

**Montana US Highway 93 South Wildlife Crossings Research
MDT # HWY – 308445-RP**

**2010 Second and Third Quarter Progress Report
April 1, 2010 to September 30, 2010**

Prepared by
Patricia Cramer, Principal Investigator,
Consultant, and Research Assistant Professor, Utah State University
patricia.cramer@usu.edu

With assistance from:
Kari E. Gunson, Research Assistant, kegunson@eco-kare.com
Robert Hamlin, Research Assistant, hamlinr@hotmail.com

Prepared for the Montana Department of Transportation
October 31, 2010



Table of Contents

1. Study Area and Purpose	5
2. White-tailed Deer Use of Existing Wildlife Crossing Structures and Future Wildlife Crossing Structure Sites	8
2.1. Methods	8
2.2. Results	12
2.3. Anticipated Work	20
3. White-Tailed Deer Usage Rates of Wildlife Crossing Structures by Type and Across Types	20
4. Relationships among Crossing Structures with Landscape Variables and Crossing Rates	20
5. Changes in Animal-Vehicle Collisions Between Pre-Construction and Post-Construction of Wildlife Crossing Structures.	21
6. Relationships between Animal-Vehicle Collision Numbers and Wildlife Crossing Structures over Time and Space, Kernel Density Analysis	21
7. Elk Use of Wildlife Crossing Structures and Jump-off Ramps at McCalla Creek South and Kootenai Springs Ranch.	21
8. Black Bear Use of Wildlife Crossing Structures.	24
9. Corvallis High School Research Projects.	25
10. Major Task Progress.	27

List of Tables

Table 1. Existing Wildlife Crossings Structures and Future Wildlife Crossing Structure Sites, US Highway 93 South, Montana.	6
Table 2. Cameras Currently Installed at Existing Wildlife Crossing Structures and Future Wildlife Crossing Structure Sites on US Highway 93 South, Montana, and a Nearby Control Site.	10
Table 3. Summary of Complete Pre-Construction Data Sets.	13
Table 4. Summary of Complete Construction Data Sets.	15
Table 5. White-tailed Deer Use of Existing Wildlife Crossing Structures.	17
Table 6. White-tailed Deer Use of Future Wildlife Crossing Structure Sites.	19

List of Figures

Figure 1. Map of US Highway 93 South Study Area and Locations of Existing and Future Wildlife Crossing Structures, Montana.	7
Figure 2. Elk Cow and Calves Using Jump-off Ramp at McCalla Creek South.	22
Figure 3. Elk Crossing US Highway 93 Post-Construction at Kootenai Springs Ranch.	23
Figure 4. Elk Calf Using the Kootenai Springs Ranch Wildlife Crossing Structure.	24
Figure 5. Black Bear using Dawn's Crossing.	25

1. Study Area and Purpose

Ten large wildlife crossing structures were installed along US Highway 93 South between Florence and Hamilton by the Montana Department of Transportation (MDT) between 2004 and 2010. Nine additional wildlife crossing structures will be installed over the coming years. Details of the ten existing wildlife crossing structures and nine future wildlife crossing structure sites are presented in Table 1. A map of the study area showing the locations of existing wildlife crossing structures and future wildlife crossing structure sites is presented in Figure 1.

The purpose of this research is to determine:

1. white-tailed deer (*Odocoileus virginianus*) usage rates of existing wildlife crossing structures and future wildlife crossing structures;
2. white-tailed deer usage rates of wildlife crossing structures by type and across types, include variables such as height, width, and length;
3. relationships among wildlife crossing structures with landscape variables and crossing rates;
4. changes in animal-vehicle collisions between pre-construction and post-construction of wildlife crossing structures within a twenty-five mile stretch of US Highway 93 South, mile post (mp) 74 to mp 49; and,
5. relationships between animal-vehicle collisions and wildlife crossing structures over time and space.

