# STEP 5. DESCRIBING OPPORTUNITIES AND SETTING PRIORITIES

## Assessment of the Problems and Risks Posed by the Current Road System

A risk assessment was conducted on the current road system to identify problem areas within the District. Four tools were used in the assessment: GIS-based analysis, erosion modeling, a road risk ranking table, and a road management graph. The scope of these assessments are as follows:

**GIS Assessment**. The effect of roads on the watershed and water resources was analyzed using GIS technology combined with the District transportation inventory and cartography feature files. All open, gated, closed, and decommissioned roads currently inventoried within the District were included in the analysis. Maps were produced to illustrate the distribution of soil units, stream tributaries, vegetation types, slope, and road categories.

In addition, the GIS assessment compiled data on indicator parameters, such as proximity to stream channels and locations of stream channel crossings.

**Erosion Modeling**. The WEPP: Road model was used to determine average annual sediment yields for the current road network. The WEPP model (Flanagan and Livingston 1995) is a physically-based soil erosion model that estimates sediment yield using site-specific soil, climate, ground cover, and topography data. The WEPP: Road version of the model was developed by the Forest Service to simulate roads and other nonvegetated, compacted soil areas within the National Forests (Elliot 1999). In each simulation, the flow of sediment is modeled as it progresses along ruts in the length of the road, then migrates off the road, down the fill slope, and into the side ditch or forest. The model simulates roads that are graveled or have native soil surfaces.

To determine the sediment yield for each of the existing roads in the District, the results of WEPP simulations were combined with a GIS assessment. First, WEPP simulations were completed that encompassed the range of soil, cover, vegetation, and slope conditions within the District. From these simulations, matrices were developed for a variety of road lengths that specified the sediment yields for the range of conditions encountered. These matrices are included in **Appendix A.** Next, GIS queries were conducted to identify the specific conditions along all the roads within the District and apply the appropriate sediment yields. These values were used to develop the road risk ranking described below.

In addition to this overall modeling, eight sections were modeled in detail to represent all road segments likely to affect stream channels. This more detailed modeling enabled a site-specific evaluation of road gradient and slope length on soils that are commonly found along District roads. The steps to accomplish this modeling are summarized below.

- A buffer distance of 200 feet was assumed to be representative for the Forest conditions (i.e., type of soil properties, slopes, and vegetative cover). In other words, it was assumed that if a road segment were within 200 feet of a channel, it would be likely that a portion of the soil detached during a typical precipitation event would reach the stream.
- All of the lowest points (points on the road to which the water would flow) along each qualifying road segment were identified.
- The road segments up-gradient from the low points were identified, and the lengths and soil types were determined.

- If the road did not cross the stream but ran adjacent to it, then the buffer zone between the stream and the road segment was characterized by determining the flow path distance, the soil type, and the type and quantity of vegetative cover. Most of the selected sections contained between 8 and 12 applicable road segments.

Modeling scenarios were developed for all of the identified road segments. The scenarios were developed to indicate potential flow paths of soil moving down a road section, and then moving off the road at a cross-drain or culvert location and moving through a forested buffer zone down to the nearest drainageway. When a forested buffer zone was not present, scenarios were developed for road sections that went directly to the stream channel. The road segments modeled within each section are shown in **Appendix C**.

**Road Risk Ranking Table**. This table was developed to assess each road segment's values and risks and then to categorize it into one of four groupings. This is a broad assessment, therefore, the detail and accuracy for road risk and values contain a degree of subjectivity and potential for inaccuracies. However, this road assessment provides information that can help identify roads that pose high risk to other resources and prioritize District-scale projects and road management decisions.

The road risks were ranked as low, moderate, high, or extreme, based on the overall modeling of all roads. Three risk factors (sediment yield, road-stream crossing locations, and road-stream proximity) were used in the assessment. The sediment yield rates are best used as a relative measure of the potential for erosion. Roads that are located within 200 feet of channels would have higher risk potential because they would be more likely to affect surface water quality by contributing sediment to the drainage system and downstream from the Forest.

