



Amendment: Highway 3
Transportation Mitigation
for Wildlife and
Connectivity in Elk Valley
of British Columbia

October 2019

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and Dr. Clayton Lamb



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October 2019

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Acknowledgements

Many individuals provided information, advice and support for the 2019 amendment to the Highway 3 Transportation Mitigation for Wildlife and Connectivity Report. We wish to thank the following stakeholders:

Batycki, Candace	Yellowstone to Yukon Conservation Initiative
Beswick, Sean	Teck
Bohm, Holger	FLNRORD
Chow, Emily	FLNRORD
Douglas, Richard	Mainroad
Fairbairn, Steve	District of Elkford
Gordon, Ryan	Conservation Officer Service
Gostick, Len	District of Elkford
Hanlon, Bill	BCHA
Heather Smith	Representing MLA
Hesse, Gayle	Wildlife Collision Working Group
Klafki, Richard	Nature Conservancy Canada
Macnair, Randal	Wildsight
Milligan, Nic	Teck
Millions, Beth	RoadWatchBC
Mitchell, Gary	Regional District of East Kootenay
O'Connor, Joe	Mainroad
Petryshen, Eddie	Wildsight
Podrasky, Kevin	Teck
Schaufle, Rob	Collision Count, Miistakis Institute
Sielecki, Leonard	MOTI
Simmons, Connie	Yellowstone to Yukon Conservation Initiative
Stent, Patrick	Cranbrook MOECSS
Wells, Duane	MOTI

Thank you to the following funders for supporting RoadWatchBC and Highway 3 Transportation Mitigation for Wildlife and Connectivity in Elk Valley of British Columbia report amendment:

Vancouver Foundation

TECK

Chawkers Foundation

Adaptive Management Initiative of the Roundtable of the Crown of the Continent

Patagonia Environmental Grants Fund of Tides Foundation

Executive Summary

The Highway 3 transportation corridor in the Elk Valley, including land use and development adjacent to the highway, has been identified as a major challenge to maintaining wildlife connectivity in the Southern Canadian Mountains. This corridor is known to fracture wildlife connectivity for large mammal species at international (USA-Canada), and local scales.

The Highway 3: Transportation Mitigation for Wildlife and Connectivity report was released by Clevenger et al. in 2010 and summarized existing knowledge on large-bodied animals including carnivores and ungulates, and animal-vehicle collision clusters to identify key linkage zones across the highway. The areas of high conservation value or collision risk were identified as potential Mitigation Emphasis Sites (MES), and the report specified site-specific mitigation considerations for these areas. For each MES strategies were recommended to best facilitate movement and reduce animal vehicle collisions (AVC) and prioritized mitigation sites for consideration in discussions with agencies (Clevenger et al. 2010).

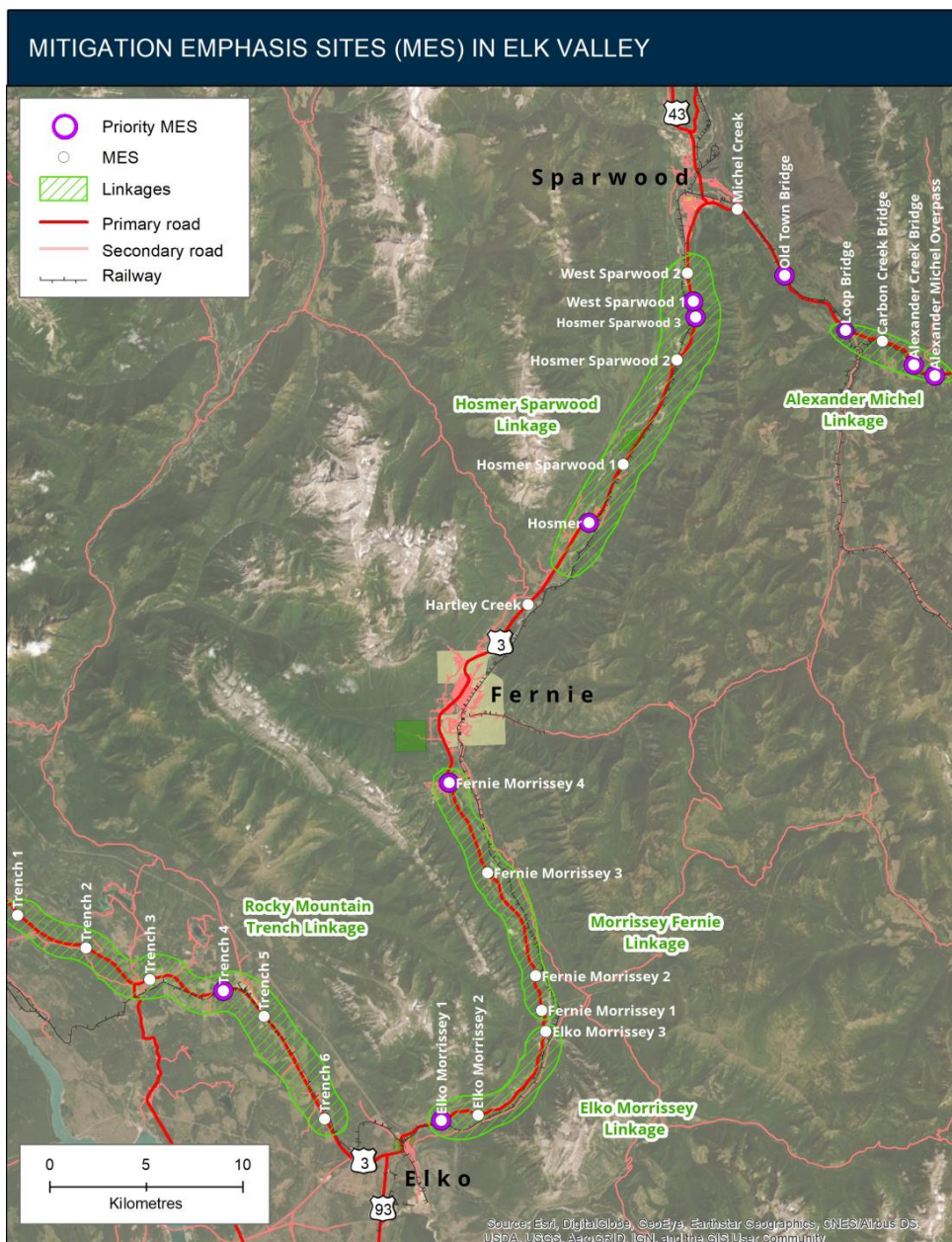
Since the release of the Clevenger et al. (2010) report, progress has been made on the ground in British Columbia to advance science on wildlife movement, establish relationships with implementing agencies and grow public support for investment in wildlife transportation mitigation measures. In light of these changes and progress, the amendment for the BC portion of Highway 3 was undertaken to address the following objectives:

- Update Mitigation Emphasis Site (MES) locations based on new monitoring data and stakeholder engagement;
- Review and update recommended mitigation strategies;
- Review criteria and scores for prioritization of MES; and
- Recommend key MES to stakeholders.

Mitigation measures and their effectiveness (including cost effectiveness) are described in Clevenger et al. 2010 report and are not included in this report. The amendment was informed by new monitoring data from a citizen science initiative, government roadkill reports, site visits by experts, and new wildlife monitoring data on elk, grizzly bear, and wolverine. To integrate learning from the new datasets into conservation action, the ENGO's engaged in RoadWatchBC hosted a stakeholder engagement workshop, From Data to Action where representatives from ENGO's, municipalities, BCMOTI, FLNRO, Land Trusts and TECK reviewed program results, developed criteria for prioritizing mitigation sites; and discussed next steps toward implementation of mitigation strategies.

Stakeholders identified four new MES as well as recommended adjustments to the location of 3 MESs along Highway 3. In addition new MES were added along Highway 43 and 93 based on expert knowledge and assessment of WARS and RoadWatchBC datasets.

Criteria for prioritizing MES were simplified and weighted according to results from a weighted average Analytical Hierarchy Process (AHP) undertaken by stakeholders. Each criterion was then scored from 1 (very low) to 5 (very high) for each MES resulting in a prioritized list of MES. The top 10 sites in order of prioritization are Alexander Michel Overpass, Alexander Creek Bridge, Old Town Bridge, West Sparwood 1, Hosmer Sparwood 3, Loop Bridge, Elko-Morrissey 1, Trench 4, Hosmer, and Fernie-Morrissey 4 (outlined in purple on map below).



