Four Forest Restoration Initiative, Rim Country EIS

DRAFT Water and Riparian Resource Report

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for:
4FRI Rim Country EIS

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Introduction/Project Information

This is the specialist report for watershed and riparian resources relevant to the proposed 4FRI Rim Country Project. The report contains the current conditions of water and riparian resources within the project area, and the effects of proposed alternatives on water and riparian resources. This report will be used for the analysis of water and riparian resources within the Rim Country project area and will include the effects analysis by alternative following the development of the proposed action and alternatives.

The Four-Forest Restoration Initiative (4FRI) is a planning effort designed to restore forest resiliency and function across four National Forests in Arizona including the Coconino, Kaibab, Apache-Sitgreaves and Tonto. This environmental analysis focuses on water and riparian resources on portions of the Coconino National Forest (hereafter referred to as Coconino NF), the Apache-Sitgreaves National Forest (hereafter referred to as the A-S NF), and the Tonto National Forest (hereafter referred to as the Tonto NF) with a project area totaling approximately 1,238,660 acres. Alternatives 2 and 3 would mechanically treat up to about 899,340 acres of vegetation mechanically or with prescribed fire.

Purpose and Need

The purpose and need for proposing an action was determined by comparing the objectives and desired conditions in the Coconino NF and A-S NF and Tonto NF Land Resource and Management Plans (forest plans) to the existing conditions related to forest resiliency, forest function and watershed function respect to water and riparian resources. Where plan information was dated or not explicit, local research and the best available science was utilized. The results of the comparison are displayed in narrative, tables. In summary, there is a need for: This report is directly related to the purpose and need of the project in that protection of water and riparian resources essential in restoration of fire adapted ecosystems.

- moving vegetation structure and diversity towards desired conditions by creating a mosaic of interspaces and tree groups of varying sizes and shapes
- improving forest health by reducing the potential for stand density-related mortality and by reducing the level of dwarf mistletoe infection
- moving towards desired conditions for vegetation diversity and composition by maintaining and promoting Gambel oak, aspen and grasslands
- moving towards the desired condition of having a resilient forest by reducing the potential for undesirable fire behavior and its effects
- moving towards the desired condition of maintaining the mosaic of tree groups and interspaces with frequent, low-severity fire by having a forest structure that does not support wide-spread crown fire
- move towards desired conditions for watersheds by water and riparian resources and improving watershed function
- move toward desired conditions for watersheds to reduce the threat to life, property, water quality and other critical values at risk from post wildfire storm events (flooding and debris flows)
- moving toward desired conditions in ecosystems by having riparian systems such as springs and seeps function at, or near, potential
- moving towards desired conditions for degraded streams by restoring channel function
- moving towards desired conditions by restoring select closed and unauthorized roads to them to more

natural conditions

Relevant Law, Regulation, and Policy

Federal Law: briefly list the federal laws directly pertaining to your resource – e.g. ESA, Clean Air Act, etc. and describe the basic requirements for compliance. Add or delete from the list below as needed for your resource.

Federal Statutes:

The following is a partial listing of relevant laws which have been enacted by Congress. A Federal statute, or law, is an act or bill which has become part of the legal code through passage by Congress and approval by the President (or via congressional override). Although not specified below, many of these laws have been amended.

Bankhead-Jones Farm Tenant Act of July 22, 1937 - Directed the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and thus assist in such things as control of soil erosion, reforestation, preservation of natural resources, and protection of fish and wildlife.

Clean Water Act (see Federal Water Pollution Control Act)

Emergency Flood Prevention (Agricultural Credit Act) Act of August 4, 1978 - Authorizes the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil-erosion prevention, in cooperation with land owners and users, as the Secretary deems necessary to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or other natural occurrence is causing or has caused a sudden impairment of that watershed.

Section 4 of the Act directs the development and implementation of recovery plans for threatened and endangered species and the designation of critical habitat. Several species listed under the Act are found on the Apache-Sitgreaves NFs, some with recovery plans and some with designated critical habitat.

Federal Land Policy and Management Act of October 21, 1976 - Requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. Also states that the United States shall receive fair market value of the use of the public lands and their resources unless otherwise provided for by law.

Federal-State Cooperation for Soil Conservation Act of December 22, 1944 - Authorized the adoption of eleven watershed improvement programs in various states for the improvement of water runoff, water flow retardation, and soil erosion prevention.

Federal Water Pollution Control Act and Amendments of 1972 (Clean Water Act) - Enacted to restore and maintain the chemical, physical, and ecological integrity of the Nation's waters. Provides for measures to prevent, reduce, and eliminate water pollution; recognizes, preserves, and protects the responsibilities and rights of States to prevent, reduce, and eliminate pollution, and to plan the development and use (including restoration, preservation, and enhancement) of land and water resources; and provides for Federal support and aid of research relating to the prevention, reduction, and elimination of pollution, and Federal technical services and financial aid to state and interstate agencies and municipalities for the prevention, reduction, and elimination of pollution.

Established goals for the elimination of water pollution; required all municipal and industrial wastewater to be treated before being discharged into waterways; increased Federal assistance for municipal treatment plant construction; strengthened and streamlined enforcement policies; and expanded the Federal role while retaining the responsibility of States for day-to-day implementation of the law.

Federal Water Project Recreation Act of July 9, 1965 - Requires that recreation and fish and wildlife enhancement opportunities be considered in the planning and development of Federal water development.

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 - Directs the Secretary of Agriculture to prepare a Renewable Resource Assessment every ten years; to transmit a recommended Renewable Resources Program to the President every five years; to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System; and to ensure that the development and administration of the resources of the National Forest System are in full accord with the concepts of multiple use and sustained yield.

Healthy Forests Restoration Act of 2003 (H.R. 1904) - Purposes are to reduce wildfire risk to communities and municipal water supplies through collaborative hazardous fuels reduction projects; to assess and reduce the risk of catastrophic fire or insect or disease infestation; to enhance efforts to protect watersheds and address threats to forest and rangeland health (including wildfire) across the landscape; to protect, restore, and enhance forest ecosystem components such as biological diversity, threatened/endangered species habitats, enhanced productivity.

Joint Surveys of Watershed Areas Act of September 5, 1962 - Authorizes and directs the Secretaries of the Army and Agriculture to make joint investigations and surveys of watershed areas in the United States, Puerto Rico, and the Virgin Islands, and to prepare joint reports setting forth their recommendations for improvements needed for flood prevention, for the conservation, development, utilization, and disposal of water, and for flood control.

Land and Water Conservation Fund Act of September 3, 1964 - Authorizes the appropriation of funds for Federal assistance to States in planning, acquisition, and development of needed land and water areas and facilities and for the Federal acquisition and development of certain lands and other areas for the purposes of preserving, developing, and assuring accessibility to outdoor recreation resources.

National Forest Management Act of October 22, 1976 - The National Forest Management Act reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest System lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple-use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of National Forests.

National Forest Roads and Trails Act of October 13, 1964 - Authorizes the Secretary of Agriculture to provide for the acquisition, construction, and maintenance of forest development roads within and near the National Forests through the use of appropriated funds, deposits from timber sale purchasers, cooperative financing with other public agencies, or a combination of these methods. The Act also authorizes the Secretary to grant rights-of-way and easements over National Forest System lands.

Organic Administration Act of June 4, 1897 - Authorizes the President to modify or revoke any instrument creating a national forest; states that no national forest may be established except to improve and protect the forest within its boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United

States. Authorizes the Secretary of Agriculture to promulgate rules and regulations to regulate the use and occupancy of the national forests.

Multiple-Use Sustained-Yield Act of June 12, 1960 - States that it is the policy of Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and authorizes and directs the Secretary of Agriculture to develop and administer the renewable surface resources of the national forests for the multiple use and sustained yield of products and services.

National Environmental Policy Act of January 1, 1970 - Directs all Federal agencies to consider and report the potential environmental impacts of proposed Federal actions, and established the Council on Environmental Quality.

Safe Drinking Water Amendments of November 18, 1977 - Amended the Safe Drinking Water Act to authorize appropriations for research conducted by the Environmental Protection Agency relating to safe drinking water; Federal grants to states for public water system supervision programs and underground water source protection programs; and grants to assist special studies relating to the provision of a safe supply of drinking water.

Soil and Water Resources Conservation Act of November 18, 1977 - Provides for a continuing appraisal of the United States' soil, water and related resources, including fish and wildlife habitats, and a soil and water conservation program to assist landowners and land users in furthering soil and water conservation.

Surface Mining Control and Reclamation Act of August 3, 1977 - Authorizes the Secretary of Agriculture to enter into agreements with landowners, providing for land stabilization, erosion, and sediment control, and reclamation through conservation treatment, including measures for the conservation and development of soil, water, woodland, wildlife, and recreation resources, and agricultural productivity of such lands.

Water Quality Improvement Act of April 3, 1970 - Amends the prohibitions of oil discharges, authorizes the President to determine quantities of oil which would be harmful to the public health or welfare of the United States; to publish a National Contingency Plan to provide for coordinated action to minimize damage from oil discharges. Requires performance standards for marine sanitation device and authorizes demonstration projects to control acid or other mine pollution, and to control water pollution within the watersheds of the Great Lakes. Requires that applicants for Federal permits for activities involving discharges into navigable waters provide state certification that they will not violate applicable water quality standards

Water Resources Planning Act of July 22, 1965 - Encourages the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal government, states, localities, and private enterprises.

Watershed Protection and Flood Prevention Act of August 4, 1954 - Establishes policy that the Federal government should cooperate with states and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public agencies for the purposes of preventing erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States; furthering the conservation, development, utilization, and disposal of water, and the conservation and utilization of land; and thereby preserving, protecting, and improving the Nation's land and water resources and the quality of the environment.

Regulations

Below is a partial listing of relevant regulations. Federal executive departments and administrative agencies write regulations to implement laws. Regulations are secondary to law. However, both laws and regulations are enforceable.

33 CFR 323 Permits for Discharges of Dredged or Fill Material into Waters of the United States - This regulation prescribes those special policies, practices and procedures to be followed by the Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States.

36 CFR 212.5 (b) Roads - ...the responsible official must identify the minimum road system needed for safe and efficient travel and for administration, utilization, and protection of National Forest System lands. ... The minimum system is the road system determined to be needed to meet resource and other management objectives adopted in the relevant land and resource management plan (36 CFR 219), to meet applicable statutory and regulatory requirements, to reflect long-term funding expectations, to ensure that the identified system minimizes adverse environmental impacts associated with road construction, reconstruction, decommissioning, and maintenance.

Identification of unneeded roads. Responsible officials must review the road system on each National Forest and Grassland and identify the roads on lands under Forest Service jurisdiction that are no longer needed to meet forest resource management objectives and that, therefore, should be decommissioned or considered for other uses, such as for motorized routes.

Travel Management Rule - On December 9, 2005, the Forest Service published the TMR. The agency rewrote direction for motor vehicle use on National Forest Service (NFS) lands under 36 CFR, Parts 212, 251, and 261, and eliminated 36 CFR 295. The rule was written to address at least in part the issue of unmanaged recreation. The rule provides guidance to the Forest Service on how to designate and manage motorized recreation on the Forests. The rule requires each National Forest and Grassland to designate those roads, motorized trails, and Areas that are open to motor vehicle use.

36 CFR 219 Planning - Sets forth a process for developing, adopting, and revising land and resource management plans for the National Forest System.

40 CFR 121-135 Water Programs - Sets forth the provisions for the administration of water programs including: state certification of activities requiring a Federal license or permit; EPA administered permit programs; state program requirements; procedures for decision making; criteria and standards for the National Pollutant Discharge Elimination System; toxic pollutant effluent standards; water quality planning and management; water quality standards; water quality guidance for the Great Lakes System; secondary treatment regulation; and, prior notice of citizen suits. See Title 40 (Protection of Environment), Chapter 1 (Environmental Protection Agency), subchapter D (Water Programs).

40 CFR 1500 Council on Environmental Quality - Council on Environmental Quality regulations implementing the National Environmental Policy Act.

Executive Orders

Below is a partial listing of relevant executive orders. Executive orders are official documents by which the President provides instructions to executive departments and agencies. An executive order may be used to reassign functions among executive branch agencies. It may adopt guidelines, rules of conduct, or rules of procedure for government employees or units of government. It can also establish an advisory body or task force.

EO 11988 Floodplain Management, 1977 - Requires each Federal agency to provide leadership and to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and

welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

EO 11990 Protection of Wetlands, 1977 - Requires each Federal agency to provide leadership and to take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, regulating, and licensing activities.

Land Management Plan Direction

Apache-Sitgreaves NF Forest Plan Direction

The following is Apache-Sitgreaves National Forest Plan components and Management Area direction. Tables 1 through 4 are summaries of the Management Areas, Descriptions/Management Approaches, Desired Conditions, Standards, Guidelines and Objectives in Rim Country EIS from the 2016 Revised Apache-Sitgreaves National Forest Plan.

Apache-Sitgreaves NF Forest Plan Forest-wide Standards and Guidelines

Table 1. A-S NF Forest Plan Forest-wide standards and guidelines.

Resource Section within Forest Plan	Plan Component	Plan Direction
Motorized Opportunities	Guideline (GL)	Roads and motorized trails removed from the transportation network should be treated in order to avoid future risk to hydrologic function and aquatic habitat.
Motorized Opportunities	GL	New roads, motorized trails, or designated motorized areas should be located to avoid meadows, wetlands, seeps, springs, riparian areas, stream bottoms, sacred sites, and areas with high concentrations of significant archaeological sites. The number of stream crossings should be minimized or mitigated to reduce impacts to aquatic species.
Riparian Areas	GL	Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.
Riparian Areas	GL	Wet meadows, springs, seeps and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
Riparian Areas	GL	Storage of fuels and other toxicants should be located at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
Riparian Areas	GL	Equipment should be fueled or serviced at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
Riparian Areas	GL	Construction or maintenance equipment service areas should be located at least 100 feet from riparian areas, and treated to prevent gas, oil, or other contaminants from washing or leaching into streams.
Water Resources	GL	Projects with ground-disturbing activities should be designed to minimize long and short term impacts to water resources. Where disturbance cannot be avoided, project specific soil and water conservation practices and BMPs should be developed.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water Resources	GL	Streams, streambanks, shorelines, lakes, wetlands, seeps, springs and other bodies of water should be protected from detrimental changes [11] in water temperature and sediment to protect aquatic species and riparian habitat.
Water Resources	GL	Aquatic management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
Water Resources	GL	As State of Arizona water rights permits (e.g., water impoundments, diversions) are issued, the base level of instream flow should be retained by the Apache-Sitgreaves NFs.
Water Resources	GL	To protect water quality and aquatic species, heavy equipment and vehicles driven into a water body to accomplish work should be completely clean of petroleum residue. Water levels should be below the gear boxes of the equipment in use. Lubricants and fuels should be sealed such that inundation by water should not result in leaks.
Water Resources	Standard (ST)	Consistent with existing water rights, water diversions or obstructions shall at all times allow sufficient water to pass downstream to preserve minimum levels of waterflow that maintain aquatic life and other purposes of national forest establishment.
Water Uses	GL	Constructed features should be maintained to -- or removed when no longer needed.
All Forested PNVTs	ST	On lands suitable for timber production, timber harvest activities shall only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest. This also applies where wildland fire is used to create openings for tree regeneration purposes on suitable timber lands. Restocking level is prescribed in a site specific silvicultural prescription for a project treatment unit and is determined to be adequate depending on the objectives and desired conditions for the plan area. In some instances, such as when lands are harvested or prescribed burned to create openings for firebreaks and vistas or to prevent encroaching trees, it is appropriate not to restock.
All Forested PNVTs	ST	Harvesting systems shall be selected based on their ability to meet desired conditions and not strictly on their ability to provide the greatest dollar return.
All Forested PNVTs	ST	Clearcutting shall be used only where it is the optimum method for meeting desired conditions.
All PNVTs	GL	Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil cover.
All PNVTs	GL	Wildfire may be used to meet desired resource conditions, maintain or promote desired vegetation species, and enable natural fires to return to their historic role.
All PNVTs	GL	Project plans should include quantitative and/or qualitative objectives for implementation monitoring and effectiveness monitoring to assist in moving toward or maintaining desired conditions.
All PNVTs	ST	Within each PNVT, vegetation management activities shall be designed to maintain or move plant composition towards a moderate to high plant community similarity as compared to site potential.
All PNVTs	ST	Vegetation treatments shall include measures to reduce the potential for introduction of invasive plants and animals and damage from nonnative insects and diseases.
Minerals and Geology	GL	Streambed and floodplain alteration or removal of material should not occur if it prevents attainment of riparian, channel morphology, or streambank desired conditions.

Apache-Sitgreaves NF Forest Plan Forest-wide Desired Conditions

Table 2 A-S NF Forest Plan Forest-wide Desired Conditions.

Resource Section within Forest Plan	Plan Component	Plan Direction
Overall Ecosystem Health	Desired Condition (DC)	Ecological components (e.g., soil, vegetation, water) are resilient to disturbances including human activities, and natural ecological disturbances (e.g., climate variability, fire, drought, wind, insects, disease, pathogens).
Overall Ecosystem Health	DC	Natural ecological disturbances return to their characteristic roles within the ecosystem. Fire, in particular, is restored to a more natural function.
Overall Ecosystem Health	DC	Natural ecological cycles (i.e., hydrologic, energy, nutrient) facilitate shifting of plant communities, structure, and ages across the landscape. Ecotone shifts are influenced at both the landscape and watershed scale by ecological processes. The mosaic of plant communities and the variety within the communities are resilient to disturbances.
Overall Ecosystem Health	DC	Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
Overall Ecosystem Health	DC	Habitat quality, distribution, and abundance exist to support the recovery of federally listed species and the continued existence of all native and desirable nonnative species.
Overall Ecosystem Health	DC	Healthy ecosystems provide a wide range of ecosystem services.
Overall Ecosystem Health	DC	Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.
Riparian Areas	DC	Riparian-wetland conditions maintain water-related processes (e.g., hydrologic, hydraulic, geomorphic). They also maintain the physical and biological community characteristics, functions, and processes.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Areas	DC	Natural ecological disturbances (e.g., flooding, scouring) promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian-dependent species.
Riparian Areas	DC	Stream (lotic) riparian-wetland areas have vegetation, landform, and/or large coarse woody debris to dissipate stream energy associated with high waterflow.
Riparian Areas	DC	Streams and their adjacent floodplains are capable of filtering, processing, and storing sediment; aiding floodplain development; improving floodwater retention; and increasing groundwater recharge.
Riparian Areas	DC	Vegetation and root masses stabilize streambanks, islands, and shoreline features against the cutting action of water.
Riparian Areas	DC	Ponding and channel characteristics provide habitat, water depth, water duration, and the temperatures necessary for maintaining populations of riparian-dependent species and for their dispersal.
Riparian Areas	DC	Beavers occupy capable stream reaches and help promote the function and stability of riparian areas.
Riparian Areas	DC	Lentic riparian areas (e.g., wet meadows, fens, bogs) have vegetation and landform present to dissipate wind action, wave action, and overland flow from uplands.
Riparian Areas	DC	Wetland riparian areas are capable of filtering sediment and aiding floodplain development that contribute to water retention and groundwater recharge.
Riparian Areas	DC	Willows (e.g., Bebb, Geyer, Arizona, Goodding's) are reproducing with all age classes present, where the potential exists.
Riparian Areas	DC	The spatial extent of wetlands is maintained [20].
Riparian Areas	DC	Soil compaction from forest activities (e.g., vehicle use, recreation, livestock grazing) does not negatively impact riparian areas.
Riparian Areas	DC	Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Areas	DC	Diversity and density of riparian forest vegetation provides for breeding, escape, hiding, and resting cover for wildlife and provides travelways between other habitat areas and seasonal ranges.
Riparian Areas	DC	The ecological function of riparian areas is resilient to animal and human use.
Riparian Areas	DC	Riparian obligate species within wet meadows, around springs and seeps, along streambanks, and active floodplains provide sufficient [15] vegetative ground cover (herbaceous vegetation, litter, and woody riparian species) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize streambanks, and provide for wildlife and plant needs.
Riparian Areas	DC	Riparian soil productivity is optimized as described by the specific TES map unit as indicated by the vigor of the herbaceous vegetation community. Based on species composition, ungrazed plant heights range from 10 inches to 36 inches.
Riparian Areas	DC	Floodplains and adjacent upland areas provide diverse habitat components (e.g., vegetation, debris, logs) as necessary for migration, hibernation, and brumation (extended inactivity) specific to the needs of riparian-obligate species (e.g., New Mexico meadow jumping mouse, Arizona montane vole, narrow-headed gartersnake).
Riparian Areas	DC	Large coarse woody debris provides stability to riparian areas and stream bottoms lacking geologic control (e.g., bedrock) or geomorphic features (e.g., functioning floodplains, stream sinuosity, width/depth ratio).
Riparian Areas	DC	Vegetation is structurally diverse, often dense, providing for high bird species diversity and abundance, especially neotropical migratory birds. It includes large trees and snags in the cottonwood-willow and mixed broadleaf deciduous riparian forests to support species such as beaver, yellow-billed cuckoo, bald eagles, Arizona gray squirrel, and various bat species.
Water Resources	DC	Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water Resources	DC	Water resources maintain the capability to respond and adjust to disturbances without long term adverse changes.
Water Resources	DC	Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.
Water Resources	DC	Instream flows provide for channel and floodplain maintenance, recharge of riparian aquifers, water quality, and minimal temperature fluctuations.
Water Resources	DC	Streamflows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling needs of aquatic, riparian dependent, and many upland species of plants and animals.
Water Resources	DC	Water quantity meets the needs for forest administration and authorized activities (e.g., livestock grazing, recreation, firefighting, domestic use, road maintenance).
Water Resources	DC	Stream channels and floodplains are dynamic and resilient to disturbances. The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows.
Water Resources	DC	Stream condition is sufficient to withstand floods without disrupting normal stream characteristics (e.g., water transport, sediment, woody material) or altering stream dimensions (e.g., bankfull width, depth, slope, sinuosity).
Water Resources	DC	Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
Water Resources	DC	Water quality meets or exceeds Arizona State standards or Environmental Protection Agency water quality standards for designated uses.
Water Resources	DC	Water quality meets the needs of desirable aquatic species such as the California floater, northern and Chiricahua leopard frog, and invertebrates that support fish populations.
Water Uses	DC	Water developments contribute to fish, wildlife, and riparian habitat as well as scenic and aesthetic values.
Water Uses	DC	Apache-Sitgreaves NFs water rights are secure and contribute to livestock, recreation, wildlife, and administrative uses.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water Uses	DC	Dams, diversions, or other water control structures are designed, maintained, and operated to conserve water resources.
All PNVTs	DC	Each PNVT contains a mosaic of vegetative conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds. The distribution of physical and biological conditions is appropriate to the natural disturbance regimes affecting the area.
All PNVTs	DC	The vegetative conditions and functions are resilient to the frequency, extent, and severity of ecological disturbances (e.g., fire, insects and disease, flood, climate variability). The landscape is a functioning ecosystem that contains all its components, processes, and better able to cope with climate change.
All PNVTs	DC	Natural processes and human and natural disturbances (e.g., wildland fire, mechanical vegetation treatments) provide desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. Natural fire regimes are restored. Uncharacteristic fire behavior is minimal or absent on the landscape.
All PNVTs	DC	Wildfire maintains and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role.
All PNVTs	DC	Native plant communities dominate the landscape.
All PNVTs	DC	The range of species genetic diversity remains within native vegetation and animal populations, thus enabling species to adapt to changing environmental and climatic conditions.
All PNVTs	DC	Vegetation characteristics (e.g., density, litter) provide favorable conditions for waterflow and quality.
All PNVTs	DC	Organic soil cover and herbaceous vegetation protect soil, facilitate moisture infiltration, and contribute to plant and animal diversity and ecosystem function.

Resource Section within Forest Plan	Plan Component	Plan Direction
All PNVTs	DC	Diverse vegetation structure, species composition, densities, and seral states provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of ecosystem diversity at multiple scales, including habitats for those species associated with late seral states and old growth forests.
All PNVTs	DC	Vegetation conditions allow for transition zones or ecotones between riparian areas, forests, woodlands, shrublands, and grasslands. Transition zones may shift in time and space due to changing site conditions from disturbances (e.g., fire, climate variability).
All PNVTs	DC	Disjunct populations of Chihuahua pine, Arizona cypress, and Rocky Mountain maple are present with the ability to reproduce on capable sites.
All PNVTs	DC	Shrub components contain a diverse array of native vegetation that is well distributed across the landscape to provide nutritional needs for browsers.
All PNVTs	DC	Vegetation provides products—such as wood fiber or forage—to help meet local and regional needs in a manner that is consistent with other desired conditions on a sustainable basis within the capacity of the land.
All PNVTs	DC	Ecosystem services are available as forests, woodlands, grasslands, and riparian communities successfully adapt to a changing and variable climate.
All PNVTs	DC	Stand densities and species compositions are such that vegetation conditions are resilient under a variety of potential future climates.
All PNVTs	DC	Vegetative ground cover (herbaceous vegetation and litter cover) is optimized [15] to protect and enrich soils and promote water infiltration. There is a diverse mix of cool and warm season grasses and desirable forbs species.
All PNVTs	DC	Grasses, forbs, shrubs, and litter are abundant and continuous to support natural fire regimes.
All PNVTs	DC	The composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.

Resource Section within Forest Plan	Plan Component	Plan Direction
All PNVTs	DC	Rare or unique plant communities (e.g., agaves, Chihuahuan pine) are intact and persisting.
Wet Mixed Conifer	DC	The wet mixed conifer forest is a mosaic of structural stages and seral states ranging from young to old trees. The landscape arrangement is an assemblage of variably sized and aged groups and patches of trees and other vegetation associations similar to reference conditions.
Dry Mixed Conifer	DC	Coarse woody debris, including logs, ranges from 5 to 15 tons per acre. Logs average 3 per acre within the forested area of the landscape.
Ponderosa Pine	DC	Coarse woody debris, including logs, ranges from 3 to 10 tons per acre. Logs average 3 per acre within the forested area of the landscape.
Ponderosa Pine	DC	Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.
Minerals and Geology	DC	Naturally occurring geological features (e.g., caves, sinkholes) remain intact to support wildlife habitat, recreation opportunities, and unique vegetation.

Table 3. A-S NF Forest Plan Forest-wide Objectives.

Resource Section within Forest Plan	Plan Component	Plan Direction
Overall Ecosystem Health	Objective (OBJ)	During the planning period, improve the condition class on at least 10 priority 6th level HUC watersheds by removing or mitigating degrading factors [2].
Riparian Areas	OBJ	Annually, move 200 to 500 acres toward desired composition, structure, and function of streams, floodplains, and riparian vegetation.
Riparian Areas	OBJ	Within the planning period, relocate, repair, improve, or decommission a minimum of 4 miles of National Forest System roads or trails that add sediment to streams, damage riparian vegetation, erode streambanks, cause gullies, and/or compact floodplain soils.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Areas	OBJ	Annually, remove an average of 2 miles of unauthorized roads or trails that add sediment to streams, damage riparian vegetation, erode streambanks, cause gullies, and/or compact floodplain soils.
Riparian Areas	OBJ	Within the planning period, enhance or restore 5 to 25 wet meadows, springs, seeps or cienegas to proper hydrologic function and native plant and animal species composition.
Riparian Areas	OBJ	Annually, work with partners to reduce animal damage to native willows and other riparian species on an average of 5 miles of riparian habitat.
All Forested PNVTs	OBJ	Annually, treat 5,000 to 35,000 acres to reduce tree densities, restore natural fire regimes, promote species habitat and ecosystem health, reduce fire hazard, maintain desired conditions, initiate recovery from uncharacteristic disturbance, and provide forest products, leaving a desired mix of species with the range of desired densities that are resilient to changing climatic conditions.

Management Areas (MA) direction on the A-S NF

Table 4. A-S NF Forest Plan Management Area Direction.

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres [1]	Acres and percent within 4FRI East project area
Apache-Sitgreaves NF – 506,889 acres				
General Forest	The emphasis of this area is to restore priority 6th level HUC watersheds, restore fire-adapted ecosystems, reduce the threat from uncharacteristic wildfire, and provide forest products. A wide variety of management activities occur and a wide variety of forest products are	**Objectives:** see forest-wide **DC:** Watershed condition rating is at satisfactory. **No standards or guidelines**	1, 224,071	417,565 (33.7%)

[1] Forest-wide acres does not include lands that are not National Forest System lands. MA acres as presented in the draft forest plan includes all acres.

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres [1]	Acres and percent within 4FRI East project area
	available within this management area. Lands identified as suitable for timber production have a regularly scheduled harvest of commercial timber.			
Community-Forest Intermix	Forest managers work toward achieving the goals outlined in the CWPPs for the counties within the Apache-Sitgreaves NFs. A higher degree of temporary ground disturbance may occur. The amount of snags and residual large coarse woody debris is generally lower than in the General Forest Management Area. In addition, forest openings are larger and basal areas are lower than in the General Forest Management Area. The management approach within this management area is to complete initial treatments to reduce fire hazard.	**Objectives:** see forest-wide **DC**: The Community-Forest Intermix Management Area is composed of smaller, more widely spaced groups of trees than the general forest. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire. **DC**: As a result of forest management, most wildfires are low to mixed severity surface fires resulting in limited loss of structures or ecosystem function. **DC**: Native grasses, forbs, shrubs, and litter (i.e., fine fuels) are abundant enough to maintain and support natural fire regimes, protect soils, and support water infiltration. **DC**: The composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems. **DC**: Ponderosa pine and dry mixed conifer forest structure is similar to forestwide conditions or is composed of smaller and more widely spaced tree groups than in the general forest. **DC**: Wet mixed conifer and spruce-fir PNVTs are growing in an overall more open condition than the wet mixed conifer PNVT outside of the Community-Forest Intermix Management Area. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire. **DC:** Grasslands have less than 10 percent woody canopy cover. **DC**: Piñon-juniper stands are represented by savanna-like conditions. **Standards: N/A**	60,564	23,365 (1.9%)

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres [1]	Acres and percent within 4FRI East project area
		Guidelines: **GL**: Retention of fire-resistant tree species (e.g., ponderosa pine, Douglas-fir, pure aspen) should be emphasized in the wet mixed conifer and spruce-fir forested PNVTs to reduce fire hazard.		
Wildlife Quiet Area	There is an emphasis on improving wildlife habitat and maintaining existing wildlife developments. Management of habitat within WQAs may provide a benchmark for assessing effects of activities on generally undisturbed wildlife populations. The road in the Open Draw WQA is managed as open on a seasonal basis.	**None applicable to soils** **Objectives:** see forest-wide **Standards**: N/A **Guidelines:**	50,173	22,401 (1.8%)
Wild Horse Territory	The forests work….. to keep grazing use in balance with available forage.	**Objectives:** see forest-wide DC – Not applicable Guidelines – Not applicable	18,761	18,761 (1.5%)
Natural Landscape	The management emphasis is to retain the natural appearing character of these areas. Management activities occur mostly for ecological restoration because of natural ecological events or previous management actions. Management activities may include restoration of ecological conditions or habitat components, soil stabilization, planned and unplanned ignitions, hazardous fuels reduction, and invasive species reduction.	**None applicable to soil, water and riparian except temporary and existing roads** **Guidelines:** GL Temporary road construction and motorized equipment may be used in order to achieve ecological desired conditions. GL: Existing roads should be maintained to the minimum standard to meet the objective maintenance level.	404,802	13,191 (1.1%)

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres [1]	Acres and percent within 4FRI East project area
	Livestock grazing may occur where appropriate			
High Use Developed Recreation Area	In addition to recreation use, other uses (including livestock grazing, timber management, and wildlife management) may occur in combination with surrounding recreation and scenic desired conditions.	**None applicable to Soil and Water**	16,549	8,096 (0.7%)
Energy Corridor	Energy corridors are generally not managed to provide recreation opportunities. They are managed for very low scenic integrity where vegetation and structural changes may attract attention and dominate the landscape when viewed from nearby.	**Objectives:** see forest-wide DC: Vegetation consists predominantly of grasses, forbs, shrubs, low-growing trees, and sapling-sized trees. **Guidelines:** GL: Within and adjacent to energy corridors, vegetation should be managed similarly to the Community-Forest Intermix Management Area so that facilities stay operational and reduce the hazards of human-caused damage, wildfire ignition, damage from wildland fire, and falling trees. GL: Trees and shrubs in riparian areas should only be removed when there is an imminent threat to facilities and, in these cases, trees should be left for large coarse woody debris recruitment to the stream and riparian system. GL: When planning and implementing vegetation treatments (e.g. corridor maintenance), vegetation within riparian zones that provide rooting strength important for bank stability should be encouraged.	2,547	1,511 (0.1%)

Coconino NF Forest Plan Direction

The following are the Coconino National Forest Plan components and management area direction. Table 5 through 8 are summaries of the Management Areas, Descriptions/Management Approaches, Desired Conditions, Standards, Guidelines and Objectives in Rim Country EIS from the 2018 Revised Coconino National Forest Plan.

Coconino NF Forest-wide Standards and Guidelines

Table 5 Coconino NF Forest Plant Forest-wide Standards and Guidelines.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water	Guidelines (GL)	Watersheds should have enough vegetative ground cover to recover rapidly from natural and human disturbances and to maintain long-term soil productivity.
Water	GL	Watershed restoration and maintenance, and vegetation treatments should focus on priority 6th code watersheds to ensure that ecosystem processes, resilient vegetation conditions, and natural disturbance regimes are functioning properly.
Water	GL	Instream flow water rights should be procured for those streams without instream water rights to ensure that sufficient flow is provided for aquatic species, habitat, and recreation.
Water	GL	Best management practices for management activities should be identified, implemented, and monitored to maintain water quality, quantity, and timing of flows, and to prevent or reduce accelerated erosion.
Water	GL	For impaired waters or non-attaining waters, approved total maximum daily load (TMDL) recommendations or implementation plans should be implemented to maintain or improve water quality to meet or exceed Arizona water quality standards and support identified designated beneficial uses.
Water	GL	Within existing water rights, excess water should remain in or be allowed to flow freely back into the natural channel, spring, and riparian habitat to maintain and improve ecological function, water quality, quantity, and timing of flows, and to benefit native species and their habitat.
Constructed Waters	GL	For new projects and management activities, a site-specific aquatic management zone should be identified and maintained around reservoirs to protect water quality and to avoid detrimental changes in water temperature or chemical composition, blockages of streamcourses, or sediment deposits that would seriously and adversely affect water conditions or aquatic habitat. Soil and vegetation disturbance from management activities should be minimized to meet this intent, but is not necessarily excluded in this zone.

Resource Section within Forest Plan	Plan Component	Plan Direction
Constructed Water	GL	Earthen stock ponds determined to be important for threatened, endangered, and Southwestern Region sensitive species, should be managed to maintain water and habitat needed for species' survival and reproduction, consistent with existing water rights.
Riparian and Stream	GL	In perennial and intermittent riparian streamcourses, projects and management activities should be designed and implemented to retain or restore natural streambank stability, native vegetation, and riparian and soil function.
Riparian and Stream	GL	An aquatic management zone for non-riparian, intermittent streamcourses should be identified and maintained to reduce sedimentation, maintain functioning of the channel within its floodplain, and maintain downstream water quality and riparian habitat and function. This management zone would also avoid detrimental changes in water temperature or chemical composition; blockages of streamcourses; or sediment deposits that would seriously and adversely affect water conditions, fish habitat, or connected downstream cave, karst, and lava tube resources. Soil and vegetation disturbance from management activities should be managed to meet these intents, but is not necessarily excluded in this zone. The general starting points for widths of aquatic management zones are shown: Erosion Hazard — Width of Zone in Nonriparian Intermittent Streamcourses Severe — 100 feet each side of streamcourse Moderate — 70 feet each side of streamcourse Slight — 35 feet each side of streamcourse
Riparian Springs	GL	Spring recharge areas, where known, should be managed to maintain or improve spring discharge.
Riparian Springs	GL	Water rights should be maintained or procured to protect in situ (onsite) water quantity where no water rights exist.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Springs	GL	Projects and activities should be designed and implemented to maintain or improve soil and riparian function; maintain or improve native vegetation; and/or prevent the introduction or spread of disease, invasive, or undesirable species. Design features could include road, recreation, and/or livestock management.
Riparian Springs	GL	Where there is a structure in place to use water from a spring as a water source or when designing restoration projects, priority should be given to the protection of spring source areas and riparian habitat to safeguard the unique ecological and biophysical characteristics, higher biodiversity, endemic species, and cultural values associated with spring sources. For example, water could be piped out of the riparian area to avoid negative impacts to soil, water, and vegetation or if water is to be diverted, a flow-splitter could be installed to maintain some flow at the source.
Riparian All	GL	Management activities such as vegetation treatments or other restoration actions should be designed to maintain or move toward desired conditions for soil, riparian vegetation, and water quality.
Riparian All	GL	Riparian areas should be managed to promote natural movement of water and sediment, to maintain ecological functions, and to maintain habitat and corridors for species.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian All	GL	An aquatic management zone should be identified and maintained in riparian areas to protect water quality and to avoid detrimental changes in water temperature or chemical composition, blockages of streamcourses, or sediment deposits that would seriously and adversely affect water conditions, fish habitat, or connected downstream cave, karst, and lava tube resources. Soil and vegetation disturbance from management activities should be managed to meet these intents, but is not necessarily excluded in this zone. The general starting points for widths of aquatic management zones are shown: Erosion Hazard Width of Zone in Riparian Areas Severe 150 feet each side of streamcourse or riparian area Moderate 125 feet each side of streamcourse or riparian area Slight 100 feet each side of streamcourse or riparian area
Riparian Forest Type	GL	Water diversions and groundwater pumping should not lower the water table to prevent loss of or undesired changes to composition, structure, or function to riparian forests or mesquite bosques.
Riparian Forest Type	GL	In riparian forests, recreation activities, permitted uses, and management activities should occur at levels that maintain or allow improvement of soil function, riparian vegetation, and water quality at the stream reach scale. This guideline would not apply to fine-scale activities and facilities such as intermittent livestock crossing locations, water gaps, or other infrastructure used to manage impacts to riparian areas at a larger scale.
Soils	GL	The forest should implement and monitor best management practices (BMPs) for all activities with the potential to impair water quality in accordance with the intergovernmental agreement between ADEQ and the Forest Service Southwestern Regional Office to control and manage nonpoint source pollution.

Resource Section within Forest Plan	Plan Component	Plan Direction
Roads and Facilities	GL	Soil and water BMPs should be implemented to protect water quality while designing, constructing, reconstructing, or relocating new and existing roads, parking areas and pullouts. For example, permanent and temporary road construction and relocation should: • Occur outside of streamcourses and aquatic management zones, except where crossing is required. • Avoid wetlands, springs, seasonally wet meadows, and montane meadows. • Avoid soils that are unstable and highly erodible where connected to streamcourses.

Coconino NF Forest Plan Forest-wide Desired Conditions

Table 6. Coconino NF Forest Plan Forest-wide Desired Conditions.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water	Desired Conditions (DC)	Watersheds are functioning properly and are resilient to natural and human disturbances.
Water	DC	Watersheds exhibit high geomorphic, hydrologic, and biotic integrity within their inherent capability. Natural hydrologic, hydraulic, geomorphic, and biologic processes function at a level that allows retention of their unique physical and biological properties to maintain or improve downstream water quality.
Water	DC	Vegetation and soil conditions in watersheds support important ecosystem services such as clean water, base flow, riparian communities, and long-term soil productivity. These conditions also help moderate climate variability and change. Soil and vegetation function to facilitate precipitation infiltration and groundwater recharge.

Resource Section within Forest Plan	Plan Component	Plan Direction
Water	DC	Watersheds exhibit a high degree of connectivity along streams, laterally across the floodplains and valley bottoms and vertically between surface and subsurface flows. Streamcourses and other links between aquatic and upland components provide access to food, water, cover, nesting areas, and protected pathways for aquatic and upland species.
Water	DC	Water quantity (base flows) of intermittent and perennial streams are sustained to mimic seasonal flow regimes. Peak flows and flood potential occur within the historic range of variability for that stream system. For baseflows, this means that during low-flow periods (fall and winter, generally), water flow is sustained within its natural capability.
Water	DC	Water quality, water quantity and the timing of water flows support ecological functions, habitat for aquatic and riparian species, and water sources for municipalities. Water quality, water quantity, and the timing of flows are sustained at levels that retain the biological, physical, and chemical integrity of associated systems and benefit survival, growth, reproduction, and migration of native species.
Water	DC	Water quality meets or exceeds Arizona water quality standards and supports identified designated beneficial uses.
Riparian Streams	DC	Perennial and intermittent riparian streamcourses maintain their natural sinuosity and have access to their floodplains so that when floods do occur, energy can be dissipated without causing damage to the streambanks of the channel. Stream channel stability is maintained or restored.
Riparian Streams	DC	Flooding is the primary natural disturbance in perennial, intermittent, and ephemeral streamcourses. In some streamcourses, flooding creates a mix of stream substrates for fish habitat, and sites for germination and establishment of riparian vegetation.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Streams	DC	Perennial and intermittent riparian streamcourses, and associated floodplains, are capable of filtering sediment, capturing and/or transporting bedload, aiding floodplain development, improving floodwater retention, improving or maintaining water quality, and providing groundwater recharge within their natural potential.
Riparian Streams	DC	Streams maintain a natural hydrograph, or waterflow over time, including periodic flooding, which promotes natural movement of water, sediment, nutrients, and woody debris.
Riparian Wetlands	DC	Wetlands provide functional soil and water resources on most acres, consistent with their flood regime and flood potential, and provide diverse habitats for native species. Wetlands are in or trending toward proper functioning condition.
Riparian Wetlands	DC	Consistent with the natural hydrologic cycle, wetland vegetation has a variety of age classes ranging from young to old and a composition of native species that reflects the individual wetland types. Plant composition can vary considerably at the fine- and mid-scales depending on site potential (as determined by TEUI or other appropriate ecological classification system) and geomorphology, elevation, climate, topography, soils, and smaller scale disturbances. Wetlands include vegetation that indicates maintenance of riparian soil moisture characteristics (plants that occupy the deepest zones).
Riparian Springs	DC	Springs have functional soil, water, and vegetative resources consistent with natural waterflow patterns, recharge rates, and geochemistry appropriate for the site.
Riparian Springs	DC	Spring vegetation has young, mid, and late seral stages and a composition of native aquatic and riparian species consistent with spring type, slope, aspect, natural disturbances, and natural solar energy budget (amount of radiation during different times of the year[2]).

[2] The number of species and the number of endemic species are correlated with solar energy.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Springs	DC	Spring riparian zones are capable of filtering sediment, capturing and/or transporting bedload, improving or maintaining water quality, providing groundwater recharge and supporting perched water-bearing zones within their natural potential, consistent with the spring type.
Riparian Springs	DC	Consistent with existing water rights and claims, springs are rarely developed and altered by human-made structures such as head boxes, cisterns, and pipelines.
Riparian Springs	DC	The physical and biological components of springs provide habitat for narrowly endemic species and those with restricted distributions.
Riparian All	DC	Within their type and capability, riparian ecosystems and corridors promote the natural role of water, sediment, woody debris, and root masses, and maintain water tables. This includes perennial and intermittent riparian streamcourses. The associated water table supports riparian vegetation.
Riparian All	DC	Instream flows provide for channel and floodplain maintenance, recharge of alluvial aquifers, water quality, and temperature fluctuations within the natural range of variability.
Riparian All	DC	Riparian areas exhibit connectivity between and within aquatic, riparian and upland components that reflects their natural range of variability and linkages. Naturally isolated springs remain isolated. Riparian areas are connected vertically between surface and subsurface flows. Streamcourses and other links between aquatic and upland components support ecological functions, and provide habitat and movement corridors for aquatic and upland species.
Riparian All	DC	Riparian areas are managed consistent with designated beneficial uses associated with existing claimed or certified water rights. Water quality is maintained or improved so it fully supports State water quality standards or designated beneficial uses identified by ADEQ.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian All	DC	Where the potential exists, vegetation, root masses, and woody debris stabilize and protect banks, edges, and shorelines of riparian areas from disturbances. Plant distribution and occurrence are resilient to natural disturbances.
Riparian Forest Type	DC	Riparian forests provide the composition and structure to filter sediments, ash, and contaminants; build and stabilize banks; reduce the effects of flooding; store and release water; and recharge aquifers. Riparian forests provide habitat and help maintain temperatures necessary for maintaining populations of native aquatic and riparian-dependent species and for their dispersal. At the landscape scale, overall plant composition is similar to site potential (greater than 66 percent). Plant composition can vary considerably at the fine- and mid-scales, depending on site potential (as determined by TEUI or other appropriate ecological classification system) and climate, elevation, geomorphology, topography, soils, and smaller scale disturbances.
Riparian Forest Type	DC	Root masses and herbaceous vegetation stabilize banks, filter sediment, and maintain or improve water quality.
Riparian Forest Type	DC	Collectively, Cottonwood Willow Riparian Forest, Mixed Broadleaf Deciduous Riparian Forest, and mesquite bosques provide a unique vegetation community favored by bird species such as the western yellow-billed cuckoo and Bell's vireo. When water tables are high, mesquite bosques persist on upland terraces. In mesquite bosques, a variety of age classes are present, including seedling, sapling, mature, and overmature trees. The understory is comprised of native grasses and forbs.
Soils	DC	Soil productivity and functions are sustained and functioning properly within site potential, so the soil has the ability to resist erosion, infiltrate water and recycle nutrients. Coarse woody debris, including downed logs, provide for long term soil productivity. Soil productivity and functions contribute to the resiliency and adaptability of terrestrial and riparian ecosystems to climate change.

Resource Section within Forest Plan	Plan Component	Plan Direction
Soils	DC	Vegetative ground cover is maintained at levels that contribute to suitable hydrologic function, soil stability, and nutrient cycling. Soils are protected by adequate vegetative ground cover on the soil surface to prevent erosion from exceeding natural rates of soil formation (soil tolerance), within their inherent capability. Soils are permeable and capable of infiltrating water to reduce instances of overland flows during precipitation events. The composition of grass and forb species and presence of plant litter and grass, forb, shrub, and tree basal area surface cover reduce occurrences of compaction and erosion.
Soils	DC	Localized short-term accelerated soil erosion occurs following high-severity fires (Fire Regimes IV and V), but it does not occur to the extent that it risks long-term impairment to connected waters downstream or causes loss of soil productivity over major portions of the 5th or 6th code watershed.
Ecosystems	DC	Within their type and capability, ecosystems are functioning properly, provide habitat for native species, and are resilient to natural disturbances (such as flooding, fire, and periodic drought) and climate change. Ecosystem processes and contributions (for example, nutrient cycling, water infiltration, and wildlife habitat) are sustained, as vegetation on the Forest adapts to a changing climate.
Ecosystems	DC	Uncharacteristic fires are infrequent as is the associated flooding and sedimentation into downstream communities, perennial streams and their tributaries, headwaters, wildernesses, and other areas and resources.
Biophysical Geology	DC	Karst landscapes and cave formations continue to develop or erode under natural conditions. Water flowing into, from, or within these systems contains naturally fluctuating background levels of water, sediment, organic matter, and dissolved minerals; and is not polluted.

Resource Section within Forest Plan	Plan Component	Plan Direction
Biophysical Geology	DC	If previously undiscovered caves are encountered above the zone of saturation for the regional water aquifer during drilling operations, precautions should be taken to protect the cave, including sealing the casing above and below the cave to prevent airflow and water leakage to maintain sensitive ecosystem conditions.
Roads and Facilities	DC	The transportation system (roads) provides reasonable motorized access to the public, city, county, State, and other Federal entities for permissible uses such as recreation, fire management, wildlife management, and access to infrastructure or neighboring land. The transportation system expands and contracts commensurate with use and needs, and it balances the desire for access with management activities and ecological impacts. An economical system of sustainable, well maintained, and marked roads provides diverse opportunities to explore the forest while protecting watershed conditions, recreation opportunities, scenery, heritage resources, rare plants, fisheries, and wildlife habitat and movement. However, the transportation system does not necessarily provide for user comfort or all-weather access on all roads.
Roads and Facilities	DC	Temporary increases in roads are appropriate for projects associated with watershed protection and restoration. Temporary roads that support ecosystem restoration activities, fuels management, or other short-term projects are rehabilitated promptly after project completion.
Roads and Facilities	DC	The minimum road system necessary for public, administrative, and private access within areas that affect water supplies, such as the Inner Basin, C.C. Cragin Reservoir, and Upper and Lower Lake Mary, protects water quality and quantity.

