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Roads Analysis Report

Project: Cimarron and Comanche National Grasslands Plan Revision

United States Department of Agriculture
Forest Service
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Introduction

Background

In August 1999, the Washington Office of the U.S. Department of Agriculture Forest Service (USFS) published Miscellaneous Report FS-643, titled "*Roads Analysis: Informing Decisions about Managing the National Forest Transportation System.*" The objective of a roads analysis is to provide decision makers with critical information for developing road systems that are safe and responsive to public needs and desires, are affordable and efficiently managed, have minimal negative ecological effects on the land, and are in balance with available funding for needed management actions.

In October 1999, the agency published Interim Directive 7710-99-1 authorizing units to use, as appropriate, the road analysis procedure embodied in FS-643 to assist land managers making major road management decisions. The Rocky Mountain Region of the Forest Service then published a roads analysis guidance document as a supplement to Appendix 1 of FS-643. This document provides guidance about the appropriate scale for addressing the roads analysis. On March 3, 2000, the Forest Service proposed revising 36 CFR Part 212 to shift emphasis from transportation development to managing administrative and public access within the capacity of the lands. This proposal would shift the focus of National Forest System road management from developing and constructing of new roads to maintaining and restoring needed roads and decommissioning unneeded roads within the context of maintaining, managing, and restoring healthy ecosystems.

On January 12, 2001, the Forest Service issued the final National Forest System Road Management Rule. This rule revises regulations concerning the management, use, and maintenance of the national Forest transportation system. Consistent with changes in public demands and uses of National Forest System resources and the need to better manage funds available for road construction, reconstruction, maintenance, and decommissioning, the final rule removes the emphasis on transportation development and adds a requirement for science-based transportation analysis. This final rule is intended to help ensure that Additions to the National Forest road network are those deemed essential for resource management and use.

Construction, reconstruction, and maintenance of roads minimize adverse environmental effects.

Unneeded roads are decommissioned and restoration of ecological processes are initiated.

Process

Roads analysis is a five-step process, described below. The steps are designed to be sequential with the understanding the process may require feedback and iteration among steps over time as an analysis matures.

1. Setting up the analysis
2. Assessing benefits, problems and risks
3. Describing the situation

4. Describing opportunities and setting priorities
5. Identifying the issues

The time and effort spent on each step differs according to the project, based on specific situations and available information. The process provides a set of possible issues and analysis questions for which the answers can inform choices about road system management. Decision makers and analysts determine the relevance of each question, incorporating public participation as appropriate.

Products

The product of the analysis is a report for decision makers and the public that documents the information and analyses used to identify opportunities and set priorities for future national grassland road systems.

This Report

This report documents the information and analysis procedure used for the Cimarron and Comanche National Grasslands Plan Revision roads analysis. It contains an analysis of major issues on the Grasslands and a list of management guidelines and opportunities for future actions. It also includes maps with the existing maintenance levels 3 and 4.

Step 1 Setting up the analysis

Objectives of the Analysis

This forest scale roads analysis puts the road system into the context of resource management. It will also be used to support travel management plans and project level analysis. This analysis will meet the requirement of providing a Roads Analysis for the revision of the Cimarron and Comanche Grasslands Plan.

Scope and Scale

Scope: In accordance with Forest Service Manual 7700-2003-2 (FSM 7712.13b) all National Forests and Grasslands are required to conduct Forest-scale roads analysis at maintenance levels 3, 4, and 5, to inform land management planning decisions. This also applies to Forests and Grasslands revising existing land and resource management plans. The analysis provides a context for road management in the broader framework of managing all grasslands resources by examining the existing transportation system, and assesses its ability to serve access needs. The analysis examines environmental issues, social and economic issues, coordination with State, county, Tribal, and other Federal agencies, effects on land and resource management plans and resource management programs. Current and future funding levels to support road construction, reconstruction, maintenance, and decommissioning are also examined. Future road management opportunities can be identified from this analysis can be carried further in site-specific watershed and project level roads analyses. The Cimarron and Comanche National Grasslands Analysis Project was designed to produce an overview of the road system and to identify pertinent economic, ecological, and social road management issues that are essential for making future decisions about affected transportation systems. In setting up the analysis, line officers established an interdisciplinary (ID) team and identified the proper analytic scales. The ID team then developed a process plan for conducting the analysis. Scale: Although the analysis area addressed in this report does not form a contiguous land unit, the scale of this roads analysis is considered to be Grasslands-wide. The Cimarron National Grassland is located in southwestern Kansas, and Comanche National Grassland and associated Carrizo and Timpas units are located southeastern Colorado. Because this analysis is a broad, grasslands-scale analysis, specific portions of roads or units were not analyzed. The road system as a whole was reviewed and site-specific improvements will be identified at a smaller scale.

Table 1. Core Interdisciplinary Team Members

Member	Responsibilities
Michelle Stevens	Archeology; Passive Use
Thomas Eikenberry	Fire Management
Gerri Mason	GIS Coordinator

Member	Responsibilities
Mari Nakada	Hydrology; Aquatic
Barb Masinton	Land Management Planner
Richard Bennin	Minerals; Transportation
Rich Riddle	Range
Robert Sitzlar	Recreation & Lands; Special Use Permits
Sarah Culhane	Social
Ken Kanaan	Soils; Vegetation
Gary Roper	Timber
Karen Mighell	Transportation
David Augustine	Wildlife & Fisheries; Aquatic Resources

Table 2. Interdisciplinary Participants

Member	Responsibilities
Steve Olson	Botany;Weeds
Joe Hartman	Cimarron District Ranger
Tom Peters	Comanche District Ranger
Julie Schaefers	Economics, Civil Rights
Bruce Schumacher	Geology; Paleontology
Deb Entwistle	Hydrology; Air Protection
Barb Timock	Public Affairs
Neil Weierbach	Scenery

Step 2 Describing the situation

Historical Context

From the 1930s through the 1950s there was a limited road system on both National Grasslands. Initially, roads were constructed from native materials with no surfacing and limited maintenance. The Cimarron road system provided primarily access to range facilities (windmills) and range allotments. The oil and gas boom of the 1950s brought a dramatic increase in the number/miles of roads with a higher level of maintenance accomplished primarily by the petroleum industry. The number of roads/miles increased at steady rate from the 1960s through 2000.

The Comanche National Grassland, because of its intermingled and fragmented land ownership pattern, has relied on the State and County Road Departments to construct and maintain the primary arterial road network. From the 1950s through today, the miles or roads and maintenance level has gradually increased. The road density increased primarily due to installation of range allotment fences throughout the grassland and oil and gas development in the Campo/Vilas area.

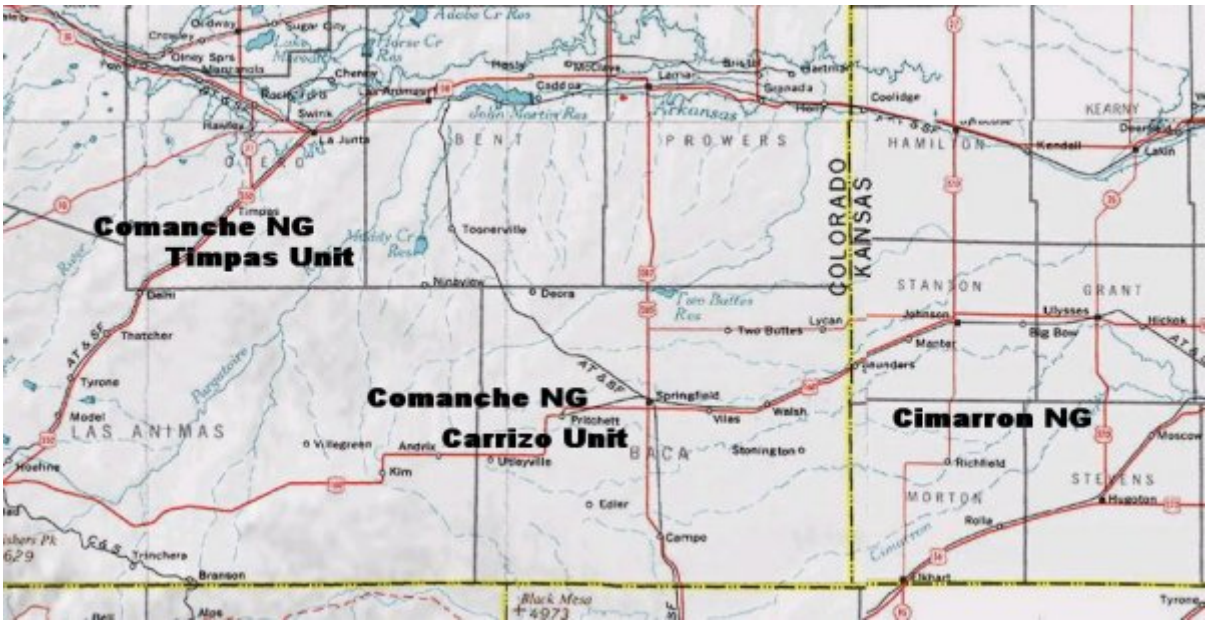


Figure 1. The Cimarron and Comanche National Grasslands and Vicinity.

Existing Road and Access System Description

The Cimarron and Comanche National Grasslands road system has 81.78 miles of maintenance level 3 and 4 classified roads under USFS jurisdiction (Table 3). Additional roads under state, county, or private jurisdiction either cross through or provide additional and necessary access to USFS roads or federal land holdings. Together, this mixture of federal, state, county and private jurisdiction roads serves as the primary means of access to the Cimarron and Comanche National Grasslands for its wide variety of uses and management needs. Major federal and state highways provide convenient access from population centers through the main Grasslands units. County and Forest System (FS) roads further provide access to most areas of the Grasslands. The majority of these roads that network the grasslands that branch to local roads and trails, are maintenance level 2 roads and are not included in this report. Major federal and state highways provide convenient access from population centers through the main Grasslands units. County and FS roads provide access to most areas of the Grasslands. The majority of these roads that branch to local roads and trails that network the grasslands are maintenance level 2 roads, and are not a part of this report.

Table 3. Road Miles – Cimarron and Comanche National Grasslands

Operational Maintenance Levels	Cimarron National Grassland	Comanche National Grassland
3	59.68	19.4
4	1.2	1.5
5	0	0
Total	60.88	20.9

The Cimarron National Grassland is in the southwest corner of Kansas, with the district office in Elkhart, Kansas, at the intersection of State Highways 56, 27 and 95. The Cimarron has completed a road inventory/atlas. Road Management Objective's have also been prepared for each road. The public has access to all roads, except roads within the Cimarron River Corridor, where a white arrow program has been established. This restricts motor vehicle travel in and along the Cimarron River Corridor. It is designed to decrease the amount of resource damage caused by motorized vehicles, to protect wildlife habitat along the river and to safeguard the soil. This corridor along the Cimarron River starts at the Colorado-Kansas state line and runs east to KS Highway 27 through the Grassland into Stevens County. No motorized vehicle travel is permitted in the river corridor except on the roads marked with a white arrow.

The Comanche National Grassland is divided into the southern Carrizo Unit with the headquarters located in Springfield, Colorado, and the northern Timpas Unit with the headquarters located in La Junta, Colorado.

Management and Maintenance

National Forest roads are maintained to varying standards depending on the level of use and management objectives. There are five maintenance levels used by the USFS to determine the work needed to preserve road investment, three of which were analyzed for this project. Direction on how to meet the maintenance levels is included in FSH 7709.58, *Transportation System Maintenance Handbook* and road definitions contained in 36 CFR 212.1 (Appendix C). Maps in Appendix F show roads at maintenance levels 3 and 4. Table 3 summarizes the miles for the 3 maintenance levels for USFS jurisdiction roads that serve as the primary means of access to the Grasslands for its wide variety of uses and management needs. The reason for the apparent increase in miles is that temporary roads serving oil and gas operations on the Grasslands were added to the system to better reflect actual conditions. Normally, temporary roads are very transitory in nature, and are obliterated after use (for example, after vegetation treatment is performed). Many of the oil and gas roads are longer-term, and they are largely available for and passable to the general public. Hence, their administrative classification was changed and these miles were added to the system.

Table 4. National Forest System Roads by Objective Maintenance Level on the Cimarron and Comanche National Grasslands.

Maintenance Level	Jurisdiction	Miles of Road 1984[a]	Miles of Road 2004[b]
3	Forest Service	57	80
4	Forest Service	1	3
	Total	58	83
4	Other	2.5	2.5
	Total	58.5	85.5

[a]From the 1984 R2TF Database.
[b]From the PSICC 2004 INFRA Database.

Current Budget

Since the late 1990s, Deferred Maintenance Surveys were conducted on nearly all Forest System roads to determine needs, improvements, and costs.

These road cost estimates have been developed from the annual plans for the operation and maintenance of National Forest System roads to meet road management objectives (RMOs) and do not include Commensurate Share, Commercial Use or other Investment Sharing costs, or requirements for budgeting, scheduling, accomplishing, reporting, and evaluating road maintenance work.

Funding through the Capital Investment Program (CIP) is divided between roads and developed recreation areas and trails.

Table 5. Maintenance Costs for Maintenance Level 3 & 4 Roads

Year	Actual Budgeted Amount
2003	$81,733
2004	$48,858

Source: INFRA Database

Current annual and deferred maintenance and CIP needs for the Grasslands roads total almost $1.8 million from the 2004 surveys. Current road management actual budgets for FY 03 were $81,733 and nearly half that for FY04 at $48,858. This is for National Forest Jurisdiction roads: 57.4 miles of maintenance level 3 roads and 1.2 miles of maintenance level 4 roads. This does not meet the needs of the annual and deferred maintenance or CIP needs for the Cimarron and Comanche National Grasslands. This is a problem because the level of funding does not keep up with the amount of road work necessary. Some of the Forest System roads are also on county road systems and are maintained by those counties to serve local public needs. There are also agreements for road maintenance with oil and gas lease operators. Where the Forest Service has primary maintenance responsibility, roads are maintained to meet resource management needs and to provide public safety.

National Objectives

The national objectives for the transportation system (Forest Service Manual (FSM) 7702) are:

- To provide sustainable access in a fiscally responsible manner to National Forest System lands for administration, protection, and utilization of these lands, and resources consistent with Land and Resource Management Plan guidance;
- To manage a transportation system within the environmental capabilities of the land; and
- To manage transportation system facilities to provide user safety, convenience, and efficiency of operations in an environmentally responsible manner and to achieve road related ecosystem restoration within the limits of current and likely funding levels.

1984 Land and Resource Management Plan Objectives

In addition to national objectives, road related objectives specific to the Comanche and Cimarron National Grasslands Land and Resource Management Plan (1984) include: Consider existing roads and trails open and allow motorized vehicle use on them unless at least one of the following occurs:

1. A decision restricts motorized use;
2. The area is designated non-motorized; or
3. Motorized use is specifically prohibited in management area direction or existing orders.

Perform site specific roads analysis, including public involvement, prior to making any decisions on road construction, reconstruction, and decommissioning.

The existing road system does meet current Forest Plan direction in relation to planning, maintenance and operation with respect to authority, jurisdiction, and common transportation interests. Road planning and construction efforts on the Comanche and Cimarron National Grasslands are driven largely by the needs of oil and gas and grazing.

Step 3 Identifying issues

Key Issues Summary

Funding
1. Road maintenance funding is not adequate to maintain existing roads and signs to standard.
Road Management and Jurisdiction
2. Roads that cross multiple jurisdictions have not clearly marked and jurisdiction is not clearly established. Improved signage is needed. 3. Consistent surface and road maintenance and management between jurisdictions. 4. FS management of agreements and special use permits is lacking. 5. Public road safety issues may also arise from road jurisdiction changes or maintenance level changes along the length of a single road and on public roads serving mixed use traffic. 6. Consistent surface management. Develop cooperative road maintenance agreements with surrounding counties that establish consistent surface maintenance standards and signage.
Environmental Concerns
7. High road densities and/or road-stream crossings effects on sedimentation,

water quality and hydrologic function of stream systems. 8. Road impacts to terrestrial and aquatic habitats, wetlands, and riparian areas. 9. Accelerated soil erosion, increased soil compaction and decreased water infiltration due to roads. 10. Habitat fragmentation at road-stream crossings. 11. Introduction of exotic species and disease due to increased access.
Recreation
12. Limited quiet opportunities due to the heavily roaded nature of the area. 13. Increase in pleasure driving and increased visitor levels
Wildlife
14. Habitat fragmentation. 15. Increased hunter access, and pressure on hunted species.