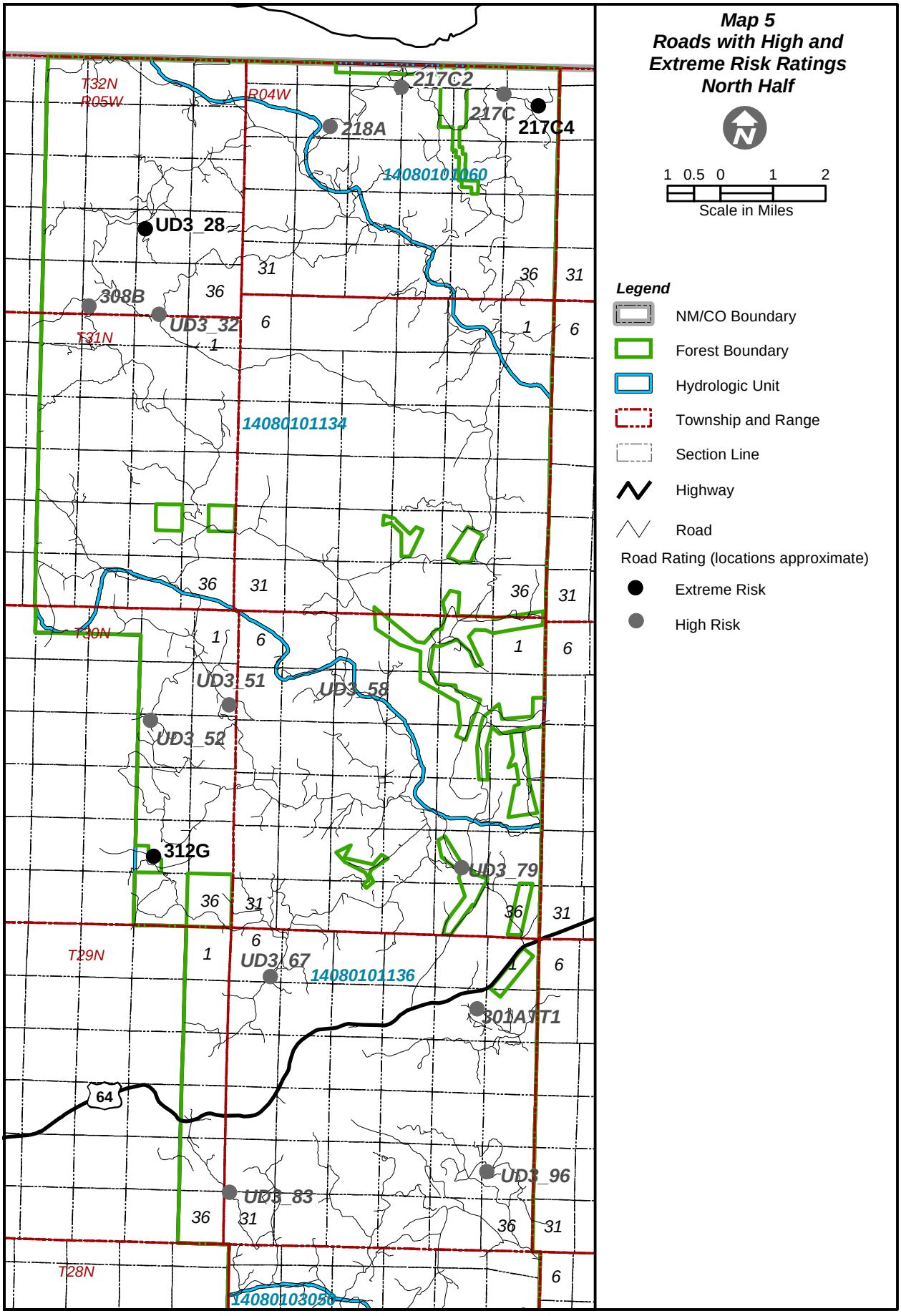
The roads were broken into segments of like erosion rates for this assessment. The road segments that fell into the Extreme and High risk categories because they were within 200 feet of a drainageway and had high predicted sediment yields are listed in **Table 7** and displayed on **Maps 5** and **6**.