Resource Section within Forest Plan	Plan Component	Plan Direction
Terrestrial ERU-Ponderosa Pine	DC	The composition, structure, and function of vegetation conditions are resilient to the frequency, extent, and severity of disturbances and climate variability. The landscape is a functioning ecosystem that contains its components, processes, and conditions that result from natural levels of disturbances (e.g. insects, diseases, fire, and wind), including snags, downed logs, and old trees. Grasses, forbs, shrubs, and needle cast (e.g., fine fuels), and small trees maintain the natural fire regime. Vegetative ground cover provides protection from accelerated soil erosion, promotes water infiltration, and contributes to soil nutrient cycling, plant and animal diversity, and to ecosystem function.
Terrestrial ERU-Mixed Conifer	DC	Mixed Conifer ERUs have a mosaic of trees with varying age classes and understory vegetation which provide habitat for wildlife species, including Mexican spotted owls and northern goshawks; ground cover for functional soil and watersheds; and fuel for fire to occur according to historic ranges of frequency and severity.
Terrestrial ERU-Grasslands	DC	In Montane Grasslands, soil surface structure is granular or well aggregated to promote water infiltration and reduce runoff. Natural surface drainages and subsurface flow patterns maintain waterflow into connected waterbodies or streams.

Coconino NF Forest Plan Forest-wide Objectives

Table 7. Coconino NF Forest Plan-Forest-wide Objectives.

Resource Section within Forest Plan	Plan Component	Plan Direction
Riparian Springs	Objective (OBJ)	Restore riparian function to at least 25 springs identified as not in proper functioning condition to provide water quantity and aquatic habitat for the recovery of plant and animal species during each 10-year period during the life of the plan.
Riparian Springs	OBJ	Restore the function of 200 to 500 acres of nonfunctioning and functioning-at-risk riparian areas during each 10-year period over the life of the plan, with emphasis on priority 6th code watersheds, so that they are in or moving toward proper functioning condition.
Riparian Wetland	OBJ	Restore 5 to 10 wetlands currently not in proper functioning condition so that they are in, or are trending toward, proper functioning condition during each 10-year period over the life of the plan.

Management Areas (MA) direction on the CNF

Table 8. Coconino NF Forest Plan Management Area Direction.

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres[3]	Acres and percent within 4FRI East project area
Coconino National Forest: 370,415 acres				
Long Valley	predominantly ponderosa pine, but also includes grasslands, riparian forest, pinyon juniper, mixed conifer, and wetlands, springs Designated wilderness, eligible WSR, IRAs, National Trails, proposed RNA	**Objectives:** see forest-wide **Standards:** N/A **Guidelines:** N/A	164,055	155,370 (12.5%)
Acres of Non-Forest System lands within MA:2,665 acres				
Pine Belt	Ponderosa pine: but also includes 8 other ERUs within 4FRI boundary?, designated wilderness, no recommended wilderness, has eligible WSR, IRAs, Gus Pearson RNA, Red Mtn Geologic Area, Scenic Roads, National Trails, Riparian forest , streams, wetlands, springs	**Objectives:** see forest-wide **Landscape Scale DC:** Mosaic of trees with varying age classes and understory vegetation which provide habitat for a variety of species, including Mexican spotted owls and northern goshawks, and ground fuels conducive to low-severity fires. **DC 1**. Roads, trails, and recreation use have minimal impacts to woody riparian vegetation and riparian habitat in Pumphouse Wash. **Check for any seasonal closure areas that overlap analysis area** **Standards:** N/A would be included if seasonal closures overlap **Guidelines:** N/A (specific to Pumphouse Wash/Oak Creek Canyon) See landscape character description document	426,832	89,663 (7.2%)
Acres of Non-Forest System lands within MA:42,829 acres				
East Clear Creek	Vegetation is predominantly ponderosa pine and mixed conifer with scattered pinyon juniper, high elevation grasslands, riparian forest, and wetlands, springs. No designated or recommended wilderness. Includes tributaries to, and portions of, East Clear	**Objectives:** see forest-wide **Standards: N/A** **Guidelines:** **GL 1: N/A – specific to camping and motorized recreation**	53,124	53,124 (4.3%)

[3] Forest-wide acres does not include lands that are not National Forest System lands. MA acres as presented in the draft forest plan includes all acres.

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres[3]	Acres and percent within 4FRI East project area
	Creek - key habitat for the Little Colorado spinedace (endemic, threatened), eligible WSR, IRA, National Trails, Riparian			
Acres of Non-Forest System lands within MA:1,835 acres				
C.C. Cragin Watersheds	Ponderosa pine and mixed conifer with scatter pockets of riparian, grasslands, and wetlands, springs. Eligible WSR, designated Botanical Area and National Trails	**Objectives:** see forest-wide **DC 1**: There is low risk of substantial damage from uncharacteristic fire and recreation to municipal water supply, infrastructure, water quality, visual quality, and cultural integrity (e.g., tribes and local communities). **Standards: N/A** **Guidelines:** **GL1**: The C. C. Cragin Watersheds MA should be managed to reduce the threat of uncharacteristic wildfires, flooding, and sedimentation, and to maintain water quality and quantity. **GL 2**: Roads and trails within the C.C. Cragin Watersheds MA should be maintained to prevent erosion and sedimentation and to protect existing infrastructure. **Note**: there is both riparian areas and riparian forest **Management Approaches for C.C. Cragin Watersheds Management Area** Coordinate with the Salt River Project, National Forest Foundation, Town of Payson, the Bureau of Reclamation, U.S. Fish and Wildlife Service, Arizona Game and Fish Department, Arizona Elk Society, the local community, and other stakeholders to proactively improve the health and resiliency of the C.C. Cragin Watersheds Management Area.	45,711	45,711 (3.7%)
Acres of Non-Forest System lands within MA: 290 acres				
Anderson Mesa	Dominated by pinyon juniper, grassland, and ponderosa pine vegetation, also mixed con with aspen and is an important pronghorn habitat area. No designated or proposed wilderness, has eligible	**Objectives:** see forest-wide		23,370 (1.9%)

Forest Plan Management Areas (MA) within the project area	Description/ Management Approach	Landscape or MA Scale Forest Plan Desired Condition, Standards, Guidelines	Forest-wide MA acres[3]	Acres and percent within 4FRI East project area
	WSR, IRAs, Scenic Roads, Riparian			
Acres of Non-Forest System lands within MA:4,986 acres				
Verde Valley	Vegetation is predominantly desert, grassland, chaparral, and pinyon juniper, some ponderosa pine, with riparian forests along stream channels. Perennial waters include portions of the Verde River, Oak Creek, Wet Beaver Creek, West Clear Creek, and Fossil Creek. Streams, wetlands, springs. Has designated and proposed wilderness, designated WSR, eligible WSR, proposed West Clear Creek RNA, 3 botanical areas, 1 geologic area, IRAs, National Trails, Riparian	**Objectives**: see forest-wide **DC 1**: Watersheds are managed to reduce the risk of uncharacteristic flooding and sedimentation into downstream communities, perennial streams and their tributaries, wildernesses, and other special areas. This would include watersheds that affect drainages such as Beaver Creek, Dry Beaver Creek, Red Tank Draw, Russell Wash, Walker Creek, West Clear Creek, and Oak Creek. **Standards: N/A** **Guidelines:** **GL 1**: Projects and activities should be designed and implemented to maintain or improve watershed and riparian function and/or prevent the introduction or spread of disease, invasive, or undesirable species. **GL 2-4:** N/A	323,455	1,052 (0.1%)
Acres of Non-Forest System lands within MA: 35,115 acres				

Tonto NF Forest Plan Direction

The following are the Tonto National Forest Plan components and management area direction relating to water and riparian resources. Table 9 through 11 summaries of the Goals, Management Areas, Descriptions/Management Approaches, and Standards and Guidelines in Rim Country EIS from the 1988 Revised Tonto National Forest Plan. The Tonto National Forest is currently working on Plan Revision.

Table 9. Tonto NF Forest Plan Forest-wide Goals.**Forestwide/ Resource Unit**	**Resource**	**Goals**
Forestwide Goals	Air, water, soil, & riparian.	(1) Meet minimum air and water quality standards, (2) Emphasize improvement of soil productivity, air and water quality, (3) Augment water supplies when compatible with other resources, (4) Enhance riparian ecosystems, by improved management. All major riparian areas under intensive management by 1995,

Table 9. Tonto NF Forest Plan Forest-wide Goals.**Forestwide/ Resource Unit**	**Resource**	**Goals**
		(5) obtain water rights necessary to ensure orderly resource development,
	Riparian Habitat	Management emphasis in riparian areas will feature wildlife needs over recreation and grazing.
	Soil and Water	During the planning period there will be high opportunity for maintenance or enhancement of watershed condition and soil productivity. The impetus to this will be the range program, which will provide for improving range forage conditions and putting all allotments under appropriate levels of management.

Tonto NF Forest Plan Standards and Guidelines

Table 10. Tonto NF Forest Plan Forest-wide Standards and Guidelines. NF Forest Plan Forest-wide Standards and Guidelines.

Resource Section within Forest Plan	**Plan Component**	**Plan Direction**
Wildlife, Fish, and Rare Plants	Standard and Guideline	Maintain a minimum of 30% effective ground cover for watershed protection and forage production, especially in primary wildlife forage producing areas. Where less than 30% exists, it will be the management goal to obtain a minimum of 30% effective ground cover.
Wildlife, Fish, and Rare Plants	Standard and Guideline	All Riparian Areas- Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80% of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas.
Wildlife, Fish, and Rare Plants	Standard and Guideline	Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas.
Wildlife, Fish, and Rare Plants	Standard and Guideline	Manage riparian areas to the level needed to provide protection and improvement.
Wildlife, Fish, and Rare Plants	Standard and Guideline	Where possible, locate roads on natural benches, ridges, flat slopes near ridges or valley bottoms, and away from stream channels.
Wildlife, Fish, and Rare Plants	Standard and Guideline	Where channel crossings are necessary, select an area where the channel is straight and cross the channel at right angles.

Resource Section within Forest Plan	Plan Component	Plan Direction
Wildlife, Fish, and Rare Plants	Standard and Guideline	Avoid channel changes or disturbance of stream channels and minimize impacts to riparian vegetation.
Wildlife, Fish, and Rare Plants	S&G (1996 amendments)	Riparian Areas: Emphasize maintenance and restoration of healthy riparian ecosystems through conformance with forest plan riparian standards and guidelines. Management strategies should move degraded riparian vegetation toward good condition as soon as possible. Damage to riparian vegetation, stream banks, and channels should be prevented.
Wildlife, Fish, and Rare Plants	S&G (1996 amendments)	Basin and Range - West: Emphasize restoration of lowland riparian habitats.
Wildlife, Fish, and Rare Plants	S&G (1996 amendments)	Manage road densities at the lowest level possible. Where timber harvesting has been prescribed to achieve desired forest condition, use small skid trails in lieu of roads.

Tonto NF Standards and guidelines for Forest-wide Prescription Decision units

Table 11. Tonto National Forest Decision Unit Standard and Guidelines.

Forestwide/ Resource Unit	Resource	Standards and Guidelines
Decision Units DU 10, 11, 12, 13, 32 Activities C01, E00	Soil and Water	Maintain a minimum of 30% effective ground cover for watershed protection and forage production, especially in primary wildlife forage producing areas. Where less than 30% exists, it will be the management goal to obtain a minimum of 30% effective ground cover.
Decision Units DU 10, 11, 12, 13, 32 Activities C01, E00	Riparian Areas	Coordinate with range to achieve utilization in the riparian areas that will not exceed 20% of the current annual growth by volume of woody species. Coordinate with range to achieve at least 80% of the potential riparian overstory crown coverage. Coordinate with range to achieve at least 50% of the cottonwood-willow and mixed broadleaf acres in structural Type 1 by 2030. Rehabilitate at least 80% of the potential shrub cover in riparian areas through the use of appropriate grazing systems and methods. Any surface or vegetation disturbing projects in riparian areas will be coordinated and will specify protection or rehabilitation of riparian dependent resources.
Decision Units 14,15,16 Activities C03	Riparian Areas	Rehabilitate and maintain, through improved management practices, mixed broadleaf riparian to achieve 80% of the potential overstory crown coverage. Natural regeneration is anticipated to achieve most of this goal. Artificial regeneration may be necessary in some areas. Re-establish riparian vegetation in severely degraded but potentially productive riparian areas. Natural regeneration is anticipated to achieve this goal, but artificial regeneration may be necessary in some areas
Decision Unit 33 Activity F05 and Decision Unit 63 Activity F05	Soil and Water	Water resource improvement projects to be implemented as needed.

Forestwide/ Resource Unit	Resource	Standards and Guidelines
Decision Unit 34 Activity F01	Soil and Water	Minimize impacts on soil and water resources from all ground disturbing activities. When developing water for National Forest purposes, preference should be given to those types of developments that waste the least amount of water. Manage vegetation to achieve satisfactory or better watershed conditions.
Decision Unit 34 Activity F01	Soil and Water	As needed, prepare water resource improvement plans for high priority watersheds and problem areas.
Decision Unit 34 F02	Soil and Water	Inventory watershed condition. This will include an assessment of the Forest once per decade, and smaller areas on an as needed basis. Prepare flood hazard analyses on proposed projects in flood prone areas per Executive Order 11988. Mitigate the adverse effects of planned activities on the soil and water resources through the use of Best Management Practices.
Decision Unit 34 Activity F03	Soil and Water	Water quality will be monitored in key locations to aid in the identification and correction of resource problems.
Decision Units 33, 63 Activity F05	Water Resources	Water resource improvement projects to be implemented as needed.
Decision Unit 46 Activity K01	Soil and Water	Lands which require erosion control measures will be identified, mapped, and cataloged.
Decision Unit 46, 62 Activities K05, K06	Soil and Water	Implement and maintain soil resource improvement projects as needed.
Decision Unit DU 1, Activities A01, C01, D01, E00, F01, G01, J01, L04	Cave Management	All surface-disturbing activities planned near or within a known cave area will be examined for potential impacts to the cave(s) and the area around each cave entrance(s), (plus feeder drainages and surface areas immediately over cave passages). The cave area will also be evaluated to determine protection measures needed. Protection measures for caves will be incorporated into project planning, and may include (but not be limited to) education, seasonal closures, and installation of entrance gates.
Decision Unit DU 1, Activity A01	Cave Management	Develop a Forest-wide Cave Implementation Plan and use it as a basis for preparation of prescriptions for significant caves and any other selected cave. Evaluate appropriateness of recreation activities as a part of the plan.
Decision Unit DU11 Activity C09	Cave Management	Bat roosts and other sensitive biological resources within caves will be managed using all appropriate means identified in the Cave Implementation Plan.
Decision Unit Du 36 Activity G02	Cave Management	Potential impacts to cave resources will be considered in reviewing all proposed Notices of Intent/Plans of Operation. Appropriate land will be withdrawn from mineral entry when necessary to provide cave protection.
Decision Unit 41 Activity J01	Cave Management	When compatible with identified resource values, research activity within caves will be permitted.
Management Area 5G Decision Unit 3 Activity 01	Cave Management	Develop implementation plan for Red Lake Cave.
MANAGEMENT AREA 4D Payson Ranger District – Mogollon Rim Area	This management area includes the ponderosa pine forested area below the Mogollon Rim.	Management Emphasis: Manage for a variety of renewable resource outputs with primary emphasis on intensive, sustained yield timber management, timber resource protection, creation of wildlife habitat diversity, increased populations of emphasis harvest species, and recreation opportunity. Timber harvesting methods and timing will include improvement of wildlife habitat quality and watershed condition, and will consider impacts on intensive range and recreation management. Mining activities are authorized in conformance with existing laws and regulations. Visual quality protection will be emphasized in the area (Analysis Area 5542) of the Highline Trail, a National Recreation

Forestwide/ Resource Unit	Resource	Standards and Guidelines
MANAGEMENT AREA 5D - Pleasant Valley Ranger District – Mogollon Rim-Sierra Ancha Area	Description: This management area includes the ponderosa pine forested area below the Mogollon Rim and in the Sierra Ancha Mountains. In 1984, 56,698 acres were classified as operable/suitable for timber harvest. The area includes 3 developed (total of 20 acres) and a 1 acre public service site.	Trail. Standard and Guidelines for both 4D and 5D Resource Area : Forestry and Forest Health 1) Timber sale road systems should be designed to minimize impacts on stream channels and water quality. Roads should be located on slopes less than 60%, and should have sustained gradients of less than 8%. Roads should not be located on unstable slopes where mass movement is likely to occur. 2) Slash and debris should be kept out of protected stream channels. 3) Raise lead end of logs when skidding to minimize gouging. Restrict skidding during wet weather if necessary to prevent watershed damage. Rehabilitate skid trails and landings when logging is completed (provide drainage, repair ruts and gullies, and seed if necessary). Standard and Guidelines for 4D only Resource Area : Forestry and Forest Health An Interdisciplinary (I.D.) team will evaluate the need for buffer strips adjacent to water bodies within proposed commercial saw timber sale areas. Where a buffer strip is deemed necessary, the I.D. team will recommend the width of strip needed to achieve adequate protection of aquatic and riparian resources. The width of the buffer strip will depend upon such factors as channel stability, side-slope steepness, erodibility of soils, existing ground cover conditions, and existing aquatic conditions. Logging vehicles will not be allowed to operate within any such designated buffer strips, except at designated crossings. Resource Area : Fire Management Use prescribed fire to treat vegetation for water yield, forage, and wildlife habitat improvement

Assumptions and Methodology

This section describes the methodology and analysis processes used to determine the environmental consequences to water quality and riparian areas from implementing the alternatives. Environmental consequences are site-specific at the project planning level and will be described with qualitative and quantitative descriptions supported by past studies and observations.

Analyses for environmental consequences to water quality and riparian areas that may result from implementation of each alternative were conducted using information contained in the Ecological Response Unit (ERU) inventory maps (Triepke et al., 2014a and b), the Watershed Condition Framework, the revised Apache-Sitgreaves National Forest Plan, (2015), the Revised Coconino National Forest Land Management Plan (2018), and the Tonto National Forest Plan (1985), information obtained from other Apache-Sitgreaves NF, Coconino NF, and Tonto, NF resource specialists, the Arizona Department of Environmental Quality (ADEQ), other agency reports, available literature, and input from collaborators and cooperators. Geospatial analysis was used to quantitatively and qualitatively assess hydrology, riparian resources using Geographic Information Systems (GIS) data obtained from a variety of sources.

Water Quality

Effects on water quality will be assessed qualitatively by alternative by comparing predicted direct, indirect, and cumulative effects by major land disturbing activities (e.g. forest thinning, prescribed burning, ephemeral channel restoration, and spring protection and restoration) within the project area.

The general classification used for surface water quality by ADEQ is attaining, attaining some uses, inconclusive/not assessed, not-attaining, and impaired for the identified uses. The classification designates each waterbody in one of five categories:

Category 1 Surface waters assessed as "attaining all uses." All designated uses are assessed as "attaining."

Category 2 - Surface waters assessed as "attaining some uses." Each designated use is assessed as either "attaining," "inconclusive," or "threatened."

Category 3 - Surface waters assessed as "inconclusive." All designated uses are assessed as "inconclusive" due to insufficient data to assess any designated use (e.g., insufficient samples or core parameters). By default, this category would include waters that were "not assessed" for similar reasons

Category 4 - Surface waters assessed as "not attaining." At least one designated use was assessed as "not attaining" and no uses were assessed as "impaired." A Total Maximum Daily Load[4] (TMDL) analysis will not be required at this time for one of the following reasons:

> **4 A. -** A TMDL has already been completed and approved by EPA but the water quality standards are not yet attained;
>
> **4 B. -** Other pollution control requirements are reasonably expected to result in the attainment of water quality standards by the next regularly scheduled listing cycle; or
>
> **4 C. -** The impairment is not related to a "pollutant" loading but rather due to "pollution" (e.g., hydrologic modification).

Category 5 - Surface waters assessed as "impaired." At least one designated use was assessed as "impaired" by a pollutant. These waters must be prioritized for TMDL development.

Water quality is assessed by comparing existing conditions (category 1 to 5) with desired conditions that are set by Arizona under authority of the Clean Water Act. The Arizona Department of Environmental Quality (ADEQ) is the regulating authority for water quality in Arizona as promulgated by EPA. Waters that are not impaired (those not on 303d[5] list or in category 4 or 5) are providing for beneficial uses identified for that stream or water body and can be considered in a desired condition until further sampling indicates impairment. Those in category 2 or higher require special attention during site specific project analysis. The ADEQ also interprets its surface water quality standards to apply to "intermittent, non-navigable tributaries." The ADEQ interprets the definition of "surface water" to include tributaries ("the tributary rule") and assigns water quality standards to intermittent surface waters that are not specifically listed by name in Arizona's surface water quality standards rules. ADEQ has determined it is necessary to regulate and protect these types of waters as "waters of the United States"

[4]A TMDL is a written analysis that determines the maximum amount of a pollutant that a surface water can assimilate (the "load"), and still attain water quality standards during all conditions. The TMDL allocates the loading capacity of the surface water to point sources and nonpoint sources identified in the watershed, accounting for natural background levels and seasonal variation, with an allocation set aside as a margin of safety.

[5] Under section 303(d) of the 1972 Clean Water Act, states, territories, and authorized tribes are required to develop lists of impaired waters. These impaired waters do not meet water quality standards that states, territories, and authorized tribes have set for them, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters. (http://www.epa.gov/region9/water/tmdl/303d.html)

because it is estimated that approximately 95 percent of the surface waters in Arizona are either intermittent or ephemeral.

In the southwestern region, the Forest Service uses a system of ecosystem types, "ecological response units" (ERUs), to facilitate landscape analysis and strategic planning. ERUs have been built from plant associations and ecosystem units that have been identified through Terrestrial Ecological Unit Inventory (Wahlberg et. al. 2013).

Water Quantity

Effects on water yield, peak flows, and stable hydrologic regime will be discussed qualitatively, based on comparison of current activities to projected effects of implementing the alternatives. Generally, reducing forest overstory in vegetation types within higher precipitation zones will generate more runoff, although these may periods may be short lived (O'Donnell, 2016, Baker 1999).

Riparian Resources

Effects on riparian resources will be discussed qualitatively, based on comparison of current activities to projected effects of implementing alternatives.

Stream ReachesThe most common method used to assess riparian area functionality along stream courses is called lotic Proper Functioning Condition (PFC) assessment (Dickard, 2015). This is the standard protocol to assess lotic riparian conditions by USDA Forest Service. This is a qualitative assessment that requires professional judgment on 17 assessment items that are rated individually to derive a summary rating. Each riparian area is judged against its capability and potential. A riparian area is considered to be PFC when adequate vegetation, landform, or large woody debris are present to:

- Dissipate stream energy associated with high waterflow, thereby reducing erosion and improving water quality.
- Capture sediment and aid floodplain development.
- Improve flood-water retention and ground-water recharge.
- Develop root masses that stabilize streambanks against erosion.
- Maintain channel characteristics.

If a riparian area is not in PFC, it is placed into the following categories;

Functional at Risk-Riparian areas: These riparian areas are in limited functioning condition; however, existing hydrologic, vegetative, or geomorphic attributes make them susceptible to impairment. Trend toward or away from PFC must be described when a rating of FAR is given. Trend is the direction of change in an attribute(s) over time and can be addressed two ways. If trend is determined using photos, monitoring data, detailed inventories, and any other measurement or documentation to compare past conditions to present conditions, it is defined as "monitored trend." Apparent trend is defined as "an interpretation of trend based on observation and professional judgment at a single point in time" (Society for Range Management 1998) and is described as upward, downward, or not apparent.

Nonfunctional: These riparian areas clearly are not providing adequate vegetation, landform, or woody material to dissipate stream energy associated with moderately high flows, and thus are not reducing erosion, improving water quality, etc.

Springs

Using descriptors from the current Forest Plans, the desired conditions for springs will be the following:"Springs and associated streams and wetlands have the necessary soil, water, and vegetative attributes to be healthy and functioning at or near potential" . Water flow patterns, recharge rates, and geochemistry are similar to historic levels and persist over time."

There are a number of various techniques to capture and display spring data. In the southwestern region, the Spring Stewardship Institute has developed a number of protocols that are commonly employed on the three forests with differing inventory variables and levels. Inventories provide data on the distribution, status of resources, processes, values, and aquatic, wetland, riparian, and upland linkages (Stevens et al, 2016). The difference between the two inventory levels are:

- A Level 1 inventory of the springs in a landscape is used to define the distribution, access, and springs types, as well as flow sampling equipment needed for Level 2 inventories.

A Level 2 springs inventory includes an array of measured, observed, or otherwise documented variables related to site and survey description, biota, flow, and the sociocultural-economic conditions of the springs at the time of the surveyAnother protocol, the Spring Ecosystem Assessment Protocol (SEAP) http://springstewardshipinstitute.org/springs-1 is a process of evaluating the inventory data as well as other external information to generate a condition and risk score in each of the six predefined categories of variables. Risk is interpreted as the potential threat or the "condition inertia" of that variable. In other words, what is the probability of that variable remaining unchanged? The six variable categories are: Aquifer and Water Quality, Site Geomorphology, Habitat and Microhabitat Array, Site Biota, Human Uses and Influences, and Administrative context under which the spring is managed.

1.

The SEAP scoring criteria can be found at Scoring Criteria with SEAP risk scores in categories below.

Table 12. SEAP scores risk categories.

Total Risk Score	Risk Category
0	No Risk to Site
1	Negligible risk to site
2	Low risk to site
3	Moderate risk to site
4	Serious risk to site
5	Very great risk to site
6	Extreme risk to site
7	Unable to access risk to site

Watershed Condition Framework

A watershed condition assessment was conducted for all sixth-level (HUC12) subwatersheds in the proposed project area as part of a Forest-level assessment of watershed condition (Potyondy and Geier, 2010) as part of the Watershed Condition Framework. The Watershed Condition Framework establishesda new consistent, comparable, and credible process for improving the health of watersheds on national forests and grasslandsDuring the watershed condition assessment, 12 indicators of watershed health were evaluated for each subwatershed. The methodology for the assessment is described in the Watershed Condition Classification Technical Guide (USDA, 2011). As described in the guide, indicators are weighted differently based on relative importance to overall watershed condition and tallied to come up with a final rating. Description of the indicators are found in Table 13. The indicator ratings are summarized into three classes and are described below.

- **Indicator Rating 1** is synonymous with "GOOD" condition. It is the expected indicator value in a watershed with high geomorphic, hydrologic, and biotic integrity relative to natural potential condition. The rating suggests that the watershed is functioning properly with respect to that attribute.
- **Indicator Rating 2** is synonymous with "FAIR" condition. It is the expected indicator value in a watershed with moderate geomorphic, hydrologic, and biotic integrity relative to natural potential condition. The rating suggests that the watershed is functioning at risk with respect to that attribute.
- **Indicator Rating 3** is synonymous with "POOR" condition. It is the expected indicator value in a watershed with low geomorphic, hydrologic, and biotic integrity relative to natural potential condition. The rating suggests that the watershed is impaired or functioning at unacceptable risk with respect to that attribute.

Table 13. Description of watershed condition indicators included in the Watershed Condition Framework scoring. (USDA Forest Service 2011, FS-978)

Aquatic Physical Indicators	
Water Quality	This indicator addresses the expressed alteration of physical, chemical and biological components of water quality.
Water Quantity	This indicator addresses changes to the natural flow regime with respect to the magnitude, duration, or timing of natural streamflow hydrograph.
Aquatic Habitat	This indicator addresses aquatic habitat condition with respect to habitat fragmentation, large woody debris, and channel shape and function.
Aquatic Biological Indicators	
Riparian/Wetland Vegetation	This indicator addresses the function and condition of riparian vegetation along streams, water bodies, and wetlands.
Terrestrial Physical Indicators	
Roads and Trails	This indicator addresses changes to the hydrologic and sediment regimes because of the density, location, distribution, and maintenance of the road and trail network.
Soils	This indicator addresses alteration to natural soil condition, including productivity, erosion, and chemical contamination.
Terrestrial Biological Indicators	
Fire Regime or Wildfire	This indicator addresses the potential for altered hydrologic and sediment regimes because of departures from historical ranges of variability in vegetation, fuel composition, fire frequency, fire severity, and fire pattern.

Forest Cover	This indicator addresses the potential for altered hydrologic and sediment regimes because of the loss of forest cover on forest lands.
Rangeland Vegetation	This indicator addresses effects on soil and water because of vegetative health of rangelands.
Forest Health	This indicator addresses forest mortality effects on hydrologic and soil function because of major invasive and native forest insect and disease outbreaks and air pollution.

The results of the Forest Service Watershed Condition Framework planning work are available through a map viewer website where users can view the priority watersheds, read about why the watershed was selected, download the Watershed Restoration Action Plans and learn about other important planning items, including estimated costs and restoration partners. Each watershed on the map also contains information on the overall watershed condition rating and the individual rating of its 12 watershed condition indicators. The interactive watershed condition map can be found online at: Watershed Condition Framework Viewer

A watershed's condition class integrates the effects of all activities within a watershed, therefore provides an ideal mechanism for interpreting the cumulative effect of a multitude of management actions on soil and hydrologic function (USDA,2011). Although, all these WCF indicators are interrelated to some degree, specific indicators in the Watershed Condition Framework were used to evaluate watershed scale cumulative effects including Water Quality, Water Quantity, and Riparian/Wetland Vegetation condition for this report. Additional watershed cumulative effects analysis is included in the Soils and Watershed Specialist Report (MacDonald,2018). It is assumed that the treatments within the proposed action may result in some short-term, localized negative effects from ground disturbance via heavy machinery operations may occur on soils where previously completed projects overlap proposed or future activities in watersheds across the project. However, no long-term cumulative effects from ground disturbance (compaction, topsoil displacement, high soil severity burning etc.) from mechanical operations or prescribed burning outlined in the proposed action are anticipated to occur to a degree or spatial extent that would negatively affect watershed condition. These activities will general have a positive effect on watershed condition proportion to the extent of the treatments.

Affected Environment

Climate Variability

The climate, for the most part, across the project area is characterized as semiarid and warm, with low annual precipitation and a high number of sunny days. Past precipitation and temperature of the region has varied sharply at timescales ranging from annual to multi-decadal.

The principal period of precipitation events in this area generally occurs during the period of late July through September. During this period, rainfall is characterized by convective, high intensity, short duration storms typical of the southwestern monsoon season. These storms are generally of limited areal extent, averaging an estimated five square miles. During the latter part of this period and continuing on into October, there is also a threat of high intensity, longer duration storms of cyclonic origin associated with Gulf of Mexico and Pacific Ocean hurricanes. These usually do not occur with the same regularity as the monsoon season rains. The second mode of a general bimodal precipitation distribution occurs during the period of November through April, when easterly storm tracks originating over the Pacific Ocean shift over the Forest, allowing widespread precipitation. This precipitation falls typically at higher elevations as snow. The snow pack at this elevation generally develops continuously over this period but melts over a much shorter time span.
http://www.atmo.arizona.edu/research/SinoUS/learning.html

Climate change, because of global warming, has come to the forefront of current scientific investigation in the Southwest. Research indicates that the late 20th century was "unusually" warm generally, with 1990, 1995, 1997, and 1998 noted as the warmest years since the beginning of instrumentally recorded climate data and potentially the warmest since AD 1000 (Mann et al. 1999). The Intergovernmental Panel on Climate Change (IPCC) and other modeled projections assert that average annual temperatures in the Southwest could rise by 4½ to 7 or more degrees (F) during this century (Lenart, 2008; IPCC, 2007). It is also predicted that drought will continue to extend its grip on the Southwest, despite the wet winter of 2004-2005 and the summer of 2006 (Lenart, 2007). A global atmospheric pattern known as Hadley Cell circulation is the primary reason for sunny days in the Southwest, as tropical air rises and eventually descends in the subtropics, making it difficult for clouds to form. The area under Hadley Cell's descending air is projected to widen, moving wetter weather poleward. Results of this movement are yet undetermined, but speculation includes less rain and snow in the Southwest, and an increased potential for flooding during strong monsoons, seemingly contradictory events (Lenart, 2007). While the future of climate change and its effects across the Southwest remains uncertain, it is certain that climate variability will continue to occur across the project area, with higher probabilities of extended drought, which can lead to dramatic effects on the landscape. Adaptive management will respond accordingly to minimize negative effects from any ongoing or proposed activity.

Effects are disclosed based on climate within its normal range of variability. Management during periods where climatic conditions occur outside the normal range of variability are described in Regional and Forest guidance papers and are considered outside the effects determination being made.

Water Quality

Section 305(b) of the Clean Water Act requires states to assess and report on the water quality status of surface waters . Section 303(d) requires states to list waters that are not attaining water quality standards. This is also known as the list of impaired waters. This information is reported to Congress on a nationwide basis. The Arizona Department of Environmental Quality (ADEQ) is responsible for conducting monitoring, assessment, reporting under CWA Sections 303(d) and 305(b), and total maximum daily load (TMDL) development for the State of Arizona. Arizona's most recent report on the status of water quality in the state is the 2016 Clean Water Act Assessment (July 1, 2010 to June 30, 2015).

Water quality of surface waters has been assessed on 113 miles of streams within the Tonto National Forest portion of the Rim Country project area,primarily within the Salt River and Verde River Watersheds, and 161 miles on the Apache-Sitgreaves and Coconino portion, primarily within the Little Colorado Watershed. In addition, 9 lakes totaling 739 acres were assessed within the Rim Country footprint. The table below identifies the water quality status of specific streams, rivers and lakes in the forest that have been assessed by ADEQ.

Table 14. ADEQ 305b listed waterbodies.

Water Body	Reach name	Reach Number	Miles/Area Assessed within Rim Country Boundary	Assessed Category	Parameters with Exceedances	Cause of Impairment	Impaired Uses*
Little Colorado River Watersheds							

Water Body	Reach name	Reach Number	Miles/Area Assessed within Rim Country Boundary	Assessed Category	Parameters with Exceedances	Cause of Impairment	Impaired Uses*
Barbershop Canyon Creek	Headwaters - East Clear Creek	15020008-0537	14.1 miles	2	Biocritera		None
Bear Canyon Lake		15020008-0130	59 acres	3	pH		
Billy Creek	Headwaters – Show Low Creek	15020005-019	3.6 miles	2	Dissolved Oxigen		None
Black Canyon Lake		15020010-0180	38 acres	5	Ammonia	High Ammonia	A&Wc
Chevelon Canyon (Downstream of Forest Boundary)	Black Canyon – Little Colorado River	14020010-001	23 miles	2	Dissolved Oxygen		None
Clear Creek (Downstream of Forest Boundary)	Sand Draw-Little Colorado	15020008-006	0.0 miles	3			None
East Clear Creek	Yeager Canyon – Willow Creek	15020008-008	17.4 miles	2	Biocriteria		None
Knoll Lake		15020008-0750	59 acres	3	Lead		None
Show Low Creek	Headwaters – Linden Wash	15020005-12	4.3 miles	2	SSC, Biocriteria		None
Walnut Creek	Pine Lake – Billy Creek	15020005-238	.2 miles	3	DO, pH, SSC		None

Water Body	Reach name	Reach Number	Miles/Area Assessed within Rim Country Boundary	Assessed Category	Parameters with Exceedances	Cause of Impairment	Impaired Uses*
Willow Springs Lake		15020010-1670	160 acres	3	DO		None
Woods Canyon Creek	Headwaters – Chevelon Creek	15020010-084	10.7 miles	3	DO		None
Woods Canyon Lake		15020010-1700	70 acres	3	DO, Lead		None
Blue Ridge Reservoir		15020008-0200	290 acres	2	pH		None
Salt River Watersheds							
Canyon Creek	Headwaters - White Mtn Apache Reservation Boundary	15060103-014	7.1	2			None
Cherry Creek	Trib at 340509/110560 - Salt River	15060103-015B	0.5	2	E. coli, Lead, phosphorus		None
Workman Creek	Headwaters - Reynolds Creek	15060103-195A	4	2	Dissolved Oxygen		None
Reynolds Creek	Headwaters - Workman Creek	15060103-202	5.4	2	pH, selenium		None
Christopher Creek	Headwaters - Tonto Creek	15060105-353	8	4A/5		E. coli(4A), Dissolved Oxygen (2016)	A&Wc

Water Body	Reach name	Reach Number	Miles/Area Assessed within Rim Country Boundary	Assessed Category	Parameters with Exceedances	Cause of Impairment	Impaired Uses*
Tonto Creek (TON)	Headwaters - Trib at 341810/1110414	1506010 5-13A	8.0	4A		E coli (4A)	A&Wc
Tonto Creek (TON)	Trib at 341810/1110414 - Haigler Creek	1506010 5-013B	2	4A/5		Mercury in fish (EPA 2010) (5) E.coli (4A)	EPA FC[3]
Gordon Canyon Creek	Headwaters - Hog Canyon	1506010 5-336A	9.8	3	Insufficient data to assess		None
Haigler Creek	Headwaters - Trib at 341223/1110011	1506010 5-012A	15.3	2	Copper		None
Haigler Creek	Trib at 341223.1/1110011-Tonto Creek	1506010 5-012B	.4	2	E. coli		None
Thompson Draw	Headwaters - Tonto Creek	1506010 5-378	6.6	3	E. coli		None
Trib to Thompson Draw	Headwaters - Thompson Draw	1506010 5-379	0.2	3	Insufficient data to assess		None
Big Canyon above Tonto Creek	Headwaters - Tonto Creek	1506010 5-373	4.4	3	Insufficient data to assess		None
Verde River Watersheds							
East Verde River	Headwaters - Ellison Creek	1506020 3-22A	7.8 miles	2	E. coli, biocriteria		None

Water Body	Reach name	Reach Number	Miles/Area Assessed within Rim Country Boundary	Assessed Category	Parameters with Exceedances	Cause of Impairment	Impaired Uses*
Patton Spring Draw	Headwaters - Webber Creek	15060203-506	2.2 miles	3	Insufficient data to assess		None
Webber Creek	Headwaters - East Verde River	15060203-058	7.6 miles	2	E. coli		None
Ellison Creek	Headwaters - East Verde River	15060203-459	9.2 miles	2	E. coli		None
Pine Creek	Headwaters – Pine Ck at 342150.85/1112648.56	15060203-049A	7.3 miles	1			None
Sycamore Creek (SYH)	Headwaters	15060203-055	2.8 miles	2	Arsenic DO		
Stoneman Lake		15060202-1490	125 acres	4A	pH		AGI, AGL, A&Wc, FBC

* Assessment Category: Category 1 assessed as "attaining all uses, Category 2 assessed as "attaining some uses", Category 3 assessed as "inconclusive", 4 A. - A Total Maximum Daily Load (TMDL) has already been completed and approved by EPA but the water quality standards are not yet attained, Category 5 - assessed as "impaired" **Designated uses: FBC – Full Body Contact, AGI – Agriculture Irrigation, AGL – Agriculture Livestock Watering, A&Wc – Aquatic and Wildlife (cold water).

Within the Salt River and Verde River Basins, primarily on the Tonto National Forest, water quality is attaining all uses in 13.8 miles (12 %), attaining some uses in 48 miles (42%), is inconclusive in 32.8 miles (29 %) streams and is not attaining/impaired in 18.2 miles (16 %) of assessed streams. Within the Little Colorado Basin, primarily on the Apache-Sitgreaves NFs and Coconino NFs, water quality is attaining some uses on 108 miles (67%) and inconclusive on 53.3 miles (33%) of assessed streams. In addition, nine lakes within the project area were assessed with two (totaling 149 acres) attaining some uses, four (totaling 387 acres) were inconclusive, one (111 acres) was not attaining some uses, and two (totaling 91 acres) were impaired.

The impaired lakes (Bear Canyon and Black Canyon) have a moderate priority for additional sampling that may indicate the need for initiating a total maximum daily load (TMDL) analysis to determine causative factors and to develop appropriate pollutant mitigation strategies. Some streams have had samples that exceed state water quality standards, however, most of the water bodies lack sufficient data to either remove or recommend impairment as there are state statutes dictating minimum data quality and quantity levels. The completion of a

total maximum daily load assessment on impaired water bodies may result in developing additional water quality improvement strategies and mitigation of effects within associated watersheds.
The Upper Tonto Creek watershed includes stream reaches that are impaired for Nitrogen, Phosphorous, Low Dissolved Oxygen (D.O.), and E. coli. TMDL assessments were completed for Nitrogen and E. coli bacteria in 2006. Sources of contamination were identified as inadequate septic systems and recreational sources. ADEQ has approved Water Quality Improvement Grants (grants that allocate funds from the US EPA for implementing nonpoint source pollution control projects) for improving septic systems at R-Bar-C Boy Scout Camp (2007), Tonto Baptist Camp (2008), and to Gila County (2006). The Forest Service has constructed new bathrooms, restricted vehicle access to maintain a buffer for the creek, and converted portions of the area from overnight camping to day-use only. A TMDL for Phosphorous has not yet been scheduled and is identified as a low priority for development by ADEQ.

The Upper Tonto Creek watershed is identified as one of Arizona's Targeted Watersheds. These watersheds are a priority in the state for Clean Water Act (CWA) Section 319 Water Quality Improvement Grants and other strategies to restore and/or protect water quality conditions. Development of a TMDL for Low Dissolved Oxygen impairment in the Headwaters of Tonto Creek is identified as a low priority by ADEQ (Source:http://www.azdeq.gov/environ/water/assessment/download/Appendix_G_Priority_Ranking.pdf).

Implementation of site specific Best Management Practices (BMPs) have been shown to be effective in mitigating effects on water quality, and the development, implementation and monitoring of BMPs are FS responsibility as described within the Memorandum of Understanding between the State of Arizona, Department of Environmental Quality and USFS Southwestern Region (USFS, 2013).

Stream Courses

Stream courses within the project area are generally low-gradient ephemeral and intermittent streams with dendritic drainage patterns, except in areas with very steep terrain such as mountains (i.e., extinct volcanoes) and cinder cones, which typically have radial drainage patterns with high-gradient ephemeral and intermittent drainages flowing in all directions from upper slopes. Approximately 4,047 miles of occur within the project area, of which approximately 385 (10.5%) miles exhibit perennial flow.

Riparian and Stream Condition

Western riparian systems are among the rarest habitat types in the Western Hemisphere (Krueper,1995). In Arizona and New Mexico, these areas occupy less than 0.5 percent of the state's land area, yet 80 percent of all vertebrates use riparian areas. In Arizona 60-75 percent of the resident wildlife species depend on riparian areas to sustain their populations (Arizona Riparian Council, Fact Sheet No.1, 1995).

Riparian can be simply defined as the vegetation or habitats that are associated with the presence of water, whether it is perennial, subsurface, intermittent or ephemeral in nature (Krueper,1993). These areas are transitional between aquatic and terrestrial areas and have components of both (DeBano and Schmidt, 1989a).

In the Southwest, the Forest Service uses a system of ecosystem types, "ecological response units" (ERUs), to facilitate landscape analysis and strategic planning. ERUs have been built from plant associations and ecosystem units that have been identified through Terrestrial Ecological Unit Inventory (Wahlberg et. al. 2013). Within the project area, there are approximately 21,330 acres identified as riparian by the Region 3 ecological response unit ERU map (Treipke, 2014a and b). Table 15 shows the percentages of each ERU within the project area. Of this total, the largest proportion consists of Narrowleaf Cottonwood/ Shrub with 35.6 percent, follow by Ponderosa Pine / Willow and Herbaceous (wetland) with 26.3 and 20.0 percent, respectively. Willow –Thinleaf Alder contributed 7.6 percent and each remaining unit comprised less than 5% of the total.

Table 15, Riparian ERU Percentages across Rim Country project area.

ERU	Acres	Proportion
Arizona Alder - Willow	228	1.1%
Arizona Walnut	68	0.3%
Fremont Cottonwood - Conifer	169	0.8%
Fremont Cottonwood / Shrub	539	2.5%
Herbaceous (wetland)	4270	20.0%
Historic Riparian - Residential/Urban	298	1.4%
Narrowleaf Cottonwood / Shrub	7584	35.6%
Ponderosa Pine / Willow	5607	26.3%
Sycamore - Fremont Cottonwood	946	4.4%
Willow - Thinleaf Alder	1617	7.6%
Total Acres	**21,326**	

Riparian areas have distinctly different vegetative species composition, diversity, and abundance depending on the type ofdrainage segmentthey occur in. The most robust riparian vegetation occurs in association with perennial and intermittent stream systems. However, some transitional ephemeral drainages do support isolated pockets of riparian woody vegetation because of the presence of shallow subsurface water. A description of the occurrence and characteristics of riparian vegetation associated with the three stream types within the project area is as following:

1. Ephemeral Drainages: in steeper, headwater reaches of drainages these drainages function solely to collect and transmit water off the uplands, hence, they contain primarily vegetation of the same species and stature as the upland vegetation. As moisture runs off before any substantial amount can be stored, there is no immediate beneficial effect to vegetation. In ephemeral reaches with lower gradients and wider valley widths, where water slows and moisture is stored in deeper alluvial soils, upland vegetation takes advantage of the greater residence time of water to grow larger and denser than what grows in the uplands or in ephemeral reaches. Tree species such as oaks grow to large trunk diameters with impressive spreading crowns while shrubby species easily attain twice the height found on adjacent uplands. Although vegetation is typically not obligate riparian in these reaches, some pockets of riparian woody vegetation do occur were shallow ground water is available for roots to tap into.

2. Riparian-Intermittent Drainages: found where obligate riparian species occur intermittently along the reach due to sporadic presence of water from spring sources or from subsurface flows; also includes areas such as isolated springs. Presence of surface water is dependent upon subterranean bedrock configuration that allows water retention at relatively shallow depths or actual surfacing of low flows along intermittent sections of the stream course. The presence of a shallow water table allows obligate riparian species to sustain themselves during dry periods.

3. Riparian-Perennial Drainages: found where there is perennial surface and ground water and riparian-obligate vegetation is fairly continual along the reach. Generally, perennial reaches are located at the mouths of fairly sizable watersheds, which are required to supply sufficient and continual discharge to sustain surface flows throughout the year.

The three forests surveyed riparian condition using different assessment methods. Therefore, for necessity of this analysis, all the forest data was cross-walked into a single protocol for display and reporting. The protocol selected is the Proper Functioning Condition (PFC) (Dichard et al., 2015). Proper functioning condition of perennial and intermittent streams includes the seventeen critical elements found in standard lotic PFC assessments, which encompasses hydrology, vegetation, and geomorphology. Reaches meeting PFC criteria are also in satisfactory riparian condition in terms of Forest Plan standards. Channel morphology (drainage configuration) is typically too variable in ephemeral reaches to allow applying any sort of standard or expectation.

Riparian condition was either documented or estimated on a total of 876 miles of intermittent and perennial streams since the late 1990's. A compilation of condition information across the three forest three forests within the project area is presented in the tables 16 through 17. A total of 257 miles (29%) were to be at PFC, with 475 miles (54%) at Functional at Risk and 145 miles (17%) rated nonfunctional.

Table 16. PFC assessment summary for the Apache-Sitgreaves NF.