This research began in 2008 and will be completed in 2015. This research is approximately 21% complete. This report presents preliminary results which preclude discussion and conclusion sections. The project is on time and on budget for all tasks.

Table 1. Existing Wildlife Crossings Structures and Future Wildlife Crossing Structure Sites, US Highway 93 South, Montana.

Existing Structures	Year Completed	Approximate Mile Post	Structure Type
Bass Creek North	2005	71	Bridge
Bass Creek South	2005	70	Bridge
Bass Creek Fishing Access	2005	70	Round Corrugated Steel Culvert
Dawn's Crossing	2005	70	Bridge
Kootenai Creek	2009	66	Bridge
McCalla Creek North	2009	66	Bridge
McCalla Creek South	2010	65	Bridge
Kootenai Springs Ranch	2010	65	Concrete Box Culvert
Indian Prairie Loop	2010	63	Concrete Box Culvert
Blodgett Creek	2008	50	Bridge
Future Sites	Expected Completion	Approximate Mile Post	Structure Type
Big Creek	2011	61	Bridge
Axmen Propane	2010	61	Concrete Box Culvert
Sweathouse Creek	Unknown	60	Bridge
Bear Creek North	Unknown	58	Bridge
Bear Creek South	Unknown	57	Bridge
Lupine	Unknown	56	Culvert
Mountain Gallery	Unknown	56	Culvert
Fun Park	Unknown	55	Culvert
Mill Creek	2011	55	Bridge

