps above shows the relationship between composite and pure watersheds for American River watersheds. Using Lower American River as an example, when ECA or NEZSED results are reported, they include all of the shaded subwatersheds. For more detail on the watershed boundaries and associated stream systems, see Maps 14 and 17.

Upward Trend

The Chief Joseph Management Framework Plan (USDI-BLM 1981) and supplement guidance (USDI-BLM, 1985, 1989a, and 1989b) provide direction that timber harvest in sediment-limited watersheds that

do not meet their Fisheries/Water Quality objectives, as listed in above in Table H.1, would occur only where concurrent watershed improvement efforts result in a positive upward trend in habitat condition. Many of the area streams do not meet their objectives and are in this category. Those are the watersheds with footnote 2 in Table H.1 above.

An upward trend can be supported by limiting new disturbances, allowing natural recovery to occur, restricting or modifying existing land uses, and/or implementing restoration activities that would improve aquatic and/or riparian habitats. In addition to Eastside Project restoration actions, upward trend can also be supported by other ongoing and planned BLM management actions (See Table H.5 FEIS) The FS also has conducted or is proposing a variety of projects that support improvement of water quality and aquatic habitats in the upper South Fork of the Clearwater River and American River.

BLM land ownership within many subwatersheds often comprise a small percentage of the total acreage, consequently, restoration opportunities may be very limited. In such watersheds, Eastside Project proposals are designed so that such would minimize impacts to aquatic habitats and water quality, and not preclude achievement of long term improving trends (attributed to BLM management actions) in subwatersheds that are below identified objectives.

The Desired Future Condition (DFC) Tables

To estimate natural fish habitat potential and quantify existing stream conditions as required by the Management Framework Plan, the Cottonwood Field Office is using Desired Future Condition (DFC) tables (USDI-BLM, 1989b) which have been further adapted from a model developed on the Clearwater National Forest (Espinosa, 1992). The DFC tables identify specific conditions and channel types found within the Cottonwood Field Office management area using a habitat quality index. Values for the habitat parameters are quantified in a set of desired future condition (DFC) tables. The DFC tables list the specific fish habitat parameter and a value or range that a stream should have in order to be at a given percentage of the streams potential and to meet the fisheries objectives for that watershed. The DFC values, habitat parameter data and their relationships are stratified by channel types and fish species. The values for the fish habitat parameters listed in the DFC tables are considered achievable for streams under natural conditions in the absence of major disturbances or are reflective of what good fish habitat should be. Most of the habitat parameters are consistent for each species, and they vary slightly by channel type. Past work has shown a need to adjust some of the elements to better-fit natural conditions and what is achievable. The DFC for acting and potential woody debris in a low gradient meadow channel is often used as an example of this. Under natural conditions trees may not be common along the channel and active and potential large woody debris may not be prevalent along specific stream reaches. Natural deposited sediment may also be at higher levels because of the existing soil and substrate conditions stream channel type, parent geologic material, and landscape characteristics.

PACFISH (1995) Supplement to BLM Management Framework Plan

The PACFISH Environmental Assessment (USDI-USDA 1995) supplemented the BLM Management Framework Plan. PACFISH establishes riparian goals, riparian management objectives (RMOs), and defines riparian habitat conservation areas (RHCAs). It includes specific direction for land management activities within riparian areas adjacent to streams, lakes, wetlands, and landslide-prone terrain. Riparian goals establish an expectation of the characteristics of healthy, functioning watersheds, riparian areas, and fish habitat. The goals direct the BLM to maintain or improve habitat elements such as water quality, stream channel integrity, instream flows, riparian vegetation, and several others.

Riparian management objectives (RMOs) for stream channel condition provide the criteria against which attainment, or progress toward attainment, of the riparian goals is measured. They include habitat attributes such as number of pools, amount of large wood in the channel, stability of the stream banks, and width-to-depth ratio. The areas adjacent to streams and wetlands (RHCAs) were established in

PACFISH to maintain the integrity of aquatic ecosystems. Healthy riparian areas are essential to maintaining or improving the quality of fish habitat in streams. This analysis will use a combination of DFC and RMO values to define desired and existing conditions in watersheds where activities occur.

Direction in PACFISH specific to Timber Management/Silviculture includes the following:

Prohibit timber harvest, including fuel woodcutting, in RHCAs, except in the following conditions:

- Where catastrophic events such as fire, flooding, volcanic, wind, or insect damage result in degraded riparian conditions, allow salvage and fuel wood cutting in RHCAs only where present and future debris needs are met, where cutting would not retard or prevent attainment of RMOs, and where adverse effects on anadromous fish can be avoided.
- Apply silviculture practices for RHCAs to acquire desired vegetation characteristics where needed to attain RMOs. Apply silviculture practices is a manner that does not retard attainment of RMOs and that avoid adverse effects on listed anadromous fish.

Direction in PACFISH specific to Fire/Fuels Management and relevant to this project includes the following:

- Design fuel treatment and fire suppression strategies, practices, and actions so as not to prevent attainment of RMOs, and to minimize disturbance of riparian ground cover and vegetation.
- Strategies should recognize the role of fire in ecosystem function and identify those instances where fire suppression or fuel management actions could perpetuate or be damaging to long-term ecosystem function, listed anadromous fish, or designated critical habitat.

Direction in PACFISH specific to Roads Management and relevant to this project includes the following:

- For each existing or planned road, meet the RMOs and avoid adverse effects on listed anadromous fish by: (a) completing Watershed Analyses prior to construction of new roads or landings in RHCAs, (b) minimizing road and landing locations in RHCAs, (c) initiating development and implementation of a Road Management Plan or a Transportation Management Plan, and (d) avoiding sediment delivery to streams from the road surfaces.
- Determine the influence of each road on the RMOs.
- Construct new, and improve existing culverts, bridges, and other stream crossing to accommodate a 100-year flood, including associated bedload and debris, where those improvements would/do pose a substantial risk to riparian conditions.
- Provide and maintain fish passage at all road crossings of existing and potential fish-bearing streams.

Direction in PACFISH specific to Recreation Management and relevant to this project includes the following:

- Design, construct, and operate recreation facilities, including trails and dispersed sites, in a manner that does not retard or prevent attainment of RMOs and avoids adverse effects on listed anadromous fish. Relocate or close recreation facilities where RMOs cannot be met or adverse effects on listed anadromous fish avoided.
- Adjust dispersed and developed recreation practices that retard or prevent attainment of RMOs or adversely affect listed anadromous fish. Where adjustment measures such as

education, use limitations, traffic control devices, increased maintenance, relocation of facilities, and/or specific site closures are not effective in meeting RMOs and avoiding adverse effects on listed anadromous fish, eliminate the practice or occupancy.

Direction in PACFISH specific to Fisheries/Wildlife Restoration includes the following:

- Design and implement fish and wildlife habitat restoration and enhancement actions in a manner that contributes to attainment of RMOs.

Channel Morphology and Sediment Routing

Stream gradient is an important parameter that has implications for sediment transport and deposition. It is also related to fish habitat quality, since many species prefer lower gradient stream reaches for certain life stages. Lower gradient reaches on 3rd to 5th order streams in the project area are particularly well-suited for chinook salmon and steelhead spawning. The data below were compiled with GIS methods using the 1:24,000 scale NHD stream layer and 30 meter DEM data.