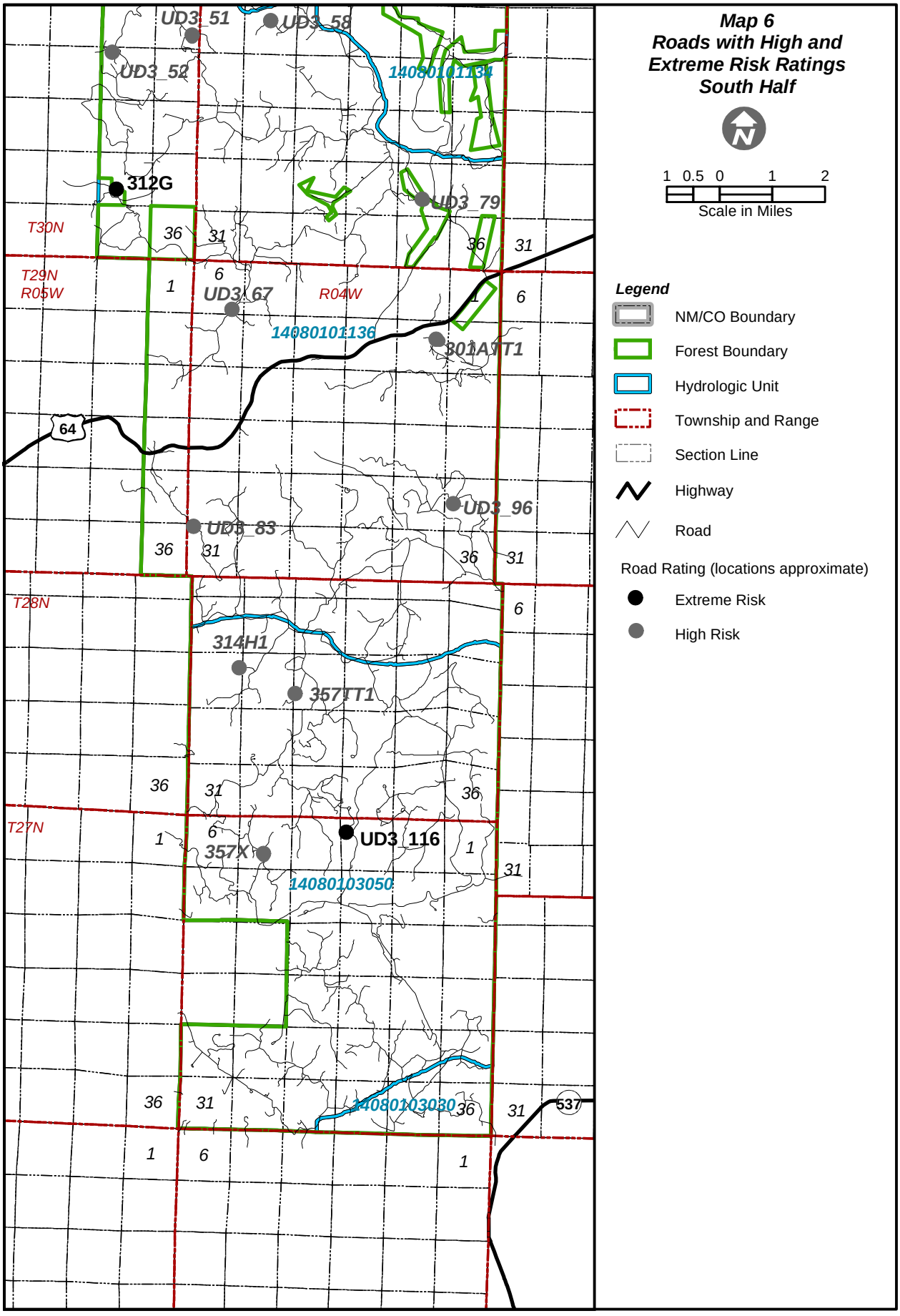
It is recommended that these roads be inventoried by District staff and site-specific mitigation measures be scheduled for maintenance to minimize the amount of sediment flowing from District land into the surface water system. A complete listing of the risk rankings for all roads is included in **Appendix B**. The complete listing includes the number of segments and the total length of the segments in each risk category.