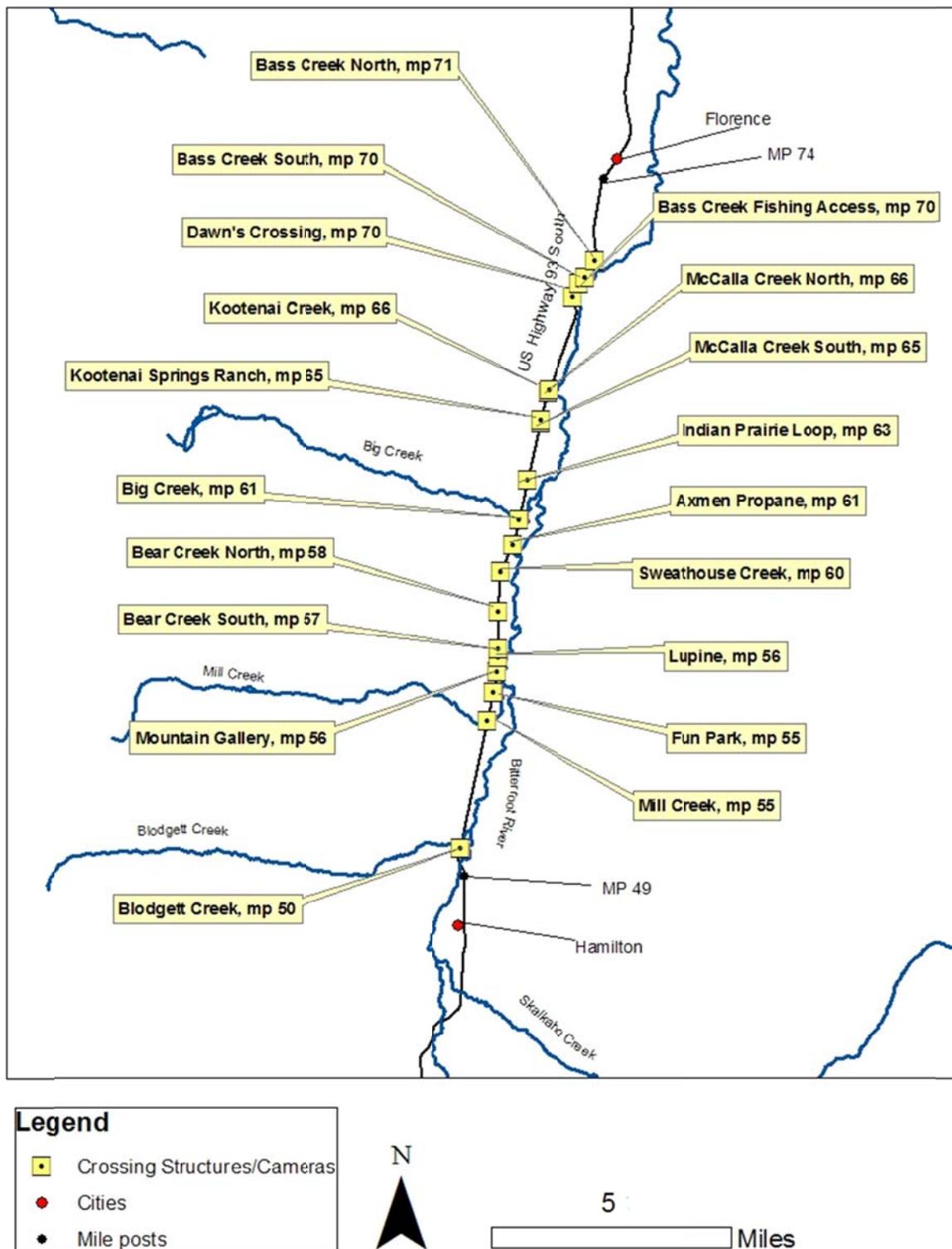


Figure 1. Map of US Highway 93 South Study Area and Locations of Existing and Future Wildlife Crossing Structures, Montana.

2. White-tailed Deer Use of Existing Wildlife Crossing Structures and Future Wildlife Crossing Structure Sites

2.1. Methods

Wildlife usage rates were determined by monitoring existing wildlife crossing structures and future wildlife crossing structure sites with Reconyx Professional Cameras, Model PC85. Cameras are triggered by motion and take pictures of large and small animals, day and night. All cameras, with one exception, were installed inside metal telephone-utility boxes. Each box was secured by a cable, locked to the camera on one end and buried in concrete at the other. All cameras were also secured by electronic code locks. The camera at Kootenai Creek (mp 66) was locked in a metal Reconyx Bear Box mounted on a large fence post and secured with locked cables.

A single camera was installed near one entrance of the following existing wildlife crossing structures: Bass Creek North (mp 71), Bass Creek South (mp 70), Bass Creek Fishing Access (mp 70), Dawn's Crossing (mp 70), Kootenai Creek (mp 66), Indian Prairie Loop (mp 63), and Blodgett Creek (mp 50). Two cameras were installed, one near each entrance, of the following existing wildlife crossing structures: McCalla Creek North (mp 66), McCalla Creek South (mp 65), and Kootenai Springs Ranch (mp 65). Cameras were placed near the entrances of existing wildlife crossing structures in order to record the number of white-tailed deer successfully using, moving parallel to, and repelled from the crossing structures. As new wildlife crossing structures are constructed, additional cameras will be installed.

Two cameras were installed at each of the future wildlife crossing structure sites. One camera was placed as near as possible to any current structures (existing culverts or bridges) or the location of the future wildlife crossing structure. A second camera was placed approximately 25 to 75 meters away. Cameras were positioned so that the first camera could capture animal usage of any current structure or other movements nearby, and the second camera could record animal movements as they approached or

departed the road way. As construction of new wildlife crossing structures is completed, pre-construction cameras will be removed.

Two cameras, Bell Crossing (east and west cameras) were also installed near a bridge over an unnamed spring run on County Road 370, approximately one-quarter mile east of the Bitterroot River. This site was selected as a control to help evaluate changes in the white-tailed deer population over time in a location where road construction is not scheduled to occur. Additional control sites will be selected in the future.