Subwatershed	6th Code	Miles of Surveyed Riparian		
		PFC	FAR	NF
Alder Canyon	150200100106		16.4	3.7
Bagnal Draw-Show Low Creek	150200050107			2.5
Bear Canyon-Black Canyon	150200100203		6.3	
Billy Creek	150200050101	3.1	2.3	
Buckskin Wash	150200100202		2.9	
Cabin Draw	150200080308	2.5		
Dalton Tank-Cottonwood Wash	150200050305			0.1
Dodson Wash	150200050309			1.2
Durfee Draw-Chevelon Canyon	150200100110	7.8		
East Clear Creek-Clear Creek	150200080311	#	#	#
Echinique Draw-Clear Creek	150200080403	1.5		
Fools Hollow	150200050103		1.7	
Gentry Canyon	150200080305		12.7	12.4
Leonard Canyon	150200080307	#	#	#
Long Tom Canyon-Chevelon Canyon	150200100102	8.2	3.6	0.5
Lower Brookbank Canyon	150200100209			0.9
Lower Willow Creek	150200080310	11.1	2.2	
Mortensen Wash	150200050308	0.9	15.4	3.6
Ortega Draw	150200050201			
Porter Creek	150200050102	2.7	0.5	0.4
Pulcifer Creek	150200020401			
Sepulveda Creek	150200020403	2.2		
Stinson Wash	150200050301			
Town Draw	150200050306			
Upper Brookbank Canyon	150200100205			12.0
Upper Brown Creek	150200050202		2.9	
Upper Chevelon Canyon-Chevelon Canyon Lake	150200100104	3.0	2.7	3.8

Upper Day Wash	150200050303			
Upper Phoenix Park Wash	150200080102	1.5	5.2	
Upper Pierce Wash	150200100204		6.9	
Upper Rocky Arroyo	150200050205		0.5	
Upper West Chevelon Canyon	150200100107			
Upper Wildcat Canyon	150200100103	13.3		
Upper Willow Creek	150200080306	0.3	21.8	4.2
West Fork Black Canyon	150200100201		1.0	
West Fork Cottonwood Wash-Cottonwood Wash	150200050302		4.0	4.8
Wilkins Canyon	150200080309		2.1	14.2
Woods Canyon and Willow Springs Canyon	150200100101	2.3	1.4	2.9
Windsor Valley	150200020406			
Totals =		**60.2**	**112.8**	**67.3**
* Source, Springs Institute				
# See Coconino shared Riparian area				

Table 17. Proper Functioning Condition assessment summary for the Coconino NF.

Subwatershed	6th Code	Miles of Surveyed Riparian		
		PFC	FAR	NF
Miller Canyon	150200080301			
Bear Canyon	150200080302	17	6	5.2
East Clear Creek-Blue Ridge Reservoir	150200080303	4.8	10.9	8.8
Barbershop Canyon	150200080304	17.3	14.3	
Leonard Canyon	150200080307	34	2.9	6.1
East Clear Creek-Clear Creek	150200080311	40.7	1.3	1.1
Echinique Draw-Clear Creek	150200080403	1.5		
Windmill Draw-Jacks Canyon	150200080501			
Tremaine Lake	150200080502			
Double Cabin Park-Jacks Canyon	150602020603	2.1	6.6	
Brady Canyon	150602020604		4.2	
Rattlesnake Canyon	150602020605			
Red Tank Draw	150602020610		3.4	
Upper Willow Valley	150602030101			
Long Valley Draw	150602030102			
Toms Creek	150602030103		1.4	1.9
Clover Creek	150602030104		0.5	
Lower Willow Valley	150602030105	2.4	1.2	
Webber Creek	150602030203			
		119.8	**52.7**	**23.1**

* Coconino NF Reference Spatial DB				

Note: PFC is Proper Functioning Condition, FAC is Functional-at-Risk, and NF is Nonfunctional.

Tonto National Forest

The PFC summary data for the Tonto NF displays estimated riparian conditions developed during the Watershed Condition classification analysis completed in March 2011. Twenty four miles of riparian areas have been inventoried. The remaining stream channel condition classes were derived from gathering all existing riparian and stream information within each HUC12 watershed using the guidance found in the National Watershed Classification Technical Guide, Indicator #5 for Riparian/Wetland Vegetation Condition.

Table 18 PFC asessment crosswalk for the Tonto NF.

Subwatershed	6th Code	Miles of Surveyed Riparian		
		PFC	FAR	NF
Canyon Creek Headwaters	150601030302		14.8	
Upper Canyon Creek	150601030304		1.2	
Gentry Canyon	150601030305		9.2	
Ellison Creek	150601030306		0.5	
Parallel Canyon-Cherry Creek	150601030401		17.4	
Crouch Creek	150601030403		1.4	
Gruwell Canyon-Cherry Creek	150601030404			16.4
Walnut Creek-Cherry Creek	150601030406			4.5
P B Creek-Cherry Creek	150601030407			3.5
Reynolds Creek	150601030801	9.4		
Workman Creek	150601030802	13.1		
Upper Salome Creek	150601030803		28.0	
Buzzard Roost Canyon	150601050101		20.1	
Rock Creek	150601050102		11.2	
Upper Spring Creek	150601050103		11.3	
Middle Spring Creek	150601050105		1.1	
Marsh Creek	150601050201		5.0	
Gordon Canyon	150601050202		18.4	
Christopher Creek	150601050203		21.0	
Horton Creek-Tonto Creek	150601050204		23.9	
Haigler Creek	150601050205		31.9	
Bull Tank Canyon-Tonto Creek	150601050206			15.9
Green Valley Creek	150601050301		8.1	
Houston Creek	150601050304			0.8
Gun Creek	150601050401		8.7	
Greenback Creek	150601050408		1.2	
Ellison Creek	150602030201	54.2		
East Verde River Headwaters	150602030202		32.7	
Webber Creek	150602030203		26.4	

Upper East Verde River	150602030205		5.1	
Pine Creek	150602030206			13.2
Rock Creek	150602030208		.05	
Hardscrabble Creek	150602030306		10.6	
		76.7	**309.3**	**54.3**
Tonto National Forest Riparian Area survey was based on the Tonto Stream and Riparian Inventory methodology.				

The principle force behind the structure and function of riparian ecosystems is streamflow. Riparian systems are primarily initiated and maintained by erosion, transport, and deposition of sediments by flowing water. Streamflow characteristics in the southwest have been highly altered over the past century, affecting riparian conditions (Baker et al. 2004). Human effects such as legacy excessive grazing, channelization, fire suppression, flow diversions, stream impoundments, and flow diversions have disrupted overall water availability, induced streamflow variability, altered seasonal patterns, and modified the sediment regimes. Currently riparian systems are drier, with reduced extent, structure complexity, density, and diversity than they have been historically.

Many of streams within the project area exhibit legacy effects from past land management, such as poor logging practices, poor road locations, overgrazing, among others. The effects of these practices include entrenchment of stream channels, increased gradient, decreased sinuosity and subsequent decrease of the streams available floodplain. Superimposed on these conditions are the effects of recent (past 30 years) of uncharacteristic wildfires. Approximately 31% of the project area has experienced wildfire over the past 30 years. The Rodeo-Chediski wildfire burned through a large portion of the Rim Country project area. Other fires, such as the Dude Fire in 1990, still may exhibitresidual effects from the change in cover density and type. Effects on the riparian systems from these fires include but were not limited to burning of the vegetation overstory, increased peak flows, increased bank erosion and sediment transport and deposition. PFC assessments conducted in 2004, two years after the Rodeo-Chedeski wildfire, recorded substantial post-fire effects including downcutting, eroded banks, and direct loss (burning) of riparian vegetation.

Wetlands and Springs

There are approximately 1,000 natural lakes, reservoirs, and natural wetland depressions within the project boundary that impound water for a sufficient duration to exhibit some wetland characteristics and are therefore listed in the U.S. Fish and Wildlife Service National Wetlands Inventory database.

Approximately 360 springs (Appendix A, Table 1) have been inventoried by the Spring Stewardship Institute within the Rim Country project area. Of these 360 springs, 214 have survey information, 138 are unverified, and 8 were verified. Information regarding historic flow or water quality from these springs is minimal. Most springs within the project area are either rheocrene- meaning they flow directly from the ground resulting in a small stream, helocrene- they emerge from low gradient wetlands, or hillslope – they emerge from confined or unconfined aquifers on a hillslope (typically 30–60º); often with indistinct or multiple sources.

Several springs within the project area (see Appendix A, Table 2) are currently being assessed using the Spring Ecosystem Assessment Protocol (SEAP) (Stevens et al. 2011) with at least one objective being that to see effects of thinning treatments such as those proposed by landscape level restoration such as theRim Country project on spring discharge. Eighty springs have been assessed using the SEAP protocol within the Rim Country project boundary. All these assessed springs are located on the Coconino NF. Eight percent of the springs were identified to be at moderate or greater risk. Many springs within the project area have been adversely affected by human activities including flow regulation through installation of spring boxes and piping of discharge to off-site locations, recreational effects, urbanization and other construction activities, and grazing by domestic livestock and wildlife herbivores.

Flood Zones

Floodplain maps have been developed for developed areas in Gila, Coconino, Navajo and Apache Counties by the Federal Emergency Management Agency. Mapped floodplains in the Rim Country project area include developments along Strawberry Creek in Strawberry, Strawberry Hollow and Pine Creek in Pine, Chase Creek, Mail Creek, North Sycamore Creek and the East Verde River for developments in the East Verde River watershed, Thompson Draw for the community of Tonto Village, Tonto Creek for the Kohl's Ranch and Bear Flat areas, Christopher Creek for the town of Christopher Creek and developments along the creek, and Cherry Creek for the Pleasant Valley area. Unmapped floodplains are likely to occur within other developments along Webber Creek, Bonita Creek, Ellison Creek, Jim Roberts Draw, Tonto Creek, Hunter Creek, Haigler Creek, Gordon Canyon Creek, Colcord Canyon, and Rose Creek. Developed Recreation sites along Canyon Creek and Rose Creek are also likely to be partly within one hundred year floodplains.

On the Coconino NFs, flood zones have been mapped on Jacks Canyon and Rocky Wash. On the Apache-Sitgreaves, Black Canyon, Buckskin Wash for the Town of Heber, Cottonwood Wash, Pinedale Wash, Water Canyon, Dodson Wash associated with Town of Pinedale and developments around them, Show Low Creek, Bagnal Draw and Billy Creek associated with towns of Show Low and Lakeside.

Caves

In May of 1995 an amendment to the Tonto Forest Plan was made to provide for cave resource management, and development of a forest wide Cave implementation Plan was called for, though never completed. A 2003 agreement between the Forest Service and the Central Arizona Grotto (CAG), a chapter of the National Speleological Society, led to the creation of a Recommendation for Tonto National Forest Cave and Karst Management document by CAG. In 2013 the CAG management plan was posted on their own website for each individual forest, it was also submitted to both the RO and each forest. It was stated in the current Forest Plan Revision that the relationship between the Forest Service and CAG will be important to ensure that cave and karst resources are appropriately considered and protected through the forest planning process; though the plan had been revised again in September 2015 the Tonto has not officially accepted the CAG management plan.

There are 38 major caves on the Tonto, nine to be considered significant and seven believed to be used regularly for recreation and/or education by several scout and youth groups. Even without individual cave management plans in place, two caves on the Payson RD have been gated, one for safety and one for vandalism. A third cave on the Pleasant Valley RD has also been gated to protect a colony of Fringed Bats (myotis thyanodes). In 2001 a significant cave finding/decision was signed by the forest supervisor identifying nine of 11 submitted caves. These include; Barberpole-PRD, Diamond-PRD, Ebony-PRD, Salamander-PRD, Pishiboro-PVRD, Redman-PVRD, Scout-PRD, Strawbones-PRD, and Woman-PRD. The exact location or description of these caves is protected under section 552 of Title 5, United States Code. This prohibits significant cave information from being made public, unless the secretary determines the release of this information would not create a substantial risk of harm, theft or destruction of the cave.

The Apache-Sitgreaves National Forests recognize that there are a large number of caves and karst formations occurring within the Rim Country boundary; however, there is no formal cave management plan in place. The management approach for caves and karst features includes the use of best management practices and site specific design features such as activity buffers that prevent silt, sediment and debris from flowing into them. In addition, cave/karst management plans will be developed as needed. This mitigation would be important for ground disturbing treatments such as road building and timber harvest.

Although caves will not be analyzed in depth in this report, they are considered important resources and accordingly warrant the upmost protection. A number of BMPs included with the design features listed in Appendix C apply directly to protecting the integrity of cave resources.

Watersheds and Watershed Condition

The Rim Country Project occurs within 141 sixth-level, or 12-digit, hydrologic units (i.e., sub-watersheds), 28 10-digit (watersheds) and 11 8-digit (sub-basins).

A watershed condition assessment was initially completed in 2011 for all sub-watersheds in the project area as part of an agency-level assessment of watershed conditions for each forest Watershed condition information is also included in the Soil and Watershed Report. Some of the sub-watersheds have very limited areal extent within the project and will not be analyzed further in detail.

The result of the analysis of all watersheds in the project area indicate 20 (15%) were rated as Functioning Properly, 111 (83%) were rated as Functioning at Risk, and two (2%) were rated as Impaired. This information is presented in Appendix B. Many of these conditions could be improved over time with implementation of an ecosystem restoration project such as the proposed action.

Across the project area, the following indicators have the most effect on the overall watershed score. Most of the functioning at risk and impaired watersheds have fair or poor ratings for these indicators.

- Water quantity – accounts for changes to the magnitude, duration, or timing of the natural streamflow hydrograph. Watersheds with dams, diversions, major impoundments or significant retention structures, groundwater pumping that affects stream base flows, effluent discharge, poor range conditions, recent fires, or urbanized areas affected this rating.
- Aquatic habitat – accounts for habitat fragmentation, large woody debris, and channel shape and function. This rating was affected by road crossings that serve as fish barriers, the condition of riparian vegetation along stream channels that controls recruitment of large woody debris and the condition of stream channels (data for approximately 170 stream channel reaches within the Rim Country project area on the Tonto NF exists to assess channel conditions).
- Aquatic biota – accounts for distribution, structure, and density of native and introduced aquatic fauna. Most of the perennial streams on the Tonto NF support populations of non-native fish and invertebrate species (including crayfish and bullfrogs).
- Riparian/Wetland vegetation – accounts for function and condition of riparian vegetation along streams, water bodies, and wetlands. Photo points, riparian surveys, and channel condition surveys were used to assess riparian conditions on the National Forest System lands.
- Roads and trails – accounts for density, location, distribution and maintenance of the road and trail network. This indicator was influenced by low frequency of maintenance on Level 2 roads (high clearance, native surface roads), location of roads in close proximity to stream channels, and to a lesser extent by road density.
- Soil condition – accounts for soil productivity, erosion, and chemical contamination. The Region 3 Soil Condition Class Rating Guide (Reference) that rates soils as satisfactory, impaired of unsatisfactory was used for this indicator.

A substantial number of watershed have functioning at risk or impaired ratings based on other indicators, such as fire regime and rangeland vegetation, but these indicators only have a small effect on the overall watershed condition rating due to the low weight assigned to them in the assessment process..

Watersheds that are identified as Class II or III (Functioning-at-risk or Impaired rating) are a result of, in large part, overly dense forests with fire regime condition classes of 2 or 3 (moderately or highly departed from reference conditions), a high-density road network that can alter hydrology with many in close proximity to stream courses, a riparian condition rating (PFC) of Functioning-at-risk and Non-functioning condition, and lack

of native fisheries or aquatic species in watersheds with perennial streams. Current conditions are dominated by overly dense forests that lead to high fuel loads with the potential of uncharacteristic wildfires. Uncharacteristic wildfires in many cases result in soils with high burn severities that pose risk to watershed function, soil productivity, and water quality following storm events. High burn severity results in water-repellent soils, loss of protective vegetative ground cover and, following storm events, accelerated erosion and sediment delivery to connected stream courses that may degrade water quality. Consequently, accelerated erosion and sediment delivery into connected stream courses leads to loss of soil productivity and watershed function.

The distribution of ratings for these indicators in the Rim Country project area are displayed in Table 19. Overall, ratings indicate that water quality was the highest of the three indicators, with 70% of watershed at a good rating. This is followed by 48 percent of the water quality ratings as Good. Riparian/Wetland condition was the lowest with most ratings at 'Fair' condition and a greater percentage of 'Poor' ratings than 'Good'. This suggests that the Riparian /Wetland indicator is most departed from desired conditions and critical to address for restoration.

Table 19. Distribution of Ratings for Water Quality, Water Quantity, and Riparian/Wetland Condition Indicators

Indicator	Poor	Fair	Good
Riparian/Wetland Condition	27%	58%	15%
Water Quality Condition	6%	23%	70%
Water Quantity Condition	15%	37%	48%

Priority watersheds are the designated watersheds where restoration activities will concentrate on the explicit goal of maintaining or improving watershed condition with watershed condition framework process (USDA,2011). The Apache-Sitgreaves NF plan objectives include improving watershed condition ratings on 10 or more 6th level HUC watersheds during the planning period of 10 to 15 years. Improvement occurs when a Watershed Restoration Action Plan (WRAP) is written and approved, and all essential projects identified within the watershed have been completed. A target is assigned annually to each FS Region for finalizing implementation of WRAPs for improving and maintaining watershed conditions. The Coconino and Tonto NFs may have similar plan objectives when approved.

Table 20. Priority watershed within the Rim Country Project Area.

The table below shows the four priority watersheds inside the Rim Country boundary. The two watersheds located on the Apache-Sitgreaves NF are rated as Functioning Properly. The other watersheds, located on the Coconino and Tonto NFs, are rated as Functional at Risk.

Hydrologic Unit Number (HUC12)	Subwatershed Name	National Forest	Percent of priority watershed within Rim Country	Condition Class
150200100103	Upper Wildcat Canyon	Apache-Sitgreaves National Forests	99.9%	Functioning Properly
150200100102	Long Tom Canyon-Chevelon Canyon	Apache-Sitgreaves National Forests	99.9%	Functioning Properly

150200080303	East Clear Creek-Blue Ridge Reservoir	Coconino NF	100.0%	Functioning at Risk
150601030401	Parallel Canyon-Cherry Creek	Tonto National Forest	94.4%	Functioning at Risk

Municipal Watersheds

The city of Pine Municipal Watershed is approximately 7,611 acres in size. Located on both the Tonto and the Coconino National Forests, the Pine Creek reservoir serves approximately 500 residents in Pine, Arizona. The Municipal watershed is entirely located in the Pine Creek subwatershed, Hydrologic Unit Number (HUC12) 150602030206.

The C.C. Cragin Management area occurs in the southeastern portion of the Coconino NF and adjoins the East Clear Creek and Long Valley Management Areas, as well as Tonto NF. It is accessed by forest roads that join Highway 87 and is characterized by C.C. Cragin Reservoir and Forest Road 300 along the Mogollon Rim. C.C. Cragin supplies water via a pipeline for the Town of Payson and other communities in northern Gila County. The subwatersheds (HUC12) that support the C.C. Cragin Reservoir are: Bear Canyon 150200080302, Miller Canyon 150200080301, and East Clear-Blue Ridge 150200080303. C.C. Cragin reservoir also provides water-based recreation.

Issues/Indicators/Analysis Topic

Water Quality and Riparian Area Issues

Water quality and riparian area analysis topics include:

- Potential for sediment delivery to waterbodies including streams, wetlands, riparian areas, and lakes.
- P
- Changes in surface runoff, erosion, and sediment delivery to stream courses from road construction, maintenance and obliteration.
- Changes to channel morphology as a consequence of increased flows caused by removal of upland vegetation resulting in increased storm water runoff.
- Cumulative effects on water quality, water quantity,and riparian areas, when combined with past, present, and reasonably foreseeable future actions could be significant.

Water Quality

The indicators for water quality includes acres of vegetation (forest, woodland, grassland, riparian) restored by mechanical and prescribed burning, the number of miles of stream channel and number of springs proposed for restoration, the changes in road miles and unauthorized routes, and overall projected changes to water quality, most importantly potential changes with compliance with the Clean Water Act.

Water quality in Arizona is reassessed and reported every 2 to 3 years by the State of Arizona. The latest assessment was documented in the Department of Environmental Quality in 2016 Clean Water Act Assessment (July 1, 2010 to June 30th, 2015) (ADEQ 2016). The findings and recommendations of the report are summarized in the affected environment section.

Most adverse effects on these resources can be minimized or mitigated through appropriate use of resource protection measures such as Soil and Water Conservation Practices (SWCPs) and Best Management Practices (BMPs) as outlined in the Soil and Watershed Conservation Practices Handbook (Forest Service Handbook 2509.22)(USDA 1990) . These resource protection measures for the Rim Country Project areincluded as design features in Appendix C. This project will incorporate Best Management Practices, both general and site specific, designed to protect water quality. A memorandum of understanding with the State of Arizona and USDA Forest Service, Region 3 (USDAFS/ADEQ 2013) states 'Ensure that all project work schedules for project implementation on the ground contain site-specific BMPs, developed through the LRMP implementation process and consider technical, economical, and institutional feasibility and water quality effects from the proposed activity in selection of the BMP. Monitor BMPs on selective activities to ensure they are implemented and are effective, adjust as necessary.' An important BMP feature is the Aquatic Management Zone (AMZ), which is an area adjacent to a waterbody where activity is restricted or limited to project aquatic and riparian values at risk. The proposed AMZ widths are outlined in the Rim Country design features.

Water Quantity

Water quantity is discussed in terms of stable hydrologic regime, persistence of flow, peak flows, and discharge to waterbodies and springs. Surrogates to analyzing these indicators are similar to those for water quality and include: acres of vegetation treated by mechanical treatments and prescribed burning, miles of roads opened and temporary constructed roads, decommissioned roads and unauthorized routes, and acres of rock pits and in-woods processing areas.

Riparian Resources

The indicators used to assess riparian include the miles of stream restoration, the number of springs proposed for restoration, and the number of acres proposed for vegetation treatments such as mechanical treatments and prescribed burning, including most importantly riparian and wetland areas. Other indicators include the miles of temporary roads constructed and Forest Service system roads reopened, the miles of Forest Service roads and unauthorized routes decommissioned. These are surrogates for assessing potential changes toresource conditions.

Cumulative Effects and the Watershed Condition Framework

As mentioned previously, although all Watershed Condition Framework indicators are interrelated to some degree. Specific indicators such as Water quality, Water Quantity, and Riparian/Wetland Vegetation condition were used to evaluate watershed-scale cumulative effects for water and riparian resources Other Watershed Condition Framework indicators are addressed in the Soil and Watershed Report (MacDonald,2018)

Summary of Alternatives

Alternative 1, No Action

Alternative 1 is the no action alternative as required by 40 CFR 1502.14(c).[6] It represents no changes to current management, and current forest plans would continue to be implemented. Ongoing vegetation treatments and fire management activities, as well as road maintenance, recreation, firewood gathering, authorized livestock grazing, and other activities already authorized in separate NEPA decisions would continue. There would be no other restoration activities approved with the Rim Country Project. The potential direct, indirect, and cumulative effects from no action will be analyzed. The no action alternative is the baseline for assessing the action alternatives (Alternatives 2 and 3).

[6] http://ww.nepa.gov/nepa/regs/ceq/1502.htm#1502.14

Action Alternatives

The restoration activities listed for the action alternatives include vegetation treatments (mechanical thinning and burning) as well as comprehensive restoration treatments (other restoration treatments) for grassland, aquatics, wildlife habitat, and rare species restoration. The activities common to both action alternatives include:

- General mechanical vegetation treatments and burning: this includes mechanical thinning with ground-based or cable-logging as outlined in the Rim Country Flexible Toolbox Approach for Mechanical Treatments.
- Wetland and riparian: restore hydrologic and vegetative function using mechanical and hand thinning techniques as outlined in the Rim Country Flexible Toolbox Approach for Aquatics and Watersheds. Treatments included mechanical harvest, mastication, grinding, and hand thinning.
- Utilization of up to 5,682 miles of Forest Service Roads.
- Restore approximately 184 springs.
- Restore function and habitat in up to 777 miles of streams, including stream reaches with habitat for threatened, endangered, and sensitive aquatic species.
- Decommission up to 200 miles of existing system roads on the Coconino and Apache-Sitgreaves NFs, and up to 290 miles on the Tonto NF.
- Decommission up to 800 miles of unauthorized roads on the Apache-Sitgreaves, Coconino, and Tonto NFs.
- Construct or improve approximately 330 miles of new temporary roads or existing non-system roads to facilitate mechanical treatments; decommission all temporary roads when restoration treatments are completed.
- Relocate and reconstruct existing open roads adversely affecting water quality and natural resources, or of concern to human safety.
- Construct up to 200 miles of protective barriers around springs, aspen, native willows, and big-tooth maples, as needed for restoration.
-

  Other Actions

- The use, including potential expansion, of 12 individual rock pits totaling 629 acres on the Apache-Sitgreaves National Forests. The removal and transportation and of the rock pit materials will be used for improvement and maintenance of roads for specific projects that utilize maintenance level 1 (closed roads, for administrative use only), maintenance level 2 roads (maintained for high-clearance vehicles). In addition the rock material could be used for construction and maintenance of temporary roads.
- Construction of 13 wood processing sites, totaling 128 acres. Tasks carried out at processing sites includes drying, debarking, chipping stems and bark, cutting logs, manufacturing and sorting logs to size, scaling and weighing logs and creating poles from suitable sized logs. Equipment types commonly used at processing sites include circular or band saws, various sizes and types of front-end loaders, log loaders and chippers of several types and may include timber processors, planers and mechanized cut to length systems, associated conveyers and log sorting bunks for accumulation and storage of logs. Electric motors and gas or diesel generators are also used to provide power.

The potential extent and types of comprehensive restoration activities available using the Rim Country Flexible Toolbox for Aquatics and Watersheds does not differ between action alternatives. The difference between the action alternatives is the extent and types of vegetative treatments and activities using the Rim Country Flexible

Toolbox Approach for Mechanical Treatments. In addition the number of potential temporary roads constructed to implement projects differs between action alternatives.

Alternative 3 (focused alternative) is scaled down version of Alternative 2 designed to focus restoration treatments in areas that are the most highly departed from the natural range of variation (NRV) of ecological conditions, and/or that put communities at risk from undesirable fire behavior and effects. High value assets will be better protected and burn boundaries will be designed to create conditions safe for personnel and to ensure fire can meet objectives. Treatment areas would be chosen to optimize ecological restoration, those areas that are most important to treat and can be moved the furthest toward desired conditions. Focusing on the higher priority ecological restoration will result in fewer acres being treated. The restoration treatments proposed in Alternative 3 will be used to address moderate and high levels of mistletoe infection, but to a lesser extent on the fewer acres proposed for mechanical treatment and fire. The presence of dwarf mistletoe will not be used to prioritize areas for treatment, but it will be addressed where it exists, using the same types of treatments as Alternative 2.

A general summary of differences between the two action alternatives are listed below.

Alternative 2 (modified Proposed Action)

- Largest extent of treatments
- Moderate BA reduction in groups, interspaces as in 1st EIS
- Significant reduction in undesirable fire behavior & effects
- Sustainable products for industry across the project area

Alternative 3: Focused Restoration

- Smallest extent of treatments
- Moderate BA reduction where treated
- Less smoke, fewer roads
- Reduction in undesirable fire behavior & effects near WUI and high value resources
- Least wildlife habitat improvements

Table xx and xx difference in treatment acres and miles of temporary roads constructed between action alternatives.

Table 21 a and b. Difference in treatment acres and miles of temporary roads constructed between action alternatives.

Mechanical and Fire Treatments	Alternative 2 Acres	Alternative 3 Acres	Difference from Alt 2 to Alt 3
General Vegetation and Burning	817,870	427,786	48%
Grassland and Savannah	54,890	38,790-	28%
Burning Only	54,070	40,630	26%
Wetland and Riparian	21,280	21,280	0%

Temporary Roads	Alternative 2 Miles	Alternative 3 Miles
Construction and later decommissioning of Temporary Roads	330	170

Note: General Vegetation = thinning and burning activities in forested types, and includes Facilitative Operations, aspen restoration, severe disturbance area treatments.

Design Features

Resource protection measures are designed to reduce the effects of harvest operations to (a) the productivity of soils, (b) the functionality of lotic and lentic systems, (c) to protect stream water quality and temperature, (d) to minimize erosion and protect drainage system integrity on road ways, and (e) to prevent the invasion or spread of noxious weeds on or originating on NFS Lands. The design features included for the Rim Country Project reference standard SWCPs and BMPs found in the Soil and Watershed Conservation Practices Handbook (USDA, 1990) and the National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1. National Core BMP Technical Guide (USDA-FS2012). Resource protection measures are implemented to minimize nonpoint source pollution as outlined in the 2013 intergovernmental agreement (MOU) between the Arizona Department of Environmental Quality and the Southwestern Region of the Forest Service. Note that no resource protection measures are required for the No Action Alternative. A comprehensive list and description of design features is provided in Appendix C.

Direct, Indirect, and Cumulative Effects

Direct effects of an action are caused by the action and occur on site and affect only the area where they occur. Indirect effects are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. In general, direct and indirect effects on water quality and riparian areas as a result of the Action Alternatives include:

- Reduction of the forest canopy would decrease interception (precipitation captured by leaves, branches, and boles) and increase net precipitation reaching the soil surface. Where disturbance is recent, surface runoff could reach waterbodies and affect water quality.
- Partial removal of the forest overstory would reduce transpiration (water lost from plants to the atmosphere), increasing soil moisture and runoff (Baker 1999, Ffolliott et al. 1989), which may improve upland understory and riparian conditions. Interflow and groundwater recharge may increase resulting in increased stream flows.
- Increased soil moisture and loss of root biomass could reduce slope stability and increase soil erosion resulting in adverse effects on water quality.
- Impervious surfaces (roads and trails) and altered hillslope contours (cutslopes and fillslopes) would modify water flowpaths, increase overland flow, and deliver overland flow and sediment directly to stream channels.
- Increased channel, soil, and riparian vegetation stability could be achieved using restoration techniques described in the Aquatic and Watershed Flexible Toolbox Approach

Table 22. provides a comparative summary of direct and indirect effects on water quality, water quantiry, and riparian areas by Alternative for the Rim Country Project.

Table 22. Comparison of direct and indirect effects for the alternatives.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
MECHANICAL VEGETATION TREATMENTS AND PRESCRIBED BURNING			
Water Quality <u>Indicators</u> Acres of mechanical vegetation and prescribed burning treatments	Excluding the effects of catastrophic wildfire, there would be no potential for short-term for water quality effects from the no action alternative. By not restoring vegetation and soil function to desired conditions, degrading contributors to water quality may persist. There would be likely be no changes to compliance with the Clean Water Act under the No Action	Minor, short- term, changes (i.e., 1-3 years) in water quality are possible in water bodies adjacent to or downstream from mechanical vegetation treatments, and areas subjected to prescribed burning. Long- term surface water quality is expected to improve through more resilient ecosystem conditions that minimize the risk of uncharacteristic fire behavior and through improvement of vegetative ground cover, that minimizes soil erosion and sediment transport to connected stream courses and other waterbodies. Resource protection measures listed in Appendix C would	Same as Alternative 2. with the exception of substantially fewer upland acres treated with mechanical vegetation and prescribed burning treatments in forested conditions 48% less) and grasslansd and savannahs (28%) less and prescribed burning treatments. Prescribed burning only acres are 26% less. In the short term, potential soil disturbance that could adversely affect surface water quality is much less. In the long term, water improvement associated with bringing uplands to desired conditions area is less. There would be no changes to compliance with the Clean Water Act.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
		minimize or mitigate most adverse effects on water quality. There would be no changes to compliance with the Clean Water Act.	
Water Quantity Indicators same as above	Water yield and stability of hydrologic flow regimes would likely continue to decline as a result of forest ingrowth that increases stand density.	Potential water yield including persistence of flow may increase depending on vegetation type and climate variables. More stable hydrologic regimes are expected, including decrease risk of damaging flows form uncharacteristic wildfire.	Under Alternative 3, fewer acres would receive mechanical vegetation treatments and prescribed burning than Alternative 2, therefore, overall water yield and stability could be slightly lower since there would be fewer forest openings and more dense forest conditions.
Riparian Resources Indicators same as above	Because conditions which are degrading these systems would continue unabated, reduced function and condition of riparian areas, including wetlands, springs are possible under the No Action Alternative,	Vegetation treatments will promote increased groundwater recharge and improved surface flows supporting riparian vegetation. Resource protection measures listed in Appendix C would minimize or mitigate most	Under Alternative 3, fewer acres would receive mechanical vegetation treatments and prescribed burning than Alternative 2, therefore the potential for increases in riparian supporting recharge and surface water flows would be less.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
	Ongoing reduction in water yield from upland tree encroachment could decrease water reaching riparian areas via groundwater discharge and surface flows.	adverse effects on riparian resources.	
RIPARIAN RESTORATION (other than vegetative treatments and prescribed burning)			
Water Quality Indicators Miles of stream proposed for restoration. Number of springs proposed for restoration Miles of proposed protective barriers	There would be no short-term potential for water quality impairments from the use of heavy machinery in waterways is expected and dislodge sediment. Water quality impairments caused by poor riparian, wetland, and channel conditions would continue.	Short-term disturbances from using equipment including heavy machinery in waterways is expected and dislodge sediment. Long-term water quality is expected to improve from restoration of up to 777 stream miles, 184 springs, and construction of up to 200 miles of protective barriers around riparian vegetation and springs. Permits will be obtained when appropriate. Resource protection measures designed to minimize water	Same as Alternative 2.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
		quality effects will be followed and are included in Appendix C.	
Water Quantity ***Indicators*** Same as above	Unstablehydrologic flow regimes caused by lack of functioning riparian vegetation and stream stability will continue under the no action alternative.	Improved riparian and stream conditions and functionality will promote more stable hydrologic flow regimes including reducing peak flows and associated damaging flooding.	Same as Alternative 2.
Riparian Condition ***Indicators*** Same as above	Declining riparian conditions and functionality that require intervention will not improve under the no action alternative.	Riparian conditions and functionality are expected to improve through restoration and stabilization activities	Same as Alternative 2.
ROADS ACTIVITIES **(road improvements, temporary road construction, decommissioning of system roads and unauthorized routes, improvement and relocation of system roads)**			
Water Quality <u>Indicators</u>	Temporary Roads needed for project implementation would not be constructed. Therefore there	Short term: potential sediment input to water bodies from construction and use of up to 330	Same as Alternative 2 with the exception of slightly lower potential for water quality

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
Miles of Temporary Roads Miles of System Roads Decommissioned Miles of User Created Routes Decommissioned	would be no potential for water impairment from sediment inputs from these routes. There would be no potential for improvement of water quality from decommissioning of Forest Service system routes or unauthorized routes No change withcompliance with Clean Water Act	miles of temporary roads These effects likely avoided and/or mitigation following resource protection measures found in Appendix C. No change withcompliance with Clean Water Act	impairment from construction of fewer (170 miles) of temporary roads No change with compliance with Clean Water Act
Water Quantity <u>Indicators</u> same as above	Temporary roads needed for project implementation would not be constructed, therefore no potential for concentration flow and subsequent increased discharge to water bodies. There would be no potential for improvement of altered flow and discharge patterns and from decommissioning of FS system routes or unauthorized routes or	Short term potential for increased concentration flow and subsequent increased discharge to water bodies from construction of 300 miles of temporary roads. These effects likely avoided and/or mitigation following resource protection measures and FS road construction and maintenance handbook direction.	Same as Alternative 2 with the exception of slightly lower potential for increased concentrated flows and discharge to water bodies from fewer (170 miles) of temporary roads.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
	the improvement and relocation of existing system roads.	Decommissioning of 490 miles of FS system roads and 800 miles of unauthorized routes, in addition to improvement and/or relocation of system roads that have altered flow patterns through increased drainage density or redirected stormwater runoff would promote a more stable flow regime.	
Riparian Resources Indicators same as above	Temporary roads needed for project implementation would not be constructed. Therefore there would be no potential for concentration flow which may affect riparian areas. FS system roads and unauthorized routes that are affecting these resource areas would not be addressed through FS road and unauthorized route decommissioning.	Temporary roads construction (up to 300 miles) and use could have negative effects on riparian resources, however the effects likely eliminated or minimal if following the Resource Protection Measures in Appendix C. Decommissioning of FS system roads and unauthorized routes, in addition to improvement and/or relocation of system roads that have altered flow patterns through increased drainage density or redirected stormwater runoff, would improve the hydrologic	Same as Alternative 2 with the exception of slightly lower potential for effects to these resource areas due to fewer (170 miles) of temporary roads.

Resource and Unit of Measure	ALTERNATIVES		
	1 **No Action**	**2**	**3**
		regime and overall watershed hydrology.	
ROCK PITS AND IN WOODS PROCESSING SITES			
Water Quality and Quantity <u>Indicators</u> Total extent in acres of rock pits Total extent in acres of woods treatment sites	No changes in water quality and quality with no action alternative. No change incompliance with Clean Water Act	Negative effects on water quality and quantity from use and expansion of 12 rock pits totaling 629 acres and 13 in woods processing sites totaling 128 acres will be minimal using selection criteria and adhering to design features in Appendix Cential positive effects on water quality by having ability to improve road surfacing. Maintains compliance with Clean Water Act	Same as Alternative 2. No change in compliance with Clean Water Act
Riparian Resources <u>Indicators</u> same as above	No adverse effects on these resource areas with no action alternative.	Negative effects on riparian resources minimized by use and expansion of 12 rock pits totaling 629 acres and construction and use of 13 in woods processing	Same as Alternative 2.

Resource and Unit of Measure	ALTERNATIVES		
	1 No Action	2	3
		sites totaling 128 acres by use of site selection criteria and adherence todesign features in Appendix C.	

Alternative 1 – No Action

There would be no direct effects on water and riparian resources as a result of the no action alternative, however there would be indirect effects by not be moving these resources towards desired conditions. Overstocked and dense stands within the project area would not be treated, leaving a less healthy, less vigorous, and under productive forest. Risk of uncharacteristic wildfire would not be reduced. No improvement would be realized in woodlands, savanna, and grassland vegetative types where vegetative ground cover conditions are departed from desired conditions. No road decommissioning, rehabilitation of unauthorized routes or stream crossings would occur improving water quality. Stream, wetland, riparian, and spring restoration would not be completed at the scale intended for this project. The project area would not move toward desired conditions, as outlined in the Apache-Sitgreaves, Coconino, and Tonto Forest Plans.

Water Quality and Quantity:

Absence of Mechanical Treatments and Prescribed Fire

This alternative would not provide for reduced vegetative conditions that are more resistant to uncharacteristic wildfire. Much of the ponderosa pine forest is in Fire Regime Condition Class 3 and trends indicate that fuel loading would continue to increase in both living biomass and woody detritus through natural forest ingrowth and tree encroachment into existing openings, resulting in increased risk of high severity wildfire. A dense forest litter layer (i.e., duff) has displaced much of the herbaceous vegetation which provides even greater benefits to soil hydrologic function due to fine root turnover, increased fine litter, improved soil porosity and aggregate stability, and increased water holding capacity (NRCS 2001). The effects on water quality and quantity in the case of wildfires resulting in high soil burn severity are well documented, and can cause heavy sediment and ash inputs to connected stream courses, as well as increased risk of damaging flows to streams, riparian areas and other downstream values at risk. It is likely that under any conditions, a wildfire entering these untreated watersheds under the no action alternative would have considerably greater effects on water quality and channel stability than wildfire occurring after implementation of the action alternatives. Increased water turbidity, and downstream flooding would be more widespread in an uncontrolled wildfire situation than under prescribed fire conditions where the size and intensity of the fire can be controlled. Lata 2012 suggests that up to 33% of ponderosa pine forest could burn under high burn severity conditions. Therefore, if a 10,000 acre wildfire were to occur within the project area, approximately 1,000 to 3,000 acres of high severity fire would be expected to adversely affect water quality and riparian conditions. Increased sediment loads are the primary physical effects on surface waters following fire. The bulking effect of sediment and ash in runoff increases the risk to surface water impoundments, infiltration basins, and public water treatment systems. Sediment and debris flows can damage water supply infrastructure. Sedimentation of impoundments can decrease their effective life, resulting in a need for dredging and other mitigation measures.

This alternative would result in no additional acres of ground disturbance from mechanical vegetation treatments, piling of activity-related woody debris, construction and maintenance of temporary roads, road obliteration, fence construction, and the use of prescribed fire. Soils with erosion rates that are exceeding tolerance thresholds would likely continue to erode at current rates. Sediment delivery to streamcourses and waterbodies could continue at current rates or gradually increase from poor upland conditions. In areas where overstory densities are high, little long-term improvement in hydrologic flow regime will occur without mechanical treatment and/or prescribed fire. The soils in these areas have

reduced moisture storage and infiltration capacity and are frequently overwhelmed by high intensity summer precipitation events, producing runoff events with relatively large peak flows of short duration. In areas that are overstocked with trees and encroached, water quantity will continue to decline as less water would be available for stream flows due to the closing of the overstory.

Absence of Riparian, Stream, and Upland Improvements:

Riparian vegetation provide many water quality maintenance functions such reducing surface water temperatures from blocking solar radiative which promotes high dissolved-oxygen concentrations. Stabilizing roots reduce the amount of bank cutting and erosion. Uptake by riparian vegetation can effectively remove excess nutrients and pollutants from water. Several stream reaches within the Rim Country Project area are experiencing increased water flows and sediment delivery from the effects of poor upland conditions some of which are the result of several fires which have occurred over the past 20 years, most notably the Rodeo Chedeski Fire of 2002. These increased flows are causing stream instabilities both vertically and laterally. Stabilizing riparian vegetation has been scoured away causing detachment and movement of channel and bank material affecting sediment concentrations in water bodies. Without active stabilization activities water quality will likely not improve as quickly as with the action alternatives.

Absence of Road Activities:

This alternative is not anticipated to produce any changes to existing water quality trends in the streams, springs and surface water bodies in or downstream of the project area. Open roads and unauthorized routes being used for motorized travel will continue to discharge runoff and sediment to project area streams, especially where the roads are poorly located in stream bottoms, have inadequate drainage structure, and are hydrologically connected to the stream network.

There will be no short-term inputs of sediment into waterbodies caused by disturbance associated with the action alternative.

Absence of Rock Pits and In Woods processing sites.

Alternative A - No Action would have slightly more potential of increased sediment yield to downstream perennial waters than the action alternatives because of use and improvements of FS systems road associated with the rock pits. Increased sediment yield by itself does not constitute an effect on water quality because the sediments leaving the road would have to enter a water body in large enough quantities to cause a change in beneficial uses. Maintaining roads to appropriate standards would be more difficult in Alternative A - No Action due to the higher haul costs of bringing in rock from elsewhere. Fewer miles of roads surfaced combined with an increase in miles driven compared to the other alternatives would result in continued water quality effects.

Riparian and Wetland Resources

Absence of Mechanical Treatments and Prescribed Fire

Under the no action alternative and assuming the absence of wildfire, current trends in condition of riparian areas within the project area would be expected to continue. Riparian condition would not benefit from improving upland watershed conditions to desired conditions with mechanical and prescribed fire treatments. There would be no potential benefit from improvement of the hydrologic flow and altered sediment regime by restoring herbaceous ground cover. Fuel loading would remain high, thus there would be greater risk of high burn severity and subsequent flooding effects, which could negatively affect riparian condition. Tree density and canopy closure within the riparian areas would increase. Current levels of large woody debris would be available to the stream channel both from the riparian and adjacent

upland zones. Areas where deciduous woody riparian vegetation is being shaded out by invading conifers would remain in that condition.

This alternative would result in riparian condition improvement at a slower rate than either of the action alternatives as there would be no direct reduction of conifer encroachment via mechanical and prescribed fire to increase the potential for expansion and vigor of riparian vegetation.

Absence of Riparian, Stream, and Upland Improvements

Many of the stream reaches accessed are not currently at desired conditions and are in less than proper functioning condition. Headcuts and other instabilities can adversely affect riparian vegetation by scouring away soils and stabilizing plants leading to channel entrenchmentand subsequent lowering the water table. It is expected that riparian condition of these reaches would continue to decline or, if recovering, recover at a slower rate with the no action alternative than the action alternatives.

Absence of Roads Activities:

Potential effects from construction of temporary roads and opening of closed Forest Service roads, such as increased runoff on disturbed soils and potential increased delivery of sediment to water bodies, would not occur with the no action alternative. Forest service roads and unauthorized roads will not be decommissioned or relocated, therefore resource degradation from these roads will continue, and the improvement to riparian condition will not occur.

Absence of Rock Pits and In-woods Processing Sites.

The absence of rock pits and in woods processing sites would have no effect on riparian or wetland resources because of the location of these away from these resources. The no action alternative would result in no additional acres of ground disturbance from rock pits and in no potential sediment generation distribution from in-woods processing sites.

Effects Common to All Action Alternatives

Water Quality and Quantity

Upland Mechanical Vegetation and Prescribed Burning Treatments

Water Quality

Fire, including prescribed burning, can disrupt nutrient cycling and cause nutrient volatilization, leaching, and transformations. When vegetation is consumed by fire some of the soil and organic matter nutrients such as calcium, magnesium, and potassium are converted into oxides and accumulated in ash (DeBano et al. 1998). During precipitation events these compounds can be delivered to nearby waterbodies. However, the primaryl short-term risk to water quality from prescribed fire and mechanical vegetation treatments is from increased sediment input to water bodies from where ground cover has been reduced or eliminated. This risk of is greatest where treatment activities result in soil disturbance or complete removal of vegetative ground cover in close proximity to drainages. Such areas would include designated stream crossings, skid trails, log landings, , installed firelines, and areas with higher soil burn severity. As reported in the Soil and Watershed Specialist report (MacDonald, 2018), erosion potential is expected to increase on 10 to 15 percent of areas treated mechanically due to removal or displacement of ground cover. However, this erosion would be short term (1 to 5 years) and localized. In the long-term, these treatments will likely increase vegetative ground cover and decrease the potential for high severity fire and substantially more drastic effects from heavy fuel loading. As shown in erosion modeling results, sediment delivery following in high to moderated soil burn severity areas is about twice than for low

severity areas, which is the predominate severity class resulting from prescribed burning. Where uncharacteristic, or high-severity wildfires have occurred, 36 percent of the TES (Terrestrial Ecosystem Survey) strata exhibited erosion and sediment delivery rates above soil loss tolerance thresholds. Bringing these areas towards desired conditions will promote stability in hydrologic and sediment regimes.

Rainfall-runoff monitoring from a study in New Mexico reported much greater runoff coefficients, total discharge, and sediment yield in pinyon-juniper woodland sites than those areas with higher herbaceous ground cover such as in grasslands (Puttock et al. 2013). Thinning of forest cover on soils currently characterized as unsatisfactory would improve those soils over the long-term by improving soil moisture and allowing greater sunlight penetration to the forest floor, resulting in an increase in forest understory of desired herbaceous species. Vegetative recovery following fuel reduction treatments is generally rapid, with erosion rates typically returning to pre-treatment levels within 1 to 2 years (Elliot 2000). The increased herbaceous vegetation would likely reduce soil erosion and associated sediment delivery rates by providing vegetative and litter ground cover. This cover would intercept rain before it can reach soil surfaces, and detach and entrain soil particles in runoff water, promoting long-term improvement in water quality.

Resource protection measures including BMPs (see design features in Appendix C) are included with this project to protect water quality are effective in preventing long-term degradation of water quality from sediment and point sources of contamination. The use of streamside buffer zones, referred to as aquatic management zones (AMZs) in this project, to increase filtration capacity, have been shown to be capable of reducing sediment entering waterways to non-significant levels (Rashin 2006). These 'buffer zones' decrease the velocity of surface runoff that carry sediment and other pollutants from upland areas and trap them prior to entering waterways (Baker et al. 2004).

Adverse effects to water quality from mechanical vegetative and prescribed burning treatments would be mitigated, but not eliminated entirely with implementation of design features. Design features SW1 through SW17 include the use and description of AMZs that are protective of water quality. Additional BMPs addressing spill prevention, and remediation are included in SW1 – SW5, SW20 – SW24, SW110 – SW111, SW104, SW106, and SW108. Other protection measures for water quality associated with mechanical vegetative treatments include design features: SW 18, SW32 –SW34, SW37 -SW 58, SW61 – SW73, SW76, SW79 –SW80, SW82, SW89-SW92, SW94-SW102, and SW105. Design features related to prescribed burning activities include:SW38, SW74-SW80,SW89,SW91-SW92,SW94,SW96,SW98,SW102, and SW105.