Table H.2 Percent Stream Length by Gradient Classes – American River

Watershed Name	Stream Miles	<2%	2-4%	4-10%	10-20%	20-40%	>40%
Middle American River[1]	12.8	45	12	34	9	0	0
East Fork American River[1]	19.6	12	12	28	39	9	0
Whitaker Creek	4.6	6	2	46	33	12	0
Queen Creek	4.8	6	12	67	16	0	0
Box Sing Creek	4.1	11	6	36	46	0	0
Kirks Fork	26.8	8	8	37	35	11	1
Lower American River[1]	17.7	53	4	12	29	2	0

[1]Data compiled for composite watersheds, not pure watersheds

Sediment Routing

Sediment routing considers the disposition of sediment within the watershed system, including processes of erosion, deposition, storage and transport. It includes upslope and instream components. The upslope component includes initial detachment, erosion and delivery efficiency. The instream component includes suspended and bedload sediment yield, as well as substrate deposition and composition. The instream component also includes consideration of streamflow and channel morphology, both of which influence the capability of the stream to transport or deposit sediment.

Erosion and Delivery Processes

The erosion process initiates with detachment of material. Detachment can occur through weathering processes such as frost heave or raindrop impact. Erosion can occur as dry ravel, surface erosion (e.g., sheet, rill and gully) and mass erosion (e.g. debris avalanches, slumps and earthflows). The rate of each is dependent on climate, landforms, geology, soils and exposure of mineral soil. For freshly exposed materials, surface erosion is probably the dominant process in the American River landscape. Transport occurs when rainfall or snowmelt generate water in sufficient quantities to carry the detached materials.

In most cases, a large proportion of eroded material is stored on the landscape without being delivered to the channel system. Storage can take place in hollows and flats or behind obstructions. It can also occur on slopes if the water transporting the material infiltrates. Delivery efficiency has been estimated for each landtype on the NPNF, which is also applicable to the Eastside Project. Sediment is considered to be delivered to the channel system when it reaches a stream with defined bed and banks. Within the sediment model, this is assumed to occur at a catchment area of 1 mi^2 (USDA-FS, 1981).

Instream Processes

Once sediment is delivered to the channel system, it is subject to transport or deposition. Transport can occur as suspended or bedload sediment. Fine materials, such as clay, silt and fine sand are transported in the water column as suspended sediment. This material usually travels through the system rapidly and only deposits in still water. It contributes to the turbidity that is seen during runoff events. During active runoff periods the travel time of suspended sediment through the American River watershed and out of the South Fork Clearwater River subbasin is less than 24 hours. Monitoring at gauging stations in nearby Red River indicated that suspended sediment constitutes about 40 percent to 60 percent of the annual sediment yield (Gloss, 1995). Recent analyses with a larger dataset suggest that suspended sediment may be a higher proportion of total sediment yield.

Bedload sediment moves along the channel bottom and typically consists of medium and coarse sand, gravel and cobble. Boulders may occasionally move as bedload, but only for short distances in any given event. Bedload transport and deposition is a complex and intermittent process. It is highly dependent on stream energy in terms of streamflow and channel morphology. Under given conditions of streamflow, a river could transport or deposit bedload sediment in different reaches or habitat units, depending on gradient and cross-sectional characteristics. Bedload transport is an episodic process that occurs at higher streamflows, with the majority occurring at discharges approaching bankfull and above. Under low and moderate flow conditions, very little if any bedload is in transport.

Materials of various sizes are deposited between episodes of transport. Deposition can involve fines (i.e. sand) intruding into coarse substrates or covering the stream bottom. When large amounts of coarse substrates are deposited, aggradation and changes in bedforms can result. In some cases this can lead to further adjustments, such as bank erosion and changes in channel morphology. Storage of deposited sediment within a given habitat unit or reach may be relatively short, for example between flow events or seasons. In other cases, storage can be on the order of years to indefinitely.

Stream gradients for the American River watershed are described above in Tables E.3 and E.4. Lower gradient reaches are particularly susceptible to sediment deposition and relatively long term storage. With regard to sediment deposition and transport, one classification system suggests that channels with <3 percent gradient can be considered response reaches and channels with >3 percent gradient can be considered either transport or source reaches (Montgomery and Buffington, 1993).

In subwatersheds affected by project activities in American River, Middle American and Lower American both have >45 percent of their channel system with gradient <2 percent. Conversely, the other subwatersheds all have >60 percent of their channel system with gradient >4 percent.

Flow Regime

The flow regime for American River is similar to the upper South Fork Clearwater River. The data represented below were collected by the USGS just upstream of the mouth of Crooked River. Though discontinued in 1974, this stream gage was re-established in 2002 and is currently in operation.

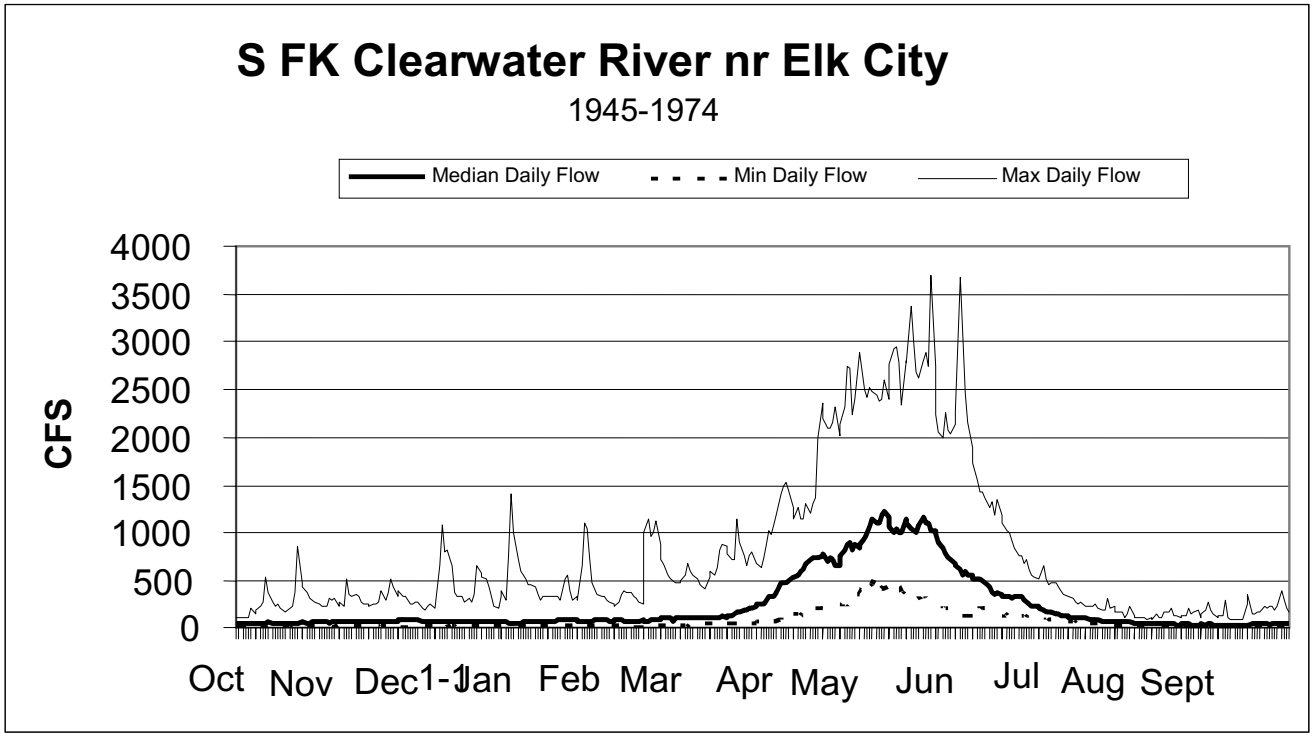

Figure H.2 Annual Hydrograph

Aquatic Model Disclosures

This section discloses the assumptions, limitations, management thresholds, and field tests associated with the three aquatic effects models used in the Eastside project analysis. The models are Equivalent Clearcut Area (ECA), NEZSED, and FISHSED.