During this reporting period, 11 cameras were installed, removed, and/or renamed as construction activities progressed. At McCalla Creek South (mp 65) “west camera, construction” was renamed “west camera”, “ramp camera, construction” was renamed “ramp camera,” and “east camera” was installed. These three cameras now monitor post-construction wildlife activity. At Kootenai Springs Ranch (mp 65) “east camera, construction” was removed, “west camera, construction” was removed, “east structure camera, construction” was installed and later renamed “east camera,” and “west structure camera, construction” was installed and later renamed “west camera.” The Kootenai Springs Ranch “east and west cameras” now monitor post-construction wildlife activity. At Indian Prairie Loop (mp 63) “west camera” was installed to monitor post-construction activity. At Axmen Propane (mp 61) “north camera, construction” and “south camera, construction” were removed, and “east camera, construction” was installed.

Locations, approximate mile posts, and installation dates of currently installed cameras are presented in Table 2.

Table 2. Cameras Currently Installed at Existing Wildlife Crossing Structures and Future Wildlife Crossing Structure Sites on US Highway 93 South, Montana, and a Nearby Control Site.

Camera Location	Approximate Mile Post	Date Installed
Bass Creek North	71	Oct. 10, 08
Bass Creek South	70	Nov 22, 08
Bass Creek Fishing Access	70	Nov 22, 08
Dawn's Crossing	70	Nov 23, 08
Kootenai Creek	66	Apr 21, 09
McCalla Creek North (east camera)	66	Apr 22, 09
McCalla Creek North (west camera)	66	Apr 22, 09
McCalla Creek South (west camera)	65	June 16, 10
McCalla Creek South (ramp camera)	65	June 16, 10
McCalla Creek South (east camera)	65	July 30, 10
Kootenai Springs Ranch (east camera)	65	June 10, 10
Kootenai Springs Ranch (west camera)	65	July 29, 10
Indian Prairie Loop (west camera)	63	Sept 27, 10
Big Creek (north camera, construction)	61	Mar 1, 10
Big Creek (south camera, construction)	61	Mar 1, 10
Axmen Propane (east camera, construction)	61	Sept 28, 10
Sweathouse Creek (north camera)	60	June 9, 09
Sweathouse Creek (south camera)	60	June 9, 09
Bear Creek North (east camera)	58	Jun 10, 09
Bear Creek North (west camera)	58	Jun 10, 09
Bear Creek South (north camera)	57	Jun 10, 09
Bear Creek South (south camera)	57	Jun 10, 09
Lupine (east camera)	56	Mar 15, 10
Lupine (west camera)	56	Mar 15, 10
Mountain Gallery (north camera)	56	July 21, 09

Camera Location	Approximate Mile Post	Date Installed
Mountain Gallery (south camera)	56	July 21, 09
Fun Park (east camera)	55	July 11, 09
Fun Park (west camera)	55	July 11, 09
Mill Creek (north camera)	55	July 8, 09
Mill Creek (south Camera)	55	July 11, 09
Blodgett Creek	50	Mar 15, 10
Bell Crossing (east camera)	CR 370	May 29, 09
Bell Crossing (west camera)	CR 370	May 29, 09

The following calculations were made for each camera location, where applicable:

- deer per day = the total number of deer observed at the structure or site divided by the number of days the camera was in operation
- success rate = the total number of deer moving through the structure or onto the roadway at future structures, divided by the total number of deer recorded at the structure or site
- rate of repellency = the total number of deer repelled at existing crossing structures or repelled at future crossing sites divided by the total number of deer recorded at the structure or site
- parallel rate = the total number of deer moving parallel to structures or sites divided by the total number of deer recorded at the structure or site.

2.2. Results

Twelve cameras, previously located at McCalla Creek South (north and south cameras, mp 65), Kootenai Springs Ranch (east and west cameras, mp 65), Indian Prairie Loop (north and south cameras, mp 63), Big Creek (north and south cameras, mp 61), Axmen Propane (north and south cameras, mp 61), and Lupine (north and south cameras, mp 56), have produced complete pre-construction data sets and are no longer installed. Results of these twelve complete pre-construction data sets are summarized in Table 3. The order of camera locations is based on the number of deer per day photographed at each camera site.