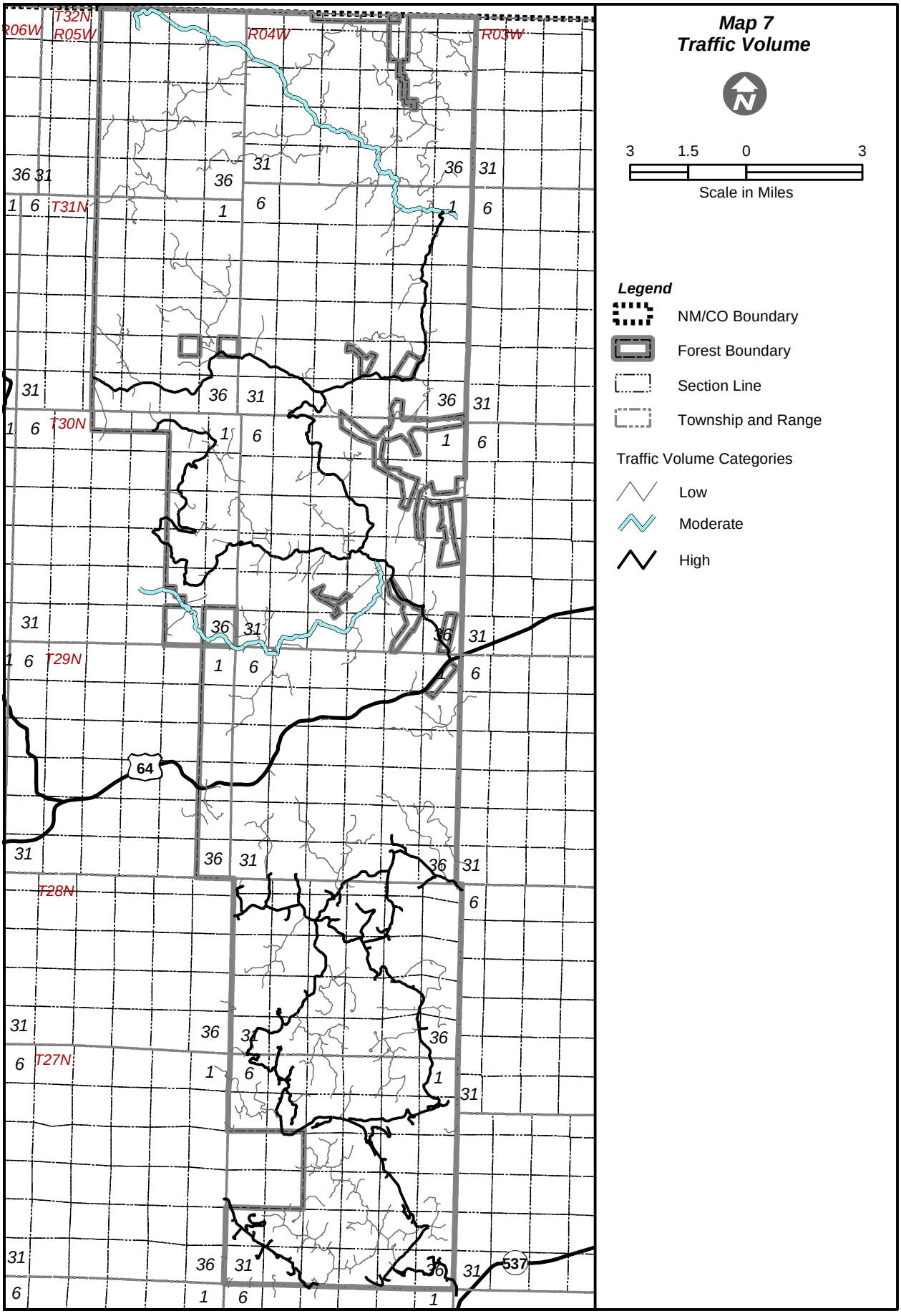
The wildlife risks were ranked as low, moderate, or high, assuming a direct correlation between traffic volumes and wildlife risk. A low risk rating was assigned to all road segments with an average vehicle usage level of 0 to 4 vehicles per day. A moderate rating was assigned to road segments with an average vehicle usage level of 5 to 25 vehicles per day, and a high rating was assigned to road segments with an average vehicle usage level of greater than 25 vehicles per day. It was assumed that during hunting season (mainly October to November) an additional 25 vehicles per day would be using the open roads. During non-drilling, non-hunting season (December to April), it was assumed that traffic levels would be reduced by 50 percent on the closed roads and by 33 percent on the open roads. **Map 7** shows the categories of traffic levels in the Jicarilla Ranger District that can be considered to determine the impacts on wildlife habitat.

