Best Management Practices for Wildlife & Roads in La Plata County
BEST MANAGEMENT PRACTICES
FOR
WILDLIFE AND ROADS IN
LA PLATA COUNTY

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FHU Reference No. 09-028
January 2010
TABLE OF CONTENTS

1.0 INTRODUCTION ................................................................................................................................. 1

2.0 BACKGROUND ................................................................................................................................. 2
  2.1 Stakeholder Survey .......................................................................................................................... 3
  2.2 La Plata County Wildlife Policies ................................................................................................. 3

3.0 WILDLIFE BEST MANAGEMENT PRACTICES ASSESSMENT ............................................. 5
  3.1 AVCs and Wildlife Habitat .............................................................................................................. 5
  3.2 Applicability and Protocol ........................................................................................................... 9

4.0 WILDLIFE BEST MANAGEMENT PRACTICES ........................................................................ 11
  4.1 Consideration of Adjacent Land Uses ...................................................................................... 13
  4.2 Road Alignment and Design ..................................................................................................... 13
  4.3 Wildlife Crossing Structures ..................................................................................................... 14
  4.4 Wildlife Fencing in Conjunction with Other BMPs ................................................................. 19
  4.5 Escape Mechanisms .................................................................................................................. 23
  4.6 Additional BMPs ......................................................................................................................... 25

5.0 ADDITIONAL CONSIDERATIONS ............................................................................................. 27
  5.1 Cost ............................................................................................................................................. 27
  5.2 Maintenance and Monitoring ..................................................................................................... 28

6.0 REFERENCES ................................................................................................................................... 29

APPENDIX A STAKEHOLDER SURVEY

APPENDIX B MAPPING APPROACH AND METHODS

APPENDIX C GENERAL WILDLIFE BEST MANAGEMENT PRACTICES INFORMATION

APPENDIX D SPECIES WITH POTENTIAL TO OCCUR OR KNOWN HISTORICAL OCCURRENCE IN LA PLATA COUNTY

APPENDIX E WESTERN GOVERNORS’ ASSOCIATION POLICY RESOLUTION 07-01 02/27/07 and MOU BETWEEN NEW MEXICO, COLORADO, NMDGF AND CDOW
LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 3.1</td>
<td>AVCs and Composite Wildlife Habitat</td>
<td>8</td>
</tr>
<tr>
<td>Figure 3.2</td>
<td>Guidance for BMP Implementation for Development</td>
<td>10</td>
</tr>
<tr>
<td>Figure 4.1</td>
<td>Three-Sided Bridge in Banff National Park, Photo Credit: Bruce Leeson</td>
<td>15</td>
</tr>
<tr>
<td>Figure 4.2</td>
<td>Elliptical Culvert, US 285, Colorado Photo Credit: CDOT</td>
<td>15</td>
</tr>
<tr>
<td>Figure 4.3</td>
<td>Standard Wildlife Fencing, US 550, Colorado</td>
<td>21</td>
</tr>
<tr>
<td>Figure 4.4</td>
<td>Escape Ramp US 550, Colorado</td>
<td>24</td>
</tr>
<tr>
<td>Figure 4.5</td>
<td>Escape Ramp, Banff National Park Photo: Bruce Leeson</td>
<td>24</td>
</tr>
</tbody>
</table>

LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2.1</td>
<td>Provisions for Wildlife within La Plata County Code</td>
<td>4</td>
</tr>
<tr>
<td>Table 4.1</td>
<td>Wildlife BMPs Placement Considerations</td>
<td>11</td>
</tr>
<tr>
<td>Table 4.2</td>
<td>Engineering Considerations</td>
<td>13</td>
</tr>
<tr>
<td>Table 4.3</td>
<td>Wildlife Crossing Structure Size Recommendations</td>
<td>16</td>
</tr>
<tr>
<td>Table 4.4</td>
<td>Species Group Recommendations</td>
<td>18</td>
</tr>
<tr>
<td>Table 4.5</td>
<td>Wildlife Fencing Recommendations</td>
<td>20</td>
</tr>
<tr>
<td>Table 4.6</td>
<td>Fencing Considerations</td>
<td>22</td>
</tr>
<tr>
<td>Table 4.7</td>
<td>Escape Mechanism Considerations</td>
<td>23</td>
</tr>
</tbody>
</table>
1.0 INTRODUCTION

Best Management Practices (BMPs) for Wildlife and Roads in La Plata County is to be used as a guide to assist La Plata County with the planning, design, and implementation of appropriate transportation-related wildlife BMPs for projects occurring within La Plata County, Colorado (e.g., residential/ commercial developments, oil and gas developments and local agency road projects). The use of these practices, as enabled by State Statue (Sec. 29-20-11) allows for the “protection of wildlife, the control of population density and growth, and the protection of the surrounding environment”. Also, implementation of these practices will help maintain and improve wildlife movement across roadways within the county and improve the safety of roads within the county by reducing the potential for animal-vehicle collisions (AVCs). This will happen in several ways by: 1) identifying areas of high AVCs for future planning, 2) promoting public safety by developing a process to reduce AVCs in those areas, 3) promoting safe and effective movement for wildlife by prioritizing county roads with high AVCs, and 4) identifying important wildlife habitats for conservation, which is already a goal within the county as demonstrated by the La Plata County Comprehensive Plan (2001) and provisions within the County Code.

Considering wildlife early in the planning stages of development and roadway projects is a crucial step to facilitate the avoidance of impacting important habitat areas and integrating wildlife BMPs early in the design process when it is more cost-effective.

This document includes a brief background (Section 2.0) to the issues concerning roads and wildlife and the benefits of implementing wildlife-friendly BMPs related to roadways. Priority roads and important wildlife areas within La Plata County are also included in this section. A step-by-step protocol (Section 3.0) is presented, which is intended to be used at the beginning of all projects to help establish whether wildlife BMPs should be considered. Guidelines for wildlife BMPs are then presented (Section 4.0), including tools to help select appropriate wildlife BMPs. The focus of the wildlife BMPs presented in this document is on roadway characteristics known to have an effect on AVCs and wildlife movement. Some roadway characteristics, such as road width, traffic volumes, and traffic speed have less of an effect on AVCs as simply having a road in wildlife habitat. Information concerning the cost, maintenance, and monitoring of wildlife BMPs are provided in Section 5.0.

The tools presented in Section 3.0 will assist to determine if BMPs should be considered for a particular project. Continued study and analysis of wildlife habitat/movement and AVCs in the County will add value to future application of BMPs. As more detailed wildlife information becomes available from additional studies by La Plata County, Fort Lewis College, the Colorado Division of Wildlife (CDOW), or wildlife linkage assessments, the areas of applicability of these guidelines may change to fit the current setting of the county.

La Plata County planning staff will be available to provide project applicants with the most up-to-date information available, including county land use maps. Priority road corridors and important wildlife areas will likely change over time as land use changes continue within the county. As such, La Plata County planning staff will also be involved with updating data layers associated with the priority road corridors and important wildlife areas.
2.0 BACKGROUND

In the United States alone, estimates indicate that over one million accidents between large animals and vehicles occur each year (USDOT, 2008). Animal-vehicle collisions (AVCs) not only cause wildlife injury and mortality, but also present safety issues for the traveling public. It has been estimated that approximately 26,000 human injuries and 200 fatalities occur yearly due to AVCs (USDOT, 2008). The costs associated with animal-vehicle collisions can be high. A recent study of accidents estimated the cost of a deer-vehicle and elk-vehicle collision is approximately $6,600 and $17,500 per incident, respectively (Huijser et al., 2009).

Roads also lead to the direct loss of habitat (i.e., habitat is removed when roads are constructed), reduced habitat quality (e.g., increased noise and light), and habitat fragmentation that can all lead to harmful impacts to wildlife. Specifically, habitat fragmentation can alter natural ecosystem processes and disrupt wildlife movements that are necessary to maintain healthy populations (Beier and Noss, 1998; Rosenberg and Noon, 1997). Threatened and endangered species and species with wide-ranging movement requirements, such as ungulates and carnivores, are highly vulnerable to road impacts (Forman and Alexander, 1998; Forman et al., 2003; Trombulak and Frissell, 2000). However, other species, including smaller mammals, reptiles, birds, amphibians, and aquatic species are also affected by roads.

In the United States, the majority of wildlife mitigation, mainly in the form of wildlife crossings, has focused on terrestrial species, although aquatic species mitigation has also received a good deal of attention. The results of a survey conducted from July 2004 through September 2005 estimated that over 450 wildlife crossings have been implemented in the United States for terrestrial species, and over 300 crossings for aquatic species (Cramer and Bissonette, 2006). The number of mitigation projects for terrestrial and aquatic species has likely grown since the publication of these survey results.

Incorporating wildlife BMPs into transportation projects has ecological, social, and economic benefits. Lessening impacts on wildlife along La Plata County roads will help to increase roadway safety by reducing the potential for AVCs. Additionally, BMPs will help to maintain or enhance landscape permeability, which is important to sustain daily and seasonal wildlife movements. Overall, this will help maintain healthier wildlife populations and ecological systems. The maintenance of healthy wildlife populations within the county enhances both recreational and economic opportunities, such as wildlife viewing and hunting.

The implementation of BMPs in Section 4.0 will help La Plata County planning staff develop a more consistent planning effort related to wildlife and habitat protection in relation to roads with the goal of creating a more sustainable transportation system. Proactive implementation of wildlife BMPs during road construction (i.e., new and/or upgraded roads) is more cost effective than addressing the issue when AVCs become a noticeable problem, which can lead to higher cost solutions. Overall, these guidelines demonstrate the importance of protecting both wildlife and the public within the county.

Lastly, this effort supports and aligns itself with the signed memorandum of understanding by the State of Colorado through the Colorado Division of Wildlife and the State of New Mexico through the New Mexico Department of Game and Fish. This memorandum is a
commitment to work together as a team to focus on key habitat connectivity and migration corridors. The MOU is attached and highlights the key points.

2.1 Stakeholder Survey

The project team conducted a survey of potential stakeholders within La Plata County in June 2009. The purpose of the survey was to serve as one tool to provide information about the concern and need for wildlife BMPs for roads in La Plata County. The stakeholders included individuals or organizations with a potential interest in the development of BMPs, including government/resource agencies, industry/businesses, advocacy groups, and educational institutions (see Appendix A for the complete survey and results).

The stakeholder survey was a way of both educating the community on wildlife and transportation issues as well as seeking feedback from residents on priority actions the County could take to reduce wildlife and road conflicts, such as AVCs. As part of the survey, the stakeholders provided information concerning the need and importance of protecting wildlife within La Plata County, known wildlife/road conflict areas, types of wildlife to be considered for implementing BMPs, and characteristics of developments viewed to affect wildlife movement.

As part of the survey, stakeholder respondents provided information concerning known wildlife/road conflict areas. Specifically, survey participants were asked if they were aware of any areas where wildlife successfully or unsuccessfully crosses roads in La Plata County. Survey participants were also asked to provide information about important habitat areas (referred to as linkage areas in the survey and important wildlife areas in these guidelines) in La Plata County. The results of these two particular questions identified several county roads that support the priority road assessment, including Florida Road (CR 240) and (CR 501). More importantly, the majority of stakeholder respondents felt establishing guidelines for roads and wildlife in La Plata County is important. Further, their primary concerns related to roads and wildlife were safety for both humans and wildlife, and the conservation/protection of important wildlife habitat (Appendix A). Results from the survey were then considered into the overall process to ensure the guidelines reflect community values.

2.2 La Plata County Wildlife Policies

La Plata County has multiple policies that support the protection of wildlife habitat. The La Plata County Comprehensive Plan (2001) has planning goals for clustered development which “…is a form of residential development that concentrates lots on only a portion of the development parcel in order to preserve rural character, agricultural uses, wildlife habitat and other open space values” (p. 3.9). Pages 3.9 to 3.12 of the La Plata County Comprehensive Plan (2001) provide basic guidelines on clustered development.

The La Plata County Comprehensive Plan also has planning goals for open space designations within a development that include:

- Maintaining open space areas that are large enough to maintain functionality as agricultural land or wildlife habitat
- Encouraging single ownership of open space parcels
- Limiting open space to agricultural, conservation, or passive recreation uses (p. 3.13)
Pages 3.12 to 3.14 of the *La Plata County Comprehensive Plan* (2001) provide basic guidelines on open space designations within a development.

In addition, specific provisions related to protection of wildlife and their habitats are identified in the *La Plata County Code*, which demonstrate the importance of wildlife protection within La Plata County (See Table 2.1).

**Table 2.1  Provisions for Wildlife within La Plata County Code**

<table>
<thead>
<tr>
<th>La Plata County Code</th>
<th>Summary of Wildlife Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapter 70. Development Districts. Article I. In General. Section 70-5. Comprehensive Planning Maps.</td>
<td>Comprehensive planning maps include Public Ownership and Wildlife Habitat and Cumulative Impact Map of Wildlife for La Plata County</td>
</tr>
<tr>
<td>Chapter 82. Land Use and Development Permits. Article II. Section 82-77.</td>
<td>Location of critical wildlife habitat, riparian areas, and wetlands considered during process.</td>
</tr>
<tr>
<td>Chapter 102. Subdivisions. Article II. Administration. Section 102-53 (g). Details concerning conceptual development plan and plat requirements.</td>
<td>Critical lands, including wildlife migration corridors and habitats to be included on plat/supporting documents.</td>
</tr>
<tr>
<td>Chapter 106. Zoning. Article III. Animas Valley Land Use Plan District, Section 106,131–133. Wildlife Protection Corridor.</td>
<td>River Corridor District protects movement along the Animas River Valley</td>
</tr>
</tbody>
</table>
3.0 WILDLIFE BEST MANAGEMENT PRACTICES ASSESSMENT

The application of the wildlife BMPs presented in this document focuses on areas within La Plata County with known wildlife movement across roadways or in important wildlife areas. This section describes the process used to identify the priority road corridors and important wildlife areas subject to these wildlife BMPs.

Data from multiple sources were researched and reviewed including important wildlife habitat data made available through the CDOW Natural Diversity Information System (NDIS) resource, the Southern Rockies Ecosystem Project (SREP) [now the Center for Native Ecosystems (CNE)], the CDOW critical habitat modeling project, AVC data from Colorado State Patrol and La Plata County accident reports, and the results of the stakeholder survey (Appendix A). Although several of these data sources focus on state and federal highways, the data were helpful in defining the area of applicability and narrowing the focus to roads within the county. Several discussions and meetings between county staff and the authors of this report resulted in an emphasis on AVC data and important wildlife habitats. Appendix B presents detailed information about this process and the data analysis, as well as informative maps.

It is important to note that an increased understanding of roads and their impacts to wildlife in La Plata County occurs through continued data collection and analysis of AVCs, wildlife habitat, wildlife movement patterns, and development patterns. Understanding the relationship between roads and wildlife as described by AVCs is an important step in protecting both human safety and wildlife habitat. Therefore, it is critical La Plata County planning staff continue to incorporate new data, as it becomes available, as well as promote improved methods of data collection. Additionally, only through on-going analysis and monitoring can La Plata County accurately understand the overall effectiveness of these guidelines in reducing AVCs and allowing wildlife to move safely among important habitats.

3.1 AVCs and Wildlife Habitat

The application of the wildlife guidelines presented in this document focuses on county roads within La Plata County with areas of high AVCs and/or within important wildlife habitats as mapped by the CDOW NDIS resource, as described below.

3.1.1 METHODS

Analysis of AVC data using Geographic Information System (GIS) attempted to answer the questions “Where are the most AVCs in the county?” and “Where are the highest and lowest rates of AVCs on a given road?” AVC data obtained from both La Plata County 2001-2009 AVC and CDOT 2002-2005 AVC records were used to answer these questions. Comparisons of the County and CDOT data sets indicated the same 9 roads as having the highest AVCs: US 160, US 550, St. Hwy. 172, St. Hwy. 140, CR 141, CR 501, St. Hwy. 151, CR 318, and CR 240. These data describe locations of AVCs in narrative form e.g., ‘near mile marker 14’ rather than Global Positioning System (GPS) locations or latitude-longitude. Knowing that most AVCs occur on US 160 is not very informative for the purposes in this document. Therefore, the AVC data were geo-coded to mileposts along these 9 roads and assigned a scaled color code to those mile markers indicating where AVCs are highest. Five other county roads had high rates of AVCs and four of these: CR 521, CR 516, CR 220, and CR 234 were also geo-coded to mile
marker. The fifth, CR 252 was only one mile long. For other county AVC data only the county road is displayed i.e., no specific mile marker. In this case, the data were normalized for each county road by total length and years of data (8.7) to get an approximate AVC/mile/year and scaled each county road using the same color scheme as used for mile makers along the 13 roads. The mile markers were further normalized by the average for the entire road, resulting in a relative AVC rate. A relative AVC rate of 0.5 indicates that the mile marker has an absolute rate of AVCs that is ½ that of the average for the road. Similarly a relative AVC rate of 2 indicates that the mile marker has an AVC rate that is twice that of average for the road. This was calculated because the absolute rate of AVCs is related to traffic and speed in addition to wildlife habitat and the Project Team determined it was more important to look for the high and low areas on each road rather than for the county as a whole. In summary, the color coding of the roads answers the question “Where are the most AVCs in the county?” and the color-coding of the mile markers answer the question “Where are the highest and lowest rates of AVCs on a given road?” Figure 3.1 shows the absolute rate of AVCs at each mile marker.

