US 93 North Post-Construction Wildlife-Vehicle Collision and Wildlife Crossing Monitoring and Research on the Flathead Indian Reservation between Evaro and Polson, Montana

Quarterly Report 2012-1

by

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A report prepared for the
Montana Department of Transportation
2701 Prospect Drive,
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October 22nd 2012

ACKNOWLEDGEMENTS

The authors of this report would like to thank the Montana Department of Transportation (MDT) for funding this research and the Confederated Salish and Kootenai Tribes (CSKT) for granting access to the reservation for this research. Additional support was provided by the U.S. Department of Transportation through the Research & Innovative Technology Administration. The authors would also like to thank Kris Christensen (MDT Research Section (project manager)) and the other members of the technical panel: Pat Basting (MDT Environmental Bureau), Dale Becker (CSKT), Kevin Christensen (MDT Construction Engineer), Vickie Edwards (Montana Fish, Wildlife & Parks (MTFWP), Jonathan Floyd (MDT Traffic Safety Bureau), Bonnie Gundrum, (MDT Environmental Bureau), Scott Jackson (US Fish and Wildlife Service (USFWS), Doug Moeller (MDT Missoula District Administrator), Sue Sillick (MDT Research Section), and Mark Zitzka (Federal Highway Administration (FHWA)). Finally, the authors would like to thank Dale Becker (CSKT), Amanda Hardy (Colorado State University), Kari Enes, AJ Bigby, Virginia "Tiny" Williams, Bruce Maestas, and Stephanie Gillen (all CSKT), and Steve Albert, Tiffany Allen, Rob Ament, Jeralyn Brodowy, Ben Dorsey, Jerry Stephens (all Western Transportation Institute – Montana State University (WTI-MSU)) for their help.

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EXECUTIVE SUMMARY

This report contains a brief description of the progress on the tasks for the US 93 North wildlife mitigation evaluation project on the Flathead Indian Reservation between Evaro and Polson, Montana. The mitigation measures consist of wildlife fencing combined with wildlife underpasses and overpasses, jump-outs, and wildlife guards at access roads. The research objectives relate to investigating the effect of the mitigation measures on human safety (an expected reduction in wildlife-vehicle collisions), habitat connectivity for wildlife (wildlife use of the crossing structures), and a cost-benefit analysis for the mitigation measures. This report documents the work conducted between 1 January 2012 and 31 March 2012.

In this quarter, the research team continued data entry from cameras, monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill, and monitoring of the wildlife guards and human access point. The research team also finalized the compilation of the costs for the mitigation measures and started preparations for the weed spraying of the tracking beds at the jump-outs. Furthermore, the research team met with MDT to discuss initiating the 5th year of data collection in Ravalli Curves and Ravalli Hill. MDT allocated $50,000 (through STEP program) to allow the 5th year of data collection to be initiated. Finally, a new student, Elizabeth Fairbank started her MSc. Thesis on the benefits of wildlife fencing associated with isolated wildlife crossing structures.

1. INTRODUCTION

1.1. Background

The US Highway 93 North (US 93 N) reconstruction project on the Flathead Indian Reservation in northwest Montana represents one of the most extensive wildlife-sensitive highway design efforts in North America. The reconstruction of the 56 mile (90 km) long road section includes the installation of 41 fish and wildlife crossing structures, 2 underpasses for live-stock, 1 bicycle/pedestrian underpass, and approximately 8.3 miles (13.4 km) of road with wildlife exclusion fencing on both sides (excluding future mitigation measures in the Ninepipes wetland area). The mitigation measures are aimed at improving safety for the traveling public through reducing wildlife-vehicle collisions and allowing wildlife to continue to move across the landscape and the road. Other examples of relatively long road sections in North America with a high concentration of wildlife crossing structures and wildlife fencing are I-75 (alligator alley) in south Florida (24 crossing structures over 40 mi; Foster & Humphrey 1995), the Trans-Canada Highway in Banff National Park in Alberta, Canada (24 crossing structures over 28 mi (phase 1, 2 and 3A); Clevenger *et al.* 2002), State Route 260 in Arizona (17 crossing structures over 19 mi; Dodd *et al.* (2006)), and I-90 at Snoqualmie Pass East in Washington State (about 30 crossing structures planned over 15 mi; WSDOT 2007). Both the road length and number of wildlife crossing structures of US 93 N on the Flathead Indian Reservation makes it the most extensive mitigation project of its kind in North America to date. If the section of US 93 South (S) (south of Missoula, Bitterroot valley) is included, the mitigation measures along US 93 are even more substantial.

The magnitude of the US 93 N reconstruction project and associated mitigation measures provide an unprecedented opportunity to evaluate to what extent these mitigation measures help improve safety through a reduction in wildlife-vehicle collisions, maintain habitat connectivity for wildlife (especially deer (*Odocoileus* spp.) and black bear (*Ursus americanus*)), and what the monetary costs and benefits are for the mitigation measures. In addition, the landscape along US 93 N is heavily influenced by human use. This is in contrast to the more natural vegetation along most of the other road sections that have large scale wildlife mitigation in North America. As the roads with most wildlife-vehicle collisions are in rural areas, the results from the US 93 N project are expected to be of great interest to agencies throughout North America (Huijser *et al.* 2008).

In 2002, prior to US 93 N's reconstruction, the Western Transportation Institute at Montana State University-Bozeman (WTI-MSU) was funded by the Federal Highway Administration (FHWA) and the Montana Department of Transportation (MDT) to initiate a before-after field study to assess the effectiveness of the wildlife mitigation measures and to document events and decisions that shaped the process of planning and designing the mitigation measures. Preconstruction field data collection efforts were completed in the fall of 2005 and a final report on the preconstruction monitoring findings was published in January 2007 (Hardy *et al.* 2007).

In 2010 MDT contracted with WTI-MSU to conduct the post-construction research with regard to the effectiveness of the mitigation measures. For this project, the Confederated Salish and Kootenai Tribes (CSKT) act as a subcontractor to WTI-MSU.

1.2. Objectives

Consistent with the direction provided by MDT, the project has the following objectives:

- Investigate the effect of the mitigation measures on human safety through an anticipated reduction in wildlife-vehicle collisions;
- Investigate the effect of the mitigation measures on the ability to maintaining habitat connectivity for wildlife (especially for deer (white-tailed deer [*Odocoileus virginianus*] and mule deer [*Odocoileus hemionus*] combined) and black bear (*Ursus americanus*) through the use of the wildlife crossing structures; and
- Conduct a cost-benefit analyses for the mitigation measures.

This document is part of a series of quarterly reports detailing the progress on these tasks.

1.3. Milestones

This project covers a period of 5.5 years (15 January 2010 – 30 June 2015). The table below provides an overview of the most important milestones.

Table 1.: Overview of Milestones.

Description Milestones	Date accomplished
Contract signed between MDT and WTI-MSU and in effect	15 January 2010
Kick-off and 1st technical panel meeting	2 February 2010
Subcontract signed between WTI-MSU and CSKT	13 May 2010
Subcontract in effect between WTI-MSU and CSKT	15 April 2010
Field visit and presentation preliminary data 2008-2010 for technical panel	24 June 2010
A field visit for technical panel was suggested but declined	February 2012
$50,000 (obtained through STEP program) was added by MDT to the project to allow the 5th year of data collection to start in Ravalli Curves and Ravalli Hill	March 2012

1.4. Related Activities

Student projects:

- "The effectiveness of wildlife guards and the use of wildlife crossing structures by deer and black bear" (Tiffany Allen, MSc. candidate at Department of Ecology, Montana State University, Bozeman, main advisor Dr. Scott Creel, 2008 - 2011). Tiffany's research focuses on the mitigation measures in Ravalli Curves and Ravalli Hill. Tiffany successfully defended her thesis on 8 A pril 2011. A manuscript on the barrier effect of

wildlife guards on deer and black bear was submitted to a scientific journal. The journal suggested a revision, and the authors are working on addressing the comments.

- "Appropriate type and dimensions of wildlife crossing structures for various wildlife species, specifically deer and black bear" (Jeremiah Purdum, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2010-2012). The emphasis of Jeremiah's project is on investigating the appropriate type and dimension of crossing structures for selected species taking their presence and abundance in the surrounding landscape into consideration, as well as their behavior when approaching the crossing structures.
- "The effect of cover in and at crossing structures on the use by amphibians and small mammals" (Hayley Conolley-Newman, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2011-2013). Selected crossing structures have been provided with cover in January-February 2012. These structures will be monitored for the presence of amphibians and small mammals before and after cover has been provided. The "before measurement took place in the fall of 2011. The expectation is that the presence of cover will not only benefit amphibians and small mammals but also invertebrates and reptiles.
- "The benefits of wildlife fencing associated with isolated crossing structures". (Elizabeth Fairbank, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2012-2013). Isolated crossing structures with varying length of wildlife fencing will be monitored for wildlife crossings through the structures and at fence ends. The purpose of this study is to investigate the benefits of increasing lengths of wildlife fencing in terms of the proportion of safe crossings by deer, particularly white-tailed deer. Suitable structures will be monitored throughout Montana.
- Through outreach funding (see below), Kylie Paul and CSKT provided presentations to school children in the region. Students were asked to participate in a drawing contest. The drawings need to show wildlife and roads or traffic, or wildlife and mitigation measures such as crossing structures, jump-outs or wildlife guards. Winners were selected by a jury, and the winning entries were also displayed at "art walk" (First Friday) in Missoula on Fri 3 February at Noteworthy Paper & Press. In addition a outreach website, an outreach logo, a twitter account and a Facebook page were set up for communicating the results of the research into the effectiveness of the mitigation measures along US 93 N (see below.

http://www.peopleswaywildlifecrossings.org

http://www.facebook.com/US93PeoplesWay

https://twitter.com/US93PeoplesWay

- On a continuous basis excursions to the mitigation measures along US 93 N are provided.
- An intern (Taylor Hopkins) worked on the US93 N project. Taylor is a student in the Wilderness and Civilization program at the University of Montana, Missoula. Taylor helped with field work, monitored cameras at jump-outs and made plywood plates for the reptile and amphibian study. Taylor will volunteer through April 2012.