Field visits with transportation engineers and road ecology specialists resulted in an update of mitigation recommendations. A key consideration for implementation of mitigation sites are the identified linkage zones which represent areas on the landscape that should be treated as a mitigation system to reduce AVCs and improve wildlife permeability across Highway 3. Although mitigation measures may be implemented in stages the overall goal should be to link MESs within linkage zones via fencing to ensure most significant value to conservation.

1.0 Introduction

The Highway 3 transportation corridor, including land use and development adjacent to the highway, has been identified as a major challenge to maintaining wildlife connectivity. This corridor is known to fracture wildlife connectivity for large mammal species at international (USA-Canada), and local scales (the Elk Valley of Southeastern British Columbia) (M.F. Proctor et al. 2005; Michael F. Proctor et al. 2012). Our focal area of Highway 3 is a two-lane, east-west highway that bisects the Continental Divide of the Rocky Mountains supporting approximately 6,000 to 9,000 vehicles per day between Cranbrook, Elko, Fernie, Sparwood, and over the continental divide into Alberta. The current rate of animal-vehicle collisions involving large mammals in this area has raised concerns among agencies and the public regarding motorist safety, with upward of 1,200 to 1,600 animal vehicle collisions/year reported in the East Kootenay's¹. Highway 3 contributes to fragmentation of wildlife populations and contributing to mortality through collisions with vehicles. A variety of species are impacted by this unmitigated highway, including wide-ranging carnivore species that persist at low densities, with limited distributions in the larger region, as well as many ungulate species. Collectively, Highway 3 impacts many species of high cultural and ecological value, and without mitigation measures collisions with these animals remain a significant risk to human safety.

The Highway 3: Transportation Mitigation for Wildlife and Connectivity report was released in 2010 (Clevenger et al. 2010). The report summarized existing knowledge on large-bodied animals including carnivores and ungulates, and animal-vehicle collision clusters to identify key linkage zones across the highway. The areas of high conservation value or collision risk were identified as potential Mitigation Emphasis Sites (MES), and the report specified site-specific mitigation considerations for these areas. For each MES strategies were recommended to best facilitate movement and reduce animal vehicle collisions (AVC) and prioritized mitigation sites for consideration in discussions with agencies (Clevenger et al. 2010).

The Clevenger et al. (2010) report has been used by the Miistakis Institute, Wildsight, and Yellowstone to Yukon Conservation Initiative as a platform for advancing wildlife conservation and human safety in the Elk Valley of British Columbia. Since the release of the Clevenger et al. (2010) report, progress has been made on the ground in British Columbia to advance science on wildlife movement, establish relationships with implementing agencies and grow public support for investment in wildlife transportation mitigation measures. To date, BC's Ministry of Transport and Infrastructure (BCMOTI) has invested \$6.3M for the first wildlife crossing, a bridge replacement and engineered wildlife

¹ Numbers provided by Mainroad East Kootenay Contracting, representing the East Kootenay Service Area (3,673 lane kilometers) <https://mainroad.ca/mainroad-east-kootenays-contracting-winter-operations-faqs>.

underpass at Lizard Creek, with plans in progress for more structures to be retrofitted to improve wildlife permeability in coming years.

In light of these changes and progress, this amendment for the BC portion of Highway 3 was undertaken to address the following objectives:

- Update Mitigation Emphasis Site (MES) locations based on new monitoring data and stakeholder engagement;
- Review and update recommended mitigation strategies;
- Review criteria and scores for prioritization of MES; and
- Recommend key MES to stakeholders.

The syntheses, field assessments and recommendations described in this report reflect the best available understanding and options for direct mitigation of highway impacts to local populations of large terrestrial wildlife. Although conservation measures at regional and landscape scales are critical in maintaining wildlife population connectivity, the focus of this report is at the finest scale necessary to address Highway 3 impacts on terrestrial wildlife: site-specific mitigation of the highway itself.

2.0 Approach

This amendment was informed by new monitoring data from a citizen science initiative, government roadkill reports, site visits by experts, and new wildlife monitoring data on elk, grizzly bear, and wolverine.

RoadWatchBC, a citizen science program, developed by Miistakis Institute, Wildsight and Yellowstone to Yukon Conservation Initiative, was designed to monitor wildlife along highways; grow community knowledge and support for wildlife mitigation; and build relationships with agencies responsible for wildlife transportation mitigation. After three years of data collection (2016 to 2019) the program generated 1,500 wildlife observations along highways in the Elk Valley. The program culminated in a stakeholder engagement workshop where results were shared, and next steps for improving human and wildlife safety were outlined. A key component of next steps is the completion of this amendment to guide mitigation implementation.

The Wildlife Accident Reporting System (WARS) is hosted by BCMOTI and represents animal carcass data reported by highway maintenance contractors.

GPS radiotelemetry (grizzly bear and elk) and genetic tagging (wolverine and grizzly bear) projects conducted since the 2010 report were used to understand where animals are crossing successfully, and where AVCs are occurring. These data are not detailed explicitly in this report but were consulted by experts while assessing the MES locations and

recommendations. Some maps of these data are displayed in Appendix B support our conclusions.

To integrate learning from the new datasets into conservation action, the ENGO's engaged in RoadWatchBC hosted a stakeholder engagement workshop, From Data to Action where representatives from ENGO's, local government, BCMOTI, FLNRO, Land Trusts and TECK reviewed program results, developed criteria for prioritizing mitigation sites; and discussed next steps toward implementation of mitigation strategies.

A series of field trips were organized for workshop stakeholders to visit MES to discuss need to additional MES locations, mitigation measures, and scoring of criteria.

3.0 Wildlife Transportation Conflict Areas

3.1 Methods

For British Columbia wildlife observation along Highway 3 were acquired from two sources:

- RoadWatchBC (2016-2019); and
- Wildlife Accident Reporting System (WARS) (2005-2017).

RoadWatchBC data was collected via a smartphone application (GPS generated location) or through an on-line mapping tool (user estimated location) and includes information on species, and species status (dead, crossing or adjacent to road).

WARS data consist of roadkill observations collected by highway maintenance contractors and were provided by BCMOTI. Locations were provided to the nearest kilometer marker along Highway 3 and converted into a GIS point dataset.

3.1.2 Data Limitations

The WARS dataset is based on the nearest road reference or landmark, therefore the spatial accuracy of AVCs is unknown and of lower quality than data collected using GPS coordinates. The data is systematically collected as highway maintenance personal drive the highway daily and remove animal carcasses.

RoadWatchBC data is not systematically collected and is subjected to bias in terms of volunteer effort, whereby more populated areas may be over represented compared to more remotely driven sections of highway. For example there are many observations in the town of Fernie likely as a result of greater participation in this area therefore resulting in more frequent reporting to the RoadWatchBC program. The location of the data is GPS coordinates and includes mortality, crossing and adjacent observations.

The WARS and RoadWatchBC datasets were used as surrogates to assess human safety risk along the road network in the Elk Valley. Ideally human safety risk per capita would have been assessed by normalizing WARS data to traffic volume to identify the most high risk areas to motorists. Unfortunately traffic volume data was not available.

3.1.3 Identification of AVC or Animal Highway Intersection Clusters

RoadWatchBC and WARS datasets were assessed using a Kernel Density Estimation (KDE) (Chung et al. 2011) to identify clusters within a road segment. Bil et al. 2016 extended the framework of the standard KDE method by introducing repeated random simulations (Monte Carlo method) to objectively determine the level of significance (threshold), selecting only significant clusters and ranking them. Furthermore, the resulting significant clusters can be ranked according to cluster strength (Bil et al. 2016). The strongest and most stable clusters are those with a KDE+ strength ≥ 0.6 and ≥ 5 animals/ cluster. These are clusters that are consistently observed over time and won't change in their strength if one or two animals are added or have gone unreported.

We will use KDE+ to identify significant clusters of RoadWatchBC animal observations and WARS mortality observations within pre-defined sections along the highway network. There are three factors that can influence KDE+ analysis, the length of highway section considered in cluster assessment, kernel diameter for analysis and number of simulations. For this analysis we will develop a point dataset of WARS mortality observations and RoadWatchBC animal observations, with the following:

- KDE+ for three pre-defined sections, including Highway 3, 93 and 43;
- Set kernel band-width at 500 m; and
- Set the number of simulations (800 recommended in software).

This analysis will help inform prioritization of statistically significant mortality and animal highway interaction clusters along Highway 3 and inform areas where human safety could be addressed.

3.2 Results

3.2.1 Datasets Summaries

The RoadWatchBC dataset included 886 observations reported between 2016-2019, including 149 animal carcasses; 172 animal crossing; and 565 animal adjacent observations. Figure 1 represents the number of large-bodied species observed along roads based on a three year average.