Table 3. Summary of Complete Pre-Construction Data Sets.

Camera Location	Mile Post	Camera Days	Deer Per Day	Successful Crossings	Success Rate (%)	Rate of Repellency (%)	Parallel Rate (%)
McCalla Creek South (south camera)	65	93	5.0	44	9	3	88
Indian Prairie Loop (north camera)	63	78	4.7	0	0	0	100
Indian Prairie Loop (south camera)	63	150	4.5	0	0	0	100
McCalla Creek South (north camera)	65	115	2.2	21	9	7	84
Big Creek (south camera)	61	260	2.2	0	0	0	100
Kootenai Springs Ranch (east camera)	65	107	2.1	78	32	8	60
Axmen Propane (north camera)	61	212	1.5	0	0	0	100
Kootenai Springs Ranch (west camera)	65	55	0.9	26	54	10	36
Big Creek (north camera)	61	277	0.8	33	14	14	72
Axmen Propane (south camera)	61	176	0.4	4	6	3	91
Lupine (south camera)	56	172	0.1	16	80	15	5
Lupine (north camera)	56	204	0.005	0	0	100	0

Eight cameras, previously located at McCalla Creek South (west and ramp cameras, construction, mp 65), Kootenai Springs Ranch (east, east structure, west, and west structure cameras, construction, mp 65), and Axmen Propane (north and south cameras, construction, mp 61), have produced complete construction data sets and are no longer installed. Results of these eight complete construction data sets are summarized in Table 4. The order of camera locations is based on the number of deer per day photographed at each camera site.

Table 4. Summary of Complete Construction Data Sets.

Camera Location	Mile Post	Camera Days	Deer Per Day	Successful Crossings	Success Rate (%)	Rate of Repellency (%)	Parallel Rate (%)
McCalla Creek South (ramp camera, construction)	65	93	0.5	20	44	22	34
Axmen Propane (north camera, construction)	61	52	0.4	0	0	0	100
Axmen Propane (south camera, construction)	61	49	0.4	0	0	0	100
Kootenai Springs Ranch (west camera, construction)	65	152	0.2	5	18	4	78
Kootenai Springs Ranch (west structure camera, construction)	65	46	0.2	0	0	0	100
Kootenai Springs Ranch (east camera, construction)	65	146	0.2	4	17	0	83
McCalla Creek South (west camera, construction)	65	199	0.1	16	67	8	25
Kootenai Springs Ranch (east structure camera, construction)	65	47	0.06	0	0	0	100

White-tailed deer use of existing wildlife crossing structures is compiled in Table 5. Cameras recorded white-tailed deer successfully moved through existing wildlife crossing structures on nearly 5,000 occasions. Bear Creek South (north camera) is included in Table 5 because the current bridge functions as a wildlife crossing structure even though it was not designed to be a wildlife crossing structure. The order of camera locations is based on the number of successful crossings at each camera location. Camera data reported were analyzed through September 16, 2010.

Table 5. White-tailed Deer Use of Existing Wildlife Crossing Structures.

Camera Location	Mile Post	Camera Days	Deer Per Day	Successful Crossings	Success Rate (%)	Rate of Repellency (%)	Parallel Rate (%)
Bear Creek South (north camera)	57	464	2.7	1245	99	0	1
Kootenai Creek	66	437	2.7	1139	94	2	4
Dawn's Crossing	70	663	1.7	1117	95	2	3
Bass Creek Fishing Access	70	653	1.0	638	94	4	2
McCalla Creek North (east camera)	66	452	0.9	383	90	3	7
McCalla Creek North (west camera)	66	420	0.8	261	77	15	8
Blodgett Creek	50	159	0.5	72	99	1	0
Bass Creek North	71	602	0.2	55	39	7	54
Kootenai Springs Ranch (east camera)	65	96	0.9	9	10	9	81
McCalla Creek South (west camera)	65	72	0.3	9	36	28	36
Kootenai Springs Ranch (west camera)	65	49	1.9	8	8	11	81
Mccalla Creek South (east camera)	65	49	0.3	8	53	20	27
Bass Creek South	71	638	0.009	2	33	17	50
Indian Prairie Loop	63	0	-	-	-	-	-

White-tailed deer use of future wildlife crossing structure sites is compiled in Table 6. The order of camera locations is based on the number of deer per day at each camera location. Camera data reported were analyzed through September 16, 2010.