Similarly, NDIS data available from the CDOW were evaluated. Based upon this analysis select habitat layers were created for elk, mule deer, carnivores (black bear and lynx), and miscellaneous (turkey, moose, bighorn sheep). Habitat layers used were for 1) species that are most likely to cause damage or injury and 2) habitats that are mostly likely to result in concentrations of individuals while representing a variety of species relative to habitat preferences. Some types of information were not available for all species e.g., migration corridors and production areas were available for elk but not for mule deer. The following layers were used for each species:

- Elk—production areas, migration corridors, winter concentrations, summer concentrations, resident populations, and severe winter areas
- Mule Deer—concentration areas, winter concentrations, severe winter areas, and resident populations
- Black Bear—summer concentrations and fall concentrations
- Lynx—potential habitat
- Moose—overall range
- Bighorn Sheep—overall range and winter range
- Turkey—winter range, winter concentrations, and production areas

Data for other species e.g., coyotes and rabbits or hares are an important consideration, but such data are unavailable at the present time.

These NDIS habitat layers were also compounded into an overlapping, semi-transparent layer so that darker areas represent increasing numbers of critical habitat, and thus more value for wildlife in general (see Figure 3.1). This layer is a composite of all species listed above (deer, elk, bear, lynx turkey, moose, and bighorn sheep). The darkest areas on this map indicate the highest number of those habitats occurring at a given site and thus road projects in these areas would be expected to have the greatest impacts on wildlife. The lighter areas in these maps identify areas within the county that may be less important for wildlife or already impacted beyond suitability for wildlife.
It is important to note that the information in Figure 3.1 will likely change over time. The information used for this analysis was the best available at the time of document development. As new information becomes available or a formalized habitat connectivity analysis is conducted in La Plata County, Figure 3.1 will likely need to be updated. Additionally, as changes in the county occur, wildlife movement could also change.

3.1.2 Assumptions and Recommendations

It is important to recognize the assumptions of the AVC data used for this process. These data come from Colorado State Patrol reports and do not include collisions that were not severe enough to warrant legal action i.e., for an insurance claim or if an injury occurred. Legal action is more likely to stem from accidents occurring on busy roads that are patrolled more frequently, where it is more important to get a disabled vehicle off the road quickly, and where it is more dangerous to swerve, brake, or take other evasive maneuvers to avoid disabled vehicles. Therefore, there may be inherent biases in the data towards busier and faster roads or where larger animals e.g., elk or bear are more likely to be involved. The AVC and wildlife habitat data were selected for this map for comparison purposes only; habitat is only one component of the rate of AVCs. Temporal variation including time of year, time of day, as well as several other considerations such as road density, road conditions, visibility, traffic, and topography are important factors in critically evaluating the cause of high and low rates of AVCs along any county road.

Another limitation of these data is the absence of species information. The CDOT AVC data report species information and included 112 deer, 12 elk, and 3 bears for the 4-year period from 2002-2005 on county roads. It is anticipated that these ratios would be similar to the data recorded by the county; however, the absence of species information makes it difficult to evaluate species-specific habitat maps. For example, it would be possible to postulate a correlation between high rates of AVCs and elk migration corridors along CR 240 or elk production areas on CR 501; however, if the majority of the AVCs in these areas involve deer, this would be an invalid assumption.

Despite these data limitations, these are the best data currently available. Further, the patterns and relationships suggested by these data are informative and relevant for planning purposes. The analysis of AVC data in La Plata county is complex, but important and worthy of further investigation in the future. Complete analysis of AVC data is beyond the scope of this project and likely beyond the scope of the AVC data as they are currently recorded. An ideal dataset would include species information, GPS locations, traffic data, and more objective accounts. Suggestions to improve the collection of AVC data include: 1) allow anonymous self-reporting of AVCs via the internet or through the La Plata County Wildlife hotline or 2) develop a simple data collection card for county maintenance crews to complete as road kill is discovered. This would not resolve all of the issues but would likely result in a more dense and robust set of data.
Figure 3.1  AVCs and Composite Wildlife Habitat
3.2 Applicability and Protocol

The step-by-step guidance in Figure 3.2 is intended to help determine if a project would benefit from the use of BMPs based on specific project characteristics that have the potential to affect wildlife movement and/or AVCs. This is primarily the location of a road in relation to wildlife habitat and AVCs. In other words, any type of road in wildlife habitat or movement corridor will create a disturbance or AVCs.

Some roadway characteristics like traffic speed, traffic volume, and road width do not have as high an effect on AVCs as simply having a road within an area of wildlife habitat. Intuitively, a higher speed, higher volume, larger facility (4- to 6-lane) would appear to produce more AVCs than a smaller, lower volume and speed road. However, a recent report to the US Congress on AVCs (USDOT 2008) presents data that does not support that assertion. The document shows that almost half of the reported AVCs were on roads with volumes less than 5,000 average daily traffic (ADT). For reference, the upper limit of a dirt/gravel road, chip seal/emulsified road, 2-lane paved road is 400 ADT, 2,000 ADT, and 12,000 ADT, respectively. The report goes on to state that collisions actually decrease when traffic volumes increases to a high enough level that creates a barrier effect. USDOT (2008) also states that nearly 90 percent of reported AVCs occur on two-lane roads. The same is true of traffic speed. USDOT (2008) states: “... the high number of AVCs on 88kph (55 mph) roadways (nearly 60 percent) is more likely the result of higher populations of wildlife on rural two-lane roadways with this design speed, rather than the 88kph (55 mph) design speed in and of itself.”

Guidance can be applied for each type of project expected to occur within La Plata County that may affect roads in La Plata County i.e., development projects, county road projects, and oil and gas projects. Regardless of the outcome of the step-by-step guidance below, the implementation of wildlife BMPs is recommended for every project, regardless of the size and scale. Section 4.0 provides general guidance for projects that will benefit from the implementation of BMPs.
Figure 3.2  Guidance for BMP Implementation for Development

**STEP 1**
Is the project within 1 mile of a “Red Dot” on Figure 3.1?

**OR**
Is the project within an area of five or more habitats as shown on Figure 3.1?

The project will require a site-specific assessment of the project area by a qualified biologist to help determine the most appropriate mitigation for the project based on the general mitigation guidelines included in Section 4.

**YES**

**NO**  Go to Step 2, the site might require Roadway BMPs for wildlife.

**STEP 2**
Is the project on a road highlighted with AVCs on Figure 3.1?

**OR**
Is the project within an area of a single wildlife habitat type, as shown on Figure 3.1?

La Plata County Planning Staff will recommend the most appropriate mitigation for the project based on the general mitigation guidelines included in Section 4.

**YES**

**NO**  Go to Step 3, the site might require Roadway BMPs for wildlife.

**STEP 3**
Have adjacent parcels implemented or plan on implementing wildlife mitigation or included a wildlife buffer in site plans? (Contact La Plata County Planning Staff for additional information)

**OR**
Is the project adjacent to protected open space, protected wildlife habitat, or other land protected from development?

If **Yes**, the project will require a site-specific assessment of the project area by a qualified wildlife biologist to help determine the most appropriate mitigation for the project based on the general mitigation guidelines included in Section 4.

If **NO** the site does not require roadway BMPs for wildlife.
4.0 WILDLIFE BEST MANAGEMENT PRACTICES

The following chapter is intended to assist with selecting appropriate wildlife BMPs and to introduce basic wildlife management design considerations. Selecting and developing effective BMPs for multiple species and different landscapes is challenging because species respond to BMP types, structure dimensions, landscape features/physical characteristics, and other variables, such as human activity and traffic in different ways. Table 4.1 includes some basic considerations when planning for wildlife BMPs, and tools that can be used to begin identifying where wildlife BMPs may best be applied. If BMPs are determined to be of benefit to a proposed land use development project, the Planning Engineer shall make a determination if the project requires consultation with a qualified wildlife biologist to help determine the appropriate mitigation measures for the project.

Table 4.1 Wildlife BMPs Placement Considerations

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Tools</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Examine Wildlife Species</strong></td>
<td>1) &quot;BMPs for Wildlife Roads in La Plata County&quot;</td>
</tr>
<tr>
<td>- What are the target species associated with the project?  The target species will vary based upon site conditions and habitat present at the site. The types of BMPs for each species group will vary based on these site-specific conditions (see Table 4.4 and Appendix C)</td>
<td>2) Consultation with the Colorado Division of Wildlife</td>
</tr>
<tr>
<td>- Large Mammals (including deer, elk, and antelope)</td>
<td>3) Additional Local Expert Knowledge including the &quot;La Plata County Living with Wildlife Advisory Board&quot;</td>
</tr>
<tr>
<td>- Medium Mammals</td>
<td>4) Habitat Analysis by a qualified wildlife biologist</td>
</tr>
<tr>
<td>- Small Mammals</td>
<td>5) Wildlife Field Surveys</td>
</tr>
<tr>
<td>- Amphibians/Reptiles</td>
<td></td>
</tr>
<tr>
<td>See Appendix D for a list of species with special conservation status that are known to occur or have the potential to occur in La Plata County.</td>
<td></td>
</tr>
<tr>
<td><strong>Examine Animal-Vehicle Collision Data</strong></td>
<td>1) Colorado State Patrol AVC Databases</td>
</tr>
<tr>
<td>- Are there areas with high animal-vehicle collisions?</td>
<td>2) Local Expert Knowledge</td>
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<tr>
<td></td>
<td>3) Wildlife Field Surveys</td>
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<td>4) SREP Linkages Assessment Data</td>
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<td>5) La Plata County AVC Database</td>
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<td></td>
<td>5) Colorado Department of Transportation AVC Database</td>
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</tbody>
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Considerations

Examine Habitat Features/Movement Data
Are there known areas of high wildlife use by the target species? Are there important habitat (topographic/terrain) features or manmade features in the project area that intersect the planned new road or existing road?

Examples include:
1) Natural or manmade drainages (intermittent or perennial) (e.g., streams, drainage ditches) or riparian areas.
2) Ridges/Valleys
3) Natural Vegetation Approaching Road/Riparian Areas Parallel to Road
4) Areas with poor sight distance (blind curves, steep hills, etc.)
5) Existing bridges or culverts
6) Planned roadway or developments

Tools
1) Field Survey/Habitat Analysis by a qualified wildlife biologist
2) Aerial Maps
3) Topographic Maps
4) GIS Data/Maps (e.g., vegetation, wildlife habitat) Example Sources: Colorado Division of Wildlife, US Fish and Wildlife Service, US Forest Service
5) GIS-based Modeling
6) County Road Attributes
7) County Capital Improvement Plans

Examine Surrounding Land Use
Examine existing and future land uses to ensure habitat is protected to maintain connectivity in the future. Are there protected public lands within the project area (e.g., local or state parks, open space, USDA National Forest lands, conservation easements)?

Tools
1) Land Use/Ownership Maps
2) Aerial Maps
3) La Plata Open Space Conservancy
4) Conservation Easement Data

Consideration should be given to the type of BMPs that are most appropriate for a particular project. A wide variety of roadway BMPs are available for wildlife, ranging from lower cost solutions such as modifying existing structures to higher cost solutions such as new bridges specifically built with wildlife needs in mind. Decisions about wildlife BMPs are complex and based on multiple factors, including biological needs, engineering limitations, and BMP cost. Success is highly dependent on collaboration between multiple groups, such as land management agencies, tribal groups, the CDOW, CDOT, and local conservation groups.

The BMPs that follow include general information on wildlife management strategies, including:

- Consideration of adjacent land uses
- Road alignment and road design features
- Wildlife crossing structures
  - Structure Size
  - Structure Design Characteristics
- Fencing (in conjunction with other BMPs)
  - Fence Type
  - Fence Length
  - Escape Mechanisms
- Other Strategies
4.1 Consideration of Adjacent Land Uses

Examining current or future characteristics of adjacent parcels may lead to the ability to develop BMPs that connect adjacent properties. This adds to the larger vision of providing wildlife habitat connectivity and improved public safety across La Plata County. Often parcels or developments have connected green space, open space, parks, or conservation easements that can serve as habitat or movement areas for wildlife. By considering these characteristics of adjacent property, the location of roadway wildlife BMPs may become apparent. Connecting these habitats or movement areas by using roadway wildlife BMPs will create opportunities for wildlife on a larger scale.

Additional forms of wildlife protection include establishing buffer areas surrounding riparian or other areas of known wildlife movement on land slated for development. This is similar to the setbacks often used in development codes, including the La Plata County code. Establishing a formal buffer area as a park feature or conservation easement may provide a development with an attractive feature that serves multiple purposes.

4.2 Road Alignment and Design

Considering the needs of wildlife during the initial planning stages of any road construction project can reduce the overall impact of the project on wildlife. When included early in the planning stages, there are several basic considerations regarding the roadway location and design that should be considered early on during the design process (see Table 4.2).

Table 4.2 Engineering Considerations

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Answer</th>
<th>Reference Guidelines (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>For Existing Roads Only: Examine Existing Road Alignment and Design Features</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the roadway as presented, required for the safety and integrity of the project? Have alternatives to this roadway system been considered?</td>
<td>Yes No</td>
<td>If No, please present La Plata County with alternative roadway scenarios.</td>
</tr>
<tr>
<td>Are there existing structures (i.e., culverts or bridges) that have the potential to be modified (see Section 4.6.5) or replaced to accommodate wildlife as part of the project?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.3 for guidelines on Wildlife Crossing Structures and Section 4.6.5 on Structure Modifications.</td>
</tr>
<tr>
<td>Are there areas along the road with high fill slope/elevated roadway that bisect important habitat features where wildlife crossing structures can be incorporated?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.3 for guidelines on Wildlife Crossing Structures. If No, refer to Section 4.6.3 for guidelines on at-grade crossing opportunities.</td>
</tr>
<tr>
<td>Are there areas with existing median barriers or fencing with the potential for modification to accommodate wildlife?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.6.2 and 4.4 for guidelines on median barriers and fencing.</td>
</tr>
<tr>
<td>Considerations</td>
<td>Answer</td>
<td>Reference Guidelines (if applicable)</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------------</td>
<td>--------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Will any type of new fencing be required for the project that can be modified to accommodate wildlife?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.4 for guidelines on fencing.</td>
</tr>
<tr>
<td>Does the project have any frontage roads or railroads that run parallel to the road?</td>
<td>Yes No</td>
<td>If Yes, selected mitigation should also apply to these parallel transportation features. This will likely require additional coordination with La Plata County, adjacent landowners, or railroad companies.</td>
</tr>
</tbody>
</table>

### For New Roads: Examine Road Alignment and Design Features

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Answer</th>
<th>Reference Guidelines (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is the roadway as presented, required for the safety and integrity of the project? Have alternatives to this roadway system been considered?</td>
<td>Yes No</td>
<td>If No, please present La Plata County with alternative roadway scenarios.</td>
</tr>
<tr>
<td>Does the project require any bridges or culverts for drainage that can be modified to accommodate wildlife?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.3 for guidelines on Wildlife Crossing Structures.</td>
</tr>
<tr>
<td>Will the roadway be relatively high compared to the surrounding topography allowing for easier construction of wildlife crossings?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.3 for guidelines on Wildlife Crossing Structures. If No, refer to Section 4.6 for guidelines on other mitigation strategies.</td>
</tr>
<tr>
<td>Will the road/roadway system require median barriers that can be modified to accommodate wildlife?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.6.2 and 4.4 for guidelines on median barriers and fencing.</td>
</tr>
<tr>
<td>Will any type of fencing be required for the project that can be modified to accommodate wildlife?</td>
<td>Yes No</td>
<td>If Yes, refer to Section 4.4 for guidelines on fencing.</td>
</tr>
<tr>
<td>Are there any concepts that can be utilized to improve driver line-of-sight?</td>
<td>Yes No</td>
<td>If No, refer to Section 4.6.1 for guidelines on roadside/right-of-way vegetation.</td>
</tr>
<tr>
<td>Does the project have any frontage roads or railroads that run parallel to the road?</td>
<td>Yes No</td>
<td>If Yes, selected mitigation should also apply to these parallel transportation features. This will likely require additional coordination with La Plata County, adjacent landowners, or railroad companies.</td>
</tr>
</tbody>
</table>

### 4.3 Wildlife Crossing Structures

Wildlife crossing structures, including both underpasses and overpasses, in combination with fencing have been shown to reduce AVCs an average of over 80 percent (USDOT, 2008). Accordingly, roadways with areas of high AVCs are good candidates for the implementation of wildlife crossing structures and fencing. Both urban/suburban two-lane roads and low/medium-volume highways have a high potential for AVCs and may be the first types of roads targeted for this type of BMP (USDOT, 2008).
The effectiveness of wildlife crossing structures is dependent on proper placement within areas where the species of interest (i.e., target species) are known or most likely to occur and move across the landscape. As previously mentioned, structure placement should be determined by a qualified wildlife biologist after a site-specific assessment of the project area.