Step 4 Assessing benefits, problems, and risks

Introduction

Step 4 contains narrative answers to the questions contained in FS-643, Roads Analysis: Informing Decisions about Managing the National Forest Transportation System and the R2 Roads Analysis Supplement to FS-643. These questions and answers provide an assessment of the ecological, social, and economic considerations of the current transportation system. Where appropriate, questions have been grouped together to facilitate a more coherent discussion of the relevant factors. The scope of the answer to each question is a reflection of its relevance to the issues raids during the Roads Analysis Process, and its relevance to the Grassland-wide scale of this analysis.

Aquatic, Riparian Zone, and Water Quality (AQ)

Grassland streams are exhibiting conditions in response to an ongoing drought. As such, aquatic, riparian, and water quality impacts are more prevalent from climatic conditions and some land uses that limit or restrict in-channel water flow, than from the existing road system. Changes to stream character and thus fish habitat are mainly from vegetation removal and direct bank damage from grazing animals. However, the presence of roads do cause a concentration of runoff at stream crossings that may actually supply any persistent volume of water beneath and immediately downstream of bridges and other crossings. In situations where roads do impact water quality or channel stability these affects will be additive to those already mentioned.

AQ (1): How and where does the road system modify the surface and subsurface hydrology of the area?

Roads have the potential to affect the natural hydrology of a watershed area by intercepting, concentrating, and diverting surface flow from its natural flow pattern. Roads expand the channel network via road ditches and reduce infiltration rates of incident precipitation, generating larger amounts of surface runoff. All of these factors combine to alter the quantity and timing of surface flow, which, in turn, affects the overall hydrology of a watershed. The hydrology on the Cimarron and Comanche National Grasslands are predominantly affected by spring runoff from snowmelt and major thunderstorm events. Although subsurface hydrology is not identified as a major issue of concern relative to road-related impacts, it can also be modified by road systems through reduced infiltration.

Roads can affect the timing of water delivered to a stream with the potential to either increase or decrease the downstream peak flows, depending on whether or not runoff from other portions of the stream's watershed is synchronized with runoff from the road system. The most common net effect is generally thought to include increases in peak discharges downstream. Streams are primarily ephemeral. Increases in peak flows occur if surface

flows are intercepted and routed directly to waterways. These effects are most likely to occur in areas with high drainage density, clay soils, and steeper slopes, where surface and shallow subsurface runoff is greatest. Roads are generally flat to gently sloped and have surfaces consisting of native materials or crushed aggregate. Due to the high clay content in many of the soils and high intensity precipitation events, infiltration is relatively slow and surface water often moves as sheet flow. However, roads can also act to decrease downstream peak flows at locations where the roads intercept and store water or route it away from nearby waterways.

Many roads on the Comanche and Cimarron National Grasslands also cross small drainages with no drainage structures (e.g. culverts) installed in the road and therefore serve to impound some stream flows and may reduce peak flows downstream in the watershed.

Design and maintenance of appropriate drainage structures minimizes the potential effects that roads may have on hydrology. Inadequate road drainage can trap water on the road surface or concentrate water flow with increased sediment load. For example, road crossings can act to attenuate flood flows and induce significant upstream backwatering, when flows exceed the design discharge of a culvert. In addition to culvert maintenance and replacement, several other types of maintenance needs related to surface drainage are currently required. These include the replacement and general maintenance of low water crossings, drainage ditch maintenance and repair, and grading and repair of numerous road cross drains. Ditches carry road drainage and runoff from contributing areas. If culverts are infrequent, this runoff can be carried long distances from their natural path. There are several ephemeral lakes on the Comanche where the inflow may be intercepted by ditches, and diverted away from the lakes. Changes to subsurface flows are unknown at this time, and therefore are likely not an issue with respect to roads, due to topology of the Grasslands.

AQ (2): How and where does the road system generate surface erosion?

The existence and magnitude of surface erosion is highly dependent on site- and project-specific conditions of road grade, design, efficiency of drainage structures, surface material, traffic level, and maintenance level. Conditions within the road corridor, such as soil type, slope, and vegetative cover, are also major factors. Surface erosion occurs on most wildland roads because of their surfaces, cutslopes, fillslopes, and associated drainage structures are usually composed of erodible material and are exposed to rainfall and concentrated surface runoff. Erosion can depend upon many factors; the most influential are the erodibility of the exposed surface, slope and area of the exposed surfaces. On the Grasslands, the existing roads generally have a low gradient, and erosion from the road surface is probably minimal. The associated ditches are very broad, however, and are erodible. These ditches are subject to erosion by fast moving water and generally are not vegetated or protected in any way. In addition, they are continually being disturbed, i.e. by runoff and/or road/ditch maintenance.

Road maintenance activities along unpaved surfaces, such as grading and ditch clearing, can cause increased surface erosion over the short-term. However, over the long-term, these practices prevent roads from degrading and developing conditions that might

otherwise induce high levels of erosion of the road surface. Roads without side ditches may be more prone to erosion of the road surface, whereas roads with drainage ditches have reduced erosion on the surface, but elevated erosion along the length of the ditch. Roads with gravel surfaces combined with vegetated or rock lined ditches are generally the optimal condition for reduced road-related erosion. Unvegetated surfaces rapidly convert precipitation to surface runoff, which more easily detaches fine particles from the native surface and elevates surface erosion rates. The inherent erodibility of a soil is the susceptibility or resistance of fine particles to detach with the runoff. Medium-textured soils with high silt content are the most erodible of all soils. They are easily detached and tend to crust and produce high rates of runoff. Conversely, soils high in clay and coarse textured soils, such as sands, are the least erodible soils and produce low rates of runoff.

AQ (3): How and where does the road system affect mass wasting?

Mass wasting is not generally a major concern for the Grasslands.

AQ (4): How and where do road-stream crossings influence local stream channels and water quality?

In general, road-stream crossings have a greater influence on local stream channels and water quality than other road areas because of their close proximity to the stream channel. Poorly designed crossings can constrict a stream channel through undersized culverts or misaligned water diversions, or act as a conduit, facilitating erosion or the transport of pollutants into the channel.

As described in question AQ (1), numerous culverts and cross drains are in need of cleaning, repair, replacement, or new installation. Undersized culverts, or blockages to flow in culverts, can cause upstream channel aggradation as particles settle and are trapped in sluggish backwater zones. When blockage is complete, flow may be redirected across or along the road, resulting in road surface erosion and added sediment delivery to streams. Likewise, without adequate cross drains to facilitate drainage of roads, intercepted precipitation may collect and cause increased surface runoff with added sedimentation.

Of additional concern is the tendency for gullies to form downslope of unprotected culvert outlets on hillslopes or in the absence of adequate cross drains. The formation of gullies is significant because it indicates a road-related extension of a surface flowpath that would not exist without the road. Several factors may influence the formation of gullies: soil type, depth to bedrock, topographic shape of hillslope, vegetation or root strength, culvert spacing, and plunge height. These factors are related to the force of water and sensitivity of the site to concentration of water and erosion of the soil mantle.

Low water crossings are also a concern due to their potential for stream channel modification and associated sediment delivery. Failing low water crossings can cause upstream sediment deposits and sluggish backwater zones. Without maintenance, redirected flow around the crossing during flood events can result in stream bank scour and undercutting of the low water crossing structure on its downstream side. High levels of sediment delivery and channel modification can ultimately result.

AQ (5): How and where does the road system create potential for pollutants, such as chemical spills, oils, de-icing salts, or herbicides, to enter surface waters?

The economic base within and surrounding the Grasslands are primarily tied to the agricultural and oil & gas industries. With this, comes the potential for spilled pesticides, herbicides, and oil and gas products. The potential for an accident involving these pollutants is greatest along US Highways 54, 160, 287, and 350, Colorado Highway 109, Kansas Highways 27 and 51, and any of the County Roads both in Colorado and Kansas.

The possibility of pollutants entering surface water applies to perennial, intermittent and ephemeral streams. However, unless these pollutants evaporate, bind with the substrate or change over time, the likelihood of these substances entering surface water is very limited due to the absence of surface water bodies and perennial streams. Pollutants spilled in or near intermittent or ephemeral streams may be "stored" until the next hydrologic event. High intensity storms can flush stored pollutants into the stream system. Normally this dilutes the pollutant because of high runoff volume. However, if the pollutant distribution is widespread, or highly concentrated, it can have an adverse cumulative effect on water quality.

AQ (6): How and where is the road system "hydrologically connected" to the stream system? How do the connections affect water quality and quantity (such as, the delivery of sediments and chemicals, thermal increases, elevated peak flows)?

"Hydrologically connected" road segments are those that deliver surface runoff directly to a stream channel. Along these road segments, a greater proportion of road drainage reaches the streams since little buffer between the stream and road is available for water infiltration. This condition occurs at stream crossings and along those roads that run closely to either a riparian area or a water body. Roads that are closely associated with stream courses contribute to elevated peak flows by adding storm water runoff directly to the channel. This causes stream peak flows to occur earlier in the precipitation event, although the magnitude of this increase is unknown. Physically, increased peak flows can cause erosion of the stream channel, resulting in deeper or wider channels and greater sediment deposition at downstream areas away from the hydrologically connected road segment.

AQ (7): What downstream beneficial uses of water exist in the area? What changes in uses and demand are expected over time? How are they affected or put at risk by road-derived pollutants?

The waters of Colorado and Kansas have been designated according to their beneficial uses for which they are presently suitable or intended to be suitable.

Cimarron National Grassland - The waters in the Upper Cimarron, North Fork Cimarron and Upper Cimarron-Liberal Basins in Kansas are designated for the following beneficial uses: domestic water supply, food procurement, groundwater recharge, industrial water supply, irrigation and livestock watering. All of these uses have numerical limits or narrative criteria, which can be obtained from the Water Pollution Control regulation. (KDHE 2002) The waters of the Upper Cimarron-Liberal are designated for Primary or Contact recreational (ingestion probable) and Secondary (non-contact) recreational (no ingestion) use for the North Fork Cimarron and Upper Cimarron. All surface waters within the

Cimarron National Grasslands are classified as "Special Aquatic Life Use waters"[1] and are the only waters in the state classified as "Outstanding National Resource Waters." [2.]

Comanche National Grassland - The waters of the Colorado are designated for the uses listed in Table 1. All of these uses have numerical or narrative criteria, which can be obtained from the Colorado Department Public Health and Environment (CDPHE) Classification and Numeric Standards - Arkansas River Basin. Regulation 32.

Table 6. Colorado's Classification of Streams in or adjacent to the Grasslands Planning Area.

Segment Description	Aquatic Life Warm 1	Aquatic Life Warm 2	Recreat. 1a	Recreat. 2	Water Supply	Agricult.	Designation
Lower Arkansas Basin							
1c. Mainstem of the Arkansas from the outlet of John Martin Reservoir to the CO/KS Border		X	X		X	X	Use Protected (UP)
2a. All tributaries to the Arkansas River, including wetlands, all lakes and reservoirs, from the Colorado Headgate to the Colorado/Kansas Border except for specific listing segments.		X		X		X	UP
4. Mainstem of Timpas Creek from the source to the Arkansas		X	X			X	UP

[1] "*Special Aquatic Life Use Waters*" is defined as surface waters that contain combinations of habitat types and indigenous biota not found commonly in the state, or surface waters that contain representative populations of threatened or endangered species (KDHE 2002).
[2] "*Outstanding National Resource Waters*" includes segments with exceptional recreational or ecological significance and is afforded the highest level of water quality protection under the antidegradation provisions. (KDHE 2002).

Segment Description	Aquatic Life Warm 1	Aquatic Life Warm 2	Recreat. 1a	Recreat. 2	Water Supply	Agricult.	Designation
River							
7. Mainstem of the Purgatoire River from I-25 to the confluence with the Arkansas River	X		X			X	
Cimarron River							
1. Mainstem of the Cimarron River, including all tributaries, lakes and reservoirs, in Las Animas, Baca and Prowers counties.		X		X		X	UP
2. Mainstem of N. Carrizo Creek from the source to the Colorado/Ok state line; mainstems of East and West Carrizo Creek, to the confluence with North Carrizo Creek; mainstems of Cottonwood Creek with West Carrizo Creek, Fitzler Pond.		X	X			X	UP

Expected changes in uses and demands of water are likely to increase. Source water for most public water suppliers is ground water. Probably the largest use of water locally is agricultural. Some road related pollutants, such as toxics, could adversely affect this use, (irrigation or livestock water). Sediment is the most common road related pollutant. It can alter stream channels, increase water temperatures, clog "intakes", and can affect aquatic species.

Roads have the potential to affect beneficial uses by changing water quality, quantity, or timing [as discussed under AQ (1) through AQ (6)] to the extent it no longer meets the requisite standards. Overall, the USFS road network on the Grasslands is not a major contributor of road-derived pollutants, such as oils and chemicals. However, there may be individual circumstances that would warrant change in road management strategies to reduce the risk of road-derived pollutants. Aquatic habitat and species may be put at risk from sediment runoff from some of the unpaved roads, road induced bank scour, changes in riparian habitat, reductions in large woody debris availability, or modifications in stream flow timing or quantity. Municipal water supplies are not likely to be impacted by USFS road management, as there are no municipal water locations identified in any of the Grasslands watersheds. Changes in beneficial uses and demand are best addressed at project scale, since site-specific conditions are needed to predict what changes might occur.

As discussed in AQ (5), any pollutants in surface runoff from the road, including chemical pollutants, have the greatest ability to degrade water quality along hydrologically connected portions of road.

AQ (8): How and where does the road system affect wetlands?

The road system can affect wetlands by direct encroachment and loss of wetland area from road fill and by indirect alteration of wetland hydrology, function, and water quality. Examples of they direct affects have been observed on the Grasslands, but data is not available to characterize the overall extent and location of the direct impacts of roads on wetlands on the Grasslands. Indirect impacts to hydrology and water quality are similar to those discussed above for streams and other waterbodies.

AQ (9): How does the road system alter physical channel dynamics, including isolation of floodplains: constraints on channel migration; and the movement of large wood, fine organic matter, and sediment?

Bridge and culvert installations at stream crossings constrain the channel from migrating or changing as it would naturally. Roads can also encroach upon or isolate floodplains, compromising their function. During periods of peak or flood flows, roads and road crossings may restrict flow or become blocked so that the water backs up, causing an actual increase in peak flows. This may, in turn, reduce the flow below the crossing, preventing flooding into the stream's normal flood-prone areas further down the drainage.

Roads passing through a major floodplain or damming an ephemeral drainage can also create sluggish backwater conditions. This can occur, for example, when waters receding from periods of high flow are trapped by roadbeds that traverse a major floodplain. Initially, ponding waters may contain small fish, macro-invertebrates, and developing amphibians that are stranded by the receding water level. If sluggish backwater conditions persist at

these sites, algal blooms may likely occur resulting in drastic reductions in oxygen available for other aquatic organisms and eventual death of much of the aquatic community.

Additional discussion pertinent to this question can be found under questions AQ (1), AQ (4), and AQ (6). More detailed discussion is most appropriate at the project level, where site-specific instances of altered channel dynamics, debris, and sediment buildups are known.

AQ (10): How and where does the road system restrict the migration and movement of aquatic organisms? What aquatic species are affected and to what extent?

Road crossings, such as culverts and fords, can act as barriers to aquatic organism movement and migration within stream systems. This effect can be further exacerbated by culvert blockages caused by debris buildup, structural failures, or as a result of trappers putting snare traps in culverts. Upstream and downstream migration obstacles can result in a decrease in population numbers and an increase in genetic isolation. Small fish, mollusk, some macroinvertebrate, amphibian, and reptile populations may experience life-cycle interruptions as a result of these obstructions. Obstructed culverts can also increase maintenance costs, lead to the failure of a culvert, or lead to road damage.