Equivalent Clearcut Area (ECA)

The ECA model procedures are derived from Forest Hydrology, Part II (USDA-FS, 1974). Equivalent Clearcut Area (ECA) analysis is a tool used to index the relationship between vegetation condition and water yield from forested watersheds. The basic assumptions of the procedure are that removal of forest vegetation results in water yield increases and that ECA can be used as an index of these increases. Depending on the interaction between water yield, sediment yield, and stream channel conditions, such increases could have impacts on stream channels.

Water yield increases can be directly modeled, but equivalent clearcut area (ECA) is often used as a surrogate. The ECA model is designed to estimate changes in mean annual streamflow resulting from forest practices or treatments (roading, timber harvest, and fires), which remove or reduce vegetative cover, and is usually expressed as a percent of watershed area (Belt, 1980). The index takes into account the initial percentage of crown removal and the recovery through regrowth of vegetation since the initial disturbance. For purposes of this assessment, ECA will be used to index changes in water yield through time based on timber harvest and roading disturbances.

There are a number of physical factors that determine the relationship between canopy conditions and water yield. These include interception, evapotranspiration, shading effects and wind flux. These factors affect the accumulation and melt rates of snow packs and how rainfall is processed. The ECA analysis takes into account the initial percentage of crown removal and the recovery through vegetative re-growth since the initial disturbance in the case of timber harvest or fire. Within the habitat types being treated

under this project, the time frame for complete ECA recovery to occur is estimated to be 65 to 85 years (USDA-FS, 1974).

Additional factors affecting water yield include compacted surfaces due to roads, skid trails, and landings. Existing and new roads are considered as permanent openings in the ECA model. Decommissioned roads are considered as openings, so the road decommissioning projects do not contribute to reductions in ECA.

The ECA model does not directly account for the effects of peak flows. Peaks flows in the project area are nearly always associated with spring snowmelt, at times accompanied by rainfall. This can be seen in Figure H.2. Winter rain-on-snow events are historically rare and only infrequently exceed the spring runoff peak. About 3 percent of annual peak flow events have occurred during the winter months of November through March (USDA-FS, 1998). The effects of peaks flows are considered using stream channel and streambank evaluations and professional judgment in the interpretation of ECA effects on stream channels.

Various ECA thresholds of concern have been in use in the Northern Region since the 1960s (Gerhardt, 2000). Early cutting guides recommended a limit of 20-30 percent ECA within a watershed (Haupt, 1967). More recently, ECA thresholds have been rejuvenated through consultation under the Endangered Species Act.

Recently, concern over water yield changes relative to stream channel condition has focused on smaller headwater catchments. Research in the nearby Horse Creek watershed study have demonstrated instantaneous peak flow increase up to 34 percent and maximum daily flow increases up to 87 percent, resulting from road construction and timber harvest in small catchments (King 1989). Recent observations have suggested that channel erosion from these streams may be contributing to increased bedload sediment in the 3rd order receiving channel (Gerhardt, 2002).

The studies by Belt (1980) and King (1989) have also served as field tests of the ECA procedure. Belt concluded that the ECA procedure is a rational tool for evaluation of hydrologic impacts of forest practices. King recommended local calibration of the model and a greater emphasis on conditions in 1st and 2nd order headwater streams.

Water yield analysis was conducted in smaller drainages (i.e., 1st and 2nd order streams) for several reasons:

1. To compare with findings from King (1993) and Troendle and King (1987);
2. To focus and conduct analyses in drainages that have proposed management activities;
3. Often smaller 1st and 2nd order stream may be potential source areas for sediment and are A type streams. Consequently, stability evaluation of these channel types is important for analyses purposes.

ECA levels above 25 percent were used to determine potential damage to stream channels as a result of increase water yield from timber harvest. This was then compared with respective channel types and channel stability ratings to determine the likelihood of observable channel change. ECA levels above 40 percent were determined to likely have observable channel changes. The 40 percent is based on the Idaho State Cumulative Effects Process hydrologic rating. (Idaho Department of Lands 1995)

The percent increase in ECA levels was used to determine an increase in risk, relative to each alternative, of causing channel changes as a result of timber harvest or other activities that increase ECA. The relative ECA risk is also assessed in conjunction with respective channel types and channel stability rating

NEZSED

Sediment yield is defined as the movement of sediment past a point in the stream system over a certain time period. Sediment yield can be sampled in the field utilizing a variety of methods. The most common method consists of sampling suspended sediment, bedload sediment, and stream discharge. Sediment yield can also be modeled using one of several approaches.

NEZSED is a computer model tiered to the R1R4 guidelines (Cline et al., 1981), developed by hydrologists and soil scientists from the Intermountain Research Station and the Northern and Intermountain Regions of the Forest Service. The model estimates the average annual natural or base rate of sediment yield, and surface erosion sediment yield produced from roads, logging, and fire. The model is limited in that it does not consider the effects of activities on mass erosion greater than 10 cubic yards. It also does not include the effects of grazing and most instream and mining activities. Effects of land uses other than roads, logging and fire are analyzed using other information and techniques.

For this analysis, NEZSED was used to model timber harvest, temporary road construction, reconstruction of existing roads and road decommissioning. Activities under this project that are not modeled are riparian restoration and streambank, recontouring, and construction of a re-connect channel for Queen Creek. The effects of these other activities were considered in the overall aquatic analysis and conclusions.

Though the model shows annual variations in response to land use, it does not estimate variations due to climate or weather events. NEZSED is not an event-based model in that sediment yield does not vary in accordance with specific assumed runoff or erosion events. It estimates average annual sediment yields. However, modeling coefficients are the result of a research base that includes the cumulative result of individual storm and runoff events. Thus, the effects of storm events are incorporated into the model coefficients, though the model results are expressed in terms of average annual yields.

Though NEZSED does not model large activity-related mass erosion events, effects of such events are considered in the effects analysis. This is done through mapping of landslide prone terrain and avoidance of areas deemed to possess high hazard and mitigation of areas deemed to possess moderate hazards. Mass erosion occurrences were also noted during field inventories.

Routing of sediment through the stream channel system is a known limitation of the R1R4 Guidelines, including the NEZSED application. The routing procedure in R1R4 is an adaptation of empirical relationships derived by Roehl (1962). It reduces the percentage of sediment to a point in the channel through application of a channel sediment routing coefficient. The sediment yield rate decreases with increasing watershed area. This simplification of a complex process is overcome through application of professional judgment and interpretation. Also, when used in conjunction with the FISHSED model, sediment routing is empirically considered, since the calibration of FISHSED was done by regressing measured sediment substrate values against modeled sediment yields.

Management thresholds for sediment yield were established in the Chief Joseph Management Framework Plan (USDI-BLM, 1981) and supplement guidance (USDI-BLM, 1985, 1989a, and 1989b). These include sediment yield guidelines, expressed as peak year percent over base sediment yield, and entry frequency guidelines, expressed as the number of times per decade that sediment yield guidelines can be equaled. For the Eastside project, these guidelines are found in Table H.1 above.

NEZSED has been tested against field sampled data in several studies at three scales of watersheds across the Nez Perce National Forest (Gerhardt, 2005). The first study compared measured and modeled natural sediment yields at fifteen small watersheds that are tributaries to Horse Creek, which is a tributary of the Meadow Creek watershed draining into the Lower Selway Subbasin (Gerhardt and King, 1987). These watersheds ranged in size from 0.08 to 0.57 square miles. Annual sediment yield was sampled with sediment detention basins, suspended sediment samples, and streamflow gauging. Of the fifteen tributaries sampled, the model over-predicted sediment yield on nine sites and under-predicted on six sites. The mean result was that the model over-predicted by about 23 percent.