Water Quantity

Departures from historical ranges of variability (HRVs) in vegetation and fire regimes have the potential for alteration of hydrologic regimes. Excessive overland flows can increase channel flow volume and velocity, causing channel erosion and increased deposition downstream. The proposed mechanical treatments and prescribed fire would move portions of the uplands toward desired conditions. The increase in vegetative grass component would improve the ability of the watershed to intercept and retain water inputs (precipitation and snow melt). Herbaceous ground cover, residual plant material, and plant vigor would increase surface roughness, reducing runoff velocities. Soil compaction would start to break up and additional organic material incorporate into the soil, allowing for reduced surface runoff, increased water infiltration, and moisture retention. Overall, these conditions could promote more stable hydrologic flow regimes. Mechanical treatments of woodlands have had mixed results as far as increasing water yield. In one study juniper treatments were shown to increase spring flow, groundwater, and soil moisture (Deboot et al.,2008). Other studies showed that water yield increases were lost to transportation from increases in herbaceous cover (Zou et al., 2009). Any water yield increase is thought to be lost to the several-fold increase in transpiration by the increased occurrence of herbaceous plants.

Fuel reduction treatments in forested watersheds, including mechanical treatments and prescribed burning, can result in long-term increases in water yields either on-site or downstream (Brewer 2008; Bosch and Hewlet 1982; Troendle et al. 2003, 2007). Treatment prescriptions that cover most of the project area and remove greater than 20 percent of tree basal area would be needed to generate a detectable change in surface flows. Treatments prescribed in the action alternatives would include leaving groups of trees, which would allow more snow collection in openings and result in greater potential for on-site water storage and yield. This could provide longer periods of flow in intermittent streams within and downstream of the project area (Zou et al. 2009). In high-elevation subalpine spruce-fir stands managed for snowpack redistribution and transpiration reduction, increases in annual water yields from one to three inches could often be expected. Water yields in mixed conifer stands are approximately 25 percent less than those expected in subalpine forests. In drier ponderosa pine stands, increased yields of one-quarter to one inch would be realistic. A modeling effort presented in Robles et al. (2014) found that runoff in thinned ponderosa pine forests was about 20 percent greater than unthinned forests, regardless if in a drought or wet period. However, these increases were temporary, occurring less than six years following treatment, and were modest (0-3 percent) when compared to total mean runoff from the study watershed. A study by Simonin et al. (2006) found that positive effects on water outflow from thinning in ponderosa pine only occurred in wet winters. Bosch and Hewlet (1982) concluded, and subsequent data (Hornbeck et al. 1997) and modeling (Troendle et al. 2003, 2007), support that removing less than 20 percent of the basal area may also result in a change in flow, but this change will not be detectable. In cases where there is a detectable hydrologic response to fuel management treatments, the observed response would be greatest in wet years and smallest or non-detectable in dry years. Prescribed fires, when designed and used as a fuel reduction tool alone, are probably less likely to influence water yield than mechanical treatments or a combination of burning with mechanical treatments, because of the smaller reduction in basal area and lack of ground disturbance by heavy machinery.

It is well documented that large scale treatments can have an effect on amount and timing of stream flows. Areas within or adjacent to flood zones may be affected by wildfire as loss of vegetation cover reduces the ability of the watershed to effectively hold and release water and sediment. Measures taken to reduce the potential effect of increased peak flows and runoff from too intensive and extensive treatments are included as project design features in Appendix C.

Adverse effects to water quantity would be mitigated, but not eliminated entirely with implementation of design features. Most of the AMZ related design features listed for water quality are applicable to water quantity. Other design features relevant to mechanical vegetation treatments include: SW18, SW 26, SW32, SW33, SW37,SW39-SW58,SW61,SW64,SW66-SW73,SW76,SW79-SW80,SW82,SW92,SW94-SW96,SW98-SW101, and SW105. For prescribed fire and other burning activities, the design features listed for water quality are all applicable.Riparian, Wet Meadow, Spring, and Stream Restoration.

Restoration activities described in the Aquatic and Watershed Flexible Toolbox Approach (AWFTA) could promote conditions for desirable water quality and quantity characteristics. Reducing trees encroachment on riparian areas would allow for decreased precipitation interception, improved infiltration andwater storage. Riparian vegetation often acts as a mitigating influence on flooding. Riparian vegetation provides instream roughness via large woody debris as well as live vegetation along stream banks. This roughness can reduce stream velocities and dissipate stream energy, resulting in an increased stream stage. The spreading of water out onto a floodplain promoteswater entering into storage, further dampens peak flows. Improving conditions in these areas would also promote resiliency during uncharacteristic wildfires, by reducing the potential for high severity burning. High severity burning in riparian areas can reduce shading causing increasing stream temperatures, and destroy stabilizing vegetation resulting in excessive erosion and sediment production.

Long-term water quality would benefit from promotion of soil and channel stability and establishment of riparian vegetation, with improved dissipation of stream energy, water storage, and more stable flow regimes. Riparian vegetation can also maintain cooler temperatures within water bodies by reducing the amount of solar radiation impinging on the water surface. Water quality improvements can also occur from nutrient uptake and storage by riparian vegetation.

Short-term effects to water quality and quantity would be mitigated from riparian, wet meadow, spring, and stream restoration activities, but not eliminated entirely with implementation of design features.. BMPs related to riparian restoration that are protective measures for water quality and quantity include those associated with AMZs and spill prevention and remediation (see water quality and quantity BMPs for general mechanical and prescribed burning). BMPs specifically related to thinning activities in and around these resource areas include: SW59,SW60,SW62,SW63-SW64,SW82,SW96, and SW98-SW102. Design features to reduce adverse effects to water quality and quantity associated with AWFTA restoration activities include: SW27-SW31, SW38,SW43,SW69,SW81-SW82,SW87-SW90,SW92-SW101,and SW105.

Transportation Activities

Transportation activities include: road improvements, temporary road construction, decommissioning of system roads and unauthorized routes, improvement and relocation of system roads.Approximately 5,682 miles of roads currently in the forest system road network would be needed for the activities proposed in the action alternatives. Of this total mileage, 2,076 would be included from the re-opening of maintenance level 1 (ML1) roads. Temporary roads would also be constructed. It is important to note that not all the ML-1 roads will be opened or temporary roads constructed at the same time across the project area. Only those ML1 and temporary roads required for implementation in a certain area would be opened or constructed. These roads would be properly maintained during implementation and closed or decommissioned, following FS policy and design features (see Transportation Report), when they are no longer required for project activities.

Vehicle traffic associated with project implementation, particularly trucks, can pulverize road surface aggregates, resulting in more fine particles that are easily transported in runoff. Additionally, the pressure of vehicular tires on saturated road surfaces can force fine particles from below the surface to move upward to the surface (Truebe and Evans 1994). Runoff from road surfaces can detach and transport the fine material from road prisms and ditches. Road proximity and connectivity to drainages can strongly influence sediment delivery to watercourses and alter flow regimes in streams. Road and stream intersections are the primary locations where sediments are delivered to stream courses. Sediment production from roads diminishes over time after proper closure and non-use (Beschta 1978). Roads induce surface runoff and can alter subsurface flow on hillslopes, and this could affect the magnitude and timing of surface runoff.

No long-term effect on water quality and quantity is expected from the action alternatives with regards to the proposed road activities. In the short term, it is possible that sediment inputs to area watercourses will increase slightly from re-opened roads, constructed temporary roads, or improved roads in the project area. However, all opened roads and temporary roads will be closed and decommissioned, respectively, when they are no longer needed. Short-term effects on water quality would be minimized by employing design features for road decommissioning and rehabilitation, including BMPs (Appendix C) which are effective in preventing sediment from reaching streams when strictly followed.

A total of approximately 800 miles of existing system roads and unauthorized roads would be decommissioned under both action alternatives. Road decommissioning would entail obliteration whereby road surfaces could be ripped and seeded or mulched, inside ditche filled, road prisms outsloped, culverts

and fill materials removed, stream crossings re-contoured, unstable sidecast or cutslopes removed or stabilized, and entrances blocked to prevent future access. These activities would return unproductive acreage to a more stable, productive status over the long term by improving water infiltration, naturalizing water flow, increasing vegetative ground cover, and reducing erosion. Upon completion of road obliteration activities, long-term erosion rates for decommissioned roads would be expected to approach natural erosion rates. Rehabilitation or removal of roads offers benefits including reduced sedimentation and decreased peak flows.

Water quality and quantity protective measures related to transportation activities include design features: SW18, SW83-SW89, SW91, and SW93. Addition design features are included for the Transportation Specialist report.

Rock Pits and In Woods processing sites

Rock Pits

The action alternatives makes use of 10 existing rock pits on the Coconino NF and 11 existing rock pits on the Apache-Sitgreaves NFs. The use of nine of the Coconino rock pits were analyzed Rock Pits Environmental Assessment for the Coconino and Kaibab National Forests (June 2016). The Rim Country EIS analyzes the use of one additional rock pit on the Coconino NF, the Park Knoll rock pit. This analysis includes the use of and potential expansion of 11 existing rock pits on the Black Mesa Ranger District of the Apache-Sitgreaves NF. Since each of the rock pits analyzed is required to be operated so that they have internal drainage, none of the proposed pits or expansion areas would result in sediment outside the boundary of the pit and there would be no direct effect on water bodies. The lower hauling costs associated with having more rock pits closer to activity areas, would result in more miles of roads with better surfacing. This would also limit effects on water quality from roads. Water quality would be expected to remain the same or improve because of the greater number of road miles surfaced and maintained.

The site selection criteria used for rock pits and expansions greatly reduce the potential for effects on waterbodies. Increased truck traffic would create some finer sediment on road surfaces and could increase sediment yield. The main concern with increased sediment yields would be from dust caused by the construction and use of the rock pits and facilities. However, increased sediment yield by itself does not constitute an effect on water quality because the sediments leaving the road would have to enter a water body and in large enough quantities to cause a change in the beneficial uses of that water body.

In-woods Processing Sites

Twelve processing and storage sites are proposed and analyzed for use in the Rim Country EIS, ranging in size from four to 21 acres. These sites were screened so as to be located outside of riparian areas and away from nearby streams where some of the most productive forest soils are found, as well as in relatively flat areas. The siting of processing sites in relatively flat areas would minimize the need for extensive site grading.

In order to facilitate the types of tasks and equipment that may be used at these sites, the sites would typically be required to be cleared and grubbed (i.e., vegetative cover and trees removed), resulting in displacement of top soil and exposure of subsoil. The operation of equipment on these sites would result in compaction of the soil, reducing the ability of soils to infiltrate water. Areas of exposed soil would have to be covered with aggregate to minimize erosion and facilitate use of the site. The aggregate surfacing would cover the surface soil where it is not graded, and would protect soil productivity. Various permits would need to be obtained for fuel storage, industrial site use, and stormwater pollution prevention. These permits would help to minimize effects on soil productivity and function. Aboveground fuel storage tanks would have to be manufactured, installed, and operated in accordance with federal, state, and local

requirements. For example, a permit for installation of an aboveground storage tank would have to be obtained through the Arizona State Fire Marshall's Office). Additionally, the processing sites would likely be regulated as industrial sites subject to permitting under the Arizona Department of Environmental Quality's Multi-Sector General Permit program. This permit program requires that certain industrial facilities, including those involved in the types of activities that would likely occur at the processing sites, implement control measures and develop site-specific stormwater pollution prevention plans to comply with Arizona Pollutant Discharge Elimination System requirements. Among other things, the prevention plan would have to identify best management practices that minimize non-point source water pollution, including measures to minimize or prevent soil erosion and contamination.

Following completion of the use of processing sites and removal of all equipment and materials, site rehabilitation would have to be accomplished, including but not limited to removal of aggregate, restoration of pre-disturbance site grades, de-compaction of soil for seedbed preparation, and seeding and mulching of the site with native grasses and forbs.

The selection criteria for processing sites included the following: flat uplands less than 5% slope; more than 200 feet distant ephemeral and intermittent stream channels, more than 300 feet from meadows, springs and karst features. These selection criteria considerations, in addition to the Rim Country design features for these sites, should greatly reduce the potential for effects on waterbodies.

Water quality and quantity design features addressing rock pits and in woods processing sites include those for spill prevention and remediation (refer to water quality protective design features for general mechanical vegetative treatments and prescribed burning. Additional design features include: SW103 through SW113.

Riparian Resources

Upland Mechanical Vegetative and Prescribed Fire Treatments

. Upland mechanical thinning and prescribed burning treatments should reduce the risks to riparian communities and ecosystem integrity from scorching, and damaging peak flows associated with uncharacteristic wildfire. The effects of wildfire and prescribed burning activities on riparian areas are highly dependent on position of fire within the watershed, proximity to riparian areas, and position relative to mainstream channel and tributaries (Dwire et al., 2016). In general, the hotter a watershed burns, the greater the extent of burning within riparian areas.

In addition, the reduction of canopy cover near riparian areas would stimulate the development of understory vegetation including deciduous woody riparian vegetation (e.g., aspens, willows and cottonwoods). Reductions in upland tree density and the long-term maintenance of open stands and forest openings should respond with increased stream flow, and overall water yield (Brewer, 2008), which in turn would provide longer periods of intermittent stream flow. Increased infiltration resulting from the vegetative treatments would move excess moisture into sub-surface storage and groundwater, resulting in a slower release of water.. Higher-intensity thinning would likely have the greatest potential for groundwater recharge, and stream and spring discharge, by reducing evapotranspiration rates. Increased water availability would support riparian vegetation abundance and vigor, and for stream channels minimize channel bank and bed instability (Fisher et al. 2008) Overall, the long-term effects of these treatmentswould likely improve riparian, stream channel, wet meadow, and spring conditions and functionality more quickly than the no action alternative. Adherence to project design features would limit the extent and degree of effects from mechanical thinning and burning activities both in the uplands and riparian areas. Treatments in AMZs would be limited in scope, space, and time to achieve multiple resource management objectives.

Design Features included to reduce adverse effects to riparian resources during mechanical vegetative activities include: SW49, SW59-SW60,SW62-SW64,SW82,SW95-SW96,SW98-SW102, and SW105. For prescribed burning relevant design features include: SW78 (which relates to riparian condition (PFC ratings), SW98, and SW105. The Fire Specialist report contains additional relevant design features.

Riparian, Wet Meadow, Spring, and Stream RestorationThinning activities and prescribed burning activities targeted for riparian resources including in around streams, wet meadows, and springs will have effects similar to those described in the prior section on effects to riparian resources from upland mechanical vegetative and prescribed fire treatments. Leaving riparian areas untreated and with higher fuel loading, while treating fuel loading in the uplands can produce high fire severities in these areas (Dwire et al., 2016). These higher severities can reduce riparian vegetation abundance and diversity and take several decades to recovery to pre-fire conditions.

Treatments can also produce other desirable effects such as potentially more groundwater and surface water to be available to promote riparian vegetation abundance and vigor. As stated previously adherence to project design features would limit the extent and degree of effects from mechanical thinning and burning activities both in the uplands and riparian areas. Treatments in AMZs would be limited in scope, space, and time to achieve multiple resource management objectives.

Activities included in the the Aquatics and Watershed Flexible Toolbox Approach (AWFTA) would directly improve riparian conditions and functionality associated with stream channels and banks with stabilization techniques, and intensive treatments that modify stream sinuosity, width/depth ratio, and gradient. Grade control structures are useful for reconnecting stream channel and floodplains, reducing degrading stream energy and aggrading entrenched systems. Vertical instabilities such as seadcuts can adversely affect riparian vegetation by scouring away of plants and soils and lowering of the water table..Reduction of bank erosion would increase stream stability and moisture-holding capacity of hydric soils, improving conditions for riparian vegetation production. Degraded wet meadows could be restored by transplanting native herbaceous species,and reposing steep banks. Upland soil stabilization would be completed at sites where soil conditions are contributing to gully formation. Stabilization techniques would include hand or mechanical installation methods, depending on site needs, access, and other resource concerns. Native vegetation would be expected to reestablish in these areas soon after restoration activities are completed (from one to three years). Additional benefits would include reduced susceptibility of sites to invasion by noxious weeds with the increased native vegetation recruitment over time. In some areas, riparian vegetation production would be augmented with planting of riparian herbaceous and woody species appropriate to those locations. Protective barriers around riparian areas would reduce the browsing and trampling effects from large ungulates, since continued heavy to extreme use of woody species could limit plants' ability to regenerate (Winward 2000).

Strict adherence to design features in Appendix C would minimize potential water quality effects. Protective measures for riparian resources as related to AWFTA activities include design features: SW69,,SW82,SW96,SW98,SW100, and SW105.

Transportation Activities

Transporation activities include: road improvements, temporary road construction, decommissioning of system roads and unauthorized routes, improvement and relocation of system roads.

Riparian areas, wetlands, stream channels and springs would not be directly affected by temporary road construction as it is prohibited in or near these resources in the project design features (Appendix C). Additionally, indirect effects are expected to be minimal. Poorly located roads and unauthorized routes

can degrade soil conditions and cause channel instabilities resulting in excess erosion and deposition which may affect riparian diversity, extent, and vigor. Decommissioning of FS system roads and user-created roads could improve functionality of riparian areas, stream channels, wetlands, and springs.

Design features related to transportation which are protective to riparian resources include:SW18,SW83-SW84,SW86, and SW88.

Rock Pits and In Woods processing sites

The selection criteria of processing sites included the following: flat uplands less than 5% slope, more than 200 feet from ephemeral and intermittent stream channels, and more than 300 feet from meadows and springs. These considerations, in addition to other relevant design features, should greatly reduce the potential for effects on adjacent riparian resources.

Effects Unique to Each Action Alternative and Differences Among Them

Water Quality and Quantity

General mechanical treatments and prescribed fire

The effects of general mechanical treatments and prescribed fire, including treatments in savannahs, to water quality and quantity described in the Effects Common to all section, and apply to this section. Acres of mechanical and fire treatments differ between the action alternatives, with 817,870 and 427,786 acres proposed for Alternatives 2 and 3, respectively. This amounts to a 48 percent difference. The difference in acres of mechanical treatment and burning in savannah vegetation types shows an even greater difference, with 54,890 proposed in Alternative 2 and 38,790 proposed in Alternative 3. This is a 28percent difference. Prescribed fire only acres are also lower in Alternative 3, with 40,630 acres proposed as compared to 54,070 acres in Alternative 2, a 26 percent difference.

For water quality, the short term effects of Alternative 3 as compared to Alternative 2, would be a potential decrease in the amount of sediment reaching waterbodies from ground-disturbing activities, such as from mechanical vegetation treatments and prescribed burning. However, in the long-term, Alternative 3 would likely result in decreased long-term water quality benefits, from decreased upland treatment acres currently not meeting desired conditions due to departures in vegetation and fuel composition. Both alternatives would maintain compliance with the Clean Water Act through strict adherence to design features.

Regarding water quantity, Alternative 2 with more treated acres could promote increased water yield, more stable hydrologic flow regimes, and increased discharge downstream. Springs would likely received more groundwater recharge, promoting increased discharge.

Road Activities

The difference between the action alternatives is the proposed number of miles of temporary roads. More miles of temporary roads would be needed for Alternative 2 because more acres are proposed for mechanical treatments and prescribed fire. Up to 330 or 170 miles are proposedfor implementation of Alternatives 2 and 3, respectively, a 49 percent difference. In the short-term, a greater number of temporary roads over the project area will remove more vegetation, exposing and compacting more bare soil, potentially leading to increased concentrated flows and sediment delivery to waterbodies. It should be noted that a potential increase in the magnitude or duration of effects from a greater number of temporary roads will likely be spread over a larger geographical area, including many additional

watersheds, thus in essence spreading out or diluting potential effects. Overall, the effect of temporary road in either action alternativeeffects will be minimized with the use of road erosion control design features (Appendix C). In addition, all temporary roads will be decommissioned through obliteration and rehabilitated as return the road footprint to as natural condition as much as possible upon nonuse, thusmitigating potential long-term effects.

Riparian and Wetland Resources

General mechanical treatments and prescribed fire including treatments in savannahs

The general effects of mechanical treatments and prescribed fire, including treatments in savannahs, on riparian and wetland resources are described in the Effects Common to all section, and apply to this section. Acres of mechanical and fire treatments differ Alternatives 2 and 3, amounted to a 48 percent difference. The difference in mechanical and prescribed burning treatment acres was 28 percent comparing Alternatives 2 to Alternative 3 Prescribed fire only acres between the action alternatives resulted in a 26 percent difference.

As these proposed treatments are primarily upland treatments, direct effects on riparian and wetland resources are not expected. With regards to indirect effects, the additional treatment acres proposed in Alternative 2 as compared with Alternative 3, would bring more acres towards desired conditions.. This will reduce the potential for riparian impairment from upland watershed conditions.. Alternative 2 would to a greater proportional extent promote longer periods of intermittent stream flow and groundwater recharge available to spring systems by bringing upland tree densities and forest openings to desired conditions. This would in turn support riparian vegetation vigor and wetland functionality.

Road Activities

Regarding roads, the difference between the action alternatives is in the proposed number of miles of temporary roads. More miles of temporary roads are requiredfor Alternative 2 because more acres are proposed for mechanical and prescribed fire treatments. Up to 330 are proposed for implementation of Alternatives 2, a 49 percent increase, as compared toAlternative 3 with proposed 170 miles.. With fewer miles of temporary roads proposed, there is likely less potential for negative effects to riparian and wetland resources with Alternative 3. Poorly located and high road densities can concentrate surface flow potentially causing increased peak flows damaging to these resources. The potential affects of temporary roads on riparian, spring, and wetland resources will be minimized with the design features included in Appendix C. Specific design features which includethe use of aquatic management zones, would be employed to protect these sensitive areas in both action alternatives. No temporary roads are to be located in close proximity (as defined as the AMZ width) to these resources. When no longer required for treatments, temporary roads are to be decommissioned through obliteration, and road footprints rehabilitated as to be returned to as natural condition as possible. The number of miles of Forest Service managed roads would return to pre-implementation numbers or those determined through the travel management rule (TMR) process. Thus, changes in open road density would be temporary, most likely 2 years or less.

Cumulative Effects Analysis

Watershed Condition Framework

The cumulative effects analysis for water quality and quantity, and riparian/wetland condition was completed at the HUC12 (subwatershed) scale using the Watershed Condition Framework. Watershed

condition is defined as the state of the physical and biological characteristics and processes within a watershed that affect the hydrologic and soil functions supporting aquatic ecosystems (USDA, 2011). As described earlier in the report, watershed condition scores are based on 12 indicators composed of attributes related to watershed processes. This analysis qualitatively describes the potential changes in the relevant indicators and, consequently, the watershed condition scores in relation to: 1) the effects from past, present, and reasonable foreseeable activities in the watersheds, and 2) the effects that would be expected with implementation of the alternatives for the Rim Country Project. Table 23 presents a relativistic comparison of effects between the alternatives. Activities and events which are at a scale and magnitude that could affect watershed condition indicators include but are not limited to: riparian, stream, and spring restoration; road decommissioning; wildfire and prescribed fire; mechanical thinning; and grassland restoration.

Table 23. Summary of Cumulative Effects by Watershed Condition Framework Indicators

TIME PERIOD			
PAST ACTIONS AND EVENTS			
Watershed Condition Indicator	**Effect on Indicators**		
Water Quality and Quantity, Riparian and Wetland Vegetation Condition	Watershed condition indicator ratings originally developed in 2010 incorporating past activities and events, such as wildfire, vegetative treatments, road management, prescribed burning, range management etc. up until2010. Some watershed ratings were updated in 2012.		
PRESENT AND REASONABLY FORESEEABLE ACTIONS			
Water Quality and Quantity, Riparian and Wetland Vegetation Condition	Maintenance or improvement with vegetation treatments, road management, and prescribed burning, springs and wetland restoration, and proper grazing management. Potential declines due to wildfire.		
PROPOSED ACTION AND NO ACTION			
	Alternative 1 No Action	**Alternative 2**	**Alternative 3**
General and Comprehensive Mechanical Forest Vegetative Treatments and Prescribed Burning			
Water Quality, Water Quantity, and Riparian/Wetland Condition	No Benefit or Potential Decline	Greatest Potential for Improvement	Maintenance or Improvement
Riparian and Stream Restoration			
Water Quality, Water Quantity, and	No Benefit or Potential Decline	Greatest Potential for Improvement	Same as Alternative 2

Riparian/Wetland Condition			
Roads improvements- temporary road construction, decommissioning of system roads and unauthorized routes, improvement and relocation of system roads			
Water Quality, Water Quantity, and Riparian/Wetland Condition	No Benefit or Potential Decline	Improvement	Similar to Alternative 2
ROCK PITS AND IN WOODS PROCESSING SITES			
Water Quality, Water Quantity, and Riparian/Wetland Condition	Minimal to no change	No change	No change

Past activities and events for a 25-year period ending in 2010 were considered in development of the initial watershed condition ratings in 2010. As discussed in the existing condition section, the majority (58 percent) of HUC12 subwatersheds had Riparian/Wetland Vegetation Condition indicator ratings of "Fair", 27 percent had "Poor" ratings, and 15 percent had "Good" ratings. For the Water Quality indicator, 70 percent of subwatersheds were rated "Good" , whereas 24 and 6 percent were rated "Fair" and "Poor," respectively. It should be noted that there are currently no waterbodies within the Rim Country project area that are impaired from excess suspended sediment concentrations, which would be the primary impairment of concern for the activities proposed in the action alternatives. Water Quantity indicator ratings were 15, 37, and 48 percent for "Poor", "Fair", and "Good", respectively.

Past management activities which have been completed within Rim Country subwatersheds are presented in Appendix D, Table 1. Most of these projects are vegetative treatments involving either burning or thinning restoration treatments.

Present (current/ongoing) activities are those that are currently being planned or implemented. Appendix D, Table 2 provides a list of these projects. Consistent with past activities, present activities mostly involve mechanical treatments and prescribed burning. Also included are reforestation, spring and meadow restoration, and noxious weed and vegetative management along transmission lines. Reasonably foreseeable activities include those that are anticipated now and for 25 years into the future and include projects with completed NEPA (planned) and those still in the planning process. Appendix D, -Table 3 incudes a list of these projects. Some of the more relevant projects include mechanical thinning in the Cragin Watershed Protection Project, the Rodeo Chediski Mastication Project, and several large prescribed burning projects such as the Haigler Fuels Analysis. Several woodland, grassland, and spring restoration projects are also proposed in the Heber, Pleasant Valley, and Northwest Grazing Allotments analyses and the Mogollon Rim Spring Restoration Project. The percentages of subwatersheds managed by the Forest Service covered (proportional extent) by current and reasonably foreseeable projects and activities are shown in Appendix D Table 4. Sixty-nine percent of subwatersheds have up to 25 % coverage by other projects. Approximately eight percent of subwatersheds are covered from 25 to 50 percent by other activities and projects, and about five percent are covered from 50 to 75 percent. Seventeen percent of Rim Country subwatersheds are covered 75 percent or more by other projects.

Cumulative effects from livestock grazing include minor, generally localized soil compaction, puddling, displacement and erosion from livestock trailing and in areas where animals congregate such as livestock waters and areas where mineral supplements are placed. Livestock trails make up a very small portion of the total project area and therefore have a negligible effect on soils or watershed condition.

These projects, with the exception of travel management, include restoration activities through the use of prescribed fire or mechanical treatments. Coupled with similar fuels reduction and vegetative treatments in the action alternatives for the Rim Country Project, these activities will maintain or potentially improve many of the Water Condition Framework indicators. Other projects in the planning stage include the A-S NFTravel Management Rule (TMR) with an expected decision in 2020. The TNF is also in the process of finishing a TMR DEIS. The rule will likely result in reduced road density, in a fewer roads crossing drainages and riparian areas, and in keeping road users in designated areas. These activities would be consistent with the Rim Country Project objects of improving Water Quality, Water Quantity, and Riparian/Wetland Vegetation Condition indicators.

Superimposed on the past, present, and reasonably foreseeable activities are the effects with respect to the full implementation of the action alternatives. A comparison of the proportional extent of subwatersheds (those acres administered by the USFS), is displayed in Appendix D Table 5. Sixty-seven percent of Rim Country subwatersheds could receive up to 25 percent additional mechanical and prescribed fire treatments acres in Alternative 2 as compared toAlternative 3. Increases between 25 and 50 percent would occur in seventeen percent more subwatersheds in Alternative 2. Increases ranging from 50 to 75 percent and 75 to 100 percent would occur in 11 percent and 5 percent of subwatersheds, respectively, with Alternative 2 as compared toAlternative 3. These numbers suggest that the Water Quality, Water Quantity, and Riparian/Wetland Vegetation Condition indicators would benefit from either alternative, more so with Alternative 2, by moving upland vegetation towards desirable vegetation structure and composition and desirable fuel composition, and by restoring natural fire regimes with mechanical treatments and prescribed fire. Bringing stands to desired cover conditions would reduce the risk of crown fire and the resulting undesirable loss of forest and ground cover, while stimulating vigorous herbaceous plant growth and promoting infiltration rates, reduced overland flow, and overall stable hydrologic and sediment regimes. The proper temporal (timing and frequency) and spatial planning, so as not to overlap treated areas still recovering from previous treatments and wildfire, are important factors for reaching desired conditions.

Stream and riparian restoration activities would promote maintenance or improvement of Water Quality, Water Quantity, and Riparian/Wetland Vegetation Conditions indicators by bringing these systems to desired conditions through stream and wetland stabilization, riparian planting and protection. The activities proposed in the Aquatics and Watershed Flexible Toolbox Approach, including stabilization structures, and riparian planting, would improve stream, riparian, and wetland conditions by bringing these systems closer to desired conditions. Improving stream channel functionality would promote stable hydrologic and sediment regimes, improving dissipation of flood energy, bank storage, and geomorphic maintenance. Barriers around riparian areas and springs would improve riparian vegetation survival and vigor, and protectvegetation from browsing and trampling by large ungulates.

The total miles of stream restoration by HUC12 subwatershed are location Appendix D- Table 6. The highest percentage of streams proposed for restoration treatments are in subwatersheds with a Water Quality indicator rating of “Good,” a Water Quantity indicator rating of “Fair,” and a Riparian/Wetland Vegetation Condition indicator rating of “Fair” (Table 24). The lowest percentage (seven percent) of streams proposed for restoration are in subwatersheds with Water Quantity and Riparian/Wetland Vegetation indicator ratings of “Good.”

Table 24. Percentage of proposed stream restoration treatment miles by overall watershed indicator ratings.

Water Condition Framework Indicators	Percentage of proposed stream restoration treatments		
	Fair	Good	Poor
Water Quantity	61%	7%	32%
Water Quality	11%	58%	31%
Riparian/Wetland	61%	7%	32%

Wildfires also can have a profound effect on Watershed Condition Framework indicators. Wildfires in Rim Country subwatersheds are included in Appendix D, Tables 7 and 8, for two time periods, 25 years prior and up to the last re-scoring of the Watershed Condition Framework in 2012 (Table 6a), and after that to the present (Table 6b). Over the past 25 years, 54 percent of Rim Country HUC12 subwatersheds burned over less than 25 percent of their total area administered by the USFS. Twenty-one percent of these watersheds burned from 25 to 50 percent of their total area, and 11 percent burned from 50 to 75 percent of their total area. Fourteen percent of the Rim Country subwatersheds burned over 75 percent. Some of the recent larger fires include the Snake Ridge, Juniper, San Juan, and Highline Fires. It should be noted that although wildfires burned over considerable proportions of many watersheds, it is the proportion of high and moderate burn severity, not reflected in these numbers, that is important relative to Watershed Condition Framework indicators. Wildfire is a natural disturbance for forest ecosystems, and frequent fire intervals are expected in most ecotypes within the Rim Country project area. A mosaic of burn intensities that are predominately on the lower end are desirable.

Roads can also affect watershed condition. Too many or poorly located roads can directly or indirectly cause loss effects such as increased surface flows, loss of soil productivity, soil erosion, and increased sediment delivery, which can cause unstable water flow regimes, degrade water quality, and riparian and wetland condition, Although roads can directly affect water quality and quantity, and riparian vegetation condition, they are included as a standalone indicator, the Roads and Trails indicator, in the Watershed Condition Framework. The Roads and Trails indicator only takes into account open system roads and trails and therefore by design would not necessarily be appropriate to capture temporary increases in road density from opening of maintenance level 1 roads and construction of temporary roads. All open roads and their potential effects on Water Quality, Water Quantity, and Riparian/Wetland Vegetation indicators have been built into the current watershed condition indicator scores. The design features in Appendix C would restrict the location of temporary roads in order to minimize short-term watershed effects. Although maintenance level 1 roads are opened, there is a reasonable degree of certainty that these roads are not currently causing, nor will into the future cause resource effects. This assumption is in part based on the ongoing Travel Management Rule processes on the three Rim Country forests, with one decision signed and in the implementation phase and the other two pending. The Travel Management Rule process involves analyzing and proposing decommissioning of Forest Service System roads causing resource concerns. Given the number of roads and trails proposed for decommissioning in the Rim Country Project, it is likely that some watershed indicators and overall scores would improve the next time Watershed Condition Framework scores are updated.

Changing a watershed condition class would, in most cases, require changes in a watershed that are substantial in their scope and include treatments for multiple resources. However, all indicator scores are expected to be maintained or improved with the multitude of past, present, and reasonably foreseeable actions combined with the activities proposed in these action alternatives. Although future watershed restoration activities are expected to have long-term benefits to watershed condition, the intensity of coincidental watershed activities (too large a proportion of a watershed over too short a time) could potentially lead to negative effects. Specific design features, SW 78 and SW 80, for treatments proposed in the Rim Country Project are included in Appendix C to avoid negative effects associated with the temporal and spatial intensity of treatments during implementation.

Monitoring Recommendations

In order to ensure that desired conditions are achieved and remain consistent with the A-SNF, CNF and TNF Forest Plans, monitoring of soil disturbance caused by timber harvesting; use of prescribed fire; precommercial thinning (both mechanized and non-mechanized); road construction, maintenance and obliteration; and commercial and personal fuelwood gathering is advised. Best Management Practices (BMP) implementation monitoring and soil disturbance monitoring should be conducted following treatment activities in order to ensure proper implementation of BMPs to prevent soil erosion and delivery of sediment and other pollutants to waterbodies and to ensure activities are consistent with Forest Plans Standards and Guidelines.

Implementation and effectiveness monitoring for the project will be integrated into the forest's National Best Management Practices (BMP) program. This program was developed to improve management of water quality consistent with the Federal Clean Water Act (CWA) and State water quality programs (http://www.fs.fed.us/biology/watershed/BMP.html). The implementation part of the evaluation is intended to answer the overall question of "Did we do what we said we'd do?" relative to protecting water resources and meeting CWA objectives. The effectiveness part of the evaluation is intended to answer the question "Were we effective at controlling nonpoint source pollution?" Monitoring is completed using protocol evaluation forms available on the National BMP Monitoring Website http://fsweb.wo.fs.fed.us/wfw/watershed/national_bmps/bmp_docs.html. A National BMP database is populated with data from all the completed evaluation forms. Reports are generated with 'implementation', 'effectiveness' and 'composite' ratings for every evaluation entered. Results of BMP monitoring will be forwarded to ADEQ in the Annual Assessment of Water Quality Accomplishment Report to be completed by the Supervisor's Office due in September of each year. In addition, an annual report is generated summarizing monitoring results for the forest. BMPs that are found to be ineffective in protecting identified resource, aquatic and water quality goals will be adjusted. Poor performance in BMP implementation will be documented and forwarded to the Districts for corrective action.

Adaptive management is built into the Aquatic and Watershed Flexible Toolbox approach and would allow for implement of the most appropriate treatment(s) to achieve the objectives of the project and move towards desired conditions. If a treatment monitoring indicates undesirable effects are occurring or is not achieve treatment goals, treatments can be modified and/or other treatments solutions from the toolbox implemented.

A recommended soil and watershed monitoring plan for mechanical vegetation treatments and prescribed burning is summarized below.

Phase 1 – During Mechanical Vegetation treatments (where applicable)

The timber sale administrator will monitor the implementation of BMP's during timber harvesting activities. Notes taken by the timber sale administrator will be used to track any issues or problems with BMP implementation. The Forest Soils and Watershed Specialists will provide assistance as needed by the timber sale administrator to provide clarification of BMP's specified in the Environmental Impact Statement (EIS).

Phase 2 – Timber Sale Closure

The timber sale administrator will verify that the timber sale purchaser has implemented all erosion control measures prior to the closure of the timber sale. Primary responsibility will be that of the timber sale administrator with assistance from the Forest Soils and Watershed Specialists if needed.

Phase 3 – Broadcast and Pile Burning

The District Fire Management Officers will verify that all erosion control measures associated with all burning activities has been implemented. The Forest Soils and Watershed Specialists will provide assistance, if needed.

Phase 4 – Effectiveness Monitoring

Within the first 5 years following timber sale closure, BMP's are evaluated for effectiveness. Monitoring will concentrate on such items as erosion control measures for skid trails, log landing or decking areas, road maintenance, road obliteration, and burned areas. The Forest Soils and Watershed Specialists will conduct a soil condition evaluation within treatment units. The focus of evaluations will be on such items as vegetative ground cover, coarse woody debris, soils erosion, soil compaction, and soil displacement. All monitoring results should be documented. Primary responsibility is with the District Ranger and the Forest Soils and Watershed Specialists.

Phase 5 – Follow Up

Documented information obtained from monitoring is used to adjust BMP's as necessary, to improve implementation and effectiveness of BMP's. Information regarding monitoring results and recommended changes to BMP's will be made available to the Arizona Department of Environmental Quality (ADEQ) for review as specified in the Intergovernmental Agreement between the State of Arizona and U.S Department of Agriculture, Forest Service Southwestern Region. Primary responsibility is with the District Ranger and the Forest Soils and Watershed Specialists.Short-term Uses and Long-term Productivity

Disturbance of soils associated with the proposed project activities including ground based harvesting operations, and the temporary opening of closed Forest Service ML-1 roads and construction of temporary roads may affect soil condition through compaction and displacement. This intern may have limited short term effects water quality and quantity, and riparian resources. However, soil condition is expected to recover fairly quickly after completion of these disturbances given strict adherence to Resource Protection Measures for this project. With the decompaction of soils over time with improved

water infiltration, and return of herbaceous cover, overall water flow and sediment regimes and riparian condition will likely be improved as compared to the predisturbance conditions.

Compliance with Forest Plan and Other relevant Laws, Regulations, Policies and Plans

Alternative 1 may comply with law, regulations, policies, however may not comply Forest Plans because the forests would not taking actions to move towards desired conditions and not meet plan objectives. Alternatives 2 and 3 would comply with the law, regulation, and the Forest Plans. Progress towards desired conditions for water resources and riparian/wetland areas, and watersheds as a whole will not improve unless many of the activities within the proposed action are implemented. These actions include improving of forest health through vegetative treatments, both mechanically and with prescribed fire, and implementation of stream, riparian, wetland, and spring restoration projects. As with all ground disturbing activities there will be short-term localized adverse effects, such loss of vegetative cover, soil compaction, soil erosion and subsequent increased sediment production and delivery to water bodies. However, maintenance of long-term effects will be beneficial to water and riparian resources and watershed resources as a whole. Short-term effects will be minimized or eliminated with the design features. These design features will ensure compliance with law, regulations, and the Forest Plan components with both action alternatives. A list of soil and water design features, including best management practices (BMPs), for soil, riparian, and water resources is located in Appendix C.

The Legal Basis for BMPs

In 1972, the Federal Water Pollution Control Act (FWPCA) Amendments became law. The Clean Water Act (CWA) amended the original document with further modifications occurring in the Reauthorization Act of 1987. Together, these documents provide the authority to manage water quality on Forest Service lands with the objective to restore and maintain the chemical, physical and biological integrity of the nation's waters. Section 319 of the amended CWA provides authority for each state to prepare a non-point source (NPS) water quality management program that includes cooperation with Federal agencies.

Section 208(b)(2)(F)-(K) of the Clean Water Act (CWA) requires the development of a State process to identify, if appropriate, agricultural, silvicultural and other nonpoint sources of pollution and to set forth procedures and methods, including land use requirements, to control to the extent feasible such sources.

Section 319(a)(1) to the CWA [as amended by the Water Quality Act of 1987] requires each State to:

Identify its navigable waters which, without additional action to control nonpoint sources of pollution, cannot reasonably be expected to attain or maintain applicable water quality standards or the goals and requirements of the Act.

Identify those categories of nonpoint sources or, where appropriate, particular nonpoint sources which add substantial pollution in amounts which contribute to such navigable waters not meeting water quality standards or the Act's goals and requirements.

Describe the process, including intergovernmental coordination and public participation, for identifying Best Management Practices (BMPs) and measures, to control those nonpoint sources identified, and to reduce to the maximum extent practicable, the level of pollution from such nonpoint sources.

Identify and describe State and local programs for controlling pollution added from nonpoint sources to, and improving the quality of, each such portion of the navigable waters, including but not limited to those programs which are receiving Federal assistance under subsection 319(h) and (i).

It is recognized that BMPs are the primary mechanism to enable the achievement of water quality standards. The State water quality plan should include identification of the process by which nonpoint source controls, including BMPs are selected to achieve water quality standards. The process should include: (1) design of BMPs based on site-specific conditions, technical, economic and institutional feasibility, and the water quality standards of those waters potentially impacted; (2) monitoring to ensure that practices are correctly designed and applied; (3) monitoring to determine: (a) the effectiveness of practices in meeting water quality standards, and (b) the appropriateness of water quality criteria in reasonably assuring protection of beneficial uses; and (4) adjustment of BMPs when it is found that water quality standards are not being protected to a desired level and/or possible adjustment of water quality standards based on considerations in 40 CFR 131" EPA Document, EPA-823-B-94-005a (SAM 32).

It is intended that proper installation of State approved BMPs will achieve water quality standards. Therefore, water quality standards are to be used to measure the effectiveness of BMPs" EPA-823-B-94-005a (SAM 32).

Once BMPs have been approved by the State, the BMPs become the primary mechanism for meeting water quality standards. Proper installation, operation and maintenance of State approved BMPs are presumed to meet a landowner's or manager's obligation for compliance with applicable water quality standards (emphasis added). If subsequent evaluation indicates that approved and properly installed BMPs are not achieving water quality standards, the State should take steps to: (1) revise the BMPs (2) evaluate and, if appropriate, revise water quality standards (designated beneficial uses and water quality criteria) or both. If BMPs are revised, the landowner or manager is expected to begin implementing such BMPs. Through the iterative process of monitoring and adjustment of BMPs and/or water quality standards, it is anticipated and expected that BMPs will lead to achievement of water quality standards" EPA-823-B-94-005a (SAM 32).

As part of that cooperation the states have recognized the Forest Service as a designated management agency for NPS water quality management. They have recognized our Integrated Resource Management (IRM) process for developing BMPs to control NPS water pollution on FS lands.The Arizona Department of Environmental Quality (ADEQ) and USDA Forest Service, Southwest Region, have an agreement[7] that states the Forest Service will endeavor to minimize and mitigate all potential non-point source pollution activities. The agreed upon method to mitigate impacts is to implement and monitor Best Management Practices (BMPs), or in Arizona, Guidance Practices. The Southwest Region, Forest Service, develops site specific Soil and Water Conservation Practices (Soil and Water Conservation Handbook, FSH 2209.18) to accomplish this goal. Soil and water conservation practices are interchangeable with the term Best Management Practices (BMPs) within this document.

Short-term Uses and Long-term Productivity

Although the activities proposed in the action alternative may produce short-term (1-3 years) impacts to water and soil resources, overall long-term productivity moving these resources to desired conditions is expected to increase.

[7] USDA-FS/ADEQ. 2013 Memorandum of Understanding between USDA Forest Service, Southwestern Region and the State of Arizona Department of Environmental Quality.

Unavoidable Adverse Effects

The activities proposed in the action alternatives are expected to produce short-term effects to water and riparian resources. Both action alternatives may result in more bare ground, loss of vegetative groundcover, and additional sediment detachment and mobilization. These adverse effects will be minimized with adherence to the design features listed in Appendix C.

Irreversible and Irretrievable Commitments of Resources

There are no expected irreversible and irretrievable commitments with regards to water and riparian resources associated with the activities proposed in the action alternatives.