Table 6. White-tailed Deer Use of Future Wildlife Crossing Structure Sites.

Camera Location	Mile Post	Camera Days	Deer Per Day	Successful Crossings	Success Rate (%)	Rate of Repellency (%)	Parallel Rate (%)
Big Creek (north camera, construction)	61	186	2.1	0	0	0	100
Lupine (west camera)	56	182	1.8	0	0	0	100
Big Creek (south camera, construction)	61	199	1.7	0	0	0	100
Fun Park (east camera)	55	432	1.5	541	79	11	10
Mill Creek (south camera)	55	402	1.3	381	68	16	16
Sweathouse Creek (north camera)	60	404	1.1	54	12	1	87
Sweathouse Creek (south camera)	60	420	0.9	205	55	5	40
Lupine (east camera)	56	185	0.9	0	0	0	100
Bear Creek North (east camera)	58	371	0.5	22	11	2	87
Bear Creek South (south camera)	57	426	0.4	120	69	9	22
Mountain Gallery (north camera)	56	296	0.4	46	44	2	54
Fun Park (west camera)	55	391	0.2	42	53	1	46
Mill Creek (north camera)	55	404	0.09	0	0	0	100
Mountain Gallery (south camera)	56	422	0.06	14	56	4	40
Bear Creek North (west camera)	58	453	0.02	1	13	25	62
Axmen Propane (east camera, construction)	61	0	-	-	-	-	-

2.3. Anticipated Work

- Install, remove, and/or rename cameras as needed during construction
- Ongoing monitoring and data analysis.

3. White-Tailed Deer Usage Rates of Wildlife Crossing Structures by Type and Across Types

A detailed statistical analysis of white-tailed deer usage rates of wildlife crossing structures by type will be completed as construction of future wildlife crossing structures is completed. An analysis of usage rates across types cannot be completed at this time because the types of structures are limited. Of the existing wildlife crossing structures, Bass Creek Fishing Access is the only corrugated steel culvert with post-construction data, and Kootenai Springs Ranch is the only concrete box culvert with post-construction data. As future wildlife crossing structures are installed and additional photographic data are collected this analysis will be completed, and will include variables such as height, width, and length.

4. Relationships among Crossing Structures with Landscape Variables and Crossing Rates

A methodology to measure and quantify variables such as structure, road, traffic, landscape, vegetation, and deer pellet counts at existing and future wildlife crossing structures was developed. Data was collected during this reporting period at all existing wildlife crossing structures and future wildlife crossing structure sites, except for the following: Indian Prairie Loop, Big Creek, and Axmen Propane. Construction activities were occurring at these three locations; and landscape variables there were drastically changed by the recent construction activities. Data will be collected at these three locations after construction is completed. Collected data and usage rates will then be analyzed using multivariate statistics.

5. Changes in Animal-Vehicle Collisions Between Pre-Construction and Post-Construction of Wildlife Crossing Structures

Generalized Linear Models (GLMs) will be used to analyze changes in AVC between pre-construction and post-construction of wildlife crossing structures. GLMs will include multiple continuous predictors such as traffic volume and deer density in addition to categorical co-variate pre-construction and post-construction AVC data. This reporting period, preliminary analysis of AVC data, traffic volume, and deer densities continued. GLMs will be completed when future wildlife crossing structures are completed and post-construction AVC data, traffic volume, and deer density data are analyzed.

6. Relationships between AVC Numbers and Wildlife Crossing Structures over Time and Space, Kernel Density Analysis

Additional kernel density analysis will continue as new wildlife crossing structures are completed and AVC data are collected.