Available information concerning the maintenance needs of fords and culverts on the Cimarron and Comanche National Grasslands indicates several fords and numerous culverts are in need of either cleaning or installation. The majorities of these culverts are small in size and found on intermittent or ephemeral drainages. Although viable fish populations are not likely found in the majority of small ephemeral drainages, these drainages are a water source for higher order streams, and a source of organic matter and food. Restrictions in water flow from these small drainages can be detrimental to viable fish communities in connected higher-order streams. In contrast, some species of mollusk, macroinvertebrates, amphibians, and reptiles may utilize small ephemeral drainages for all or a portion of their lifecycle. These species may be impacted by culvert blockages that limit habitat connectivity or alter local hydroperiods (the duration of water level at or above the substrate surface).

Road drainage associated impacts can also alter local hydroperiods by increasing drainage efficiency in some areas (reducing the hydroperiod), and decreasing it in others (lengthening the hydroperiod) (Forman et al., 2003). If hydroperiod is shortened, amphibian and some macroinvertebrates may become desiccated prior to reaching their adult life-stage. If hydroperiod is lengthened, such as ponding that occurs upstream of blocked culverts or in road-impounded drainages, the potential increases for predatory fish to become established. Predatory fish populations can induce the extinction of localized amphibian populations. In some cases, it should also be noted that culvert blockages and road drainage structures, may improve or create habitat where no or only limited habitat previously existed (Forman et al., 2003). More detailed discussion of this issue is best left to the project level scale, where habitat type and blockage locations are known and can be compared with detailed current and historic aquatic organism survey data.

AQ11: How does the road system affect shading, litterfall, and riparian plant communities?

Road systems often affect shading, litterfall, and riparian plant communities where roads cross streams or where roads run parallel to streams. Although reduced canopy cover and litter fall may occur at some sites due to the presence or construction of a road right-of-way, it is not generally considered a widespread concern on the due to the limited number of riparian areas with appreciable canopy cover.

Roads that run parallel to streams are generally the greatest concern when considering limits on stream shade and litter fall due to the lack of canopy cover within the road corridor. In these areas, decreased stream shading can increase stream water temperature. Although this is often a major concern in forested landscapes with cool water streams, it is not considered a major concern on the Grasslands for several reasons. First, due to the gentle topography of the landscape, few roads parallel a stream course for any appreciable length. Moreover, as described above, few riparian areas have significant canopy cover. Lastly, and perhaps most importantly, fish populations and other aquatic organisms and habitat in this landscape are well adapted to warm water conditions and any minor increases in stream temperature as a result of road associated reductions in canopy cover are likely to have minimal effects on these species. Similarly, reductions in litter fall as a result of a road crossing in this landscape would not be expected to significantly reduce organic debris input to a stream or significantly affect aquatic habitat and food supply associated with litter fall.

Riparian plant communities are directly impacted by roads as a result of removal and disturbance of plants during road construction. In addition, improved access to the riparian area also increases human activity and associated disturbance associated with these activities. Both construction and increased disturbance in the riparian area also result in indirect impacts from an increase in the potential for invasive species establishment at the road/riparian corridor interface.

AQ12: How and where does the road system contribute to fishing, poaching, or direct habitat loss for at-risk aquatic species?

While poaching is not generally considered an issue of concern and does not significantly affect aquatic populations and at-risk aquatic species, the open road system does provide public access for recreational fishing.

There are few natural lakes, ponds, or marshes with sufficient water depth to maintain game fish. However, aquatic plants, amphibians, and smaller native fish, such as dace, chub, and minnow, can be found in the streams and creeks, where the road system can directly contribute to habitat loss. Threats to native species include the introduction of non-native predatory species, reduced water flows from surface water diversions, channelization of streams, pollution, and increased sedimentation from road runoff. Roads that cross or run parallel to creeks and streams are of particular concern as they have the potential to degrade habitat quality through increased sediment input, increased peak stream flows, and by limiting the passage of aquatic organisms when flow obstruction or blockages are created at culverts and bridges.

The streambed is often intentionally altered at a road crossing. It can be deepened or realigned not only at the crossing but both upstream and downstream of the actual crossing.

This is usually done to more efficiently allow water flow through a culvert or under a bridge. If these streambed changes result in a change in channel slope, the stream character can change by developing deep pools beneath the crossing that is disconnected from the channel during low flows. This type of feature can function as a refuge for fish making them more vulnerable to capture or predation if there is little hiding cover or they are unable to leave the pool.

AQ13: How and where does the road system facilitate the introduction of non-native aquatic species?

The greatest impact of non-native species introduction from the road system occurs where Forest roads provide recreational water users, direct access to surface water. Fishing equipment can carry the eggs of non-native fishes, insects, mollusks, fungi, and non-native invasive plants from one body of water and deposit them in another. In addition, fishermen can introduce non-native fish to a water body by releasing unused baitfish or by stocking the water body with non-native fish.

AQ14: To what extent does the road system overlap with areas of exceptionally high aquatic diversity or productivity or areas containing rare or unique aquatic species or species of interest?

Although several streams support populations of fish and/or amphibians that are considered sensitive to aquatic habitat degradation, there are no known areas of exceptionally high aquatic diversity or productivity on the grassland.

Terrestrial Wildlife (TW)

TW (1) and TW (3): What are the direct and indirect effects of the road system on terrestrial species habitat? What are the direct and indirect effects on wildlife species?

General Effects

Road construction into a new area causes terrestrial habitat loss, and can result in habitat and population fragmentation. Normally, direct habitat loss within the road right-of-way is minimal compared to the amount of available habitat across a landscape. However, when considering the impacts a road may have on habitat use, fragmentation, and potential effects on animal movements, overall habitat losses from a road expand well beyond losses within the immediate road corridor. As an example, a study of grassland birds in Massachusetts found a dramatic reduction in bird density and species number extending 1 kilometer away from a heavily used highway (Forman and Deblinger, 2000).

Roads dissect habitat and increase the number of habitat patches, increase the amount of edge habitat within an area, decrease the amount of interior habitat, and increase the distance between suitable interior habitat patches (Reed et al, 1996). Roads in the grasslands also have the effect of increasing the diversity of habitats in an area by inducing the establishment of new invasive species along the road corridor or creating new habitat for established species such as the prairie dog. Habitat dissection effects are disruptive for interior species and for species that require a diversity of habitats, some of which may be less accessible due to road avoidance effects.

Roads often restrict or modify animal movements and can sometimes result in population isolation, an increase in inbreeding and loss of genetic variability, and potential extinction of local populations. For larger animals, impacts on movements are best addressed by looking at the intensity of the species' road-avoidance behavior relative to the overall road density of an area. In contrast, a single road can limit movements of smaller mammals by acting as an effective barrier to population dispersal. These effects are mostly observed with larger, wider roads.

Roads can also act as corridors for animal movements or promote population dispersal of edge-dwelling species into areas that were previously inaccessible or inhospitable. Predators such as swift fox and coyotes often utilize roads for foraging (Forman et al, 2003), and as a consequence, predation is often higher along the road corridor. Many species benefit by the creation of edge habitat due to an increased variety of vegetation types and food. These species are typically habitat generalists, with no population risks or sensitivity. Many small rodents appear to be either unaffected or positively influenced by the presence of roads (Forman et al, 2003). In contrast, species that are adversely affected by increased edge tend to be habitat specialists and are more sensitive to edge associated impacts, and often have a higher conservation concern.

Traffic on roadways can also increase direct wildlife mortality and degrade wildlife habitat through increased human activity. Small, slow-moving animals are especially vulnerable to mortality on roads. Edge species drawn to roadsides also experience higher road-kill rates. Predators that are drawn to these areas and forage along the road corridor often experience increased mortality from vehicular trauma (Black et al, 1997). However, wildlife mortality is typically more evident on roads with high use and high traffic speeds. Road use results in increased human activity both on and off the road in adjacent areas. Human activity can result in a range of effects to wildlife from limiting wildlife movements, to breeding disturbance, to habitat alteration through invasive species establishment. Power lines associated with roads may prevent some grassland species such as prairie chickens from using adjacent habitat.

Species Group Discussions

The discussion and analysis presented below is primarily focused on potential impacts of the road system on selected groups of USFS Region 2 sensitive species and species of local value, providing information and discussion pertinent to question TW(1). At the same time, due to the broad scope of habitats, feeding habits, and animal families covered by the selected individuals from the sensitive species list, the analysis presented here also addresses road associated impacts to major habitats TW(3). These questions were combined due to the inherent link between road associated effects on wildlife and their associated habitats. Both direct and indirect effects of the road system are discussed below with respect to major species groupings and their associated habitats.

Ungulates

Ungulate species include elk, antelope, mule deer, and white tailed deer. Primary road effects on this group of species can include increased mortality along the road corridor,

disturbance impacts, habitat fragmentation, and limitations on dispersal and movement patterns. Numerous studies have shown that ungulates are sensitive to disturbance caused by roads. Elk were shown to avoid large open areas near roads open to vehicular traffic (Lyon, 1983; Rowland et al., in press; Ager et al., in press), with avoidance increasing with increasing traffic volume. Lyon (1983) showed that elk habitat effectiveness can be expected to decrease by at least 25 percent with a density of 1 mile of road per square mile of land (mi/mi 2), and by at least 50 percent with a density of 2 mi/mi 2 . Both year-long and crucial winter habitats are found in this variable topography terrain bordered by areas of high road density due to oil and gas development. Due to the sensitivity of elk to disturbance, it is possible that the adjacent areas of high road density and land use are limiting elk use and movement in these areas. Elk do use flat open spaces with few roads. Where topographic relief is higher, elk tend to tolerate a bit more road use.

Antelope are widely dispersed throughout the Grasslands, with greatest densities in shortgrass and arid shortgrass prairie. Antelope are sensitive to open roads with traffic (Bright and van Riper, 1999). Approximately 50% percent of the USFS maintenance level 3 road system passes through shortgrass and arid shortgrass prairie habitat, although the amount of roads in the level 3 road systems is small compared to county roads and level 2 roads. Roads which have to be fenced on either side (e.g. to prevent the danger of collisions with livestock) reduce movement corridors for pronghorn
Mule deer habitat is spread more evenly throughout both Grasslands. In general, mule deer are less sensitive than elk to disturbance from roads, but increased road densities can result in road mortality impacts (Reed, 1988), increased hunting pressure, and decreased habitat effectiveness of wintering grounds. In general, deer collisions would be considered less common in grasslands when compared to mountainous or forested regions due to higher visibility provided by the open terrain and lower traffic volumes (Forman et al., 2003). Due to a gentle topography, roads generally do not follow stream courses or riparian zones. As a result, potential impacts of the road system on deer habitat in the non-winter range habitats are generally limited, occurring primarily where roads cross major riparian zones.

Upland Game Birds

Primary road effects on this group may include direct loss of suitable habitat, disturbance impacts, habitat fragmentation, and modification of habitat through invasive species establishment and spread. Mortality from vehicle collisions has been documented in some areas for lesser prairie chickens (Patten et al. 2004). Breeding and display areas (leks) are crucial for management of this species may be an approximation of the center of the nesting habitat in a given area. Noise disturbance interferes with the mating ritual, or “dance,” on leks. Roads and road-related activities, such as recreation and commercial use, contribute to this noise disturbance. Changes in land-use, including mineral resource development and associated road construction, are identified as major causes of the loss or degradation of habitats.

Roads destroy habitat directly along the road corridor. Vehicular traffic and associated uses further isolate fragmented habitat patches through avoidance behavior and mortality along the road corridor (both from increased predation and roadkill). Roads and land-disturbing activities promote the development of invasive species, which can affect the quality of

habitat. Breeding and display areas, or “leks,” are crucial for management of this species may be an approximation of the center of the nesting habitat in a given area. Noise disturbance interferes with the mating ritual, or “dance”, on leks. Roads and road-related activities, such as recreation and commercial use, contribute to this noise disturbance. Changes in land-use, including mineral resource development and associated road construction, may also cause the loss or degradation of prairie-chicken habitat. Roads destroy habitat directly along the road corridor. Vehicular traffic and associated uses further isolate fragmented habitat patches through avoidance behavior and mortality along the road corridor (both from increased predation and roadkill). Roads and land-disturbing activities promote the development of invasive species, which can affect the quality of habitat.

Raptors

A variety of raptors are found on the Comanche and Cimarron National Grasslands including both year-long and migratory species of hawks, eagles, falcons, vultures, and owls. Typical road-related impacts on this species group include disruption of nesting sites and direct injury and mortality to raptors hunting along high volume roads from vehicles. Road kills primarily occur along state highways and major public transportation arteries, which are largely under the jurisdiction of county or state agencies.

Loss of bald eagle habitat often involves physical disturbance associated with development and other human activities. This disturbance can deter eagles from otherwise suitable habitats, flush adults from nests exposing eggs or young to adverse weather conditions or deprive them of food, and decrease hatch rates and young survivability. Human activities near active communal winter roosting areas can cause eagles to abandon these habitats and expend energy finding other suitable roost areas. The additional energy used and added stress can lead to general deterioration in health and possibly affect survivability and reproductive success (BLM, 2003). However, communal winter roost sites for eagles do not occur on the Grasslands, and occasional individual eagles that winter on the Grasslands are typically not in vicinity of the level 3 road system.

The ferruginous hawk is considered highly susceptible to human disturbance during nesting (Nicholoff, 2003). This species is found in open basin and grassland habitats, and requires large tracts of relatively undisturbed habitat (Nicholoff, 2003; DeGraaf et al., 1991). Current population declines in this species are due to conversion of native prairie habitats to other land uses and disturbance of nesting birds. Because this species rotates nesting sites, recycling nest sites anywhere from every year to every seven years, road impacts on known nesting sites are a major concern for management of this species.

The burrowing owl is a ground-nesting owl that utilizes some of the same habitats as the ferruginous hawk (DeGraaf et al., 1991), but with a greater focus on areas with colonial burrowing mammals, such as the prairie dog. This owl uses abandoned burrows created by burrowing mammals as nest sites. Populations of this species are declining primarily due to widespread elimination of burrowing rodents, notably prairie dogs and ground squirrels. In addition, like the ferruginous hawk, the burrowing owl is sensitive to disturbance. Construction of roads often leads to the spread or new development of prairie dog colonies (see the “Small Mammals” discussion below). Thus, in some instances, particularly along

low maintenance level/low use roads where disturbance effects would be minimal, a road may promote habitat characteristics favored by this species.

Migratory Songbirds and Others

The Cimarron and Comanche National Grasslands provide important habitat for a variety of songbird, waterfowl, and shorebird species (USFS, 2001b). Migratory songbirds, shorebirds, water birds, and waterfowl utilize sage brush habitats and riparian areas extensively. Several birds on the sensitive species list are of particular importance when addressing road-related impacts on upland birds. These include the Cassin's sparrow, grasshopper sparrow, and the loggerhead shrike. Habitat, in general, for these species is dominated by sagebrush with an interspersed grass component or shortgrass prairie with a variety of structural stages (Nicholoff, 2003). Road-associated effects to this habitat include direct destruction of habitat from mineral-development related road construction, increased recreational use of road accessible areas, and impacts from all terrain vehicle (ATV) user-created roads. Driving vehicles off-road destroys vegetation, contributes to soil erosion, and can directly destroy nests and nestlings (Nicholoff, 2003). Due to the ground-nesting habits of most Sensitive species, these species would most likely be impacted by nest destruction from illegal off-road vehicle use in sagebrush habitat. Road construction and use also result in opportunities for weed invasion, roadkills, and fragmentation of sagebrush habitat.

The long billed curlew and mountain plover are sensitive upland bird species that inhabit areas of shortgrass prairie. The long billed curlew utilizes a complex of short grass prairies, agricultural fields, wet and dry meadows and prairies, and grazed mixed-grass and scrub communities (Nicholoff, 2003). This species is sensitive to the effects of fragmentation from land use conversion and the disturbance of its habitat during the breeding season (April through July). Increased recreational use of waterbodies with road access may affect this species which is sensitive to disturbance during the nesting period (this species often nests on the ground near water). The mountain plover inhabits areas of shortgrass prairie, typically in association with areas of bare ground. Although this species is adapted to many natural forms of disturbance (such as heavy grazing, fire, and disturbance caused by prairie dog activities) it is sensitive to oil and gas development, recreational activities, eradication of prairie dogs, and habitat conversion (Nicholoff, 2003).