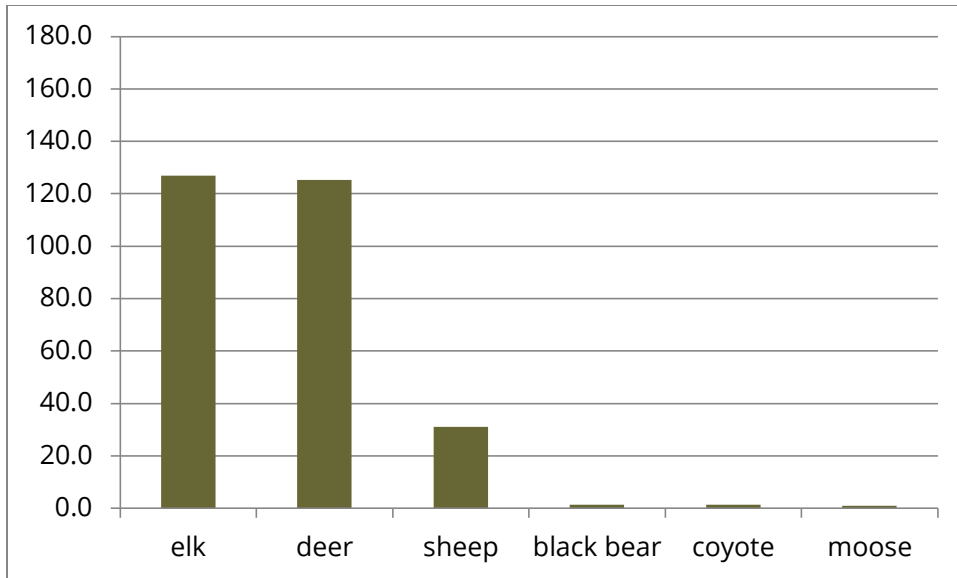


Figure 1: Annual average of large-bodied animals reported to RoadWatchBC

The WARS dataset included 1443 animal carcasses reported from 2012-2017. Figure 2 represents the number of large-bodied species carcasses reported based on a six year average.

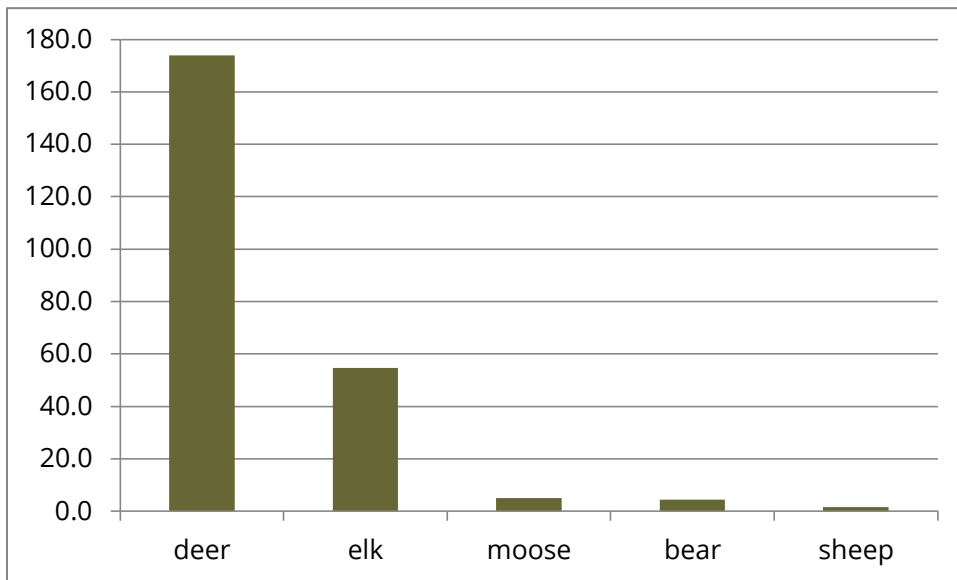


Figure 2: Annual average large-bodied animal carcasses reported to WARS

3.2.2 KDE + Analysis

RoadWatchBC clusters were identified using KDE+ analysis (Figure 3, Figure 4, Figure 5) to represent areas where wildlife activity intersects (crossing, mortality and adjacent) with the road network. There were four significant clusters, represented as light purple lines and thirteen non-significant clusters, represented as bright purple lines. These clusters

represent areas where ungulate species are most commonly active along Highway 3 and therefore inform discussions on highway mitigation for wildlife.

WARS clusters were identified using KDE+ analysis to represent areas where wildlife are most commonly involved in AVCs. Along Highway 3 there were eleven significant clusters, represented as bright yellow lines and nine non-significant clusters, represented as dark yellow lines. These areas represent best locations for mitigation to reduce total number of collisions and therefore improve human safety.