Acronyms

ADEQ – Arizona Department of Environmental Quality

AMZ – Aquatic Management Zone

AWFTA- Aquatic and Watershed Flexible Toolbox Approach

A-S NF – Apache-Sitgreaves National Forests

BMP – Best Management Practice

CAG – Central Arizona Grotto

CNF – Coconino National Forest

CFR – Code of Federal Regulations

CWA – Clean Water Act

DC – Desired Condition

DEIS-Draft Environmental Impact Statement

EPA – Environmental Protection Agency

FAR – Functional at Risk

FS – Forest Service

FSH – Forest Service Handbook

GL - Guideline

HRV – Historic Range of Variability

IDT- Interdisciplinary Team

IPCC – Intergovernmental Panel on Climate Change

LRMP – Land Management Plan

ML-Maintenance Level

NF - Nonfunctional

NFS – National Forest Service

NPS- Non-point Source

OBJ – Objective

PFC – Proper Functioning Condition

SEAP – Spring Ecosystem Assessment Protocol

SSI – Spring Stewardship Institute

ST – Standard

TES- Terrestrial Ecosystem Survey

TNF – Tonto National Forest

TMDL- Total Maximum Daily Load

TMR- Travel Management Rule

USFS – United States Forest Service

WCF – Watershed Condition Framework

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Appendix A Spring and Seeps

Table 1. Springs and Seeps

SiteID	SiteName	Township	Range	Section	Quarter Section	LandUnitDetail	SpringType1	SpringType2
72	Foster Spring	0160N	0080E	016	NWSE	Coconino NF, Mogollon Rim RD	hillslope	
139	Campbell Spring	0160N	0080E	027	SWNW	Coconino NF, Mogollon Rim RD	hillslope	
143	Clover Spring east	0130N	0090E	023	NWNE	Coconino NF, Mogollon Rim RD		
144	Pivot Rock Spring	0130N	0090E	028	NWNE	Coconino NF, Mogollon Rim RD	cave	
145	Pieper Hatchery	0120N	0100E	011	ALL	Tonto National Forest	rheocrene	
162	Clover Spring West	0130N	0090E	023	NWNE	Coconino NF, Mogollon Rim RD	hillslope	
392	Dane Spring	0130N	0110E	035	NWSE	Coconino NF, Mogollon Rim RD	hillslope	anthropogenic
393	West Moonshine Spring	0130N	0110E	026	NESE	Coconino NF, Mogollon Rim RD	hillslope	
411	Merritt Springs	0120N	0110E	003	NESW	Coconino NF, Mogollon Rim RD	exposure	
412	Whistling Springs	0120N	0110E	004	SESE	Coconino NF, Mogollon Rim RD	hillslope	
413	FS139C Spring Pond	0120N	0110E	009	SWNE	Coconino NF, Mogollon Rim RD	limnocrene	
414	Barbershop Springs	0120N	0110E	009	NWSE	Coconino NF, Mogollon Rim RD	hillslope	
416	Cliffside Springs	0120N	0110E	010	SWSW	Coconino NF, Mogollon Rim RD	hillslope	
418	Lower Buck Spring	0120N	0110E	012	NENE	Coconino NF, Mogollon Rim RD	exposure	

419	Poverty Spring	0130N	0100E	030	SENW	Coconino NF, Mogollon Rim RD	hillslope	
421	Upper Buck Spring High	0120N	0110E	013	SWSW	Coconino NF, Mogollon Rim RD	hillslope	
422	Upper Buck Spring	0120N	0110E	013	NESW	Coconino NF, Mogollon Rim RD	hillslope	
423	Dora Springs	0120N	0110E	014	NENE	Coconino NF, Mogollon Rim RD	hillslope	
424	Morningcloak Springs	0120N	0110E	011	SESW	Coconino NF, Mogollon Rim RD	hillslope	
425	Moonshine Spring	0130N	0110E	036	NWNW	Coconino NF, Mogollon Rim RD	Helocrene	
426	Bone Dry Springs	0130N	0100E	027	NESW	Coconino NF, Mogollon Rim RD	hillslope	
427	Hidden Spring	0120N	0110E	010	NWSW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
428	McClintock Spring	0130N	0110E	026	NENW	Coconino NF, Mogollon Rim RD	hypocrene	
429	Hi Fuller Spring	0130N	0100E	035	SENW	Coconino NF, Mogollon Rim RD	Helocrene	exposure
430	General Springs	0120N	0100E	001	L 3	Coconino NF, Mogollon Rim RD	exposure	Helocrene
432	Lockwood Spring	0130N	0110E	001	L 3	Coconino NF, Mogollon Rim RD	exposure	
433	Coldwater Spring	0130N	0100E	028	NWNW	Coconino NF, Mogollon Rim RD	rheocrene	hypocrene
435	Quail Spring	0130N	0110E	010	SWNE	Coconino NF, Mogollon Rim RD	exposure	
437	Coyote Spring	0120N	0110E	011	NENE	Coconino NF, Mogollon Rim RD	exposure	hillslope
438	Big Moqui Spring	0140N	0110E	021	SWNW	Coconino NF, Mogollon Rim RD	hillslope	
439	Royal Bull Springs	0120N	0110E	014	NWNE	Coconino NF, Mogollon Rim RD	hillslope	

475	Lara Springs	0130N	0110E	034	SWSE	Coconino NF, Mogollon Rim RD	hillslope	exposure
492	Pinchot Springs Channel	0130N	0110E	021	SWNW	Coconino NF, Mogollon Rim RD	rheocrene	
543	Quien Sabe Spring	0130N	0110E	020	NWNW	Coconino NF, Mogollon Rim RD	hillslope	
544	Monkshood Spring	0120N	0110E	011	NENW	Coconino NF, Mogollon Rim RD	hillslope	
545	Hunter Springs	0140N	0110E	028	SWNE	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
546	Keller Spring	0130N	0100E	027	NWNE	Coconino NF, Mogollon Rim RD	hillslope	
547	Dry Spring	0130N	0100E	027	SWNE	Coconino NF, Mogollon Rim RD	hillslope	
548	Monongye Spring	0130N	0100E	027	SWNE	Coconino NF, Mogollon Rim RD	hillslope	
549	Drier Spring	0130N	0100E	027	NWSE	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
550	Lower Quail Spring	0130N	0110E	010	NWNE	Coconino NF, Mogollon Rim RD	cave	
551	Pinchot Springs West	0130N	0110E	020	SENE	Coconino NF, Mogollon Rim RD	cave	
552	Pinchot Springs East	0130N	0110E	021	SWNW	Coconino NF, Mogollon Rim RD	cave	
558	Quail Spring lower	0130N	0110E	010	SWNE	Coconino NF, Mogollon Rim RD		
575	Roaring Spring	0130N	0100E	027	SENW	Coconino NF, Mogollon Rim RD	hillslope	
576	Black Bear Spring	0120N	0110E	011	NENW	Coconino NF, Mogollon Rim RD	helocrene	helocrene
577	Cut Stump Spring	0120N	0110E	002	SESW	Coconino NF, Mogollon Rim RD	hillslope	
578	One Hundred One Spring	0130N	0090E	025	SWNW	Coconino NF, Mogollon Rim RD	gushet	

590	Huffer Spring	0130N	0090E	034	SWSW	Coconino NF, Mogollon Rim RD	Helocrene	
591	Windfall Spring	0130N	0090E	035	SENW	Coconino NF, Mogollon Rim RD	Helocrene	
592	Long Valley south lower	0130N	0100E	018	SENW	Coconino NF, Mogollon Rim RD	rheocrene	
593	Clover Spring	0130N	0090E	023	NWNE	Coconino NF, Mogollon Rim RD	rheocrene	
594	Little 44 Upper	0130N	0090E	026	NWSW	Coconino NF, Mogollon Rim RD	rheocrene	
595	Paul Spring	0120N	0090E	010	NWSE	Coconino NF, Mogollon Rim RD	hillslope	
596	Patton Spring	0120N	0090E	011	NENE	Coconino NF, Mogollon Rim RD	Helocrene	
597	Lee Johnson Spring	0120N	0090E	012	ALL	Coconino NF, Mogollon Rim RD	rheocrene	
598	Kinder Spring	0130N	0100E	017	SESW	Coconino NF, Mogollon Rim RD	anthropogenic	
713	Wildcat Spring	0120N	0090E	004	ALL	Coconino NF, Mogollon Rim RD	hillslope	
714	Rim Spring	0120N	0090E	010	SWSE	Coconino NF, Mogollon Rim RD	hypocrene	
790	Long Valley Spring	0130N	0100E	018	SENW	Coconino NF, Mogollon Rim RD	Rheocrene	
884	58 Tank	0160N	0090E	036	SENW	Coconino NF, Mogollon Rim RD	rheocrene	
885	63 Tank	0150N	0100E	016	SWSE	Coconino NF, Mogollon Rim RD	limnocrene	
886	Adders Mouth	0130N	0110E	033	SENE	Coconino NF, Mogollon Rim RD	hillslope	
893	Audra Spring	0120N	0110E	004	SENE	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
895	Baker Spring	0120N	0090E	003	ALL	Coconino NF, Mogollon Rim RD	limnocrene	anthropogenic

896	Banfield Spring	0150N	0080E	025	SWSE	Coconino NF, Mogollon Rim RD	helocrene	
904	Bill Back Spring	0160N	0080E	004	SESW	Coconino NF, Mogollon Rim RD	limnocrene	helocrene
905	Bill Dick Spring	0160N	0080E	011	SESW	Coconino NF, Mogollon Rim RD	hillslope	helocrene
908	Blue Eye Spring	0120N	0110E	014	SWNW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
910	Bottle Spring	0150N	0090E	004	L 2	Coconino NF, Mogollon Rim RD	Helocrene	
916	Burn Spring	0130N	0110E	023	NWSW	Coconino NF, Mogollon Rim RD	hillslope	
917	Burnt Spring	0130N	0110E	028	SWNW	Coconino NF, Mogollon Rim RD	cave	hillslope
921	Carla Spring	0120N	0110E	003	L 1	Coconino NF, Mogollon Rim RD	hillslope	
922	Cassie Spring	0130N	0100E	028	NESE	Coconino NF, Mogollon Rim RD		
923	Cathy Spring	0120N	0110E	002	SENE	Coconino NF, Mogollon Rim RD	hillslope	
930	Christianson Spring	0120N	0110E	004	SENE	Coconino NF, Mogollon Rim RD	cave	anthropogenic
938	Coneflower Spring	0120N	0110E	004	L 2	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
939	Cornlily Spring	0120N	0110E	010	NESE	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
942	Crackerbox Spring	0130N	0100E	024	SENW	Coconino NF, Mogollon Rim RD	hillslope	hanging garden
947	Floyd Spring	0130N	0110E	035	NENW	Coconino NF, Mogollon Rim RD		
950	Delinator Spring	0130N	0100E	031	SENE	Coconino NF, Mogollon Rim RD	rheocrene	
951	Derrick Spring	0130N	0110E	027	SENE	Coconino NF, Mogollon Rim RD	hillslope	cave

958	Drift Fence Spring	0130N	0110E	027	SWSW	Coconino NF, Mogollon Rim RD		
966	Fleishman Spring	0130N	0110E	033	SENE	Coconino NF, Mogollon Rim RD	hillslope	hanging garden
967	Fortyfour Spring	0130N	0090E	026	SWNW	Coconino NF, Mogollon Rim RD	rheocrene	
972	Foster Canyon	0160N	0080E	022	SWNW	Coconino NF, Mogollon Rim RD	helocrene	
974	Fred Haught Spring	0130N	0110E	030	NENW	Coconino NF, Mogollon Rim RD		
975	Fred Haught Spring	0130N	0110E	030	SENW	Coconino NF, Mogollon Rim RD	limnocrene	rheocrene
978	George Spring	0130N	0110E	027	SWSE	Coconino NF, Mogollon Rim RD	cave	anthropogenic
980	Gooseberry Springs	0170N	0090E	035	NENE	Coconino NF, Mogollon Rim RD	Helocrene	
981	Gooseberry Springs 1	0170N	0090E	035	NENE	Coconino NF, Mogollon Rim RD	hillslope	helocrene
982	Goshawk Spring	0120N	0110E	016	NENE	Coconino NF, Mogollon Rim RD	hillslope	
986	Half Pint Spring	0130N	0100E	031	SESE	Coconino NF, Mogollon Rim RD	limnocrene	anthropogenic
988	Headwater Spring	0120N	0110E	001	SENE	Coconino NF, Mogollon Rim RD		
989	Homestead Spring	0130N	0100E	034	NWSW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
990	Horseshoe Spring	0160N	0090E	009	SWSE	Coconino NF, Mogollon Rim RD	rheocrene	
991	Hospital Ridge North	0120N	0120E	006	SESE	Coconino NF, Mogollon Rim RD	rheocrene	anthropogenic
993	Houston Draw Spring	0130N	0110E	033	NWSW	Coconino NF, Mogollon Rim RD	rheocrene	
999	Immigrant Spring	0120N	0100E	009	ALL	Coconino NF, Mogollon Rim RD		

1004	Jones Springs	0160N	0080E	022	SWNW	Coconino NF, Mogollon Rim RD	hillslope	helocrene
1005	Kehl Spring	0120N	0100E	008	ALL	Coconino NF, Mogollon Rim RD	helocrene	
1011	Lauren Spring	0130N	0100E	027	NENE	Coconino NF, Mogollon Rim RD	hillslope	
1014	Leopard Frog Spring	0120N	0110E	002	NESE	Coconino NF, Mogollon Rim RD	hillslope	
1018	Little Dick Spring	0130N	0090E	031	NENW	Coconino NF, Mogollon Rim RD	hillslope	
1024	Kaibab Ledge Spring	0140N	0100E	028	NWSW	Coconino NF, Mogollon Rim RD	limnocrene	anthropogenic
1025	Middle Leonard Canyon Spring #2	0120N	0110E	025	SENW	Coconino NF, Mogollon Rim RD	anthropogenic	limnocrene
1027	Mahan Spring	0160N	0090E	009	SENW	Coconino NF, Mogollon Rim RD		
1032	McFarland Spring	0130N	0110E	033	NWNW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
1033	Meadow Spring	0120N	0110E	014	SWNE	Coconino NF, Mogollon Rim RD	hillslope	helocrene
1034	Megan Spring	0120N	0110E	004	L 2	Coconino NF, Mogollon Rim RD	hillslope	
1036	Middle Kehl Meadow Spring	0120N	0100E	008	ALL	Coconino NF, Mogollon Rim RD	rheocrene	helocrene
1037	Middle Kehl Spring	0120N	0100E	008	ALL	Coconino NF, Mogollon Rim RD	rheocrene	
1048	Mushroom Spring	0120N	0110E	002	NESE	Coconino NF, Mogollon Rim RD	hillslope	anthropogenic
1057	Pauly Spring	0120N	0110E	015	NWNW	Coconino NF, Mogollon Rim RD		
1061	Pine Spring	0160N	0090E	013	SENW	Coconino NF, Mogollon Rim RD		
1062	PoleyQuiva Spring	0130N	0110E	033	SESE	Coconino NF, Mogollon Rim RD	hillslope	

1065	Quinamptewa Spring	0150N	0090E	006	NESW	Coconino NF, Mogollon Rim RD	helocrene	
1070	Red Squirrel Spring	0120N	0110E	011	SWNW	Coconino NF, Mogollon Rim RD	hillslope	
1071	Retired Spring	0120N	0110E	004	L 1	Coconino NF, Mogollon Rim RD	hillslope	anthropogenic
1074	Rock Crossing Spring	0140N	0110E	032	SWSE	Coconino NF, Mogollon Rim RD		
1076	Rocky Spring	0120N	0110E	023	SESE	Coconino NF, Mogollon Rim RD	rheocrene	
1081	Schell Spring	0160N	0090E	010	SWSE	Coconino NF, Mogollon Rim RD	helocrene	
1082	Schneider Spring	0130N	0110E	025	L 2	Coconino NF, Mogollon Rim RD	hillslope	
1084	Secret Spring	0120N	0110E	002	NWSE	Coconino NF, Mogollon Rim RD	hillslope	
1088	Sheep Tank Draw Unnamed	0150N	0090E	026	NENE	Coconino NF, Mogollon Rim RD		
1105	Taylor Spring	0130N	0110E	033	SESE	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
1106	Tenakhongua Spring	0160N	0090E	019	L 6	Coconino NF, Mogollon Rim RD	helocrene	
1112	Trouble Spring	0120N	0110E	024	NENE	Coconino NF, Mogollon Rim RD		
1116	Twin Tanks	0120N	0110E	010	SWSE	Coconino NF, Mogollon Rim RD	hillslope	
1119	Unreliable Spring	0130N	0110E	022	SESW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
1124	Wee Stead Seep	0120N	0110E	015	SWSW	Coconino NF, Mogollon Rim RD	rheocrene	anthropogenic
1135	Wingfield Corral	0150N	0090E	013	NWSW	Coconino NF, Mogollon Rim RD	hillslope	helocrene
1138	Schnaeger Springs	0130N	0110E	025	NWSE	Coconino NF, Mogollon Rim RD	hillslope	

1139	Yeager Springs	0120N	0110E	013	NWNW	Coconino NF, Mogollon Rim RD		
1145	Maple Spring	0120N	0110E	010	NESE	Coconino NF, Mogollon Rim RD	hillslope	
1146	Mud Spring	0130N	0100E	032	SESW	Coconino NF, Mogollon Rim RD	rheocrene	helocrene
1150	Willow Spring	0130N	0100E	034	NWSE	Coconino NF, Mogollon Rim RD	hanging garden	
1151	Yellow Jacket Spring	0160N	0090E	029	SWSE	Coconino NF, Mogollon Rim RD	helocrene	
1167	Little Spring Upper	0140N	0110E	018	SESW	Coconino NF, Mogollon Rim RD		
1170	Stoneman Lake Upper East	0160N	0080E	016	NENW	Coconino NF, Mogollon Rim RD		
1264	Bear Spring (tnf)	0120N	0090E	024	ALL	Tonto National Forest	Rheocrene	
1270	Campbell Road Spring	0160N	0080E	027	SWNW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
1273	Cottonwood Spring (tnf)	0120N	0080E	035	SESW	Tonto National Forest		
1274	Dripping Spring #1	0120N	0090E	030	SESE	Tonto National Forest	Rheocrene	
1276	Fuller Spring	0120N	0080E	023	ALL	Tonto National Forest	Rheocrene	
1277	Geronimo Spring (tnf)	0120N	0090E	024	ALL	Tonto National Forest	Rheocrene	
1299	Pine Spring	0120N	0090E	034	ALL	Tonto National Forest	Helocrene	
1300	Poison Sping (tnf)	0120N	0100E	019	ALL	Tonto National Forest	Rheocrene	
1304	Red Rock Spring	0112N	0090E	023	ALL	Tonto National Forest	Rheocrene	
1313	Turkey Spring	0120N	0090E	022	NWSE	Tonto National Forest	Rheocrene	

1315	Washington Spring	0120N	0100E	011	ALL	Tonto National Forest	Rheocrene	
1344	Little 44 Spring	0130N	0090E	026	NWSW	Coconino NF, Mogollon Rim RD	hillslope	
1345	Aspen Spring	0130N	0110E	028	SWNW	Coconino NF, Mogollon Rim RD	cave	
10641	Limestone Spring	0130N	0120E	015	SENE	Apache-Sitgreaves NF, Black Mesa RD		
10642	Spaulding Spring	0130N	0120E	024	SWNW	Apache-Sitgreaves NF, Black Mesa RD		
10643	Pius Spring	0130N	0130E	017	SWSW	Apache-Sitgreaves NF, Black Mesa RD		
10649	Gentry Spring	0120N	0120E	023	NWSW	Apache-Sitgreaves NF, Black Mesa RD		
10650	Double Cabin Spring	0120N	0120E	011	NENW	Apache-Sitgreaves NF, Black Mesa RD		
10651	Jumping Spring	0130N	0120E	021	SESE	Apache-Sitgreaves NF, Black Mesa RD		
10653	Cliff Springs	0120N	0130E	026	NWNE	Apache-Sitgreaves NF, Black Mesa RD		
10654	Cliff Springs (Middle)	0120N	0130E	026	NWNE	Apache-Sitgreaves NF, Black Mesa RD	limnocrene	
10655	Nagel Logging Camp Unnamed	0120N	0132E	001	L 6	Apache-Sitgreaves NF, Black Mesa RD		
10656	Wildcat Spring	0120N	0150E	033	SESE	Apache-Sitgreaves NF, Black Mesa RD	rheocrene	
10663	Turkey Springs	0110N	0160E	033	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
10664	Wilford Spring	0110N	0160E	009	L 7	Apache-Sitgreaves NF, Black Mesa RD		
10665	Whiskey Spring	0100N	0170E	006	NENE	Apache-Sitgreaves NF, Black Mesa RD		
10666	Saint Joe Spring	0110N	0140E	012	SESE	Apache-Sitgreaves NF, Black Mesa RD	rheocrene	anthropogenic
11621	Parsnip Spring	0120N	0090E	008	SWSW	Tonto National Forest		

11622	Unnamed	0120N	0090E	014	NENW	Tonto National Forest		
11623	Tonto Spring	0120N	0120E	033	NENW	Tonto National Forest		
11637	Clover Spring	0112N	0080E	036	ALL	Tonto National Forest		
11646	Wildcat Spring	0110N	0110E	013	SWSE	Tonto National Forest		
11649	Bearhide Spring	0110N	0120E	034	NWSW	Tonto National Forest		
11650	Bootleg Spring	0110N	0120E	027	NENE	Tonto National Forest		
11651	Herman Spring	0110N	0130E	018	NENE	Tonto National Forest		
11652	Horton Spring	0110N	0120E	002	SENW	Tonto National Forest		
11653	Nappa Spring	0110N	0130E	007	SWNE	Tonto National Forest		
11654	See Spring	0110N	0130E	008	NWSW	Tonto National Forest		
11656	Bear Spring	0102N	0130E	035	NESE	Tonto National Forest		
11657	Outlaw Seep	0110N	0170E	034	SWSW	Apache-Sitgreaves NF, Black Mesa RD		
11658	Trough Spring	0110N	0180E	027	NENE	Apache-Sitgreaves NF, Black Mesa RD		
11659	Hidden Spring	0100N	0180E	001	NESW	Apache-Sitgreaves NF, Black Mesa RD		
11660	Shingle Spring	0100N	0180E	012	NENE	Apache-Sitgreaves NF, Black Mesa RD		
11662	Grover Spring	0110N	0190E	030	SESW	Apache-Sitgreaves NF, Black Mesa RD		
11663	Left Hand Spring	0100N	0190E	001	SESW	Apache-Sitgreaves NF, Lakeside RD		
11664	Indian Well Spring	0110N	0190E	027	NENW	Apache-Sitgreaves NF, Black Mesa RD		
11665	Red Rock Spring	0100N	0190E	005	SESE	Apache-Sitgreaves NF, Black Mesa RD		
11721	Sycamore Spring	0100N	0130E	008	NWNE	Tonto National Forest		

11723	Cherry Spring	0102N	0130E	031	ALL	Tonto National Forest		
11724	Lost Salt Spring Number One	0100N	0140E	003	SWNE	Tonto National Forest		
11725	Lost Salt Spring Number Two	0100N	0140E	003	NESE	Tonto National Forest		
11726	Saunders Spring	0100N	0140E	027	SENE	Tonto National Forest		
11728	Clay Spring	0100N	0140E	013	NWNW	Tonto National Forest		
11729	Bottle Spring	0090N	0150E	006	SESE	Tonto National Forest		
11730	Sheep Corral Spring	0090N	0140E	012	NWNE	Tonto National Forest		
11732	Carroll Spring	0090N	0150E	007	SESE	Arizona Game & Fish Department		
11794	Sparky Spring	0080N	0130E	013	ALL	Tonto National Forest		
11889	Bear Head Spring	0070N	0120E	016	NWSE	Tonto National Forest		
11893	Hidden Spring	0070N	0120E	009	SWNW	Tonto National Forest		
11907	Elephant Corral Spring	0080N	0130E	033	SWNE	Tonto National Forest		
11909	Rock Spring	0070N	0130E	033	ALL	Tonto National Forest		
12061	Cienega Spring	0060N	0140E	017	NENW	Tonto National Forest		
12062	Switchbacks Spring The	0060N	0140E	021	SESE	Tonto National Forest		
12063	Knoles Hole Spring	0060N	0140E	028	SESE	Tonto National Forest		
12066	Rose Creek Spring	0060N	0130E	035	ALL	Tonto National Forest		
13566	Pinedale Spring	0100N	0200E	005	L 1	Apache-Sitgreaves NF, Lakeside RD		
13587	Thompson Spring	0090N	0230E	034	NWSW	Apache-Sitgreaves NF, Lakeside RD	hillslope	helocrene
13589	Log Cabin Spring	0090N	0230E	019	L 2	Apache-Sitgreaves NF, Lakeside RD		
13591	Pat Mullen Spring	0090N	0230E	023	SWSW	Apache-Sitgreaves NF, Lakeside RD		
13592	Brushy Spring	0090N	0240E	033	L 12	Apache-Sitgreaves NF, Lakeside RD		
13593	Danstone Springs	0090N	0240E	021	SESE	Apache-Sitgreaves NF, Lakeside RD	hillslope	anthropogenic

13595	Chipmunk Spring	0090N	0230E	026	SWSE	Apache-Sitgreaves NF, Lakeside RD	helocrene	anthropogenic
13596	Dipping Vat Spring	0090N	0240E	003	NWSE	Apache-Sitgreaves NF, Lakeside RD	hillslope	anthropogenic
13597	Whitcom Spring	0090N	0230E	026	NWSE	Apache-Sitgreaves NF, Lakeside RD		
13598	Hog Spring	0090N	0240E	006	NESW	Apache-Sitgreaves NF, Lakeside RD	hillslope	helocrene
13601	Brown Spring	0090N	0240E	014	SWNW	Apache-Sitgreaves NF, Lakeside RD		
13602	Los Burros Spring	0090N	0240E	026	SWSW	Apache-Sitgreaves NF, Lakeside RD	hillslope	anthropogenic
13603	Mud Spring	0090N	0240E	003	L 1	Apache-Sitgreaves NF, Lakeside RD	limnocrene	anthropogenic
13605	Pit Spring	0090N	0240E	024	NWSE	Apache-Sitgreaves NF, Lakeside RD	anthropogenic	exposure
13606	Quakie Patch Spring	0090N	0250E	020	SENE	Apache-Sitgreaves NF, Lakeside RD		
13608	Firebox Spring	0090N	0250E	029	NENW	Apache-Sitgreaves NF, Lakeside RD		
13610	Aniceto Spring	0090N	0250E	005	NESE	Apache-Sitgreaves NF, Lakeside RD		
13611	Aspen Spring	0090N	0250E	017	SWSE	Apache-Sitgreaves NF, Lakeside RD	helocrene	
13616	Tom Canovis Spring	0090N	0250E	007	SWSE	Apache-Sitgreaves NF, Lakeside RD		
13617	Willow Spring	0090N	0250E	008	NWNW	Apache-Sitgreaves NF, Lakeside RD	hillslope	
13618	Porter Spring	0090N	0250E	028	L 9	Apache-Sitgreaves NF, Lakeside RD		
13622	Pancho Spring	0090N	0250E	008	SENW	Apache-Sitgreaves NF, Lakeside RD		
13624	McKay Spring	0090N	0250E	007	SENE	Apache-Sitgreaves NF, Lakeside RD	hillslope	

13660	Pinetop Springs	0080N	0230E	004	NENE	Apache-Sitgreaves NF, Lakeside RD		
15032	Mahan Ranch unnamed	0160N	0090E	010	SWSW	Coconino NF, Mogollon Rim RD		
15095	Cottonwood Spring	0120N	0080E	035	NESW	Tonto National Forest		
15096	Dripping Springs Unnamed 1	0120N	0090E	030	SESE	Tonto National Forest		
15097	Dripping Springs Unnamed 2	0120N	0090E	030	SESE	Tonto National Forest		
15098	Dripping Springs Unnamed 3	0120N	0090E	030	SESE	Tonto National Forest		
15100	Unnamed	0120N	0110E	026	SWSW	Tonto National Forest		
15101	Whiskey Springs	0120N	0130E	006	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
15102	Unnamed	0120N	0130E	026	SENW	Apache-Sitgreaves NF, Black Mesa RD		
15103	Swallows Lydia	0120N	0140E	008	SWSW	Arizona Game & Fish Department	helocrene	exposure
15104	Waters Draw Spring	0120N	0130E	001	L 5	Apache-Sitgreaves NF, Black Mesa RD		
15105	Unnamed	0130N	0130E	026	SENE	Apache-Sitgreaves NF, Black Mesa RD		
15107	Amorpha Spring	0120N	0150E	005	L 3	Apache-Sitgreaves NF, Black Mesa RD	rheocrene	
15108	Breed Spring	0130N	0140E	033	SWNW	Apache-Sitgreaves NF, Black Mesa RD	hillslope	
15109	Pierce Seep Number Two	0120N	0170E	034	L 2	Apache-Sitgreaves NF, Black Mesa RD		
15154	Unnamed	0112N	0090E	035	ALL	Tonto National Forest		
15158	Unnamed	0112N	0110E	024	SENE	Tonto National Forest		
15160	Unnamed	0110N	0140E	006	SWNE	Apache-Sitgreaves NF, Black Mesa RD		
15161	Unnamed	0110N	0160E	028	NESW	Apache-Sitgreaves NF, Black Mesa RD		

15162	Turkey Springs middle unnamed	0110N	0160E	033	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
15163	Turkey Springs north unnamed	0110N	0160E	033	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
15164	Unnamed	0110N	0150E	026	NWNE	Apache-Sitgreaves NF, Black Mesa RD		
15165	Gentry Canyon Upper Spring	0110N	0150E	026	NWNE	Apache-Sitgreaves NF, Black Mesa RD		
15166	Gentry Canyon Lower Spring	0110N	0150E	023	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
15167	Gibson Ranch Spring	0110N	0160E	020	L 4	Apache-Sitgreaves NF, Black Mesa RD		
15168	Unnamed	0110N	0160E	017	NWNE	Apache-Sitgreaves NF, Black Mesa RD		
15169	Hidden Spring	0110N	0170E	032	NESW	Apache-Sitgreaves NF, Black Mesa RD		
15170	Unnamed	0110N	0170E	016	NWNE	Apache-Sitgreaves NF, Black Mesa RD		
15171	Day Spring	0110N	0180E	032	L 8	Apache-Sitgreaves NF, Black Mesa RD		
15172	Bear Springs	0110N	0180E	029	NWSW	Apache-Sitgreaves NF, Black Mesa RD		
15173	Pearce Spring	0100N	0190E	015	NWSW	Apache-Sitgreaves NF, Lakeside RD		
15174	Cottonwood Seep	0100N	0190E	017	SENE	Apache-Sitgreaves NF, Lakeside RD		
15175	Lons Spring	0100N	0190E	013	SENE	Apache-Sitgreaves NF, Lakeside RD		
15176	Perkins Spring	0110N	0190E	024	NWSE	Apache-Sitgreaves NF, Black Mesa RD		
15719	Unnamed	0090N	0230E	034	NESW	Apache-Sitgreaves NF, Lakeside RD		
15721	Peterson Spring	0090N	0230E	019	L 1	Apache-Sitgreaves NF, Lakeside RD		

15722	Unnamed	0090N	0230E	019	L 1	Apache-Sitgreaves NF, Lakeside RD		
15723	Unnamed	0090N	0230E	019	L 1	Apache-Sitgreaves NF, Lakeside RD		
15726	Unnamed	0090N	0230E	023	SESW	Apache-Sitgreaves NF, Lakeside RD		
15727	L Spring	0090N	0230E	024	SENE	Apache-Sitgreaves NF, Lakeside RD	hillslope	
15728	Rhoton Seep	0090N	0240E	015	NESW	Apache-Sitgreaves NF, Lakeside RD		
15729	McCormick Spring	0090N	0240E	026	SENW	Apache-Sitgreaves NF, Lakeside RD	helocrene	hypocrene
15731	Unnamed	0090N	0250E	029	SENW	Apache-Sitgreaves NF, Lakeside RD		
15732	Pierce Spring	0090N	0250E	030	L 4	Apache-Sitgreaves NF, Lakeside RD		
15736	Gobbler Seep Spring	0080N	0240E	006	NENE	Apache-Sitgreaves NF, Lakeside RD		
16324	Gilliland Spring	0110N	0110E	010	NWNW	Tonto National Forest		
16325	Unnamed	0110N	0120E	025	NENE	Tonto National Forest		
16326	Indian Gardens Spring	0110N	0120E	020	NESE	Tonto National Forest		
16328	Allenbaugh Spring	0102N	0140E	027	ALL	Tonto National Forest		
16329	Unnamed	0110N	0130E	028	SESW	Tonto National Forest		
16331	Unnamed	0110N	0140E	035	NWSE	Tonto National Forest		
16332	Unnamed	0110N	0140E	035	NWSE	Tonto National Forest		
16333	Unnamed	0110N	0140E	035	NWSE	Tonto National Forest		
16334	Unnamed	0110N	0150E	031	L 3	Tonto National Forest		
16362	Unnamed	0100N	0140E	018	SENE	Tonto National Forest		
16366	Sanders Spring	0100N	0140E	027	SENE	Tonto National Forest		
16367	Gruwell Spring	0090N	0140E	002	SWNW	Tonto National Forest		
16371	Rock Tanks Spring	0100N	0140E	036	L 2	Tonto National Forest		

16372	Rock Spring	0090N	0150E	006	SWNW	Tonto National Forest		
16413	Unnamed	0080N	0130E	001	ALL	Tonto National Forest		
16415	McKenney Spring	0080N	0140E	004	ALL	Tonto National Forest		
16418	Unnamed	0090N	0140E	032	NWNW	Tonto National Forest		
16445	Unnamed	0090N	0150E	017	SESE	Tonto National Forest		
16446	Cunningham Spring	0090N	0150E	018	NESE	Arizona Game & Fish Department		
16475	Turkey Spring	0070N	0130E	013	ALL	Tonto National Forest		
16476	Unnamed	0060N	0140E	009	SWNE	Tonto National Forest		
16477	Unnamed	0060N	0140E	009	SENE	Tonto National Forest		
16478	Unnamed	0060N	0140E	009	NWNE	Tonto National Forest		
16597	Unnamed	0060N	0130E	025	ALL	Tonto National Forest		
16598	Knoles Hole Spring	0060N	0140E	028	NESE	Tonto National Forest		
16599	Unnamed	0060N	0140E	015	NESW	Tonto National Forest		
16600	Unnamed	0060N	0140E	018	L 1	Tonto National Forest		
18822	A-13-11 18BAA unnamed	0130N	0110E	018	NENW	Coconino NF, Mogollon Rim RD		
18823	A-13-11 18C CB	0130N	0110E	018	L 4	Coconino NF, Mogollon Rim RD	limnocrene	hillslope
18885	Henturkey	0110N	0120E	016	NENW	Tonto National Forest		
18899	Winters no 1	0120N	0120E	032	SESW	Tonto National Forest		
18914	Potamogeton Tank	0130N	0100E	025	NENW	Coconino NF, Mogollon Rim RD	limnocrene	
18915	Unknown	0120N	0110E	017	SESW	Coconino NF, Mogollon Rim RD		
19070	A-11-14 35dbb unnamed	0110N	0140E	035	SWNE	Tonto National Forest		
19071	A-11-14 35dba2 unnamed	0110N	0140E	035	SWNE	Tonto National Forest		
19072	A-11-14 35dba1 unnamed	0110N	0140E	035	SWNE	Tonto National Forest		

19116	A-16-08 16bda	0160N	0080E	017	SENE	Coconino NF, Red Rock RD		
19238	Fleishman False Spring	0130N	0110E	034	SWNW	Coconino NF, Mogollon Rim RD	rheocrene	
19781	Spoonseller Siding	0090N	0230E	003	L 12	Apache-Sitgreaves NF, Lakeside RD		
19816	Gillespie Spring	0090N	0250E	009	NWNE	Apache-Sitgreaves NF, Lakeside RD	rheocrene	helocrene
19884	Rice Seeps	0120N	0180E	030	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
164136	Turkey Upper Upper	0110N	0160E	033	SWSW	Apache-Sitgreaves NF, Black Mesa RD		
164137	Baca Lake Spring	0110N	0160E	032	NESW	Apache-Sitgreaves NF, Black Mesa RD		
164138	Twin Lakes Spring	0100N	0152E	003	NESE	Apache-Sitgreaves NF, Black Mesa RD	limnocrene	
179489	Gobbler Seep Spring	0080N	0240E	006	NENE	Apache-Sitgreaves NF, Lakeside RD		
179507	Lee Spring	0090N	0250E	004	SWSE	Apache-Sitgreaves NF, Lakeside RD		
179508	Goodman Spring	0090N	0250E	004	SWSE	Apache-Sitgreaves NF, Lakeside RD		
179509	Porter Spring No 2	0090N	0250E	028	L 7	Apache-Sitgreaves NF, Lakeside RD		
179516	Turkey Springs lower unnamed	0110N	0160E	033	SWSE	Apache-Sitgreaves NF, Black Mesa RD		
179522	Baca Springs	0110N	0160E	030	SWNW	Apache-Sitgreaves NF, Black Mesa RD		
179523	Blevins Seep Spring	0110N	0170E	002	L 9	Apache-Sitgreaves NF, Black Mesa RD		
179524	Bunger Spring	0110N	0160E	035	SWNE	Apache-Sitgreaves NF, Black Mesa RD		
179527	Gillespie Spring	0090N	0250E	009	NWNE	Apache-Sitgreaves NF, Lakeside RD		

179529	Highway Seep Spring	0110N	0190E	009	SESW	Apache-Sitgreaves NF, Black Mesa RD		
179530	Hog Springs	0100N	0230E	036	NESE	Apache-Sitgreaves NF, Lakeside RD		
179531	Holcolm Spring	0110N	0170E	028	NENE	Apache-Sitgreaves NF, Black Mesa RD		
179534	Jumping Springs	0130N	0120E	022	NWSW	Apache-Sitgreaves NF, Black Mesa RD		
179535	Larson Spring	0120N	0140E	028	NWNW	Apache-Sitgreaves NF, Black Mesa RD		
179536	Open Draw Spring	0120N	0120E	012	SWSW	Apache-Sitgreaves NF, Black Mesa RD		
179538	Slim Jim Spring	0120N	0140E	026	SWNW	Apache-Sitgreaves NF, Black Mesa RD		
179540	Walker Park Spring	0110N	0160E	034	NENE	Apache-Sitgreaves NF, Black Mesa RD		
179541	West Fork Seeps	0110N	0160E	017	NENE	Apache-Sitgreaves NF, Black Mesa RD		
179542	Wilford Spring	0110N	0160E	009	SENW	Apache-Sitgreaves NF, Black Mesa RD		
179559	Unknown	0130N	0100E	036	SWNW	Coconino NF, Mogollon Rim RD		
179560	Unknown	0130N	0100E	025	SENW	Coconino NF, Mogollon Rim RD		
179639	Buckeye Crossing Springs	0120N	0132E	001	NWSE	Apache-Sitgreaves NF, Black Mesa RD	rheocrene	
179790	Peterson Springs	0090N	0230E	019	L 2	Apache-Sitgreaves NF, Lakeside RD	anthropogenic	
179793	Arizona Game and Fish Spring	0120N	0132E	001	NWNW	Arizona Game & Fish Department		
179794	Cliff Upper Springs	0120N	0130E	026	SENW	Apache-Sitgreaves NF, Black Mesa RD	rheocrene	
226443	Potatito Tank Springs	0120N	0090E	001	ALL	Coconino NF, Mogollon Rim RD	anthropogenic	limnocrene

226445	Stump Glen Spring	0130N	0100E	031	SWNE	Coconino NF, Mogollon Rim RD	rheocrene	helocrene
226446	Overhang Spring	0130N	0090E	036	SESE	Coconino NF, Mogollon Rim RD	helocrene	rheocrene
226447	Cienega Draw Springs	0120N	0090E	001	ALL	Coconino NF, Mogollon Rim RD	rheocrene	anthropogenic
226448	East Clear Creek Headwaters Spring	0130N	0100E	031	L 3	Coconino NF, Mogollon Rim RD	rheocrene	
226449	Miller Springs	0130N	0100E	028	SWSE	Coconino NF, Mogollon Rim RD	rheocrene	
226450	Mashed Potato Spring	0120N	0090E	001	ALL	Coconino NF, Mogollon Rim RD	rheocrene	helocrene
226457	Homestead Channel Springs	0130N	0100E	033	NESE	Coconino NF, Mogollon Rim RD	rheocrene	
226458	Blowdown Springs	0120N	0110E	003	SWNW	Coconino NF, Mogollon Rim RD	hillslope	rheocrene
226459	Dragonfly Tank Springs	0130N	0110E	033	SWSW	Coconino NF, Mogollon Rim RD	anthropogenic	limnocrene
226460	Driftfence Spring	0120N	0110E	003	NWSE	Coconino NF, Mogollon Rim RD	hillslope	helocrene
226461	Ridgeline Tank	0120N	0110E	022	SENW	Coconino NF, Mogollon Rim RD	limnocrene	anthropogenic
226462	Hongote Springs	0120N	0110E	002	NESE	Coconino NF, Mogollon Rim RD	hillslope	anthropogenic
226463	Oxidado Tank	0120N	0110E	016	NWSW	Coconino NF, Mogollon Rim RD	anthropogenic	helocrene
226651	Yanthro Spring	0120N	0110E	012	SESW	Coconino NF, Mogollon Rim RD	hillslope	anthropogenic
226652	Spikerush Spring	0120N	0110E	016	NESE	Coconino NF, Mogollon Rim RD	hillslope	
226839	Unreliable Lower Seeps	0130N	0110E	022	SESW	Coconino NF, Mogollon Rim RD	hanging garden	
226841	Lydia Tank	0130N	0100E	027	NESE	Coconino NF, Mogollon Rim RD	limnocrene	anthropogenic

NOTE: EOD = Extent of data

SEAP Scores and Risk

Background http://springstewardshipinstitute.org/springs-1

The Springs Ecosystem Assessment Protocol (SEAP) is the second phase in assessing site's condition and risk level following the first phase of Springs Inventory Protocol (SIP). SEAP is a process of evaluating the inventory data as well as other external information to generate a condition and risk score in each of the six predefined categories of variables. Risk is interpreted as the potential threat or the "condition inertia" of that variable. In other words, what is the probability of that variable remaining unchanged?

The six variable categories are:

Aquifer and Water Quality

Site Geomorphology

Habitat and Microhabitat Array

Site Biota

Human Uses and Influences

Administrative context under which the spring is managed.

Each category is scored on the basis of 5-8 subcategory variables that are ranked on a 0-6 scoring scale. Variables 1-5 are evaluated by the inventory team. Variable 6 is evaluated through a discussion with the land or resource manager. Subcategory scores are averaged to produce the overall Category scores. The ecological health score is evaluated in relation to human influences, which is then compared with the stewardship plan for the site.

Table 2. SEAP scores

Name Date of Survey	Land Unit	Total Ecological Score	Total Risk Score
Schnaeger Springs 2017-06-03	Coconino NF, Mogollon Rim RD	3.8	2
Delinator Spring 2017-06-21	Coconino NF, Mogollon Rim RD	5.2	1.7
Kehl Spring 2017-06-02	Coconino NF, Mogollon Rim RD	4	2
Big Moqui Spring 2017-06-02	Coconino NF, Mogollon Rim RD	3.4	3
Baker Spring 2017-06-23	Coconino NF, Mogollon Rim RD	3.8	2.8
Mud Spring 2017-06-23	Coconino NF, Mogollon Rim RD	4.3	2.4
Stump Glen Spring 2017-06-22	Coconino NF, Mogollon Rim RD	4.3	2.2
Potatito Tank Springs 2017-06-21	Coconino NF, Mogollon Rim RD	3.8	2.3
Overhang Spring 2017-06-22	Coconino NF, Mogollon Rim RD	4.5	2
Cienega Draw Springs 2017-06-25	Coconino NF, Mogollon Rim RD	3.9	2.1
Coldwater Spring 2017-06-24	Coconino NF, Mogollon Rim RD	2.5	3.5
Homestead Spring 2017-06-24	Coconino NF, Mogollon Rim RD	4.6	2.1
Half Pint Spring 2017-06-22	Coconino NF, Mogollon Rim RD	3.7	2.5
Little Dick Spring 2017-06-23	Coconino NF, Mogollon Rim RD	2.3	2.7
Middle Kehl Spring 2017-06-23	Coconino NF, Mogollon Rim RD	4.9	1.7
Miller Springs 2017-06-24	Coconino NF, Mogollon Rim RD	4.7	2
Mashed Potato Spring 2017-06-22	Coconino NF, Mogollon Rim RD	4.3	2.2
Middle Kehl Meadow Spring 2017-06-23	Coconino NF, Mogollon Rim RD	3.8	2.2
Cliffside Springs 2017-07-08	Coconino NF, Mogollon Rim RD	4.3	2.1
Leopard Frog Spring 2017-07-07	Coconino NF, Mogollon Rim RD	4.6	2
Cathy Spring 2017-07-07	Coconino NF, Mogollon Rim RD	4.4	1.3
Cut Stump Spring 2017-07-07	Coconino NF, Mogollon Rim RD	4.5	1.5
Secret Spring 2017-07-07	Coconino NF, Mogollon Rim RD	4.2	1.7
Red Squirrel Spring 2017-07-07	Coconino NF, Mogollon Rim RD	4.3	1.6

Blue Eye Spring 2017-07-06	Coconino NF, Mogollon Rim RD	4.4	1.8
Adders Mouth 2017-07-20	Coconino NF, Mogollon Rim RD	4.9	1.9
Aspen Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4	1.6
Blowdown Springs 2017-07-18	Coconino NF, Mogollon Rim RD	4.7	2.1
Audra Spring 2017-07-18	Coconino NF, Mogollon Rim RD	4.6	1.9
Burn Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.5	2.1
Burnt Spring 2017-07-19	Coconino NF, Mogollon Rim RD	3.8	2.2
Middle Leonard Canyon Spring #2 2017-07-17	Coconino NF, Mogollon Rim RD	3.7	2.3
Christianson Spring 2017-07-17	Coconino NF, Mogollon Rim RD	4.7	2.1
Carla Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.8	1.8
Coneflower Spring 2017-07-18	Coconino NF, Mogollon Rim RD	4.6	1.4
Cornlily Spring 2017-07-21	Coconino NF, Mogollon Rim RD	4.7	2.1
Derrick Spring 2017-07-19	Coconino NF, Mogollon Rim RD	5.2	1.4
Dragonfly Tank Springs 2017-07-20	Coconino NF, Mogollon Rim RD	4.2	2.2
George Spring 2017-07-19	Coconino NF, Mogollon Rim RD	5.1	1.9
Driftfence Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.3	1.8
Hidden Spring 2017-07-20	Coconino NF, Mogollon Rim RD	4.6	1.3
Fleishman False Spring 2017-07-18	Coconino NF, Mogollon Rim RD	4	1.7
Fleishman Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.5	1.7
Mushroom Spring 2017-07-20	Coconino NF, Mogollon Rim RD	4.1	2.1
Retired Spring 2017-07-18	Coconino NF, Mogollon Rim RD	4.5	1.1
Ridgeline Tank 2017-07-18	Coconino NF, Mogollon Rim RD	4.3	2.1
PoleyQuiva Spring 2017-07-20	Coconino NF, Mogollon Rim RD	4.4	2.2
Hongote Springs 2017-07-20	Coconino NF, Mogollon Rim RD	4.5	2
Oxidado Tank 2017-07-21	Coconino NF, Mogollon Rim RD	3.8	2.4
Houston Draw Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.5	1.2
Megan Spring 2017-07-17	Coconino NF, Mogollon Rim RD	4.4	1.2

Rocky Spring 2017-07-18	Coconino NF, Mogollon Rim RD	4.3	2.3
McFarland Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.7	1
Maple Spring 2017-07-21	Coconino NF, Mogollon Rim RD	4.3	2.2
Taylor Spring 2017-07-19	Coconino NF, Mogollon Rim RD	4.4	1.6
Kaibab Ledge Spring 2017-06-25	Coconino NF, Mogollon Rim RD	3.2	2.7
Wee Stead Seep 2017-07-18	Coconino NF, Mogollon Rim RD	4.1	2
Spikerush Spring 2017-07-08	Coconino NF, Mogollon Rim RD	3.9	2.7
Unreliable Spring 2017-07-21	Coconino NF, Mogollon Rim RD	4.3	1.5
Goshawk Spring 2017-07-08	Coconino NF, Mogollon Rim RD	4.6	1.2
Twin Tanks 2017-07-21	Coconino NF, Mogollon Rim RD	4.5	2.1
Unreliable Lower Seeps 2017-07-20	Coconino NF, Mogollon Rim RD	5.3	0.3
Homestead Channel Springs 2017-06-24	Coconino NF, Mogollon Rim RD	4.5	2.1
Dane Spring 2017-08-07	Coconino NF, Mogollon Rim RD	4.3	2.2
A-13-11 18C CB 2017-08-06	Coconino NF, Mogollon Rim RD	4.1	2.2
Lauren Spring 2017-08-05	Coconino NF, Mogollon Rim RD	4.5	2.2
Meadow Spring 2017-08-07	Coconino NF, Mogollon Rim RD	4.3	2
Potamogeton Tank 2017-08-06	Coconino NF, Mogollon Rim RD	4.2	2.3
Crackerbox Spring 2017-08-06	Coconino NF, Mogollon Rim RD	4.6	2
Roaring Spring 2017-08-05	Coconino NF, Mogollon Rim RD	4.6	1.9
Dry Spring 2017-08-05	Coconino NF, Mogollon Rim RD	2.8	2.9
Cassie Spring 2017-08-05	Coconino NF, Mogollon Rim RD	2.4	3.5
Gooseberry Springs 2017-08-17	Coconino NF, Mogollon Rim RD	2.4	3.7
Lydia Tank 2017-08-05	Coconino NF, Mogollon Rim RD	3.6	2.3
East Clear Creek Headwaters Spring 2017-06-25	Coconino NF, Mogollon Rim RD	4.4	2
Chavez Spring 2017-06-03	Coconino NF, Mogollon Rim RD	0.7	4.6
Yanthro Spring 2017-07-18	Coconino NF, Mogollon Rim RD	2.1	1.6
Big Moqui Spring 2017-09-30	Coconino NF, Mogollon Rim RD	3.4	3