Amphibians and Reptiles

Typical road-related impacts on this species group may include disruption of nesting sites by traffic or illegal off-road vehicle use, reduced dispersal, population isolation, and direct injury or mortality of reptiles or amphibians either crossing the road or 'sunning' in the road travelway (Forman et al., 2003). Amphibians and reptiles that must migrate to breed or hibernate, including many species of salamanders, frogs, toads, snakes, and turtles, often incur the greatest population losses of all animal groups from roadkill mortality. Significant losses in amphibian populations can occur during mass migrations to breeding ponds and other wet habitats. The presence or absence and density of entire local amphibian populations can be affected by increased mortality due to traffic and higher predation rates near roads (Forman et al., 2003).

Roads also can increase vehicle-induced mortality to reptile and amphibian populations, which may be of particular concern for ornate box turtles, northern leopard frog, Texas horned lizards, and massasauga rattlesnakes.

The massasauga rattlesnake is a Sensitive species that primarily inhabits sandsage and shortgrass prairie on the Comanche NG. Roads have the potential to modify habitat for this species when crossing prairie habitats and vehicles can be an important cause of mortality. Most of our knowledge regarding the distribution of this snake in Colorado has in fact been derived from collections of road-killed individuals (Hobert 1997).

The northern leopard frog is a Sensitive amphibian species and rare across the Grasslands. Northern leopard frogs are wetland obligates, using a wide variety of aquatic habitats from springs to slow streams and marshes. Road impacts on this species may include direct impacts, such as mortality on roads by automobiles and limitations on movement or habitat use from blocked culverts (during tadpole stage); or indirect impacts, such as those associated with pollution from road runoff, transmission of disease, and potential for the introduction of predators (Smith, 2003).

Road mortality effects on amphibians are well-known and documented (Forman et al., 2003), and are most likely to occur during the summer as adults move more frequently into upland areas for food. Road access to leopard frog habitat increases the likelihood of the introduction of predators of the leopard frog. The most notable of these species is the American bullfrog, which has been well-known to eliminate entire local populations of other ranid frogs (Smith, 2003). Species of commonly introduced fish also have been shown to increase predation pressure on the northern leopard frog, including the commonly stocked largemouth bass, green sunfish, and rock bass (Smith, 2003). Road access can increase the likelihood of the spread of disease through more frequent recreation activity. Ranaviruses can be introduced by transplanted bullfrogs, and chytrid fungus can be transported on the boots of recreationists passing from one pond to the next, by fish stocking, or also by transplanted bullfrogs (Smith, 2003) (see also AQ 10 and TW2). Both ranaviruses and chytrid fungus can eliminate entire local populations of leopard frogs. Lastly, frogs and other amphibians are highly susceptible to changes in water quality due to their reliance on aquatic habitats for critical phases of their life cycle and the high permeability of their skin. Studies have shown that road runoff agents, such as motor oil and solvents, can kill some amphibians. These chemicals can leave a roadway and pass into nearby frog ponds during rain and snowmelt (Smith, 2003).

Small Mammals

A variety of small mammals, varying in size, habitat preference, food preference, and distribution are found across the landscape. Not surprisingly, the effect of roads on small mammals and their habitat use is also varied. Road avoidance behavior, habitat fragmentation, habitat creation, increased predation along the road corridor, increased mortality from roadkill along the road corridor, and impacts on movement and dispersal patterns are common associated impacts on small mammal populations. Prairie dogs are considered an ecological “keystone species,” since many other wildlife species depend on the unique habitat created by their foraging and burrowing activities. The mountain plover

and burrowing owl are believed to be prairie dog habitat dependent species (Van Pelt, 1999; May, 2001). Road impacts on prairie dogs are varied, with some factors of road construction and development improving habitat opportunity for the species, and other factors, primarily associated with road usage, having potentially adverse effects on populations. Road construction efforts result in disturbed soil conditions along the road right-of-way that are favored by prairie dogs for constructing burrows. At the same time, increased access to areas generally increases exposure of colonies to hunting pressure.

Bats

Major road-associated threats to these species include those associated with disturbance of roosting sites by noise produced by off-road vehicles, firearms, or other noise producing activities (other recreational uses, mineral resource extraction operations, etc.). The Towensend's big eared bat is noted as being "extremely sensitive to disturbances in the vicinity include disturbance of riparian area habitats (road cuts, recreational activities brought to riparian areas by roads, etc.), and the establishment of invasive species by these activities can alter vegetation patterns for key prey species development (Schmidt, 2003a, b).

TW (2) and TW (3): How does the road system facilitate human activities that affect habitat? How does the road system affect legal and illegal human activities (including trapping, hunting, poaching, harassment, road kill, or illegal kill levels)?

The road system provides access for a multitude of human activities, both legal and illegal, that affect wildlife habitat and species. These human activities can be grouped into three major categories: recreational uses, mineral resource extraction, and rangeland management.

Recreational Use

Recreational use is increased wherever roads provide access, specifically near road accessible waterbodies and areas typically used for hunting. Recreation is highest during the hunting season, and thereafter drops dramatically for the rest of the year. Roads facilitate access for legal and illegal hunting (poaching), and new roads open up areas to higher levels of hunting pressure. Effects to wildlife include direct human-caused mortality and injury from hunting or poaching activities. Increased hunter presence and activity near roads can result in disturbance to wildlife species, damage to habitats from trampling and disturbance, alter movement patterns, and increased potential for invasive species dispersal (see question TW (1) and TW (3) for species-specific examples). Higher vehicle use during hunting season leads to ungulate movement off NFS lands onto private land where hunting pressure is lower. This fragments populations, disrupts normal distribution, and alters hunter success. Hunters entering from the roadside, where invasive species are most often established, may hike into interior areas, and in so doing, promote the spread of invasive species. The effects of poaching on wildlife are similar to those addressed for legal hunting effects, but go beyond what the states have planned for a manageable, sustained harvest.

Passenger cars and four-wheel drive vehicles are commonly used to support all forms of recreational use. The branches, stems, and seeds of noxious weeds frequently lodge in the undercarriage or bumpers of these vehicles and travel great distances, dispersing seeds

along the way. When on the road, these vehicles disperse seed and add to the potential for the establishment and spread of non-native species along the road corridor. However, perhaps of greater concern is the tendency for illegal off-road use of these vehicles. Due to the open terrain and low vegetation, this can occur virtually anywhere. Illegal off-road use results in the dispersal of non-native invasive species from the road corridor into interior areas of the grassland, disturbing wildlife, destroying vegetation, and altering vegetative species composition. Illegal off-road use can also result in the permanent destruction of habitat if the route is used repeatedly, resulting in the formation of a user-created road. The use of motorized vehicles, including snowmobiles, can reduce wildlife habitat effectiveness via noise disturbance, stress, and displacement of animals, nest abandonment, and interruption of breeding behavior. Constant disturbance can result in changes in behavior, abandonment of territory and even death of animals (USFS, 2003c).

Natural Resource Extraction

Roads are the principal means of access for conventional oil and gas operations, field development, and production operations. Effects to wildlife from these operations may include:
increased direct mortality (including legal hunting, poaching, collision with power lines and vehicles, electrocution on power lines, and nest loss).
the introduction of new habitats suitable for avian and mammalian predators, and thus a potential change in predation rates on other wildlife species.
direct loss or degradation of habitats.
indirect disturbance resulting from human activity (including harassment, displacement, diversion from public to private lands, noise and dust, altered nutritional status and reproductive success, and changes in habitat effectiveness).
habitat fragmentation (particularly through construction of roads).
changes in population levels.

Wildlife effects are generally greatest during the oil and gas construction phase, when the highest level of activity occurs. Wildlife may avoid areas with these activities and use other locations in response to the increased levels of human activity, equipment operation, vehicular traffic, and noise. This avoidance often results in the under-use of otherwise suitable habitats, thereby decreasing overall habitat effectiveness. Additional impacts from ground disturbance activities also result in mortality or habitat destruction impacts for some wildlife, particularly small mammals, reptiles, insects, and ground-nesting birds. Wildlife effects during the production phase are generally lesser than those of the construction phase, and are focused primarily on wildlife disturbance impacts from maintaining the pumpjack and other well equipment. For conventional oil and gas, operators may check installations between once a day and once every four days, depending on well production. This routine activity and disturbance can result in long-term alteration of the local wildlife community, tending towards species that are either more tolerant of human presence, or more readily adapted to routine disturbance.

Livestock Operations

Roads provide the primary means of access for livestock operations. Rangeland use and management effects on wildlife vary from species to species, and vary depending on the

habitat grazed. If the distribution of the road system contributes to the overuse of some areas and under-use of others, then the road system itself can potentially contribute to rangeland management-induced impacts on wildlife.

TW (4): How does the road system directly affect unique communities or special features in the areas?

The road system may facilitate introduction of non-native invasive species that could adversely affect unique communities or special features. In addition, open roads may increase the incidence of human activities that could have negative impacts on characteristics of unique communities. People are often drawn to unique areas or special features, and proximity to a road allows for better access by more people. Examples of negative impacts could include the disturbance of a site or over collection of rare species. Conversely, the road system can also beneficially affect unique communities by providing access for management and protection activities. Unique communities are managed to preserve their characteristic features and ecological processes and to minimize disturbance. Unique communities and special features include sensitive plant populations, rare plant communities, wetlands, riparian areas, and wooded draws. .

Existing roads within the vicinity of, or passing through, areas containing rare plant communities may directly affect the condition of these communities and their long-term viability. Potential road-related effects include: changes in hydrological processes from road runoff, which could affect vegetative composition; introduction and spread of non-native/noxious plant species that can out-compete desired vegetation; adverse effects on botanical features from the control of non-native plant species alongside roadways; adverse effects associated with public access to these areas, such as trampling and collection; increase in the potential for illegal off-road all-terrain vehicle (ATV) use, which could damage or destroy these rare communities; and increased access to these areas for monitoring and resource management purposes. Building roads in areas containing rare plant communities could destroy these communities or further exaggerate the above-listed effects.

Ecosystem Functions and Processes (EF)

EF (1): What ecological attributes, particularly those unique to the region, would be affected by roading of current unroaded areas?

General Habitat Fragmentation

Constructing additional roads in the few remaining unroaded areas of the Grasslands would add to the already heavily fragmented nature of these lands. The effects of new roads on the ecological attributes of the Grasslands when added to the equally fragmented adjacent private lands would be cumulative. The presence of new roads implies increased access and levels of disturbance. Increased habitat fragmentation through new road construction can further affect the ecological integrity of the Planning Area through direct and indirect impacts to soil and water resources, vegetative species presence (absence) and composition, and wildlife species, as described below.

Soil and Water Resources

Within the Planning Area, road construction and the presence of new and existing roads on the sandy soils that occur in areas such as the Cimarron Corridor and in the sandsage prairie ecosystems are much more susceptible to erosion than those on shortgrass prairie. Wildlife species that are closely associated with sandsage habitats, such as the lesser prairie chicken, are indirectly affected by soil instability where successful revegetation has yet to occur. Although some species of plants and animals rely on unstable soils of dunes and blowouts, most prefer stabilized soil and vegetative conditions. The increase in and presence of roads may add to the amount of land currently in an unstable condition, resulting in changes to species presence, abundance and distribution.

The roading of currently unroaded areas can increase sediment inputs to streams, change timing and quantity of flow and depending upon the location and level of road, can alter the riparian vegetation, the channel shape and capacity, and flow dynamics.

Increased sediment can come from the construction, and maintenance of roads. Even if a road is paved, or stabilized with rock, an unlined ditch is source of sediment. Roads in general reduce infiltration, making response to precipitation events more rapid and with more runoff (flashy). Streams in Grasslands climates are susceptible to sediment pulses, because the storms are of high intensity, and the hydrologic response is so flashy--this includes intermittent streams, as well as perennial streams. Roading in unroaded areas brings new sources for these effects.

If a road is located near a riparian area, or the floodplain of stream, it can alter the shape, capacity and flow dynamics. Rivers create their own channels to carry the sediment and flow of the existing climate and watershed conditions. If a road is located too close to, or within a river's floodplain, it impedes the river's ability to adjust and respond to hydrologic inputs. If a river's ability to adjust is impeded, it may respond to larger hydrologic events with flooding, massive bank erosion, and wide scale deposition.

Vegetative Components

The presence of roads can be associated with changes in vegetative composition and structure, the distribution and spread of exotic and invasive plants at the expense of native species. Road density, road class, road location, and types of habitats traversed by roads may influence the severity of those effects. Road construction in an unroaded area can accelerate access related to a variety of uses and management activities that can change the amount, pattern, and composition of vegetative cover, and may in turn lead to changes in terrestrial wildlife and overall ecological processes. More frequent and perhaps unwanted or unnecessary habitat conversions due to human-caused fires may result from the presence or new roads and increased access. However, additional roads produce more fire breaks that can result in smaller fires.

Wildlife

As previously mentioned, there can be both direct and indirect effects on terrestrial and aquatic species and habitats by roading an unroaded area. New roads would disrupt the existing dispersal patterns of resident and migratory wildlife species in and adjacent to the

Planning Area. New roads not only fragment wildlife habitat but reduce or remove available habitat, impacting populations (i.e. habitat associated with lesser prairie chicken). New roads can increase vehicle-induced mortality to reptile and amphibian populations, which may be of particular concern for ornate box turtles, Texas horned lizards, and massasauga rattlesnakes. New roads may provide increased hunter access, with an associated increase in hunting pressure and disturbance to species such as antelope and deer. Increased access associated with the presence of roads may hasten the spread of invasive species which can lead to less diverse plant communities and a reduction in suitable habitat for many wildlife species.

EF (2): To what degree do the presence, type, and location of roads increase the introduction and spread of exotic plant and animal species, insects, diseases, and parasites? What are the potential effects of such introductions to plant and animal species and ecosystem function in the area?

The presence, type, location and use of roads affect the rate and magnitude of the introduction and spread of exotic organisms. This frequently occurs when vehicles unwittingly transport organisms acquired from local or distant sources. Vehicle access may range from recreational use to normal road maintenance activities. Once an exotic organism is introduced, further dispersal along the road corridor and across the landscape by "natural" agents such as wind and water is also common.
Because many exotic organisms are opportunists, their rate of spread can be enhanced during new road construction and before disturbed habitat has been stabilized through revegetation efforts. They often become established and rapidly multiply in the absence of competition from native species. Unless native species can regain a foothold on these early-seral sites, the persistence of exotic organisms may have long-lasting, detrimental effects to soils, watersheds, desirable plants and native species habitats and populations.

Exotic Plants

Over 100 species of non-native plants have been identified in the vicinity of the Comanche National Grassland (Hazlett, 2004), the majority of which occur in disturbed riparian areas. Of these known non-native plants, only a handful is aggressively invasive (i.e. noxious weeds).

Although few habitats in the Planning Area of the Grasslands are immune to at least some invasion by exotic plants, predicting which species will become pests is usually difficult. Assessing the scale of a biological invasion problem is complicated by the typical lag between when an exotic is introduced and when it begins to expand its distribution and population size in a new area.

Relatively few non-native plants can tolerate conditions of the Grasslands, most notably cheatgrass (*Bromus tectorum*), Japanese brome (*Bromus japonicus*), Russian tumbleweed (*Salsola tragus*), alkali weed (*Kochia scoparia*), and horseweed (*Conyza canadensis*). A greater diversity of weedy plants is found in more mesic sites such as riparian strips and along roadsides. The most prominent species are tamarisk (*Tamarix spp*.), smooth brome (*Bromus inermis*), yellow sweet clover (*Melilotus officinalis*), musk thistle (*Carduus nutans*), and dalmatian toadflax (*Linaria genistifolia*).

Exotic Animals, Insects, Disease and Parasites

Within the Planning Area, there is minimal information available regarding the presence and/or introduction of exotic animals, insects, disease and parasites or how the existing road system influences their spread affecting ecosystem function.

Where these exotic organisms may be present, existing roads, new road construction and road maintenance can provide corridors for dispersal (keying in on disturbances), or provide barriers for dispersal (unable to cross wider roads).

EF (3): To what degree does the presence, type, and location of roads contribute to the control of insects, diseases, and parasites?