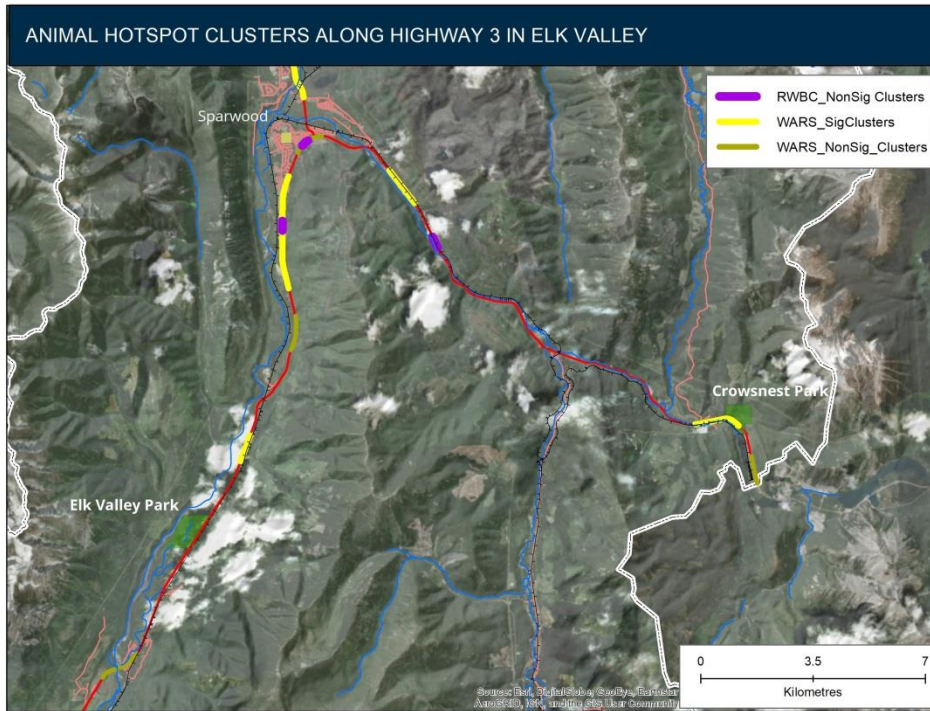


Figure 3: RoadWatchBC and WARS KDE+ animal clusters around Sparwood

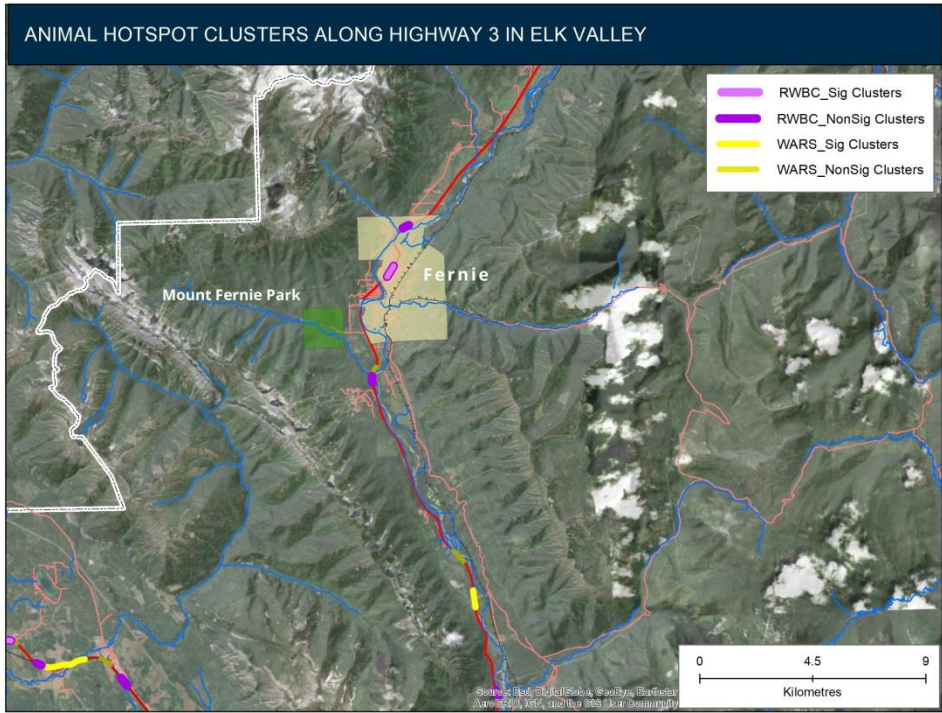


Figure 4: RoadWatchBC and WARS KDE+ animal clusters around the town of Fernie

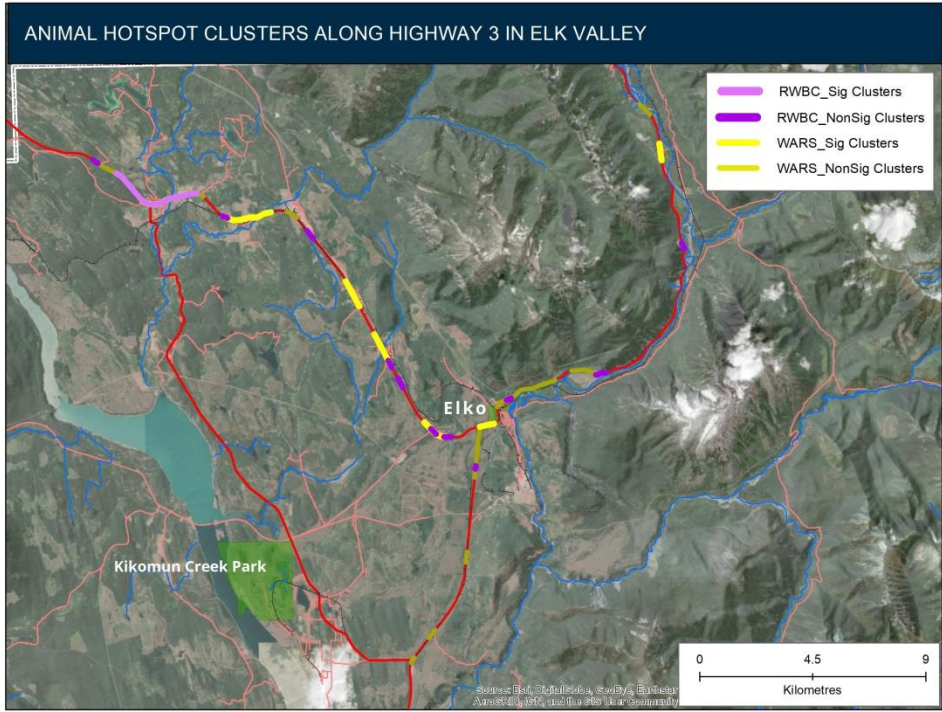


Figure 5: RoadWatchBC and WARS KDE+ animal clusters around Elko

4.0 Highway 3 Wildlife Mitigation Options

4.1 Adjustment to Mitigation Emphasis Sites

The Clevenger et al. (2010) report identified 22 MES in British Columbia along Highway 3 within the focal area. MES were added and shifted in location based on a review of new datasets, expert knowledge from Forests, Lands, Natural Resource Operations and Rural Development (FLNRORD), Southern Rockies Grizzly Bear Research Project, and transportation engineers in the field. Figure 6 displays all 26 MES along Highway 3, including the addition of 4 new MES. New MES or adjustments to old MES include:

- Amalgamating Michel Alexander 1 and 2, to new location most appropriate from an engineering perspective for development of an overpass, now called Alexander Michel Overpass.
- Addition of Alexander Creek Bridge as a low cost solution to improve carnivore movement across Highway 3.
- Name adjustment of Michel Creek 1, now referred to as the Loop Bridge
- Addition of Old Town bridge and Michel Creek MESs to better facilitate animal movement under existing bridges with minor adjustments if combined with fencing;
- Addition of West Sparwood 1 and 2 to address AVCs zones near the town of Sparwood;
- Fernie Morrissey 2 was shifted to align with land owned by Nature Conservancy of Canada; and
- Elko Morrissey 3 was moved to tunnel with recommendation to use current tunnel overpass to facilitate movement. This steep overpass would mostly focus on sheep connectivity.

Additionally through expert knowledge at the workshop we identified new MES for Highway 43 (Figure 7) and 93 (Figure 8). These are not assessed further in the amendment but represent important future considerations for highway mitigation in the Elk Valley.