The second study evaluated data from eight stream gauging stations on the Nez Perce National Forest, ranging in size from 5.7 to 113 square miles. Three of these were located within the South Fork Clearwater Subbasin (Gloss, 1995). At six stations, the field data consisted of suspended and bedload sediment samples, along with streamflow gauging. At two stations, sediment yield was estimated through

the use of sediment detention basins and streamflow gauging. This study found that NEZSED under-predicted sediment yields at six stations and over-predicted at two stations, when compared to observed data from field sampling during water years 1986 through 1993. For the three stations within the South Fork Clearwater Subbasin, field-sampled sediment yields averaged about 30 tons/mi²/yr. and modeled sediment yields averaged about 12 tons/mi²/yr. In general, the model predicted better in average to below average water years, and more significantly under-predicted in above average water years.

A third study to test the NEZSED model compared field sampled and modeled sediment yield at the subbasin scale, using data from the South Fork Clearwater and Selway Rivers. Sampling in both rivers occurred between 1988 and 1992 and consisted of 52 suspended sediment samples. The South Fork data were collected at the Mt. Idaho Bridge, near the forest boundary where the watershed area is about 830 square miles. When calculated as annual sediment yield, these data suggest an annual sediment yield at this site of 17,880 tons/year, or about 22 tons/mi²/yr. Sediment yield predictions at this site, based on NEZSED, were estimated to be 15,080 tons per year, or about 18 tons/mi²/yr (USDA-FS, 1998).

The Selway River data were collected at the USGS gage near Ohara Creek, where the watershed area is about 1910 square miles. When calculated as annual sediment yield, these data suggest a sediment yield at this site of 54,900 tons/year, or if adjusted to the mouth, 55,700 tons/year. The watershed area at the mouth is 1974 square miles, so the sediment production is 28 tons/mi²/yr. Sediment predictions based on modeled sediment at the mouth of the Selway River were 54,400 tons/year or about 27.5 tons/mi²/yr (USDA Forest Service 2001).

A fourth study (Thomas and King 2004) tested NEZSED against measured data at stream gages in Red River and South Fork Red River. Results showed that NEZSED predicted 74 percent and 89 percent, respectively, of field-sampled sediment yield over a 16-year period at these two gauging stations. The model results were closer to measured values at these two stations than found in the Gloss study.

FISHSED

The Guide for Predicting Salmonid Response to Sediment Yields in Idaho Batholith Watersheds (Stowell, et.al., 1983, aka the FISHSED model) has been used in this project to predict the effect of sediment yields on stream habitat and fish populations. This model is based on assumptions and has limitations.

The assumptions of the FISHSED model are listed in Appendix A of the model documentation (Stowell et al., 1983). Some of the key assumptions with influence on the limitations of this model include: 1) on those Management Units or Forests in which mass erosion is a significant hazard, predicted sediment yield will include a mass erosion component. The Eastside Project does not occur in a landscape where mass erosion is a significant hazard; 2) The relative response of salmonid fish populations to increased levels of sediment and percent fines in the substrate as depicted in laboratory studies approximates the response under natural conditions. The model documentation (p. 6) describes studies that support this assumption and others that show some differences.

The FISHSED model has other recognized limitations including: 1) the model simplifies an extremely complex physical and biological system and is developed from limited scientific knowledge (p. 2). The complex sequence of sediment movement, from the slopes to the channel, transport down, and deposition in a channel reach, and its effect on fish habitats and populations, have not been fully described (p. 5); 2) the method was developed for watersheds and fish species associated with the Idaho Batholith (p. 4), using data from the Clearwater and Nez Perce National Forest. Given the source of the original data, the model is applicable to the Eastside Project; 3) the specific fish response curves in this model were partially developed from laboratory experiments and may constitute only partial simulation of natural conditions (p. 6); 4) the model evaluates embryo survival, winter carrying capacity, and summer rearing capacity. While invertebrate insect abundance may be directly affected by sediment, the relationship between sediment deposition and invertebrate production is not included in the model (p.10); 5) the utilization of channel types to stratify fish response, particularly with respect to the modeling of "A"

channel types, may not realistically represent changes in fish habitat (p. 21); 6) the model does not include a "recovery function" that predicts the changes in substrate condition based on natural flow events; 7) the model was calibrated to the original Nez Perce Forest sediment model and landtypes, which have been updated since model development. Limited testing and validation of the model has been conducted by the Cottonwood Field Office; and 8) the model outputs are reasonable estimates, but are not absolute numbers of high statistical precision (p. 6). As appropriate given this limitation, the model outputs have been used by the fisheries biologists in this project in combination with sound biological judgment.

WEPP

Disturbed WEPP (Elliott et al. 2000) is an interface to the Water Erosion Prediction Project (WEPP) soil erosion model to allow users to easily describe numerous disturbed forest and rangeland erosion conditions. The interface presents the results as a summary and extended WEPP outputs, and also presents the probability of a given level of erosion occurring the year following a disturbance. Disturbed WEPP is linked to the Rock:Clime climate generator with a database of climate statistics for more than 2600 weather stations.

Disturbed WEPP is one in a series of the USDA Forest Service's Internet-based computer programs based on the Agricultural Research Service's WEPP model. Disturbed WEPP is designed to predict runoff and sediment yield from:

- young and old undisturbed forests
- prescribed and wild forest fires
- skid trails and harvested forests
- rangelands with short grass, tall grass, and shrub plant communities
- any condition with little soil disturbance (no tillage) but a definable amount of soil residue cover (such as parks, pastures, no till agriculture)

Disturbed WEPP is not intended for:

- tilled agricultural conditions (use USDA-ARS templates (WEPP 1999))
- sites where soil is severely disturbed or compacted, such as roads and trails (use WEPP:Road), construction sites, heavily-used playgrounds or trampled rangelands,

Disturbed WEPP allows the user to specify the characteristics of the site in terms of

- climate
- soil texture
- local topography
- plant community
- surface residue cover

Forest Erosion Processes: Forests generally have very low erosion rates unless they are disturbed. Common disturbances include prescribed and wild fire, and harvesting operations. The impact of these operations, however, last only for a short time, perhaps one or two years. After that, the rapid regrowth of vegetation soon covers the surface with plant litter, and potential erosion is quickly reduced. In one study, Robichaud and Brown (1999) reported that erosion rates dropped from almost 40 Mg ha (40,000 kg ha; 19.6 tons acre) the first year after a fire to 2.3 Mg ha (2,300 kg ha; 1.1 tons acre) the second, and 1 Mg ha (1000 kg ha; 0.5 ton acre) the third year. The regrowth of vegetation and subsequent increase in canopy and ground cover overshadow any differences due to climate variation among the years. For any one of the given years, however, the potential erosion depends on the climate.
If the year is normal or dry, then it is unlikely for there to be any significant erosion. If the year has above average precipitation, however, then there could be significant soil erosion. With such variation from one

year to the next, the concept of "average annual erosion" is not appropriate as there is no such thing as an "average" year. The erosivity of a given year is either above average, or below average. A more appropriate analysis of soil erosion following a forest disturbance may be the probability of a given level of erosion occurring. For example, some recent estimates of runoff and erosion after a wild fire required an estimation of a 5-year return period event (an exceedance probability of 0.20).

The WEPP model (Flanagan and Livingston, 1995) is a physically-based soil erosion model that can provide estimates of soil erosion and sediment yield considering the specific soil, climate, ground cover, and topographic conditions. It was developed by an interagency group of scientists including the U.S. Department of Agriculture's Agricultural Research Service (ARS), Forest Service, and Natural Resources Conservation Service; and the U.S. Department of Interior's Bureau of Land Management and Geological Survey.

WEPP simulates the conditions that impact erosion--such as the amount of vegetation canopy, the surface residue, and the soil water content for every day in a multiple-year run. For each day that has a precipitation event, WEPP determines whether the event is rain or snow, and calculates the infiltration and runoff. If there is runoff, WEPP routes the runoff over the surface, calculating erosion or deposition rates for at least 100 points on the hillslope. It then calculates the average sediment yield from the hillslope.