Additional funding sources:

CSKT received a Tribal Wildlife Grant (TWG) from the US Fish and Wildlife Service. About $40k of this grant will be dedicated to activities and materials related to the investigation of the effectiveness of the mitigation measures along US 93 N (personal communication Dale Becker, CSKT).

In March 2012 MDT allocated an additional $50,000 to the research project. These funds were obtained through the STEP program. These funds allowed the researchers to start the 5th year of data collection in Ravalli Curves and Hill (2012), though this effort is still $6,658 short. Note: There is an additional $119,401 required for the 5th year of data collection in Evaro in 2015.

Additional funding sources for outreach received:

• TransWild	$2,500	2010
• Defenders of Wildlife	$2,000	2010
• Yellowstone to Yukon Conservation Initiative	$3,000	2010
• Dennis and Phyllis Washington Foundation	$10,000	April 2011
• Y2Y Minigrant	$2,500	April 2011
• Mountaineers Foundation	$4,000	June 2011
• Transwild	$2,500	August 2011

2. MITIGATION MEASURES AND HUMAN SAFETY

Activities this quarter:

No activities this quarter.

Anticipated activities next quarter:

New data (through 2011) will be requested from MDT next quarter.

3. MITIGATION MEASURES AND HABITAT CONNECTIVITY FOR WILDLIFE

3.1. Road Sections with Continuous Fencing and Crossing Structures

The preconstruction research measured the number of animals, especially deer and black bear, that crossed the road before the road was widened and before the mitigation measures were put in place. For this purpose dozens of tracking beds (100 m long, 2 m wide) were installed along the road, covering about 30% of the road sections that would later be fenced. Now that the road has been widened and the fences and crossing structures are in place, the animals can only cross the road by using the crossing structures (although some animals may cross wildlife guards or climb fences). The wildlife use of the crossing structures are measured through camera traps. A camera trap consists of an automated camera that detects and then photographs wildlife. Because cameras may have a different detection probability for wildlife than sand tracking beds, a relationship between crossings measured through camera images and crossings measured through tracking beds must be established. Therefore four crossing structures have a tracking bed placed inside and outside the structures. The outside tracking beds are exposed to the elements, similar to pre-construction methods. The selected four crossing structures have a relatively high use by deer and black bear, which should result in a high enough sample size to establish this relationship.

There are several wildlife guards (similar to cattle guards) to discourage ungulates from entering the fenced road corridor at access roads. Wildlife guards that receive relatively little use by humans are monitored to measure how much of a barrier they really are to different wildlife species. Two structures were monitored starting in 2008. Additional structures for monitoring were selected in summer 2010.

Animals that do end up in the fenced road corridor may escape by using one of the jump-outs. These jump-outs allow animals to walk up to the height of the fence and then jump down to safety. Ideally, the jump-outs should be low enough so that animals readily jump down to safety but high enough to discourage them from jumping into the fenced road corridor. To investigate appropriate jump-out height, jump-outs in the Ravalli Curves (RC) and Hills (RH) sections have already been monitored through tracking beds since 2008 (summer only). Fortunately relatively few animals end up in the fenced road corridor, but this also means it takes time to collect a high enough sample size. In summer 2010 the jump-outs in the Evaro section (EV) were included in further monitoring. One of the jump-outs also has a camera trap installed. Note that many of the names for the structures consist of a two letter code (based on the area) followed by a number (based on the numbering of the 100 m road segments). Other structure names are based on the location, and then written in full, or on their specific purpose.

Activities this quarter:

- Continued data entry from cameras.
- Continued monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill.
- Continued monitoring of the wildlife guards.

- Preparations were made for the weed spraying of the tracking beds at the jump-outs in Evaro, Ravalli Curves and Ravalli Hill.

The status of the field work and the dates or periods that data were collected are summarized in Table 2.

Table 1: Activities Road Sections with Continuous Fencing and Crossing Structures.

Description Activities	**Date or period monitored**
Crossing Structures Ravalli Curves and Ravalli Hill	
Tracking on tracking beds in the wildlife crossing structures in Ravalli Curves (9 wildlife crossing structures) and Ravalli Hill (2 wildlife crossing structures) took place from May 2008 until 26 February 2010. These data were supplemented by images from a limited number of cameras.	23 May 2008 – 26 February 2010
Camera traps were installed at all remaining crossing structures in Ravalli Curves and Ravalli Hill. The cameras, battery status and memory card status were checked once a month from 26 February 2010 onwards. Tracking in the structures coincides with the camera checks, and is supplemental to the images from the cameras from this date onwards. Note: most of the cameras were positioned outside the structure to be able to collect data on animal behavior as they approach the crossing structures.	26 February 2010 - present
The structures RC 396, RC 427, RC 432, and RH 459 had a tracking bed installed outside the structures. Tracking, twice a week, on the beds outside as well as inside the structures took place between 9 August 2010 and 2 November 2010, and between 27 May 2011 and 25 October 2011.	9 August 2010 - 2 November 2010, and 27 May 2011 – 25 October 2011.
Crossing Structures Evaro	
Partial coverage wildlife overpass (partial coverage with 4 cameras; 6-29 July 2010) (full coverage 1 approach with 7 cameras; 29 July 2010- 18 August 2010, full coverage both approaches 8 August 2010-present).	6 July 2010 – present
Montana Rail Link underpass (partial coverage with 2 cameras 8 September 2010) full coverage from 18 September 2010 onwards.	18 September 2010 - present
The other structures in the road section with continuous fencing in Evaro had cameras installed 3 September 2010 with full coverage from 8 September 2010 onwards	8 September 2010 - present
Livestock underpasses	
One camera was installed at livestock underpass near McClure Rd on 24 June 2011. The cameras, battery status and memory card status were checked once a month from 24 June 2011 onwards.	24 June 2011 – autumn 2011
Wildlife guards	
Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section took place on a biweekly basis from July 2008 until 26 February 2010.	July 2008 – 26 February 2010

Continued - Table 2: Activities Road Sections with Continuous Fencing and Crossing Structures.

Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Camera traps at two additional wildlife guards were installed on 20 October 2010 (guard just north of RC 396) and 31 October 2010 (guard north of RC 381 on east side). One camera has a technical problem (removed 1 May 2011). The repaired camera was used at another location that had higher priority. The other camera was removed 21 October 2011 to a location with a higher priority. Cameras reinstalled 20 March 2012.	20 October 2010- 1 May 2011 / 21 October 2011 20 March 2012 - present
Jump-outs	
Tracking beds in Ravalli Curves and Ravalli Hill were monitored from May 2008 until September 2009 (summer only).	July 2008 – September 2009
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 13 June 2010. Monitoring continued on a weekly basis until 2 November 2010. Further monitoring to start in May 2011.	13 June 2010 – 2 November 2010
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 2 May 2011. Monitoring continued on a weekly basis until 25 October 2011.	27 May 2011 – 25 October 2011
Tracking beds were installed in the Evaro section on 20 July 2010. Monitoring took place on a weekly basis between 4 August 2010 and 2 November 2010. Further monitoring to start in May 2011.	4 August 2010 - 2 November 2010.
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Evaro (23 jump-outs in total) on 27 May 2011. Monitoring continue on a weekly basis through 25 October 2011.	27 May 2011 – 25 October 2011
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a biweekly basis until 26 February 2010.	July 2008 – 26 February 2010
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Human access point Ravalli Curves	
Camera trap at the human access point was installed on 5 March 2011 (south end, west side of road)	5 March 2011 - present
Fence ends (north end Evaro fencing)	
Two camera traps were installed at two fence ends of the Evaro fencing on 4 April 2011 (north end, east and west side of road)	4 April 2011 – 16 Sep 2011 (NE) 4 April 2011 – 19

	Aug 2011 and 16 Sep 2011 – 1 Jan 2012
Pellet group counts	
Pellet group counts were conducted in the Ravalli Curves and Ravalli Hill section between 23 August and 15 September 2010	23 August 2010 - 15 September 2010
Pellet group counts were conducted in the Evaro, Ravalli Curves and Ravalli Hill section between 24 August 2011 and 8 September 2011.	24 August 2011 - 8 September 2011

3.2. Road Sections with Isolated Underpasses

A large part of North America consists of landscapes heavily altered and used by humans. Such areas can nonetheless be important for nature conservation and large wild ungulates such as deer may even be abundant. Wildlife-vehicle collisions may also occur in such landscapes, but because of the human use and presence certain types of mitigation measures such as long sections of wildlife fencing are not always possible or appropriate. While crossing structures may still allow for safe crossings by wildlife, there may only be limited fencing, or sometimes no fencing, associated with such structures. Ten of such "isolated" structures are monitored for this project to evaluate their effectiveness. The structures and periods they were monitored are listed in Table 3.

Activities this quarter:

- Continued monitoring of the isolated structures.

Table 2: Isolated Structures Monitored.