In conjunction with structure placement and the consideration of the target species, several design elements should be considered, including:

- Structure type
- Structure size (height, width, and length) and Openness ratio (structure opening size), which is the (height x width)/length of a structure
- Structure Design Characteristics

4.3.1 Structure Type and Size

Several different types of wildlife crossing structure types, including overpasses and underpasses have been constructed worldwide to restore natural wildlife movements across roadways, reduce AVCs, and increase the overall safety of roads. Common types of underpasses include round culverts, box culverts, elliptical culverts, and open span bridges (Figure 4.1 and Figure 4.2). Appendix C includes detailed information concerning specific types of structures and species-specific considerations.

Figure 4.1  Three-Sided Bridge in Banff National Park, Photo Credit: Bruce Leeson

Figure 4.2  Elliptical Culvert, US 285, Colorado Photo Credit: CDOT

Selecting the appropriate wildlife crossing structure and structure size should be based on the species of concern (i.e., target species) in the project area. Identification of the target species within the project area requires consultation with a qualified wildlife biologist. Different species
have different structure size requirements based on factors such as the actual physical size of the target species, habitat preferences, and behavioral characteristics (USDOT, 2008).

Structure size is one factor that influences the effectiveness of wildlife crossing structures. The structure size can directly or indirectly alter elements such as the amount of traffic noise, light levels, and other factors that affect wildlife use of a wildlife crossing structure. General structure size recommendations are provided in Table 4.3. Additionally, Appendix C includes detailed information concerning specific types of structures and fencing guidelines.

### Table 4.3 Wildlife Crossing Structure Size Recommendations

<table>
<thead>
<tr>
<th>Crossing Structure</th>
<th>Round Culvert</th>
<th>Concrete Box Culvert</th>
<th>Steel or Concrete Arch</th>
<th>Open-Span Bridge, Bridge Extension</th>
<th>Fencing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Large Wildlife</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deer</td>
<td>10 feet +</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20 feet wide +</td>
<td>8 feet high,</td>
</tr>
<tr>
<td></td>
<td>diameter</td>
<td>20 feet wide +</td>
<td>20 feet wide +</td>
<td></td>
<td>page wire</td>
</tr>
<tr>
<td>Elk</td>
<td>12 feet +</td>
<td>12 feet high x 32</td>
<td>12 feet high x 23</td>
<td>12 feet high x 20 feet wide +</td>
<td>8 feet high,</td>
</tr>
<tr>
<td></td>
<td>diameter</td>
<td>feet wide +</td>
<td>20 feet wide +</td>
<td></td>
<td>page wire</td>
</tr>
<tr>
<td>Antelope</td>
<td>10 feet +</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20 feet wide +</td>
<td>8 feet high,</td>
</tr>
<tr>
<td></td>
<td>diameter</td>
<td>20 feet wide +</td>
<td>20 feet wide +</td>
<td></td>
<td>page wire</td>
</tr>
<tr>
<td>Black Bear and Mountain Lion</td>
<td>10 feet +</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20</td>
<td>10 feet high + x 20 feet wide +</td>
<td>8 feet high,</td>
</tr>
<tr>
<td></td>
<td>diameter</td>
<td>20 feet wide +</td>
<td>20 feet wide +</td>
<td></td>
<td>page wire</td>
</tr>
<tr>
<td><strong>Medium-sized Wildlife</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bobcat and Coyote</td>
<td>48 inches +</td>
<td>48 inches high + x 48</td>
<td>Not necessary, unless</td>
<td>Not necessary, unless structures</td>
<td>At least 4 feet</td>
</tr>
<tr>
<td></td>
<td>diameter</td>
<td>inches wide +</td>
<td>structures also</td>
<td>also needed for larger mammals</td>
<td>high, wire mesh</td>
</tr>
<tr>
<td>Lynx and Wolverine</td>
<td>10 feet +</td>
<td>10 feet high + x 20</td>
<td>Not necessary, unless</td>
<td>Not necessary, unless structures</td>
<td>At least 4 feet</td>
</tr>
<tr>
<td>(research needed)</td>
<td>diameter</td>
<td>20 feet wide +</td>
<td>structures also</td>
<td>also needed for larger mammals</td>
<td>high, wire mesh</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>needed for larger</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mammals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small Wildlife</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e.g., Spotted Skunk, Gray</td>
<td>36 inches +</td>
<td>36 inches high +</td>
<td>Not necessary, unless</td>
<td>Not necessary, unless structures</td>
<td>36 inches high,</td>
</tr>
<tr>
<td>Fox, Raccoon, Ringtail Cat,</td>
<td>diameter</td>
<td></td>
<td>structures also</td>
<td>also needed for larger mammals</td>
<td>with ¼ to ½ inch</td>
</tr>
<tr>
<td>Long-tailed Weasel)</td>
<td></td>
<td></td>
<td>needed for larger</td>
<td></td>
<td>wire mesh or</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>mammals</td>
<td></td>
<td>plastic/fabric</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>material</td>
</tr>
</tbody>
</table>

Note: Table Adapted from Ruediger and DiGiorgio, 2007; "Information in this table was established from current studies, including recommendations from biologists and engineers with extensive wildlife crossing experience. The table is a general guide to designing and choosing appropriate structures for many target species. Other factors, such as terrain, engineering feasibility, cost, and site-specific conditions are always a consideration. The table is meant only as a broad guideline to assist in the selection of wildlife crossings (p. 18)." Additionally, these dimension guidelines will vary based on the determined length of the structure.

For larger roadways (i.e., four-lane facilities), the consideration of the openness factor should be considered by a wildlife biologist experienced in wildlife crossings layout development. The height and width of a structure designed for wildlife should increase as the length of a structure increases relative to the roadway width. This is referred to as the openness factor (height X
width/length of a structure). The openness factor is calculated in meters. Recommendations for minimum openness factors for large mammals range from the low end of 0.75 up to 2.0. Overall, the openness factor is an important feature of wildlife crossing structures that affects structure use for many species. Increasing the openness helps to improve an animal's line of sight and view of the habitat that exists on the other side of the structure (Cramer and Bissonette, 2005; Foster and Humphrey, 1995; Jackson and Griffin, 2000; Jacobson, 2002, Forman et al., 2003; Ruediger, 2005; Wall and Wall, 2006).

4.3.2 Structure Design Characteristics

Natural Characteristics

It is important to maintain the physical characteristics (e.g., vegetative cover, moisture, light) of the natural habitat in the surrounding landscape to help encourage and facilitate use of wildlife crossing structures. Natural vegetation provides cover for predators, helps filter light from traffic, helps maintain natural lighting conditions, and reduces the distance traveled between the habitat separated by the roadway (Forman et al., 2003; Clevenger and Waltho, 2005; Gagnon et al., 2006; Ruediger and Wall, 2006). The type and amount of vegetation considered for the structure and approaches is dependent on the target species, which have different cover preferences and requirements for activities such as foraging, daily and seasonal movements, and dispersal. Providing habitat that meets the basic needs of target species will also likely meet the needs of other species that depend on the same habitat. Other considerations related to maintaining the natural characteristics of the surrounding habitat include:

- When possible, roadway lighting should be placed away from wildlife crossing structures.
- Consider constructing two separate structures, with a fenced open median, if the project contains a divided highway. This design will allow more light into the structures.
- Provide a natural soil substrate (not rock, riprap or concrete).
- Maintain moist conditions within structures that connect wetland areas or other areas that sustain moisture-dependent species. For more detailed information on reptile and amphibian considerations, please refer to:
  

Bridge Features

Projects that involve either upgraded bridge structures or new bridge structures provide good opportunities to consider the needs of wildlife and incorporate some basic design elements that can help promote wildlife movement. Table 4.3 includes recommended bridge sizes that help maintain/enhance movement. In addition, the following bridge design features can help maintain/enhance wildlife movement.

- Maintain or incorporate a well-drained, flat/stable, natural area to allow wildlife to freely move beneath the bridge structure. For bridges that span drainages, maintain a natural (relatively dry path) area along both sides of the drainage, if possible.
• If a BMP is for large mammals, the width of the natural area (path) should as wide as possible (at least 6.5 feet wide) and above the high water mark, and still maintain the recommended clearance height for the target species (see Table 4.3).
• Keep riprap to a minimum on the side slopes and along the channel banks. If possible, consider alternative erosion control methods, or consider burying the riprap and re-vegetating the slope.
• Keep the vegetation and substrate of the side slopes as natural as possible.

**Species Group Recommendations**

Different species have different structure preferences based on factors such as the physical size of the target species, habitat preferences, and behavioral characteristics (USDOT, 2008). Table 4.4 provides some basic design considerations for large, medium, and small mammals and reptiles and amphibians. It is recommended that a qualified wildlife biologist work with engineers to incorporate the species group recommendations presented in Table 4.4 into roadway design plans.

**Table 4.4 Species Group Recommendations**

<table>
<thead>
<tr>
<th>Structure Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Openness Factor:</strong> Prefer structures with high openness factor – These structures are shorter in length and wider and have a large clearance height (See Table 4.3 for recommendations). These characteristics help improve the line of sight to habitat that exists on the other side of the structure, which influences structure use by many species (Cramer and Bissonette, 2005; Foster and Humphrey, 1995; Jackson and Griffin, 2000; Jacobson, 2002; Forman et al., 2003; Wall and Wall, 2006).</td>
</tr>
<tr>
<td><strong>Structure Access:</strong> Wildlife access issues should be considered in structure placement considerations. Structures should be in areas of natural movement for the target species. Avoid placing structures in areas with steep grades and steep slopes that make access difficult (AZGF, 2006).</td>
</tr>
<tr>
<td><strong>Structure Approaches:</strong> Keep the vegetation natural and similar to surrounding vegetation. If vegetation is removed during construction, re-vegetate the area with similar native vegetation. Vegetation provides cover for some species and helps visually screen highway traffic and filter noise. Vegetated approaches also reduce the distance traveled between habitats separated by the roadway (Forman et al, 2003; Clevenger and Waltho, 2005; Gagnon et al., 2006; Ruediger and Wall, 2006). The vegetation at the approaches should not obstruct the view of the other side of the structure. Avoid obstacles to wildlife access near structure entrances, such as construction debris piles and riprap, which may cause avoidance of the structure. Also avoid placement of lighting near approaches.</td>
</tr>
<tr>
<td><strong>Structure Bottom Surface:</strong> Maintain or place natural substrate on the bottom of the structure. This will help maintain natural sounds and a natural footing surface when animals are walking through structure (Ruediger, 2005; Forman et al., 2003; Jackson and Griffin, 2000). Consider using three-sided structures (i.e., bottomless) or burying the structure floor using the natural substrate from the area.</td>
</tr>
</tbody>
</table>

Large Mammals (e.g., elk, deer, black bear)
<table>
<thead>
<tr>
<th>Medium and Small Mammals (e.g., fox, skunk, coyote, bobcat)</th>
<th><strong>Structure Considerations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Openness Ratio</strong>: In areas that do not require use by large mammals, smaller and less elaborate structures will typically suffice (See <strong>Table 4.3</strong> for recommendations).</td>
<td></td>
</tr>
<tr>
<td><strong>Structure Approaches</strong>: Follow the same guidelines provided for large mammals. Avoid obstacles to wildlife access near structure entrances, such as erosion control fencing, which can be problematic for smaller species that are not able to jump over or crawl underneath the fencing. Also avoid placement of lighting near approaches.</td>
<td></td>
</tr>
<tr>
<td><strong>Structure Bottom Surface</strong>: Follow the same guidelines provided for large mammals.</td>
<td></td>
</tr>
<tr>
<td><strong>Structure Modifications</strong>: For structures that periodically convey water, provide alternative passage (e.g., wildlife shelves) options for animals to continue movements across the road at all times. For multi-species culverts and bridges place vegetative debris (e.g., old stumps, logs, brush) along one edge of the structure to provide protective cover for smaller mammals. Consider using construction waste as the source of the vegetative debris (Jackson and Griffin, 2000).</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reptiles and Amphibians</th>
<th><strong>Structure Considerations</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>See Appendix C, page 12</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Structure Approaches</strong>: Avoid obstacles to wildlife access near structure entrances, such as erosion control netting, which can be problematic for species such as snakes that can get tangled in netting. Also, avoid placement of lighting near approaches.</td>
<td></td>
</tr>
</tbody>
</table>

### 4.4 Wildlife Fencing in Conjunction with Other BMPs

Where possible wildlife fencing should not be used as a stand alone BMP, but should be considered in conjunction with other BMPs, such as wildlife crossing structures and at-grade crosswalks (see **Section 4.5**). When combined with wildlife crossing structures or at-grade crosswalks, fencing helps to guide animals to the crossing structures or at-grade crosswalks and reduces the number of animals entering the road right-of-way (Clevenger, Chruszcz, Gunson, and Wierzchowski, 2002; Forman et al., 2003; Hardy et al., 2007; USDOT, 2008).

Fencing long stretches of roadway without providing opportunities for wildlife to cross increases habitat fragmentation effects and can further restrict natural wildlife movements (Clevenger, 2002; Jaeger and Fahrig, 2004; USDOT, 2008). As such, continuous wildlife fencing over large stretches of roadway is generally not recommended.

Routine fence maintenance is essential to retain the effectiveness of the fencing, because the integrity of fencing can be affected by multiple factors, such as soil erosion, rock fall/avalanches, vandalism, damage from trees, vehicle accidents, and animals digging underneath (Clevenger et al., 2002).

It is important to note that fencing and related accessories along La Plata County owned roads are generally owned and maintained by the adjacent parcel owner for his or her own needs.
New roads and/or improvements to existing roads should take into consideration the impacts of existing fencing on wildlife and to the extent possible reasonable recommendations should be considered by both the public and private sector to accommodate BMPs at any identified critical crossing areas.

### 4.4.1 Fence Types

The type of and height of fencing selected is dependent on the species of concern for the area. General guidelines are included in Table 4.5.

Table 4.5 Wildlife Fencing Recommendations

<table>
<thead>
<tr>
<th>Species</th>
<th>Fencing Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Large Wildlife</strong></td>
</tr>
<tr>
<td>Deer</td>
<td>8 feet high page wire</td>
</tr>
<tr>
<td>Elk</td>
<td>8 feet high page wire</td>
</tr>
<tr>
<td>Antelope</td>
<td>8 feet high page wire</td>
</tr>
<tr>
<td>Black Bear and Mountain Lion</td>
<td>8 feet high page wire</td>
</tr>
<tr>
<td></td>
<td><strong>Medium Wildlife</strong></td>
</tr>
<tr>
<td>Bobcat and Coyote</td>
<td>At least 4 feet high wire mesh</td>
</tr>
<tr>
<td>Lynx and Wolverine (research needed)</td>
<td>At least 4 feet high wire mesh</td>
</tr>
<tr>
<td></td>
<td><strong>Small Wildlife</strong></td>
</tr>
<tr>
<td>(e.g., Spotted Skunk, Gray Fox, Raccoon, Ringtail Cat, Long-tailed Weasel)</td>
<td>18 inches to 24 inches with ¼ to ½ inch wire mesh or plastic/fabric material</td>
</tr>
</tbody>
</table>

Typically, eight to nine foot fencing, with six inch by six inch mesh, and wooden or metal posts is recommended for large carnivores and ungulates (e.g., deer and elk) (Figure 4.3) (Ruediger and DiGiorgio, 2007; USDOT, 2008).
Other types of fencing that can be used include chain link and electric (USDOT, 2008). The fence should be taller if placed on a steep slope and animals are approaching the fence from the above (USDOT, 2008). Table 4.6 includes a list of potential fencing considerations.