The WEPP model allows a hillslope to be divided into segments with similar soils and vegetation, called overland flow elements. Disturbed WEPP assumes there are two overland flow elements. This allows users to specify a buffer strip below a skid trail, prescribed fire, or harvesting activity in forests. In rangelands, the user may wish to describe different vegetation in the riparian area than in the upland areas.

Disturbed WEPP Assumptions: Because WEPP is process-based, it can be applied to conditions where the necessary input data are known. WEPP is difficult to apply, however, because of the amount of input data required. To simplify the application of WEPP to forest and rangeland conditions anywhere in the U.S., a custom interface was developed.
Soil properties are based on research findings from Forest Service research (Robichaud, 1996) and USDA Agriculture Research Service (ARS) (Flanagan and Livingston, 1995, Franks et al., 1998). The soil file database includes four textural categories. Within each of these categories, there is a separate set of erodibility values for each of the eight types of vegetation or disturbance. Thus, the database has a total of 32 soil/vegetation conditions.

Disturbed WEPP gives both an average annual erosion, as predicted by most USLE-based erosion technologies, and the probability of a given annual erosion rate following a disturbance. The average annual erosion is more appropriate for application to rangelands, whereas the probabilities of annual erosion are more applicable to disturbed forest conditions, where a forest quickly revegetates following a disturbance.

To estimate an average annual erosion, Disturbed WEPP generates a stochastic climate for the climate selected, for the number of years specified. The WEPP model then runs a daily simulation for the specified period of time, and calculates the average annual runoff, erosion, and sediment yield values.

To determine the probability values, Disturbed WEPP is run for the number of years requested, and the annual values of runoff, erosion, and sediment yield are generated by WEPP. Disturbed WEPP then sorts the annual values by magnitude.

For a 50-year run, the largest values estimate a 50-year return period (or 0.02 probability of occurring) value; the second largest, a 25-year return period; the fifth largest a ten-year return; and the 20th largest a 2.5-year return period.

The average value is the same as a 2-year return period regardless of the number of years of simulation selected.

Forest Assumptions: For forest conditions, there are two levels of forest age: 5-year-old and 20-year-old. By the time a forest reaches 20 years of age, the impact of the canopy and residue accumulation is sufficient to provide as much erosion protection as can be achieved from vegetation.
The 5-year-old forest is considered a reasonable condition to describe a forest that has been heavily logged, leaving some side trees and considerable groundcover, or to describe a forest one to two years after a prescribed fire, or two to three years after a wild fire.

The skid trail condition describes a compacted, bladed skid trail with very little cover.

The prescribed burn and wildfire conditions contain soil properties similar to those observed in research (Robichaud, 1996).

Climate: Several climates (Birmingham, AL; Flagstaff, AZ; Mount Shasta, CA; Denver, CO; Moscow, ID; and Charleston, WV) are listed in the climate list as stock climates for Disturbed WEPP. These climates are provided to allow the user to quickly select a regional climate for an initial run.

Most users will prefer to use the Rock:Clime weather generator to select desired climates from the 2,600 sets of climate statistics in the database.

Users may select several nearby climates to determine the sensitivity of their site to climate effects. Up to five sets of custom climate statistics may be selected for the Disturbed WEPP interface.

Thirty years of simulation is generally adequate for average values, and 50 or 100 years for Return Period Analyses.

The user must specify the number of years of simulation. For climates with more than 500 mm of precipitation, 30 years of simulation is generally adequate to obtain an estimate of the average annual erosion, and 50 years is adequate for the probability distribution of erosion.

For drier climates, 50 or more years of simulation may be needed to achieve an average value, and 100 years for the probability of a given amount of erosion occurring. In dry climates, there are more years with little or no erosion, so a greater total number of years is necessary to ensure that there have been an adequate number of wet years for the analysis. The maximum number of years in Disturbed WEPP is 200.

Users may wish to carry out some preliminary runs for some typical local climates to determine how many years of run are necessary for their conditions to ensure a stable average erosion value.

The ARS CLIGEN weather generator uses the climate statistics from the selected station to generate a daily weather sequence for the number of years specified. The WEPP model reads the generated daily weather to predict the erosion for the specified conditions.

Soil Texture: The erosion potential of a given soil depends on the vegetation cover, the surface residue cover, the soil texture, and other soil properties that influence soil strength. Because research in forest and range conditions is limited and data are not available to support a detailed database, only four soil textures (sand, silt, clay, and loam) are listed for Disturbed WEPP. The specific soil properties associated with each selection can be seen by selecting the desired soil and vegetation, and clicking the Soil Texture title. As new information is accumulated, the values of the soil parameters and new soil options may be added to the database.
To fully describe each set of soils for WEPP requires 24 soil parameter values. Further details describing these parameters are available in the WEPP Technical Documentation (Alberts et al., 1995).

Vegetation Treatment: There are eight categories of vegetation or treatment. A default cover is associated with each vegetation treatment, but users are encouraged to alter this value to suit site conditions. The vegetation treatments are:

- Twenty-year old forest
- Five-year old forest
- Shrub dominated rangeland
- Tall-grass dominated rangeland
- Short-grass dominated rangeland
- Low severity fire
- High severity fire
- Skid trail

These categories can describe a wide range of forest and rangeland conditions. The selection of a given vegetation treatment alters these key input values for the WEPP model:

- Plant height, spacing, leaf area index and root depth
- Percent of live biomass remaining after vegetation
- Soil rill and interrill erodibility and hydraulic conductivity
- Default radiation energy to biomass conversion ratio

The user has the option to alter the desired amount of cover, which increases the range of conditions that can be described. Disturbed WEPP is very sensitive to cover, so this value should be carefully selected. The user may wish to consider several cover amounts to understand the impacts of varying cover on the resulting soil erosion.

Predicting Erosion from Regeneration: After a disturbance in a forest, the vegetation regenerates. The vegetation treatments in Disturbed WEPP allow users to analyze the erosion in the years following regeneration.
Cover (%): The percent cover for a given vegetation is predicted by the WEPP model as a function of a biomass conversion ratio, the percent of biomass remaining after senescence, and the residue decomposition rate. These values are stored in the Disturbed WEPP database, and are entered in the WEPP management file for each WEPP run. The biomass conversion ratio is estimated from the percent cover by the relationship:

$$\text{Ratio} = 8.17 * \exp(0.031 * \text{Cover} - 0.0023 * \text{Precipitation})$$

where Ratio is the biomass conversion ratio in the WEPP Management input file for the respective overland flow element, between 1 and 1,000; Cover is the percent cover entered on the input screen, with a maximum value of 100 percent; and Precipitation is the average annual precipitation for the selected climate in mm, with a maximum value of 450 mm.

The percent cover also varies with the distribution of precipitation, daily temperature values, and soil water content throughout the growing season. In some cases, average cover may be over-predicted, in others under-predicted. The predicted cover for a given set of conditions can be observed by selecting the desired vegetation, entering the desired cover, specifying at least 10 years of simulation. The WEPP model will then be run for the specified number of years, the average erosion values calculated, and the average above ground live biomass and percent cover determined from the daily values.

If the resulting average cover is too low or too high, the value entered on the input screen can be adjusted by trial and error until the desired cover is predicted by WEPP. The user should make a note of the input value necessary to achieve the desired cover for his/her conditions.

Topography – Slope: The topographic input for Disturbed WEPP includes two gradient or slope entries for the top element and two for the bottom. If the first element starts at the top of the hill, the first slope is zero. The final slope is the steepness at the bottom of the hillslope. The other two slopes are the steepness at the centers of the respective elements. Disturbed WEPP calculates an average of these two values for the steepness where the two elements intersect. Generally, WEPP is not real sensitive to detailed

variations in slope. The overall average slope, and the slope at the bottom of the hill are the two most important variables that impact slope.