7. Elk Use of Wildlife Crossing Structures and Jump-off Ramps at McCalla Creek South and Kootenai Springs Ranch

The wildlife crossing structures and jump-off ramps at McCalla Creek South and Kootenai Springs Ranch were designed to be utilized by white-tailed deer. Elk (*Cervus elaphus*) were not known to be present during the design of these structures. However, cameras have recorded 136 elk observations at these two locations during this research. Ninety-one of these observations were parallel movements. During pre-construction monitoring, 22 elk were recorded crossing US Highway 93. During post-construction monitoring (structures and wildlife fencing in place), 21 elk were recorded crossing US Highway 93. Of these 21 elk, 3 were recorded using jump-off ramps (Figure 2.), and 17 appear to have used jump-off ramps to leave the road (Figure 3.). An elk calf was

recorded successfully using the Kootenai Springs Ranch wildlife crossing structure on two occasions (possibly two individual calves, Figure 4.). As of September 16, 2010, no adult elk were recorded using either of the wildlife crossing structures.



Figure 2. Elk Cow and Calves Using Jump-off Ramp at McCalla Creek South.



Figure 3. Elk Crossing US Highway 93 Post-Construction at Kootenai Springs Ranch.



Figure 4. Elk Calf Using the Kootenai Springs Ranch Wildlife Crossing Structure.

8. Black Bear Use of Wildlife Crossing Structures.

During this reporting period, black bear (*Ursus americanus*) were recorded on three occasions successfully using the structures at Dawn's Crossing, Bear Creek South, and Blodgett Creek (Figure 5.).



Figure 5. Black Bear using Dawn's Crossing.

9. Corvallis High School Research Projects.

During this reporting period, eight Corvallis High School students in the Classroom Without Walls program (<http://sites.google.com/site/corvallisclassroomwithoutwalls/home>) began conducting individual research projects utilizing data from the US Highway 93 South Wildlife Crossings Research. Their teacher contacted MDT requesting information about wildlife crossing structures. Background information on wildlife crossing structures installed by MDT, transportation ecology, and this research was provided through email during the

month of September, 2010. A half-day field trip was conducted on September 27, 2010. The eight students and their teacher visited the Blodgett Creek, Bass Creek Fishing Access, and McCalla Creek South wildlife crossing structures. The students were encouraged to formulate specific research questions and test their hypotheses. Additional information, research guidance, and monitoring data were shared with the students through email during the months of October and November, 2010. The students will complete their projects and present their results on December 9, 2010 at Corvallis High School.

Major Task Progress

Note: Only first 10 tasks of 30 total submitted to MDT pre-study are presented at this time

Task	Description	Estimated Span of calendar years Estimated after kickoff	Cost	Total billed to date	Percentage complete based on original budget
1	Task 1 Purchase equipment	Oct 1, 08 - Aug 31, 09	\$49,650	40,094.41	80.7%
2	Task 2 Install equipment	Oct 9, 08 – Aug 31, 09	6,300	6,300	100%
3	Task 3 Monitor wildlife movement	Nov 1 08 – May 1, 09, 6 months	18,105	18,105	100%
4	Task 4 Obtain & analyze current a-v-c	Fall, 08 - Aug 31, 09	8,520	7,669.5	90 %
5	Task 5 Hold public meeting	Summer 09	Not applicable	Not applicable	Not applicable
6	Task 6 Create a-v-c prediction models	Spring/ Summer/ Fall 09	9,880	680	6.9%
7	Task 7 Monitor wildlife movement	May 1, 09- April 30 '10 = 12 months	41,810	41,810	100%
8	Task 8 Create Interim Report	Aug 09	3,720	3,720	100%
9	Task 9 Hold public meeting	Summer '10	2,760	2,760	100%
10	Task 10 Monitor wildlife movement	May 1 10 – April 30 '11 = 12 months	40,560	10,140	25%