If other types of fencing are required (e.g., livestock fencing), but not in connection with the roadway right-of-way, wildlife-friendly fencing should be used. For guidance on wildlife-friendly fencing, refer to:


Table 4.6  Fencing Considerations

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Answer</th>
<th>Recommendations (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fencing Placement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Does the project include drainage culverts that may facilitate movement of wildlife?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place the fencing so that culvert openings are on the non-highway side of the fence. Inclusion of gates for maintenance access should be used.</td>
</tr>
<tr>
<td>If the project contains drainage features, such as roadside ditches, can the fencing plan be modified so that the fence does not cross the drainage feature?</td>
<td>Yes No</td>
<td>If <strong>No</strong>, fencing must extend to the ditch floor or the ditch may be piped at these sections to prevent animals’ access to the roadway at these locations.</td>
</tr>
<tr>
<td><strong>Fence Ends/Fence Gaps</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can the fencing be tied into a natural feature (e.g., steep rock face) to prevent animals from breaching the right-of-way at the fence end?</td>
<td>Yes No</td>
<td>If <strong>No</strong>, place a non-preferable walking surface (e.g., boulders/geogrid) between the edge of pavement and fence end.</td>
</tr>
<tr>
<td>Will the fence have gaps created from access roads or driveways?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place wildlife guards or electric mats at these locations.</td>
</tr>
<tr>
<td><strong>Fence Mesh/Overhangs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there animals in the project area that have the ability to climb fences (e.g., black bears, mountain lions)?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>: consider: 1) Adding an overhang with barbed wire at the top of the fence. 2) Using a finer mesh fence.</td>
</tr>
<tr>
<td>Are there animals in the project area that have the ability to dig underneath the fence (e.g., coyotes)?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, consider burying the fence in the ground or use a dig barrier and/or seat it in the concrete headwalls of the wildlife crossing structures.</td>
</tr>
<tr>
<td>Are there any reptiles, amphibians, or smaller animals that have the ability to move through the standard size mesh?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, consider adding a finer mesh fencing, screen, or lipped wall to the bottom of the standard large mammal fence. Mesh size will be dependent on species.</td>
</tr>
</tbody>
</table>

Note: For more specific information on fencing, please refer to: USDOT, *Wildlife Vehicle Collision Reduction Study*, 2008.

4.4.2  FENCE LENGTH

For projects that do not necessitate continuous fencing to connect a series of wildlife crossing structures, stand-alone structures can be initially designed with a conservative amount of “wing” or “funnel” fencing. Wing or funnel fencing length recommendations vary based on the landscape, but may range from ¼ to ½ mile or more when carnivores, deer, and elk are target species. However, fencing decisions are inherently site-specific and dependent on factors such as local topography and the target species the structure is aiming to accommodate (Ruediger, 2005; Bastings, 2007). Following installation, the initial fence length may need to be modified based on careful monitoring of the fence ends to determine if wildlife are by-passing the structure and crossing at-grade.
4.5 **Escape Mechanisms**

Escape mechanisms are recommended for projects that require miles of continuous fencing to help wildlife safely exit the road right-of-way if they manage to breach the fence (i.e., push through, dig under, climb over). Escape mechanisms include earthen escape ramps, swing gates, and one-way gates. The recommended escape mechanism is an earthen escape ramp (also referred to as a jump-out), which is typically constructed of earthen fill material and placed on the highway side of the wildlife fencing so that animals can ascend up the ramp and safely jump to the other side (Figure 4.4 and Figure 4.5). The ramp height must be sufficient to prevent animals from jumping into the right-of-way from the non-highway side of the fence. Ramp heights are generally between six and seven feet (USDOT, 2008). Table 4.6 includes a list of potential escape mechanism considerations.

**Table 4.7 Escape Mechanism Considerations***

<table>
<thead>
<tr>
<th>Considerations</th>
<th>Answer</th>
<th>Recommendations (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the project have at least 1 mile of continuous game fencing?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place escape ramps every ¼ mile to ½ mile throughout the limits of fencing. Escape ramps should be placed on both sides of the road.</td>
</tr>
<tr>
<td>Does the project have fence ends where wildlife could enter the roadway?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place escape mechanisms within ½ mile of each fence end.</td>
</tr>
<tr>
<td>Will the project have wildlife crossing structures?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place escape mechanisms on each side of the road near the wildlife crossing structures so wildlife can easily access the structures after exiting the road right-of-way.</td>
</tr>
<tr>
<td>Are there access roads and/or driveways that intersect the project?</td>
<td>Yes No</td>
<td>If <strong>Yes</strong>, place escape mechanisms within approximately 1/8 to 1/4 mile of these potential access points.</td>
</tr>
</tbody>
</table>


Note: Placement of escape ramps every ¼ mile to ½ mile is based on recommendations in Bissonette & Hammer, 2000.
Considerations for escape ramps include:

- Place in areas with natural vegetative cover
- Stagger escape ramps on each side of the road
- Place at least one escape ramp near each wildlife crossing structure entrance
- Place away from structures (e.g., houses, barns) – for areas that are primarily agricultural fields or residential/farm properties to reduce the potential for human/wildlife conflict
• Place within ¼ mile to ½ mile from all major access roads and driveways
• Escape ramp slopes may range from 2:1 to 6:1 depending on the topography, right-of-way, and fill requirements to maintain the specific ramp height
• Allow ample room for the landing area (six to eight feet) beyond the retaining wall
• Place at least four to six inches of sand or other soft material to create a protective landing surface for wildlife as they jump off of the ramp

4.6 Additional BMPs

4.6.1 Roadside/Right-of-Way Vegetation Removal
Vegetation, which attracts many animals to the roadside, can reduce the sight distance for drivers, making it harder to see wildlife approaching the road. Although research on the effectiveness of using roadside/right-of-way vegetation management techniques to reduce animal-vehicle collisions is limited, such strategies (e.g., mowing and trimming grasses/shrubs) may help improve driver sight distance. Improving sight distance can help drivers see animals that are approaching or crossing the road. Other techniques include planting unpalatable roadside vegetation for the species of concern and planting low-growing vegetation. The success of these techniques depends on on-going maintenance, local conditions, and the behavior of the species of concern (USDOT, 2008).

4.6.2 Median Barrier Mitigation Strategies
The need for median barriers is often required for roadway safety purposes. The type of barrier can have a substantial effect on wildlife movement. Barriers such as open guard rails or cable-rails should be considered before concrete median barriers are integrated. Concrete median barriers (i.e., jersey barriers), especially those that extend for long distances, can disrupt or limit movement for certain wildlife species. These barriers also have the potential to cause direct mortality due to animal-vehicle collisions as animals stop or turn around at the barrier. This causes animals to spend more time in the road, thereby increasing the chances of getting hit by vehicles (USDOT, 2008; Clevenger and Kociolek, 2006).

If concrete median barriers are to be used, consideration of other wildlife BMPs should be considered. However, there are several modified median barrier designs that may help reduce, but not eliminate, the negative wildlife effects of median barriers on wildlife. Examples include:

• Include small openings at the bottom of the barriers for smaller animals (sometimes referred to as scuppers)
• Maintaining gaps between smaller sections of median barrier
• Using different types of median, such as cable barrier
• The effectiveness of these techniques is still unknown because they are relatively new.

For more guidance on median barrier BMPs, refer to:

4.6.3 ANIMAL DETECTION SYSTEMS
Interactive warning signs, also referred to as animal detection systems, help to maintain at-grade animal crossings of the roadway. These types of systems have sensors capable of detecting wildlife near the road. The sensors trigger a warning (i.e., flashing lights or signs) to warn drivers of the presence of wildlife near the road (USDOT, 2008). The effectiveness of animal detection systems is highly dependent on driver behavior in that the system must successfully get drivers to slow down or increase their alertness as they drive through the area (USDOT, 2008).

For detailed information concerning animal detection systems, refer to:


4.6.4 TEMPORARY ROAD CLOSURES
Small, low-volume roads are good candidates for temporary road closures during times when animal movement is high, such as during seasonal migrations. Temporary road closures have been implemented for amphibian and reptile migrations and range from complete closure during a specific time period to just nightly closures during a specific time period (USDOT, 2008). This technique could also be applied during the seasonal migration of big game, if practical detour options are available. This option requires close coordination with CDOT. This technique would typically not apply to major roads, but could apply to low-volume roads with convenient alternate roads to route traffic during the temporary road closures.

4.6.5 STRUCTURE MODIFICATIONS (RETROFITTING)
Existing roadway structures can be modified with wildlife-friendly features to potentially encourage wildlife use. An inventory of existing roadway structures and features should be completed to help identify potential retrofitting opportunities. Retrofit considerations include:

- Developing a vegetation plan for existing structures that may include planting additional native vegetation at the structure approaches. The vegetation plan may also include recommendations for clearing vegetation at structure entrances that are prone to becoming overgrown, which may prevent wildlife use.
- Adding a conservative amount of “funnel” or “wing” wildlife fencing to help guide wildlife to existing structures (see Section 4.4.2).
- Modifying existing wildlife fencing placement in relation to structure entrances.
- Adding wildlife shelves to structures that periodically convey water to provide wildlife movements across the road at all time. Guidance on wildlife shelves is located on the Montana Department of Transportation website: http://www.mdt.mt.gov/research/docs/research_proj/animal_use/phasell/implementation.pdf
5.0 ADDITIONAL CONSIDERATIONS

The decisions regarding the application of roadway wildlife BMPs are multi-faceted. Consideration of issues beyond wildlife usage, such as costs, maintenance, and monitoring will help to ensure that the appropriate BMP is selected and implemented.

5.1 Cost

During the decision-making process for selecting appropriate wildlife BMPs, cost will likely be a factor. There are a wide range of capital cost associated with each BMP identified in this document. Using the least-cost alternative that still provides improved wildlife movement for site-specific target species is often an appropriate recommendation. The costs associated with a wildlife BMP can be very complicated and site-dependant. Cost savings measures, such as retrofitting structures should always be considered during the decision making process.

The lower end of the initial capital cost range includes signage, vegetation treatment, and temporary road closures (USDOT, 2008). Capital and maintenance costs generally increase as the structures get larger, for example, box culverts or arched culverts. The increased costs are a result of additional design, materials, and construction. The next tier of increased costs are bridges designed to be wildlife-friendly. These structures are often large enough to accommodate a wide-range of species, from elk and bear to smaller animals. Generally, the most expensive wildlife crossing structure is the wildlife overpass. These structures can cost an order of magnitude greater than box or arch culverts. However, wildlife overpasses are truly a continuation of wildlife habitat across roadways. These structures can be 160 feet wide and span across four to six lanes of highway.

When considering the appropriate wildlife crossing structure for county roads, the lower to moderate cost structure will typically be more appropriate. However, site-specific situations may arise where a bridge structure may be the best option when wildlife movement is deemed vitally important.

Additional considerations associated with costs should be evaluated during decision making. Generally, the capital costs associated with installing small animal crossings, such as round culverts less than 48 inches high with a natural materials in the bottom can cost less than an arch culvert or box culvert designed for elk. However, additional site-specific characteristics may affect the costs and thus decision making. To continue with the same example, if there is a large population of small animals—that is, less mobile than elk—in the project area, more than one crossing structure will be required to allow the population to move safely across the roadway. As the number of crossing structures climbs, so does the cost. The overall costs associated with give small animal crossings may end up being similar to one arch or box culvert designed to accommodate elk movement. Of course, site-specific features will affect costs on that may not be accounted in this example.

Retrofitting existing structures can provide a cost-effective solution and should always be considered. When a mitigation measure includes a structure, such as a box-culvert or bridge, the costs can significantly increase. The concept of retrofitting existing structures to be more wildlife-friendly and considering wildlife movement requirements for structures required to span
streams/rivers or floodplains are good examples of ways to incorporate effective wildlife BMP at a lower cost than new construction.

The benefits associated with the BMP should also be considered and weighed during the decision making process. It should be noted that there are both direct and indirect monetary benefits associated with implementing wildlife BMPs. A recent study estimated the monetary costs associated with AVCs involving deer, elk, and moose. The costs associated with deer and elk collisions is $6,600 and $17,500 per accident, respectively (Huijser et al., 2009). Instituting wildlife BMPs designed to reduce the collisions will provide monetary benefits by eliminating these costs associated with AVCs.

Recent studies have attempted to quantify the cost-benefits associated with various wildlife BMPs. This is an emerging consideration and more detailed information continues to become available. The results of these studies attempt to determine a net benefit in terms of capital investment dollars, as well as on-going maintenance costs. One study identified that wildlife fencing, associated with underpasses had one of the highest cost-benefit ratios. It also identified lower initial capital cost options, such as wildlife fencing alone, vegetation removal, and seasonal wildlife signs as having an advantageous cost–benefit ratio (USDOT, 2008).

Besides the strict monetary benefits, the potential to reduce human injury and even fatalities provides a higher societal value than just the monetary benefits.

5.2 Maintenance and Monitoring

The maintenance needs and monitoring requirements of any implemented mitigation measure should be considered during the planning process. Depending on the type of wildlife BMP, the level of maintenance can be relatively low or high. For example, while the initial capital costs associated with a wildlife-friendly box-culvert may be relatively high, the on-going maintenance requirements of the structure alone (not including associated fencing) is relatively low compared to other types of BMPs. In contrast, the vegetation treatment BMP requires on-going, diligent maintenance to remain effective, as does all wildlife fencing. If not properly maintained, vegetation will grow back and the improved sight distance is lost. Early discussions and agreements on maintenance requirements of BMPs will aid in effective decision making.

Monitoring is recommended to evaluate the effectiveness of the BMP. Monitoring can also help to identify potential modifications (e.g., fencing retrofit, landscape/vegetation enhancements) that may improve the effectiveness of the BMP.

The type and extent of monitoring can vary with the type of BMP and site. If a roadway project has a high level of AVCs and plans on implementing an expensive BMP, such as an underpass specifically for wildlife, then a higher level of monitoring is appropriate. Both pre- and post-construction monitoring is necessary to determine the effectiveness of the BMP. Because the implementation of wildlife BMPs is a relatively new science, this type of information can be used to aid in the application of future BMPs.

The consideration of post-project requirements, both maintenance and monitoring, should be considered during the planning process. Addressing these topics early in the development process will aid in identifying the BMP for the project.
6.0 REFERENCES

Arizona Game and Fish Department. (2006). Guidelines for Bridge Construction or Maintenance to Accommodate Fish and Wildlife Movement and Passage.


Wildlife Guidelines for La Plata County Roads Project
Stakeholder Survey Summary Report

Prepared by:

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ENVIRONMENTAL SERVICES

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Durango, CO 81301
970.382.7256

August 31, 2009
# TABLE OF CONTENTS

1.0 INTRODUCTION................................................................................................ 1  
2.0 SURVEY RESULTS ............................................................................................. 1  

<table>
<thead>
<tr>
<th>1.0 INTRODUCTION</th>
<th>2.0 SURVEY RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTRODUCTION</td>
<td>SURVEY RESULTS</td>
</tr>
</tbody>
</table>

- Summary of Key Findings .............................................................................. 1
- Demographics (Questions 1 and 2).................................................................. 2
- Question 3: Interest in Remaining Informed About/Involved in the Project Process .......... 2
- Question 4: Importance of Establishing Wildlife Guidelines for La Plata County Roads .......... 2
- Question 5: Most Important Issues or Concerns Regarding Wildlife and Roads .............. 3
- Question 6: Areas Where Wildlife are Particularly Unsuccessful in Crossing Roads within the County .... 4
- Question 7: Areas Where Wildlife are Particularly Successful in Crossing the County Road System .......... 4
- Question 9: Sources to Compile List of Small, Medium and Large Wildlife .................. 5
- Question 10: Important Wildlife Habitat Linkages .............................................. 6
- Question 11: Specific Developments or Road Improvement Projects of Concern .................. 6
- Question 12: Useful Information Regarding Wildlife Activity/Movement in La Plata County .......... 7
- Question 13: Ranking of Attributes Important for Consideration During Development of Wildlife Guidelines for La Plata County Roads ........................................ 8
- Question 14: Other Thoughts, Concerns or Issues ............................................... 9

APPENDIX A: ALL RESPONSES TO QUESTION 5
1.0 INTRODUCTION

To gain stakeholder input on the Wildlife Guidelines for La Plata County Roads Project (Project), Ecosphere Environmental Services (Ecosphere), as a subcontractor to Project lead Felsburg Holt & Ullevig, developed a questionnaire on Survey Monkey. The survey was distributed on June 30, 2009, by Project Manager Alex Pulley to a targeted list developed previously by the Project team. Recipients were also encouraged to forward the email with the survey link to other knowledgeable members of the community who may be potentially interested in the project. Additionally, the effort was announced at the Division Street premier on June 30 (hosted by La Plata County Living with Wildlife Advisory Board for their Summer Speaker Series), the survey link was posted on the La Plata County website, and the survey was highlighted in a July 1, 2009, Durango Herald article about the Division Street viewing. Initially, the deadline to complete the survey was June 24, 2009; however, it was extended to July 31, 2009, at the request of a key stakeholder.

This report summarizes the key findings, aggregating results to maintain the confidence promised in the survey introduction. Although some questions in the survey offer the opportunity for quantitative analysis, the vast majority contained qualitative information. In the case of qualitative information, responses were reviewed and a coding schema was allowed to organically emerge. Respondent comments provided in this report are generally verbatim; however, basic spelling errors were corrected and any personal information was omitted.