MITIGATION EMPHASIS SITES (MES) IN ELK VALLEY

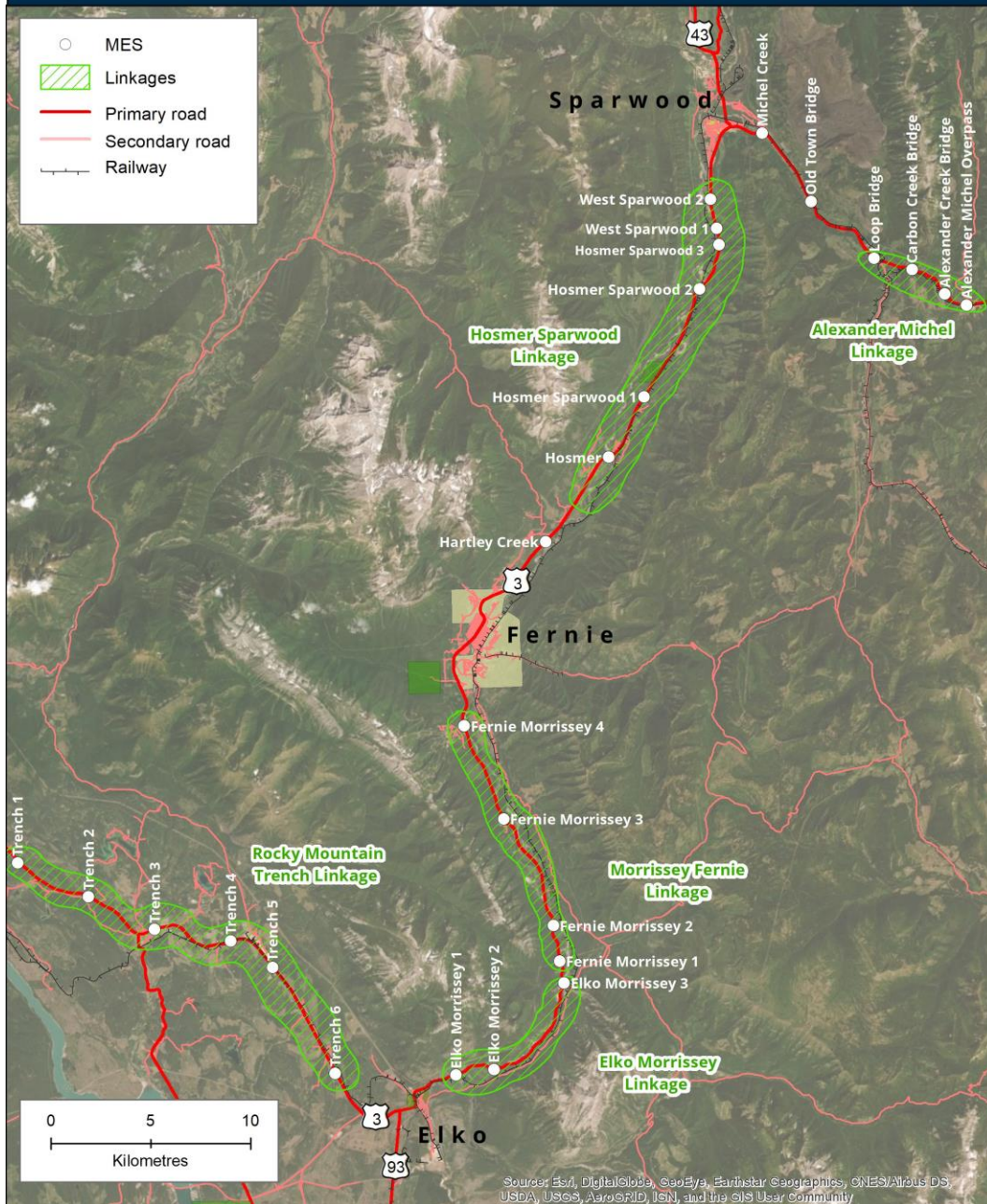


Figure 6: MES and linkage zones along Highway 3 in the Elk Valley

MITIGATION EMPHASIS SITES (MES) IN ELK VALLEY

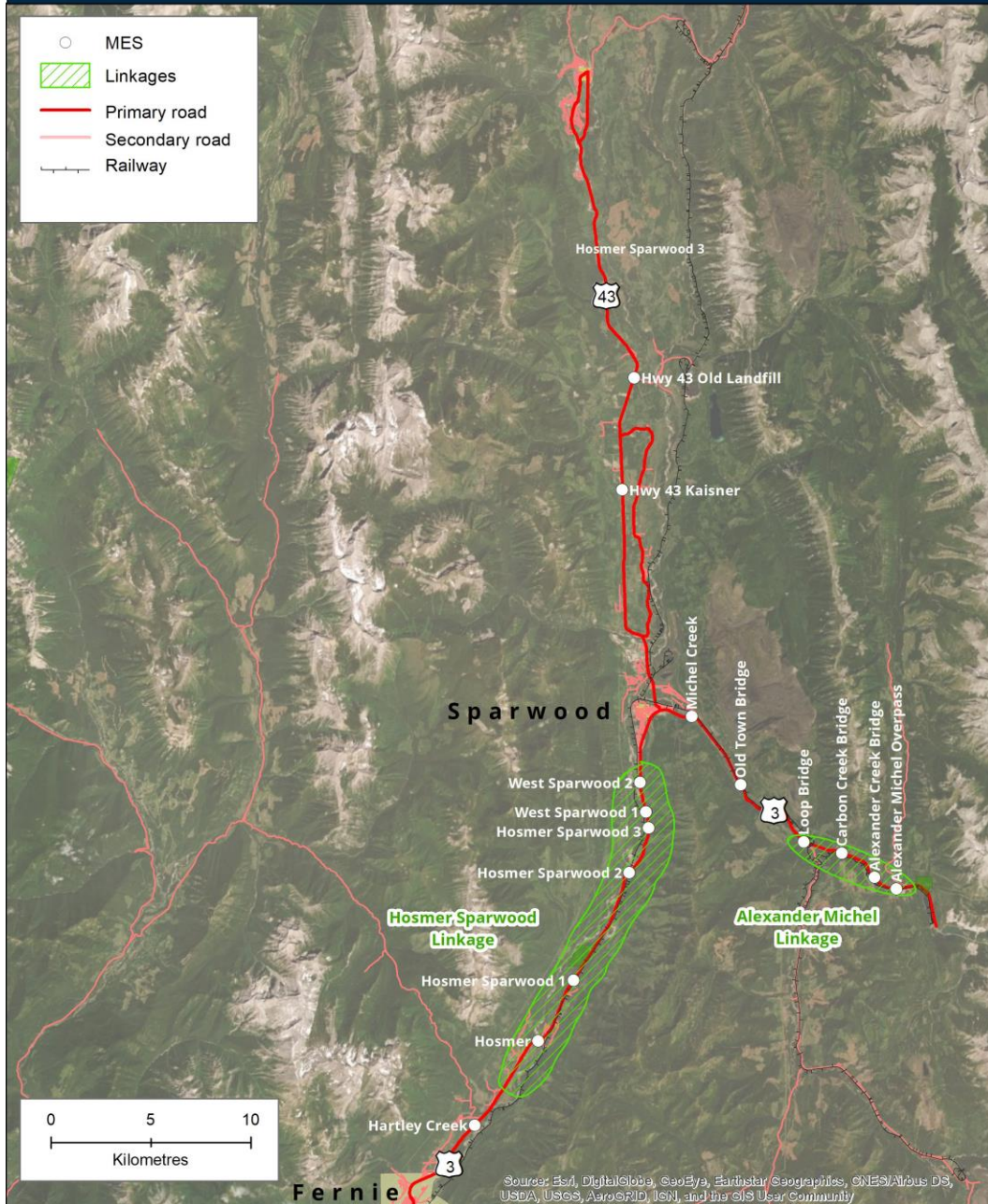


Figure 7: MES along Highway 43 in the Elk Valley

MITIGATION EMPHASIS SITES (MES) IN ELK VALLEY

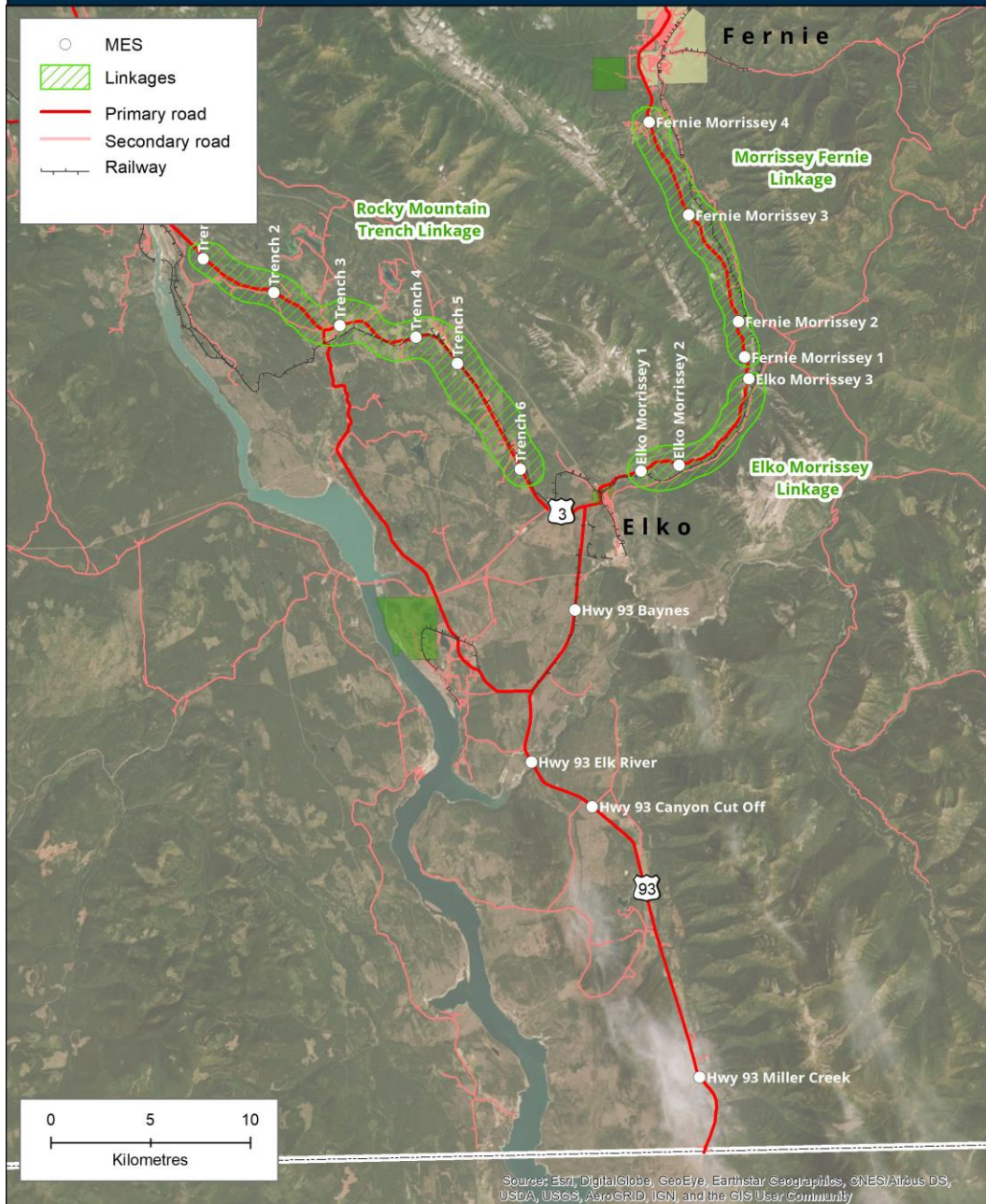


Figure 8: MES along highway 93 in the Elk Valley

4.2 Prioritization of MES

4.2.1 Criteria

At the stakeholder workshop participants were asked to identify criteria for prioritizing MESs. Based on workshop discussions, four criteria were identified, human safety (as a surrogate we used AVCs clusters), conservation significance, land security and transportation mitigation opportunity. An adjustment from the Clevenger et al. (2010) included amalgamation of local and regional conservation significance.

- Highway Safety: relative rate of AVCs as a proxy for motorist safety risk;
- Land-Use Security: the degree to which lands adjacent to the site are secured de facto for conservation;
- Opportunities for Highway Mitigation: the degree to which mitigation options are available and can be implemented with reasonable cost; and
- Conservation Significance: captures the importance of maintaining connectivity for the seasonal movement of herds of ungulates, and/or carnivores.