Structure name	Date or period monitored through December 2009	Date or period monitored from 1 Jan 2010 onwards
North Evaro	None	6 July 2010 – present
Schley creek	None	29 June 2010 – present
East Fork Finley creek	None	4 October 2010 - present
Pistol creek 1 (station 498+55.7)	November 2007-1 January 2008 27 August 2009- 31 December 2009	1 January 2010 – present
Pistol creek 2 (station 501+63)	August 2009- 31 December 2009	1 January 2010 – present
Mission creek (station 528+90)	September 2009 – 31 December 2009	1 January 2010 – present (south bank) 13 October 2010 – present (north bank)
Post creek 1 (station 550+56.6)	November 2007 - May 2009	29 June 2010 – present
Post creek 2 (station 555+06)	November 2007 – October 2008 January 2009 – May 2009 August 2009 – 31 December 2009	1 January 2010 – present
Post creek 3 (559+98.4)	November 2007 – 31 December 2009	1 January 2010 – present
Spring creek 1 (774+00)	May 2009 - December 2009	1 January 2010 – present
Spring creek 2	None	11 March 2010 – present
Mud creek	23 June 2009 – 23 July 2009	None
Polson Hill	None	11 October 2010 - present

3.3. Anticipated Activities 2nd Quarter 2012

1. Update the protocol for releasing images.
2. Catching up with data interpretation and entry from cameras.
3. Start field season tracking in May

4. COST-BENEFIT ANALYSIS

Activities this quarter:

- The research team finalized organizing the cost information regarding the mitigation measures.
- The research team discussed the data with Pat Basting (MDT) on 26 January 2012.

5. OTHER FINDINGS

No specific other findings to report.

6. SCHEDULE AND BUDGET

The planned and the actual schedule through 2012 are shown in Table 4. T he percentage completion for each task is shown in Table 5.

Table 3: Planned Schedule 2011-2012.

	2011				2012			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Deer and black bear vehicle collisions								
Summary crash and carcass data								
2. Wildlife use of underpasses								
Cameras operational structures RC and RH								
Cameras operational structures EV								
Cameras operational isolated structures								
Tracking beds operational outside 4 structures								
Cameras operational fence ends								
Cameras operational 2 guards RC								
Cameras operational additional guards								
Camera operational at people access point RC								
Camera operational 1 jump-out								
Tracking beds operational jump-outs RC and RH								
Tracking beds operational jump-outs EV								
Deer pellet group counts								
3. Cost-benefit analyses								
Obtain cost data from MDT								

Legend
- planned
- on schedule
- ahead
- behind

Table 4: Percentage Complete.

Task	Planned Percentage complete	Actual Percentage complete
1. Deer and black bear vehicle collisions	45%	45%
2. Wildlife use of underpasses	45%	40%*
3. Cost-benefit analyses	45%	45%

*Behind on data entry

Through 31 March 2012 the total amount spent (15 January 2010 – 31 March 2012) on the MDT account for the project was $ 90,887 (Figure 1). This was less than budgeted. The difference is mostly explained by bills that have not been received yet (e.g. from CSKT) and student involvement.

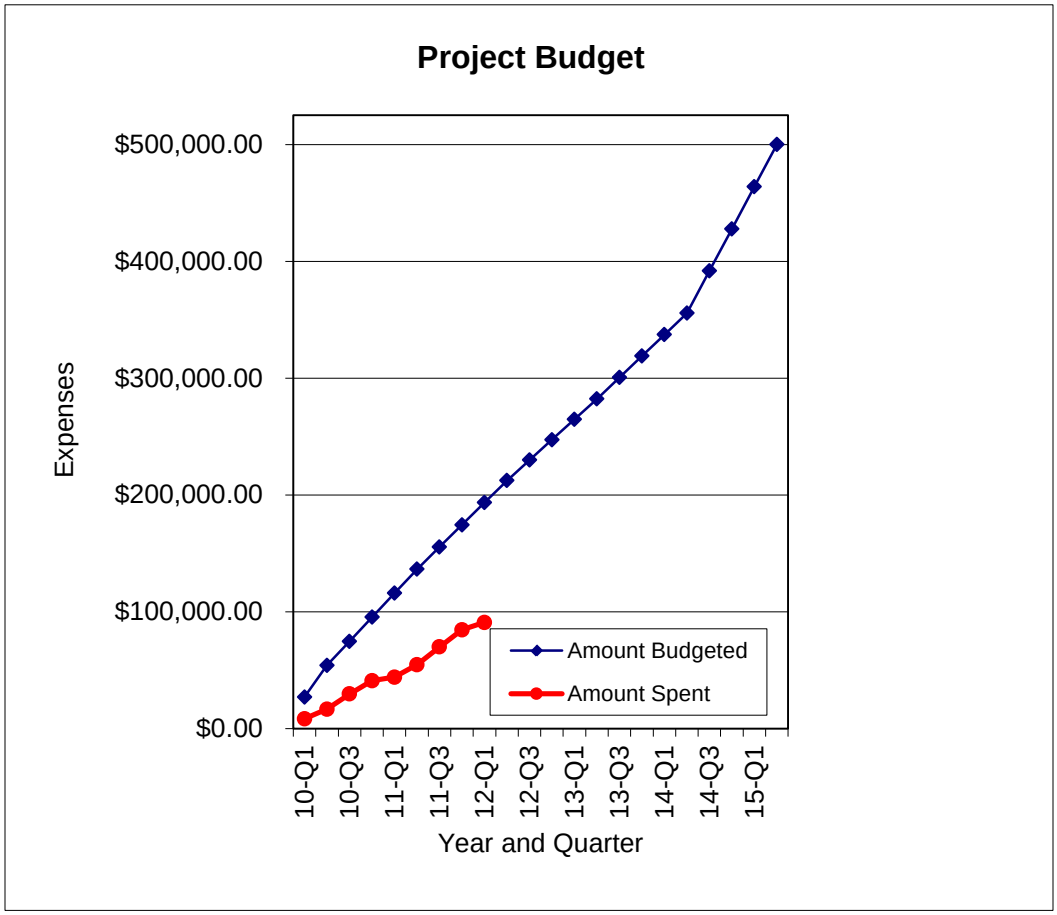

Figure 1: Project budget MDT account; cumulative expenses, with a distinction between the amount that was budgeted (blue line) and the amount that was actually spent (red line) through 30 June 2015. Note that the budgeted amount and the actual amount spent are cumulative. For example, the expenses for the quarter that this report relates to have been added to the total expenses incurred through the previous quarter (red line). Note that the actual amount available through MDT is now $550,000 ($50,000 was added in March 2012 for 5th year in Ravalli Curves and Ravalli Hill).

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A report prepared for the
Montana Department of Transportation
2701 Prospect Drive,
Helena, Montana

October 22nd 2012

ACKNOWLEDGEMENTS

The authors of this report would like to thank the Montana Department of Transportation (MDT) for funding this research and the Confederated Salish and Kootenai Tribes (CSKT) for granting access to the reservation for this research. Additional support was provided by the U.S. Department of Transportation through the Research & Innovative Technology Administration. The authors would also like to thank Kris Christensen (MDT Research Section (project manager)) and the other members of the technical panel: Pat Basting (MDT Environmental Bureau), Dale Becker (CSKT), Kevin Christensen (MDT Construction Engineer), Vickie Edwards (Montana Fish, Wildlife & Parks (MTFWP), Jonathan Floyd (MDT Traffic Safety Bureau), Bonnie Gundrum, (MDT Environmental Bureau), Scott Jackson (US Fish and Wildlife Service (USFWS), Doug Moeller (MDT Missoula District Administrator), Sue Sillick (MDT Research Section), and Mark Zitzka (Federal Highway Administration (FHWA)). Finally, the authors would like to thank Dale Becker (CSKT), Amanda Hardy (Colorado State University), Kari Enes, AJ Bigby, Virginia "Tiny" Williams, Bruce Maestas, and Stephanie Gillen (all CSKT), and Steve Albert, Tiffany Allen, Rob Ament, Jeralyn Brodowy, Ben Dorsey, Jerry Stephens (all Western Transportation Institute – Montana State University (WTI-MSU)) for their help.

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In this quarter, the research team continued data entry from cameras, monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill, and monitoring of the wildlife guards and human access point. The research team also restored the tracking beds at the jump-outs and started monitoring tracks again for the season. Additional funding was obtained from Y2Y for outreach activities.

1. INTRODUCTION

1.1. Background

The US Highway 93 North (US 93 N) reconstruction project on the Flathead Indian Reservation in northwest Montana represents one of the most extensive wildlife-sensitive highway design efforts in North America. The reconstruction of the 56 mile (90 km) long road section includes the installation of 41 fish and wildlife crossing structures, 2 underpasses for live-stock, 1 bicycle/pedestrian underpass, and approximately 8.3 miles (13.4 km) of road with wildlife exclusion fencing on both sides (excluding future mitigation measures in the Ninepipes wetland area). The mitigation measures are aimed at improving safety for the traveling public through reducing wildlife-vehicle collisions and allowing wildlife to continue to move across the landscape and the road. Other examples of relatively long road sections in North America with a high concentration of wildlife crossing structures and wildlife fencing are I-75 (alligator alley) in south Florida (24 crossing structures over 40 mi; Foster & Humphrey 1995), the Trans-Canada Highway in Banff National Park in Alberta, Canada (24 crossing structures over 28 mi (phase 1, 2 and 3A); Clevenger *et al.* 2002), State Route 260 in Arizona (17 crossing structures over 19 mi; Dodd *et al.* (2006)), and I-90 at Snoqualmie Pass East in Washington State (about 30 crossing structures planned over 15 mi; WSDOT 2007). Both the road length and number of wildlife crossing structures of US 93 N on the Flathead Indian Reservation makes it the most extensive mitigation project of its kind in North America to date. If the section of US 93 South (S) (south of Missoula, Bitterroot valley) is included, the mitigation measures along US 93 are even more substantial.