Appendix B Watershed Condition Framework Scores

Watershed Condition Framework Scores**FOREST**	**HUC 12 #**	**Watershed Name**	**Watershed Condition**	**Riparian/Wetland Condition**	**Water Quality Condition**	**Water Quantity Condition**	**% in Rim Country**
ASNF	150200020401	Pulcifer Creek	Functioning Properly	Fair	Good	Good	10%
ASNF	150200020403	Sepulveda Creek	Functioning Properly	Fair	Good	Good	45%
ASNF	150200020406	Windsor Valley	Functioning Properly	Fair	Good	Good	10%
ASNF	150200050101	Billy Creek	Functioning at Risk	Fair	Good	Poor	50%
ASNF	150200050102	Porter Creek	Functioning at Risk	Fair	Good	Poor	96%
ASNF	150200050103	Fools Hollow	Functioning at Risk	Fair	Good	Poor	51%
ASNF	150200050104	Show Low Lake-Show Low Creek	Functioning at Risk	Fair	Good	Poor	6%
ASNF	150200050104	Show Low Lake-Show Low Creek	Functioning at Risk	Fair	Good	Poor	27%
ASNF	150200050105	Long Lake	Functioning at Risk	Good	Good	Poor	19%
ASNF	150200050106	Linden Draw	Functioning at Risk	Fair	Good	Good	51%
ASNF	150200050107	Bagnal Draw-Show Low Creek	Functioning at Risk	Fair	Good	Poor	43%
ASNF	150200050108	Bull Hollow	Functioning at Risk	Poor	Good	Fair	10%
ASNF	150200050109	Thistle Hollow-Show Low Creek	Functioning at Risk	Fair	Good	Poor	5%
ASNF	150200050201	Ortega Draw	Functioning Properly	Fair	Good	Good	67%
ASNF	150200050202	Upper Brown Creek	Functioning at Risk	Poor	Good	Poor	95%
ASNF	150200050204	Lower Brown Creek	Functioning at Risk	Poor	Good	Poor	3%
ASNF	150200050205	Upper Rocky Arroyo	Functioning at Risk	Poor	Good	Good	73%
ASNF	150200050206	Lower Rocky Arroyo	Functioning at Risk	Fair	Good	Fair	15%
ASNF	150200050301	Stinson Wash	Functioning at Risk	Fair	Good	Good	100%
ASNF	150200050302	West Fork Cottonwood Wash-Cottonwood Wash	Functioning at Risk	Fair	Good	Good	99%
ASNF	150200050303	Upper Day Wash	Functioning at Risk	Fair	Good	Good	94%
ASNF	150200050304	Lower Day Wash	Functioning at Risk	Fair	Good	Good	7%
ASNF	150200050305	Dalton Tank-Cottonwood Wash	Functioning at Risk	Poor	Good	Good	14%
ASNF	150200050306	Town Draw	Functioning at Risk	Fair	Good	Good	19%
ASNF	150200050308	Mortensen Wash	Functioning at Risk	Fair	Good	Good	100%

ASNF	150200050309	Dodson Wash	Functioning at Risk	Fair	Good	Fair	43%
ASNF	150200080101	Decker Wash	Functioning at Risk	Fair	Good	Good	38%
ASNF	150200080102	Upper Phoenix Park Wash	Functioning at Risk	Fair	Good	Good	66%
ASNF	150200080305	Gentry Canyon	Functioning Properly	Fair	Good	Good	100%
ASNF	150200080306	Upper Willow Creek	Functioning at Risk	Fair	Poor	Poor	100%
ASNF	150200080308	Cabin Draw	Functioning at Risk	Fair	Good	Good	100%
ASNF	150200080309	Wilkins Canyon	Functioning Properly	Poor	Good	Good	100%
ASNF	150200080310	Lower Willow Creek	Functioning Properly	Fair	Good	Good	99%
ASNF	150200080401	Tillman Draw	Functioning at Risk	Fair	Good	Good	2%
ASNF	150200080402	Sand Draw	Functioning at Risk	Good	Good	Fair	1%
ASNF	150200100101	Woods Canyon and Willow Springs Canyon	Functioning at Risk	Fair	Good	Poor	100%
ASNF	150200100102	**Long Tom Canyon-Chevelon Canyon**	Functioning Properly	Good	Good	Good	100%
ASNF	150200100103	**Upper Wildcat Canyon**	Functioning Properly	Good	Good	Good	100%
ASNF	150200100104	Upper Chevelon Canyon-Chevelon Canyon Lake	Functioning at Risk	Good	Good	Poor	100%
ASNF	150200100105	Middle Wildcat Canyon	Functioning at Risk	Fair	Good	Good	95%
ASNF	150200100106	Alder Canyon	Functioning Properly	Fair	Good	Good	100%
ASNF	150200100107	Upper West Chevelon Canyon	Functioning Properly	Fair	Good	Good	100%
ASNF	150200100108	Lower West Chevelon Canyon	Functioning Properly	Good	Good	Good	50%
ASNF	150200100109	Lower Wildcat Canyon	Functioning at Risk	Fair	Good	Good	37%
ASNF	150200100110	Durfee Draw-Chevelon Canyon	Functioning Properly	Good	Good	Good	61%
ASNF	150200100201	West Fork Black Canyon	Functioning at Risk	Fair	Good	Poor	100%
ASNF	150200100202	Buckskin Wash	Functioning at Risk	Fair	Good	Good	92%
ASNF	150200100203	Bear Canyon-Black Canyon	Functioning at Risk	Poor	Good	Good	93%
ASNF	150200100204	Upper Pierce Wash	Functioning at Risk	Fair	Good	Good	60%
ASNF	150200100205	Upper Brookbank Canyon	Functioning at Risk	Poor	Good	Good	100%
ASNF	150200100206	Long Draw	Functioning at Risk	Fair	Good	Fair	0%
ASNF	150200100208	Long Hollow Tank-Black Canyon	Functioning at Risk	Poor	Good	Good	2%

ASNF	150200100209	Lower Brookbank Canyon	Functioning at Risk	Poor	Good	Good	8%
ASNF	150200100301	Upper Potato Wash	Functioning at Risk	Fair	Good	Good	83%
ASNF	150200100302	Lower Potato Wash	Functioning at Risk	Fair	Good	Good	1%
ASNF	150601030301	Bull Flat Canyon	Functioning at Risk	Fair	Good	Good	35%
ASNF	150601030302	Canyon Creek Headwaters	Functioning at Risk	Fair	Good	Good	82%
ASNF	150601040302	Buckskin Canyon-Carrizo Creek	Functioning at Risk	Fair	Fair	Good	16%
CNF	150200080301	Miller Canyon	Functioning at Risk	Poor	Fair	Good	100%
CNF	150200080302	Bear Canyon	Functioning at Risk	Poor	Good	Poor	100%
CNF	150200080303	**East Clear Creek-Blue Ridge Reservoir**	Functioning at Risk	Poor	Good	Poor	100%
CNF	150200080304	**Barbershop Canyon**	Functioning at Risk	Poor	Good	Good	100%
CNF	150200080307	Leonard Canyon	Functioning at Risk	Poor	Good	Good	100%
CNF	150200080311	East Clear Creek-Clear Creek	Functioning at Risk	Fair	Good	Poor	100%
CNF	150200080403	Echinique Draw-Clear Creek	Functioning Properly	Good	Good	Good	3%
CNF	150200080501	Windmill Draw-Jacks Canyon	Functioning at Risk	Fair	Fair	Fair	100%
CNF	150200080502	Tremaine Lake	Functioning at Risk	Good	Fair	Fair	82%
CNF	150200080503	Dogie Tank-Jacks Canyon	Functioning at Risk	Fair	Fair	Fair	99%
CNF	150200080504	Chavez Draw	Impaired Function	Fair	Fair	Fair	1%
CNF	150200080505	Hart Tank	Functioning at Risk	Fair	Fair	Good	38%
CNF	150200150201	Mormon Lake	Functioning Properly	Good	Fair	Fair	1%
CNF	150200150401	Sawmill Wash	Functioning at Risk	Poor	Fair	Fair	3%
CNF	150200150402	Long Lake-Chavel Pass Ditch	Functioning at Risk	Good	Poor	Poor	19%
CNF	150602020601	Bar M Canyon	Functioning Properly	Good	Good	Fair	1%
CNF	150602020602	Upper Woods Canyon	Functioning at Risk	Fair	Fair	Good	8%
CNF	150602020603	Double Cabin Park-Jacks Canyon	Functioning at Risk	Fair	Fair	Fair	87%
CNF	150602020604	Brady Canyon	Functioning at Risk	Poor	Fair	Fair	89%
CNF	150602020605	Rattlesnake Canyon	Functioning at Risk	Good	Fair	Fair	26%
CNF	150602020609	Upper Wet Beaver Creek	Functioning Properly	Good	Good	Good	1%
CNF	150602020610	Red Tank Draw	Functioning at Risk	Fair	Poor	Fair	32%
CNF	150602030101	Upper Willow Valley	Functioning at Risk	Fair	Fair	Fair	100%

CNF	150602030102	Long Valley Draw	Functioning at Risk	Good	Fair	Fair	100%
CNF	150602030103	Toms Creek	Functioning at Risk	Poor	Fair	Fair	95%
CNF	150602030104	Clover Creek	Functioning at Risk	Poor	Good	Good	90%
CNF	150602030105	Lower Willow Valley	Functioning at Risk	Fair	Fair	Fair	97%
CNF	150602030106	Home Tank Draw	Functioning at Risk	Fair	Good	Fair	65%
CNF	150602030107	Upper West Clear Creek	Functioning Properly	Good	Good	Fair	76%
CNF	150602030108	Middle West Clear Creek	Functioning at Risk	Good	Good	Fair	14%
CNF	150602030305	Upper Fossil Creek	Functioning at Risk	Good	Fair	Fair	48%
TNF	150601030304	Upper Canyon Creek	Functioning at Risk	Fair	Good	Good	10%
TNF	150601030305	Gentry Canyon	Functioning at Risk	Poor	Good	Good	67%
TNF	150601030306	Ellison Creek	Functioning at Risk	Fair	Fair	Fair	3%
TNF	150601030401	Parallel Canyon-Cherry Creek	Functioning at Risk	Poor	Good	Good	94%
TNF	150601030402	Pleasant Valley	Impaired Function	Poor	Fair	Fair	2%
TNF	150601030403	**Crouch Creek**	Functioning at Risk	Fair	Fair	Fair	14%
TNF	150601030404	Gruwell Canyon-Cherry Creek	Functioning at Risk	Poor	Good	Fair	28%
TNF	150601030404	Gruwell Canyon-Cherry Creek	Functioning at Risk	Poor	Good	Fair	7%
TNF	150601030406	Walnut Creek-Cherry Creek	Functioning at Risk	Poor	Good	Good	4%
TNF	150601030407	P B Creek-Cherry Creek	Functioning at Risk	Poor	Good	Good	10%
TNF	150601030408	Cooper Forks-Cherry Creek	Functioning at Risk	Poor	Good	Fair	4%
TNF	150601030409	Bladder Canyon-Cherry Creek	Functioning at Risk	Poor	Good	Poor	0%
TNF	150601030801	Reynolds Creek	Functioning at Risk	Good	Good	Good	84%
TNF	150601030802	Workman Creek	Functioning at Risk	Good	Good	Good	58%
TNF	150601030803	Upper Salome Creek	Functioning at Risk	Fair	Good	Good	90%
TNF	150601030804	Middle Salome Creek	Functioning Properly	Fair	Good	Good	2%
TNF	150601030907	Cottonwood Wash	Functioning at Risk	Fair	Fair	Fair	0%
TNF	150601030908	Armer Gulch	Functioning at Risk	Fair	Fair	Fair	1%
TNF	150601050101	Buzzard Roost Canyon	Functioning at Risk	Fair	Good	Good	99%
TNF	150601050102	Rock Creek	Functioning at Risk	Fair	Fair	Good	46%
TNF	150601050103	Upper Spring Creek	Functioning at Risk	Fair	Good	Good	46%
TNF	150601050103	Upper Spring Creek	Functioning at Risk	Fair	Good	Good	1%

TNF	150601050105	Middle Spring Creek	Functioning at Risk	Fair	Good	Fair	1%
TNF	150601050201	Marsh Creek	Functioning at Risk	Fair	Good	Fair	12%
TNF	150601050202	Gordon Canyon	Functioning at Risk	Poor	Good	Good	98%
TNF	150601050203	Christopher Creek	Impaired Function	Poor	Poor	Fair	100%
TNF	150601050204	Horton Creek-Tonto Creek	Functioning at Risk	Fair	Fair	Fair	100%
TNF	150601050205	Haigler Creek	Functioning at Risk	Fair	Good	Good	78%
TNF	150601050206	Bull Tank Canyon-Tonto Creek	Functioning at Risk	Poor	Poor	Fair	55%
TNF	150601050301	Green Valley Creek	Functioning at Risk	Poor	Fair	Fair	26%
TNF	150601050304	Houston Creek	Impaired Function	Poor	Poor	Fair	2%
TNF	150601050401	Gun Creek	Functioning Properly	Fair	Good	Good	22%
TNF	150601050404	Cottonwood Creek	Functioning at Risk	Fair	Fair	Fair	0%
TNF	150601050405	Oak Creek	Functioning at Risk	Fair	Fair	Fair	0%
TNF	150601050406	Lambing Creek-Tonto Creek	Impaired Function	Poor	Poor	Fair	0%
TNF	150601050408	Greenback Creek	Functioning at Risk	Fair	Good	Fair	9%
TNF	150602030201	Ellison Creek	Functioning at Risk	Fair	Good	Fair	99%
TNF	150602030202	East Verde River Headwaters	Functioning at Risk	Poor	Good	Poor	100%
TNF	150602030203	Webber Creek	Functioning at Risk	Fair	Fair	Fair	79%
TNF	150602030205	Upper East Verde River	Functioning at Risk	Fair	Poor	Fair	7%
TNF	150602030206	Pine Creek	Functioning at Risk	Poor	Good	Poor	56%
TNF	150602030208	Rock Creek	Functioning at Risk	Fair	Fair	Fair	10%
TNF	150602030306	Hardscrabble Creek	Functioning at Risk	Fair	Fair	Fair	46%

Note: priority watersheds are in bold.

Appendix C. Design Features (Resource Protection Measures)

DF/BMP/M&CM Number	Description	Primary Purpose	Forest Plan Compliance	Specialist Recommendation	Primary Resource	Other Resources Affected	Category (BMP, CM, DF)
SW001	All stream channels will be protected with Aquatic Management Zones (AMZs), measured as the slope distance from the edge of each side the stream. Where AMZ widths are not customized to site conditions and don't occur in Narrow-headed or Northern Mexican Garter Snake proposed critical habitat (see AQ021), the default minimum width for ground-based mechanical and prescribed burning treatments for perennial, intermittent, and ephemeral streams are 150, 75, and 50 feet, respectively. Lakes and reservoirs should follow the same default AMZ widths (150 feet) as those for perennial waters.	To insure adequate protection of surface water quality during ground-based mechanical vegetation treatments and to provide consistency in how AMZ widths are measured and identified on the ground.	X	X	Soils and Watershed	AQ, FE, SI, WL	BMP+

SW002	AMZs can be customized by an ID team of qualified specialists prior to project implementation based on desired conditions along the stream reach and the nature of resource values at risk (such as the presence of aquatic ESA species or its potential introduction), special concerns for water quality degradation, erosion hazard, existing vegetative ground cover conditions, stream bank and riparian conditions, natural geologic features, and flow regime. The IDT will determine appropriate AMZ widths and treatment limitations within these zones. These changes should be reflected in the plan-in-hand documents and included in the task order or contract maps.	To allow the greatest flexibility in designing AMZ prescription to meet resource benefits while protecting the values at risk.	X	X	Soils and Watershed	AQ, FE, SI, WL	BMP
SW003	Stream channels to be protected with a prescribed aquatic management zone (AMZ) will be shown on the project task order,	Reduce ground disturbance by limiting the turning of equipment in or near the stream		X	Soils and Watershed	AQ, FE, SI	BMP

	contract maps, or burn plan maps. AMZ widths will be clearly labeled or described.	channels, and retain as much of the filtering effect of undisturbed ground cover as possible.					
SW004	Accepted activities within AMZs include mechanical and conventional tree felling, yarding, skidding, backing fire. Landings, decking areas, machine or hand piles, and skidding across streams or wetlands are to occur outside of AMZs unless otherwise specified. Skidding across ephemeral or intermittent streams may occur at designated crossing under no-flow conditions.	To avoid, improve, or minimize effects on aquatic species and habitat.	X	X	Soils and Watershed	AQ, FE, SI	BMP
SW005	If completing mechanical vegetation treatments within an AMZ, the preferred method of using feller-buncher or grapple skidder equipment is to approach the material to be extracted on the contour as much as	Allows for a reduction in ground disturbance by limiting the number of passes required to extract material and turning of equipment.		X	Soils and Watershed	SI, AQ	BMP

	possible to the stream, then back equipment out. Turning machines and skidding within AMZs should be minimized to the greatest extent possible.	Maintaining this type of travel pattern aims to reduce potential concentrated run-off and sediment delivery downslope compared to travel courses that follow the slope direction. BMP ultimately aims to reduce the amount of disturbed area affected during operation and to retain as much as possible the filtering effect of the undisturbed ground.					
SW006	Landings, log decks, and piles (burn, slash, or biomass) should be placed in upland locations and will not be allowed in areas such as: meadows, riparian areas, springs, seeps, AMZs, stream channels, or at the heads of stream channels. Landings, log decks and	Limit the overall amount and extent of heavy ground disturbance that implicates soil stability/ productivity as well as the	X	X	Soils and Watershed	AQ, SI, TR	BMP

	burn piles will be located outside at least 100 feet from these features, far enough away that direct (unfiltered) entry of sediment, bark, ash and burning products will not enter. The authorized FS officer AND a watershed specialist may authorize landings in these areas if absolutely required.	filtering capacity of upland areas.					
SW007	Mechanical vegetation treatments within AMZs will minimize the amount of thinning debris deposited in stream channels and remove excess debris by hand or end-lining with one end suspension except where coarse woody debris is needed for stream health as identified by fisheries or watershed specialists. Remove thinning debris less than six inches in diameter and less than six feet long and place it above the ordinary high water mark.	To minimize the potential for stream or culvert blockage.		X	Soils and Watershed	AQ, SI	BMP

SW008	Mechanical vegetation treatments within AMZs will fell trees outside the stream channel unless otherwise specified as a stream treatment.	To minimize disturbance to stream morphology as much as possible and reduce the amount of fine woody debris entering the stream system.		X	Soils and Watershed	AQ, SI	BMP
SW009	If completing mechanical vegetation treatments within an AMZ, do not cut trees where the root system is important in maintaining channel morphology.	To provide for bank stability and minimize erosion and bank instability to streams or other aquatic habitats.	X	X	Soils and Watershed	SI, AQ	BMP
SW010	New temporary road construction is not allowed in AMZs.	To minimize adverse environmental effects within aquatic management zones.		X	Soils and Watershed	AQ, SI, TR	BMP
SW011	Establish staging areas 150 feet outside of AMZs or from natural water bodies and wetlands for storage of vehicles, equipment and fuels, and fueling/servicing areas to minimize erosion into or	To prevent the spread of invasive and noxious weeds, aquatic diseases, and invasive species, and to prevent	X		Soils and Watershed	AQ, BT, FE, NW, SI	BMP

	contamination of streams, wetlands, and floodplains.	petroleum contamination and minimize ground disturbance and sedimentation in aquatic and associated habitats					
SW012	Site-specific criteria whereby either fire is allowed to burn in AMZs or is actively ignited will be solely driven by the need to maintain or improve riparian and stream habitat. A site-specific evaluation will be conducted by a specialist as a part of the burn plan for each unit where fire is proposed.	Proper maintenance of prescribed burning activities adjacent to and/or within AMZs should help maintain the sediment filtering capacity of drainage way and reduce potential erosion in these locations.		X	Soils and Watershed	AQ, FE	BMP
SW013	Fire control lines shall only be constructed within AMZs if mutually agreed upon by the authorized FS officer, fuels specialist, watershed specialist, and biologist. Only the following are allowed in AMZs:	To minimize the disturbance of riparian vegetation.		X	Soils and Watershed	AQ, FE	BMP

	Raking, brushing (less than 3 feet wide), leaf-blower, or other techniques that do not disturb soils or cause erosion.						
SW014	The following direction should be incorporated in developing the burn plan: High soil burn severity should not occur on greater than 5 percent areal extent of the uplands or an AMZ in each burn unit. High severity should be patchy rather than concentrated. No more than 5 percent mortality is allowed in the mature forest canopy along a streamside in each burn unit, with this mortality occurring as discontinuous patches. Variance in these parameters would need to be approved by appropriate specialist(s).	Maintaining low / moderate burn intensities and limiting the areal extent of high intensity burning will reduce the potential for severe soil burning which ultimately helps retain long-term soil stability/productivity and minimizes detrimental effects to soil, aquatic species, aquatic habitat, and desirable riparian species (flora and fauna) in AMZs.	X	X	Soils and Watershed	AQ, FE, WL	BMP

SW015	Apply the following direction if AMZ is within ½ mile of private land boundary or designated WUI: Treatment measures necessary to reduce the risk of wildfire encroachment on adjacent private lands may take priority over other considerations in these AMZs. Entry and treatments in these reaches will be considered on a case-by-case basis by ID teams.	To ensure that the fire management objectives and water quality objectives for these reaches are appropriately balanced.		X	Soils and Watershed	AQ, FE, SI	BMP
SW016	Do not apply surface fertilizer within an AMZ.	To protect water quality	X	X	Soils and Watershed	AQ	BMP

SW017	Domestic livestock grazing within an AMZ affected by prescribed fire will be deferred until ground cover is adequately re-established.	Promote recovery and establishment of riparian species, protect floodplain function, and provide for resilient stream systems.		X	Soils and Watershed	AQ, FE, RM	BMP
SW018	During project implementation use existing system travel courses and stream crossings whenever possible, unless new construction would result in less resource disturbance. Minimize the number of temporary access roads and travel paths to lessen soil disturbance, compaction, and impacts to vegetation. Temporary roads will not be built on slopes where grade, soil, or other features suggest a likelihood of excessive erosion or failure. Temporary roads areas will be restored to natural, preconstruction	To minimize soil disturbance and reduce sedimentation and erosion in aquatic habitats.	X	X	Soils and Watershed	AQ	BMP

	conditions as much as possible.						
SW019	When altering spring developments or splitting flow, place troughs far enough away from groundwater-dependent ecosystems (GDEs), wetlands, and other sensitive or unique habitats to prevent erosion, compaction, or degradation to sensitive soils and vegetation due to livestock or wildlife congregations.	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems (GDE) and minimize effects on these sensitive systems.		X	Soils and Watershed	AQ, RM	BMP
SW020	Spill prevention, containment, and counter measure plans are required if the fuel exceeds 660 gallons in a single container or if the total fuel storage at a site exceeds 1,360 gallons.	To protect soil/water resources and aquatic species from petroleum contamination.	X	X	Soils and Watershed	AQ	BMP
SW021	Any leaks originating from contractor equipment shall be repaired or the equipment	To protect soil/water resources and aquatic species	X	X	Soils and Watershed	AQ	BMP

	replaced in a timely manner.	from petroleum contamination.					
SW022	During servicing and refueling of equipment, pollutants shall not be allowed to enter any waterway, riparian area or stream course. Construct berms where necessary to contain potential spills. An authorized FS Official shall also be aware of actions to be taken in case of a hazardous substance spill.	To protect water resources and aquatic species from petroleum contamination.	X	X	Soils and Watershed	AQ	BMP
SW023	Equipment operators shall maximize that recovery and proper disposal of all fuels, fluids, lubricants, empty containers, and replacement parts.	To protect soil/water resources and aquatic species from petroleum contamination.	X	X	Soils and Watershed	AQ	BMP
SW024	Refuse resulting from the contractor's use, servicing, repair or abandonment of equipment shall be removed from National Forest System lands by the contractor to the appropriate disposal facilities.	To protect soil/water resources and aquatic species from petroleum contamination.	X	X	Soils and Watershed	AQ, FE, SI	BMP

SW025	All dry meadow locations identified during the layout phase of a project sale will be clearly labeled on sale contract maps.	To improve implementation.		X	Soils and Watershed	SI	BMP
SW026	Heavy equipment, vehicle operation, road construction, staging areas, stockpile areas, piling of slash, fence construction, fire lines, and other operational activities shall not be allowed in springs, seeps, or any other Groundwater-dependent Ecosystem (GDE), unless it is for the benefit or protection of the GDE or development of the springs.	To maintain or improve the integrity of springs and other GDEs and minimize effects on these sensitive systems.	X	X	Soils and Watershed	AQ, FE, SI	BMP
SW027	At spring development restoration sites, place watering troughs far enough from a steam or surround with a protective surface to prevent sediment delivery to the stream. Avoid steep slopes and areas where compaction or damage could occur to sensitive soils, slopes or vegetation	To reduce sediment delivery to aquatic habitats.		X	Soils and Watershed	AQ	BMP

	due to congregating livestock or wildlife.						
SW028	At spring restoration sites, ensure that each livestock or wildlife water development has a float valve or similar device, a return flow system, a fenced overflow area, or similar means to minimize water withdrawal and potential runoff and erosion.	To reduce water withdrawal, protect stream/spring flows, and channel functionality.		X	Soils and Watershed	AQ, RM	BMP
SW029	Spring developments should not disturb the spring orifice (point where water emerges). Spring head boxes should be places in a location that will cause the least amount of disturbance to the soils and vegetation of the GDE. Preferable locations for spring head boxes should be in an established channel downstream from the orifice or a locations	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems (GDE) and minimize effects on these sensitive systems.		X	Soils and Watershed	RM	BMP

	where flowing water becomes subsurface.						
SW030	When necessary, construct barriers around spring developments to prevent damage from wild or domestic ungulates, OHVs, or other recreational impacts.	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems (GDE) and minimize effects on these sensitive systems.		X	Soils and Watershed	RM	BMP
SW031	Spring developments shall have a return flow system to minimize the diversion of surface and subsurface water from the catchment area. Consider using a float valve or similar device to reduce the amount of water withdrawn from the groundwater-dependent ecosystems (GDE).	To maintain or improve the integrity of springs and other groundwater-dependent ecosystems (GDE) and minimize effects on these sensitive systems.		X	Soils and Watershed	RM	BMP

SW032	Formerly used skid trails should be utilized where properly located. The designation of new skid trails should be oriented to the contour of the slope as much as operationally feasible. Skid trail design should minimize concentrated runoff and sediment delivery by avoiding long, straight skid trails and providing breaks in grade.	Utilization of existing skid trails, designation of new skid trails, and proper skidding design should reduce the overall heavy disturbance footprint across the treatment unit. Skid trail placement that follows the contour of the slope as much as operationally feasible will help lessen the potential for accelerated erosion downslope.		X	Soils and Watershed		BMP
SW033	Closed skid trails and roads must have adequate runoff and erosion control features. Slash is the preferred method for diverting water if of sufficient quantity and size is available to maintain complete contact with the ground. Otherwise construct water	Minimize the concentration of run-off and sediment delivery into stream channels.	X	X	Soils and Watershed	TR	BMP

	bars and lead out ditches. Waterbars should not be more than 2 feet deep and need at least a 10-foot lead-out. Waterbars are only to be implemented with equipment with an articulating blade (no skidders), or by hand to remove berms, seeded, mulched, and cross-ripped. Waterbar spacing should be approximately 130 feet for slopes 0-5%, and 100 feet for slopes 6-10%. All berms and depressions (i.e., ruts) created along the skid trail or road will be filled in to restore the natural grade of the slope as much as possible.						
SW034	Erosion control structures and measures must be in place prior to the first erosive event. Contracts and agreements should outline the timing and application of erosion control methods to minimize soil loss and sedimentation of stream courses.	Minimize the concentration of run-off and sediment delivery into stream channels.	X	X	Soils and Watershed		BMP

SW035	Scarification or ripping of landings should be conducted in a manner as not to mix the surface soil and subsoils to the point where subsoil becomes inverted and exposed at the surface.	Mixing of surface soil and subsoil is generally not conducive to obtaining desirable herbaceous revegetation.		X	Soils and Watershed		BMP
SW036	During machine piling of slash, rough piling is encouraged. This involves piling only large concentrations of slash, leaving areas of low concentration undisturbed. Also, where feasible, rack and pile.	Rough piling minimizes disturbance to existing ground cover and the surface soil.		X	Soils and Watershed		BMP
SW037	Slash can be placed on skid trail and travel corridors to drive on to reduce rutting and soil disturbance from mechanized equipment.	To reduce potential for rutting and compaction along mechanical equipment travel courses.	X	X	Soils and Watershed		BMP
SW038	Seed mixes for post-thinning erosion control can include any of the following certified weed-free native species at a minimum of 5 pounds per acre pure live seed.	Minimize soil loss and sedimentation of stream courses from skidding operations. Minimize	X		Soils and Watershed	SI	BMP

	Potential vegetation for individual sites should utilize the Apache-Sitgreaves, Coconino, and Tonto NFs' Terrestrial Ecosystem Surveys (TES) to identify species to be utilized.	noxious weed spread and reestablish native vegetation. Minimize effects on severe erosion soils.					
SW039	Mechanical crushing of lopped slash can only occur on 0–25 percent slopes.	Incorporate slash into the soil to promote long term soil productivity.	X		Soils and Watershed	SI	BMP
SW040	Slash and/or chips can be scattered on landings to help minimize the formation of rills and gullies.	Minimize the concentration of run-off and sediment delivery into stream channels.		X	Soils and Watershed	SI	BMP
SW041	Skid trail stream crossings will not be allowed unless pre-approved by the authorized FS officer AND a watershed specialist for perennial and intermittent streams. Ephemeral streams crossings will be authorized by the FS officer. Crossings will be at right angles to channel and drainage banks. The	A qualified person should designate stream crossings in order to protect stream banks and stream morphology.		X	Soils and Watershed	TR	BMP

	number of designated crossings should be minimized.						
SW042	Felling to the lead would be required within the integrated resource service contract to minimize ground disturbance from skidding operations.	Felling of timber should be done to minimize ground disturbance from skidding operations and to minimize effects on severe erosion soils.	X		Soils and Watershed		BMP
SW043	Culverts, temporary bridges, low-water crossings, or log-fords will be required on all temporary roads and skid crossings on all streams that will have flowing water during the life of the temporary crossing. Temporary road and skid trail crossings will be removed when no longer needed. Any fill material will be removed and the channel and stream banks restored to a pre-project condition.	Protect stream morphology from damage from crossings while avoid damming or impounding free-flowing waters to provide streamflows needed for aquatic and riparian-dependent species.	X	X	Soils and Watershed	AQ, TR, WL	BMP

SW044	During thinning, operators shall avoid excavating skid trails whenever practical.	To prevent soil displacement		X	Soils and Watershed	SI	BMP
SW045	During thinning, operators shall locate skid trails where the need for sidecasting is minimized	To prevent soil displacement		X	Soils and Watershed	SI	BMP
SW046	During thinning, avoid adverse skidding to the greatest extent possible unless specialized equipment capable of adverse skidding without creating adverse soil impacts is utilized	To prevent excess rutting and compaction of soil surfaces and minimize downhill movement of slash and soils.		X	Soils and Watershed	SI	BMP
SW047	Slash should be distributed throughout skid trails, forwarder trails and cable corridors wherever mineral soils are exposed.	To provide surface roughness and prevent concentrated runoff that could cause accelerated erosion.		X	Soils and Watershed		BMP
SW048	Operators shall limit cable thinning to uphill yarding whenever practical. When downhill cable yarding is necessary, operators shall layout the cutting system	To prevent soil displacement from cable yarding operations.		X	Soils and Watershed		BMP

	in a manner which minimizes soil displacement.						
SW049	Operators shall minimize the yarding of logs across streams or wetlands	To prevent adverse effects to water quality		X	Soils and Watershed		BMP
SW050	Cable yarding across ephemeral streams shall be performed in ways that minimize soil and bank disturbances.	To prevent erosion and sedimentation by reducing potential for damage to stream banks and beds		X	Soils and Watershed		BMP
SW051	Operators shall minimize the numbers and widths of yarding corridors.	To minimize soil disturbance and prevent erosion and sediment delivery to streams		X	Soils and Watershed		BMP
SW052	Where it is necessary to yard across intermittent or perennial streams or wetlands, it shall be done by swinging the yarded material free of the ground to the greatest extent practicable (i.e., full suspension).	To prevent adverse effects to stream banks, beds and wetlands.		X	Soils and Watershed		BMP

SW053	During cable thinning, operators shall install effective cross ditches that drain onto undisturbed forest floor on all skid trails and cable corridors located on steep or erosion-prone slopes.	To prevent erosion and sediment delivery to stream courses and other waterbodies.		X	Soils and Watershed		BMP
SW054	Location of new skid trails and overall skid trail placement should be designed to minimize the overall disturbance footprint across the treatment unit while still meeting the objectives of the stand treatment.	Limit the overall amount and extent of heavy ground disturbance that implicates soil stability/ productivity as well as the filtering capacity of upland areas.		X	Soils and Watershed		BMP
SW055	Landings and decks should be clearly designated on the project area task order or contract maps.	To aid in implementation of project.		X	Soils and Watershed		BMP
SW056	Sizing, spacing, and placement of landings should be designed to minimize the overall ground disturbance footprint across the treatment unit while still	Limit the overall amount and extent of heavy ground disturbance that implicates soil stability/ productivity as well as the	X	X	Soils and Watershed		BMP

	meeting the objectives of the stand treatment.	filtering capacity of upland areas.					
SW057	Heavy ground disturbance activity areas (landings, major skid trails, unsurfaced haul roads, etc.) and excessive ground disturbance in any location (i.e., exceeding the rutting guidelines) should aim to not exceed 15 percent -areal extent of a treatment unit within a timber sale area.	To meet soil condition thresholds for management concern and to reduce the overall heavy ground disturbance footprint across a treatment unit.	X	X	Soils and Watershed		BMP
SW058	Skid trails, landings, and temporary roads are to be closed post-treatment and landings are to be scarified and seeded with a certified weed-free mix of primarily native, perennial grasses. The Coconino NF does not require scarification unless compaction is present.	Scarification and seeding of heavily disturbed areas will help break up soil compaction and reintroduction of native, perennial grass species will aid in mitigating the over-establishment of exotic or noxious weeds. Water-barring, restoring the natural grade	X	X	Soils and Watershed		BMP

		or the slope, and utilizing slash for additional erosion control mitigation will dissipate the run-off energy, reducing sediment delivery, as well as aiding in long-term site stability/productivity.					
SW059	In meadow restoration sites where trees are being removed, designate skid trails in order to limit disturbance from skidding. Where material is not being removed, lop and scatter or manually remove slash from meadow; these are the preferred methods of treating slash.	To minimize impacts to streams and soils in meadows from tree thinning operations.	X		Soils and Watershed		BMP
SW060	When thinning trees, no skidding is allowed across wetlands or springs and their outflows.	To minimize impacts to streams and soils in meadows from tree thinning operations.	X		Soils and Watershed		BMP

SW061	The authorized FS officer AND a watershed specialist will verify that the contractor has properly implemented the project watershed BMPs and erosion control measures prior to the closure of the project contract. In evaluating acceptance the following definition will be used by the FS: “Acceptable” erosion control means only minor deviation from the established standards and guidelines, providing no major or lasting impact is caused to soil and water resources. Include Biology staff where units are adjacent to federally listed and sensitive aquatic species habitat. Certified Timber Sales Administrators or CORs will not accept erosion control measures that fail to meet these criteria.	It is necessary to have a watershed specialist present during closeout to ensure that project watershed BMPs were implemented correctly as they were the original designer of the conservation practice. To minimize sediment delivery to T&E and sensitive species aquatic habitat		X	Soils and Watershed	AQ, SI, WL	BMP

SW062	In grassland restoration sites, limit skidding and designate skid trails if wood is to be removed. Where material is not to be removed, do not skid logs in meadows, and lop and scatter is the preferred method of treating slash. Do not machine pile within meadows. If skidding has to occur across a riparian or nonriparian stream course, designate any crossing prior to skidding.	Minimize effects on streams and soils in meadows from tree thinning operations.	X		Soils and Watershed	SI,RM	BMP
SW063	Wet Meadows, springs, seeps or other wet features where mechanized equipment is to be excluded will be designated as "protected areas" be clearly labeled on task order or contract maps and marked on the ground. Any features discovered during the layout phase of a project will also be included on task order or contract maps and boundaries shall be delineated on the ground during layout.	Soils and vegetation in wet meadows, dry meadows, springs, seeps or other sources where the presence of water is indicated will be protected from disturbance which could cause adverse effects on water quality, quantity, wildlife and aquatic habitat.		X	Soils and Watershed	SI,CK,AQ	DF

SW064	Only hand-felling methods will be permitted when removing trees from designated protected areas and other sensitive areas such wet meadows, or around springs, seeps, and other wet features unless approved by a watershed specialist or a biologist. The use of end-lining for removal of encroachment trees in these areas will be determined on a case-by-case basis by the authorized FS officer AND a watershed specialist.	Wet meadows, springs, seeps, and other wet areas have soil types with low soil weight-bearing strength due to permanently or seasonally high moisture contents and inherent soil characteristics which make them highly prone to detrimental soil compaction and topsoil displacement.		X	Soils and Watershed		BMP
SW065	Dry meadows will be treated in a site-specific manner to be determined by a watershed specialist in consultation with the project ID team.	Dry meadow soil types have low soil weight-bearing strength due to seasonally high moisture contents and inherent soil characteristics which make them highly prone to detrimental soil compaction and		X	Soils and Watershed		BMP

		topsoil displacement.					
SW066	Mechanized equipment usage for thinning timber or biomass will be restricted to slope gradients of 25 percent or less on fragile or sensitive soil types (e.g., cinder cones).	Severe erosion hazards are present on soil types above these slope gradients.		X	Soils and Watershed	SI	DF
SW067	Whether identified pre-implementation and on a task order/contract area map OR during the implementation phase, locations above 25 percent slope gradient on sensitive soil types will include a "protected area" designation that is clearly marked to exclude the use of mechanized thinning equipment. Hand-felling methods only will be permitted in these locations.	To protect highly erodible/sensitive soils on steep slopes by preventing traffic by heavy machinery on soils that are susceptible to destabilization and erosion.		X	Soils and Watershed		BMP

SW068	Use of specialized thinning equipment may allow operations on steeper slopes. Viability and authorization of specialized equipment use above these slope gradients will be determined during the layout phase of a sale by the pre-sale forester AND a watershed specialist. This equipment must be specified in the contract.	To insure that highly erodible/sensitive soils on steep slopes are protected during the layout of mechanical vegetation treatments.	X	X	Soils and Watershed		BMP
SW069	All ground disturbing activities using heavy equipment must be done under conditions which maintain soil condition (i.e. avoiding excess rutting, compaction, displacement).	Insure that mechanical operations do not take place when ground conditions are such that detrimental soil compaction and topsoil displacement can occur.		X	Soils and Watershed		BMP
SW070	Skid Trails: Allow up 6 inches of rutting over no more than 15 percent areal extent along a skid trail (two or more drags being considered a skid trail). Depth of rut is a measurement from the	Excessive ground disturbance and rutting causes detrimental soil compaction and topsoil displacement.	X	X	Soils and Watershed		BMP

	bottom to the top of a berm. Slope gradients of 20 percent or more will be considered on a case-by-case basis.	Compaction effects to the surface soil and inverted, exposed subsoil is not conducive to obtaining desirable long-term herbaceous revegetation. Excessive ground disturbance hinders long-term soil stability and productivity through increased erosion and establishment of exotic or invasive species that out-compete native, perennial grasses and forbs.					
SW071	At landings and within 75 feet of landings, rutting depths greater than 10 inches will not be allowed. Equipment shall not be turned on roads. Landings on slopes will be minimized to the	Prevents detrimental soil disturbance to depths that are difficult to adequately ameliorate and that could lead to	X	X	Soils and Watershed	SI	BMP

	greatest extent practicable and soil and watershed mitigation measures will be applied on a case by case basis to ensure that unacceptable soil loss does not occur.	broken tree roots resulting in drought stress of remaining trees.					
SW072	Rutting will not exceed 8 inches depth for more than 75 linear feet or 10% of road length, whichever is shorter. Rutting in excess of 3 inches depth will not be permitted on surfaced collector or arterial roads. If unsurfaced, guideline will be the same as for terminal and service roads.	Prevents rutting of the road traveled way that could lead to concentrated runoff, erosion and adverse effects to surface water quality.	X	X	Soils and Watershed	SI,TR	BMP
SW073	For any other locations (e.g., interior locations) within a sale area, if wheel tracks or depressions consistently exceed 2 inches then conditions are too wet to operate in these areas.	To prevent detrimental soil disturbance and compaction that would make it difficult for vegetation to become reestablished.	X	X	Soils and Watershed	SI,TR	BMP

SW074	No fire control lines should be constructed using mechanized equipment on slopes greater than 40 percent or greater than 25 percent on identified fragile or sensitive soil types.	Restriction of fire control line construction and burning activities to these slope breaks will help mitigate accelerated overland flow and erosion typically associated with these settings.		X	Soils and Watershed	FE	BMP
SW075	If fire control lines are constructed, rehabilitate lines after use by either rolling berm back over the entire fire line, spreading slash across the fire line, or water barring the fire line. If water barring only, vary spacing dependent on slope and disguise the first 400 feet of line to discourage use as a trail.	To prevent erosion and sediment delivery from firelines to stream courses. Also prevents firelines from being used as trails, thereby hastening recovery.		X	Soils and Watershed	FE	BMP

SW076	Surface fuel loading will be managed to achieve forest plan direction and specialist recommendations. These recommended levels may be lower in WUI areas. Ponderosa Pine Forest: 3 to 10 tons/acre (For Tonto NF: Refer to Forest Plan) Dry Mixed Conifer: 5 to 15 tons/acre (For Tonto NF: Refer to Forest Plan) For facilitative operations or other activities that may occur in non-target vegetation types (E.g., Pinyon-Juniper, Wet Mixed Conifer), refer to the applicable forest plan to find appropriate fuel loading levels.	Maintain long term soil productivity. To provide levels of surface fuels (fine and coarse woody debris) to address the need for habitat (cover), soils (organic material and limited areas of high burn severity), and fire (to limit areas of high burn severity and a high resistance to control).	X	X	Soils and Watershed	FE,SI	BMP

SW077	High soil burn severity fire should occur on no more than 5 percent of the entire treatment area for all prescribed fire in the project area.	Maintain long term soil productivity by minimizing erosion from containment lines and minimizing high soil burn severity to the degree possible.	X	X	Soils and Watershed	FE	BMP
SW078	Burn plans will be designed to minimize fire intensity in riparian areas that have a PFC rating of Nonfunctional or Functional-at-Risk with a downward trend.	These systems may lack the vegetation to adequately dissipate energy and protect stream banks, therefore retaining the vegetative cover is necessary.		X	Soils and Watershed	AQ, FE	BMP
SW079	Avoid treatment intensities (mechanical thinning and prescribed burning) which may cumulatively produce undesirable effects in subwatersheds. A watershed specialist will evaluate the potential for adverse cumulative subwatershed effects prior to	Reduce potential cumulative effects which may adversely affect subwatershed scale (HUC12) condition or function.		X	Soils and Watershed	AQ	DF

	implementation. Method ologies may include but are not limited to an Equivalent Disturbed Area analysis or watershed modeling software. If it is determined that potential cumulative effects may be adverse to watershed function and condition, treatments can be spread out spatially and/or temporally.						
SW080	If a watershed analysis is not completed, the default limit of areal extent of mechanical vegetative treatments which may occur in a subwatershed (HUC12) is 25% in a given year and 40% over 5 years of that subwatershed. For prescribed burning the percentages of subwatershed treated can be doubled over the same time periods.	Reduce potential cumulative effects which may adversely affect subwatershed scale (HUC12) condition or function.		X	Soils and Watersh ed	AQ,SI,FE	DF

SW081	When restoring floodplains, mimic to the extent possible, the elevation, width, gradient, length, and roughness that would occur naturally for that stream reach and associated valley type.	To improve hydrologic function and connectivity and reduce detrimental effects to channel morphology and aquatic habitat. Reconnecting floodplains to their historic stream channels will improve soil hydrologic function, increase wetted area, and provide for improved stream morphology.		X	Soils and Watershed	AQ	BMP
SW082	Without changing the location of the bank toe, restore damaged streambanks to a natural slope and profile suitable for establishment of riparian vegetation. This may include sloping of unconsolidated bank material to a stable angle of repose or the use of	To guide streambank restoration treatments.		X	Soils and Watershed	AQ	BMP

	benches in consolidated, cohesive soils.						
SW083	Road erosion control, such as lead-out ditches or water bars, shall be constructed to hydrologically disconnect road surface runoff from stream channels.	Minimize the concentration of run-off and sediment delivery into stream channels.		X	Soils and Watershed	AQ,TR	BMP
SW084	Road drainage is controlled by a variety of methods including rolling the grade, insloping, outsloping, crowning, water spreading ditches, and contour trenching. Sediment loads at drainage structures can be reduced by installing sediment filters, rock and vegetative energy dissipaters, and settling ponds. Design of roads is included in the transportation plan of the IRSC and T- specs.	Minimize soil movement, maintain water quality, and minimize effects on severe erosion soils.	X	X	Soils and Watershed	TR	BMP
SW085	Road maintenance through the integrated resource service contract should require pre-haul	To minimize soil movement, maintain water quality, and to	X	X	Soils and Watershed	TR	BMP

	and post-haul maintenance on all roads to be used for haul.	minimize effects on severe erosion soils.					
SW086	Relocated trails or roads will be constructed in a manner that does not hydrologically connect them to stream courses to the extent practical. Relocated roads and trails will have sufficient drainage features to maintain the integrity of the traveled way. New cross drains shall discharge to stable areas where the outflow will quickly infiltrate the soil and not develop a channel to a stream.	To provide for stable and serviceable roads and trails that do not adversely affect soils, surface water quality or aquatic habitats.		X	Soils and Watershed	AQ,TR,RS,SI	BMP
SW087	Site rehabilitation on riparian sites for stream channel and road reconstruction projects where ground disturbance occurs: seed at 5 pounds per acre or other appropriate rate with certified weed-free native seed mix to rehabilitate the site and minimize effects of noxious weeds.	To comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover.	X	X	Soils and Watershed	AQ, BT,RM	BMP

SW088	**Site rehabilitation on disturbed sites and stream channel shaping on previously decommissioned roads**: Site rehabilitation consists of several revegetation methods, such as, but not limited to: (1) Storing sod removed from the initial ground disturbance and replace the sod from the top of the bank on the disturbed site; (2) Use appropriate mix of species that will achieve vegetation establishment and erosion control objectives at the site. (3) Protect site with slash spread across the disturbed area to create microclimates and protect from grazing ungulates. Slash placement should be limited to the upper two-thirds of the bank to limit transport downstream of woody material;(4) Consider the use of mycorrhizal inoculum on severely disturbed sites where no topsoil is left; and (5) install erosion mat.(6)	Comply with State and Federal water quality standards by minimizing soil erosion through the stabilizing influence of vegetation ground cover. Minimize noxious weed spread.		X	Soils and Watershed	AQ, TR, WL	BMP

	Protect site with herptile-friendly barriers until the site has reestablished (see AQ018). Temporary erosion control should be installed before land or channel disturbing activities commence and will be inspected for adequacy/effectiveness at sufficient intervals to minimize adverse effects to soils or surface water quality.						
SW089	All potential seeding areas as part of restoration treatment to re-establish native, perennial grass abundance and vigor will be evaluated on a site-specific, case-by-case basis by the project interdisciplinary team (IDT). Seeding product for potential treatment areas will contain a mixture of certified weed-	For locations that do not have a viable enough seed bank to be propagated by prescribed fire activities alone, seeding may be necessary to help sites rejuvenate a more abundant and diverse herbaceous		X	Soils and Watershed	SI,FE,BT,RM,CK,TR	BMP

	free native grasses which will contain a composition and ratio to be determined by the IDT.	cover component that is aligned with the natural vegetative potential of the site.					
SW090	De-compact soil by scarifying the soil surface of roads and paths, stream crossings, staging, and stockpile areas so that seeds and plantings can root.	To rehabilitate all disturbed areas from aquatic and watershed restoration treatments, minimize erosion and sedimentation to aquatic habitats and potential effects on species.	X		Soils and Watershed		BMP
SW091	Potential revegetation seeding for individual sites should utilize the Apache-Sitgreaves, Coconino, and Tonto NFs (Terrestrial Ecosystem Surveys (TES) to identify species to be utilized. Where feasible, protect site with a variety of methods (e.g., ungulate	Minimize noxious weed spread.	X		Soils and Watershed	BT, NW, AQ, CK, FE, RM, SI, TR, WL	BMP

	proof fence, spreading slash, etc.).						
SW092	Upon project completion, rehabilitate all disturbed areas in a manner that results in similar or better than pre-work conditions through removal of project related waste, spreading of stockpiled materials (soil, large wood, trees, etc.), seeding, or planting with local native seed mixes or plants.	To rehabilitate all disturbed areas from aquatic and watershed restoration treatments, minimize erosion and sedimentation to aquatic habitats and potential effects to species.	X		Soils and Watershed	AQ, BT, CK, NW, FE, RM SI, TR, WL	BMP
SW093	For road, trail, aquatic, and watershed treatments: dispose of slide and waste material in stable sites out of the flood-prone area. Use native materials to restore natural or near-natural contours.	To protect water quality and aquatic habitat		X	Soils and Watershed	AQ, BT, NW, SI,RM,TR,WL,RS,CK	BMP