At the stakeholder engagement workshop we used an Analytical Hierarchy Process (AHP) to rate criteria in terms of their importance to prioritizing MESs. The AHP, introduced by Thomas Saaty is an effective tool for dealing with complex decision making, and may aid the decision maker to set priorities and make the best decision (Saaty 1977). By reducing complex decisions to a series of pairwise comparisons, and then synthesizing the results, the AHP helps to capture both subjective and objective aspects of a decision.

At the workshop stakeholders ran through an AHP process to help familiarize people with the process. Participants then scored the criteria through an on-line survey after the workshop to determine weights for each criterion. The weighted averages (Figure 9) were then used as percentages for accessing the criteria at each MES.

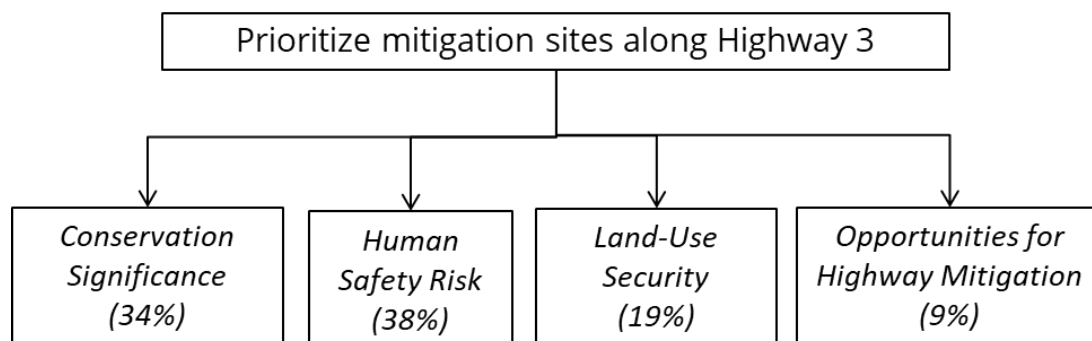


Figure 9: AHP structure and stakeholder derived weighted averages used for each criteria

4.2.2 Scoring and prioritization of MES

The MES were visited in the field and expert knowledge was sought to further refine prioritization by assigning each MES a subjective score from 1 (low) to 5 (high).

Table 1 presents descriptions for scoring the criteria for each MES.

Table 1: Descriptions of Low (1) to high (5) scores to rate criterion

Land Use Security	
5	public lands (federal, provincial, municipal) or private lands with a conservation easement
4	public lands or conservation easement on one side of MES, open space on the other (with unsecured easements)
3	open space lands on both sides, but unsecured conservation easements for these private lands
2	housing development or industrial/commercial site on one side, open space on other side (with unsecured easements)
1	developed land (houses, light industrial) on both sides of hwy
Conservation Significance	
5	Primary connectivity corridor (GB/wolverine movement), or high mortality area with likely population-level effects. Generally multispecies
4	Secondary connectivity corridor (GB or wolverine movement), or high-moderate mortality area with potential population-level effects. Generally multispecies
3	Tertiary connectivity corridor, moderate mortality area with potential population-level effects. Generally multispecies.
2	Connectivity corridor or mortality area for single species
1	Not a connectivity corridor, low mortality area
Human Safety Risk (animal movement clusters)	
5	Statistically significant AVC cluster >0.5 overlapped between WARS and RWBC data sets
4	Statistically significant AVC cluster >0.5 but no overlap between two datasets
3	Statistically significant cluster not statistically significant AVC <0.5 for either dataset
2	Reported AVCs in area but no cluster
1	No reports of AVCs
Opportunities for Highway mitigation	
5	Site characteristics optimal (terrain, topography) and/or easy retrofit of existing structure
4	Site characteristics good (terrain, topography) and/or potential retrofit of existing structure
3	Site characteristics moderate (terrain, topography)
2	Site characteristics challenging (terrain, topography)
1	mitigation not feasible

Based on the AHP weighted values for criteria and scores assigned to each MES, Table 2 presents the prioritized list of MES along Highway 3 in the Elk Valley.

Table 2: Highway 3 MES prioritization matrix in the Elk Valley listed in geographical order from Alberta/BC boarder to Cranbrook

Site Name	Species	Highway Human Saftey Risk (1-5)	Land Use* Land Security (1-5)	Transportation Mitig Opp. (1-5)	Regional/local Cons. Signif. (1-5)	Average Value (AHP)
Alexander-Michel Overpass	Multi	4	5	3	5	3.875
Alexander Creek Bridge	Multi	3	5	5	5	3.875
Carbon Creek Bridge	BHS	2	5	3	2	2.365
Loop Bridge	Multi	2	5	5	4	3.245
Old Town Bridge	Multi	3	5	5	3	3.375
Michel Creek	Multi	2	5	5	3	2.995
West Sparwood 2	Multi	4	2	2	2	2.665
West Sparwood 1	Multi	4	4	3	3	3.285
Hosmer-Sparwood 3	Multi	3	3	4	4	3.255
Hosmer-Sparwood 2	Multi	2	5	2	2	2.175
Hosemer-Sparwood 1	Multi	2	5	2	4	2.675
Hosmer	Multi	3	5	5	2	3.125
Hartley Creek	Multi	2	2	2	2	1.905
Fernie-Morrissey 4	Multi	3	5	5	2	3.125
Fernie-Morrissey 3	Multi	2	5	2	1	1.925
Fernie-Morrissey 2	Multi	2	5	4	4	3.055
Fernie-Morrissey 1	Multi	3	5	2	3	2.805
Elko-Morrissey 3	BHS	2	5	4	4	3.055
Elko-Morrissey 2	Multi	3	3	2	3	2.625
Elko-Morrissey 1	Multi	3	5	3	4	3.245
Trench 1	Multi	2	5	2	4	2.675
Trench 2	Multi	3	5	3	3	2.995
Trench 3	Multi	5	2	1	3	3.105
Trench 4	Multi	4	3	3	3	3.195
Trench 5	Multi	2	4	2	3	2.335
Trench 6	Multi	3	5	3	3	2.995

It is important to note that implementation of mitigation strategies is influenced by many variables, and the conservation community remains flexible to opportunities that arise. This prioritization is presented to stimulate dialogue around mitigation implementation.

4.3 Linkage Zones and Mitigation Sites

The 26 MES were divided into 5 Habitat Connectivity Linkage Areas along Highway 3 (Figure 6). MESs within each linkage zone from east to west include:

- **Alexander to Michel Linkage** occurs from the Continental Divide to Loop Bridge; and includes Alexander Michel Overpass, Alexander Creek Bridge, Carbon Creek Bridge and Loop Bridge MESs (Figure 10);
- **Hosmer to Sparwood Linkage** occurs from West of Sparwood to Hosmer; and includes West Sparwood 1 and 2, Hosmer Sparwood 1-3 and Hosmer MESs (Figure 10);
- **Morrissey to Fernie Linkage** includes Fernie Morrissey 1-4 (Figure 11);

- **Elko to Morrissey Linkage** includes Elko-Morrissey 1-3 MESs (Figure 12); and
- **Rocky Mountain Trench Linkage** occurs from Elko to Kootenay River and includes Trench 1-6 MESs (Figure 12).

Three MESs were located outside Linkage Areas including Old Town Bridge, Michel Creek and Hartley Creek.