The magnitude of the US 93 N reconstruction project and associated mitigation measures provide an unprecedented opportunity to evaluate to what extent these mitigation measures help improve safety through a reduction in wildlife-vehicle collisions, maintain habitat connectivity for wildlife (especially deer (*Odocoileus* spp.) and black bear (*Ursus americanus*)), and what the monetary costs and benefits are for the mitigation measures. In addition, the landscape along US 93 N is heavily influenced by human use. This is in contrast to the more natural vegetation along most of the other road sections that have large scale wildlife mitigation in North America. As the roads with most wildlife-vehicle collisions are in rural areas, the results from the US 93 N project are expected to be of great interest to agencies throughout North America (Huijser *et al.* 2008).

In 2002, prior to US 93 N's reconstruction, the Western Transportation Institute at Montana State University-Bozeman (WTI-MSU) was funded by the Federal Highway Administration (FHWA) and the Montana Department of Transportation (MDT) to initiate a before-after field study to assess the effectiveness of the wildlife mitigation measures and to document events and decisions that shaped the process of planning and designing the mitigation measures. Preconstruction field data collection efforts were completed in the fall of 2005 and a final report on the preconstruction monitoring findings was published in January 2007 (Hardy *et al.* 2007).

In 2010 MDT contracted with WTI-MSU to conduct the post-construction research with regard to the effectiveness of the mitigation measures. For this project, the Confederated Salish and Kootenai Tribes (CSKT) act as a subcontractor to WTI-MSU.

1.2. Objectives

Consistent with the direction provided by MDT, the project has the following objectives:

- Investigate the effect of the mitigation measures on human safety through an anticipated reduction in wildlife-vehicle collisions;
- Investigate the effect of the mitigation measures on the ability to maintaining habitat connectivity for wildlife (especially for deer (white-tailed deer [*Odocoileus virginianus*] and mule deer [*Odocoileus hemionus*] combined) and black bear (*Ursus americanus*) through the use of the wildlife crossing structures; and
- Conduct a cost-benefit analyses for the mitigation measures.

This document is part of a series of quarterly reports detailing the progress on these tasks.

1.3. Milestones

This project covers a period of 5.5 years (15 January 2010 – 30 June 2015). The table below provides an overview of the most important milestones.

Table 1: Overview of Milestones.

Description Milestones	Date accomplished
Contract signed between MDT and WTI-MSU and in effect	15 January 2010
Kick-off and 1st technical panel meeting	2 February 2010
Subcontract signed between WTI-MSU and CSKT	13 May 2010
Subcontract in effect between WTI-MSU and CSKT	15 April 2010
Field visit and presentation preliminary data 2008-2010 for technical panel	24 June 2010
A field visit for technical panel was suggested but declined	February 2012
$50,000 (obtained through STEP program) was added by MDT to the project to allow the 5th year of data collection to start in Ravalli Curves and Ravalli Hill	March 2012

1.4. Related Activities

Student projects:

- "The effectiveness of wildlife guards and the use of wildlife crossing structures by deer and black bear" (Tiffany Allen, MSc. candidate at Department of Ecology, Montana State University, Bozeman, main advisor Dr. Scott Creel, 2008 - 2011). Tiffany's research focuses on the mitigation measures in Ravalli Curves and Ravalli Hill. Tiffany successfully defended her thesis on 8 A pril 2011. A manuscript on the barrier effect of

wildlife guards on deer and black bear was submitted to a scientific journal. The journal suggested a revision, and the authors are working on addressing the comments.

- "Appropriate type and dimensions of wildlife crossing structures for various wildlife species, specifically deer and black bear" (Jeremiah Purdum, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2010-2012). The emphasis of Jeremiah's project is on investigating the appropriate type and dimension of crossing structures for selected species taking their presence and abundance in the surrounding landscape into consideration, as well as their behavior when approaching the crossing structures.
- "The effect of cover in and at crossing structures on the use by amphibians and small mammals" (Hayley Conolley-Newman, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2011-2013). Selected crossing structures have been provided with cover in January-February 2012. These structures will be monitored for the presence of amphibians and small mammals before and after cover has been provided. The "before measurement took place in the fall of 2011. The expectation is that the presence of cover will not only benefit amphibians and small mammals but also invertebrates and reptiles.
- "The benefits of wildlife fencing associated with isolated crossing structures". (Elizabeth Fairbank, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2012-2013). Isolated crossing structures with varying length of wildlife fencing will be monitored for wildlife crossings through the structures and at fence ends. The purpose of this study is to investigate the benefits of increasing lengths of wildlife fencing in terms of the proportion of safe crossings by deer, particularly white-tailed deer. Suitable structures will be monitored throughout Montana.
- Through outreach funding (see below), Kylie Paul and CSKT provided presentations to school children in the region. Students were asked to participate in a drawing contest. The drawings need to show wildlife and roads or traffic, or wildlife and mitigation measures such as crossing structures, jump-outs or wildlife guards. Winners were selected by a jury, and the winning entries were also displayed at "art walk" (First Friday) in Missoula on Fri 3 February at Noteworthy Paper & Press. In addition a outreach website, an outreach logo, a twitter account and a Facebook page were set up for communicating the results of the research into the effectiveness of the mitigation measures along US 93 N (see below.

http://www.peopleswaywildlifecrossings.org

http://www.facebook.com/US93PeoplesWay

https://twitter.com/US93PeoplesWay

- On a continuous basis excursions to the mitigation measures along US 93 N are provided.
- An intern (Taylor Hopkins) worked on the US93 N project. Taylor is a student in the Wilderness and Civilization program at the University of Montana, Missoula. Taylor helped with field work, monitored cameras at jump-outs and made plywood plates for the reptile and amphibian study. Taylor will volunteer through April 2012.

Additional funding sources:

CSKT received a Tribal Wildlife Grant (TWG) from the US Fish and Wildlife Service. About $40k of this grant will be dedicated to activities and materials related to the investigation of the effectiveness of the mitigation measures along US 93 N (personal communication Dale Becker, CSKT).

In March 2012 MDT allocated an additional $50,000 to the research project. These funds were obtained through the STEP program. These funds allowed the researchers to start the 5th year of data collection in Ravalli Curves and Hill (2012), though this effort is still $6,658 short. Note: There is an additional $119,401 required for the 5th year of data collection in Evaro in 2015.

Additional funding sources for outreach received:

• TransWild	$2,500	2010
• Defenders of Wildlife	$2,000	2010
• Yellowstone to Yukon Conservation Initiative	$3,000	2010
• Dennis and Phyllis Washington Foundation	$10,000	April 2011
• Y2Y Minigrant	$2,500	April 2011
• Mountaineers Foundation	$4,000	June 2011
• Transwild	$2,500	August 2011
• Y2Y	$2,500	June 2012

2. MITIGATION MEASURES AND HUMAN SAFETY

Activities this quarter:

Wildlife crash data and carcass removal data were requested from MDT on 7 May 2012.

The data were received early June 2012.

Anticipated activities next quarter:

Crash and carcass data analyses through 2011.

3. MITIGATION MEASURES AND HABITAT CONNECTIVITY FOR WILDLIFE

3.1. Road Sections with Continuous Fencing and Crossing Structures

The preconstruction research measured the number of animals, especially deer and black bear, that crossed the road before the road was widened and before the mitigation measures were put in place. For this purpose dozens of tracking beds (100 m long, 2 m wide) were installed along the road, covering about 30% of the road sections that would later be fenced. Now that the road has been widened and the fences and crossing structures are in place, the animals can only cross the road by using the crossing structures (although some animals may cross wildlife guards or climb fences). The wildlife use of the crossing structures are measured through camera traps. A camera trap consists of an automated camera that detects and then photographs wildlife. Because cameras may have a different detection probability for wildlife than sand tracking beds, a relationship between crossings measured through camera images and crossings measured through tracking beds must be established. Therefore four crossing structures have a tracking bed placed inside and outside the structures. The outside tracking beds are exposed to the elements, similar to pre-construction methods. The selected four crossing structures have a relatively high use by deer and black bear, which should result in a high enough sample size to establish this relationship.

There are several wildlife guards (similar to cattle guards) to discourage ungulates from entering the fenced road corridor at access roads. Wildlife guards that receive relatively little use by humans are monitored to measure how much of a barrier they really are to different wildlife species. Two structures were monitored starting in 2008. Additional structures for monitoring were selected in summer 2010.

Animals that do end up in the fenced road corridor may escape by using one of the jump-outs. These jump-outs allow animals to walk up to the height of the fence and then jump down to safety. Ideally, the jump-outs should be low enough so that animals readily jump down to safety but high enough to discourage them from jumping into the fenced road corridor. To investigate appropriate jump-out height, jump-outs in the Ravalli Curves (RC) and Hills (RH) sections have already been monitored through tracking beds since 2008 (summer only). Fortunately relatively few animals end up in the fenced road corridor, but this also means it takes time to collect a high enough sample size. In summer 2010 the jump-outs in the Evaro section (EV) were included in further monitoring. One of the jump-outs also has a camera trap installed. Note that many of the names for the structures consist of a two letter code (based on the area) followed by a number (based on the numbering of the 100 m road segments). Other structure names are based on the location, and then written in full, or on their specific purpose.

Activities this quarter:

- Continued data entry from cameras.
- Continued monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill.
- Continued monitoring of the wildlife guards.