Any questions related to this summary report can be directed to:

Vicki Calwell  
Ecosphere Environmental Services  
776 E. 2nd Ave.  
Durango, CO 81301  
970.382.7256 or vicki@ecosphere-services.com

2.0 SURVEY RESULTS

Both a summary of key findings and detailed results are provided in this section.

SUMMARY OF KEY FINDINGS

Several key takeaways can be gleaned from the survey results:

- The majority of respondents felt that establishing guidelines for roads and wildlife in La Plata County is important.
- The top issues related to wildlife and roads include:

---

1 Given the strategic nature of this project, survey respondents were targeted, rather than randomly selected from the general population.
Wildlife Guidelines for La Plata County Roads Project
Survey Summary Report
August 31, 2009

- Preservation/protection of habitat, habitat connectivity and historic migration routes (designs for large animals were of greatest importance to respondents); and
- Safety of both humans and wildlife.

- Primary reasons for conflicts with wildlife include driver behavior (e.g., high speeds, carelessness) and roadway design (e.g., size, alignment, siting).
- Concerns related to the development of guidelines include the cost of mitigation and the inability of the County to enforce them.

**DEMOGRAPHICS (QUESTIONS 1 AND 2)**

A total of 47 people responded to the survey request. The vast majority of respondents were from Durango with the remaining from communities close in proximity to the area (Bayfield, Hesperus, Ignacio, Pagosa Springs, Mancos, Mesa Verde National Park and Farmington). Members from the Government and Industry/Business sectors represented the largest groups of respondents. Figure 1 provides a detailed look at the types of organizations respondents belong to.

![Figure 1](image)

**QUESTION 3: INTEREST IN REMAINING INFORMED ABOUT/INVOLVED IN THE PROJECT PROCESS**

Nearly all respondents (96%) requested that they be kept informed about this Project. The names and email addresses of these respondents have been added to the Project stakeholder list.

**QUESTION 4: IMPORTANCE OF ESTABLISHING WILDLIFE GUIDELINES FOR LA PLATA COUNTY ROADS**

More than half of the respondents (56%) considered establishing wildlife guidelines for La Plata County roads important or very important. Roughly 17% were neutral and 27% felt it was not important. See Figure 2 for a complete breakdown of responses.
Table 1. Most important issues and concerns regarding wildlife and roads.

<table>
<thead>
<tr>
<th>Topic</th>
<th>Number Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preservation/protection of habitat, habitat connectivity, and migration routes</td>
<td>24</td>
</tr>
<tr>
<td>Wildlife safety/mortality</td>
<td>18</td>
</tr>
<tr>
<td>Driver Issues: High speeds/lack of enforcement; careless, uninformed drivers</td>
<td>16</td>
</tr>
<tr>
<td>Human safety/protection of property</td>
<td>12</td>
</tr>
<tr>
<td>Roadway size/alignment/siting/signage/mitigation measures</td>
<td>12</td>
</tr>
<tr>
<td>Costs/funding of mitigation measures, research/monitoring, and animal clean up</td>
<td>4</td>
</tr>
<tr>
<td>Useless process</td>
<td>3</td>
</tr>
<tr>
<td>Protection of threatened and endangered species</td>
<td>2</td>
</tr>
</tbody>
</table>

**Figure 2.**

4. On a scale of 1-6, how important do you consider establishing wildlife guidelines for La Plata County roads (1 = very important, 5 = not important)?

<table>
<thead>
<tr>
<th>Response Percent</th>
<th>Response Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Question 5: Most Important Issues or Concerns Regarding Wildlife and Roads**

The top three issues and concerns provided by respondents include: 1) Preservation/protection of habitat, habitat connectivity and migration routes; 2) wildlife safety/mortality; and 3) driver issues (high speeds and lack of enforcement; careless and uninformed drivers). Table 1 below provides a breakdown of the types of comments received. A complete list of comments can be found in Attachment A.
**Question 6: Areas Where Wildlife are Particularly Unsuccessful in Crossing Roads within the County**

The majority of respondents (74%) were aware of areas where wildlife are particularly unsuccessful in crossing roads within the county. Specific areas identified that were mentioned more than once include:

- Florida Road (CR 240) (11 mentions)
- CR 250 (7 mentions)
- CR 501 (6 mentions)
- CR 234 (3 mentions)
- CR 203 (3 mentions)
- CR 213 (2 mentions)
- CR 204 (2 mentions)
- CR 510 (2 mentions)

More research is needed to identify specific areas along these roads where wildlife are particularly unsuccessful in crossing roads within the county.

**Question 7: Areas Where Wildlife are Particularly Successful in Crossing the County Road System**

The majority of respondents (72%) were not aware of any areas where wildlife are particularly successful in crossing the county road system. Of those that were, respondents provided the following information: South La Posta Road (CR 213), CR 214, CR 502 (slower sections), CR 240 (excluding Florida Road in Durango) and CR 228. Other comments included areas where speeds are limited.

More research is needed to identify specific areas along these roads where wildlife are particularly successful in crossing roads within the county. Many of the roads mentioned in this question were also identified in Question 6 (i.e., for unsuccessful crossings). The difference between the two questions may simply be a matter of seeing animals crossing the road and not being struck by vehicles and others seeing animals hit by vehicles.

**Question 8: Wildlife Size Groupings in Order of Importance for Consideration During the Development of Wildlife Guidelines**

Respondents appear to be most concerned with large animals, as indicated in Figure 3 (the lowest number/lowest bar column indicates highest importance to respondents). Small animals were regarded as the least important.
QUESTION 9: SOURCES TO COMPILE LIST OF SMALL, MEDIUM AND LARGE WILDLIFE

More than half of respondents (54%) agree with the approach to compile the list of species to analyze from Federally threatened and endangered species, State-listed species, human-wildlife conflict species and Big Game. About 22% were neutral and 24% disagreed with this approach. See Figure 4 for a complete breakout of results.
Comments of note included:

“This approach puts human safety and property damage (big game) on the same scale as biological significance (generally smaller body size). I’m not sure you can ever reach a consensus about the value of each of those, they are just different values. I agree with your use of resources a-b-c-d above. I just don’t think you can ask people to put human safety and biological value on the same scale, maybe 2 scales are required.”

**QUESTION 10: IMPORTANT WILDLIFE HABITAT LINKAGES**

More than 76% of respondents believed certain areas within La Plata County serve as important wildlife habitat linkages. About 21% were uncertain and 3% felt that no areas served as important wildlife habitat linkages. Information provided by respondents is summarized below.

- Animas Valley (generally considered north of Durango)
- Drainage areas/roads near riparian/water sources
- Migration corridors as mapped by CDOW; mountains in the north to lowlands south
- Horse Gulch
- Hills west of CR 213
- Mountain lion territories
- Bayfield area
- CR 234, 240, 250, 501 and 502
- Florida Road
- Hesperus-La Plata Canyon

(Note: There were numerous comments about State Highways (e.g., 550, 160, and 151); however, they were not included in the list above given they are out of scope for this project.)

**QUESTION 11: SPECIFIC DEVELOPMENTS OR ROAD IMPROVEMENT PROJECTS OF CONCERN**

More than half of respondents (57%) indicated that there were specific developments or road improvement projects of concern because of the potential to create impacts to wildlife or human-wildlife conflicts. Twenty-seven percent felt that there weren’t any specific developments/road improvement projects and 16% were not sure of any. Below is a summary list of areas of concern:

- Animas Valley (3 mentions)
- Twin Buttes (3 mentions)
- Indian Shadows (2 mentions)
- Forest Lakes expansion
- Three Springs
- Horse Gulch Road
- Grandview
- Oil and Gas development in general
- Anywhere near riparian areas/water sources, and those bisecting migration paths
- Growth in outlaying areas in general

(Note: Hwy 550 was mentioned several times, but not included in the list given it is out of scope for this project.)

**QUESTION 12: USEFUL INFORMATION REGARDING WILDLIFE ACTIVITY/MOVEMENT IN LA PLATA COUNTY**

Almost half of respondents (49%) indicated they had information that would useful for this project. Table 2 below lists information provided by a total of 20 respondents.

### Table 2. Respondent information useful to the project.

<table>
<thead>
<tr>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>The San Juan Public Lands center has much habitat modeling data….I’m too new to know the extent but could probably help find specific information.</td>
</tr>
<tr>
<td>In Rancho Durango Subdivision or up La Posta Canyon, or Willimex Lane, these fee lands are subject to poaching sometimes due to the economic needs for residents as well as the proximity of the lands to tribal surface.</td>
</tr>
<tr>
<td>See the Colorado Natural Heritage Program study done in 2002 or 2003 on the shelves of the planning dept.</td>
</tr>
<tr>
<td>A person told me after hitting a buck deer that he saw the deer but didn't slow down or stop because he had the right-of -way!!!! I assumed people are smarter than animals.</td>
</tr>
<tr>
<td>hwy 151 17 to 32.5 mm this part of the hwy is loaded with deer, the elk are mainly between the 31-32.5 In the winter you will see deer every green post, the elk hang out in the meadow to the west of lake capote.</td>
</tr>
<tr>
<td>Mile by mile road kill data on state highways</td>
</tr>
<tr>
<td>Road Kill Data on State Highways</td>
</tr>
<tr>
<td>Twilight, nighttime and early morning are times to be extra cautious while driving. Deer travel in groups; wait for all to reach safety.</td>
</tr>
<tr>
<td>Yes, I am willing to share all I have.</td>
</tr>
<tr>
<td>CDOW</td>
</tr>
<tr>
<td>CDOW is completely willing to share this information.</td>
</tr>
<tr>
<td>I think members of the Durango Gun Club, many of whom are hunters, might have valuable information to share. The club's phone number is 247-9722. I am not an active member of the club so my name is not likely to be helpful.</td>
</tr>
<tr>
<td>We watch the wildlife daily from our home in Horse Gulch (CR 237)</td>
</tr>
<tr>
<td>Animals Vehicle collision data on State Highways. Could be looked at for areas near county road interfaces.</td>
</tr>
<tr>
<td>Life time resident that has had various auto/wild life wrecks.</td>
</tr>
<tr>
<td>not me specifically, but wildlife biologists I work with would and should be part of this effort</td>
</tr>
<tr>
<td>I have been conducting research on mule deer in and around the HD Mountains for the past 6 years. I have modeled the migration data and it shows pretty striking images of road crossings on Hwy 160. In addition I have very detailed information on dates and times that animals cross the highway.</td>
</tr>
<tr>
<td>I think you know it all - SREP, CDOT and LPC AVC data</td>
</tr>
</tbody>
</table>
CDOT is doing an ongoing research project on US 160 by tracking wildlife movements and vehicle hits to attempt to reduce wildlife hits. This is ongoing research at this time and it will be a while before more plausible data is available.

My family and I have hit dear on 501, 228, Hwy 550. Each time it appears they were watching vehicles headed the other way then darted into our cars as soon as the other vehicle passed by. Does that help?

**QUESTION 13: RANKING OF ATTRIBUTES IMPORTANT FOR CONSIDERATION DURING DEVELOPMENT OF WILDLIFE GUIDELINES FOR LA PLATA COUNTY ROADS**

Animal movement/habitat, increased human safety and reduced wildlife mortality are considered the top attributes for consideration during development of wildlife guidelines by most respondents. See Figure 5 for a detailed breakdown (the lowest number/lowest bar column indicates highest importance to respondents). Note that results for question 13 closely mirror (although not exactly) the responses in Question 5.

**Figure 5.**

![Bar chart](image-url)
**QUESTION 14: OTHER THOUGHTS, CONCERNS OR ISSUES**

Table 3 below provides all other comments received from respondents (a total of 13).

<table>
<thead>
<tr>
<th>Table 3. Other thoughts, concerns, or issues provided by respondents.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have worked on a handful of road mitigation projects in my career...I would recommend the county strongly consider long-term maintenance costs and benefits of something like the activated signs on Highway 160. These systems are extremely expensive and do not solve the problem. They may reduce mortality, but long term estimates of equipment maintenance are not yet clear. For not much more money “hard fixes”, such as wildlife underpasses and fences (especially when built during road expansions or repairs) are much more effective at almost eliminating wildlife/vehicular collisions. Lastly, while working for the Utah Division of Wildlife Resources (last three years) we developed wildlife crossing guidelines based on a review of all available wildlife crossing research. I suggest the county consider this as a reference guide if they haven’t already. It was prepared for us by Dr. Patricia Cramer with Utah State University.</td>
</tr>
<tr>
<td>I am not sure of the purpose of the guidelines, if it is for development of subdivisions, then it would punish the developer with no possible mitigation purpose that would serve the already existing subdivisions of the past. Additionally, with ranch lands and water access this seems too late.</td>
</tr>
<tr>
<td>This is an important issue that has not received enough thoughtfulness in planning, particularly in increased road use because of growth. I ranked reduced wildlife mortality as 2nd, but that is specifically endangered species. It is vital that protected species remain protected from vehicles. Cost of mitigation for unprotected species is more important than the general protection of unprotected species. Current mitigation is insufficient in regards to large animal protection. Deer and elk crossing signs do not deter drivers who frequently use particular roads from unsafe driving practices. Driver education is an important part of the process. Looking at ways to improve animal safety from the standpoint of vehicle improvements as well as changes to roadways should be pursued.</td>
</tr>
<tr>
<td>Wildlife Guidelines should be enforced with every proposed development, regardless of governmental responsibility, i.e., state, county. Where possible, they should be retroactive. We are destroying many of the attributes that made this country so appealing.</td>
</tr>
<tr>
<td>With the loss of budget to do everything we need to be cost minded. We all want to see a safe hwy home, but we all have to realize that living in paradise has a cost. Folks need to be aware of whatever may be moving around them.</td>
</tr>
<tr>
<td>Please let’s lobby for smart development, i.e. renovating instead of erecting new structures and roads. The less sprawl, the less conflict (and suffering) for wildlife. Impose speed limits on back roads, especially at night. Consider lowering these speed limits.</td>
</tr>
<tr>
<td>First, I see that research and monitoring are not on the above list! I have been working on a student regarding the wildlife detection zone along 160. The design and placement of this has made interpretation nearly impossible because of all the confounding variables that were not controlled. Additionally, I suggest consideration of motion-triggered cameras so we can determine numbers of large mammals who DO cross the highway successfully, not just those who get killed or injured. Other research efforts and road-kill surveys (on county roads too) should be a necessary part of this process. Management doesn’t even exist without monitoring the efficacy of management efforts. These research/monitoring efforts need to be supported with funds.</td>
</tr>
</tbody>
</table>
Wildlife Guidelines for La Plata County Roads Project
Survey Summary Report  August 31, 2009

I believe the wildlife issue can be linked to providing multimodal non-motorized linkages for people too. Make the trails and underpasses “Dusk to Dawn” only for humans.

Well, perhaps zoning & development codes/laws that limit population density, type of development, etc. So that we can limit the “human sprawl” factor & preserve wildlife habitat & migration corridors. One way, that adheres to our capitalistic moralism, is to have greater governmental support for local ranching & farming so that maintaining large tracts of land is possible/practicable/profitable.

Local radio PSAs when hearings are held along with utility bill mailers through the towns billing process.

I don’t understand the questions that have to add up to specific numbers.

Wildlife connectivity fund that is funded by new development impacts. Development impact or mitigation requirements for impact to key habitats.
### Attachment A

**Q5:** In your opinion, what are the top two or three most important issues or concerns regarding wildlife and roads in La Plata County?

<table>
<thead>
<tr>
<th>One</th>
<th>Two</th>
<th>Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human and property safety.</td>
<td>Protection of historic migration routes for big game species.</td>
<td>Maintaining/restoring habitat connectivity for a large variety of other wildlife, e.g. amphibians, lynx, bears...etc...</td>
</tr>
<tr>
<td>People driving too fast</td>
<td>Country roads upgraded to freeways</td>
<td>Signage warning drivers of wildlife crossings</td>
</tr>
<tr>
<td>Wildlife collision with vehicles</td>
<td>Fencing</td>
<td>rects</td>
</tr>
<tr>
<td>La Plata County cannot enforce regulations on a variety of topics, it is all complaint driven</td>
<td>Guidelines are just an expensive document and their uses are inconsistent</td>
<td>Wildlife management is the responsibility of the Division of Wildlife</td>
</tr>
<tr>
<td>Habitat fragmentation</td>
<td>T&amp;E protection</td>
<td></td>
</tr>
<tr>
<td>Improve habitat connectivity and link core habitats through mitigation measures such as wildlife underpasses, overpasses, wildlife crossings and jump outs</td>
<td>Reduce road kill to reduce wildlife mortality</td>
<td>Reduce road kill to improve driver safety</td>
</tr>
<tr>
<td>Reducing the number of collisions with deer and elk</td>
<td>Establishing &quot;safe crossing&quot; zones</td>
<td>Safety of smaller animals, particularly skunks and rabbits</td>
</tr>
<tr>
<td>Speeding</td>
<td>Reduced line of sight on many roads</td>
<td>Inattention while driving on rural roads</td>
</tr>
<tr>
<td>It’s not the wildlife, it’s the drivers of the vehicles!!!</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear zone</td>
<td>Finding and mapping high hit areas</td>
<td></td>
</tr>
<tr>
<td>Vehicle/animal crashes</td>
<td>Allow animal population to migrate</td>
<td></td>
</tr>
<tr>
<td>Vehicle/animal collisions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of wildlife mitigation</td>
<td>Traffic speeds in conflict areas</td>
<td></td>
</tr>
<tr>
<td>Vehicles vs. Animals</td>
<td>Animals vs. vehicles</td>
<td></td>
</tr>
</tbody>
</table>
Q5: In your opinion, what are the top two or three most important issues or concerns regarding wildlife and roads in La Plata County?