**Table 7. Roads with Extreme or High Risk**

| Forest Service Road Number | Road Risk |
|---|---|
| 217C4 | E |
| 312G | E |
| UD3_116 | E |
| UD3_28 | E |
| 217C | H |
| 217C2 | H |
| 218A | H |
| 301ATT1 | H |
| 308B | H |
| 314H1 | H |
| 357TT1 | H |
| 357X | H |
| UD3_116 | H |
| UD3_32 | H |
| UD3_51 | H |
| UD3_52 | H |
| UD3_58 | H |
| UD3_67 | H |
| UD3_79 | H |
| UD3_83 | H |
| UD3_96 | H |


T32N
R05W
R04W
217C2
217C
217C4
218A
14080101060
UD3_28
308B
UD3_32
T31N
14080101134
T30N
UD3_51
UD3_58
UD3_52
312G
UD3_79
T29N
UD3_67
14080101136
301A
T1
64
UD3_96
UD3_83
T28N
14080103050
31
36
6
1
Map 5
Roads with High and Extreme Risk Ratings
North Half
1 0.5 0 1 2
Scale in Miles
Legend
NM/CO Boundary
Forest Boundary
Hydrologic Unit
Township and Range
Section Line
Highway
Road
Road Rating (locations approximate)
Extreme Risk
High Risk


UD3_51
UD3_58
UD3_52
14080101134
312G
UD3_79
T30N
36
31
36
31
T29N
R05W
1
6
UD3_67
R04W
1
6
14080101136
301ATT1
64
UD3_96
UD3_83
36
31
36
31
T28N
6
314H1
357TT1
36
31
36
T27N
1
6
UD3_116
357X
1
31
14080103050
36
31
14080103030
36
31
537
1
6
1
Map 6
Roads with High and
Extreme Risk Ratings
South Half
N
1 0.5 0 1 2
Scale in Miles
Legend
NM/CO Boundary
Forest Boundary
Hydrologic Unit
Township and Range
Section Line
Highway
Road
Road Rating (locations approximate)
Extreme Risk
High Risk


T32N
R06W
R05W
R04W
R03W
T31N
T30N
T29N
T28N
T27N
64
537
Map 7
Traffic Volume
3 1.5 0 3
Scale in Miles
Legend
NM/CO Boundary
Forest Boundary
Section Line
Township and Range
Traffic Volume Categories
Low
Moderate
High

### Characteristics of High Maintenance Roads

The detailed modeling of the eight representative sections identified some parameters that can be used in addition to the list in Table 7 to predict the road segments that are most likely to require frequent additional maintenance. Soil texture, the slope of the road, and the length of the slope between water control structures are the most sensitive factors to consider when identifying roads that are the most likely to erode. Unpaved roads on soils with a Unified Classification System group of CL (in general, silt loam, clay loam, loam in the District) have the highest sediment yield. Steeper slopes result in higher sediment yields, especially if they occur on slopes longer than 400 feet. The modeling results demonstrate that roads steeper than 6 percent slope have the highest sediment yield. Applying these factors to the Jicarilla Ranger District roads, those most likely to erode would have the following characteristics:

- Roads on TES map units 70, 71, 119, 145, 162, 721, 731, 765;
- Roads segments with slopes greater than 6 percent;
- Road segments with more than 400 feet between water control structures.