Where insects, disease and parasites are being present, roads can provide access for potential control measures. Question EF (2) describes how roads contribute to the introduction and proliferation of exotic plant and animal species. Roads also provide land managers access to areas infested by insects, diseases, and parasites for efficient sampling, monitoring, and ground-based treatment/suppression activities. The entire road system provides the means to access areas for early detection of insect, disease, and parasitic infestations and outbreaks. These roads then become the primary means of access for management operations associated with the control of insect and disease spread. Overall, the benefits of roads with regard to exotic plant species control and monitoring are outweighed by their detrimental effects. There is no data available to assess current insect and disease levels.

EF (4): How does the road system affect ecological disturbance regimes in the area?

The presence of roads can also interrupt large-scale ecological disturbances, particularly wildfire. Roads create firebreaks that cause the area to experience smaller and less frequent fires than occurred historically. Stopping fires may encourage growth of woody species on the Grasslands. This changes the structure of the vegetation and is detrimental to the native plant and animal communities. It may also make the area less suitable to grazing.

With the limited miles of levels 3 and 4 roads in the Planning area, the opportunity for these roads to affect ecological disturbances is minimal.

EF (5): What are the adverse effects of noise caused by developing, using, and maintaining roads?

There are wildlife species that may be adversely affected by the noise associated with developing, using and maintaining roads. These activities may affect breeding, nesting, and movement/migration patterns; species may avoid a roaded area all together. For example, developing, using and maintaining roads can cause lesser prairie chickens to abandon breeding (lek) sites that are located near roads.

Economics (EC)

EC1: How does the road system affect the agency's direct costs and revenues? What, if any, changes in the road system will increase net revenue to the agency by reducing cost, increasing revenue, or both?

Most of the roads within this project area were created over the years for a variety of access needs, and considerable capital investments were incurred to construct these roads. Most of these roads were analyzed in some form, which likely included use needs, construction design standards, environmental considerations, and economic assessment.
An examination of funding levels needed to maintain and improve the Level 3 and 4 roads show that the annual road maintenance funding for this Forest was still significantly less than adequate. Forest Road agreements with counties provide the forest some maintenance on Level 3 and 4 roads.

EC2: How does the road system affect the priced and non-priced consequences included in economic efficiency analysis used to assess net benefits to society?

Based on guidance provided in the *Region 2 Road Analysis Supplement to FS-643*, a detailed analysis of this question is more appropriate at the subforest or individual project scale. At this more narrow scale, it is possible to quantify certain economic outcomes as a comparison between alternative conditions.

EC3: How does the road system affect the distribution of benefits and costs among affected people?

Based on guidance provided in the *Region 2 Road Analysis Supplement to FS-643*, a detailed analysis of this question is more appropriate at the subforest or individual project scale. At this more narrow scale, it is possible to quantify certain economic outcomes as a comparison between alternative conditions.

The question of jurisdiction and the extent to which maintenance responsibilities are borne by non-USFS entities are important considerations for the analysis of the distribution of costs associated with the road system. Jurisdiction is primarily divided between the USFS and the local counties. However, actual jurisdiction depends on where the road is located. Of importance are those roads that pass through multiple jurisdictions resulting in some confusion as to the identification of the responsible entity. In these instances, identification of the responsible entity and/or cooperative agreements is required. The key question is the extent to which the correct entity (public or private) is assuming responsibility for maintenance.

Timber Management (TM)

TM (1), TM (2), and TM (3): How does the road spacing and location affect logging system feasibility? How does the road system affect managing the suitable timber base and other lands? How does the road system affect access to timber stands needing silvicultural treatment?

Because timber management does not occur on the Comanche and Cimarron National Grasslands, these questions were not addressed.

Minerals Management (MM)

MM (1): How does the road system affect access to locatable, leasable, and salable minerals?

The Bank-Head Jones Farm Tenant Act of 1937 does not allow locatable or salable mineral development on the Grasslands. In the case of aggregate minerals (gravel, caliche), the Forest Service will continue to develop sources of aggregate for internal and public use. The Bank Head Jones Farm Tenant Act allows extraction of leasable energy minerals. The Cimarron National Grassland has approximately 450 oil/gas related facilities and the Comanche National Grassland has approximately 35 oil/gas related facilities.

Level 3 roads on the Cimarron serve as primary collector roads, with individual well sites accessed via class two roads. On the Comanche, Level 3 roads serve as access within the Campo Oil Field and County and State roads serve as the primary collector road system for the Grassland. Road access is crucial to the extraction of leasable minerals on the Grasslands and is considered essential in meeting the terms of prudent operations of an oil/gas lease.

Range Management (RM)

RM (1): How does the road system affect access to range allotments?

In general the road system can improve and reduce cost of livestock management. It can allow access and transportation of sick animals reducing death loss. It can also increase vandalism, disturbance of livestock and provide opportunity for livestock theft by the general public, which increases the cost of management.

This system of roads, and the network of lower maintenance level roads that stem from it, currently provide more than adequate access for range management purposes. These roads provide primary access to large areas with a high density of active range allotments and receive frequent traffic from ranchers.

Water Production (WP)

WP(1): How does the road system affect access, constructing, maintaining, monitoring, and operating water diversions, impoundments, and distribution canals or pipes?

Based on guidance provided in the *Region 2 Road Analysis Supplement to FS-643*, a detailed analysis of this question is more appropriate at the subforest or individual project scale.

WP (2) and WP (3): How does road development and use affect water quality in municipal watersheds? How does the road system affect access to hydroelectric power generation?

This is not an issue on the Grasslands.

Special Forest Products (SP)

SP (1): How does the road system affect access for collecting special forest products??

Harvesting native grass seed has been the only request and activity conducted under the non-timber product program on the Grasslands. Other non-timber products also occur on the Grasslands, and future requests for collection may largely be driven by demand for such things like medicines, natural foods, botanicals, decoratives, and a host of other products. In the harvest of any non-forest product on the Grasslands, the existing road system has been (or would be) used to access the source materials.

The current road system limits access to canyonland areas. As a result, American Indian or other ethnic groups wishing to access special forest products in these areas may be restricted by lack of Levels 3-5 maintained roads. However, there have yet to be any special requests from American Indians or other ethnic groups to collect special forest products on the Grasslands.

While some of these activities can provide employment opportunities, any revenues which might be collected from permitting these activities doe not contribute to the maintenance of existing roads.

Illegal collection can be a problem in many forested or grassland habitats, and the presence of roads do play a role in providing easy access to target harvesting areas. The occurrence of illegal collection on the Grasslands is not known. The presence of roads does facilitate monitoring harvest activities.

Based on guidance provided in the *Region 2 Road Analysis Supplement to FS-643*, a detailed analysis of this question is more appropriate at the subforest or individual project scale.

Special-Use Permits (SU)

SU (1): How does the road system affect managing special-use permit sites (concessionaires, communications sites, utility corridors, and so on)?

The Grasslands have over 500 miles of oil or gas pipelines authorized by special use permits. The Grasslands also provide for a variety of other types of special uses, such as weather stations, compressor sites, communication towers. To manage the operation, maintenance and monitoring of these special uses, access to these areas via the existing road system is essential.

General Public Transportation (GT)

GT (1): How does the road system connect to public roads and provide primary access to communities?

The Comanche National Grassland is encompassed by an intermingled land pattern and has limited miles of Level 3 and 4. With the exception of David Canyon road providing primary access to Picket Wire and Vogel Canyons, the Level 3 and 4 roads within the Grassland play a very limited role in providing primary access to the communities of La Junta, Kim, and Springfield, Colorado. The primary road system within the Comanche National Grassland consists of County and State Highways. The internal road system is primarily primitive two-track (Level 2) roads.

The Cimarron National Grassland's land pattern is relatively consolidated... FDR 700 (South River Road) and FDR 600 (North River Road) provide the primary access to and from the communities of Elkhart, Richfield and Rolla, Kansas, and to access recreational sites within the Grassland along the Cimarron River corridor.

GT (2): How does the road system connect large blocks of land in other ownership to public roads (ad hoc communities, subdivisions, inholdings and so on)?

The Level 3 and 4 roads within the Grasslands have limited value or impact in relation to connecting large blocks of land in other ownership. With the intermingled land patterns, connection of large blocks of land in other ownership is primarily accomplished through County and State highway road systems.

GT (3): How does the road system affect managing roads with shared ownership or with limited jurisdiction? (RS 2477, cost-share, prescriptive rights, FLPMA easements, FRTA easements, DOT easements)?

This is not applicable on the Grasslands.

GT (4): How does the road system address the safety of road users?

To the extent current road maintenance funding allows, the Levels 3 and 4 roads within the Grasslands are maintained and signed in accordance with their assigned level of maintenance and traffic service. The road system itself is designed for safety, including adding precautionary signs relating directions and safety that are intended to reduce accidents. Any management activity that increases or alters normal traffic patterns could be mitigated with appropriate warning and/or precautionary signing and restricted use.

Travel management regulations are posted on the ground and described on the Grassland Visitor's map. These regulations have been established to enable safe motorized travel while protecting natural resources and minimizing conflicts between users. Off-road recreational vehicles such as trail motorcycles and ATVs are discouraged on higher standard arterial and collector roads.

Administrative Use (AU)

AU (1): How does the road system affect access needed for research, inventory, and monitoring?

The current road system limits access to some Forest Systems lands in Picket Wire Canyon and Little Black Mesa. While helping protect resources, the limited access also makes it more difficult to conduct research, inventory and monitoring.

AU (2): How does the road system affect investigative or enforcement activities?

Access using the existing road system does not affect investigative or enforcement activities on the Grasslands.

Protection (PT)

PT (1), PT (2) and PT (3): How does the road system affect fuels management? How does the road system affect the capacity of the Forest Service and cooperators to suppress wildfires? How does the road system affect risk to firefighters and to public safety?

The existing road system provides more than adequate access for wildfire suppression and prescribed burning activities. Roads provide fire control structures to halt fire spread and contain fires; used as egress and ingress routes; serve as escape routes and safety zones for fire personnel. Roads may be used as a means of direct and indirect attack by using them as anchor points. Roads decrease risk to firefighters because they may be used as escape routes and safety zones and may be utilized as anchor points and control structures. Traffic along roadways may endanger burn personnel. Visibility hazard to traffic during smoky conditions may increase risk of accidents. Fencelines and powerlines, typically found along roadways, are in danger from fire and must be protected before ignition, which increases overall costs.

PT (4): How does the road system contribute to airborne dust emissions resulting in reduced visibility and human health concerns?

There are no non-attainment areas within the Cimarron and Comanche National Grasslands. Reduced visibility during non-windy conditions may be a concern due to an increased possibility of colliding with on-coming or slower traffic and rollovers if a single car runs off the road. During strong atmospheric inversions, dust settles in low valleys, which affects visibility and may affect human health with prolonged exposure. The road system does contribute to air quality problems through dust emitted into the atmosphere by vehicles moving on unpaved roads.

Non-Motorized and Motorized Recreation (UR and RR)

UR & RR (1): What are the supply and demand relationships for unroaded and/or roaded recreation opportunities?

Currently, with the large number of roads that exist on the Grasslands (mainly county roads), there are limited opportunities for unroaded recreation. Unroaded recreation opportunities

are a scarce resource; there will not be excess supply in the future. However, there could be excess demand in the future.

UR & RR (2): Is developing new roads into unroaded areas, decommissioning of existing roads, or changing the maintenance of existing roads causing substantial changes in the quantity, quality, or type of unroaded and roaded recreation opportunities?

With the extensive amount of road coverage on the Grasslands (county roads), unroaded recreation opportunities are almost nonexistent.

UR & RR (3): What are the adverse effects of noise and other disturbances caused by building, using, and maintaining roads, on the quantity, quality, and type of unroaded and unroaded recreation opportunities?

This is not considered an important issue, as there are very limited unroaded recreation opportunities. Oil and gas wells may be considered an undesirable noise near unroaded areas. The sound and dust of road use and maintenance is not a problem in areas of low public use. High use due to guided auto tours, other visitors and administrative use, may adversely impact those who are seeking an unroaded recreation experience.

UR & RR (4): Who participates in unroaded recreation and road-related recreation in the areas affected by constructing, maintaining, and decommissioning roads?

The primary participants of unroaded recreation are hunters, birdwatchers, hikers, mountain bikers, horseback riders, archeology and paleontology enthusiasts, and users seeking solitude.

UR & RR (5): What are these participants' attachments to the area, how strong are their feelings, and are alternative opportunities and locations available?

These participants have strong attachments to areas such as Picket Wire Canyon, Carrizo Canyon, lesser prairie chicken leks, Cimarron River. There are few other areas that offer the quality recreation experience that these areas provide. All of these areas are accessed through the existing road system and are not considered as unroaded recreation opportunities. ATV use areas are limited as well, with few areas that the activity can occur without major resource damage.

UR & RR (6): How does the road system affect the scenic integrity? How is developing new roads, decommissioning of exiting roads, or changing the maintenance of existing roads into unroaded areas affecting scenic integrity? Is there now or will there be in the future excess supply or excess demand for roaded recreation opportunities?

Currently, with the amount of roads present (county roads and user created roads); there is relatively low demand for additional roads on public lands. The supply of available roads greatly exceeds the demand in most areas, based on the latest available NVUM[3] survey data. Many of the roads provide needed access to the fragmented portions of the Grasslands for all users. Over the next 10-20 years, the demand for roaded recreation may increase, but it probably would not exceed the current supply.

[3] National Visitor Use Monitoring.

RR (7): How does road management affect wilderness attributes, including natural integrity, natural appearance, opportunities for solitude, and opportunities for primitive recreation?

There are no wilderness areas designated, however, there are areas in abundance that offer solitude. The current maintenance level of existing roads is low and thus also preserves the qualities of the area.

RR(7): Is developing new roads into unroaded areas, decommissioning of existing roads, or changing maintenance of existing roads causing substantial changes in the quantity, quality, or type of roaded recreation opportunities?

The existing road coverage and management on the Grasslands does not cause substantial changes needed or expected in the quantity, quality or type of roaded recreation opportunities.

RR(3): What are the adverse effects of noise and other disturbances caused by constructing, using, and maintaining roads on the quantity, quality, or type of roaded recreation opportunities?

In most roaded areas on the Grasslands use is relatively low and the adverse effects are minimal. Road based recreationists may experience short-term temporary disturbance or inconvenience due to encounters with other users, road construction or maintenance. This temporary disturbance or inconvenience may affect the quality of roaded recreation opportunities for some users.

RR (4): Who participates in roaded recreation in the areas affected by road constructing, changes in road maintenance, or road decommissioning?

The primary participants are hunters, birdwatchers, and archeology and paleontology enthusiasts, users seeking solitude, sightseers, and ATV users, 4 wheel-drive and motorcyclists in some areas.

RR (5): What are these participants' attachments to the area, how strong are their feelings, and are alternative opportunities and locations available?

Grassland users tend to have very strong feelings about their favorite areas and activities. Much of the attachment to the Grasslands is from local populations, hunters, and archeology and paleontology enthusiasts that return year after year. There are few alternative locations that provide opportunities these recreationists desire.

Social Issues (SI) and Civil Rights and Environmental Justice (CR)

SI (1): Who are the direct users of the road system and of the surrounding areas? What activities are they directly participating in on the forest? Where are these activities taking place on forest.

The road system provides access and basic transportation needs to a diverse group of local residents, and local and national visitors. International visitors also make use of Grasslands resources. Users of the road system can be generally categorized into six separate groups:
Local residents who use Grasslands roads as a part of their daily transportation system;
Local school districts who rely on the road system to bus students;
Ranchers who rely on the road system to support grazing and ranching operations that are interspersed throughout Cimarron and Comanche National Grasslands acreage;

Workers in the oil and gas fields who use the road system for transportation to work or to access drilling sites;
Visitors and tourists who use resources for recreation, thru-traffic and other activities; and
Ethnic or other subcultures who have a spiritual, cultural, historical, or sacred attachment to the area.
In addition to oil and gas development, and ranching, the road system supports a broad range of other uses and activities, such as hunting, ATV use, pleasure driving, scenic and wildlife viewing, camping, picnicking, and biking.

SI (2): Why do people value their specific access to national forest and grasslands – what opportunities does access provide?