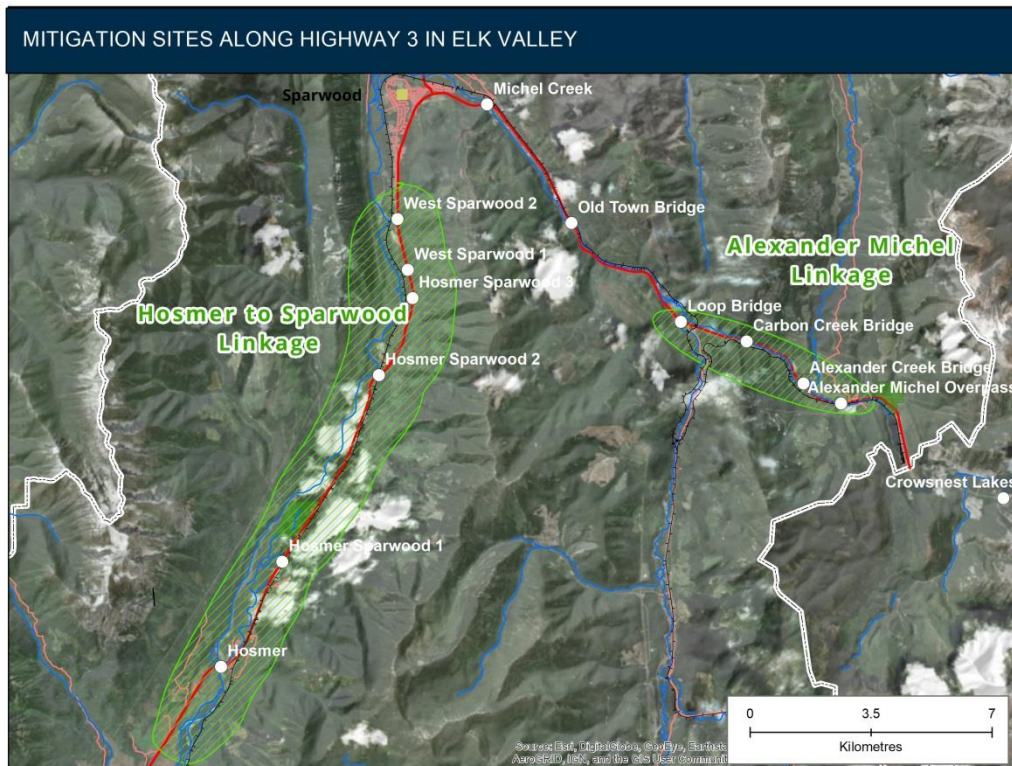


Figure 10: MES along Highway 3 from Continental Divide to Hosmer.

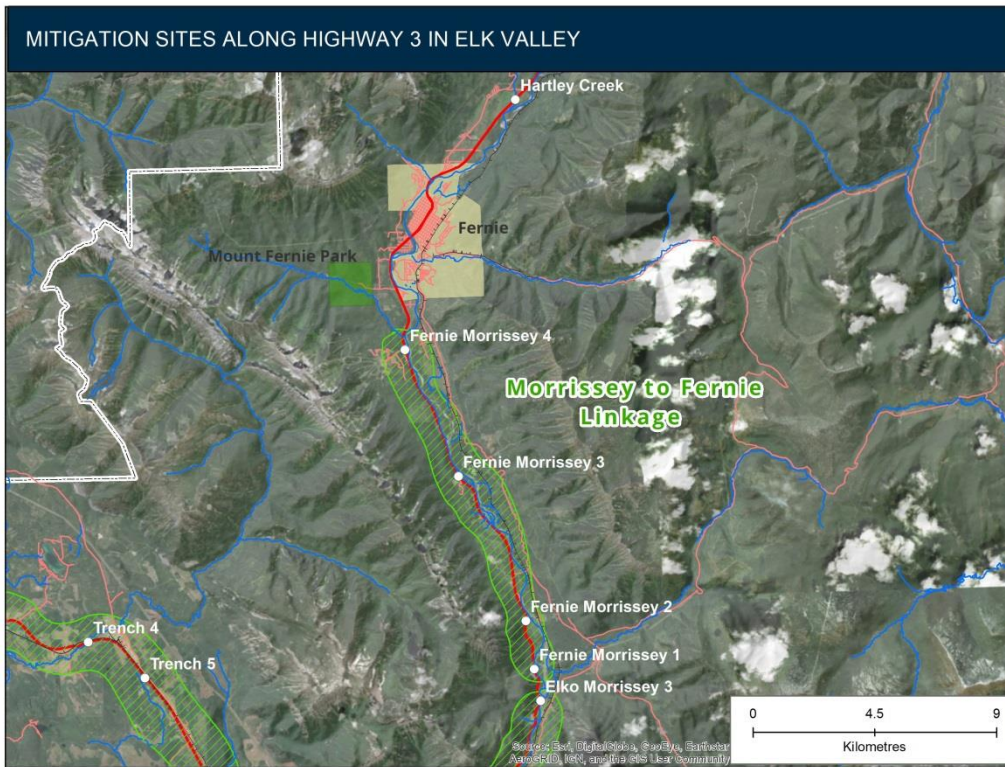


Figure 11: MES along Highway 3 from Morrissey to Fernie

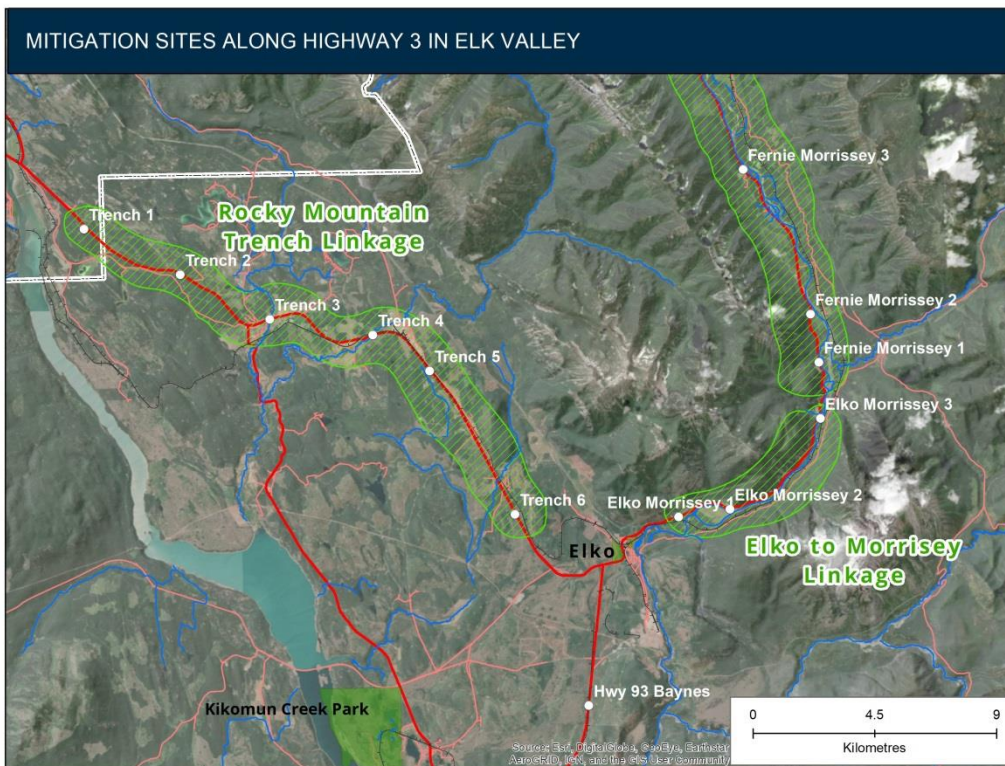


Figure 12: MES along Highway 3 from Morrissey to intersection of Highway 3 and Kootenay River

A large amount of information has been amassed specific to each MES. Information or “Hot Sheets” (**Appendix A**) were prepared for the top 15 prioritized MESs and describe all site-specific information with regard to mitigation importance, target species, wildlife objectives, and recommendations for mitigation measures. The Hot Sheets are a quick and easy reference that summarizes mitigation opportunities at each site.

There are 26 MES along the Highway 3 corridor here we highlight the most relevant sites primarily with regard to AVCs reduction and regional conservation and wildlife connectivity. The maximum and minimum score for a MES was 3.875 and 1.905, respectively. The average score for the matrix valuation of the 26 sites was 2.921. The 10 highest-ranking sites are listed in Table 3 and displayed on Figure 13.

Table 3: Prioritization of MES based on matrix valuation scores list in order of priority

Priority MES	Site Name	Species	Highway	Land Use*	Transportation	Regional /local	Average Value (AHP)
			Human Safety Risk (1-5)	Land Security (1-5)	Mitig Opp. (1-5)	Cons. Signif. (1-5)	
1	Alexander-Michel Overpass	Multi	4	5	3	5	3.875
2	Alexander Creek Bridge	Multi	3	5	5	5	3.875
3	Old Town Bridge	Multi	3	5	5	3	3.375
4	West Sparwood 1	Multi	4	4	3	3	3.285
5	Hosmer-Sparwood 3	Multi	3	3	4	4	3.255
6	Loop Bridge	Multi	2	5	5	4	3.245
7	Elko-Morrissey 1	Multi	3	5	3	4	3.245
8	Trench 4	Multi	4	3	3	3	3.195
9	Hosmer	Multi	3	5	5	2	3.125
10	Fernie-Morrissey 4	Multi	3	5	5	2	3.125
11	Trench 3	Multi	5	2	1	3	3.105
12	Fernie-Morrissey 2	Multi	2	5	4	4	3.055
13	Elko-Morrissey 3	BHS	2	5	4	4	3.055
14	Michel Creek	Multi	2	5	5	3	2.995
15	Trench 2	Multi	3	5	3	3	2.995
16	Trench 6	Multi	3	5	3	3	2.995
17	Fernie-Morrissey 1	Multi	3	5	2	3	2.805
18	Hosemer-Sparwood 1	Multi	2	5	2	4	2.675
19	Trench 1	Multi	2	5	2	4	2.675
20	West Sparwood 2	Multi	4	2	2	2	2.665
21	Elko-Morrissey 2	Multi	3	3	2	3	2.625
22	Carbon Creek Bridge	BHS	2	5	3	2	2.365
23	Trench 5	Multi	2	4	2	3	2.335
24	Hosmer-Sparwood 2	Multi	2	5	2	2	2.175
25	Fernie-Morrissey 3	Multi	2	5	2	1	1.925
26	Hartley Creek	Multi	2	2	2	2	1.905