<table>
<thead>
<tr>
<th>One</th>
<th>Two</th>
<th>Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>collisions with animals</td>
<td>loss of habitat due to development</td>
<td>fences, dogs, houses etc add to congestion and these all inhibit movement of animals</td>
</tr>
<tr>
<td>high speed and numbers of vehicles</td>
<td>need of wildlife to move between summer and winter ranges</td>
<td>Fragmentation by roads eliminates habitat in addition to creating more places for animals to be hit.</td>
</tr>
<tr>
<td>speed of travel</td>
<td>unaware of wildlife in area</td>
<td>ignorant of safety/roads /wildlife</td>
</tr>
<tr>
<td>Speed limits are too high on both state highways and county roads and there is almost no enforcement.</td>
<td></td>
<td>There is little to no educational effort or support for research.</td>
</tr>
<tr>
<td>Road alignment through topography and habitat</td>
<td>Traffic speeds</td>
<td></td>
</tr>
<tr>
<td>Maintaining safe (for people and wildlife) crossings for WL to move as needed between habitats</td>
<td>Route roads where possible through areas that will have the least impact on wildlife (as opposed to prime habitat)</td>
<td>Clear vegetation (especially brush) from roadsides to give drivers and opportunity to &quot;SEE&quot; animals</td>
</tr>
<tr>
<td>Obtaining funds for implementation</td>
<td>Public education</td>
<td>continued studies by competent biologist so funds available will be put to best use</td>
</tr>
<tr>
<td>Providing safe road crossings for wildlife</td>
<td>educating the public regarding areas of wildlife/vehicular conflict</td>
<td></td>
</tr>
<tr>
<td>allowing wildlife safe passage especially on key migratory routes</td>
<td>keeping drivers safe</td>
<td>efficient use of trails, underpasses etc that both wildlife and pedestrians/bikes can use</td>
</tr>
<tr>
<td>Wildlife &quot;corridors&quot; - Hwy 151, during winter, is inundated w/ elk &amp; deer herds, need more speed control</td>
<td>Wildlife access routes - to allow animals to use their normal migratory routes more safely</td>
<td></td>
</tr>
<tr>
<td>Connectivty</td>
<td>Habitat Loss</td>
<td>Env. degradation (i.e. water and air quality)</td>
</tr>
<tr>
<td>People safety</td>
<td>Wild life safety</td>
<td>Damage prevention</td>
</tr>
<tr>
<td>safety of humans and wildlife</td>
<td>retrofitting existing problems</td>
<td>planning to avoid future problems</td>
</tr>
</tbody>
</table>
Q5: In your opinion, what are the top two or three most important issues or concerns regarding wildlife and roads in La Plata County?

<table>
<thead>
<tr>
<th>One</th>
<th>Two</th>
<th>Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human safety</td>
<td>Keeping connectivity of migration corridors</td>
<td></td>
</tr>
<tr>
<td>Animal vehicle collisions</td>
<td>Loss of habitat from construction of new roads</td>
<td>Fragmentation of habitat from existing roads</td>
</tr>
<tr>
<td>safety of wildlife, migration patterns</td>
<td>safety of drivers</td>
<td>safer roads for all multi model transportation</td>
</tr>
<tr>
<td>public safety</td>
<td>wildlife preservation</td>
<td>clean up</td>
</tr>
<tr>
<td>collisions with wildlife</td>
<td>wildlife mortality</td>
<td>endangered species</td>
</tr>
<tr>
<td>Land Use planning is allowing prime habitat to be developed which places increased stress on wildlife</td>
<td>Many County Roads bisect winter and summer habitat for Deer and Elk</td>
<td></td>
</tr>
<tr>
<td>preventing wildlife/vehicle collisions</td>
<td>correct siting of roads to minimize habitat destruction</td>
<td>road standards that allow a smaller section through environmentally sensitive areas</td>
</tr>
<tr>
<td>collisions</td>
<td>habitat reduction</td>
<td></td>
</tr>
<tr>
<td>Wildlife vs. auto crashes</td>
<td>Preserving wildlife corridors across roadways</td>
<td></td>
</tr>
<tr>
<td>Disruption of natural migration patterns</td>
<td>Destruction of public and private property due to collision</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX B  MAPPING APPROACH AND METHODS

The Project Team attempted to evaluate and utilize the most appropriate and current set of data available to identify priority areas for wildlife habitat in La Plata County. These data included Animal-Vehicle Collision (AVC) records from both La Plata County and Colorado Department of Transportation (CDOT), as well as data from the Colorado Division of Wildlife (CDOW) Natural Diversity Information System (NDIS) resource, the CDOW critical habitat modeling project, and the Southern Rockies Ecosystem Project (SREP).

La Plata County 2001-2009 AVC data (and CDOT 2002-2005 AVC data)
The analysis of the AVC using a geographic information system (GIS) attempted to answer the questions “Where are the most AVCs in the county?” and “Where are the highest and lowest rates of AVCs on a given road?” Comparisons of the County and CDOT data sets indicated the same 9 roads as having the highest AVCs: US 160, US 550, ST 172, ST 140, CR 141, CR 501, ST 151, CR 318, and CR 240. These data describe locations of AVCs in narrative form e.g., ‘near mile marker 14’ rather than Global Positioning System (GPS) locations or latitude-longitude. Knowing that most AVCs occur on US 160 is not very informative for the purposes in this document. Therefore, the AVC data was geo-coded to mileposts along these 9 roads and assigned a scaled color code to those mile markers indicating where AVCs are highest. Five other county roads had high rates of AVCs and four of these: CR 521, CR 516, CR 220, and CR 234 were also geo-coded to mile marker. The fifth, CR 252 was only one mile long. For other county AVC data only the county road is displayed i.e., no specific mile marker. In this case, the data were normalized for each county road by total length and years of data (8.7) to get an approximate AVC/mile/year and scaled each county road using the same color scheme as used for mile makers along the 13 roads. The mile markers were further normalized by the average for the entire road, resulting in a relative AVC rate. A relative AVC rate of 0.5 indicates that the mile marker has an absolute rate of AVCs that is ½ that of the average for the road. Similarly a relative AVC rate of 2 indicates that the mile marker has an AVC rate that is twice that of average for the road. This was calculated because the absolute rate of AVCs is related to traffic and speed in addition to wildlife habitat and the Project Team determined it was more important to look for the high and low areas on each road rather than for the county as a whole. In summary, the color coding of the roads answers the question “Where are the most AVCs in the county?” and the color-coding of the mile markers answer the question “Where are the highest and lowest rates of AVCs on a given road?” Figure B-1 shows the absolute rate of AVCs at each mile marker. Figure B-2 (and the subsequent figures using the AVC data) shows the relative rates of AVC at each mile marker.

CDOW NDIS data
The Project Team evaluated the NDIS data and used select layers to create Figure B-3 for elk, Figure B-4 for mule deer, Figure B-5 for carnivores (black bear and lynx), and Figure B-6 for miscellaneous habitat (turkey, moose, bighorn sheep). The layers used were for 1) species most likely to cause damage or injury to vehicles and 2) habitats that are mostly likely to result in concentrations of animals. Some types of information were not available for all species, for instance migration corridors and production areas were available for elk but not for mule deer. For elk, the team included production areas, migration corridors, winter concentrations, summer
concentrations, resident populations, and severe winter areas. For mule deer, the layers included winter concentrations, severe winter areas, concentration areas, and resident populations. For black bear, the layers used were summer concentrations and fall concentrations. For lynx, potential habitat was used. For moose, overall range was used. For bighorn sheep, the layers used were overall range and winter range. For turkey, winter range, winter concentrations, and production areas was used. It important to note that data for other species e.g., coyotes, rabbits, etc. but data for these species are unavailable at the present time. According to the metadata, the Southwest Region was updated 2007 and due to be updated in 2011. The data described above were downloaded as they were last updated on August 20, 2009; however, it appears there have been changes since 2007, e.g., the inclusion of some new types of activity such as the mule deer concentration areas.

These NDIS habitat layers (19) were also compounded into an overlapping, semi-transparent layer so that darker areas represent increasing numbers of critical habitat, and thus more value for wildlife in general. Figure B-7 presents only deer and elk habitats because most of the AVCs involve deer and elk. Only the CDOT data included species in their records and only 3 were for bear – all other records were deer and elk collisions. However, Figure B-8 includes a composite of all species described above (deer, elk, bear, lynx turkey, moose, and bighorn sheep). The darkest areas on this map indicate the highest number of the above habitats occurring at a given site and thus road projects in these areas would be expected to have the greatest impacts on wildlife. The lighter areas in these maps identify areas within the county that may be less important for wildlife or already impacted beyond suitability for wildlife. AVC data are included on these maps for comparison purposes only and note that habitat is only one component to the rate of AVCs. Rates of traffic, speed, visibility, housing density, species, and time of year would also be important information in order to critically evaluate the reason behind areas of high and low rates of AVCs.

**CDOW critical habitat data**
The CDOW used several data sets to model critical wildlife habitat on private lands specifically to “aid La Plata County with ranking habitat” according to their metadata. This effort used 1) wildlife habitat (specifically, mule deer winter concentration, elk winter concentration, black bear fall concentration, bald eagle nest sites, and bald eagle winter concentration), 2) vegetation, 3) parcel size, and 4) proximity to public lands to rank critical wildlife habitat on private lands only within La Plata County. According to Jon Kindler (CDOW GIS Unit Supervisor, personal communication) the vegetation data is based on the Basinwide Vegetation from the Colorado Vegetation Classification Project (CVCP) published by CDOW in 2003. It is a 30-m resolution statewide vegetation classification derived from Landsat imagery from the 1990s available from the NDIS website. Similarly, the wildlife habitat data come from the NDIS resource, as described above. The public lands map comes from an older version from the Colorado Ownership Management and Protection (CoMAP) project to build a statewide protected areas map for Colorado.

The areas ranked as high and medium/high critical habitat data from this effort were used to display on Figure B-9 along with the AVC data and land ownership.
SREP data
As part of developing the “Making Connections for Wildlife Aligning Transportation Projects with State Wildlife Action Plans: A Step-by-Step Guide for Integrated Conservation Planning” process, the SREP, in collaboration with the CDOT, the Federal Highway Administration, the Nature Conservancy, and Colorado State University released a report in 2007 identifying critical wildlife linkages across highways for the entire state of Colorado. These linkages were identified both from expert knowledge and fine-scale movement modeling using the corridor design tool developed by Dr. Paul Beier, Northern Arizona University. The modeling and mapping effort spearheaded by SREP provides a resource which is an important consideration for county planning. However, their approach focused on state and federal highways, which although may present data indirectly related to county roads, are not roads under jurisdiction of La Plata County. Further, the SREP report focused on improving connectivity at a statewide level, while the BMPs described in these efforts focus on reducing AVCs and protecting important wildlife habitats within La Plata County. For this reason, the Project Team felt it important to focus this mapping effort on county roads and AVCs. Figure B-10 presents the linkages identified by the SREP report as well as the focal areas identified during Phase II of the SREP mapping effort.

Parcel data
In first analyzing the AVC data, an potential relationship was observed by where some of the highest AVC rates fell in relation to surrounding parcel size, development, land uses. Coincidentally, high AVCs in the north Animas Valley were near James Ranch and high AVCs along Florida Road coincided with Rainbow Ranch. Therefore, the team coupled the AVC data with parcel data to explore the relationship between where wildlife crosses country roads relative to surrounding land uses and parcel size (Figure B-11). The data on Figure B-11 suggest wildlife may select crossing areas where large parcels of land occur or conversely, where high-density development does not occur. These data suggest a very interesting relationship that may significantly help future planning in La Plata County. However, further research with empirical data and statistical analysis is necessary to substantiate this theory.

Stakeholder survey data
Figure B-12 identifies important information from the stakeholder survey.
Figure B-1  Absolute Rate of AVCs at Each Mile Marker
La Plata County
Colorado
Relative Animal - Vehicle Collisions
January 2001 to August 2009

Relative AVC (Quintiles) AVC/MileYear (Quintiles)
- 0.00
- 0.01 - 0.05
- 0.06 - 0.10
- 0.11 - 0.16
- 0.17 - 0.19
- 0.20 - 0.29

Figure B-2 Relative Rates of AVCs at Each Mile Marker
Figure B-3  CDOW Elk Habitat with Relative Rates of AVCs
Best Management Practices for Wildlife and Roads in La Plata County

Figure B-4  CDOW Mule Deer Habitat with Relative Rates of AVCs
Best Management Practices for Wildlife and Roads in La Plata County

Figure B-5  CDOW Carnivore Habitat (Black Bear and Lynx) with Relative Rates of AVCs
Figure B-6     CDOW Misc. Habitat (Turkey, Moose, Bighorn Sheep) with Relative Rates of AVCs
Appendix B

Figure B-7  Composite of Deer and Elk Habitat with Relative Rates of AVCs
Figure B-8  Composite of Habitat for All Species with Relative Rates of AVCs
Figure B-9  CDOH Critical Habitat with Relative Rates of AVCs
Figure B-10  SREP Phase II Linkages and Focal Areas with Composite of Habitat for All Species and Relative Rates of AVCs
La Plata County
Colorado
Parcels

Relative AVC (Quintiles)
- 0.00
- 0.01 - 0.58
- 0.58 - 1.15
- 1.15 - 2.00
- 2.00 - 4.19

Figure B-11  Land Use and Parcel Size with Relative Rates of AVCs
Figure B-12  Information from the Stakeholder Survey
APPENDIX C  GENERAL WILDLIFE BMPS INFORMATION
General Guidelines for Wildlife and Aquatic Organism Crossings

The following are some general guidelines for providing wildlife crossings and wildlife and aquatic habitat connectivity. They are useful whenever road or highways cross habitats that are important to terrestrial or aquatic species. The appropriate use of these “tools” is up to the decision-makers, agencies and their staffs. Not every road crossing is important as a wildlife habitat linkage. Some areas have too much existing habitat fragmentation, too few acres of useable habitat – or are of too little value to justify placing expensive structures for minimal gains. Having mentioned this, many riparian or riverine habitats are highly used by wildlife and often existing or new structures can be used effectively for minimal costs. Using existing drainage and other crossing, with additional fencing or other modifications, is called “retro-fitting” and often can provide substantial benefits with a fraction of the cost of “stand-alone” wildlife crossings. The other issue encountered in developments is using a recreational, traffic or other type of crossing to benefit wildlife. Each situation needs to be analyzed on the merits of the situation. Not every wildlife crossing is going to be an ideal situation, in fact, few are. Any opportunity to improve wildlife habitat connectivity and reduce road or highway mortality should receive serious consideration.

Figure 3. Newberg wildlife crossing in Canada. This is an example of an arch type structure.

Fencing with associated wildlife crossings has been shown to be an effective measure to substantially reduce large animal road-kill mortality and reduce highway collisions (Romin and Bissonette 1996a). The efficacy of various structures to pass wildlife across highways continues to mount ((Foster and Humphrey 1995, Clevenger and Waltho 2003, Gordon and Anderson 2003, Dodd et al. 2007a). There is little doubt that the most effective highway crossing structures are wildlife overpasses and large multi-span “eco-bridges”, but these structures are also more expensive than many DOT’s can or will afford. One of the benefits of wildlife overpasses and
“eco-bridges is that they allow for habitat (grass, shrubs and often tree cover) to extend over or under the highway. For large species like deer and elk, bridges are also favored for highway crossings. These structures are less expensive compared to wildlife overpasses and eco-bridges, but still can cost $3,000,000 per structure, or more. Large box culverts have many of the characteristics of bridges (relatively wide at the top of the structure, which allows light to penetrate), but are usually less expensive. Arches may be the least expensive structures, but also may be the least effective for some species (elk, moose and antelope). Arches and box culverts are readily used by many common large species such as deer, black bear and mountain lion.