The roads of the Cimarron and Comanche National Grasslands provide access to recreational and cultural resources; valued commodity resources; and historic, traditional, paleontological, or prehistoric sites of significance to specific groups within the user community. Access to these sites affords opportunity for economic gain, recreation, and educational experiences, as well as spiritual or emotional satisfaction. In addition to providing access, the roads themselves can often take on special meanings that include them as a part of the user experience. The values that users attribute to access are developed as a part of their social experience. For a number of users, access represents the opportunity to engage in a specific activity or view and experience the natural environment. For others, access is a question of facilitating a commute to work or the transportation of economic goods from source to market.

Visitors may associate the Cimarron and Comanche National Grasslands with ceremonial, commemorative, or celebratory activities, or value the area for its spiritual, sacred, or traditional qualities. The need for access to these areas is of importance to maintaining these use values. Alterations or changes to the roads may affect not only people's access to areas important to these values, but may also interfere with the aesthetic or emotional experience of visitors when they reach the sites. However, users may also value the absence of roads in certain areas as an enhancement of the wilderness experience. Although certain economic uses and recreational activities are road-dependent, other uses depend on the "remoteness" of areas that have little or no access. Roads are also a potential threat to sensitive wildlife and habitats. They may increase both motorized and non-motorized traffic in areas where such access may threaten the integrity or setting and quality of historic or cultural sites. The creation of new roads or other means of access, closure of existing roads, or alterations in the management approach to maintenance of roads involves a cost – benefit analysis at the project level not only for monetary (or priced) consequences and benefits, but also for the social values and patterns of behavior that may depend on the specific access in question. Also important are the preservation of the natural qualities of the area and any important scenic vistas, cultural sites, or unique features.

SI (3): What are the broader social and economic benefits and costs of the current forest road system and its management?

Human communities are dependent on road systems to support important economic, social, and public safety requirements. Effective road management results in improved conditions

for safe and accessible travel. Alterations in the road system and associated management practices may have a substantial effect on community social patterns and practices. Such changes may have beneficial or adverse effects on residential transportation requirements, individual lifestyles, employment, and quality of life in local communities, or the income derived from local businesses engaged in National Grassland products or tourism. Benefits associated with the road system and its management has broader social and economic impacts that go beyond direct users and the communities surrounding the Cimarron and Comanche National Grasslands. For example, local counties receive additional revenue based on the production of goods and services on public lands.

Beyond the direct economic benefits from jobs and income associated with commodity production (oil and gas and rangeland operations), local communities may also benefit from indirect trade in ancillary businesses associated with tourism and visitation. These include lodging and food services, guide/outfitter providers, and other social services. Other support industries may be developed to provide necessary services and products to Grassland workers and businesses, such as feed and equipment sales to ranchers, or housing, entertainment, and social services for oilfield personnel and coal miners. The cumulative effect of changes in the road system may have important considerations for the overall economic and social benefit derived by both recreational and other users. Over time, incremental changes both beneficial and adverse may alter both the relationship of the individual user to the Cimarron and Comanche National Grasslands and of surrounding communities.

SI (4): How does the road system and road management contribute to or affect people's sense of place?

The extent to which local residents or visitors attach meaning to a designated area and identify a "sense of belonging" or a "sense of place" associated with it can be both directly and indirectly affected by road management practices. "Sense of place" involves the value that people place on a given site, vista, or activity, and the emotional response elicited by feelings attached to the individual's experience. Important spaces may include natural or scenic vistas, residential, historic or other structures, traditional use areas, or places of scenic or other value for the local community. Other important factors in determining a sense of place concern the extent to which humans identify a place with specific activities that occur there or with spiritual, traditional, or sacred values associated with the place or its wildlife or vegetation. The individual attachment to place may be sufficiently strong so that, in the event that a site is damaged, destroyed, or inaccessible, the activity itself may no longer have meaning and may be abandoned.

Specific road management practices can affect access to or alter the physical setting and character of a place, affecting what people value and diminishing their collective experience of the place. Poor road conditions may affect the frequency with which residents use certain places or may contribute to an overall deterioration of visual quality. Similarly, noise, traffic, or other disturbances associated with maintenance or new construction activity may also contribute to a sense of lost value.

SI (5): What are the current conflicts between users, uses, and values (if any) associated with the road system and road management? Are these conflicts likely to change in the future with changes in local population, community growth, recreational use, resource developments, etc?

Given the multiple and varied uses supported by the Cimarron and Comanche National Grasslands the potential for conflict between users with differing interests is inevitable. Generally, conflicts occur between different types of users and are based on the perceived value of the particular resource to the activity in question. Road management policies and practices are important to resolving these potential conflicts, especially as related to changes in access or alteration of the setting of specific sites. Conflicts may emerge between various types of users, such as those between recreationists and commercial users, motorized and non-motorized users, consumptive and non-consumptive game users, and environmental preservationists and resource extraction users. Conflicts may also emerge between conflicting land uses, such as an oil well drilled in an otherwise natural area or intruding into a scenic landscape. Several specific sources of conflict have been identified.

One key issue is related to the emerging emphasis on environmental concerns. These views tend to conflict with other users view of the of the area's value, which is primarily associated with commodity production. Another source of potential conflict exists between older residents and users and the growing trend in ATV use. Illegal ATV use is an ongoing concern, as is the introduction of motor vehicles into non-motorized-designated areas. Other potential conflicts are related specifically to road safety as slower moving ranch vehicles and ATVs compete for the same roadways as faster moving passenger cars. These conflicts are a part of the context in which road management decisions are made. Consideration of these potential conflicts as a part of the site-specific roads analyses will allow for the prediction of potential outcomes and, in some cases, may allow for decisions that serve to mitigate conflict among users.

CH (1): How does the road system affect access to paleontological, archaeological, and historical sites and the values people hold for these sites?

Access to cultural heritage (archeological and historical) or paleontological sites can be greatly enhanced by the presence of nearby roads. In some instances, this may be a desirable outcome, as access increases opportunities for academic study or public education and enjoyment of natural history and cultural heritage. Roads also provide access to areas that have not yet been surveyed for important cultural heritage resources. However, increased access may also lead to an increased level of human activity at the sites, indirectly contributing to site disturbance, the possibility of vandalism, destruction of the site, or the illegal removal of artifacts from the site. Increased access may also introduce new and incompatible uses that may compete with the site's setting and character. The current road system limits access to paleontological, archaeological and historic sites in the canyonland areas of the Comanche. The Cimarron has a more extensive road system so they have improved public access to archaeological sites.

CH (2): How does the road system and road management affect the exercise of American Indian Treaty Rights?

By increasing public access to areas that have acquired specific cultural or traditional value, roads may indirectly result in the introduction of "modern" elements or artifacts, thereby disturbing the aesthetics of a site or its surrounding environment or influencing the site's sacred or spiritual qualities. Determination of the specific effects to any given site must be made at the project level.

CH (3): How does road use and road management affect roads that constitute historic sites?

Historic roads are roads that, through design, experience, or association, have contributed to culture in a meaningful way. This quality may be based on the road's aesthetics, engineering, or historic significance. In some cases, features forming parts of a road or that are associated with a road, such as roadside structures, bridges, or trails, may also be historically or culturally valuable for their own merits and be designated as historic sites. Where roads are designated under the National Historic Preservation Act of 1966 (NHPA), they must be managed in accordance with this Act, including project-level assessments for compliance with Section 106 of the Act. While the Grasslands have historic roads, none are maintained at a level 3 or above.

CR (4): Is the road system used or valued differently by minority, low-income, or disabled populations than by the general population? Would potential changes to the road system or its management have disproportionate negative impacts on minority, low-income, or disabled populations?

Access to the road system is open and available to all user groups for a broad range of activities. However, members of certain cultural groups or income strata are more likely to use the Cimarron and Comanche National Grasslands for specific practices or forms of recreation than others. For members of economically disadvantaged, minority, or handicapped groups, access to resources may represent a valued alternative recreational experience, or represent a place for traditional gatherings for celebration, commemoration, or ceremony. For others, the hunting opportunities or the gathering of products, such as plants or firewood, may be important to supplementing lifestyle values. Alternatively, some activities, such as nature walks, hiking, picnicking, or sightseeing, are commonly enjoyed among almost all groups.

Changes to specific roads may have a greater effect on minority and low-income populations, depending on the extent to which these groups value access to resources and products to supplement income or lifestyle. Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994), requires that Federal Agencies consider any disproportionately high and adverse human health or environmental effects to minority and low income populations. Agencies are required to ensure that these potential effects are identified and addressed. The U.S. Environmental Protection Agency defines environmental justice as "the fair treatment and meaningful involvement of all people regardless or race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Consideration of the potential consequences of management decisions for environmental justice requires three main components:

A demographic assessment of the affected community to identify the presence of minority or low income populations that may be potentially affected;
An integrated assessment of all potential impacts identified to determine if any result in a disproportionately high and adverse impact to these groups; and
Involvement of the affected communities in the decision-making process and the formation of any mitigation strategies.
The USFS does not discriminate against any group or persons based on color, creed, abilities, nationality, income, age, or background. In accordance with Executive Order 12898, the USFS evaluates all of its programs and projects for adverse effects on minority or low-income populations before implementation.

Step 5 Describing opportunities and setting priorities

Introduction

The following sections outline management opportunities and recommendations identified by the ID Team, based on the analyses presented in Steps 4 and 5 of this document. To provide overall context and organization, recommendations are generally arranged by the categories that were used to organize major issues listed in Step 3, and subcategorized by major question themes in Step 4. Because of this, some recommendations are listed more than once in different general categories.

Problems and Risks Posed by Current Road System

Problems and risks associated with the current road system include: lack of signing, improper maintenance, and inadequate maintenance. Improper maintenance can be more damaging than no maintenance in certain instances, over widened roads is just one example on the Grasslands.

Opportunities for Addressing Important Problems and Risks

General Opportunities:

Opportunities for addressing other road-related problems and risks include:

1. Require the use of this Cimarron and Comanche National Grasslands Roads Analysis for all sub-grassland scale roads analyses.
2. Analyze the roads data to determine new opportunities that may have developed as new information is collected.
3. Review and update RMOs (with current line officer signatures) for any project affecting roads.
4. Pursue opportunities to develop cooperative agreements in assisting in enforcement and monitoring activities with area ranching organizations.
5. Inform road users of the type of travel permitted on Cimarron and Comanche National Grasslands roads through appropriate signing and education, especially when the road crosses through multiple jurisdictions.
6. Identify and implement road closure methods that are most appropriate for effective road closure in an open, grassland setting.
7. As set forth in MUTCD[4], establish and maintain proper signing on roads subject to the Highway Safety Act.
8. Post signs on roads warning of road surface changes for roads that change objective maintenance levels along their path.

[4] Manual on Uniform Traffic Control Devices.

9. Develop an accident reporting system or program in conjunction with local law enforcement that provides for tracking the locations, types, and frequencies of motor vehicle accidents on National Grassland roads.
10. Use motor vehicle accident safety investigations and reports to help identify road safety hazards, including recurring road washout locations.
11. Conduct road location reviews prior to all new construction and road relocations. Ensure the location meets public and agency needs, while mitigating environmental impacts identified in the analysis. Responsible line officers and resource and engineering specialists should participate in the review.
12. Develop a cost effective plan for conducting an inventory of unclassified roads.
13. Monitor high road density area for illegal off-road use or the signs thereof.
14. Improve timeliness of responding to road washouts that present a public safety concern.

Resource Extraction:

Oil and Gas Management Opportunities

1. Assess those roads that are considered valuable to private oil and gas operations and of high maintenance cost to the USFS. Determine if additional maintenance cost sharing agreements are required.
2. Monitor road closure, rehabilitation, or removal efforts by oil and gas operators for compliance with lease agreements.
3. Develop a plan to inventory the lower maintenance level road system. Identify those areas where roads were not rehabilitated following oil and gas operations.

Rangeland Access Opportunities

1. Assess roads listed as moderate value for rangeland management to determine which, if any, can be reduced in objective maintenance level.
2. Identify areas of natural resource damage along roads heavily used for rangeland management purposes and take corrective action.

Environmental Concerns:

Opportunities for Addressing Risks to Wildlife/Sensitive Species

1. Develop an education program regarding the adverse effects of both off-road travel and motorized use of closed roads on wildlife and aquatic resources. Education may be the best tool to discourage additional development and use of unclassified roads.
2. Develop a strategy to inventory unclassified roads.
3. Consider certain roads for seasonal closures to reduce the effects of motorized vehicles in some areas of wildlife concern.
4. Strategically close certain low-value roads to reduce the encroachment of recreationists into wildlife habitat.
5. When roads with high risk to wildlife cannot be removed, plan maintenance outside of key habitat use periods (such as nesting periods, ungulate winter range).

6. When roads with high risk to wildlife cannot be removed, reroute road around or away; or limit road use from traditional key use habitats such as leks and nest sites Allow access by special use permit only, if possible.
7. In occupied reptile and amphibian habitat, post warning signs (not speed limit signs) or utilize road design and maintenance techniques to discourage high speeds while maintaining safety requirements for the road. Examples of road design and maintenance techniques can include: limiting road width, reducing driving comfort level, remove gravel surfacing, add rolling dips.
8. Within two miles of sage grouse leks, regulate traffic to meet seasonal noise limitations from road use.

Opportunities for Addressing Risks to Aquatic Communities

1. Develop an education program regarding the adverse effects of both off-road travel and motorized use of closed roads on aquatic resources.
2. Consider relocating roads identified for potential for mass failures.
3. Conduct culvert and drainage structure condition surveys. As part of the effort, identify those locations where gully formation is induced by road drainage.
4. Focus maintenance efforts on drainage improvements for those roads considered to have high potential for hydrologic impact and high risk to aquatic communities.
5. Develop and implement a strategy for monitoring the effects of oil and gas development on roads and road drainage structures.
6. Conduct a survey of roads with potential to impact wetland habitats, particularly playas. (See question AQ (8) for a list of potential survey targets.)
7. Assess recreational reservoirs and waterbodies during field surveys for the presence of: chytrid fungus, frogs carrying ranavirus, and bullfrogs. Provide information at recreation hot spots that inform the public of these concerns and methods for limiting recreation induced dispersal to other water bodies in the grasslands.
8. Conduct surveys or obtain current information regarding the amount and distribution of wetlands on the Cimarron and Comanche National Grasslands to determine potential impacts of the road system.

Opportunities for Addressing Hydrologic Risks

1. Design roads to minimize interception, concentration, and diversion potential.
2. Evaluate and eliminate diversion potential at stream crossings.
3. Conduct culvert and drainage structure condition surveys. As part of this effort, identify those locations where gully formation is induced by road drainage.
4. Design measures to reintroduce intercepted water back into slow subsurface pathways.
5. Use outsloping and drainage structures to disconnect road ditches from stream channels rather than delivering water in road ditches directly to stream channels.

6. Consider surfacing measures such as rocking, armoring, or paving high use roads to protect the integrity of the road surface.
7. Increasing the number and effectiveness of drainage structures.
8. Allow use of the road only during dry or frozen conditions to minimize rutting.
9. Relocate roads currently located on unstable soils.
10. Relocate drainage structures so that the outlets are on less sensitive areas which may include flatter slopes and locations with better-drained soils.
11. Design crossings to pass all potential products including sediment and woody debris, not just water.
12. Realign crossings that are not consistent with the channel pattern.
13. Change the type of crossing to better fit the situation; for example, consider bridges or hardened crossings on streams with floodplains, and consider bottomless arch culverts in place of round pipe culverts.
14. Add cross-drains near road-stream crossings to reduce the connected disturbed area.
15. Reduce the number of road-stream crossing to minimize the potential for adverse effects.
16. Relocate roads out of wetland areas. Where relocation is not an option, use measures to restore the hydrology of the wetland.
17. Set road-stream crossing bottoms at natural levels of wet meadow surfaces.
18. Relocate roads out of riparian areas.
19. Restore the hydrology in riparian areas that have been dewatered by the road system.

Recreation Opportunities

1. Develop an education program regarding the adverse effects of both off-road travel and motorized use of closed roads on vegetation, wildlife, and aquatic resources.
2. Develop educational material and signage to help users understand appropriate motorized and non-motorized uses, as well as restrictions to motorized use.
3. Monitor inventoried roadless areas for illegal off-road use, and potential for user created roads.
4. Monitor visitor use for the Cimarron and Comanche National Grasslands to determine the overall current and likely future demands on the roads system from recreation.
5. Inventory and evaluate low value, low risk roads for their potential as motorized trails. Work with user groups from local counties.