The roads most likely to erode, thereby requiring the most maintenance to keep them in good condition, would combine all three of the above factors. Most roads in the District, according to Forest Service staff, exceed the maximum of 400 feet between water control structures (culverts, turnouts, water bars), so this factor would apply to most of the Forest Roads. To narrow the list and identify the roads in the TES map units listed above that have steeper than 6 percent slopes, GIS was applied to the existing roads coverage. This list of roads in **Appendix C** includes those roads that can be expected to require more maintenance to control erosion and should be considered the priority list to be evaluated in the field.

In summary, there are two priority lists to screen roads to be evaluated for planning treatments to minimize erosion.

- The roads ranked as having extreme or high risk listed in Table 7 are those that were predicted to have high sediment yields that are located close to drainageways. In planning road maintenance projects, these roads should be evaluated first to determine ways to reduce the amount of sediment entering the surface water system and leaving the Forest to affect downstream water quality.
- The three characteristics of high maintenance roads listed above can be used by District planners to identify the roads (listed in Appendix C) most likely to need frequent maintenance. These can be considered the next level to be evaluated and treated to minimize erosion. They may not result in impacts to water quality, but would cost time and money to keep them passable until water control structures and possibly surfacing material are installed to reduce frequent maintenance.

## Assessment of the Potential Problems of Building Roads in a Currently Unroaded Area

The unroaded areas of the District are unique to this heavily roaded District and have natural and cultural significance. Bancos Canyon and the surrounding area is the largest unroaded block (approximately 6,300 acres) on the District and significant because it contains a high density of archaeological sites that represent overlapping late Pueblo and early Navajo populations. This combination of cultures and density of sites has resulted in the area under consideration for nomination as an archaeological District to the NRHP, and of direct interest to the New Mexico SHPO. Bancos Canyon was also determined to be eligible for inclusion into the National Wild and

Scenic Rivers System in 1998 due to its free-flowing condition and its outstanding cultural, wildlife, and recreational values. It is used by bald eagles and has cliffs with roosts that are used by wintering bald eagles. It also contains a riparian area along the river corridor with the largest concentration of willows on the District, providing habitat for migratory birds and other wildlife. As a result of the Wild classification, there is a requirement that the river's free-flowing character and outstanding values be preserved.

A road ran the entire length of Bancos Canyon until the early 1970s when it was closed due to poor road conditions and high maintenance requirements. Soil erosion is severe on the closed road where piping and discontinuous gullies are a common characteristic. The two main soil map units along this road are rated as having severe limitations for road construction; one of the soil map units has identified problems with mass wasting through soil creep. There are currently no active gas wells in this area, although some are projected.

Construction of roads in the Bancos Canyon area would result in disturbance to important archaeological and wildlife resources. The disturbance to wildlife resources would lead to direct habitat loss as well as indirect functional habitat loss for some species and habitat fragmentation. In addition, road construction would likely increase soil erosion beyond the relatively high rates now occurring.

La Jara and Valencia Canyons are also areas of low road density that can be considered sensitive because they provide valuable wildlife habitat as primary elk winter range and migration corridors. La Jara Canyon contains two Navajo pueblitos that are listed on the NRHP. La Jara Canyon's river classification has been identified as Recreational, and is eligible for inclusion in the National Wild and Scenic Rivers System. Because it is very steep, it is unlikely to be the location of road construction. Valencia Canyon is not as steep so its wildlife habitat would be affected if new roads fragment the area.

Fierro Canyon and Fierro Mesa contain more roads than the other areas described above, but still have a road density much less than the rest of the District, providing relatively secure wildlife habitat, which would be damaged if roads were allowed to further fragment the area.

## Opportunities for Addressing Problems and Risks

This section provides suggestions on how to mitigate problem/high risk areas. The primary road-related problems identified are erosion causing sediment delivery to the surface water drainage network, wildlife habitat fragmentation, and safety hazards.