Area and Width: The area of the slope is also required by Disturbed WEPP. The program divides this area by the length of the hill to estimate an average width of hillslope. The predicted soil erosion rates are presented in tonnes per hectare (tons per acre), so the total erosion, or total sediment delivery from the hillslope is the result of these predictions multiplied by the area.

Aquatic Trend Analysis

Introduction to Trend Analysis

To assess the expected trend in aquatic habitat condition, from the variety of influences both quantitative and qualitative, the activities and their expected contribution to aquatic condition are summarized in a table below. The following table H.3 is a summary of the expected influence of the alternatives on the aquatic conditions in the American River watersheds respectively. It does not represent an assessment of cumulative effects, or expected trend within specific subwatersheds. Various activities are considered with respect to the variety of aquatic processes that they potentially affect. For additional information and specific summary of restoration projects refer to Appendix I – Watershed and Fisheries Restoration.

The contribution to the overall aquatic condition is estimated in terms of positive influence (denoted by "+") where the activity is expected to contribute to an improvement in condition, and a negative influence (denoted by "-") where the activity is expected to contribute to degradation in aquatic condition. The amount of influence a specific activity is expected to have on the overall aquatic condition (either positive or negative) is represented by a ranking of high (H), moderate (M), or low (L). Activities rated "High" are those that are expected to have potential for detectable effect at the watershed scale (considering both scope and magnitude). Those rated as "Moderate" are those activities that are expected to have a measurable or detectable local effect (i.e. at the subwatershed or stream reach scale), but result in a negligible effect at the watershed scale. Those activities rated "Low" are expected to have only a negligible effect at the stream reach, subwatershed, and watershed scale.

All of the processes potentially affected by an activity are listed in the table. No ranking represents "no expected" influence on conditions from this project. A negligible positive influence (denoted by "+Negl.") where the activity is expected to contribute minimal or minor improvement in condition, and a negligible negative minor influence (denoted by "-Negl.") where the activity is expected to contribute to minimal or minor degradation in condition. The expected contribution of a specific activity on aquatic condition is considered both in terms of short-term and long-term. Short-term influence is judged to be the immediate results of implementing the activity, generally expected to be around a 5-year timeframe. Long-term influence is judged to be the influence the activity will have on aquatic condition as a result of changes in processes and resource conditions that will over time result in changes in aquatic habitat condition. The timeframe for this influence is greater than 5 years.

Table H.3 American River Aquatic Trend Analysis

Action	Process Affected	Characteristic Indicator	Alt. A Short Term	Alt. A Long Term	Alt. B Short Term	Alt. B Long Term	Alt. C Short Term	Alt. C Long Term	Alt. D Short Term	Alt. D Long Term
Vegetation Treatments	Surface Erosion	Sediment		-L	-L		-L		-L	
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process		-L	-L		-L		-L	
	Riparian Shading	Riparian Condition & Water Temp.				+L		+L		+L
	LWD Recruitment	Potential LWD				+L		+L		+L
Temporary Road Construction	Surface Erosion	Sediment			-M		-L		-L	
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process			-L		-L		-L	
	Riparian Shade	Riparian Condition & Water Temp.								
	LWD Recruitment	Potential LWD								
Road Improvement and Maintenance	Surface Erosion	Sediment			-L	+L	-L	+L	-L	+L
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process								
	Fish Passage	Habitat Availability								
	Riparian Shade	Riparian Condition & Water Temp.								
	LWD Recruitment	Potential LWD								
New Road Construction and Bridge	Surface Erosion	Sediment					-L	-L	-L	-L
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process					-L	-L	-L	-L
	Riparian Shading	Riparian Condition & Water Temp.						-Negl.		-Negl.

Action	Process Affected	Characteristic Indicator	Alt. A Short Term	Alt. A Long Term	Alt. B Short Term	Alt. B Long Term	Alt. C Short Term	Alt. C Long Term	Alt. D Short Term	Alt. D Long Term
	LWD Recruitment	Potential LWD						-Negl.		-Negl.
Watershed and Fisheries Restoration										
Road Decomm.	Surface Erosion	Sediment		-L	-L	+L	-L	+M	-L	+L
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process		-L	+L	+L	+L	+M	+L	+L
	Riparian Shading	Riparian Condition & Water Temp.				+L		+M		+L
	LWD Recruitment	Potential LWD				+L		+M		+L
American River Vehicle Road Relocation & Road Decomm. in Riparian	Surface Erosion	Sediment			-L	+M	-L	+M		
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process			+L	+M	+L	+M		
	Riparian Shading	Riparian Condition & Water Temp.				+M		+M		
	LWD Recruitment	Potential LWD				+M		+M		
Riparian Restoration	Surface Erosion	Sediment			-M	+M	-M	+M	-M	+M
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process			-L	+L	-L	+L	-L	+L
	Riparian Shading	Riparian Condition & Water Temp.		+L	-L	+M	-L	+M	-L	+M
	LWD Recruitment	Potential LWD		+L		+M		+M		+M
	Fish Disturbance & Aquatic Habitat	Habitat Use and Quality			-Negl.		-Negl.		-Negl.	
Road to ATV Trail Conversion (includes closing fords and ATV	Surface Erosion	Sediment			-L	+L	-L	+L	-L	+M
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process			-L	+L	-L	+L	-L	+L
	Riparian Shading	Riparian Condition & Water Temp.				+L		+L		+M

Action	Process Affected	Characteristic Indicator	Alt. A Short Term	Alt. A Long Term	Alt. B Short Term	Alt. B Long Term	Alt. C Short Term	Alt. C Long Term	Alt. D Short Term	Alt. D Long Term
bridges)	LWD Recruitment	Potential LWD				+L		+L		+L
	Fish Disturbance & Aquatic Habitat	Habitat Use and Quality			+L	+L	+M	+M	+M	+M
Hardening Ford and Meadow Restoration	Surface Erosion	Sediment			+L	+L				
	Infiltration, Runoff, Peaks	Hydrologic Process		.	+Negl.	+Negl.				
	Riparian Shading	Riparian Condition & Water Temp.			+Negl.	+Negl.				
	LWD Recruitment	Potential LWD			+Negl.	+Negl.				
	Fish Disturbance & Aquatic Habitat	Habitat Use and Quality			+L	+L				
Mine Reclamation	Surface Erosion	Sediment			-L	+L	-L	+L	-L	+L
	Mass Failure Risk	Sediment								
	Infiltration, Runoff, Peaks	Hydrologic Process			+Negl.	+Negl.	+Negl.	+Negl.	+Negl.	+Negl.
	Riparian Shading	Riparian Condition & Water Temp.								
	LWD Recruitment	Potential LWD								
Queen Creek Channel Re-connect	Surface Erosion	Sediment			-L		-L		-L	
	Infiltration, Runoff, Peaks	Hydrologic Process								
	Riparian Shading	Riparian Condition & Water Temp.								
	LWD Recruitment	Potential LWD								
	Fish Disturbance & Aquatic Habitat	Habitat Use and Quality								
	Fish Passage	Habitat Availability & Aquatic Integrity[1]			+M	+M	+M	+M	+M	+M
	Non-native competition and/or hybridization	Native Species Viability[1]				-L		-L		-L

The expected short-term consequences of the Eastside project on aquatic condition in American River are fairly balanced between positive and negative influences. The factors contributing to a short-term effects to aquatic condition are primarily related to short term increases in sediment generated from the implementation of the action (timber harvest, temporary road construction, new permanent road construction, new vehicle bridge construction, road decommissioning, road reconstruction and improvement). The temporary road construction and new road construction and bridge are judged to be the largest contributor to this influence, followed by the harvest activities, road decommissioning, and road improvements. The consequences of the Eastside Project on aquatic condition in American River is to generally have short-term negative influences, but positive influences in the long term. Short-term increases in sediment would primarily be attributed to projects such as temporary road construction, new road construction, and riparian restoration actions that would require bank recontouring and would be followed by vegetation treatments. Primary long-term benefits to aquatic conditions would occur from riparian restoration, decommissioning roads within riparian areas, decommissioning of fords, and reconnecting Queen Creek with American River.