- Weeds were sprayed on the tracking beds at the jump-outs in Evaro, Ravalli Curves and Ravalli Hill on 19 April 2012.
- Tracking beds at the jump-outs were restored on 30 April 2012.
- Monitoring of the jump-outs started 22 May (Ravalli Curves and Hill) and 31 May (Evaro).

The status of the field work and the dates or periods that data were collected are summarized in Table 2.

Table 2: Activities Road Sections with Continuous Fencing and Crossing Structures.

Description Activities	**Date or period monitored**
Crossing Structures Ravalli Curves and Ravalli Hill	
Tracking on tracking beds in the wildlife crossing structures in Ravalli Curves (9 wildlife crossing structures) and Ravalli Hill (2 wildlife crossing structures) took place from May 2008 until 26 February 2010. These data were supplemented by images from a limited number of cameras.	23 May 2008 – 26 February 2010
Camera traps were installed at all remaining crossing structures in Ravalli Curves and Ravalli Hill. The cameras, battery status and memory card status were checked once a month from 26 February 2010 onwards. Tracking in the structures coincides with the camera checks, and is supplemental to the images from the cameras from this date onwards. Note: most of the cameras were positioned outside the structure to be able to collect data on animal behavior as they approach the crossing structures.	26 February 2010 - present
The structures RC 396, RC 427, RC 432, and RH 459 had a tracking bed installed outside the structures. Tracking, twice a week, on the beds outside as well as inside the structures took place between 9 August 2010 and 2 November 2010, and between 27 May 2011 and 25 October 2011.	9 August 2010 - 2 November 2010, and 27 May 2011 – 25 October 2011.
Crossing Structures Evaro	
Partial coverage wildlife overpass (partial coverage with 4 cameras; 6-29 July 2010) (full coverage 1 approach with 7 cameras; 29 July 2010- 18 August 2010, full coverage both approaches 8 August 2010-present).	6 July 2010 – present
Montana Rail Link underpass (partial coverage with 2 cameras 8 September 2010) full coverage from 18 September 2010 onwards.	18 September 2010 - present
The other structures in the road section with continuous fencing in Evaro had cameras installed 3 September 2010 with full coverage from 8 September 2010 onwards	8 September 2010 - present
Livestock underpasses	
One camera was installed at livestock underpass near McClure Rd on 24 June 2011. The cameras, battery status and memory card status were checked once a month from 24 June 2011 onwards.	24 June 2011 – autumn 2011
Wildlife guards	
Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section took place on a biweekly basis from July 2008 until 26 February 2010.	July 2008 – 26 February 2010

Continued - Table 2: Activities Road Sections with Continuous Fencing and Crossing Structures.

Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Camera traps at two additional wildlife guards were installed on 20 October 2010 (guard just north of RC 396) and 31 October 2010 (guard north of RC 381 on east side). One camera has a technical problem (removed 1 May 2011). The repaired camera was used at another location that had higher priority. The other camera was removed 21 October 2011 to a location with a higher priority. Cameras reinstalled 20 March 2012.	20 October 2010- 1 May 2011 / 21 October 2011 20 March 2012 - present
Jump-outs	
Tracking beds in Ravalli Curves and Ravalli Hill were monitored from May 2008 until September 2009 (summer only).	July 2008 – September 2009
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 13 June 2010. Monitoring continued on a weekly basis until 2 November 2010. Further monitoring to start in May 2011.	13 June 2010 – 2 November 2010
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 2 May 2011. Monitoring continued on a weekly basis until 25 October 2011.	27 May 2011 – 25 October 2011
Tracking beds were installed in the Evaro section on 20 July 2010. Monitoring took place on a weekly basis between 4 August 2010 and 2 November 2010. Further monitoring to start in May 2011.	4 August 2010 - 2 November 2010.
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Evaro (23 jump-outs in total) on 27 May 2011. Monitoring continue on a weekly basis through 25 October 2011.	27 May 2011 – 25 October 2011
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Evaro (23 jump-outs in total) on 30 May 2011. Monitoring will continue on a weekly basis through end October 2012.	22 May 2012 (Ravalli Curves and Hill)/ 31 May (Evaro) 2012 – End October 2012
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a biweekly basis until 26 February 2010.	July 2008 – 26 February 2010
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Human access point Ravalli Curves	
Camera trap at the human access point was installed on 5 March 2011 (south end, west side of road)	5 March 2011 - present

Fence ends (north end Evaro fencing)	
Two camera traps were installed at two fence ends of the Evaro fencing on 4 April 2011 (north end, east and west side of road)	4 April 2011 – 16 Sep 2011 (NE) 4 April 2011 – 19 Aug 2011 and 16 Sep 2011 – 1 Jan 2012 (NW)
Pellet group counts	
Pellet group counts were conducted in the Ravalli Curves and Ravalli Hill section between 23 August and 15 September 2010	23 August 2010 - 15 September 2010
Pellet group counts were conducted in the Evaro, Ravalli Curves and Ravalli Hill section between 24 August 2011 and 8 September 2011.	24 August 2011 - 8 September 2011

3.2. Road Sections with Isolated Underpasses

A large part of North America consists of landscapes heavily altered and used by humans. Such areas can nonetheless be important for nature conservation and large wild ungulates such as deer may even be abundant. Wildlife-vehicle collisions may also occur in such landscapes, but because of the human use and presence certain types of mitigation measures such as long sections of wildlife fencing are not always possible or appropriate. While crossing structures may still allow for safe crossings by wildlife, there may only be limited fencing, or sometimes no fencing, associated with such structures. Ten of such "isolated" structures are monitored for this project to evaluate their effectiveness. The structures and periods they were monitored are listed in Table 3.

Activities this quarter:

- Continued monitoring of the isolated structures.

Table 3: Isolated Structures Monitored.

Structure name	Date or period monitored through December 2009	Date or period monitored from 1 Jan 2010 onwards
North Evaro	None	6 July 2010 – present
Schley creek	None	29 June 2010 – present
East Fork Finley creek	None	4 October 2010 - present
Pistol creek 1 (station 498+55.7)	November 2007-1 January 2008 27 August 2009- 31 December 2009	1 January 2010 – present
Pistol creek 2 (station 501+63)	August 2009- 31 December 2009	1 January 2010 – present
Mission creek (station 528+90)	September 2009 – 31 December 2009	1 January 2010 – present (south bank) 13 October 2010 – present (north bank)
Post creek 1 (station 550+56.6)	November 2007 - May 2009	29 June 2010 – present
Post creek 2 (station 555+06)	November 2007 – October 2008 January 2009 – May 2009 August 2009 – 31 December 2009	1 January 2010 – present
Post creek 3 (559+98.4)	November 2007 – 31 December 2009	1 January 2010 – present
Spring creek 1 (774+00)	May 2009 - December 2009	1 January 2010 – present
Spring creek 2	None	11 March 2010 – present
Mud creek	23 June 2009 – 23 July 2009	None
Polson Hill	None	11 October 2010 - present

3.3. Anticipated Activities 2nd Quarter 2012

1. Update the protocol for releasing images.
2. Catching up with data interpretation and entry from cameras.
3. Initiate pellet group counts.

4. COST-BENEFIT ANALYSIS

Activities this quarter:

- No activities in this quarter.

5. OTHER FINDINGS

No specific other findings to report.

6. SCHEDULE AND BUDGET

The planned and the actual schedule through 2012 are shown in Table 4. T he percentage completion for each task is shown in Table 5.

Table 4: Planned Schedule 2011-2012.

	2011				2012			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Deer and black bear vehicle collisions								
Summary crash and carcass data								
2. Wildlife use of underpasses								
Cameras operational structures RC and RH								
Cameras operational structures EV								
Cameras operational isolated structures								
Tracking beds operational outside 4 structures								
Cameras operational fence ends								
Cameras operational 2 guards RC								
Cameras operational additional guards								
Camera operational at people access point RC								
Camera operational 1 jump-out								
Tracking beds operational jump-outs RC and RH								
Tracking beds operational jump-outs EV								
Deer pellet group counts								
3. Cost-benefit analyses								
Obtain cost data from MDT								

Legend
- planned
- on schedule
- ahead
- behind

Table 5: Percentage Complete.

Task	Planned Percentage complete	Actual Percentage complete
1. Deer and black bear vehicle collisions	50%	50%
2. Wildlife use of underpasses	50%	45%*
3. Cost-benefit analyses	50%	50%

*Behind on data entry

Through 30 June 2012 the total amount spent (15 January 2010 – 30 June 2012) on the MDT account for the project was $ 142,591.05 (Figure 1). This was less than budgeted, but there was a substantial bill from CSKT for work done during previous quarters. The under-spending is mostly explained by bills that have not been received yet (e.g. from CSKT) and student involvement.