SW094	If soil compaction occurs during implementation, mitigate through ripping, seeding with native weed-free seed, and covering compacted areas with slash.	Minimize soil compaction, soil detachment, and sediment transport. To maintain long term soil productivity.	X		Soils and Watershed	AQ, BT, NW, SI,RM,TR,WL	BMP
SW095	The project fisheries biologist/hydrologist will ensure that project design features are incorporated into implementation contracts. If a biologist or hydrologist is not the Contracting Officer Representative, then the project Contracting Officer Representative must regularly coordinate with the biologist or hydrologist to ensure project design features and conservation measures are being followed.	To ensure technical skill and planning requirements for all aquatic and watershed restoration treatments.		X	Soils and Watershed	AQ, SI, TR, RM	DF
SW096	Prior to construction / site preparation, critical riparian vegetation areas, wetlands, and other sensitive sites will be clearly delineated to minimize ground disturbance, erosion, and	To minimize ground disturbance in aquatic and associated habitats during site preparation and		X	Soils and Watershed	AQ, TR, RM	BMP

	sedimentation to aquatic habitats.	sedimentation to aquatic habitats.					
SW097	Minimize clearing and grubbing activities when preparing staging, project, and or stockpile areas. Any large wood, topsoil, and native channel material displaced by construction will be stockpiled for use during restoration. Materials used for implementation of aquatic and watershed restoration categories (e.g., large wood, boulders, fencing material) should be staged out of the 100-year floodplain.	To minimize ground disturbance in aquatic and associated habitats during site preparation and sedimentation to aquatic habitats.		X	Soils and Watershed	AQ, TR, RM, CK, WL	BMP
SW098	Minimize time in which heavy equipment is in stream channels, riparian areas, and wetlands. Complete earthwork as quickly as possible and prior monsoon season. During excavation, stockpile native streambed materials	To minimize ground disturbance in aquatic and associated habitats during site preparation and	X	X	Soils and Watershed	AQ, TR, RM, CK, WL	BMP

	above the bankfull elevation, where it cannot reenter the stream, for later use.	sedimentation to aquatic habitats.					
SW099	Streambank vegetation will be protected except where its disturbance or removal is absolutely necessary for completion of the work.	To protect riparian vegetation and stream channel stability.		X	Soils and Watershed	AQ, SI,RM	BMP
SW100	Do not borrow road fill or embankment materials from the stream channel or meadow surface on road maintenance projects. End-load all material hauled onsite and compact fill.	Minimize disturbance in drainage systems and minimize sediment production within channel.		X	Soils and Watershed	AQ, TR	BMP
SW101	Heavy equipment will be commensurate with the project and operated in a manner that minimizes adverse effects to the environment (e.g., minimally-sized, low pressure tires, minimal hard turn paths for tracked vehicle, temporary mats or plates within wet areas or sensitive soils.)	To minimize impacts to streams and wetlands as well as aquatic habitats from heavy equipment use to implement restoration treatments.	X	X	Soils and Watershed	AQ, BT, NW, CK, FE, RM, SI, TR, WL	BMP

SW102	Placement of lop / scatter material or piling for burning will occur outside of fragile or sensitive soil types.	Minimize disturbance of sensitive soil.		X	Soils and Watershed	SI	BMP
SW103	Soil and vegetation disturbance would be avoided to the extent practicable. Clear only the area needed for expansion of the pit.	Prevents impacts to soil, vegetation, and wildlife.		X	Soils and Watershed	TR	BMP
SW104	All operators at a proposed rock pit site must obtain coverage under an Arizona Pollutant Discharge Elimination System Permit (AZPDES) and establish and implement a stormwater pollution prevention plan (SWPPP), if required to comply with State water requirements based on the magnitude of the specific rock pit operation.	To avoid and minimize impacts to water quality and watershed integrity.	X		Soils and Watershed	TR	BMP
SW105	Erosion control work would be kept current immediately preceding expected seasonal periods of precipitation or runoff.	To avoid and minimize impacts to water quality and watershed integrity.	X	X	Soils and Watershed	AQ, NW,CK,RM,SI,TR, WL	BMP

SW106	One 50-gallon spill kit (or two 30-gallon spill kits) must be located on-site during use of all heavy equipment.	To avoid impacts to water quality and wildlife.		X	Soils and Watershed	TR	BMP
SW107	No permanent structures would be constructed as part of any rock pit; although at least one self-contained portable toilet is required to be on-site during all operations.	To protect water quality and prevent unnecessary impacts to vegetation and wildlife.		X	Soils and Watershed	TR	BMP
SW108	Mine pit areas would be designed to be internally draining during mining activity.	To avoid and minimize impacts to water quality.		X	Soils and Watershed	TR	BMP
SW109	Where there is topsoil that is first removed to access the aggregate material source, this soil shall be stockpiled for reclamation. Soil would be stockpiled instratum and replaced so that the "A" horizon is back on the surface.	To facilitate reclamation efforts.		X	Soils and Watershed	TR	BMP
SW110	Stockpiled material should be placed and shaped to prevent water from ponding and to	To protect water quality.		X	Soils and Watershed	AQ, TR	BMP

	direct water to a drainage system.						
SW111	Keep sediment on-site of rock pits using settling ponds, check dams, or sediment barriers; and monitor and inspect the site frequently and correct problems promptly. Ponds should be cleaned out before they are more than 1/3 full of sediment.	To avoid and minimize impacts to water quality.		X	Soils and Watershed	TR	BMP
SW112	Removal of pit material will not involve disturbance of riparian areas or alteration of streambeds and/or floodplain.	To protect riparian and stream habitat.	X		Soils and Watershed	AQ, TR	BMP
SW113	Replace topsoil, revegetate, and reclaim mined areas pit as soon as possible once pit use is discontinued.	To protect soil and water resources.		X	Soils and Watershed	TR	BMP

Note: TR = Transportation, AQ = Aquatics, NW = Noxious Weeds, CK = Cave and Karst, RM = Range Management, SI = Silviculture, WL = Wildlife

Appendix D. Cumulative Effects Project Information

Table 1. Past/Completed project activities

Past Activities

Project Name	NEPA Decision Year	Treatment Types	Acres Planned Mechanical/Prescribed Fire/Other	Acres Implemented Mechanical/Prescribed Fire/Other	FOREST
Vegetation Management Projects (Mechanical Thinning and Prescribed Fire)					
Mullen Saw timber and Whitcom Multiproduct Offerings	1990	Group selection, intermediate thinning, pre-commercial thin, shelterwood/seed cut	3,238 / 0 / 0 (Mullen: 1,798 / 0 / 0 ; Whitcom: 1,440 / 0 / 0)	0 / 130 broadcast burning / 685 wildlife habitat grasses and forbs	ASNF
Jersey Horse Timber Sale	1991	Species habitat improvements, timber sales, forest vegetation improvements, fuel treatments		414 precommercial thinning; 1,038 salvage cut / 351 pile burning / 0	ASNF
Amended Elk Timber Sale	1993	Commercial and pre-commercial mechanical thinning	2,589 / 0 / 0	834 thinning / 382 pile burning ; 84 site prep for natural regeneration-burning / 0	ASNF

Brookbank Multi-Product Timber Sale	1994	Mechanical Thinning and Prescribed Fire	6,177/ 6,465 / 0	1,441 commercial thinning; 4,183 precommercial thinning / 3,751 broadcast burning; 1,230 pile burning / 0	ASNF
Cottonwood Wash Ecosystem Management Area	1995	Mechanical thinning, fuelwood sale, prescribed fire	3,493 / 10,896 / 0	516 precommercial thinning / 1,815 broadcast burning; 632 pile burning / 0	ASNF
Blue Ridge-Morgan	1997	Commercial mechanical thinning, fuelwood sales, broadcast burning	8,280 / 7,618 / 0	14,471 thinning / 4,430 broadcast burning ; 10,122 pile burning / 0	CNF
Gentry	1997	Thinning, fire	7,718	125 precommercial thinning; 326 commercial thinning / 191 pile burning / 0	ASNF

Sundown Ecosystem Management Area	1997	Salvage cut: intermediate treatment; not regen, fire	7,607	75 precommercial thinning; 2,000 salvage cut / 24 pile burning / 170 range control vegetation; 1,830 range cover manipulation and type conversion; 3,463 tree encroachment control; 1,560 tree release and weed	ASNF
Wiggins Analysis Area	1998	Group selection, intermediate thinning, pre-commercial thinning, broadcast burning	5,935 / 3,385	0 / 3,989 broadcast burning; 235 pile burning / 0	ASNF
Show Low South (#22297)	1999	Prescribed fire and construction and maintenance of defensible space		0 / 2,696 broadcast burning / 0	ASNF
Larson Rx Burn	2001	Prescribed fire	0 / 2,500 / 0	0 / 3,015 broadcast burning / 0	ASNF

Treatment of Dead Trees in the Rodeo-Chediski Fire (#20740)	2002	Treatment of dead trees for trail management, facility maintenance, road maintenance, and safety along utility lines		3,475 salvage cut / 1,587 pile burning; 15 compacting fuels / 293 site prep for natural regeneration - burning; 1,579 site preparation for natural regeneration - mechanical; 676 site preparation for planting - mechanical	ASNF
Heber-Overgaard WUI	2003	Mechanical thinning, prescribed fire	3,593 / 489 / 0	2,696 precommercial thinning; 2,393 commercial thinning / 686 pile burning / 571 chipping of fuels; 541 range forage improvement; 96 special products removal	ASNF
Hidden Lake Rx Burn	2003	Prescribed fire	0 / 2,000 broadcast burning / 0	0 / 2,828 broadcast burning / 0	ASNF
Camp Tatiyee / Camp Grace Fuel Reduction	2004	Pile Burning	340 / 340 / 0	0 / 172 pile burning / 0	ASNF

Country Club Escape Route	2004	Commercial thinning, fire	0 / 975 / 0	524 pre- and commercial thinning / 933 broadcast burning; 915 pile burning / 915 range cover manipulation	ASNF
High Value Ponderosa Pine Tree Protection	2004	Mechanical thinning, insecticide treatment	698 / 0 / 698	505 precommercial thinning; 480 commercial thinning / 826 pile burning / 203 insect control and prevention	ASNF
Rodeo-Chediski Fire Salvage	2004	Mechanical thinning of fire-killed trees and fuel treatments	47,467 / 0 / 0	25,913 salvage cut / 626 pile burning; 1,256 fuel breaks / 411 site prep for planting and regeneration	ASNF
Forest Lakes WUI Treatment	2005	Mechanical thinning, hand thinning, piling, pile burning		737 precommercial thinning; 954 commercial thinning / 989 broadcast burning; 656 pile burning / 0	ASNF

Rim Top Rx Burn (formerly Woods Canyon Fuel Treatment)	2005	Prescribed fire	0 / 665 / 0	0 / 665 broadcast burning / 0	ASNF
Show Low South (#4456)	2005	Thinning and fuels treatments		10 thinning for fuels reduction / 575 broadcast burning; 10 pile burning / 0	ASNF
Dye Thinning	2006	Mechanical thinning to reduce dwarf mistletoe and protect regeneration	250 / 250 / 0	247 pre- and commercial thinning / 0 / 0	ASNF
Hilltop WUI	2006	Vegetation management-mechanical thinning & mastication, prescribed fire	1,544 / 1,544 / 0	857 precommercial thinning; 677 commercial thinning / 45 pile burning / 616 range forage improvement	ASNF
Bruno Thinning and Slash	2009	Hand Thinning, piling, pile burning	0 / 86 / 0	0 / 70 pile burning / 0	ASNF
Whitcom WUI	2009	Commercial thinning, fire	0	925 pre- and commercial thinning / 0 / 0	ASNF
Hilltop II Fuels Reduction	2011	Vegetation management-mechanical thinning, prescribed fire	190 / 1,544 / 0	0 / 799 broadcast burning / 616 cultural site protection	ASNF

Rodeo-Chediski Site Prep for Reforestation (#48660)	2016	Mastication of alligator juniper and small woody re-growth to prep for planting	200 / 0 / 0		ASNF
Pocket Baker	2000	Mechanical treatment and prescribed fire.	5,200 thinning / 17,000 prescribed fire / 0	0 / 5,450 broadcast burning / 0	CNF
Blue Ridge Urban Interface	2001	Precommercial thinning and prescribed fire	8,158 / 10,549 / 0	200 precommercial thin / 6,225 broadcast burning; 216 thinning for fuels reduction / 2325 range control vegetation	CNF
IMAX	2002			0 / 5,708 broadcast burning; 300 underburn - low intensity / 0	CNF
Pack Rat Salvage	2004	Salvage, thinning and pile burning of area burned in Pack Rat fire	550 thinning / 550 pile burning / 0		CNF

Bald Mesa Fuels Reduction	2005	Mechanical treatment and prescribed fire to reduce fuels in the Clear Creek Pines subdivision		2,485 precommercial thin / 4,500 broadcast burning; 650 pile burning; 4,500 underburn / 0	CNF
APS Blue Ridge 69kV Transmission Line	2005	Mechanical treatment and prescribed fire		0 / 1,600 broadcast burning	CNF
Good/Tule	2006	Thinning 5-18" trees and prescribed fire	4,337 mechanical thinning / 8,361 prescribed fire/ 0	1,253 commercial thinning; 136 single-tree selection / 2,025 broadcast burning /0	CNF
Post-Tornado Resource Protection and Recovery	2011	Remove downed wood and thin adjacent stands	14,776 thinning/ 3,990 salvage and/or burning, chipping, lop & scatter, removal of conifers and slash	765 sanitation cut / 0 / 0	CNF
Lake Mary Road ROW Clearing (ADOT)	2016			788 harvest without restocking / 0 / 0	CNF

Ridge Analysis Area	1994	Commercial thinning, salvage, vegetation improvements, hazardous fuels reduction		1,102 single-tree selection cut; 18 commercial thinning; 691 precommercial thinning / 31,500 thinning for fuels reduction / 1,094 range control vegetation	TNF
Lion Analysis Area	2001	Intermediate thinning, prep cutting, uneven-aged management, wildlife forage areas, prescribed burning	2,455 / 9,000-10,000 / 0?	664 commercial thinning / 5,500 broadcast burning; 1,400 fuel breaks; 5,000 pruning to raise canopy height / 664 tree release and weed	TNF

Verde WUI	2004	Thin from below to 18" DBH, thin from below to 9" DBH, PJ savanna restoration, fuel break construction, prescribed burning	10,710 thin from below / 28,438 pile and broadcast burning; 4,761 fuel break construction / 1,401 PJ savanna restoration	1,000 precommercial thinning / 34,000 broadcast burning; 14,500 pile burning; 648 fuel break construction; 5,000 pruning to raise canopy height; 4,000 hazardous fuels thinning / 5,000 range cover manipulation	TNF
Parallel Prescribed Burn	2014	Prescribed fire to improve timber stands and wildlife habitat	0 / 24,089 / 0	0 / 4,759 broadcast burning / 0	TNF
Cottonwood Wash Ecosystem Management Area	1995	Mechanical thinning, fuelwood sale, prescribed fire	3,493 / 10,896 / 0	516 precommercial thinning / 1,815 broadcast burning; 632 pile burning / 0	ASNF

Buzzard Roost Ecosystem Management Area	1995			130 commercial thinning / 0 / 0	TNF
Mint Springs Analysis Area	1998	Mechanical thinning, fuels treatments and road decommissioning	3,900 / 12,000 / 30 miles roads	2,243 commercial thinning / 12,340 broadcast burning; 500 pile burning; 464 hazardous fuels reduction / 5,990 range control vegetation	CNF
Rocky Park Fuels Reduction	2001	Mechanical thinning and Prescribed fire	5,000 / 13,000 / 0	0 / 7,435 broadcast burning / 1,035 range control vegetation	CNF

Camp Tatiyee / Camp Grace Fuel Reduction	2004	Pile Burning	340 / 340 / 0	0 / 172 pile burning / 0	ASNF
Mormon Lake Basin Fuel Reduction	2005	Mechanical thinning and Prescribed fire	2,831 / 2,831 / 0	179 precommercial thinning; 2,033 commercial thinning / 3,000 broadcast burning; 1,000 pile burning / 7 wildlife habitat improvement	CNF
Hilltop WUI	2006	Vegetation management-mechanical thinning & mastication, prescribed fire	1,544 / 1,544 / 0	857 precommercial thinning; 677 commercial thinning / 45 pile burning / 616 range forage improvement	ASNF
Shoofly Juniper Thinning Project	2010		58 commercial thinning / 0 / 0		TNF

No Decision Document (Durfee)	Unknown			0 / 17 pile burning / 0	ASNF
No Decision Document (Woodlands/Camps Stewardship)	Unknown			1,702 commercial thinning / 50 hazardous fuels reduction / 0	ASNF
No Decision Document (Apache Maid-Stoneman RX)	Unknown			0 / 1,170 broadcast burning / 0	CNF
No Decision Document (Freedom B Commercial Fuel Wood)	Unknown			5 commercial thinning / 0 / 0	TNF

No Decision Document (Marsh Creek)	Unknown			0 / 850 broadcast burning / 850 range cover manipulation	TNF
No Decision Document (Naeglin)	Unknown			0 / 2,000 broadcast burning / 0	TNF
Right-of-Way (ROW) Projects with Herbicide Use					
Management of Noxious Weeds and Hazardous Vegetation on State Highway ROWs	2004	Authorize ADOT to treat noxious weeds and hazardous vegetation within ROWs using herbicides		0 / 0 / 11,005 pesticide control of invasives; 25 mechanical control of invasives	TNF
Reforestation/Planting Projects					
Bison Reforestation	2003	Site prep and planting	0 / 0 / 500	0 / 96 pile burning, / 356 site prep for planting-mechanical; 216 site prep for natural regeneration - burning; 308 tree planting; 275 animal damage control for reforestation	ASNF

Clay Springs Reforestation	2004	Site prep and planting	0 / 0 / 710	0 /0 / 169 tree planting; 169 animal damage control for reforestation	ASNF
Jacques Marsh Elk Proof Fence & Riparian Planting	2006	Creation of 10 acre exclosure to improve songbird nesting habitat, planting of riparian trees and shrubs	0 / 0 / 10	0 / 73 broadcast burning / 0	ASNF
Pierce Reforestation	2009	Site prep and planting	0 / 0 / 1,375	0 / 0 / 203 tree planting; 203 animal damage control for reforestation	ASNF
Rodeo-Chediski Riparian Planting	2010	Willow and cottonwood planting in riparian areas within R-C fire footprint	0 / 0 / 1 planting	0 / 0 / 0.6 Planting	ASNF
Conifer Weeding for Aspen Enclosure	Unknown			65 liberation cut / 0 / 0	ASNF
Spring and Meadow Restoration Projects					
Bill Dick, Foster, and Jones Springs Enhancement	2013	Pond and trough installation, fence installation and maintenance, and willow pole planting (at Jones Spring)	0 / 0 / 9.3	N/A	CNF

Wildlife Habitat Improvement, Grassland Restoration Projects/Allotment Projects					
Park Day Allotment	1994	Vegetation management-mechanical and hand thinning, fuelwood sales, broadcast burning	14,665 (8,279 acres of fuelwood, 6,286 acres machine and hand thinning of P-J, 100 acres of ponderosa thinning) / 250 / 0	1,031 commercial thinning; 1,162 improvement cut / 0 / 701 range vegetation control	ASNF
Clear Creek Allotment	2000	Species habitat improvements, rangeland vegetation improvements, forest vegetation improvements, watershed improvements	108	0 / 2,397 chipping of fuels / 949 tree encroachment control; 2,288 range cover manipulation	ASNF
Wallace Allotment	Unknown			0 / 0 / 1,586 tree encroachment control; 161 control of understory vegetation	ASNF
Apache Maid Grassland Restoration	2004			54,528 / 6,770 broadcast burning / 0	CNF

No Decision Document (Pierce Wash Allotment)	Unknown			0 / 0 / 64 tree encroachment control	ASNF
Other Projects					
Fossil Creek Watershed Restoration and Native Fish Habitat Protection	2006			0 / 0 / 21 invasives treatment - pesticide; 3 invasives treatment - mechanical	CNF,TNF
No Decision Document (Powerline Maintenance)	Unknown			0 / 0 / 1,845 tree encroachment control	ASNF
No Decision Document (San Juan Road Hazard Salvage)	Unknown			291 salvage cut / 0 / 0	ASNF

Noxious Weed Treatment Projects on the Tonto National Forest (#22874)	2005	Manual treatment of noxious weeds and invasive plants, including small-scale prescribed burns within 50' of system roads		0 / 0 / 174 mechanical/physical control of invasives	TNF
Grapevine Interconnect (Grapevine Canyon Wind Project)	2012	Powerline and switchyard installation	24 thinning; clearing / 0 / 0		CNF
APS Line Maintenance	Unknown			87 permanent land clearing / 0 / 0	CNF

COF - No NEPA docs found - various activities reported in FACTS but not tied to other named projects	Unknown	N/A	N/A	9,159 precommercial thinning; 4,544 commercial thinning; 112 group selection cut; 788 harvest without restocking; 65 liberation cut; 44 overstory removal; 87 permanent land clearing; 669 shelterwood establishment cut; 365 shelterwood prep cut / 15,175 broadcast burning; 216 hazardous fuels thinning / 15 biocontrol(classic) of invasives; 20 pesticide control of invasives; 3,921 range control vegetation; 739 tree release and weed	CNF

TNF - No NEPA docs found - various activities reported in FACTS but not tied to other named projects	Unknown	N/A	N/A	5,661 precommercial thinning; 2,518 commercial thinning; 1,215 sanitation cut; 259 shelterwood prep cut / 23,111 broadcast burning; 3,275 pile burning; 1,231 hazardous fuels thinning; 2,965 fuel break construction / 260 tree planting; 198 fill-in or replant of trees; 1,716 mechanical control of invasives; 4,018 pesticide control of invasives; 21,000 biocontrol (livestock) of invasives; 6,890 range cover manipulation; 11,345 tree release and weed	

Table 2. Current/Ongoing project activities

Project Name	NEPA Decision Year	Treatment Types	Acres Planned Mechanical/Prescribed Fire/Other	Acres Implemented Mechanical/Prescribed Fire/Other	FOREST
Vegetation Management Projects (Mechanical Thinning and Prescribed Fire)					

Little Springs WUI	2003	Group selection, improvement cut, commercial thin	7,991 / 0 / 0	1,733 precommercial thinning; 133 improvement cut; 1,403 group selection cut; 107 commercial thinning / 2,500 broadcast burning; 1,727 pile burning / 2,500 range cover manipulation	ASNF
Rodeo-Chedeski Mastication (Heber-Overgaard and Ricochet/Williams Ranch Fuels Reduction	2018	Mastication and removal of small trees, hand thinning, and piling, and burning	301/301/0	0/0/0	ASNF

Nagel	2005	Commercial thin; Salvage cut, Fire	116,618	551 salvage cut; 8,503 precommercial thinning; 10,757 commercial thinning / 12,228 broadcast burning; 896 pile burning; 5,107 underburn / 889 range cover manipulation; 1,592 range forage improvement; 321 scarify and seed landings	ASNF
Los Burros	2006	WUI thinning, hazardous fuels treatments, woodland stand thinning, thin from below, aspen regeneration treatments	15,976 WUI thinning, 2,688 habitat improvement thinning, 3,560 old growth improvement thinning and aspen regeneration thinning / 3,560 broadcast burning / 0	14,934 precommercial thinning; 13,200 commercial thinning; 597 shelterwood cut / 1,840 broadcast burning; 11,015 pile burning; 204 jackpot burning; 939 thinning for fuels reduction / 29 range cover manipulation; 567 wildlife habitat mechanical treatment	ASNF

Nutrioso WUI	2006	Commercial thin, salvage cut, fire	28,576 mechanical thinning / 39,356 prescribed fire / 0	5,571 precommercial thinning; 3,316 commercial thinning; 4,624 salvage cut / 6,954 pile burning; 2,916 jackpot burning; 5,965 thinning to reduce fuels / 827 tree planting; 394 range vegetation control; 33 tree encroachment control	ASNF
Show Low South (#29987)	2011	Commercial thin, group selection, fire	3,739 thinning / 4,637 prescribed fire / 0	3,271 pre- and commercial thinning; 101 group selection cut / 0 / 0	ASNF
Rodeo-Chediski Fire Rx Burn	2012	Fire, pruning, limbing	0 / 148,222 / 0	0 / 9,506 broadcast burning / 9,670 range cover manipulation; 5,162 tree release and weed	ASNF

Timber Mesa/Vernon WUI	2012	Single tree and group selection, commercial thinning, fire	27,000 / as needed / 0	11,051 commercial thinning; 5,421 group selection cut; 1,656 precommercial thinning; 136 single-tree selection / 39,047 pile burning; 713 jackpot burning / 9,911 range cover manipulation; 3,979 tree encroachment control; 6,551 tree release and weed; 517 wildlife habitat mechanical treatment	ASNF
Rim Lakes Forest Restoration	2013	Select cut then burn, broadcast burn w/out cut, select cut w/out burn	23,671 / 32,954 / 0	5,839 precommercial thinning; 6,530 commercial thinning; 80 snag removal; 34 sanitation cut / 1,335 broadcast burning / 116 pruning; 6,251 range cover manipulation; 80 tree release and weed	ASNF

Larson Forest Restoration	2015	Group selection, intermediate thinning, pre-commercial thin, shelterwood/seed cut, broadcast burn	25,726 / 4,906	1,867 pre- and commercial thinning / 0 / 2,513 range cover manipulation; 3 tree release and weed	ASNF
Upper Rocky Arroyo Restoration	2016	Mechanical thinning, hand thinning, fire	30,400 / fire-as needed	696 commercial thinning / 4,897 broadcast burning; 368 pile burning; 146 jackpot burning / 3,960 wildlife habitat non-structural improvement	ASNF
Section 31 Fuels Reduction	2017	Mechanical thinning of ponderosa pine, juniper, and pinyon trees up to 12" within RC fire footprint	230 / 0 / 0	44 precommercial thinning / 0 / 0	ASNF

Lake Mary Meadows Two Fuel Reduction	2005			117 precommercial thinning / 7,523 broadcast burning; 2,700 pile burning / 803 range control vegetation	CNF
East Clear Creek Watershed Health Improvement	2006	Mechanical treatment and prescribed fire	10,407 mechanical thinning / 10,497 prescribed fire / 0	30,000 precommercial thin / 38,470 broadcast burning; 10,020 hazardous fuels thinning / 30,000 tree release and weed; 10,000 tree encroachment control	CNF
Victorine 10K Area Analysis	2006	Mechanical thinning and prescribed fire	1,293 mechanical thinning / 8,407 prescribed fire / 0	8,195 precommercial thinning / 29,585 broadcast burning; 820 hazardous fuels thinning / 0	CNF
Upper Beaver Creek Watershed Fuel Reduction	2010	Mechanical thinning, prescribed fire	15,807 thinning / 31,162 burning; 43,906 maintenance prescribed burning	20,000 precommercial thinning; 608 commercial thinning / 20,000 broadcast burning (RRRD); 24,000 broadcast burning (MRRD); 20,000 pile burning / 0	CNF

Blue Ridge Community Fire Risk Reduction	2012	Private land mechanical with limited pile burning	0 / 5 prescribed fire; 50-75 hazardous fuels thinning / 0	0 /30,000 broadcast burning; 15,000 pile burning / 0	CNF
Clints Well Forest Restoration	2013	Mechanical thinning and prescribed fire	12,899 mechanical thinning / 16,444 prescribed fire / 25 rock pit expansion	11 permanent land clearing / 6,639 broadcast burning / 0	CNF

Hutch Mountain Communication Site	2017	Clearing approximately 0.6 acres of land to build and house a communication site and solar array. Thinning of trees <9" DBH on approximately 1.9 acres surrounding the communication site area	0.6 clearing; 1.9 thin from below / 0 / 0	0.5 permanent land clearing / 0 / 0	CNF

Pine-Strawberry WUI	2006	Thin from below, grassland restoration, fuel break construction, prescribed fire (pile and broadcast burning) or vegetative maintenance	8,764 thin from below / 40,928 pile and broadcast burning; 945 fuel break construction / 7,525 grassland restoration	503 precommercial thinning; 168 commercial thinning; 503 salvage cut / 13,868 broadcast burning; 6,000 pile burning; 14,630 thinning for fuels reduction; 7,282 fuel break construction; 18,000 pruning to raise canopy height / 200 range cover manipulation	TNF
Chamberlain Analysis Area	2008	Mechanical thinning, prescribed burning, shaded fuel breaks	7,072 mechanical thinning / 20,050 prescribed burning; 1,000 shaded fuel breaks / 0	504 group selection and/or commercial thinning; 1,030 precommercial thinning; 258 single tree selection / 12,500 broadcast burning; 6,500 pile burning; 6,700 thinning for fuels reduction; 552 fuel break / 1,675 range control vegetation	TNF

Christopher/Hunter WUI	2009	Thin from below, fuel break construction, pile and broadcast burning, vegetative maintenance	10,838 thinning from below / 20,550 pile and broadcast burning; 970 fuel break construction / 20,550 vegetative maintenance	450 group selection and/or commercial thinning / 11,000 broadcast burning; 8,000 pile burning; 2,500 hazardous fuels thinning; 2,813 fuel breaks; 5,000 pruning to raise canopy height / 450 tree release and weed; 489 range control vegetation	TNF
Cherry Prescribed Burn	2012	Prescribed burning	0 / 14,700 – 21,000 / 0	0 / 6,582 broadcast burning / 0	TNF
Myrtle WUI	2012	Fuel breaks, thin from below prescribed fire	12,265 thin from below / 27,131 prescribed fire; 4,437 shaded fuel breaks / 0	1,053 commercial thinning; 38 single-tree selection cut / 37,900 broadcast burning; 37,900 pile burning; 102,800 hazardous fuels thinning / 1,091 tree release and weed; 744 range control vegetation	TNF

Mineral Ecosystem Management Area	2002	Vegetative fuel treatments to reduce fire risk, manage old-growth, improve wildlife habitat and watershed conditions, and provide forest products		224 precommercial thinning; 3,410 commercial thinning / 81,666 broadcast burning; 4,285 pile burning; 380 underburn; 1,157 hazardous fuels reduction / 80,080 wildlife habitat mechanical treatment; 1,830 wildlife habitat prescribed fire; 882 range cover manipulation	ASNF
Payson WUI	2004	Thin from below, grassland restoration, fuel break construction, prescribed fire (pile and broadcast burning) or vegetative maintenance	4,373 thin from below / 35,037 pile and broadcast burning; 2,640 fuel break construction / 3,294 grassland restoration	2,700 precommercial thinning / 12,000 broadcast burning; 5,750 pile burning; 19,778 hazardous fuels reduction; 2,965 fuel breaks; 4,000 pruning to raise canopy height and discourage crown fire / 400 tree release and weed; 4,250 range cover manipulation	TNF

Cherry Prescribed Burn	2012	Prescribed burning	0 / 14,700 – 21,000 / 0	0 / 8,582 broadcast burning / 0	TNF
Four-Forest Restoration Initiative - 1st EIS	2015			385 precommercial thinning / 0 / 0	CNF
Section 31 Fuels Reduction	2017	Mechanical thinning of ponderosa pine, juniper, and pinyon trees up to 12" within RC fire footprint	230 / 0 / 0	44 precommercial thinning / 0 / 0	ASNF
Wildlife Habitat Improvement, Grassland Restoration Projects/Allotment Projects					

Bar T Bar/Anderson Springs Allotment	2005	Meadow and grassland restoration treatments followed by prescribed fire	0 / 32,677 prescribed fire / 32,677 PJ removal for grassland restoration and maintenance and wildlife corridor creation	1,304 precommercial thinning / 116,084 broadcast burning; 16,854 pile burning / 1,519 range control vegetation; 39,180 tree encroachment control; 652 wildlife habitat improvement	CNF
Railroad Allotment (Formerly Carlisle Complex Vegetation Treatments)	2007	Vegetation management-mechanical removal of juniper	10,000 / 0 / 0	0 / 0 / 444 tree encroachment; 2,620 wildlife habitat mechanical treatment; 547 wildlife habitat rehabilitate openings; 497 range control vegetation	ASNF
Railroad Allotment (Formerly Carlisle Complex Vegetation Treatments)	2007	Vegetation management-mechanical removal of juniper	10,000 / 0 / 0	0 / 0 / 561 tree encroachment; 2,873 wildlife habitat mechanical treatment	ASNF

Bar T Bar/Anderson Springs Allotment	2005	Meadow and grassland restoration treatments followed by prescribed fire	0 / 32,677 prescribed fire / 32,677 PJ removal for grassland restoration and maintenance and wildlife corridor creation	1,304 precommercial thinning / 116,084 broadcast burning; 16,854 pile burning / 1,519 range control vegetation; 39,180 tree encroachment control; 652 wildlife habitat improvement	CNF
Reforestation/Planting Projects					
Rodeo-Chediski Reforestation (#18675)	2007	Planting, shade installation, fencing	0 / 0 / 3,071	0 / 150 pile burning / 551 tree planting; 303 animal damage control; 202 tree release and weed	ASNF
Spring and Meadow Restoration Projects					

Long Valley Work Center Meadow Restoration	2018	Raise water table, shape and realign channel, construction of grade control structures (e.g., media lunas, Zuni bowls), removal of encroaching trees, removal of stock pond, and placement of biodegradable erosion control matting		0 / 0 / 16 tree encroachment control	CNF
Other Projects					

ASNF - No NEPA docs found - various activities reported in FACTS but not tied to other named projects	Unknown	N/A	N/A	24,081 precommercial thinning; 4,571 commercial thinning; 389 group selection cut; 4,022 improvement cut; 6,095 salvage cut; 137 sanitation cut; 90 shelterwood establishment cut / 62,879 broadcast burning; 7,798 pile burning; 3,165 hazardous fuels thinning / 2,158 tree planting; 350 fill-in or replant of trees; 1,720 initiate natural regeneration; 59 animal damage control for reforestation; 82 mechanical control of invasives; 497 range control vegetation; 4,297 range cover manipulation; 438 range seeding and planting; 3,525 site prep for natural regeneration - burning; 186 site prep for natural regeneration - mechanical; site prep for planting - mechanical; 5,563 tree encroachment control; 27 tree release and weed; 1,465 wildlife	ASNF

				habitat activities; 27 wildlife habitat mechanical treatment; wildlife habitat rehab openings	

Sixteen Rock Pits and Additional Reclamation	2017	Vegetation removal for expansion and reclamation of rock pits on the Coconino	66 thinning or clearing / 0 / 66 excavation; 5 re-contouring; 5 planting	0 / 0 / 0	CNF
Glen Canyon-Pinnacle Peak 345kV Transmission Line Vegetation Management (WAPA)	2014	Mechanical and/or manual removal and regular management of vegetation except grasses, forbs, and small shrubs in ROW and adjacent 60 feet (420 feet total corridor width for management).	4,580 vegetation removal / 0 / 0		CNF

Noxious Weed Treatment Projects	2005	Treatment of infestations of noxious weeds <10 acres and/or within 50 feet of system roads using manual, mechanical, and prescribed fire treatments		0 / 0 / 2,021 pesticide control of invasives; 61,015 mechanical control of invasives; 1,008 cultural and fire control of invasives; 11 biocontrol (livestock) of invasives	TNF

Table 3. Reasonably Foreseeable project activities

Project Name	NEPA Decision Year	Treatment Types	Acres Planned Mechanical/Prescribed Fire/Other	Acres Implemented Mechanical/Prescribed Fire/Other	FOREST
Vegetation Management Projects (Mechanical Thinning and Prescribed Fire)					

Emery Oak Restoration	Unknown	Construction of exclosures, thinning, transplanting, and other actions.		0/0/0	TNF
Pierce Wash Allotment Section 18 Analysis of Vegetative Treatments	Unknown	Grassland Restoration			ASNF
Heber –Overgaard Insect and Disease Farm Bill CE					ASNF

Cragin WPP	2018	Mechanical thinning and prescribed fire	41,046 mechanical thinning/ 63,656 prescribed fire / 0	0 / 0 / 0	CNF
Flying V&H Prescribed Fire	Decision expected 2018	Prescribed burning on 59,124 acres and create shaded fuel breaks on 1,798 acres within the 59,124 acres fuel analysis area to manage timber and other woody vegetation	0 / 59,124 prescribed fire; 1,798 fuel break construction / 0	0 / 0 / 0	
Haigler Fuels Analysis		Prescribed burning on 43,435 acres and creation of shaded fuel breaks around Haigler Creek Estates	0 / 43,435 prescribed fire / 0	0 / 0 / 0	
Right-of-Way (ROW) Projects with Herbicide Use					

APS-Herbicide Use within Authorized Power Line ROWs on NFS Lands in AZ	Decision expected 2019	Application of FS-approved herbicides in ROWs on FS lands. Application could be foliar, cut-stump, basal, or defensible space around poles (DSAP) depending on specific herbicide and targeted species	0 / 0 / herbicide application (ASNF-1,258 ac, COF-82 ac, TNF-796 ac)	0 / 0 / 0	ASNF, CNF, TNF
WAPA Glen Canyon-Rogers 230/345kV Integrated Vegetation Management	Decision expected 2019	Integrated Vegetation Mgmt: Protect facilities from fire, control the spread of noxious weeds, and establish and maintain stable, low-growing plant communities in the ROW. This includes removal of all danger trees in ROW and adjacent area (420' total corridor width) and may involve manual or mechanical removal and application of approved herbicides. Operations & Maintenance: road repair to provide access for maintenance and emergencies.	13,338 vegetation removal / 0 / 0	0 / 0 / 0	CNF

SRP-Herbicide Use within Authorized Power Line ROWs on NFS Lands in AZ	Decision expected 2018 or 2019	Application of EPA- and USDA-approved herbicides in ROWs on FS lands. Application could be foliar, hack and squirt, cut-stump, basal, or combustible free space treatments (to maintain a 10-ft radius of bare ground around distribution and transmission poles) depending on specific herbicide and targeted species	0 / 0 / herbicide application (ASNF-1,068 ac, TNF-6,401 ac)	0 / 0 / 0	ASNF
Reforestation/Planting Projects					
AGFD Fairchild Draw Elk Exclosure	2018	Permit renewal for AGFD to allow maintenance of existing elk exclosure in Fairchild Draw	0 / 0 / 16 fence maintenance	0 / 0 / 0	ASNF
Spring and Meadow Restoration Projects					

Mogollon Rim Spring Restoration Project	2018	Improve the hydrologic function and ecological integrity of 16 spring ecosystems by removing invasive weeds through manual and chemical treatment means, planting native riparian vegetation, fencing around the spring emergence zone and associated spring ecosystem and thinning of trees up to 12" diameter at breast height (dbh) to accommodate fence construction and other proposed restoration activities. Activities would occur on approx. 5 acres	N/A		CNF
Wildlife Habitat Improvement, Grassland Restoration Projects/Allotment Projects					
Heber Allotment		Vegetation management-mechanical thinning, prescribed fire	39,000 grassland restoration and maintenance	0 / 0 / 0	ASNF
Flying V and Flying H Allotment		Remove encroaching junipers, reclaim a former homestead area by pushing over encroaching junipers and seeding native grasses, and construct fence to improve water and herd management	0 / 0 / 10,875 juniper encroachment removal; 112 acres fence construction	0 / 0 / 0	

Hardscrabble Allotment Juniper Clearing		Authorize the permittee to treat an area using an agra-axe mounted on a rubber-tired or tread skid steer tractor to cut juniper trees of less than 8 inch diameter breast height (DBH)	0 / 0 / 100 tree encroachment removal	0 / 0 / 0	
New Delph Tank & Bear Tank Maintenance		Construct a new earthen stock tank (Delph) and maintain existing stock tank (Bear)	0 / 0 / 0.15 acres dredging and berm construction for new tank	0 / 0 / 0	
Pleasant Valley Northwest Grazing Allotments		Structural improvements to allotments (54,147 acres total), including fencing to exclude livestock from the Haigler campground and portions of Haigler Creek, and removal of juniper to increase herbaceous vegetation		0 / 0 / 0	
Red Lake Tanks		Authorize permittee to construct 7 new tanks on Red Lake allotments. Ground disturbance would include using a bulldozer to dig tanks, build berms, and construct ditches to collect water. Incidental shrub removal may occur in the tank footprints.	0 / 0 / 0.8 acres dredging, berm construction, ditch excavation	0 / 0 / 0	
Other Projects					

Four Springs Trail Realignment	Decision expected 2018	Reroute and rehabilitate approx. 4.5 miles of Four Springs Trail to a safer, more sustainable route that will decrease erosion and effects on historic and cultural features/sites	0 / 0 / 4.5 miles	0 / 0 / 0	ASNF
Heber-Overgaard Non-motorized Trail System		Creation of trail system to connect the County Park to existing trails off of system roads 50 and 51		0 / 0 / 0	ASNF
Navopache Electric Cooperative Trunk Line Addition		Add new trunk line extending from transfer station to FR488H. New line would occupy less than 1/4 mile total distance crossing forest, parallel to FR488H in a 20' corridor.		0 / 0 / 0	ASNF
Cragin-Payson Water Pipeline and Treatment Plant	2012	Issuance of a special use permit to the Town of Payson to locate, construct, operate, and maintain a 15 mile by 100 foot wide water transmission pipeline right-of-way.	Up to 352 acres temporary land clearing for staging, excavation, construction, and pipeline burial / 0 / 0	0 / 0 / 0	

Table 4. Distribution of current/ongoing and reasonably foreseeable activities by subwatershed.