Social Opportunities

1. Review maintenance and cost share agreements for roads that are primarily used to provide access to private land inholdings, and are not used for Cimarron and Comanche National Grasslands management purposes. Develop formal agreements with private land holders where none exist.
2. Identify roads supporting school bus traffic and consider transferring jurisdiction to the County.
3. Consult with local affected private landholders, before decommissioning or altering road management regimes.

Opportunities for Addressing Risks from Jurisdictional Issues

1. Conduct a thorough review of jurisdiction and legal right-of way for all roads, particularly roads with proposed projects.
2. Involve land and engineering specialists in the project planning process early to help determine if access is going to be an issue.
3. Update the USFS right-of-way database, and keep the database current.
4. Keep existing road maintenance agreements updated.
5. Pursue new cooperative agreements for maintenance needs with other jurisdictions.
6. Inform road users of type of travel permitted on Cimarron and Comanche National Grasslands roads through appropriate signing and education, especially when the road crosses through multiple jurisdictions.
7. When road use patterns change, review road for appropriate jurisdiction and maintenance responsibility.
8. Identify roads supporting school bus traffic for potential transfer of jurisdiction to the county.

Funding:

Opportunities for Addressing Maintenance Cost Issues

1. Keep existing road maintenance agreements updated.
2. Pursue new cooperative agreements for maintenance needs with other jurisdictions.
3. Reduce the maintenance level on identified low-value maintenance level 3 roads and those roads where the access needs would be adequately met by maintenance level 1 or 2 roads. Consider this option during sub-forest/grassland scale roads analyses. Reduced maintenance of these roads should not result in any increased watershed risks as the most basic road maintenance will focus on maintaining road drainage. The reduced maintenance should only result in reduced user comfort.
4. To reduce annual maintenance costs, implement seasonal travel restrictions on roads susceptible to damage during wet or thawing conditions.
5. Collect road maintenance and surface rock replacement deposits, as appropriate, on all road use permits and special use permits.

6. Require authorized, permitted operations using USFS roads to pay a portion of road maintenance costs.
7. Develop an annual maintenance plan to prevent deferred maintenance costs from accruing on high value roads.
8. When road use patterns change, review road for appropriate jurisdiction and maintenance responsibility.
9. Prioritize funding to address critical health and safety and resource protection needs.

Decommissioning Guidelines:

Discussion

Road decommissioning results in the removal of a road from the road system. The goal is to return the roadway to a more natural state where the roadway is hydrologically self-maintaining and to permanently remove it from the transportation system. To accomplish this, a number of techniques can be used, such as posting the road closed and installing waterbars earth berms, posting and installing barriers and barricades, ripping and seeding, scattering slash or boulders, planting vegetation in the roadway, converting the road to a trail, and full reclamation by restoring the original topography. There is a different cost associated with each of these techniques, and their effectiveness for deterring unauthorized motorized vehicle use varies as well. Planning for the location of these closures is important insuring their effectiveness.

Decommissioning level 1 and 2 roads can consist of removing the few culverts, ripping and seeding, posting closed with signs, and installing waterbars to discourage unauthorized motorized vehicle use and ensure proper drainage over time.

Decommissioning level 3, 4, and 5 roads is more expensive than decommissioning most level 1 and 2 roads. When choosing a technique for road decommissioning, the objective is to eliminate the need for future road maintenance.

Level 3, 4, and 5 roads are usually wider than level 1 and 2 roads, have culverts installed at designed intervals to cross drain the road, are ditched, have better sight distances designed on horizontal and vertical curve, have larger cuts and fills, and are designed through the topography rather than with the topography. It is much more expensive to decommission these roads than level 1 and 2 roads. Given the cost, it may be cheaper to maintain level 3, 4 and 5 roads than to decommission them. However, future maintenance costs may not be the only factor to consider; other resource considerations may outweigh the cost. For a particular road (level 3, 4 or 5) high deferred maintenance costs may exceed the costs of decommissioning.

Guidelines:

1. Balance cost with resource risk and effectiveness of the treatment when selecting methods for decommissioning roads.

2. Convert roads to trails as a decommissioning method when analysis of recreation demand indicates a need to expand, connect or improve the existing trail system in the area. Provide adequate trailhead parking as part of this treatment method
3. Decommission by restoring the road to original contours when mitigating visual impacts is required by the forest plan or when necessary to assure the elimination of vehicular traffic.

Capital Improvement Guidelines:

Discussion:

This analysis shows a need to reconstruct existing roads to correct deferred maintenance work items or to improve some roads to meet the increasing use and traffic requirements. Funding limitations require prioritization for reconstruction work. The following guidelines are to be used when selecting, prioritizing, and implementing road reconstruction and construction projects.

Guidelines:

Conduct road location reviews proper to all new construction and road relocations. Ensure the location meets public and agency needs while mitigating environmental impacts identified in the analysis. Responsible line officers and resource and engineering specialists should participate in the review.

1. Establish a traffic counting program to identify high-use roads and traffic patterns.
2. Consider reconstruction to two lanes for roads with seasonal average daily traffic volumes exceeding 400 vehicles per day.
3. Use motor vehicle accident safety investigations and reports to help identify road safety hazards.
4. Use the following categories to prioritize road investments planned to reduce deferred maintenance backlog on roads: 1 – Critical Health and Safety; 2 – Critical Resource Protection; 3 – Critical Forest Mission. Data for these work items can be found in the Infrastructure database.
5. Coordinate reconstruction and construction work with other agencies whenever possible. Utilize interagency agreements to develop investment and maintenance partnerships.

Road Management Guidelines

If a road's maintenance condition has decreased, evaluate the need for the road and the historic use, as well as alternative roads in the area, before permanently changing the maintenance level. Use the RMOs to document any changes.

Reduce the maintenance level on low-value level 3, 4, and 5 roads and those roads where the access needs would be adequately met by a maintenance level 1-2 road. Consider this option during subforest scale roads analyses, as this can be a cost effective alternative. Reduced maintenance of these roads should not result in any increased

watershed risks as the most basic road maintenance will focus on maintaining road drainage. The reduced maintenance should only result in reduced user comfort. Less use due to reduced user comfort will further decrease the potential for road-related watershed risks.

Provide travelers with sufficient information necessary to decide which road(s) they will travel. When appropriate, use entrance treatments, warning signs, route markers, and information bulletin boards to advise travelers of conditions ahead.

Do not post speed limit and other regulatory signs on roads under Forest Service jurisdiction without a Forest Supervisor's order and a law enforcement plan.

Consider prohibiting OHV use on NFS roads when one or more of the following condition exist:

- The road is maintained at level 3, 4, or 5 and connects to a state, county, or other public agency road that is similarly regulated.
- Traffic volumes exceed 100 vehicles per day (SADT) on single-lane roads.
- Average traffic speed on the road exceeds 25 mph.

To reduce annual maintenance costs, implement seasonal travel restrictions on roads susceptible to damage during wet or thawing conditions.

Collect road maintenance and surface rock replacement deposits, as appropriate, on all road use permits and special use permits.

General Guidelines

The following are general road-related guidelines:

Require authorized, permitted operations utilizing NFS roads to pay their fair share of road maintenance costs.

Consider road decommissioning when planning projects that involve the construction and use of short-term, single-resource roads: for example, roads planned for oil and gas projects that undergo exploration, development, and abandonment phases. Incorporating decisions to decommission single-resource roads during the initial stages of project planning helps move the Forest toward the potential minimum road system. Document planned decommissioning when developing road management objectives.

Develop an annual maintenance plan to prevent deferred maintenance costs from accruing on high value rated roads.

Update the road system databases and keep them current.

Use an interdisciplinary process to develop, update, and implement road management objectives for all system roads. Ensure that information in the transportation atlas and inventory conforms to approved road management objectives.

Determine new opportunities as new information is collected.

Require the use of this Cimarron and Comanche National Grasslands Roads Analysis for all subforest scale roads analysis through a Forest supplement to the 7700 Manual.

NEPA Analysis Needs

This roads analysis does not require any NEPA documentation because it provides information and opportunities for subforest-scale roads analysis. Any decisions that change management of the road system resulting from subforest-scale roads analyses will require the appropriate level of NEPA analysis.

ce Public involvement – because this roads analysis is not a decision document, the ID Team decided not to involve the public directly at this time. There will be additional opportunities for public involvement in the upcoming travel management decisions planned for the next few years.

Appendix A

Management Areas from 1984 PSICC Forest Plan

Current Management Areas for the Cimarron & Comanche National Grasslands

Management Area	Management Prescription Summary	Road Usage
2B	Rural & Roaded Natural Recreation	Rural and roaded-natural recreation opportunities
4B	Wildlife Habitat	Roaded-natural recreation opportunities are provided along Forest arterial and collector roads.
6B	Livestock Grazing Area.	Roaded natural recreation opportunities within ½ mile of Forest arterial, collector and local roads.
9A	Riparian Area	Semi-primitive nonmotorized, semi-primitive motorized, roaded natural and rural recreation opportunities. Roaded natural recreation opportunities within ½ mile of Forest arterial, collector and local roads. Maintain 100 ft buffer each side of riparian ecosystem.
10A	Research Natural Area	Generally, physical improvements, such as roads are not permitted.
10B	Experimental Forest	Protecting, managing and utilizing forest and rangeland renewable resources.
10C	Special Interest Area	Protect and where appropriate, foster public use and enjoyment of these areas.

Question Number	Addressed in Analysis (Yes/No)	If addressed directly, page # in environmental document; or Forest Plan location or standard and guideline	If addressed indirectly, location in administrative record	Rationale or location in administrative record
EF1				Increased erosion
EF2				Low to moderate
EF3				
EF4				Increase erosion
EF5				Reduction in solitude
AQ1				
AQ2				
AQ3				
AQ4				
AQ5				
AQ6				
AQ7				Biological, Fishing, Pollutants
AQ8				Address at mtc lv 3-5
AQ9				Moderate movement of sediment
AQ10				Which streams and species are affected?
AQ11				
AQ12				Possible poaching

Question Number	Addressed in Analysis (Yes/No)	If addressed directly, page # in environmental document; or Forest Plan location or standard and guideline	If addressed indirectly, location in administrative record	Rationale or location in administrative record
AQ13				At road/stream crossing
AQ14				Minimal effects
TW1				Road density/Habitat effectiveness
TW2				Road density/Habitat effectiveness
TW3				
TW4				
EC1				Increase Cost & Revenue, REC, grazing and mineral
EC2				
EC3				
TM1				
TM2				
TM3				
MM1				Adequate, maintaining access, active mine claims?
RM1				Road system adequate
WP1				Access is adequate
WP2				
WP3				No hydro-electric
SP1				Adequate access
SU1				Adequate access to

Question Number	Addressed in Analysis (Yes/No)	If addressed directly, page # in environmental document; or Forest Plan location or standard and guideline	If addressed indirectly, location in administrative record	Rationale or location in administrative record
				power, water-pipe line
GT1				Local & collector roads
GT2				Adequate access
GT3				Not an issue, RS2477
GT4				Adequate width, curve, steepness. Mixed use reduced, increase ipp for both motorized & non motorized
AU1				Adequate access
AU2				Adequate access
PT1				Adequate access
PT2				Adequate access
PT3				No affect
PT4				Insignificant amounts
UR1				
UR2				
UR3				
UR4				
UR5				
UR6				
RR1				
RR2				
RR3				

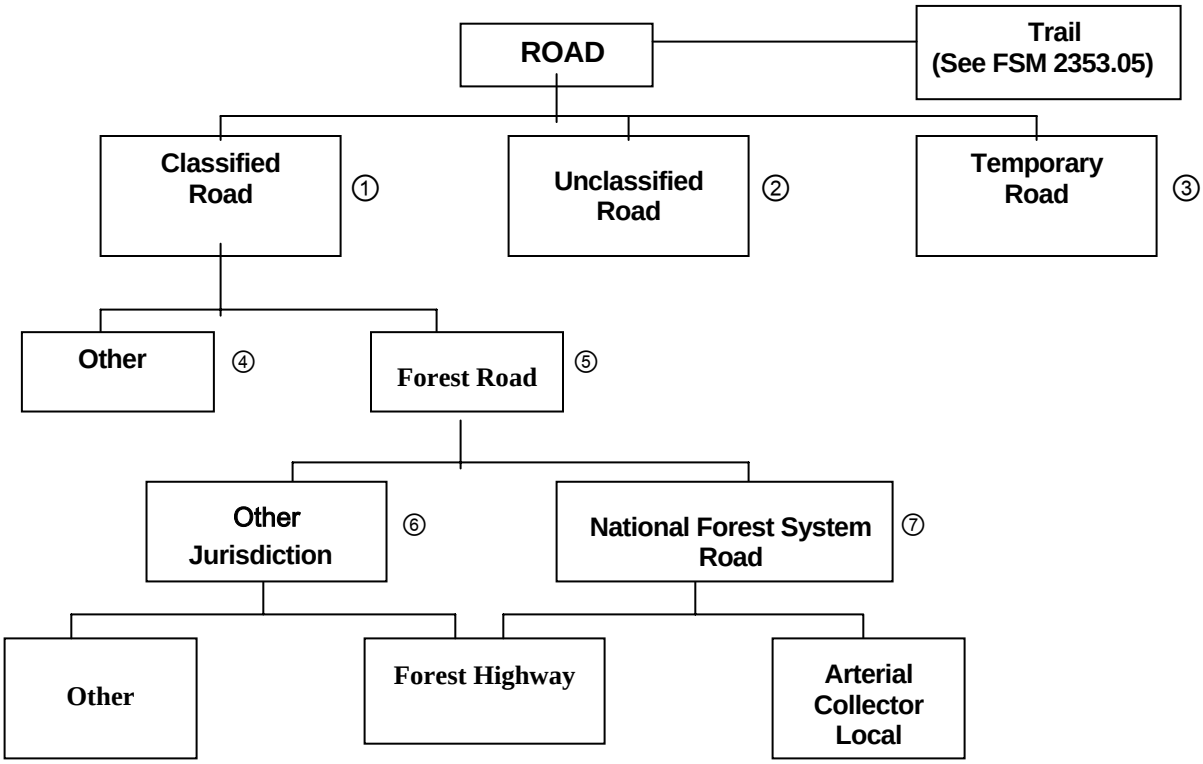
Question Number	Addressed in Analysis (Yes/No)	If addressed directly, page # in environmental document; or Forest Plan location or standard and guideline	If addressed indirectly, location in administrative record	Rationale or location in administrative record
RR4				
RR5				
RR6				
PV1				
PV2				
PV3				
PV4				
SI1				
SI2				
SI3				Maintain & improve rt/access to site
SI4				
SI5				
SI6				Maintain & improve rt/access to site
SI7				
SI8				Helps to maintain areas- beneficial effects
SI9				Hunting
SI10				Maintain & improved
CR1				Affects everyone equally

Appendix C Road Terminology Relationships

From FSM 7705 – Transportation System

Exhibit FSM 7705 – Exhibit 01, Road Terminology Relationships, illustrates the relationships among various road terms (down below). Definitions of terms that are quoted verbatim from Forest Service regulations at Title 36 Code of Federal Regulations Part 212 are set out in boldface.
7705 - Exhibit 01

Road Terminology Relationships



1. Federal, State, Tribal, County, local, private
2. Not managed or intended as part of the transportation system
3. Authorized by permit, lease, contract, etc. and not necessary for long-term resource management
4. Not important to Forest Service administration
5. Important to Forest Service administration, protection, utilization, access, and management
6. State, Tribal, County, local, private
7. Under Forest Service jurisdiction

Appendix D Glossary

Access Rights. A privilege or right of a person or entity to pass over or use another person's or entity's travel way (36 CFR 212.1, FSM 5460.5 – Rights of Way Acquisition, FSM 7700 – Transportation System).

Annual Maintenance. Work performed to maintain serviceability, or repair failures during the year in which they occur. Includes preventive and/or cyclic maintenance performed in the year in which it is scheduled to occur. Unscheduled or catastrophic failures of components or assets may need to be repaired as a part of annual maintenance (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Arterial Road. A forest road that provides service to large land areas and usually connects with other arterial roads or public highways (FSH 7709.54 - Forest Transportation Terminology Handbook, no longer in print).