Wildlife habitat fragmentation could be minimized by decommissioning roads, especially those in the Low Value rating, once roads are not needed for access to gas wells. Consideration could also be given to finding ways to raise the value of some of these Low Value roads by providing recreation opportunities along the road. Overall recreation use on the forest is increasing and road-related opportunities exist to better disperse this use and lessen recreation impacts that are occurring elsewhere. An example of increasing recreation use on a low value road would be to develop a trailhead and trail system at the end of the road. There are many opportunities on the forest to convert roads to motorized and non-motorized trails after their use is not needed to serve industry.

The primary opportunities to reduce surface erosion include:

- Lay out roads on less than 10 percent grade with a minimum of stream crossings. Road segments between 6 and 10 percent grades should be surfaced with sandstone.
- Use outsloping and drainage structures like culverts to disconnect road ditches from stream channels rather than delivering water in road ditches directly to stream channels.
- Evaluate the appropriateness of the existing drainage structure sizes. The culverts should be adequately sized to accommodate a 10-year storm event from the upstream watershed. From past experience, the District has determined that the minimum culvert diameter to be used is 18 inches. Consider using fords stabilized with rock instead of culverts at road-stream crossings where stormwater runoff frequently overtops and erodes the road surface.
- Improving the road surface by either graveling (i.e., crushed sandstone) or adding a binding material to those roads that have native surfaces with no inherent binder.
- Improving the drainage ditches that are associated with the roads by graveling.

Opportunities to address existing roads in areas with high mass wasting potential include:

- Road relocation to an area with more stable soils.
- Relocation of drainage structures so that the outlets are on less sensitive areas, which may include flatter slopes and better-drained soils.
- Stabilize the Vigas Canyon erosion problem along Forest Service 357 by installing rock riprap at the streambank that is keyed into the bottom of the channel. Use the riprap to support roadfill once the streambank is stable. Install rock or log deflectors in the channel at the outside of the meander to provide additional protection for the road and the pipeline crossing the channel.

Opportunities to improve local channels at road-stream crossings include:

- Designing crossings to pass all potential products including sediment and woody debris, not just water.
- Realign crossings that are not consistent with the drainage pattern.
- Change the type of crossing to better fit the situation. For example, consider bridges or hardened crossings on drainages with floodplains, and consider bottomless arch culverts in place of round pipe culverts.
- Add cross-drains near road-stream crossings to reduce the connected disturbed area.
- Reduce the number of road-stream crossings to minimize the potential for adverse effects.

Opportunities to address roads that affect riparian plant communities include:

- Relocate roads out of riparian areas.
- Restore the hydrology in riparian areas that have been dewatered by the road system.

## Recommendations

According to projections for the next 20 years, the oil and gas industry will most likely be drilling additional wells within the District at a rate of approximately 35 per year. New roads would be required to access new well locations. NEPA analyses will be required to determine the impact of constructing the new roads in addition to keeping the existing roads that serve wells open. The overall, long-term effects of all roads within the District should be evaluated in order to determine whether new road and new well development will be permitted to occur. The impacts of varying levels of road density should be considered when evaluating the long-term impacts of mineral development.

The impacts of preserving the few relatively unroaded areas in the District will be considered in the EIS. The obliteration or reopening of the two Class 1 roads that have been closed for over a year should also be considered.

It is recommended that Forest Roads 218, 309, 310, 314, and 357 be upgraded to Maintenance Level 3. These roads are currently maintained as Level 2. Due to their use as arterial and collector roads, expected to increase over the next 20 years as the gas field continues to develop, the higher maintenance level designations would improve their condition and provide a higher level of stability and resource protection by reducing sediment delivery. Designation of these roads as Level 3 in the future Forest-wide Roads Analysis Plan would make funding available for improvements, such as the installation of drainage structures, surfacing, ditches, and signing, necessary for bringing them up to the higher standard of maintenance that would be commensurate with the type and amount of vehicle traffic that currently exists and is expected to increase.