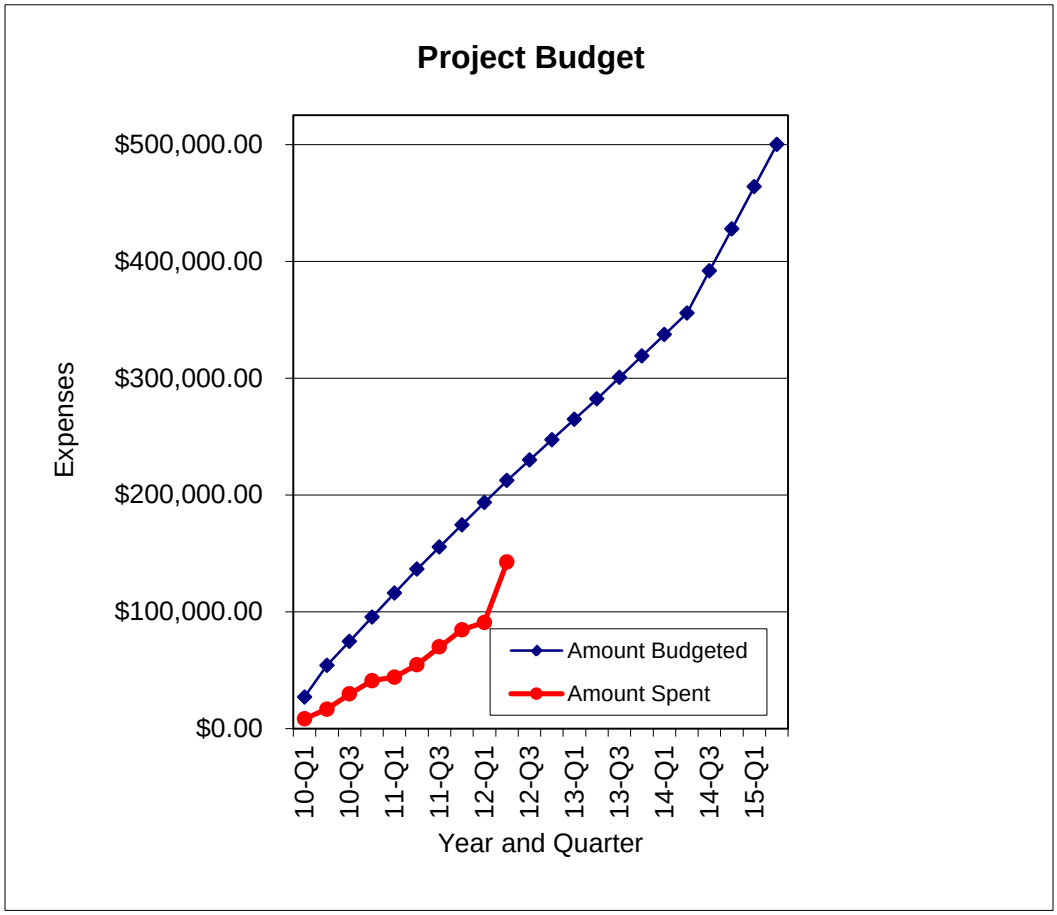

Figure 1: Project budget MDT account; cumulative expenses, with a distinction between the amount that was budgeted (blue line) and the amount that was actually spent (red line) through 30 June 2015. Note that the budgeted amount and the actual amount spent are cumulative. For example, the expenses for the quarter that this report relates to have been added to the total expenses incurred through the previous quarter (red line). Note that the actual amount available through MDT is now $550,000 ($50,000 was added in March 2012 for 5th year in Ravalli Curves and Ravalli Hill).

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US 93 North Post-Construction Wildlife-Vehicle Collision and Wildlife Crossing Monitoring and Research on the Flathead Indian Reservation between Evaro and Polson, Montana

Quarterly Report 2012-3

by

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A report prepared for the
Montana Department of Transportation
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October 22nd 2012

ACKNOWLEDGEMENTS

The authors of this report would like to thank the Montana Department of Transportation (MDT) for funding this research and the Confederated Salish and Kootenai Tribes (CSKT) for granting access to the reservation for this research. Additional support was provided by the U.S. Department of Transportation through the Research & Innovative Technology Administration. The authors would also like to thank Kris Christensen (MDT Research Section (project manager)) and the other members of the technical panel: Pat Basting (MDT Environmental Bureau), Dale Becker (CSKT), Kevin Christensen (MDT Construction Engineer), Vickie Edwards (Montana Fish, Wildlife & Parks (MTFWP), Jonathan Floyd (MDT Traffic Safety Bureau), Bonnie Gundrum, (MDT Environmental Bureau), Scott Jackson (US Fish and Wildlife Service (USFWS), Doug Moeller (MDT Missoula District Administrator), Sue Sillick (MDT Research Section), and Mark Zitzka (Federal Highway Administration (FHWA)). Finally, the authors would like to thank Dale Becker (CSKT), Amanda Hardy (Colorado State University), Kari Enes, AJ Bigby, Virginia "Tiny" Williams, Bruce Maestas, and Stephanie Gillen (all CSKT), and Steve Albert, Tiffany Allen, Rob Ament, Jeralyn Brodowy, Ben Dorsey, Jerry Stephens (all Western Transportation Institute – Montana State University (WTI-MSU)) for their help.

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EXECUTIVE SUMMARY

This report contains a brief description of the progress on the tasks for the US 93 North wildlife mitigation evaluation project on the Flathead Indian Reservation between Evaro and Polson, Montana. The mitigation measures consist of wildlife fencing combined with wildlife underpasses and overpasses, jump-outs, and wildlife guards at access roads. The research objectives relate to investigating the effect of the mitigation measures on human safety (an expected reduction in wildlife-vehicle collisions), habitat connectivity for wildlife (wildlife use of the crossing structures), and a cost-benefit analysis for the mitigation measures. This report documents the work conducted between 1 July 2012 and 30 September 2012.

In this quarter, the research team continued data entry from cameras, monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill, and monitoring of the wildlife guards and human access point. The research team also continued monitoring the tracking beds at the jump-outs and initiated the pellet group surveys. Additional funding was obtained from Cinnabar for outreach activities and MDT provided in kind support for outreach. On 24 September 2012 the manuscript “Effectiveness of wildlife guards at access roads" was accepted for publication in the Wildlife Society Bulletin.

1. INTRODUCTION

1.1. Background

The US Highway 93 North (US 93 N) reconstruction project on the Flathead Indian Reservation in northwest Montana represents one of the most extensive wildlife-sensitive highway design efforts in North America. The reconstruction of the 56 mile (90 km) long road section includes the installation of 41 fish and wildlife crossing structures, 2 underpasses for live-stock, 1 bicycle/pedestrian underpass, and approximately 8.3 miles (13.4 km) of road with wildlife exclusion fencing on both sides (excluding future mitigation measures in the Ninepipes wetland area). The mitigation measures are aimed at improving safety for the traveling public through reducing wildlife-vehicle collisions and allowing wildlife to continue to move across the landscape and the road. Other examples of relatively long road sections in North America with a high concentration of wildlife crossing structures and wildlife fencing are I-75 (alligator alley) in south Florida (24 crossing structures over 40 mi; Foster & Humphrey 1995), the Trans-Canada Highway in Banff National Park in Alberta, Canada (24 crossing structures over 28 mi (phase 1, 2 and 3A); Clevenger *et al.* 2002), State Route 260 in Arizona (17 crossing structures over 19 mi; Dodd *et al.* (2006)), and I-90 at Snoqualmie Pass East in Washington State (about 30 crossing structures planned over 15 mi; WSDOT 2007). Both the road length and number of wildlife crossing structures of US 93 N on the Flathead Indian Reservation makes it the most extensive mitigation project of its kind in North America to date. If the section of US 93 South (S) (south of Missoula, Bitterroot valley) is included, the mitigation measures along US 93 are even more substantial.

The magnitude of the US 93 N reconstruction project and associated mitigation measures provide an unprecedented opportunity to evaluate to what extent these mitigation measures help improve safety through a reduction in wildlife-vehicle collisions, maintain habitat connectivity for wildlife (especially deer (*Odocoileus* spp.) and black bear (*Ursus americanus*)), and what the monetary costs and benefits are for the mitigation measures. In addition, the landscape along US 93 N is heavily influenced by human use. This is in contrast to the more natural vegetation along most of the other road sections that have large scale wildlife mitigation in North America. As the roads with most wildlife-vehicle collisions are in rural areas, the results from the US 93 N project are expected to be of great interest to agencies throughout North America (Huijser *et al.* 2008).

In 2002, prior to US 93 N's reconstruction, the Western Transportation Institute at Montana State University-Bozeman (WTI-MSU) was funded by the Federal Highway Administration (FHWA) and the Montana Department of Transportation (MDT) to initiate a before-after field study to assess the effectiveness of the wildlife mitigation measures and to document events and decisions that shaped the process of planning and designing the mitigation measures. Preconstruction field data collection efforts were completed in the fall of 2005 and a final report on the preconstruction monitoring findings was published in January 2007 (Hardy *et al.* 2007).

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Consistent with the direction provided by MDT, the project has the following objectives:

- Investigate the effect of the mitigation measures on human safety through an anticipated reduction in wildlife-vehicle collisions;
- Investigate the effect of the mitigation measures on the ability to maintaining habitat connectivity for wildlife (especially for deer (white-tailed deer [*Odocoileus virginianus*] and mule deer [*Odocoileus hemionus*] combined) and black bear (*Ursus americanus*) through the use of the wildlife crossing structures; and
- Conduct a cost-benefit analyses for the mitigation measures.

This document is part of a series of quarterly reports detailing the progress on these tasks.

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This project covers a period of 5.5 years (15 January 2010 – 30 June 2015). The table below provides an overview of the most important milestones.

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A field visit for technical panel was suggested but declined	February 2012
$50,000 (obtained through STEP program) was added by MDT to the project to allow the 5th year of data collection to start in Ravalli Curves and Ravalli Hill	March 2012

1.4. Related Activities

Student projects:

- "The effectiveness of wildlife guards and the use of wildlife crossing structures by deer and black bear" (Tiffany Allen, MSc. candidate at Department of Ecology, Montana State University, Bozeman, main advisor Dr. Scott Creel, 2008 - 2011). Tiffany's research focuses on the mitigation measures in Ravalli Curves and Ravalli Hill. Tiffany successfully defended her thesis on 8 April 2011. On 24 September 2012 the manuscript "Effectiveness of wildlife guards at access roads" was accepted for publication in the Wildlife Society Bulletin.