Reduction of road densities, particularly in riparian habitats would reduce chronic "press" sources of sediment. Riparian restoration actions would improve streambank and channel conditions, reduce potential for bank erosion, and provide for large woody debris recruitment in the long term. Reduction of chronic sediment sources and improvement of shading would help support achievement of the South Fork Clearwater River TMDL for sediment and water temperature in the long term.

The expected long-term consequences of the Eastside project on aquatic condition in the American River watershed is over-all positive. The road decommissioning, riparian restoration, road relocations out of riparian areas, and Queen Creek channel re-connect and improved habitat accessibility are judged to be the largest contributors to long-term improved aquatic conditions. The reduction in chronic sediment and improved hydrologic process from the road decommissioning, road improvement, and soil restoration are the other contributors to this expected improvement. The amount of the improvement associated with this later group of activities is rated low due to the amount of this work being completed with this project with respect to the remaining amount of degraded mainstem habitat, roads and compacted soils in the American River watershed. These will continue to contribute negatively to these aquatic processes. BLM lands comprise a relatively small percentage of the total ownership in the watershed, and actions identified in the Eastside Project would reduce negative effects attributed to BLM lands and support upward trends. Additional planned Bureau of Land Management work in this drainage will further improve in channel and riparian conditions along the mainstem as well as tributary streams. The Forest Service has also identified watershed restoration measures that will support long term improvements to aquatic conditions.

The above ratings by activity can be summarized by the effect pathways by assigning a value to the Low, Moderate, and High ranking (L=1, M=2, H=3). Table H.4 below summarizes an overall comparison of the alternatives by the effect pathway for short term and long term.

The No Action alternative in American River suggests no change in the short term, but a slight negative trend in the long term related to fire risk associated with untreated stands, and long term slight positive trends for potential LWD and improving riparian conditions with riparian successional advancement towards mid and late seral stages. Alternatives B, C, and D suggest a short term negative effect, followed by long term improving trend.

Table H.4 American River Aquatic Trend Summary

Action	Process Affected	Characteristic Indicator	Alt. A Short Term	Alt. A Long Term	Alt. B Short Term	Alt. B Long Term	Alt. C Short Term	Alt. C Long Term	Alt. D Short Term	Alt. D Long Term
Summary	Surface Erosion	Sediment	0	-2 (-2, +0)	-10 (-11, +1)	+9 (-0, +9)	-10 (-10, +0)	+8 (-1, +9)	-10 (-10, +0)	+6 (-1, +7)
	Mass Failure Risk	Sediment	0	0 (-0, +0)	0 (-0, +0)	0 (-0, +0)	0 (-0, +0)	0 (-0, +0)	0 (-0, +0)	0 (-0, +0)
	Infiltration, Runoff, Peaks	Hydrologic Process	0	-2 (-2, +0)	-2 (-4, +2)	+5 (-0, +5)	-3 (-5, +2)	+5 (-1, +6)	-4 (-5, +1)	+2 (-1, +3)
	Riparian Shading	Riparian Condition & Water Temp.	0	+1 (-0, +1)	-1 (-1, +0)	+7 (-0, +7)	-1 (-1, +0)	+8 (-0, +8)	-1 (-1, +0)	+6 (-0, +6)
	LWD Recruitment	Potential LWD	0	+1 (-0, +1)	0 (-0, +0)	+7 (-0, +7)	0 (-0, +0)	+8 (-0, +8)	0 (-0, +0)	+5 (-0, +5)
	Fish Disturbance & Aquatic Habitat	Habitat Use and Quality	0	0 (-0, +0)	+1 (-0, +1)	+1 (-0, +1)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)
	Fish Passage	Habitat Availability & Aquatic Integrity	0	0 (-0, +0)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)	+2 (-0, +2)
	Non-Native Competition and/or Hybridization	Native Species Viability	0	0 (-0, +0)	0 (-0, +0)	-1 (-1, +0)	0 (-0, +0)	-1 (-1, +0)	0 (-0, +0)	-1 (-1, +0)
Total			**0 (-0, +0)**	**-2 (-4, +2)**	**-10 (-16, +6)**	**+31 (-1, +32)**	**-10 (-16, +6)**	**+32 (-3, +35)**	**-11 (-16, +5)**	**+22 (-3, +25)**

Effectiveness Monitoring and Trend

BLM has an active monitoring program as shown in Table H.5. This monitoring is done to: validate models and assumptions; validate the effectiveness of restoration efforts and BMPs; assess existing conditions and trends; apply adaptive management for changes to existing management if warranted; and provide baseline data for decision making and management of resources.

Trend analysis of aquatic habitats, water quality, and riparian conditions in the Eastside Project area is important because it provides documentation in regards baseline conditions, comparison to desired conditions, and long term changes. Trend monitoring data is especially valuable for assessments of ongoing and new management actions occurring on public lands, because streams within the project area provide habitat for federally listed and BLM sensitive species and MFP requirements related to upward trend requirements for below objectives streams.

Trend monitoring is accomplished through three primary methods, which includes: (1) Monitoring of specific aquatic and/or riparian characteristics at permanently established monitoring stations; (2) conducting stream reach specific surveys which characterize and evaluate habitat and resource conditions; and/or (3) watershed evaluations and assessments. Following is a list of primary data which is utilized for trend assessments.

- Deposited Sediment/Substrate Monitoring
- Riparian/Stream Channel Monitoring
- Stream Reach Surveys and Evaluations
- Water Temperature, Water Quality, and Discharge Monitoring
- Fish Population Monitoring and Distribution Surveys
- Watershed Evaluations and Assessments

Table H.5 illustrates trend monitoring in the Eastside Project Area.

Table H.5 BLM Trend Monitoring – Eastside Project Area

Watershed	Substrate Monitoring	Riparian/Stream Channel Monit. (Livestock Grazing Summary)	Subbasin Fish Habitat Survey	Water Temperature & Discharge
Lower American River	Yes	Yes	Yes	Yes
Middle American River	Yes	Yes	Yes	Yes
East Fork American River	Yes	No (Not Leased for Grazing)	Yes	Yes
Whitaker Creek	Yes	No (Not Leased for Grazing)	Yes	Yes
Queen Creek	Yes	No (Not Leased for Grazing)	Yes	Yes
Box Sing Creek	Yes	Yes	Yes	Yes
Kirks Fork	Yes	Yes	Yes	Yes
Elk Creek	Yes	Yes (Elk Creek Fenced to Exclude Grazing)	Yes	Yes
Little Elk Creek	Yes	Yes	Yes	Yes
South Fork American River	Yes	No (Not Grazed by Livestock)	No	Yes

Additionally, the BLM has established fish population snorkeling stations in all prescription watersheds in the Eastside Project. Population monitoring has been sporadic or very limited consequently; limited population trend data is available. However, the monitoring does provide species presence/absence and general population data that provides baseline population

information. Population data may not always be directly correlated with aquatic habitat conditions, particularly with anadromous fish (i.e., chinook salmon, steelhead trout), because returning adult fish numbers fluctuates annually.

Other monitoring information is available. American River is monitored annually (1981 – 2006) by IDFG for chinook redds and 2006 counts totaled 59 redds. During 2006, the BLM started monitoring the South Fork Clearwater River for chinook redds (Crooked River to American/Red Rivers) and counts totaled 2 redds. The BLM is planning to monitor this segment of the South Fork Clearwater River annually.

Deposited Sediment Trend Monitoring

For the substrate monitoring shown in Table H.4, a minimum of two years of data collection has occurred, and has ranged to a high of eleven years (occurring from 1980s – 2006). The primary "reference monitoring station" occurs in lower American River, below the mouth of Buffalo Gulch, and has been monitored eleven times. Substrate monitoring includes cobble embeddedness, surface fines, fines by depth, pebble count, and free matrix. Substrate monitoring protocols and methods are on file at the BLM Cottonwood Field Office.