Species tend to use all types of structures more over time. This increase in use may extend for 10 years, or more, and make a decision for less costly structures a good alternative. If the animals are resident to the area (as opposed to migratory) and have access year-round to the crossing structure, it is thought that they more exposure and hence may adapt faster than ungulates that only see the structures two or three times per year. Virtually all species (except antelope) use all of the structures defined above. The correct decision as to type and number of structures involves both economic and biological factors. Redundancy is often and important aspect of wildlife crossing efficacy and 2 or 3 structures are often recommended within a wildlife habitat linkage.

**Terrestrial Wildlife Crossings:** The following tools are available to highway agencies and development concerns:

1. **Across Grade Wildlife Crossings:** These are normally situations where traffic volume is relatively low and where wildlife crossing structures are either too expensive, or otherwise not feasible. Fencing may be employed to funnel animals across the highway grade at a specific point. The crossing location might be 50 to 100 feet wide to several hundred yards. The most sophisticated crossings have animal detection systems that are connected to wildlife warning signs that flash or light up only when animals are in the right of way. The “interactive signing” is needed because motorists will not slow down when standard wildlife signs are used (Huijser, et al. March 2009). The downside of across grade wildlife crossings is that the detection systems now available only detect large animals the size of deer and elk (sometimes as small as coyote). The systems currently used often fail for a variety of reasons relating to maintenance, weather and equipment failure. The good news is that the detection and interactive signing is getting better as equipment improvements continue. A recent development is called Electro-MATs which are placed across the highway so animals do not walk into the highway right-of-way and get trapped by the fencing in the traffic lanes. The Electro-
MATs provide a mild electrical shock when animals try to cross them. The cost of an across grade wildlife crossing is not inexpensive, but is less than many higher cost structures would be. Electric power is often provided by solar panels – or directly off power lines when available (Gagnon, et al 2008).

2. **Small Culverts for Reptiles, Amphibians and Small Mammals**: These are usually pipes or box culverts 12” to 24” in diameter or width. These structures are adequate for frogs, lizards, salamanders, toads, small turtles and mammals such as mice, voles, ground squirrels, badger and marmots (Forman, et al. 2003). Wing-fencing is almost always necessary and can be either a plastic or fabric material 18” to 24” in height. Erosion fencing works well for this purpose (used to minimize sediment going into ditches and streams). Wire mesh of ¼” to ½” also can be used. Small pipes work better if a small amount of soil or sand is available throughout the length of the culvert to provide a natural surface (Bank, et al. 2002, Clevenger et al 2001).

![Figure 5. Small culvert in The Netherlands used for badger and other small animals. Note fencing.](image)

3. **Medium-sized Culverts for Reptiles, Amphibians, and Small to Medium Sized Mammals**: Include 24” to 36” pipes and box culverts (Forman, et al. 2003). Three-sided or box culverts are often better wildlife crossing structures than corrugated steel round pipes, since the bottom is flat, wider and more natural than corrugated steel. Concrete is also better than corrugated steel. The reasons for this are that the wider surface area on
the bottom of box culverts provides a better platform for wildlife movement and concrete usually retains or absorbs some moisture, which is important to some species (especially amphibians). Soil, sand or gravel should be placed in the bottom of the structure to provide a more natural surface. Fencing is usually at least 36” tall, with appropriate mesh size to prevent target species from crawling through the fence. Erosion control fencing provides a suitable barrier. Target species include animals up to raccoon (use at least 36” pipes), badger, marmots, skunks and similar sized, or smaller animals. Coyotes and bobcats will use 36” culverts, but structures at least 48” wide or high provide more suitable crossings. Coyotes and bobcats will also jump three foot high fences. Concrete is the recommended structure material, but steel pipe with soil, gravel or sand will also suffice.

4. **Four to Six Foot Culverts for Wildlife up to and Including Coyotes and Bobcats.** Either round or box types (3-sided or box culvert). Concrete is preferred, as are “box” structures. Fencing should be at least four feet high page wire with one or two strands of wire and cannot have areas where coyotes and bobcat will push under the fencing. All animals up to and including coyote and bobcat will use 48” structures, but deer will not use structures this small (Ruediger and DiGiorgio 2007).

5. **Large Animal Wildlife Underpass Crossings.** Size requirements for large animals like deer, bighorn sheep, black bear and mountain lion are generally at least 10 feet high and 20 feet wide (or larger) for deer, bighorn sheep, black bear and mountain lion. For elk, antelope and moose structures at least 12 feet high and 30 feet wide are recommended. Moose and antelope may require larger structures for consistent use – 14 feet to 18 feet
high if possible. Both antelope and moose have been observed using the 12’ x 30’ crossing sizes, but scientific studies are inconclusive at this time as to structure size or types preferred (Clevenger and Waltho 2000, Dodd et al 2007a, Evink 2002, Forman et al 2003, Gordon 2003, Hardy et al 2003, Ruediger et al 2007a, Ruediger and DiGiorgio 2007b, Watson and Klingel 2000).

Figure 7. Wildlife underpass (box culvert) on the Copeland Project, Highway 95, north of Bonners Ferry, Idaho.

Specific Types of Large Animal Wildlife Crossings:

1. **Steel or Concrete Arches:** Are the most economical of large animal underpass designs. Lower cost is a benefit of these structures. Since arches are narrow at the top and wide at the bottom, the amount of direct and ambient light that penetrates the structure is lower than for either box culverts or bridges. All species use arch type structures, but more open designs are often recommended for migratory elk, migratory mule deer, antelope and moose.

   For resident wildlife such as deer and elk, arches provide an economical and effective wildlife crossing. Black bear, mountain lion and most deer readily use arch structures (Forman et al 2003). See fencing section.
2. **Three-Sided Boxes and Box Culverts**: Intermediate in cost and effectiveness for all large species. These structures are wider at the top than arches and allow more light and interior room. All species are known to use adequate sized box type wildlife crossings, including migratory elk, migratory deer, moose and antelope. Cost is usually slightly more than arches, but often worth the additional funds. See fencing section.
3. **Wildlife Bridges:** Are wide at the top and narrower at the bottom. Provide more light and interior space than either box culverts or arches. Also cost more (up to three times as much). Bridges are often recommended for high volume migratory elk herds, grizzly bear and are probably superior for moose and antelope because they are more open. Often used in four-lane or greater, Interstate Highways in combination with divided highways that minimize the length of structure encountered at any one time (Forman et al 2003). See fencing section.
4. **Multi-Span Bridges (Ecobridges or Viaducts):** Almost never built strictly for wildlife alone, but provide high and wide bridges that may span large floodplains, rivers or other habitat. Are often large enough that rain and light are adequate for vegetation to grow naturally under the structures. See fencing section.

![Figure 10. Wildlife bridge in Banff National Park, Canada. Bruce Leeson photo.](image)

![Figure 11. Multispan bridge near Vail, Colorado on I-70. Provides excellent habitat and population connectivity.](image)
5. **Wildlife Overpasses or Ecopasses:** Are expensive, but effective wildlife and habitat connectivity structures. Since these structures span over highways, they are light and receive the same moisture and climate as surrounding natural habitat. Benefits include having the habitat transcend the highway, which provides continuous plant and animal habitat connectivity. The larger of these structures, called ecopasses, are used to connect plant and animal communities and provide superior crossing opportunities for everything from invertebrates (including insects) to grizzly bears. Ecopasses are often used in Europe where they have been constructed for decades and are where acceptance of the extra cost is required. Ecopasses are generally 50 meters, or more in width and are planted with vegetation similar to the surrounding area, including trees. Smaller wildlife overpasses are used where underpass locations are not available for deer, elk, moose, antelope, bighorn sheep and all carnivores. Even these smaller structures provide small strips of native grass or shrub communities and superior to most underpass designs because they are completely open and have natural moon, sun and moisture regimes (Bank et al 2002). See fencing section.

![Figure 12. Wildlife Overpass, Europe.](image)

**Fencing for Large Animals:** Fencing is an important aspect of wildlife crossings for large and small animals. Most animals are intimidated to cross under a highway through a structure that appears unnatural and even dangerous. Fencing forces animals to use crossings, rather than cross highways – which is dangerous for both motorists and wildlife. The usual big game fencing is 8 foot high page wire (stout wire) with sturdy poles (Clevenger et al 2001). Fencing is not an
incidental part of wildlife crossings; either from a planning or cost standpoint. Once a wildlife crossing type and size is determined, a detailed assessment of fencing needs to be conducted. Some fencing will likely be continuous (from one crossing to another) and most will likely be “wing-fencing”, which is placed on all sides to a length that funnels most wildlife into the structure. There is no set length for wing-fencing and it depends on topography and vegetation, target species, cost considerations and other factors. Often, wing-fencing must be monitored for effectiveness and modified if a significant number of animals go around the structure and attempt to cross the highway surface (Dodd et al 2007c).

![Wildlife fencing on TransCanada Highway (for big game). Katie McDermott photo.](image)

In many situations, contractors do not have experience with building wildlife fencing and the result can be fencing that is too fragile or not constructed so that wildlife cannot enter the highway right—of-way. A good source of information on contracting species and wildlife fencing requirements is the following:

MDT’s website has their contract specifications. This information can be accessed at:

http://www.mdt.mt.gov/other/csd/external/us93_corridor_specials/DETAILS/

Also at:

http://www.mdt.mt.gov/other/csd/external/us93_corridor_specials/SECTION%20E

For coyotes, badger and similar sized animals, three foot fencing will usually funnel animals the along highways, but individuals may dig under or climb these fences. Adding two wires on top will provide some additional security and will also dissuade deer from crossing if it is at least 5
feet high. This is for wing fences and not recommended for big game crossings, even if deer are target species.

**Fencing For Small Wildlife:**

There are many situations where fencing will allow small wildlife species to move into structures (could be either existing stream crossings or highway cross ditches) and avoid becoming highway mortality. Fencing for small wildlife is common in Europe, but has not evolved in much of North America (Banks, et al 2002). Often, fencing is an existing element on highways. Most state DOT’s have right-of-way fencing on highways. This fencing can incorporate features to funnel small wildlife species into structures and allow passage across highways. Small wildlife would include animals from approximately the size of raccoons or smaller. It includes wildlife such as small carnivores (weasels, skunks, raccoon and badgers), squirrels, other rodents, snakes, turtles, frogs, toads and salamanders. These species are often not thought of as significant wildlife deserving of protection from road impacts, but are part of the native wildlife that provide citizens with contact with nature. Small wildlife crossings are not as expensive as large wildlife crossings and can often be accommodated with little cost or effort. Fencing for coyotes, badger and similar sized animals should be at least three feet high and be anchored or tightened closely to the ground so animals do not find holes or dig under the fence.

![Figure 14. Screening is used on the bottom half of this wildlife fence in The Netherlands to prevent amphibians and small mammals from crossing onto the highway surface.](image)

There are several fencing designs that will funnel wildlife through culverts or small crossings. These include:
1. Right-of-way fencing. This is often three to four feet high, using page wire (also called sheep fencing or hog wire). Instead of using normal sized mesh (4"x4") mesh size can be reduced to 1”x2” for small mammals (down to large squirrel sized wildlife), or even ¼” x ¼” for reptiles, amphibians and small mammals. Another option is using 18” of small (¼” x ¼”) mesh fencing attached to larger fencing.

2. For only reptiles and amphibians, a stand-alone fence 18” to 24” high will funnel most species. Lizards may climb this fencing. Small (¼” x ¼”) wire mesh or cloth (similar to erosion fencing used on highways) can be used.

Aquatic and Riparian Crossing Recommendations:

Riparian habitats are unusually rich in plant and wildlife abundance and productivity. Many highway and road crossings designed and built even a few decades ago considered only transmission of water. Later on, starting in about 1970, emphasis began to be placed on culverts and bridges moving water and fish (usually adult trout or salmon) through structures. In the last two decades, knowledge of terrestrial and aquatic systems has grown and has changed the way many agencies view stream crossings. Now, there is emphasis on maintaining natural stream channels (with similar bottoms and grade as natural surrounding channels), passage of fish, other aquatic organisms and terrestrial species likely to use riparian channels. Many motorists take note that road-killed wildlife often most common near bridges and culverts that cross streams. This is because many animals use riparian corridors for travel.


(The above is the best and most current Forest Service stream crossing guideline)


Figure 15. Large bottomless arch on a stream on the Wenatchee National Forest. Note that the stream can move within the structure and small animals are allowed passage. USFS photo.
Stream crossings provide an opportunity to allow aquatic and terrestrial animal passage. To allow passage the following should be considered (Also, see Appendix B):

1. A natural substrate (bottom) is recommended to allow fish, aquatic organism and terrestrial animal passage.

2. Adequate dry area is recommended on each side of the structure to allow a natural stream bank for animals needing to pass under the bridge. Ideally, this includes a wetted perimeter next to the water for salamanders and other species that require damp habitat. There should also be adequate dry or upland habitat to allow target species to walk along the stream bank.

3. There should be enough height to the structure to allow passage of target species. Examples of heights necessary include 3’ x 3’ for species up to raccoon in size; 4’ x4’ for species up to coyote and bobcat; 10 feet for species up to deer (includes black bear and cougar) and 12 feet for elk and moose (and antelope until better research is available).

4. Fencing is recommended to funnel animals into the crossing structure and prevent them from accessing the highway.

5. Based on wildlife passage requirements, the best structures are often bottomless, such as bridges, three sided box culverts and arches. In situations where streams are intermittent, cement box culverts and pipes are somewhat better for small animal crossings than corrugated steel pipes. Steel pipes are functional if soil is placed on the bottom to facilitate use. Getting soil into pipes, and keeping it stable if water runs through the structure is challenging.

Bat boxes and Other Structures Useful to Wildlife on Bridges:

Bat boxes can be either designed into, or added to bridges to provide roosting areas for bats. Other structural aspects of bridges useful to wildlife include places where swallows can attach mud nests and roosting areas on top of beams for owls and other birds.
REFERENCES AND LITERATURE CITED


Utah Department of Transportation. September 2005. US 6 final environmental impact statement and section 4 (f) evaluation. UDOT Project Number SP-0005 (51) 172. Volumes I and II.


### APPENDIX D SPECIES WITH POTENTIAL TO OCCUR OR KNOWN HISTORICAL OCCURRENCE IN LA PLATA COUNTY

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>STATUS1</th>
<th>HABITAT ASSOCIATION(S)</th>
<th>CATEGORY</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAMMALS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black-footed ferret (<em>Mustela nigripes</em>)</td>
<td>FE; SE;</td>
<td>Open grasslands with prairie dog colonies year-round.</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Wolverine (<em>Gulo gulo</em>)</td>
<td>SE; SJNF S</td>
<td>Large, remote tracts of boreal forest and alpine tundra.</td>
<td>Terrestrial</td>
<td>Medium</td>
</tr>
<tr>
<td>Canada lynx (<em>Lynx canadensis</em>)</td>
<td>FT; SE</td>
<td>Large tracts of high elevation (&gt;8,000 ft) mixed coniferous forest, especially spruce-fir.</td>
<td>Terrestrial</td>
<td>Medium</td>
</tr>
<tr>
<td>Northern river otter (<em>Lontra canadensis</em>)</td>
<td>ST; SJNF S</td>
<td>Riparian habitats with an abundant food base of fish and/or crustaceans. Minimum estimated water flow is 10 cubic feet per second (cfs).</td>
<td>Aquatic</td>
<td>Medium</td>
</tr>
<tr>
<td>American marten (<em>Martes americana</em>)</td>
<td>SJNF S</td>
<td>Subalpine spruce-fir forests, alpine tundra, and montane forests</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Gunnison’s prairie dog (<em>Cynomys gunnisoni</em>)</td>
<td>SJNF S</td>
<td>Grasslands; semi-desert and montane shrublands</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Botta’s pocket gopher (<em>Thomomys bottae rubidus</em>)</td>
<td>SC;</td>
<td>Sandy soils of valley bottom riparian areas within agricultural areas, grasslands, piñon-juniper woodlands, montane forests/shrublands, and semi-desert shrublands.</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Northern pocket gopher (<em>Thomomys talpoides macrotis</em>)</td>
<td>SC</td>
<td>Grassy prairies, alpine meadows, brushy areas and open pine forests; where deep soils occur.</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Rocky Mountain bighorn sheep (<em>Ovis canadensis canadensis</em>)</td>
<td>SJNF S</td>
<td>Steep, high mountain terrain dominated by grass, low shrubs, rock cover and areas near open escape</td>
<td>Terrestrial</td>
<td>Large</td>
</tr>
<tr>
<td>Desert bighorn (<em>Ovis canadensis nelsoni</em>)</td>
<td>SJNF S; BLM SOC</td>
<td>Dolores River canyons</td>
<td>Terrestrial</td>
<td>Large</td>
</tr>
<tr>
<td>Pronghorn antelope (<em>Antilocapra americana</em>)</td>
<td>BLM SOC</td>
<td>Sagebrush grasslands</td>
<td>Terrestrial</td>
<td>Large</td>
</tr>
<tr>
<td>Townsend’s big-eared bat (<em>Corynorhinus townsendii pallescens</em>)</td>
<td>SC; SJNF S; BLM S</td>
<td>Dry grasslands or forests associated with caves/mines. Forages in riparian, wetland and forest edge habitats.</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Spotted bat (<em>Euderma maculatum</em>)</td>
<td>SJNF S; BLM S</td>
<td>Piñon-juniper woodlands; desert shrublands; possibly riparian areas</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
</tbody>
</table>
# Best Management Practices for Wildlife and Roads in La Plata County