- A manuscript on the barrier effect of wildlife guards on deer and black bear was submitted to a scientific journal. The journal suggested a revision, and the authors are working on addressing the comments.
- "Appropriate type and dimensions of wildlife crossing structures for various wildlife species, specifically deer and black bear" (Jeremiah Purdum, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2010-2012). The emphasis of Jeremiah's project is on investigating the appropriate type and dimension of crossing structures for selected species taking their presence and abundance in the surrounding landscape into consideration, as well as their behavior when approaching the crossing structures.
- "The effect of cover in and at crossing structures on the use by amphibians and small mammals" (Hayley Conolley-Newman, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2011-2013). Selected crossing structures have been provided with cover in January-February 2012. These structures will be monitored for the presence of amphibians and small mammals before and after cover has been provided. The "before measurement took place in the fall of 2011. The expectation is that the presence of cover will not only benefit amphibians and small mammals but also invertebrates and reptiles.
- "The benefits of wildlife fencing associated with isolated crossing structures". (Elizabeth Fairbank, MSc. candidate at the Environmental Studies Program at University of Montana, Missoula, main advisor Dr. Len Broberg, 2012-2013). Isolated crossing structures with varying length of wildlife fencing will be monitored for wildlife crossings through the structures and at fence ends. The purpose of this study is to investigate the benefits of increasing lengths of wildlife fencing in terms of the proportion of safe crossings by deer, particularly white-tailed deer. Suitable structures will be monitored throughout Montana.
- Through outreach funding (see below), Kylie Paul and CSKT provided presentations to school children in the region. Students were asked to participate in a drawing contest. The drawings need to show wildlife and roads or traffic, or wildlife and mitigation measures such as crossing structures, jump-outs or wildlife guards. Winners were selected by a jury, and the winning entries were also displayed at "art walk" (First Friday) in Missoula on Fri 3 February at Noteworthy Paper & Press. In addition a outreach website, an outreach logo, a twitter account and a Facebook page were set up for communicating the results of the research into the effectiveness of the mitigation measures along US 93 N (see below.

http://www.peopleswaywildlifecrossings.org

http://www.facebook.com/US93PeoplesWay

https://twitter.com/US93PeoplesWay

- On a continuous basis excursions to the mitigation measures along US 93 N are provided.
- An intern (Taylor Hopkins) worked on the US93 N project. Taylor is a student in the Wilderness and Civilization program at the University of Montana, Missoula. Taylor helped with field work, monitored cameras at jump-outs and made plywood plates for the reptile and amphibian study. Taylor will volunteer through April 2012.

Additional funding sources:

CSKT received a Tribal Wildlife Grant (TWG) from the US Fish and Wildlife Service. About $40k of this grant will be dedicated to activities and materials related to the investigation of the effectiveness of the mitigation measures along US 93 N (personal communication Dale Becker, CSKT).

In March 2012 MDT allocated an additional $50,000 to the research project. These funds were obtained through the STEP program. These funds allowed the researchers to start the 5th year of data collection in Ravalli Curves and Hill (2012), though this effort is still $6,658 short. Note: There is an additional $119,401 required for the 5th year of data collection in Evaro in 2015.

Additional funding sources/support for outreach received:

• TransWild	$2,500	2010
• Defenders of Wildlife	$2,000	2010
• Yellowstone to Yukon Conservation Initiative	$3,000	2010
• Dennis and Phyllis Washington Foundation	$10,000	April 2011
• Y2Y Minigrant	$2,500	April 2011
• Mountaineers Foundation	$4,000	June 2011
• Transwild	$2,500	August 2011
• Y2Y	$2,500	June 2012
• Cinnabar	$3,000	July 2012
• MDT (printing pamphlets)	in kind	July/August 2012

2. MITIGATION MEASURES AND HUMAN SAFETY

Activities this quarter:

No activities this quarter.

Anticipated activities next quarter:

Crash and carcass data analyses through 2011.

3. MITIGATION MEASURES AND HABITAT CONNECTIVITY FOR WILDLIFE

3.1. Road Sections with Continuous Fencing and Crossing Structures

The preconstruction research measured the number of animals, especially deer and black bear, that crossed the road before the road was widened and before the mitigation measures were put in place. For this purpose dozens of tracking beds (100 m long, 2 m wide) were installed along the road, covering about 30% of the road sections that would later be fenced. Now that the road has been widened and the fences and crossing structures are in place, the animals can only cross the road by using the crossing structures (although some animals may cross wildlife guards or climb fences). The wildlife use of the crossing structures are measured through camera traps. A camera trap consists of an automated camera that detects and then photographs wildlife. Because cameras may have a different detection probability for wildlife than sand tracking beds, a relationship between crossings measured through camera images and crossings measured through tracking beds must be established. Therefore four crossing structures have a tracking bed placed inside and outside the structures. The outside tracking beds are exposed to the elements, similar to pre-construction methods. The selected four crossing structures have a relatively high use by deer and black bear, which should result in a high enough sample size to establish this relationship.

There are several wildlife guards (similar to cattle guards) to discourage ungulates from entering the fenced road corridor at access roads. Wildlife guards that receive relatively little use by humans are monitored to measure how much of a barrier they really are to different wildlife species. Two structures were monitored starting in 2008. Additional structures for monitoring were selected in summer 2010.

Animals that do end up in the fenced road corridor may escape by using one of the jump-outs. These jump-outs allow animals to walk up to the height of the fence and then jump down to safety. Ideally, the jump-outs should be low enough so that animals readily jump down to safety but high enough to discourage them from jumping into the fenced road corridor. To investigate appropriate jump-out height, jump-outs in the Ravalli Curves (RC) and Hills (RH) sections have already been monitored through tracking beds since 2008 (summer only). Fortunately relatively few animals end up in the fenced road corridor, but this also means it takes time to collect a high enough sample size. In summer 2010 the jump-outs in the Evaro section (EV) were included in further monitoring. One of the jump-outs also has a camera trap installed. Note that many of the names for the structures consist of a two letter code (based on the area) followed by a number (based on the numbering of the 100 m road segments). Other structure names are based on the location, and then written in full, or on their specific purpose.

Activities this quarter:

- Continued data entry from cameras.
- Continued monitoring of the crossing structures in Evaro, Ravalli Curves, and Ravalli Hill.
- Continued monitoring of the wildlife guards.

- Continued monitoring of the jump-outs through end October 2012.
- Pellet groups counts were initiated 14 August 2012.

The status of the field work and the dates or periods that data were collected are summarized in Table 2.

Table 2: Activities Road Sections with Continuous Fencing and Crossing Structures.

Description Activities	**Date or period monitored**
Crossing Structures Ravalli Curves and Ravalli Hill	
Tracking on tracking beds in the wildlife crossing structures in Ravalli Curves (9 wildlife crossing structures) and Ravalli Hill (2 wildlife crossing structures) took place from May 2008 until 26 February 2010. These data were supplemented by images from a limited number of cameras.	23 May 2008 – 26 February 2010
Camera traps were installed at all remaining crossing structures in Ravalli Curves and Ravalli Hill. The cameras, battery status and memory card status were checked once a month from 26 February 2010 onwards. Tracking in the structures coincides with the camera checks, and is supplemental to the images from the cameras from this date onwards. Note: most of the cameras were positioned outside the structure to be able to collect data on animal behavior as they approach the crossing structures.	26 February 2010 - present
The structures RC 396, RC 427, RC 432, and RH 459 had a tracking bed installed outside the structures. Tracking, twice a week, on the beds outside as well as inside the structures took place between 9 August 2010 and 2 November 2010, and between 27 May 2011 and 25 October 2011.	9 August 2010 - 2 November 2010, and 27 May 2011 – 25 October 2011.
Crossing Structures Evaro	
Partial coverage wildlife overpass (partial coverage with 4 cameras; 6-29 July 2010) (full coverage 1 approach with 7 cameras; 29 July 2010- 18 August 2010, full coverage both approaches 8 August 2010-present).	6 July 2010 – present
Montana Rail Link underpass (partial coverage with 2 cameras 8 September 2010) full coverage from 18 September 2010 onwards.	18 September 2010 - present
The other structures in the road section with continuous fencing in Evaro had cameras installed 3 September 2010 with full coverage from 8 September 2010 onwards	8 September 2010 - present
Livestock underpasses	
One camera was installed at livestock underpass near McClure Rd on 24 June 2011. The cameras, battery status and memory card status were checked once a month from 24 June 2011 onwards.	24 June 2011 – autumn 2011
Wildlife guards	
Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section took place on a biweekly basis from July 2008 until 26 February 2010.	July 2008 – 26 February 2010

Continued - Table 2: Activities Road Sections with Continuous Fencing and Crossing Structures.