Capital Improvement. The construction, installation, or assembly of a new fixed asset, or the significant alteration, expansion, or extension of an existing fixed asset to accommodate a change of purpose (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Classified Road. Road wholly or partially within or adjacent to National Forest System lands that are determined to be needed for long-term motor vehicle access, including State roads, county roads, privately owned roads, National Forest System roads, and other roads authorized by the Forest Service (36 CFR 212.1, FSM 7705 – Transportation System).

Collector Road. A forest road that serves smaller land areas than an arterial road. Usually connects forest arterial roads to local forest roads or terminal (FSH 7709.54 – Forest Transportation Terminology Handbook, no longer in print).

Construction (new). The erection, construction, installation, or assembly of a new fixed asset (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Critical Need. A requirement that addresses a serious threat to public health or safety, a natural resource, or the ability to carry out the mission of the organization (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Critical Vehicle. The vehicle, normally the largest (by weight, size, or unique configuration), whose limited use on the road is necessary to complete the planned activity (FSH 7709.56, Sec 4.1 – Road Preconstruction Handbook).

Culvert. A conduit or passageway under a road, trail, or other obstruction. A culvert differs from a bridge in that it is usually constructed entirely below the elevation of the traveled way (EM 7720-100R, EM 7720-100LL, Sec 102).

Decommission. Demolition, dismantling, removal, obliteration and/or disposal of a deteriorated or otherwise unneeded asset or component, including necessary cleanup work. This action eliminates the deferred maintenance needs for the fixed asset. Portions of an asset or component may remain if they do not cause problems nor require maintenance (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Deferred Maintenance. Maintenance that was not performed when it should have been or when it was scheduled and which, therefore, was put off or delayed for a future period. When allowed to accumulate without limits or consideration of useful life, deferred maintenance leads to deterioration of performance, increased costs to repair, and decrease in asset value. Deferred maintenance needs may be categorized as critical or noncritical at any point in time. Continued deferral of noncritical maintenance will normally result in an increase in critical deferred maintenance. Code compliance (for example, life safety, ADA, OSHA, environmental, etc.), Forest Plan Direction, Best Management Practices, Biological Evaluations other regulatory or Executive Order compliance requirements, or applicable standards not met on schedule are considered deferred maintenance (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Design Speed. The speed determined for design and correlation of the physical features of a route that influence vehicle operation. The maximum safe speed that the design vehicle can maintain over a specified segment of a route when conditions are so favorable that the design features of the road, rather than operational limitations of the vehicle, govern. The design speed is the safe speed for the design situation only (FSH 7709.56, Sec 4.25 – Road Preconstruction Handbook).

Design Vehicle. The vehicle frequently using the road that determines the minimum standard for a particular design element. No single vehicle controls the standards for all the design elements for a road. Determine the maximum and minimum standards from the type and configuration of the vehicles using the road. Analyze each design element to determine which vehicle governs the standard for that element (FSH 7709.56, Sec 4.1– Road Preconstruction Handbook).

Emergency Need. An urgent maintenance need that may result in injury, illness, or loss of life, natural resource, or property; and must be satisfied immediately. Emergency needs generally require a declaration of emergency or disaster, or a finding by a line officer that an emergency exists (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Fatality. A fatality in the National Forest Road System annual fatality report is the death of a person (either an occupant of a vehicle or a non-motorist) that is the result of a crash involving a state highway legal motor vehicle (including motorcycles) traveling on a System Road open to traffic (operationally maintenance level 2, 3, 4, or 5) that occurs within 30 days of the crash (Annual Roads Accomplishment Report FY 2002).

Forest Road. As defined in Title 23, Section 101 of the United States Code (23 U.S.C. 101), any road wholly or partly within, or adjacent to, and serving the National Forest System and which is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources (FSM 7705 – Transportation System).

Forest Highway. A forest road under the jurisdiction of, and maintained by, a public authority and open to public travel (USC: Title 23, Section 101(a)).

Forest Transportation Atlas. An inventory, description, display, and other associated information for those roads, trails, and airfields that are important to the management and use of National Forest System lands or to the development and use of resources upon which communities within or adjacent to the National Forests depend (36 CFR 212.1).

Forest Transportation Facility. A classified road, designated trail, or designated airfield, including bridges, culverts, parking lots, log transfer facilities, safety devices and other transportation network appurtenances under Forest Service jurisdiction that is wholly or partially within or adjacent to National Forest System lands (36 CFR 212.1, FSM 7705 – Transportation System).

Forest Transportation System Management. The planning, inventory, analysis, classification, record keeping, scheduling, construction, reconstruction, maintenance, decommissioning, and other operations undertaken to achieve environmentally sound, safe, cost-effective, access for use, protection, administration, and management of National Forest System lands (FSM 7705 – Transportation System).

Functional Class. The way a road services land and resource management needs, and the character of service it provides (FSH 7709.54, Forest Transportation Terminology Handbook, no longer in print).

Health and Safety Need. A requirement that addresses a threat to human safety and health (e.g. violations of National Fire Protection Association 101 Life Safety Code or appropriate Health Code) that requires immediate interim abatement and/or long-term permanent abatement (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Jurisdiction. The legal right to control or regulate use of a transportation facility. Jurisdiction requires authority, but not necessarily ownership. The authority to construct or maintain a road may be derived from fee title, an easement, or some other similar method (FSM 7705 – Transportation System).

Local Road. A forest road that connects terminal facilities with forest collector, forest arterial or public highways. Usually forest local roads are single purpose transportation facilities (FSH 7709.54 – Forest Transportation Terminology Handbook, no longer in print).

Maintenance. The preservation of the entire highway, including surface, shoulders, roadsides, structures and such traffic-control devices as are necessary for its safe and efficient utilization (USC: Title 23, Section 101(a)).

Maintenance. The upkeep of the entire forest development transportation facility including surface and shoulders, parking and side areas, structures, and such traffic-control devices as are necessary for its safe and efficient utilization (36 CFR 212.2(i)).

Maintenance. The act of keeping fixed assets in acceptable condition. It includes preventive maintenance normal repairs; replacement of parts and structural components, and other activities needed to preserve a fixed asset so that it continues to provide acceptable service and achieves its expected life. Maintenance excludes activities aimed at expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than those originally intended. Maintenance includes work needed to meet laws, regulations, codes, and other legal direction as long as the original intent or purpose of the fixed asset is not changed (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).
Maintenance Level. Defines the level of service provided by, and maintenance required for, a specific road, consistent with road management objectives and maintenance criteria. (FSH 7709.58, Sec 12.3 – Transportation System Maintenance Handbook).

Maintenance Level 1: Assigned to intermittent service roads during the time they are closed to vehicular traffic. The closure period must exceed 1 year. Basic custodial maintenance is performed to keep damage to adjacent resource to an acceptable level and to perpetuate the road to facilitate future management activities. Emphasis is normally given to maintaining drainage facilities and runoff patterns. Planned road deterioration may occur at this level. Appropriate traffic management strategies are "prohibit" and "eliminate". Roads receiving level 1 maintenance may be of any type, class or construction standard, and may be managed at any other maintenance level during the time they are open for traffic. However, while being maintained at level 1, they are closed to vehicular traffic, but may be open and suitable for non-motorized uses.

Maintenance Level 2: Assigned to roads open for use by high clearance vehicles. Passenger car traffic is not a consideration. Traffic is normally minor, usually consisting of one or a combination of administrative, permitted, dispersed recreation, or other specialized uses. Log haul may occur at this level. Appropriate traffic management strategies are either (1) discourage or prohibit passenger cars or (2) accept or discourage high clearance vehicles.

Maintenance Level 3: Assigned to roads open and maintained for travel by a prudent driver in a standard passenger car. User comfort and convenience are not considered priorities. Roads in this maintenance level are typically low speed, single lane with turnouts and spot surfacing. Some roads may be fully surfaced with either native or processed material. Appropriate traffic management strategies are either "encourage" or "accept." "Discourage" or "prohibit" strategies may be employed for certain classes of vehicles or users.

Maintenance Level 4: Assigned to roads that provide a moderate degree of user comfort and convenience at moderate travel speeds. Most roads are double lane and aggregate surfaced. However, some roads may be single lane. Some roads may be paved and/or dust abated. The most appropriate traffic management strategy is "encourage." However, the "prohibit" strategy may apply to specific classes of vehicles or users at certain times.

Maintenance Level 5: Assigned to roads that provide a high degree of user comfort and convenience. Normally, roads are double-lane, paved facilities. Some may be aggregate surfaced and dust abated. The appropriate traffic management strategy is "encourage."

Major Culvert. A culvert that provides an opening of more than 35 square feet (3.3 m2) in a single or multiple installation. A major culvert may consist of a single round pipe, pipe arch, open

or closed-bottom box, bottomless arch, or multiple installation of these structures placed adjacent or contiguous as a unit. Certain major culverts are classified as bridges when they provide an opening of more than 20 feet (6.1 m), measured parallel to the roadway; such culverts may be included in the bridge inventory. See "Federal Highway Administration Coding Guide for Bridge Inventory and Appraisal," items 49 and 112 (sec. 8.08) for culverts being classified as bridges. (FSH 7709.56b, Sec 05 – Transportation Structures Handbook)

Minor Culvert. Any culvert not classified as a major culvert. (FSH 7709.56b, Sec 05 – Transportation Structures Handbook).

Mission Need. A requirement that addresses a threat or risk to carrying out the mission of the organization. Needs related to administration and providing services (transportation, recreation, grazing, etc.). Needs not covered by health and safety or natural resource protection. (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

National Forest System Road. A classified forest road under the jurisdiction of the Forest Service. The term “National Forest System roads” is synonymous with the term “forest development roads” as used in 23 U.S.C. 205. (FSM 7705 – Transportation System).

New Construction. The erection, construction, installation, or assembly of a new fixed asset. (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

New Road Construction. Activity that results in the addition of forest classified or temporary road miles. (36 CFR 212.1, FSM 7705 – Transportation System).

Noncritical Need. A requirement that addresses potential risk to public or employee safety or health, compliance with codes, standards, regulations etc., or needs that address potential adverse consequences to natural resources or mission accomplishment. (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Objective Maintenance Level. The maintenance level to be assigned at a future date considering future road management objectives, traffic needs, budget constraints, and environmental concerns. The objective maintenance level may be the same as, or higher or lower than, the operational maintenance level. (FSH 7709.58, Sec12.3 – Transportation System Maintenance Handbook).

Open for Public Travel. The road section is available and passable by four-wheeled standard passenger cars, and open to the general public for use without restrictive gates, prohibitive signs, or regulation other than restrictions based on size, weight or class of registration, except during scheduled periods, extreme weather or emergency conditions. (23 CFR 460.2(c)).

Operational Maintenance Level. The maintenance level currently assigned to a road considering today’s needs, road condition, budget constraints, and environmental concerns. It defines the level to which the road is currently being maintained. (FSH 7709.58, Sec 12.3 – Transportation System Maintenance Handbook).

Other System. Additional network(s) of travel ways serving a common need or purpose, managed by an entity with the authority to finance, build, operate and maintain the routes. (U.S.C. 101 23 CFR 660, FSM 7740.5 – Federal Lands Highway Programs).

Primary Maintainer. The agency or party having primary (largest share) financial responsibility for maintenance. (FSH 7709.58, Chapter 13 – Transportation System Maintenance Handbook).

Private Road. A road under private ownership authorized by easement to a private party, or a road which provides access pursuant to a reserved or private right. (FS-643, Roads Analysis; Informing Decisions About Managing the National Forest Transportation System, August 1999).

Public Authority. A Federal, State, county, town or township, Indian tribe, municipal or other local government or instrumentality thereof, with authority to finance, build, operate or maintain toll or toll-free highway facilities (23 CFR 460.2(b)).

Public Forest Service Road. A designated public road under Forest Service jurisdiction that meets the definition of 23 U.S.C. Section 101.

Public Road. Any road or street under the jurisdiction of and maintained by a public authority and open to public travel (23 U.S.C. 101(a), 23 CFR 460.2(a), FSM 7705 – Transportation System) .

Resource Protection Need. A requirement that addresses a threat or risk of damage, obstruction, or negative impact to a natural resource (Financial Health – Common Definitions for Maintenance and Construction Terms, July 22, 1998).

Road. A motor vehicle travelway over 50 inches wide, unless designated and managed as a trail. A road may be classified, unclassified, or temporary (36 CFR 212.1, FSM 7705 – Transportation System).

Road Decommissioning. Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR 212.1, FSM 7705 – Transportation System).

Road Improvement. Activity that results in an increase of an existing road's traffic service level, expands its capacity, or changes its original design function (FSM 7705 – Transportation System).

Road Maintenance. The ongoing upkeep of a road necessary to retain or restore the road to the approved road management objective (FSM 7705 – Transportation System).

Road Management Objectives (RMO). Defines the intended purpose of an individual road based on management area direction and access management objectives. Road management objectives contain design criteria, operation criteria, and maintenance criteria (FSH 7709.55, Sec 33 – Transportation Planning Handbook).

Road Realignment. Activity that results in a new location of an existing road or portions of an existing road and treatment of the old roadway (FSM 7705 – Transportation System).

Road Reconstruction. Activity that results in a Road Improvement or Road Realignment of an existing classified road (FSM 7700 – Transportation System).

Service Life. The length of time that a facility is expected to provide a specified service (FSH 7709.56b, Sec 05 – Transportation Structures Handbook).

Subject to the Highway Safety Act. National Forest System roads that are open to use by the public for standard passenger cars. This includes roads with access restricted on a seasonal basis and roads closed during extreme weather conditions or for emergencies, but which are otherwise open for general public use (FSM 7705 – Transportation System).

Temporary Road. Road authorized by contract, permit, lease, other written authorization, or emergency operation not intended to be a part of the forest transportation system and not necessary for long-term resource management (36 CFR 212.1, FSM 7705 – Transportation System).

Traffic Service Level. Describes the significant characteristics and operating conditions of a road (FSH 7709.56, Ch 4 – Road Preconstruction Handbook, FSM 7705 – Transportation System).

Transportation Facility Jurisdiction. The legal right to control or regulate use of a transportation facility derived from fee title, an easement, an agreement, or other similar method. While jurisdiction requires authority, it does not necessarily reflect ownership (FSM 7705 – Transportation System).

Traveled Way. The portion of the roadway used for the movement of vehicles; not including turnouts, exclusive of shoulders and auxiliary lanes (EM 7720-100LL, Section 102).

Unclassified Roads. Roads on National Forest System lands that are not managed as part of the forest transportation system, such as unplanned roads, abandoned travelways, and off-road vehicle tracks that have not been designated and managed as a trail; and those roads that were once under permit or other authorization and were not decommissioned upon the termination of the authorization (36 CFR 212.1, FSM 7705 – Transportation System). Unclassified roads are categorized into two types and recorded in the SYSTEM linear event. The two types are:
UND – UNDETERMINED – Roads where long term purpose and need has yet to be determined
NOT – NOT NEEDED – Roads not needed for long term management of national forest resources as determined through an appropriate planning document

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Appendix F
Maps

Figure 6.01 – Cimarron National Grassland - Roads and Allotments
Figure 6.02 – Comanche National Grassland – Carrizo Unit – Roads and Allotments
Figure 6.03 – Comanche National Grassland – Timpas Unit – Roads and Allotments
Figure 6.04 – Cimarron National Grassland – Management Areas and Ecosystems
Figure 6.05 – Comanche National Grassland – Carrizo Unit – Management Areas and Ecosystems
Figure 6.06 – Comanche National Grassland – Timpas Unit – Management Areas and Ecosystems
Figure 6.07 – Cimarron National Grassland – Streams and Oil and Gas
Figure 6.08 – Comanche National Grassland – Carrizo Unit – Streams and Oil and Gas
Figure 6.09 – Comanche National Grassland – Timpas Unit – Streams and Oil and Gas
Figure 6.10 – Cimarron National Grassland – Watershed and Riparian
Figure 6.11 – Comanche National Grassland – Carrizo Unit – Watershed and Riparian
Figure 6.12 – Comanche National Grassland – Timpas Unit – Watershed and Riparian