Subwatershed	Status Unknown	Current/Ongoing	Reasonably Foreseeable	Grand Total

150200020406 Windsor Valley		29%		29%
150200050101 Billy Creek		89%		89%
150200050102 Porter Creek		77%		77%
150200050103 Fools Hollow		1%		1%
150200050104 Show Low Lake-Show Low Creek		63%		63%
150200050105 Long Lake		25%		25%
150200050106 Linden Draw		78%		78%
150200050107 Bagnal Draw-Show Low Creek		49%		49%
150200050201 Ortega Draw		100%		100%
150200050202 Upper Brown Creek		38%		38%
150200050204 Lower Brown Creek		9%		9%
150200050205 Upper Rocky Arroyo		77%		77%
150200050206 Lower Rocky Arroyo		22%		22%
150200050301 Stinson Wash		100%		113%
150200050302 West Fork Cottonwood Wash-Cottonwood Wash		100%		103%
150200050303 Upper Day Wash		79%		79%
150200050304 Lower Day Wash		3%		3%
150200050305 Dalton Tank-Cottonwood Wash		1%		1%
150200050306 Town Draw		16%		16%

150200050308 Mortensen Wash		100%		100%
150200050309 Dodson Wash		28%		28%
150200080101 Decker Wash		29%	0%	29%
150200080102 Upper Phoenix Park Wash		56%	0%	56%
150200080301 Miller Canyon			100%	100%
150200080302 Bear Canyon			100%	100%
150200080303 East Clear Creek-Blue Ridge Reservoir		2%	98%	100%
150200080304 Barbershop Canyon			0%	0%
150200080305 Gentry Canyon		18%		18%
150200080306 Upper Willow Creek		32%		32%
150200080308 Cabin Draw		95%		95%
150200080310 Lower Willow Creek		44%		44%
150200080311 East Clear Creek-Clear Creek	0%		17%	17%
150200080401 Tillman Draw		2%		2%
150200080402 Sand Draw		1%		1%
150200080403 Echinique Draw-Clear Creek		0%		0%
150200080501 Windmill Draw-Jacks Canyon		5%	16%	22%
150200080505 Hart Tank	7%			7%
150200100101 Woods Canyon and Willow Springs Canyon		100%		99%

150200100102 Long Tom Canyon-Chevelon Canyon		54%		54%
150200100103 Upper Wildcat Canyon		63%	23%	86%
150200100104 Upper Chevelon Canyon-Chevelon Canyon Lake		10%		10%
150200100105 Middle Wildcat Canyon		0%		0%
150200100106 Alder Canyon		2%		2%
150200100107 Upper West Chevelon Canyon		36%		36%
150200100201 West Fork Black Canyon		100%	0%	100%
150200100202 Buckskin Wash		100%		100%
150200100203 Bear Canyon-Black Canyon		98%		98%
150200100204 Upper Pierce Wash		60%	14%	74%
150200100205 Upper Brookbank Canyon		1%	36%	36%
150200100206 Long Draw			0%	0%
150200100208 Long Hollow Tank-Black Canyon		0%	3%	3%
150200100209 Lower Brookbank Canyon			7%	7%
150200100301 Upper Potato Wash		0%	30%	30%
150200100302 Lower Potato Wash			3%	3%
150200150402 Long Lake-Chavel Pass Ditch	0%			0%
150601030301 Bull Flat Canyon		100%	0%	100%
150601030302 Canyon Creek Headwaters		53%	0%	53%

150601030304 Upper Canyon Creek		0%		0%
150601030401 Parallel Canyon-Cherry Creek		75%		75%
150601030402 Pleasant Valley		1%		1%
150601030403 Crouch Creek		0%		0%
150601030404 Gruwell Canyon-Cherry Creek		28%		28%
150601030406 Walnut Creek-Cherry Creek		4%		4%
150601030407 P B Creek-Cherry Creek		2%		2%
150601040302 Buckskin Canyon-Carrizo Creek		99%	1%	100%
150601050103 Upper Spring Creek		2%		2%
150601050105 Middle Spring Creek		0%		0%
150601050201 Marsh Creek		6%		6%
150601050202 Gordon Canyon		10%		10%
150601050203 Christopher Creek		11%		11%
150601050204 Horton Creek-Tonto Creek		73%		73%
150601050205 Haigler Creek		5%		5%
150601050206 Bull Tank Canyon-Tonto Creek		12%		12%
150601050301 Green Valley Creek		8%		8%
150601050304 Houston Creek		2%		2%
150602020603 Double Cabin Park-Jacks Canyon	1%			1%

150602020604 Brady Canyon	0%			0%
150602020605 Rattlesnake Canyon	0%			0%
150602020610 Red Tank Draw	3%			3%
150602030101 Upper Willow Valley	1%			1%
150602030102 Long Valley Draw		59%	16%	76%
150602030103 Toms Creek			5%	5%
150602030104 Clover Creek		16%	43%	59%
150602030105 Lower Willow Valley	1%	10%		11%
150602030106 Home Tank Draw	1%			1%
150602030107 Upper West Clear Creek	0%			0%
150602030108 Middle West Clear Creek	0%			0%
150602030201 Ellison Creek		91%		91%
150602030202 East Verde River Headwaters			0%	0%
150602030203 Webber Creek			4%	4%
150602030205 Upper East Verde River		0%		0%
150602030206 Pine Creek			1%	1%
150602030305 Upper Fossil Creek	0%			0%

Table 5. Alternatives 2 and 3 Comparison for Vegetative Treatments and Prescribed Burning

Subwatershed	Percent of USFS Subwatershed Treated		
	ALT 2	ALT 3	Difference
150200020401 Pulcifer Creek	**10%**	**5%**	**5%**
Fire	1%	0%	1%
UplandVeg	0%	0%	0%
VegFire	9%	5%	3%
150200020403 Sepulveda Creek	**90%**	**53%**	**37%**
Riparian	2%	2%	0%
UplandVeg	6%	5%	1%
VegFire	82%	46%	36%
150200020406 Windsor Valley	**86%**	**58%**	**28%**
Fire	8%	8%	0%
Riparian	1%	1%	0%
UplandVeg	23%	22%	1%
VegFire	55%	28%	27%
150200050101 Billy Creek	**5%**	**1%**	**4%**
Riparian	0%	0%	0%
UplandVeg	1%	1%	0%
VegFire	4%	0%	4%
150200050102 Porter Creek	**30%**	**5%**	**25%**
Fire	0%	0%	0%
Riparian	1%	1%	0%
UplandVeg	6%	1%	4%
VegFire	23%	3%	21%
150200050103 Fools Hollow	**7%**	**6%**	**1%**
VegFire	7%	6%	1%
150200050104 Show Low Lake-Show Low Creek	**30%**	**30%**	**0%**

Riparian	1%	1%	0%
UplandVeg	21%	22%	0%
VegFire	8%	8%	0%
150200050105 Long Lake	**3%**	**3%**	**0%**
UplandVeg	3%	3%	0%
150200050106 Linden Draw	**68%**	**23%**	**45%**
Riparian	0%	0%	0%
UplandVeg	0%	0%	0%
VegFire	68%	23%	45%
150200050107 Bagnal Draw-Show Low Creek	**48%**	**15%**	**33%**
Riparian	1%	1%	0%
VegFire	47%	13%	33%
150200050108 Bull Hollow	**11%**	**0%**	11%
VegFire	11%	0%	11%
150200050109 Thistle Hollow-Show Low Creek	**5%**	**0%**	**5%**
VegFire	5%	0%	5%
150200050201 Ortega Draw	**25%**	**20%**	**5%**
UplandVeg	19%	19%	0%
VegFire	6%	1%	5%
150200050202 Upper Brown Creek	**70%**	**33%**	**37%**
Fire	3%	3%	0%
Riparian	3%	3%	0%
UplandVeg	17%	13%	4%
VegFire	47%	15%	32%
150200050204 Lower Brown Creek	**2%**	**2%**	**0%**
UplandVeg	2%	2%	0%
150200050205 Upper Rocky Arroyo	**8%**	**8%**	**0%**
UplandVeg	8%	8%	0%
150200050206 Lower Rocky Arroyo	**3%**	**3%**	**0%**
UplandVeg	3%	3%	0%

150200050301 Stinson Wash	**100%**	**34%**	**66%**
Riparian	0%	0%	0%
VegFire	100%	34%	66%
150200050302 West Fork Cottonwood Wash-Cottonwood Wash	**100%**	**14%**	**85%**
Riparian	1%	1%	0%
VegFire	99%	14%	85%
150200050303 Upper Day Wash	**96%**	**15%**	**81%**
Riparian	0%	0%	0%
VegFire	95%	14%	81%
150200050304 Lower Day Wash	**7%**	**0%**	**7%**
Riparian	0%	0%	0%
VegFire	7%	0%	7%
150200050305 Dalton Tank-Cottonwood Wash	**15%**	**1%**	**14%**
Riparian	1%	1%	0%
VegFire	14%	0%	14%
150200050306 Town Draw	**21%**	**0%**	**21%**
VegFire	21%	0%	21%
150200050308 Mortensen Wash	**100%**	**35%**	**64%**
Riparian	3%	3%	0%
VegFire	97%	33%	64%
150200050309 Dodson Wash	**45%**	**3%**	**42%**
Riparian	0%	0%	0%
VegFire	45%	2%	42%
150200080101 Decker Wash	**38%**	**0%**	38%
VegFire	38%	0%	38%
150200080102 Upper Phoenix Park Wash	**66%**	**1%**	**65%**
Riparian	1%	1%	0%
VegFire	65%	0%	65%
150200080301 Miller Canyon	**4%**	**4%**	**0%**

Riparian	4%	4%	0%
VegFire	0%	0%	0%
150200080302 Bear Canyon	**3%**	**3%**	**0%**
Riparian	3%	3%	0%
VegFire	1%	1%	0%
150200080303 East Clear Creek-Blue Ridge Reservoir	**5%**	**5%**	**0%**
Riparian	4%	4%	0%
VegFire	1%	1%	0%
150200080304 Barbershop Canyon	**99%**	**99%**	**0%**
Fire	12%	12%	0%
Riparian	3%	3%	0%
VegFire	84%	84%	0%
150200080305 Gentry Canyon	**82%**	**82%**	**0%**
Fire	6%	6%	0%
Riparian	2%	2%	0%
VegFire	74%	74%	0%
150200080306 Upper Willow Creek	**80%**	**80%**	**0%**
Fire	8%	8%	0%
Riparian	3%	3%	0%
VegFire	68%	68%	0%
150200080307 Leonard Canyon	**99%**	**98%**	**0%**
Fire	10%	10%	0%
Riparian	2%	2%	0%
VegFire	86%	86%	0%
150200080308 Cabin Draw	**100%**	**31%**	**69%**
Fire	1%	0%	1%
Riparian	0%	0%	0%
VegFire	99%	30%	68%
150200080309 Wilkins Canyon	**100%**	**87%**	**13%**
Fire	5%	4%	1%

Riparian	1%	1%	0%
VegFire	94%	82%	11%
150200080310 Lower Willow Creek	**99%**	**67%**	**31%**
Fire	7%	5%	2%
Riparian	3%	3%	0%
VegFire	89%	59%	30%
150200080311 East Clear Creek-Clear Creek	**83%**	**64%**	**18%**
Fire	8%	7%	0%
Riparian	2%	2%	0%
UplandVeg	0%	0%	0%
VegFire	73%	55%	18%
150200080401 Tillman Draw	**2%**	**0%**	**2%**
VegFire	2%	0%	2%
150200080402 Sand Draw	**2%**	**0%**	2%
VegFire	2%	0%	2%
150200080403 Echinique Draw-Clear Creek	**5%**	**2%**	**4%**
Riparian	0%	0%	0%
VegFire	5%	1%	4%
150200080501 Windmill Draw-Jacks Canyon	**79%**	**35%**	44%
Fire	4%	4%	0%
Riparian	1%	1%	0%
UplandVeg	11%	9%	3%
VegFire	62%	21%	41%
150200080502 Tremaine Lake	**82%**	**25%**	**57%**
Riparian	0%	0%	0%
UplandVeg	47%	25%	23%
VegFire	34%	0%	34%
150200080503 Dogie Tank-Jacks Canyon	**99%**	**28%**	**71%**
Fire	4%	0%	4%
Riparian	1%	1%	0%

UplandVeg	32%	22%	9%
VegFire	62%	4%	57%
150200080504 Chavez Draw	**1%**	**1%**	**0%**
UplandVeg	1%	1%	0%
150200080505 Hart Tank	**32%**	**32%**	0%
UplandVeg	6%	6%	0%
VegFire	26%	26%	0%
150200100101 Woods Canyon and Willow Springs Canyon	**2%**	**2%**	**0%**
Fire	0%	0%	0%
Riparian	1%	1%	0%
VegFire	1%	1%	0%
150200100102 Long Tom Canyon-Chevelon Canyon	**47%**	**47%**	**0%**
Fire	12%	12%	0%
Riparian	1%	1%	0%
VegFire	34%	34%	0%
150200100103 Upper Wildcat Canyon	**40%**	**38%**	**2%**
Fire	1%	1%	0%
Riparian	0%	0%	0%
VegFire	39%	37%	2%
150200100104 Upper Chevelon Canyon-Chevelon Canyon Lake	**90%**	**61%**	**29%**
Fire	9%	9%	0%
Riparian	3%	3%	0%
VegFire	78%	49%	29%
150200100105 Middle Wildcat Canyon	**95%**	**9%**	**86%**
Fire	5%	1%	4%
Riparian	1%	1%	0%
VegFire	88%	7%	81%
150200100106 Alder Canyon	**98%**	**84%**	**15%**
Fire	4%	1%	4%

Riparian	1%	1%	0%
VegFire	93%	82%	11%
150200100107 Upper West Chevelon Canyon	**99%**	**89%**	**9%**
Fire	6%	4%	2%
Riparian	2%	2%	0%
VegFire	91%	84%	7%
150200100108 Lower West Chevelon Canyon	**50%**	**1%**	**50%**
Fire	0%	0%	0%
Riparian	0%	0%	0%
VegFire	50%	1%	50%
150200100109 Lower Wildcat Canyon	**37%**	**0%**	**37%**
VegFire	37%	0%	37%
150200100110 Durfee Draw-Chevelon Canyon	**63%**	**3%**	**60%**
Riparian	1%	1%	0%
VegFire	62%	2%	60%
150200100201 West Fork Black Canyon	**100%**	**3%**	**97%**
Fire	11%	0%	10%
Riparian	2%	2%	0%
VegFire	87%	0%	87%
150200100202 Buckskin Wash	**100%**	**25%**	**75%**
Riparian	3%	3%	0%
VegFire	97%	23%	75%
150200100203 Bear Canyon-Black Canyon	**98%**	**25%**	**73%**
Fire	5%	0%	5%
Riparian	4%	4%	0%
VegFire	88%	21%	67%
150200100204 Upper Pierce Wash	**75%**	**0%**	**75%**
Riparian	0%	0%	0%
VegFire	75%	0%	75%
150200100205 Upper Brookbank Canyon	**100%**	**61%**	**39%**

Riparian	1%	1%	0%
VegFire	99%	59%	39%
150200100206 Long Draw	**0%**	0%	**0%**
VegFire	0%	0%	0%
150200100208 Long Hollow Tank-Black Canyon	**3%**	**3%**	**0%**
VegFire	3%	3%	0%
150200100209 Lower Brookbank Canyon	**9%**	**6%**	**2%**
Riparian	0%	0%	0%
VegFire	8%	6%	2%
150200100301 Upper Potato Wash	**83%**	**32%**	**51%**
Riparian	1%	1%	0%
UplandVeg	0%	0%	0%
VegFire	82%	31%	51%
150200100302 Lower Potato Wash	**3%**	**0%**	**3%**
VegFire	3%	0%	3%
150200150201 Mormon Lake	**0%**	**0%**	0%
Riparian	0%	0%	0%
UplandVeg	0%	0%	0%
150200150401 Sawmill Wash	**3%**	**3%**	**0%**
Fire	3%	3%	0%
VegFire	0%	0%	0%
150200150402 Long Lake-Chavel Pass Ditch	**19%**	**5%**	14%
Fire	2%	1%	1%
UplandVeg	6%	4%	3%
VegFire	11%	0%	10%
150601030301 Bull Flat Canyon	**100%**	**0%**	**100%**
Fire	46%	0%	46%
VegFire	54%	0%	54%
150601030302 Canyon Creek Headwaters	**65%**	**48%**	**18%**
Fire	14%	11%	3%

Riparian	2%	2%	0%
VegFire	49%	35%	14%
150601030304 Upper Canyon Creek	**100%**	**2%**	**98%**
VegFire	100%	2%	98%
150601030305 Gentry Canyon	**86%**	**85%**	1%
Fire	8%	8%	0%
Riparian	1%	1%	0%
VegFire	77%	76%	1%
150601030306 Ellison Creek	**5%**	**5%**	**0%**
VegFire	5%	5%	0%
150601030401 Parallel Canyon-Cherry Creek	**100%**	**100%**	**0%**
Fire	4%	4%	0%
Riparian	3%	3%	0%
VegFire	93%	92%	0%
150601030402 Pleasant Valley	**3%**	**0%**	**3%**
VegFire	3%	0%	3%
150601030403 Crouch Creek	**13%**	**13%**	**0%**
VegFire	13%	13%	0%
150601030404 Gruwell Canyon-Cherry Creek	**39%**	**26%**	**13%**
Riparian	0%	0%	0%
VegFire	38%	26%	13%
150601030406 Walnut Creek-Cherry Creek	**4%**	**0%**	**4%**
Riparian	0%	0%	0%
VegFire	4%	0%	4%
150601030407 P B Creek-Cherry Creek	**10%**	**0%**	**10%**
Fire	1%	0%	1%
Riparian	0%	0%	0%
VegFire	9%	0%	9%
150601030408 Cooper Forks-Cherry Creek	**3%**	**0%**	**3%**
Fire	0%	0%	0%

VegFire	3%	0%	3%
150601030409 Bladder Canyon-Cherry Creek	**0%**	**0%**	**0%**
VegFire	0%	0%	0%
150601030801 Reynolds Creek	**84%**	**26%**	**58%**
Fire	13%	0%	13%
Riparian	1%	1%	0%
VegFire	69%	24%	45%
150601030802 Workman Creek	**58%**	**40%**	**18%**
Fire	4%	4%	0%
Riparian	1%	1%	0%
VegFire	53%	35%	18%
150601030803 Upper Salome Creek	**90%**	**50%**	**40%**
Fire	2%	2%	0%
Riparian	1%	1%	0%
VegFire	88%	48%	40%
150601030804 Middle Salome Creek	**2%**	**1%**	**1%**
VegFire	2%	1%	1%
150601030907 Cottonwood Wash	**0%**	**0%**	**0%**
VegFire	0%	0%	0%
150601030908 Armer Gulch	**1%**	**1%**	**0%**
VegFire	1%	1%	0%
150601040302 Buckskin Canyon-Carrizo Creek	**100%**	**50%**	**50%**
Fire	6%	0%	6%
VegFire	94%	50%	44%
150601050101 Buzzard Roost Canyon	**99%**	**0%**	**99%**
Fire	2%	0%	2%
Riparian	0%	0%	0%
VegFire	97%	0%	97%
150601050102 Rock Creek	**46%**	**15%**	**31%**
Fire	3%	0%	3%

Riparian	0%	0%	0%
VegFire	43%	15%	28%
150601050103 Upper Spring Creek	**47%**	**1%**	**46%**
Riparian	0%	0%	0%
VegFire	47%	1%	46%
150601050105 Middle Spring Creek	**1%**	**0%**	**1%**
Riparian	0%	0%	0%
VegFire	1%	0%	1%
150601050201 Marsh Creek	**12%**	**9%**	**3%**
Riparian	0%	0%	0%
VegFire	12%	9%	3%
150601050202 Gordon Canyon	**85%**	**80%**	**5%**
Fire	9%	9%	0%
Riparian	2%	2%	0%
VegFire	75%	69%	5%
150601050203 Christopher Creek	**85%**	**85%**	**0%**
Fire	15%	15%	0%
Riparian	1%	1%	0%
VegFire	69%	69%	0%
150601050204 Horton Creek-Tonto Creek	**96%**	**71%**	**25%**
Fire	4%	4%	0%
Riparian	3%	3%	0%
VegFire	89%	64%	26%
150601050205 Haigler Creek	**72%**	**64%**	**9%**
Fire	8%	8%	0%
Riparian	2%	2%	0%
VegFire	62%	53%	9%
150601050206 Bull Tank Canyon-Tonto Creek	**52%**	**39%**	**13%**
Fire	1%	1%	0%
Riparian	1%	1%	0%

VegFire	50%	38%	13%
150601050301 Green Valley Creek	**26%**	**24%**	**2%**
Riparian	1%	1%	0%
VegFire	25%	23%	2%
150601050304 Houston Creek	**2%**	**2%**	**0%**
VegFire	2%	2%	0%
150601050401 Gun Creek	**22%**	**0%**	**22%**
Riparian	0%	0%	0%
VegFire	22%	0%	22%
150601050404 Cottonwood Creek	**0%**	0%	**0%**
VegFire	0%	0%	0%
150601050405 Oak Creek	**0%**	0%	0%
VegFire	0%	0%	0%
150601050406 Lambing Creek-Tonto Creek	**0%**	0%	0%
VegFire	0%	0%	0%
150601050408 Greenback Creek	**9%**	**0%**	**9%**
Fire	0%	0%	0%
Riparian	0%	0%	0%
VegFire	9%	0%	9%
150602020601 Bar M Canyon	**0%**	**0%**	**0%**
UplandVeg	0%	0%	0%
150602020602 Upper Woods Canyon	**1%**	**1%**	**0%**
UplandVeg	1%	1%	0%
150602020603 Double Cabin Park-Jacks Canyon	**23%**	**16%**	**7%**
Fire	1%	1%	0%
Riparian	0%	0%	0%
UplandVeg	5%	5%	1%
VegFire	16%	10%	7%
150602020604 Brady Canyon	**14%**	**10%**	**5%**
Riparian	0%	0%	0%

UplandVeg	7%	7%	0%
VegFire	7%	2%	5%
150602020605 Rattlesnake Canyon	**1%**	**1%**	**0%**
Riparian	0%	0%	0%
UplandVeg	1%	1%	0%
150602020609 Upper Wet Beaver Creek	**0%**	**0%**	**0%**
UplandVeg	0%	0%	0%
150602020610 Red Tank Draw	**6%**	**6%**	**0%**
Riparian	0%	0%	0%
UplandVeg	6%	6%	0%
150602030101 Upper Willow Valley	**100%**	**25%**	**75%**
Fire	7%	4%	4%
Riparian	1%	1%	0%
UplandVeg	9%	2%	6%
VegFire	83%	18%	65%
150602030102 Long Valley Draw	**19%**	**2%**	**17%**
Fire	0%	0%	0%
Riparian	2%	2%	0%
UplandVeg	0%	0%	0%
VegFire	17%	0%	17%
150602030103 Toms Creek	**87%**	**87%**	**0%**
Fire	4%	4%	0%
Riparian	1%	1%	0%
VegFire	82%	82%	0%
150602030104 Clover Creek	**32%**	**32%**	**0%**
Fire	1%	1%	0%
Riparian	1%	1%	0%
UplandVeg	0%	0%	0%
VegFire	30%	30%	0%
150602030105 Lower Willow Valley	**83%**	**35%**	**48%**

Fire	2%	1%	1%
Riparian	1%	1%	0%
UplandVeg	8%	3%	5%
VegFire	72%	31%	41%
150602030106 Home Tank Draw	**59%**	**27%**	**32%**
Riparian	0%	0%	0%
UplandVeg	28%	27%	1%
VegFire	31%	0%	31%
150602030107 Upper West Clear Creek	**74%**	**51%**	**24%**
Fire	3%	3%	1%
Riparian	0%	0%	0%
UplandVeg	5%	5%	0%
VegFire	66%	43%	23%
150602030108 Middle West Clear Creek	**14%**	**9%**	**5%**
Fire	0%	0%	0%
UplandVeg	4%	4%	0%
VegFire	10%	5%	5%
150602030201 Ellison Creek	**91%**	**56%**	**34%**
Fire	1%	1%	0%
Riparian	4%	4%	0%
VegFire	86%	51%	34%
150602030202 East Verde River Headwaters	**100%**	**95%**	**5%**
Fire	7%	7%	0%
Riparian	5%	5%	0%
VegFire	88%	83%	5%
150602030203 Webber Creek	**76%**	**76%**	**0%**
Fire	11%	11%	0%
Riparian	3%	3%	0%
VegFire	62%	62%	0%
150602030205 Upper East Verde River	**7%**	**2%**	**6%**

VegFire	7%	2%	6%
150602030206 Pine Creek	**51%**	**48%**	**3%**
Fire	2%	2%	0%
Riparian	0%	0%	0%
VegFire	49%	46%	3%
150602030208 Rock Creek	**10%**	**1%**	**10%**
VegFire	10%	1%	10%
150602030305 Upper Fossil Creek	**46%**	**5%**	**41%**
Fire	1%	0%	1%
UplandVeg	2%	2%	0%
VegFire	43%	3%	40%
150602030306 Hardscrabble Creek	**42%**	**31%**	**11%**
Fire	2%	2%	0%
VegFire	40%	29%	11%

Table 6. Miles of Stream Restoration Proposed for Alternative 2 and 3.

HUC12 Subwatershed	Miles of Stream Restoration proposed in Action Alternatives.
150200020403 Sepulveda Creek	0.8
150200020406 Windsor Valley	3.6
150200050102 Porter Creek	7.5
150200050103 Fools Hollow	5.6
150200050104 Show Low Lake-Show Low Creek	2.4
150200050106 Linden Draw	3.6
150200050107 Bagnal Draw-Show Low Creek	11.9
150200050201 Ortega Draw	4.1

150200050202 Upper Brown Creek	5.1
150200050205 Upper Rocky Arroyo	0.0
150200050301 Stinson Wash	7.5
150200050302 West Fork Cottonwood Wash-Cottonwood Wash	31.7
150200050303 Upper Day Wash	6.9
150200050305 Dalton Tank-Cottonwood Wash	0.2
150200050306 Town Draw	4.9
150200050308 Mortensen Wash	23.2
150200050309 Dodson Wash	2.2
150200080101 Decker Wash	8.1
150200080102 Upper Phoenix Park Wash	6.8
150200080301 Miller Canyon	15.7
150200080302 Bear Canyon	28.2
150200080303 East Clear Creek-Blue Ridge Reservoir	34.3
150200080304 Barbershop Canyon	25.4
150200080305 Gentry Canyon	26.5
150200080306 Upper Willow Creek	23.2
150200080307 Leonard Canyon	43.7
150200080308 Cabin Draw	12.8
150200080309 Wilkins Canyon	5.6
150200080310 Lower Willow Creek	13.2
150200080311 East Clear Creek-Clear Creek	43.3
150200080403 Echinique Draw-Clear Creek	1.4
150200080501 Windmill Draw-Jacks Canyon	11.9
150200080503 Dogie Tank-Jacks Canyon	2.3
150200100101 Woods Canyon and Willow Springs Canyon	8.2
150200100102 Long Tom Canyon-Chevelon Canyon	9.3
150200100104 Upper Chevelon Canyon-Chevelon Canyon Lake	13.7
150200100106 Alder Canyon	14.1

150200100107 Upper West Chevelon Canyon	14.7
150200100110 Durfee Draw-Chevelon Canyon	7.7
150200100201 West Fork Black Canyon	6.6
150200100202 Buckskin Wash	20.9
150200100203 Bear Canyon-Black Canyon	14.3
150200100204 Upper Pierce Wash	8.6
150200100205 Upper Brookbank Canyon	7.1
150200100209 Lower Brookbank Canyon	0.8
150200100301 Upper Potato Wash	1.9
150601030302 Canyon Creek Headwaters	8.7
150601030401 Parallel Canyon-Cherry Creek	2.0
150601030403 Crouch Creek	0.4
150601030404 Gruwell Canyon-Cherry Creek	1.1
150601050203 Christopher Creek	4.4
150601050204 Horton Creek-Tonto Creek	3.5
150601050205 Haigler Creek	6.9
150601050206 Bull Tank Canyon-Tonto Creek	0.1
150601050301 Green Valley Creek	0.0
150602020603 Double Cabin Park-Jacks Canyon	0.0
150602020610 Red Tank Draw	0.5
150602030101 Upper Willow Valley	3.3
150602030102 Long Valley Draw	9.2
150602030103 Toms Creek	4.1
150602030104 Clover Creek	4.0
150602030105 Lower Willow Valley	15.7
150602030106 Home Tank Draw	0.4
150602030107 Upper West Clear Creek	2.9
150602030201 Ellison Creek	1.3
150602030202 East Verde River Headwaters	2.3
150602030203 Webber Creek	2.6

150602030206 Pine Creek	1.8
150602030305 Upper Fossil Creek	0.5

Table 7. Wildfires current up to Watershed Condition Framework Scoring (2012)

HUC12 Subwatershed	Watershed % burned
150200020401 Pulcifer Creek	**0%**
1998 Coon	0%
1999 Sepulveda	0%
2004 Carlock	0%
150200020403 Sepulveda Creek	**0%**
1994 Guzzler	0%
150200050101 Billy Creek	**0%**
2011 Club	0%
150200050102 Porter Creek	**1%**
2009 Pierce Mountain	1%
150200050103 Fools Hollow	**1%**
2002 Rodeo-Chediski	1%
150200050104 Show Low Lake-Show Low Creek	**0%**
2009 Fawn	0%
150200050106 Linden Draw	**48%**
2002 Rodeo-Chediski	48%
2011 Lone Pine	0%
150200050107 Bagnal Draw-Show Low Creek	**37%**
1999 Fence	0%
2002 Rodeo-Chediski	37%
2011 Lone Pine	0%
150200050108 Bull Hollow	**12%**
2002 Rodeo-Chediski	12%
150200050109 Thistle Hollow-Show Low Creek	**0%**

2011 Lone Pine	0%
150200050201 Ortega Draw	**0%**
2011 Mud	0%
150200050301 Stinson Wash	**100%**
2002 Rodeo-Chediski	100%
2010 Crooked	0%
150200050302 West Fork Cottonwood Wash-Cottonwood Wash	**100%**
1996 Cottonwood	1%
2002 Rodeo-Chediski	100%
150200050303 Upper Day Wash	**99%**
2002 Rodeo-Chediski	99%
150200050304 Lower Day Wash	**14%**
2002 Rodeo-Chediski	14%
150200050305 Dalton Tank-Cottonwood Wash	**16%**
2002 Rodeo-Chediski	15%
2010 District	0%
150200050306 Town Draw	**13%**
2002 Rodeo-Chediski	13%
150200050308 Mortensen Wash	**100%**
1996 Cottonwood	6%
2002 Rodeo-Chediski	97%
150200050309 Dodson Wash	**40%**
2002 Rodeo-Chediski	40%
2007 Hunt	0%
150200080101 Decker Wash	**37%**
2002 Rodeo-Chediski	34%
2011 Wash	2%
150200080102 Upper Phoenix Park Wash	**77%**
1995 Phoenix	0%

2002 Rodeo-Chediski	69%
2009 Wye	0%
2011 Wash	7%
150200080301 Miller Canyon	**46%**
1995 General	1%
2002 Packrat	8%
2009 July 4th Complex	0%
2009 Rim	0%
2010 Bravo	29%
2010 Ranger	0%
2011 Scout	8%
150200080302 Bear Canyon	**24%**
1995 General	0%
2009 Dude Lake	0%
2009 General	0%
2009 July 4th Complex	21%
2009 Rim	2%
2009 Tucker	0%
2010 Bravo	0%
150200080303 East Clear Creek-Blue Ridge Reservoir	**14%**
1995 General	0%
2000 Mile	0%
2002 Packrat	0%
2004 Webber	0%
2005 Tater	1%
2006 February	1%
2009 July 4th Complex	0%
2010 Bravo	1%
2010 Ranger	11%
2011 Kehl	1%

150200080304 Barbershop Canyon	**22%**
2008 Yeager	0%
2009 Tucker	19%
2011 International	2%
150200080305 Gentry Canyon	**0%**
2002 Open	0%
2003 Park	0%
2011 McGuire	0%
150200080306 Upper Willow Creek	**4%**
1995 Dud	0%
2002 Persistent	0%
2006 Hart	0%
2007 Vincent	1%
2007 Wilkins	0%
2008 Dutch Joe	1%
2011 Dudley	0%
2011 Willow	1%
150200080307 Leonard Canyon	**1%**
2007 Wilkins	0%
2009 Limestone	0%
2010 Tag	0%
2011 Knoll	0%
2012 One Three Seven	0%
150200080308 Cabin Draw	**1%**
2001 Creswell	0%
2002 Grama	0%
2002 Tillman	0%
150200080309 Wilkins Canyon	**56%**
1999 Spaulding	0%
2007 Wilkins	55%

2010 Halloween	1%
150200080310 Lower Willow Creek	**1%**
2007 Wilkins	1%
150200080311 East Clear Creek-Clear Creek	**2%**
1995 Aztec	0%
1998 Clear	0%
2002 Springer	0%
2006 Moqui	0%
2007 Wilkins	0%
2008 Yeager	1%
2009 Reservoir	0%
2009 Tucker	0%
2012 One Three Seven	0%
150200080401 Tillman Draw	**0%**
2002 Tillman	0%
150200080501 Windmill Draw-Jacks Canyon	**9%**
1996 Pot	0%
1998 Turkey	0%
1999 Eden	0%
2002 Springer	3%
2008 Lost Eden	6%
150200080502 Tremaine Lake	**8%**
1997 Association	0%
1998 Turkey	0%
1999 Turkey	4%
2000 Horn	0%
2010 Plantation	0%
2011 Bargaman	0%
2012 Canyon	3%
150200080503 Dogie Tank-Jacks Canyon	**7%**

1999 Turkey	4%
2009 Jack	0%
2010 Plantation	0%
2012 Canyon	3%
150200080504 Chavez Draw	**25%**
1994 Small	0%
2005 Turkey	1%
2012 Canyon	24%
150200080505 Hart Tank	**0%**
2012 Canyon	0%
150200100101 Woods Canyon and Willow Springs Canyon	**5%**
2002 Rodeo-Chediski	2%
2007 Promontory	2%
2007 Promotory	2%
2008 Carr	0%
2009 Palomino	0%
2010 Willow	0%
150200100102 Long Tom Canyon-Chevelon Canyon	**2%**
1998 Long Tom	0%
1999 Slim Jim	0%
2001 Chevelon	0%
2002 Rodeo-Chediski	0%
2003 Long Tom	0%
2008 Palomino	2%
2009 Palomino	0%
2010 Circle Bar	0%
150200100103 Upper Wildcat Canyon	**3%**
1995 Aspen Lake	0%
1998 Potato	0%
1999 Broken Complex	0%

2002 Rodeo-Chediski	1%
2002 Wildcat	0%
2007 Little Springs	0%
2009 Wagon Draw	0%
2010 Smith	1%
2011 Power	0%
2011 Slim Jim	0%
150200100104 Upper Chevelon Canyon-Chevelon Canyon Lake	**45%**
1994 Weimer	0%
1995 Bar	1%
1996 Chevelon	0%
1999 Weimer	0%
2002 Weimer	2%
2009 Wagon Draw	5%
2009 Weimer	15%
2010 Circle Bar	21%
2010 Weimer	0%
150200100105 Middle Wildcat Canyon	**64%**
2002 Wildcat	0%
2005 Line	2%
2006 Daze	0%
2006 North	0%
2006 Potato	24%
2009 Durfee	37%
2009 Wagon Draw	0%
150200100106 Alder Canyon	**2%**
2006 Sand	1%
2009 Crossing	0%
2010 Circle Bar	0%

2012 Dyes	0%
150200100107 Upper West Chevelon Canyon	**18%**
1996 Sand	0%
2005 Work Center	0%
2006 Sand	0%
2006 Workcenter	0%
2007 Vincent	0%
2009 Crossing	17%
150200100108 Lower West Chevelon Canyon	**7%**
2000 Crossing	0%
2006 Sand	6%
2010 Circle Bar	0%
2010 Tillman	0%
2010 Tillman 2	0%
150200100109 Lower Wildcat Canyon	**41%**
2006 Potato	14%
2009 Durfee	23%
2009 Wagon Draw	3%
2009 Weimer	0%
150200100110 Durfee Draw-Chevelon Canyon	**9%**
2004 Durfee	0%
2009 Wagon Draw	0%
2009 Weimer	7%
2010 Circle Bar	1%
2011 Durfee	0%
150200100201 West Fork Black Canyon	**101%**
1995 Black	1%
2000 Baldwin	0%
2002 Rodeo-Chediski	100%
150200100202 Buckskin Wash	**93%**

2002 Rodeo-Chediski	93%
2009 Camp Knoll	0%
150200100203 Bear Canyon-Black Canyon	**68%**
1999 Upper Sharp	0%
2000 Baldwin	0%
2002 Rodeo-Chediski	68%
2010 Legacy	0%
150200100204 Upper Pierce Wash	**67%**
2002 Rodeo-Chediski	67%
150200100205 Upper Brookbank Canyon	**6%**
1995 Black	0%
1999 Broken Complex	1%
2000 Broken	0%
2002 Rodeo-Chediski	0%
2007 Shadow Pine South	0%
2007 Shadow Pines	1%
2009 Brookbank	0%
2010 Smith	0%
2010 Walnut Canyon	3%
150200100206 Long Draw	**0%**
2002 Rodeo-Chediski	0%
150200100209 Lower Brookbank Canyon	**0%**
1999 Bigler	0%
150200100301 Upper Potato Wash	**2%**
2001 Wagon Box	0%
2005 Line	1%
2006 Potato	0%
2006 Purcell	0%
2009 Delodo	0%
2009 Purcell	0%

2011 Power	0%
150200100302 Lower Potato Wash	**3%**
2006 Potato	3%
2006 Purcell	0%
2012 Turkey	0%
150200150201 Mormon Lake	**1%**
1999 Minty	0%
2001 Roadside	0%
2003 Mints	0%
2004 Coyote	0%
2006 Bear	0%
2009 Raptor	1%
150200150401 Sawmill Wash	**1%**
1998 Sawmill	0%
2002 Sawmill	0%
2006 Sawmill	0%
2011 Diablo	0%
150200150402 Long Lake-Chavel Pass Ditch	**0%**
2004 Boondock	0%
2009 Spring	0%
150601020107 Gooseberry Creek	**0%**
2009 Pierce Mountain	0%
150601030301 Bull Flat Canyon	**102%**
2002 Rodeo-Chediski	100%
2009 Bull Flat	2%
150601030302 Canyon Creek Headwaters	**96%**
1995 Nelson Lake Point	0%
2002 Rodeo-Chediski	90%
2009 Bachelor	0%
2012 Bull Flat	6%

150601030304 Upper Canyon Creek	**99%**
2002 Rodeo-Chediski	99%
150601030305 Gentry Canyon	**0%**
2002 Rodeo-Chediski	0%
150601030310 Middle Canyon Creek	**7%**
2002 Rodeo-Chediski	7%
150601030401 Parallel Canyon-Cherry Creek	**52%**
2002 Rodeo-Chediski	3%
2011 Bluff	8%
2012 Bull Flat	0%
2012 Poco	41%
150601030404 Gruwell Canyon-Cherry Creek	**30%**
2011 Bluff	8%
2012 Poco	22%
150601030407 P B Creek-Cherry Creek	**0%**
2010 Turkey	0%
150601030408 Cooper Forks-Cherry Creek	**16%**
2000 Coon Creek	16%
2012 Aztec	0%
150601030409 Bladder Canyon-Cherry Creek	**6%**
2000 Coon Creek	5%
2011 Deep	1%
2012 Aztec	0%
150601030801 Reynolds Creek	**0%**
2000 Coon Creek	0%
150601030802 Workman Creek	**49%**
1994 Armer	2%
2000 Coon Creek	9%
2011 Tanner	38%
150601030803 Upper Salome Creek	**4%**

2005 Greenback	0%
2010 Turkey	3%
2012 Mistake Peak	1%
150601030804 Middle Salome Creek	**4%**
2005 Greenback	4%
2012 Mistake Peak	0%
150601030907 Cottonwood Wash	**20%**
1994 Armer	17%
1998 Cottonwood	0%
2000 Coon Creek	0%
2011 Tanner	3%
150601030908 Armer Gulch	**11%**
1994 Armer	10%
2011 Tanner	1%
150601040103 Cottonwood Canyon	**57%**
2002 Rodeo-Chediski	57%
150601040104 Hop Canyon	**100%**
2002 Rodeo-Chediski	100%
150601040301 Foot Canyon	**100%**
2002 Rodeo-Chediski	100%
150601040302 Buckskin Canyon-Carrizo Creek	**100%**
2002 Rodeo-Chediski	100%
150601040303 Deer Springs Canyon	**100%**
2002 Rodeo-Chediski	100%
150601040304 Jumpoff Canyon	**100%**
2002 Rodeo-Chediski	100%
150601040305 Mud Creek	**100%**
2002 Rodeo-Chediski	100%
150601040308 Limestone Canyon	**93%**
2002 Rodeo-Chediski	93%

150601050101 Buzzard Roost Canyon	**33%**
2003 Picture	24%
2012 Mistake Peak	9%
150601050102 Rock Creek	**54%**
2003 Picture	50%
2011 Chalk	1%
2012 Mistake Peak	3%
150601050103 Upper Spring Creek	**0%**
2010 Turkey	0%
150601050201 Marsh Creek	**1%**
2012 Poco	1%
150601050202 Gordon Canyon	**0%**
2007 Haigler	0%
150601050203 Christopher Creek	**44%**
1998 Promontory	2%
2005 Promontory	2%
2005 Promotory	1%
2007 Promontory	20%
2007 Promotory	20%
150601050204 Horton Creek-Tonto Creek	**7%**
1998 Promontory	1%
2005 Zane	1%
2007 Promontory	0%
2007 Promotory	0%
2010 Tag	2%
2011 Horton	2%
2012 Big Canyon	1%
150601050205 Haigler Creek	**7%**
2002 Rodeo-Chediski	0%
2007 Haigler	2%

2009 Bachelor	4%
2011 Bluff	0%
2012 Poco	1%
150601050401 Gun Creek	**2%**
2003 Picture	2%
2011 Chalk	1%
150601050404 Cottonwood Creek	**4%**
2003 Picture	4%
150601050405 Oak Creek	**3%**
2003 Picture	0%
2005 Salome	0%
2012 Mistake Peak	2%
150601050406 Lambing Creek-Tonto Creek	**45%**
2005 Edge Complex	43%
2006 Hackberry	2%
150601050408 Greenback Creek	**16%**
2003 Picture	0%
2005 Salome	2%
2012 Mistake Peak	14%
150602020601 Bar M Canyon	**33%**
2001 Long	0%
2003 Mints	0%
2007 Birdie	22%
2009 Raptor	8%
2009 Real	3%
150602020602 Upper Woods Canyon	**14%**
2002 Gash	0%
2006 Gash	0%
2007 Birdie	2%
2009 Raptor	2%

2009 Real	8%
2010 Weir	3%
150602020603 Double Cabin Park-Jacks Canyon	**5%**
2009 Brady	0%
2009 Raptor	1%
2010 Pratt	0%
2011 Rocky	4%
150602020604 Brady Canyon	**24%**
1994 Hollingshead	1%
1995 Columbus	0%
1997 Bucky	0%
1999 Brady	0%
2001 Bucks	0%
2004 Good	1%
2007 Short	0%
2009 Brady	22%
150602020605 Rattlesnake Canyon	**9%**
2007 Hunt	0%
2009 Rattleridge	2%
2010 Weir	7%
150602020609 Upper Wet Beaver Creek	**0%**
2011 Maverick	0%
150602020610 Red Tank Draw	**12%**
2000 Mulligan	0%
2008 August	0%
2009 Campbell	0%
2009 Rattleridge	0%
2011 Rocky	11%
150602030101 Upper Willow Valley	**9%**
1995 Saddle	0%

1997 Cookie	0%
1998 Turkey	1%
1999 Schroeder	0%
2000 Willow	6%
2002 June	0%
2007 Bargaman	1%
2011 Bargaman	0%
150602030102 Long Valley Draw	**8%**
1994 Limestone	0%
1995 Poor	0%
1996 Pot	7%
1998 Ghost	0%
2009 Independence	0%
150602030103 Toms Creek	**14%**
2009 Peoples	0%
2011 Sandrock	14%
150602030104 Clover Creek	**14%**
2000 Chilson	0%
2009 Independence	14%
2009 Peoples	0%
150602030105 Lower Willow Valley	**25%**
1995 Columbus	0%
1995 Experiment	0%
1996 Pot	14%
2000 Chilson	0%
2000 Clover	0%
2000 Willow	0%
2004 Pecks	0%
2008 Poor Farm	0%
2009 Bow	10%

150602030106 Home Tank Draw	**7%**
2000 Golf	6%
2004 Capital	0%
150602030107 Upper West Clear Creek	**4%**
1996 Pot	1%
1999 Deeper	1%
1999 Norm	0%
2002 Tram	1%
2008 Oh	1%
2008 Poor Farm	0%
150602030108 Middle West Clear Creek	**0%**
2011 Sandrock	0%
150602030202 East Verde River Headwaters	**30%**
2002 Packrat	12%
2006 February	6%
2009 Rim	11%
2009 Water Wheel	1%
150602030203 Webber Creek	**33%**
1995 Thanksgiving	0%
2004 Webber	19%
2006 February	13%
2009 Point	1%
150602030205 Upper East Verde River	**2%**
2009 Water Wheel	2%
150602030206 Pine Creek	**4%**
1998 Reserve	0%
2004 Webber	0%
2009 Point	3%
2011 Sandrock	0%
150602030305 Upper Fossil Creek	**15%**

1997 Sandrock	0%
1998 Sand	1%
2002 Five Mile	0%
2002 Fivemile	0%
2007 Soldier	0%
2011 Sandrock	13%
150602030306 Hardscrabble Creek	**3%**
2002 Five Mile	1%
2002 Fivemile	2%
150602030307 Lower Fossil Creek	**1%**
1995 Plant	1%
2003 Backbone	0%
2005 Bull Run	0%

Table 8. Wildfires after Watershed Condition Framework Scoring (2012)

HUC 12 Subwatershed	Watershed % burned
150200020401 Pulcifer Creek	**37%**
2014 San Juan	37%
150200020403 Sepulveda Creek	**5%**
2014 San Juan	5%
150200050101 Billy Creek	**0%**
2014 Chipmunk Spring	0%
150200050102 Porter Creek	**10%**
2015 Turkey	5%
2016 Elk	5%

150200050205 Upper Rocky Arroyo	**5%**
2015 Turkey	1%
2016 Elk	4%
150200050302 West Fork Cottonwood Wash-Cottonwood Wash	**17%**
2014 Scott Point	0%
2016 Fill	17%
150200050308 Mortensen Wash	**0%**
2016 Fill	0%
150200080101 Decker Wash	**0%**
2016 Horse	0%
2016 Phoenix	0%
150200080102 Upper Phoenix Park Wash	**3%**
2016 Phoenix	3%
2016 Rice	0%
150200080301 Miller Canyon	**8%**
2016 Crackerbox	8%
150200080302 Bear Canyon	**79%**
2013 Hart	0%
2014 General	14%
2015 General	12%
2016 Crackerbox	0%
2016 Pinchot	21%
2016 Reservior	0%
2017 Bear	15%
2017 Highline	15%
150200080303 East Clear Creek-Blue Ridge Reservoir	**4%**
2013 Hart	0%
2014 Kinder	2%
2016 Crackerbox	0%

2016 Poverty	1%
2016 Reservior	0%
150200080304 Barbershop Canyon	**1%**
2015 General	0%
2015 Rebel	0%
2016 Pinchot	0%
2017 Bear	0%
2017 Highline	1%
150200080305 Gentry Canyon	**1%**
2014 McGuire	0%
2016 Ohaco	0%
2017 Right	0%
150200080306 Upper Willow Creek	**0%**
2015 Pius Spring	0%
2016 Turkey	0%
150200080307 Leonard Canyon	**4%**
2015 Rebel	0%
2017 33 Springs	4%
2017 Highline	0%
150200080308 Cabin Draw	**0%**
2016 Dutch Joe	0%
2016 Grama	0%
150200080309 Wilkins Canyon	**5%**
2015 Wilkins	0%
2017 33 Springs	5%
150200080310 Lower Willow Creek	**0%**
2015 Spring	0%
150200080311 East Clear Creek-Clear Creek	**10%**
2013 Hart	0%
2015 General	2%

2015 Rebel	6%
2015 Victorine	0%
2016 Pinchot	2%
2016 Reservior	0%
2017 Highline	0%
2017 Middle	0%
150200080402 Sand Draw	**0%**
2017 Sand	0%
150200080501 Windmill Draw-Jacks Canyon	**30%**
2015 Goose	1%
2016 Eden	4%
2016 Jack	22%
2016 Thunderstruck	2%
150200080502 Tremaine Lake	**23%**
2015 Camillo	2%
2016 Jack	21%
150200080505 Hart Tank	**0%**
2014 Jack	0%
150200100101 Woods Canyon and Willow Springs Canyon	**1%**
2013 General	0%
2014 Woods Canyon	1%
150200100102 Long Tom Canyon-Chevelon Canyon	**15%**
2016 Sam Jim	0%
2017 Slim	15%
150200100103 Upper Wildcat Canyon	**3%**
2015 Little Springs 2	0%
2015 Potato Patch	3%
2016 Cat	0%
2016 Sam Jim	0%

150200100104 Upper Chevelon Canyon-Chevelon Canyon Lake	**15%**
2015 Potato Patch	0%
2016 Sam Jim	14%
2017 Fisher	1%
2017 Slim	1%
150200100106 Alder Canyon	**15%**
2015 Alder	15%
2016 Badger	0%
150200100107 Upper West Chevelon Canyon	**0%**
2014 Widow Maker	0%
2015 Alder	0%
2017 Dudley	0%
150200100201 West Fork Black Canyon	**7%**
2017 Gentry	7%
150200100202 Buckskin Wash	**9%**
2016 Baldwin	9%
150200100203 Bear Canyon-Black Canyon	**0%**
2016 Baldwin	0%
2017 Gentry	0%
150200100205 Upper Brookbank Canyon	**0%**
2014 West Fork	0%
150200150201 Mormon Lake	**11%**
2015 Camillo	11%
150200150401 Sawmill Wash	**45%**
2014 Sawmill	0%
2015 Camillo	45%
150200150402 Long Lake-Chavel Pass Ditch	**14%**
2015 Camillo	14%
2016 Jack	0%

150601020107 Gooseberry Creek	**1%**
2014 San Juan	1%
150601030301 Bull Flat Canyon	**0%**
2017 Gentry	0%
150601030302 Canyon Creek Headwaters	**0%**
2016 Fulton	0%
2016 Loner	0%
2016 Parallel	0%
150601030305 Gentry Canyon	**0%**
2013 Frog	0%
150601030407 P B Creek-Cherry Creek	**26%**
2016 Juniper	26%
150601030408 Cooper Forks-Cherry Creek	**15%**
2015 Sierra	0%
2016 Juniper	15%
150601030409 Bladder Canyon-Cherry Creek	**2%**
2015 Aztec	0%
2015 Sierra	0%
2016 Bill	0%
2016 Juniper	2%
150601030801 Reynolds Creek	**65%**
2016 Juniper	65%
150601030802 Workman Creek	**38%**
2016 Juniper	38%
150601030803 Upper Salome Creek	**0%**
2016 Juniper	0%
150601030907 Cottonwood Wash	**19%**
2016 Juniper	19%
150601040304 Jumpoff Canyon	**0%**
2016 Fill	0%

150601040305 Mud Creek	**0%**
2016 Fill	0%
150601050103 Upper Spring Creek	**0%**
2016 Juniper	0%
150601050202 Gordon Canyon	**10%**
2016 Fulton	10%
150601050205 Haigler Creek	**4%**
2016 Fulton	4%
150601050401 Gun Creek	**0%**
2016 Breadpan	0%
150601050404 Cottonwood Creek	**0%**
2014 Picture	0%
2017 Picture Mountain	0%
150601050406 Lambing Creek-Tonto Creek	**0%**
2014 Picture	0%
2016 Ord	0%
150602020601 Bar M Canyon	**26%**
2014 Bar-M	25%
2016 Jones	0%
150602020602 Upper Woods Canyon	**18%**
2014 Bar-M	17%
2014 Rock	1%
2014 Woods	0%
2017 Gash	0%
150602020603 Double Cabin Park-Jacks Canyon	**1%**
2016 Jack	1%
150602020604 Brady Canyon	**8%**
2016 Jack	0%
2017 Snake Ridge	8%
150602020610 Red Tank Draw	**0%**

2013 Table #6	0%
150602030101 Upper Willow Valley	**64%**
2016 Jack	64%
150602030102 Long Valley Draw	**0%**
2016 Charlie	0%
2016 Wolfman	0%
150602030103 Toms Creek	**58%**
2014 Pothole	0%
2016 Corduroy	1%
2016 Pivot Rock	57%
150602030104 Clover Creek	**11%**
2014 Pothole	1%
2016 Pivot Rock	10%
150602030105 Lower Willow Valley	**44%**
2014 Maxwell	0%
2016 Jack	21%
2017 Snake Ridge	24%
150602030106 Home Tank Draw	**30%**
2013 Wildhorse	0%
2014 Island	1%
2017 Snake Ridge	29%
150602030107 Upper West Clear Creek	**18%**
2013 Egypt	4%
2014 Maxwell	0%
2014 Point	0%
2014 Pothole	14%
2016 Pivot Rock	0%
150602030108 Middle West Clear Creek	**0%**
2017 Bull Pen	0%
150602030201 Ellison Creek	**9%**

2017 Highline	9%
150602030202 East Verde River Headwaters	**2%**
2017 Bear	0%
2017 Highline	2%
150602030206 Pine Creek	**0%**
2015 Horse Tank	0%
2016 Pivot Rock	0%
150602030305 Upper Fossil Creek	**14%**
2015 Horse Tank	14%
2016 Pivot Rock	0%
150602030306 Hardscrabble Creek	**0%**
2015 Horse Tank	0%