Maintenance of the two camera traps at two wildlife guards in Ravalli Curves section continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Camera traps at two additional wildlife guards were installed on 20 October 2010 (guard just north of RC 396) and 31 October 2010 (guard north of RC 381 on east side). One camera has a technical problem (removed 1 May 2011). The repaired camera was used at another location that had higher priority. The other camera was removed 21 October 2011 to a location with a higher priority. Cameras reinstalled 20 March 2012.	20 October 2010- 1 May 2011 / 21 October 2011 20 March 2012 - present
Jump-outs	
Tracking beds in Ravalli Curves and Ravalli Hill were monitored from May 2008 until September 2009 (summer only).	July 2008 – September 2009
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 13 June 2010. Monitoring continued on a weekly basis until 2 November 2010. Further monitoring to start in May 2011.	13 June 2010 – 2 November 2010
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Ravalli Curves and Ravalli Hill (29 jump-outs in total) on 2 May 2011. Monitoring continued on a weekly basis until 25 October 2011.	27 May 2011 – 25 October 2011
Tracking beds were installed in the Evaro section on 20 July 2010. Monitoring took place on a weekly basis between 4 August 2010 and 2 November 2010. Further monitoring to start in May 2011.	4 August 2010 - 2 November 2010.
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Evaro (23 jump-outs in total) on 27 May 2011. Monitoring continue on a weekly basis through 25 October 2011.	27 May 2011 – 25 October 2011
Tracking beds were restored (removal weeds, fluffing sand on tracking bed) in Evaro (23 jump-outs in total) on 30 May 2011. Monitoring will continue on a weekly basis through end October 2012.	22 May 2012 (Ravalli Curves and Hill)/ 31 May (Evaro) 2012 – End October 2012
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a biweekly basis until 26 February 2010.	July 2008 – 26 February 2010
Maintenance of the one camera trap at one jump-out (Ravalli Hill, east side road) continued on a monthly basis from 26 February 2010 onwards.	26 February 2010 - present
Human access point Ravalli Curves	
Camera trap at the human access point was installed on 5 March 2011 (south end, west side of road)	5 March 2011 - present

Fence ends (north end Evaro fencing)	
Two camera traps were installed at two fence ends of the Evaro fencing on 4 April 2011 (north end, east and west side of road)	4 April 2011 – 16 Sep 2011 (NE) 4 April 2011 – 19 Aug 2011 and 16 Sep 2011 – 1 Jan 2012 (NW)
Pellet group counts	
Pellet group counts were conducted in the Ravalli Curves and Ravalli Hill section between 23 August and 15 September 2010	23 August 2010 - 15 September 2010
Pellet group counts were conducted in the Evaro, Ravalli Curves and Ravalli Hill section between 24 August 2011 and 8 September 2011.	24 August 2011 - 8 September 2011
Pellet group counts were conducted in the Evaro, Ravalli Curves and Ravalli Hill section between 14 August 2011 and -ongoing-.	14 August 2012 - ongoing

3.2. Road Sections with Isolated Underpasses

A large part of North America consists of landscapes heavily altered and used by humans. Such areas can nonetheless be important for nature conservation and large wild ungulates such as deer may even be abundant. Wildlife-vehicle collisions may also occur in such landscapes, but because of the human use and presence certain types of mitigation measures such as long sections of wildlife fencing are not always possible or appropriate. While crossing structures may still allow for safe crossings by wildlife, there may only be limited fencing, or sometimes no fencing, associated with such structures. Ten of such "isolated" structures are monitored for this project to evaluate their effectiveness. The structures and periods they were monitored are listed in Table 3.

Activities this quarter:

- Continued monitoring of the isolated structures.

Table 3: Isolated Structures Monitored.

Structure name	Date or period monitored through December 2009	Date or period monitored from 1 Jan 2010 onwards
North Evaro	None	6 July 2010 – present
Schley creek	None	29 June 2010 – present
East Fork Finley creek	None	4 October 2010 - present
Pistol creek 1 (station 498+55.7)	November 2007-1 January 2008 27 August 2009- 31 December 2009	1 January 2010 – present
Pistol creek 2 (station 501+63)	August 2009- 31 December 2009	1 January 2010 – present
Mission creek (station 528+90)	September 2009 – 31 December 2009	1 January 2010 – present (south bank) 13 October 2010 – present (north bank)
Post creek 1 (station 550+56.6)	November 2007 - May 2009	29 June 2010 – present
Post creek 2 (station 555+06)	November 2007 – October 2008 January 2009 – May 2009 August 2009 – 31 December 2009	1 January 2010 – present
Post creek 3 (559+98.4)	November 2007 – 31 December 2009	1 January 2010 – present
Spring creek 1 (774+00)	May 2009 - December 2009	1 January 2010 – present
Spring creek 2	None	11 March 2010 – present
Mud creek	23 June 2009 – 23 July 2009	None
Polson Hill	None	11 October 2010 - present

3.3. Anticipated Activities 4th Quarter 2012

1. Update the protocol for releasing images.
2. Catching up with data interpretation and entry from cameras.
3. Compile annual report through 2011.

4. COST-BENEFIT ANALYSIS

Activities this quarter:

- No activities in this quarter.

5. OTHER FINDINGS

No specific other findings to report.

6. SCHEDULE AND BUDGET

The planned and the actual schedule through 2012 are shown in Table 4. T he percentage completion for each task is shown in Table 5.

Table 4: Planned Schedule 2011-2012.

	2011				2012			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1. Deer and black bear vehicle collisions								
Summary crash and carcass data								
2. Wildlife use of underpasses								
Cameras operational structures RC and RH								
Cameras operational structures EV								
Cameras operational isolated structures								
Tracking beds operational outside 4 structures								
Cameras operational fence ends								
Cameras operational 2 guards RC								
Cameras operational additional guards								
Camera operational at people access point RC								
Camera operational 1 jump-out								
Tracking beds operational jump-outs RC and RH								
Tracking beds operational jump-outs EV								
Deer pellet group counts								
3. Cost-benefit analyses								
Obtain cost data from MDT								

Legend
- planned
- on schedule
- ahead
- behind

Table 5: Percentage Complete.

Task	Planned Percentage complete	Actual Percentage complete
1. Deer and black bear vehicle collisions	55%	50%
2. Wildlife use of underpasses	55%	50%*
3. Cost-benefit analyses	55%	55%

*Behind on data entry

Through 30 June 2012 the total amount spent (15 January 2010 – 30 September 2012) on the MDT account for the project was $ 153,215.04 (Figure 1). This was less than budgeted, but there was a substantial bill from CSKT for work done during previous quarters. The under-spending is mostly explained by bills that have not been received yet (e.g. from CSKT) and student involvement.

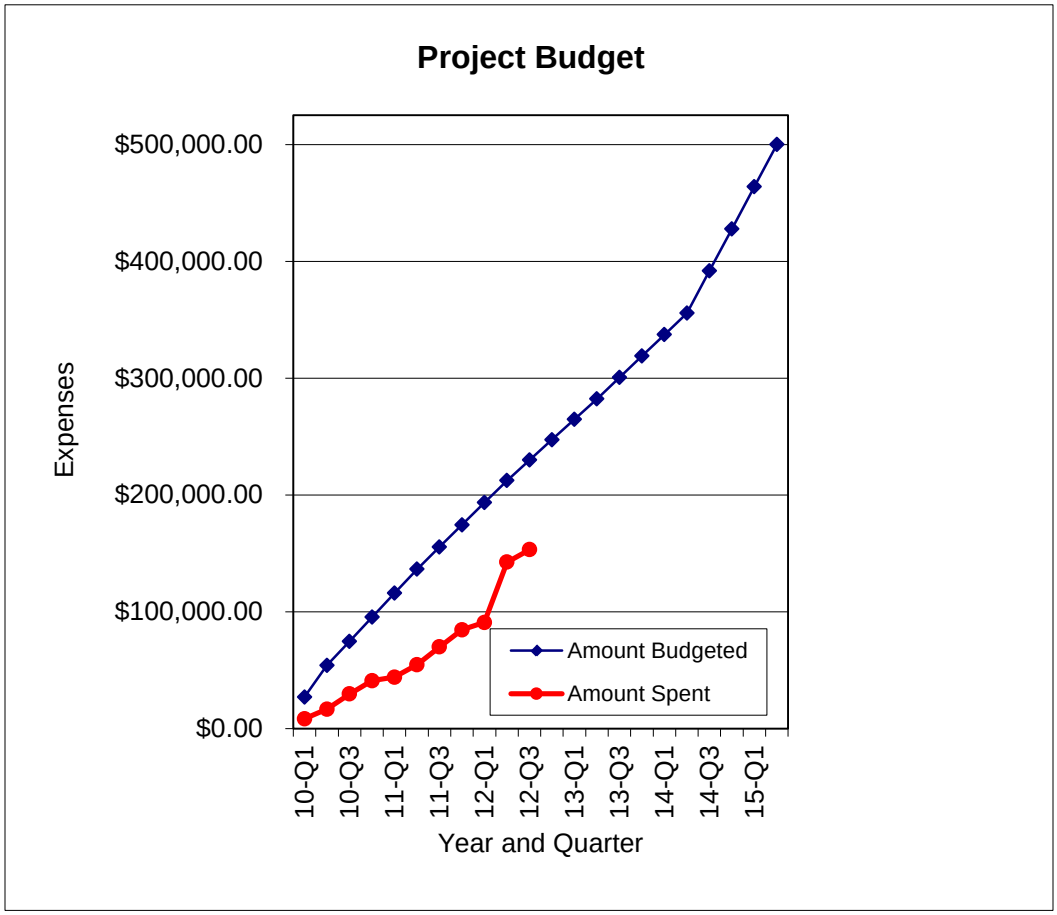

Figure 1: Project budget MDT account; cumulative expenses, with a distinction between the amount that was budgeted (blue line) and the amount that was actually spent (red line) through 30 June 2015. Note that the budgeted amount and the actual amount spent are cumulative. For example, the expenses for the quarter that this report relates to have been added to the total expenses incurred through the previous quarter (red line). Note that the actual amount available through MDT is now $550,000 ($50,000 was added in March 2012 for 5th year in Ravalli Curves and Ravalli Hill).

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