## Appendix D

### SPECIES

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>STATUS</th>
<th>HABITAT ASSOCIATION(S)</th>
<th>CATEGORY</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fringed myotis (Myotis thysanodes)</td>
<td>SJNF S; BLM S</td>
<td>Piñon juniper and other coniferous woodlands</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Allen’s big-eared bat (Idionycteris phyllotis)</td>
<td>BLM S</td>
<td>Montane forests, piñon juniper woodlands, prefers mines, caves for roosting</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Big free-tailed bat (Nyctinomops macrotis)</td>
<td>BLM S</td>
<td>Rocky canyons; lower elevation piñon juniper woodlands, grasslands, and shrublands; roost in caves, mines, rock fissures, or buildings</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
<tr>
<td>Yuma bat (Myotis yumanensis)</td>
<td>BLM S</td>
<td>Piñon juniper woodlands, semi-desert shrublands, and riparian areas</td>
<td>Terrestrial</td>
<td>Small</td>
</tr>
</tbody>
</table>

### BIRDS

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>STATUS</th>
<th>HABITAT ASSOCIATION(S)</th>
<th>CATEGORY</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southwestern willow flycatcher (Empidonax traillii extimus)</td>
<td>FE; SE</td>
<td>Dense, shrubby riparian vegetation, usually in close proximity to surface water or saturated soil.</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Bald eagle (Haliaeetus leucocephalus)</td>
<td>ST; SJNF S; BLM S</td>
<td>Primarily found around lakes, reservoirs and rivers. Large branched trees used for nesting, roosting and foraging.</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>Mexican spotted owl (Strix occidentalis lucida)</td>
<td>FT; ST;</td>
<td>Mature to old growth stands of mixed conifer in canyon/cliff habitat.</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Burrowing owl (Athene cunicularia)</td>
<td>ST;</td>
<td>Dry, open, short-grass plains, usually associated with prairie dog towns.</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Yellow-billed cuckoo (Coccyzus americanus)</td>
<td>FE; SC; SJNF S; BLM S</td>
<td>Cottonwood forest with dense understory vegetation. Minimum habitat patch size 2 ha (Halterman et al. 2006).</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Greater sandhill crane (Grus canadensis tabida)</td>
<td>SC</td>
<td>Migrants use mudflats around reservoirs, agricultural fields, marshes and wet meadows. Breeding range does not include Colorado.</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>Ferruginous hawk (Buteo regalis)</td>
<td>SC; SJNF S; BLM S</td>
<td>Flat or rolling terrain in grassland, shrub-steppe and desert habitats. Winter migrant only.</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>Gunnison sage grouse (Centrocercus minimus)</td>
<td>SC; BLM S</td>
<td>Sagebrush shrub-steps with low vegetation; two known small populations on BLM SJFO.</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>American peregrine falcon (Falco peregrinus anatum)</td>
<td>SC; SJNF S; BLM S</td>
<td>Rugged terrain with rocky cliffs and canyons, 30–1000+ ft high, adjacent to rivers, lakes or streams.</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>Greater sage grouse (Centrocercus)</td>
<td>SC</td>
<td>Sagebrush shrublands are primary habitat; adjacent meadows, grasslands,</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>SPECIES</td>
<td>STATUS</td>
<td>HABITAT ASSOCIATION(S)</td>
<td>CATEGORY</td>
<td>SIZE</td>
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<tr>
<td>---------</td>
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<td>----------------------------------------------------------------------------------------</td>
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<td>-------</td>
</tr>
<tr>
<td>urophasianus</td>
<td></td>
<td>aspen and willow thickets also used in summer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>American bittern (Botaurus lentiginosus)</td>
<td>SJNF S</td>
<td>Marsh, swamp, or bog with cattails, rushes, grasses, and sedges</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>American three-toed woodpecker (Picoides tridactylus)</td>
<td>SJNF S</td>
<td>Mature spruce-fir forests; post-fire areas, especially stand-replacement events</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Black swift (Cypselooides niger)</td>
<td>SJNF S</td>
<td>Vertical rock faces, near waterfalls or in dripping caves</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Brewer’s sparrow (Spizella breweri)</td>
<td>SJNF S</td>
<td>Primarily sagebrush but also in mixed shrublands (rabbitbrush, greasewood, etc)</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Boreal owl (Aegolius funereus)</td>
<td>SJNF S</td>
<td>Mature spruce-fir forest with high canopy closure</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Flammulated owl (Otus flammeolus)</td>
<td>SJNF S</td>
<td>Open ponderosa pine forests; dry montane conifer or aspen forests, often with dense saplings</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Loggerhead shrike (Lanius ludovicianus)</td>
<td>SJNF S</td>
<td>Lowland riparian, pinyon-juniper woodlands, semi-desert shrublands</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Northern goshawk (Accipiter gentilis)</td>
<td>SJNF S; BLM S</td>
<td>Ponderosa pine, aspen, mixed-conifer and spruce-fir forests</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td>Northern harrier (Circus cyaneus)</td>
<td>SJNF S</td>
<td>Grasslands, agricultural lands, mountain sagebrush, and marshes; requires abundant cover (same as for short-eared owl)</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>Olive-sided flycatcher (Contopus cooperi)</td>
<td>SJNF S</td>
<td>Snags and conifers, often on steep slopes, open stands, and natural openings</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Purple martin (Progne subis)</td>
<td>SJNF S</td>
<td>Mature aspen stands near streams, springs, or ponds</td>
<td>Avian</td>
<td>Small</td>
</tr>
<tr>
<td>Short-eared owl (Asio flammeus)</td>
<td>SJNF S</td>
<td>Open habitats including grasslands, marsh edges, shrub-steppe, and agricultural lands; requires taller grass cover than Northern harrier</td>
<td>Avian</td>
<td>Large</td>
</tr>
<tr>
<td>White-tailed ptarmigan (Lagopus leucurus)</td>
<td>SJNF S</td>
<td>Alpine tundra, especially with rock fields and willow carrs</td>
<td>Avian</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>AMPHIBIANS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boreal toad (Bufo boreas boreas)</td>
<td>SE</td>
<td>Springs, streams, ponds, lakes and marshes in spruce-fir or sub-alpine forests or meadows at elevations &gt; 7,000 ft.</td>
<td>Aquatic</td>
<td>Small</td>
</tr>
<tr>
<td>Northern leopard frog (Rana pipiens)</td>
<td>SC</td>
<td>Wet meadows, marshes, ponds, lakes, reservoirs, streams, and ditches.</td>
<td>Aquatic</td>
<td>Small</td>
</tr>
</tbody>
</table>

**FISH**
<table>
<thead>
<tr>
<th>SPECIES</th>
<th>STATUS</th>
<th>HABITAT ASSOCIATION(S)</th>
<th>CATEGORY</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorado pikeminnow (<em>Ptychocheilus lucius</em>)</td>
<td>ST</td>
<td>Large rivers with a strong current, deep pools, eddies, and quiet backwaters.</td>
<td>Aquatic</td>
<td>Small</td>
</tr>
<tr>
<td>Colorado roundtail chub (<em>Gila robusta</em>)</td>
<td>SC</td>
<td>Found in slow moving water of large rivers, adjacent to faster moving water.</td>
<td>Aquatic</td>
<td>Medium</td>
</tr>
<tr>
<td>Colorado River cutthroat trout (<em>Oncorhynchus clarki pleuriticus</em>)</td>
<td>SC</td>
<td>Gravel-bottomed creeks, lakes and small rivers, primarily of the upper Colorado River watershed.</td>
<td>Aquatic</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Note: This list includes species with special conservation status that are known to occur or have the potential to occur in La Plata County, including their status and habitat association(s). This list is a compilation of data made available by the US Fish and Wildlife Service (USFWS), Colorado Division of Wildlife (CDOW), San Juan National Forest (SJNF), and San Juan Bureau of Land Management (SJ BLM).

1FE = Federally Endangered, FT = Federally Threatened, SE = CDOW State Endangered, ST = CDOW State Threatened, SC = CDOW State Species of Concern, SJNF S = San Juan National Forest Sensitive, BLM S = Bureau of Land Management Sensitive

APPENDIX E  WESTERN GOVERNORS' ASSOCIATION POLICY
RESOLUTION 07-01 02/27/07 and MOU BETWEEN
NEW MEXICO, COLORADO, NMDGF, AND CDOW
A. BACKGROUND

1. Large intact and functioning ecosystems, healthy fish and wildlife populations, and abundant public access to natural landscapes are a significant contributing factor to the West's economic and in-migration boom as well as quality of life. Critical wildlife migration corridors and crucial wildlife habitats are necessary to maintain flourishing wildlife populations.

2. The Western States are particularly and uniquely affected by activity occurring in wildlife migration corridors and crucial wildlife habitats. Western States must also contend with an inter-connected mixture of private, state and federal lands. Migration corridors cross all political boundaries and States need to protect migration corridors on federal land through various state planning documents.

3. Natural resource development, urban development, and maintenance of the existing infrastructures of the West impact wildlife species, their habitats and migration corridors. Western States are increasingly expending limited state funds to participate in federal public land resource management planning as a result of the growing national focus on energy production and independence. States continue to expend scarce funds to protect or mitigate impacts to wildlife resources by energy development.

4. States possess broad trustee, police powers and primacy over fish and wildlife within their borders. With the exception of marine mammals, states retain concurrent jurisdiction even where Congress has directed specific federal authority of fish and wildlife species.

5. Typically, Resource Management Plans (RMPs) prepared by the Bureau of Land Management (BLM) and Forest Management Plans (FMPs) prepared by the Forest Service are completed to provide broad scale land use allocations or land suitability. Impacts are not evaluated to provide specific information related to impacts on local wildlife populations, wildlife migration corridors, and crucial wildlife habitats. Wildlife corridors and crucial wildlife habitat are identified in the RMP/FMP development process in consultation with state agencies. “Crucial” includes species with the greatest conservation need as described in the Comprehensive Wildlife Conservation Strategy, Wildlife Action Plans or other similar documents of respective States.

6. The Energy Policy Act of 2005 provides 5 categorical exclusions located in Section 390. Subpart B (3) reads: “Drilling an oil or gas well within a developed field for which an approved land use plan or any environmental document prepared pursuant to NEPA
analyzed such drilling as a reasonably foreseeable activity, so long as such plan or document was approved within 5 years prior to the date of spudding the well.”

7. Because a land use plan does not typically evaluate site specific impacts, site or project specific NEPA analyses are necessary for protecting unique wildlife habitat such as migration corridors which will be carried through to permitting conditions.

B. GOVERNORS’ POLICY STATEMENT

1. The Western Governors urge Congress to amend Section 390. Subpart B (3) of the Energy Policy Act of 2005 to remove the categorical exclusion for NEPA reviews for exploration or development of oil and gas in wildlife corridors and crucial wildlife habitat on federal lands. By removing the categorical exclusion, appropriate environmental site analysis will be completed as necessary to protect crucial wildlife habitat and significant migration corridors located in the field of development.

2. Until Congress amends Section 390 Subpart B (3) of the Energy Policy Act of 2005 the Western Governors ask the Secretaries of the Interior and Agriculture to consider placing a moratorium on such categorical exclusions in crucial habitat or migration corridors, and to work collaboratively with the states to ensure that states’ concerns in preserving wildlife migration corridors and crucial wildlife habitats are met.

3. One possible way to achieve such protection of wildlife corridors and habitat would be for the federal land management agencies and the states to agree when and where additional environmental analyses and possible protections or conditions of approval need to be put in place, for example once the land manager receives a full field development plan. The BLM should also use its land use plans and amendments to consider incorporation of State or other Federal agencies, local governments, and Indian tribes approved or adopted resource-related plans, including but certainly not limited to big game population objectives.

4. Additionally, the Western Governors would like to see the federal land managers, working with the states, develop a performance-based, objective protocol for permits to drill that includes industry monitoring of how well the protocol is being met, and enforcement by the federal agencies should the monitoring determine that the protocol is not being met.

5. The Western Governors believe that the Western States, working in partnership with the federal land management agencies, Department of Defense, Western and National Association of Fish and Wildlife Agencies, the energy industry, and conservation groups, should identify key wildlife migration corridors and crucial wildlife habitats in the West and make recommendations on needed policy options and tools for preserving those landscapes.
C. GOVERNORS' MANAGEMENT DIRECTIVE

1. The Western Governors direct WGA to work with Congress, the Administration, and other appropriate entities to implement the policies contained in this resolution.

2. The Western Governors direct WGA to establish a wildlife migration corridors and crucial habitats working group to oversee staff’s implementation of this resolution, particularly the collaborative effort pursuant to policy statement B.5.

3. The Western Governors direct WGA to seek funding to help pay the costs of the collaborative effort to implement policy statement B.5.
MEMORANDUM OF UNDERSTANDING
BETWEEN AND AMONG
STATE OF NEW MEXICO,
STATE OF COLORADO,
NEW MEXICO DEPARTMENT OF GAME AND FISH,
AND
COLORADO DIVISION OF WILDLIFE

PURPOSE

This Memorandum of Understanding (“MOU”) establishes and formalizes the intent to cooperate through the sharing of data, coordinated planning and joint development of strategies to facilitate the management of shared wildlife corridors between the State of New Mexico and the State of Colorado.

WHEREAS, the States of Colorado and New Mexico are members of the Western Governors’ Association;

WHEREAS, a Western Governors’ Association initiative is to identify and protect Wildlife Corridors across the Western United States;

WHEREAS, the Colorado Division of Wildlife and the New Mexico Department of Game and Fish are responsible for managing wildlife in their respective States;

WHEREAS, both the States of Colorado and New Mexico recognize the necessity for many species of wildlife to migrate from one location to another at different times of the year irrespective of political boundaries and that many of these animals migrate across the Colorado-New Mexico border, and;

WHEREAS, the State of Colorado and the State of New Mexico are concerned about potential negative impacts to the habitat connectivity, travel and migration corridors as a consequence of a variety of land use activities on the landscape.

THEREFORE, BE IT RESOLVED THAT, the State of New Mexico through the New Mexico Department of Game and Fish, and the State of Colorado through the Colorado Division of Wildlife, will work together as a team to:

- Identify key habitat connectivity, travel and migration corridors used by elk, deer, pronghorn antelope and bighorn sheep, and, as identified by the two states, other key species of wildlife that migrate across the shared border between the State of Colorado and the State of New Mexico;
• Evaluate and prioritize these corridors, using the best available science, in respect to their importance and identify key habitat connectivity, travel and migration corridors to be further evaluated;

• Consult with and involve the Southern Ute Indian Tribe, Ute Mountain Tribe, and/or Jicarilla Apache tribal governments when a key habitat connectivity, travel and migration corridor crossing tribal land is identified;

• Map the key habitat connectivity, travel and migration corridors to the greatest extent possible using a mutually agreeable geospatial mapping system and consistent protocols to inform the decision-making processes in both States;

• Identify existing and potential land use changes and other impediments that are limiting, may limit or may eliminate the viability of key wildlife corridors;

• Develop and prioritize strategies that will positively contribute to the protection of key wildlife corridors, consistent with shared conservation objectives;

• Share recommended strategies with land management agencies, counties, municipalities, non-governmental entities, and the public, to inform and guide future decision-making processes.

FURTHER, IT IS MUTUALLY AGREED AND UNDERSTOOD THAT,

• This MOU and resulting work products shall not restrict or impede legal authorities, responsibilities or obligations vested in either State or their respective agencies.

• Specific work projects or activities that involve the transfer or expenditure of funds, services or property among the parties to this MOU will require the execution of separate agreements or contracts.

• Nothing in this MOU shall obligate the parties to expend appropriations or to enter into any contract or other obligations.

• This MOU may be modified or amended upon written request of either party and the subsequent written concurrence of the other party. Participation in this MOU may be terminated with a 60-day written notice to the other party.

• This MOU shall have a term of 5 (five) years from the date of approval. At the end of this period this MOU shall expire unless canceled, extended or renewed.

Agreed upon this 4th day of December, 2009.

Bill Richardson, Governor
State of New Mexico

Bill Ritter, Jr., Governor
State of Colorado
Tod Stevenson, Director
New Mexico Department of Game and Fish

Tom Remington, Director
Colorado Division of Wildlife

Rev. 12.4.09