The period between the earliest and most recent substrate monitoring is generally over ten years. Some stations may have limited trend implications because of limited monitoring data and/or statistical implication. Analysis of all collected deposited sediment data during a given year (e.g., cobble embeddedness, surface fines, core sampling of spawning gravels, pebble counts etc.) may provide some inference of trend conditions when compared to previous monitoring efforts conducted 5 or more than 10 years apart. However, comparison of this various deposited data may not always result in definitive trend direction. Sampling error may have occurred, but long term data collection is continuing to provide for improved trend analysis capability. It is difficult to display a statistically significant change in deposited sediment from the current data however; following is a summary of inference of trend.

Lower American River – Appears to have a stable to slight upward trend for deposited sediment.
Middle American River – Very limited data, but suggested trend at a minimum appears to be at least stable, if not slightly upward.
East Fork American River - Limited data, but trend appears to be stable. Elevated deposited sediment levels noted despite little development in watershed; attributed to natural conditions (i.e., channel type, parent material, land types).
Whitaker Creek – Monitoring station is located immediately upstream from private property (i.e., stream mile 0.4). Limited data, but trend appears to be stable.
Queen Creek – Limited data, but trend appears to be stable.
Box Sing Creek – Limited data, but trend appears to be stable.
Kirks Fork – Limited data, but trend appears to be stable. Elevated deposited sediment levels noted despite little development in watershed; attributed to natural conditions (i.e., channel type, parent material, land types).
South Fork Clearwater River – No definitive trend conclusions made. Various fluctuations between yearly monitoring results and various deposited sediment parameters do not support valid conclusions. Some monitoring inconsistencies noted.

Desired range of cobble embeddedness is 20 – 30 percent or less. Monitoring data for prescription subwatersheds has documented cobble embeddeness levels that range from 30 percent to above 50 percent. Changes to deposited sediment may not be apparent or expected for many years (e.g., decades), even with minimal land uses and active restoration actions. Some channels have been severely altered by dredge mining activity, and expected changes would be

very slow. Some drainages have elevated levels, even with minimal current or historic land uses taking place.

Deposited Sediment Monitoring Limitations: The analysis and comparison of deposited sediment data between watersheds needs to be used with caution and proper professional judgement. Deposited sediment (e.g., cobble embeddedness) exhibits high spatial and temporal variability in both natural and disturbed streams, consequently sampling must be intensive to detect changes (Sylte and Fischenich 2003). Many studies compare sites with different stream power and bed roughness, so they cannot distinguish management effect from effects of local hydraulic conditions unless the management effects are significant. Lisle (1989) identifies that the size of sediment in transport can change with discharge because of size-dependent entrainment thresholds [Jackson and Beschta 1982]. Changes in bed topography can alter transport vectors and local shear stress and thereby cause sediment that is coarser or finer than was present before in a local area to deposit. As a consequence, the spatial distribution of bed material size in natural gravel channels in undisturbed watersheds can vary considerably over time [Adams and Beschta 1980; Scrivener and Brownlee 1981].

Trend Indicators and General Observations

All prescriptions watersheds and fish bearing stream segments have had various surveys conducted, which provide trend data when repeated. One of particular importance is the BLM subbasin fish habitat survey, using a modified Hankin and Reeves (1998) survey methodology, which provides good baseline data in regards to important fish habitat factors, such as pool/riffle ratios and large woody debris, see Table 3.6.6 for summaries of such data. These surveys were conducted during 1991 and 1992. Repeating these surveys provides good data in regards to changes in fish habitat conditions and trends.

Streams surveys (BLM subbasin surveys) were not recently conducted for all fish bearing streams in the project area. However, all fish bearing stream reaches within the project area were recently evaluated by BLM Fisheries Biologist (2004–2006), some general trend observations were noted from such evaluations. Such observations are in regards to changes and trends occurring over past two decades on stream segments occurring on BLM lands, and are summarized as follows:

- LWD is increasing in all fish bearing stream reaches;
- Creation of pools and instream cover conditions are also improving for all fish bearing stream reaches, which is attributed to increases in LWD;
- Natural succession and no new (or minimal) development activity within RHCAs is supporting improving riparian conditions and streambank stability;
- Instream restoration efforts in dredge mined reaches of American River resulted in major improvements to pool habitats and LWD;
- Improved livestock management and reduction of riparian and stream channel impacts ~~effects~~;
- Fish passage improvement effort are providing for improved adult and juvenile access to several streams; and
- East Fork American River and Kirks Fork have low levels of human disturbance, however, elevated levels of deposited sediment occur. Trends probably stable to slightly upward.

A variety of restoration and management activities support upward trend within the project and analysis area, and include BLM Eastside Project restoration actions identified in Appendix I, FS restoration actions (see FEIS American and Crooked River Project), and past and planned BLM

restoration actions. Table H.6 is a brief summary of BLM restoration actions which have recently taken place (within one to three years) or are proposed (foreseeable future) to support upward trend in the American River watershed and the South Fork of the Clearwater River.

Table H.6 Additional Key BLM Actions Supporting Upward Trend Within Project and Analysis Area

Watershed	Action	Key Indicator Affected (BLM Project or Natural Recovery)	Implementation
Lower American River	Create pool habitat in 2.1miles of American R.	Pools (American River Restoration Projects)	2007–2009
	Install LWD and habitat rocks in 2.1 miles of American R.	LWD (American River Restoration Projects)	2007–2009
	Replaced three barrier culverts in Buffalo Gulch	Fish passage – improved distribution (Buffalo Gulch Culvert Replacement Project)	2005
	Construct reconnect channel for Telephone Creek	Fish Passage – improved distribution (American River Restoration Projects)	2007–2008
	Road restoration and obliteration Buffalo Gulch	Sediment (Buffalo Gulch Road Obliteration)	2007
	Convert Telephone Creek road to ATV trail, rehab. fords, improve stream channel conditions.	Sediment (American River Restoration Projects)	2007–2008
	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
Middle American River	Create pool habitat in 1.3 miles of American R.	Pools (American River Restoration Projects)	2007–2009
	Install LWD and habitat rocks in 1.3 miles of American R.	LWD (American River Restoration Projects)	2007–2009
	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
E. Fk. American River	Replaced barrier culvert with 20 foot wide bridge.	Fish Passage – Improved Distribution (American River Restoration Projects)	2006
	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
Whitaker Creek	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
Queen Creek	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
Box Sing Creek	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
Kirks Fork Creek	Natural Recovery	Sediment, Riparian, LWD, Pools	N/A
South Fork Clearwater River	Riparian restoration and reconnect of perennial stream.	Riparian/Water Temperature (South Fork Clearwater	2007–2008

Watershed	Action	Key Indicator Affected (BLM Project or Natural Recovery)	Implementation
		River Restoration Project)	
	Decommisioning of road segments and improved drainage on ATV trail.	Sediment (South Fork Clearwater River Restoration Project)	2007–2008
	Maintenance and improvement of two South Fork Clearwater River side channels.	Fish Habitat – Side Channels (South Fork Clearwater River Restoration Project)	2007–2008
	Natural Recovery	Sediment, Riparian, LWD	N/A

Natural recovery is taking place with the primary benefits to riparian conditions, bank stability, shading, LWD, and pools. Expected trends for these changes are long term improvement in conditions with slightly improving trends. With natural succession, riparian habitat consisting of mixed conifer types are advancing to mid-age to mature overstory trees, subsequently improving riparian shading and conditions. Dead and dying lodgepole pine will contribute to increased levels of LWD and subsequent improvement of instream cover conditions and creation of pool habitat.