MITIGATION EMPHASIS SITES (MES) IN ELK VALLEY

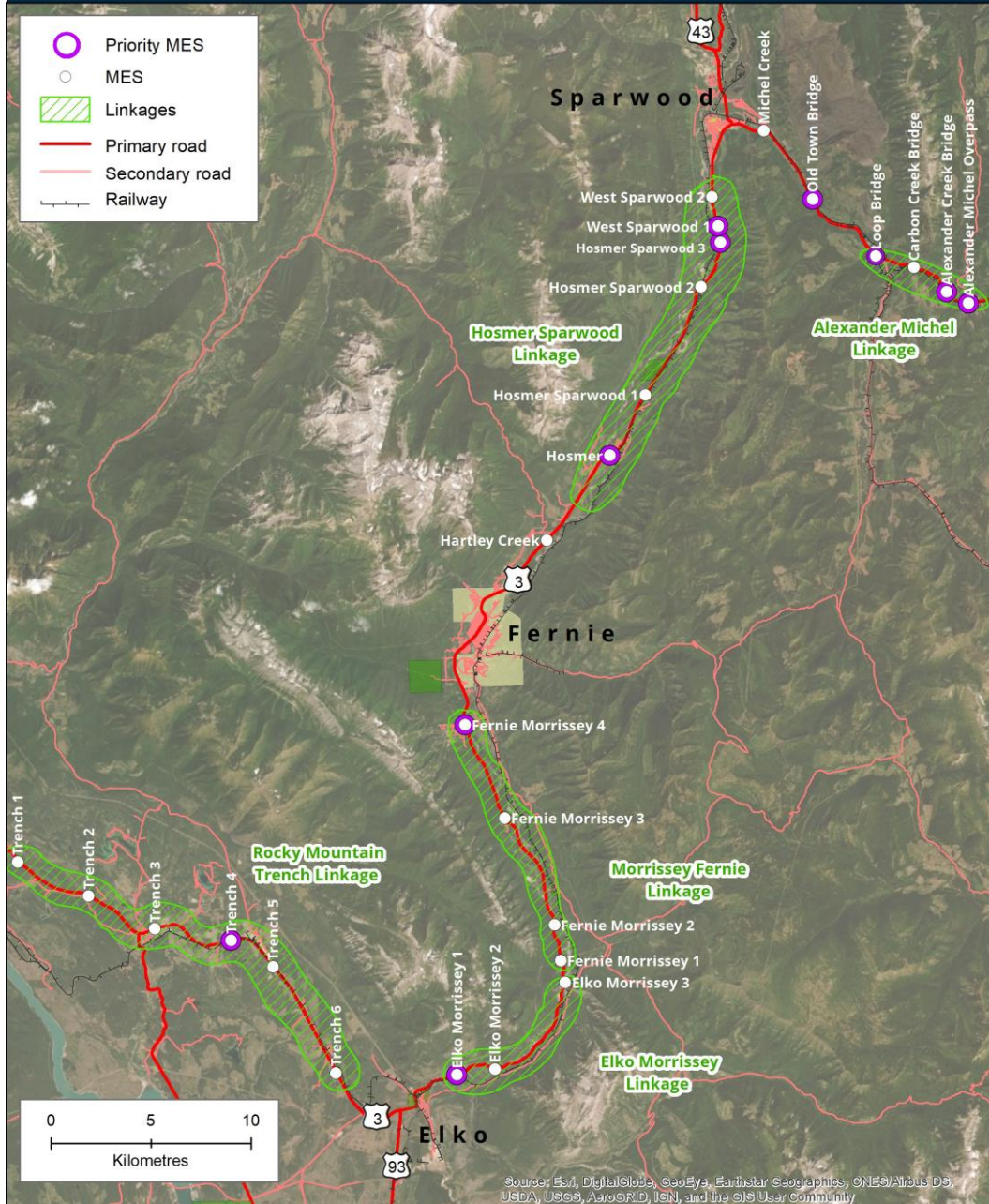


Figure 13: Priority MES along Highway 3 in the Elk Valley.

4.4 Mitigation Recommendations for Priority Sites

Priority MES 1: Alexander-Michel Overpass

This MES ranked highest of all 26 sites along Highway 3 (Figure 14). It was rated high (5) for *Regional Conservation Significance* and *Land Security* (5). It had a moderately high score for *Human Safety Risk* (4) for reducing wildlife mortality on Highway 3. The site had a moderate score for *Mitigation Opportunity/Constructability* (3). The site is within the Alexander-Michel Linkage Area an important linkage for large carnivore species.

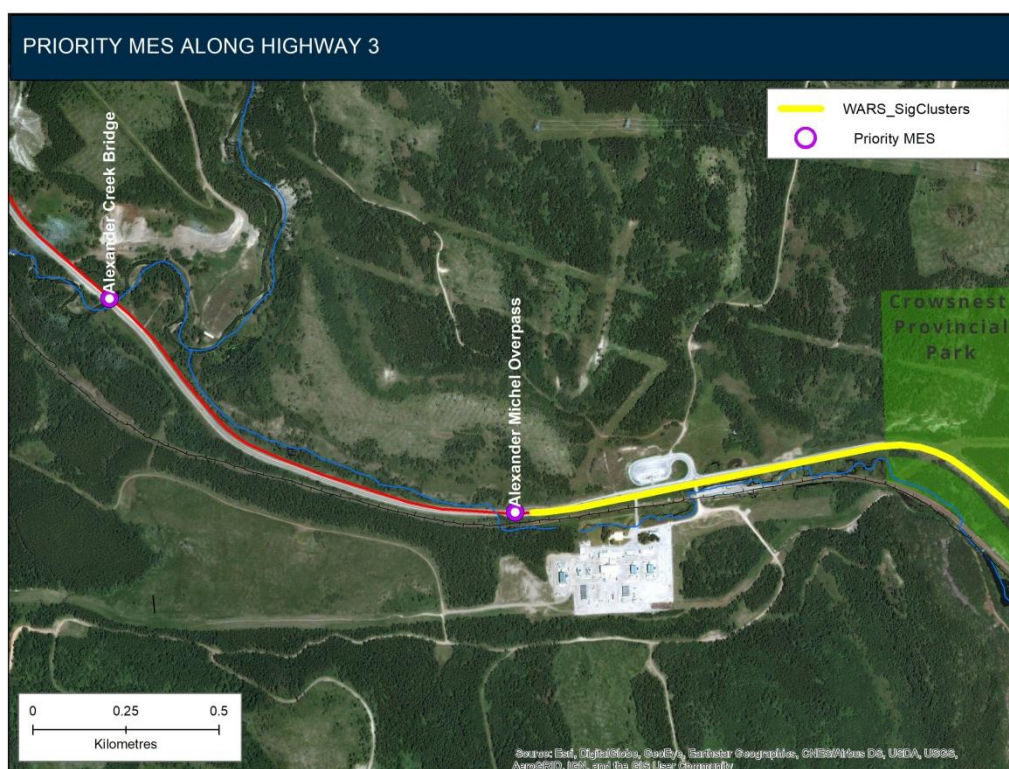


Figure 14: Alexander Michel Overpass and Alexander Creek Bridge Priority MESs along Highway 3

Existing infrastructure: There is no existing below-grade infrastructure in place.

Target species at this site are grizzly bears, wolverines, lynx, wolves, cougar, elk and deer.

The Alexander-Michel Linkage Area is the most important for ensuring regional and continental scale connectivity of wide-ranging fragmentation-sensitive species (grizzly bears, wolverines, lynx, and wolves) and local movement of valued ungulates such as deer, and elk. Highway 3 is barrier to functional connectivity for grizzly bears (Michael F. Proctor et al. 2012; M.F. Proctor et al. 2005). Recent long-term research in Banff National Park demonstrated that the most effective means of restoring functional connectivity of grizzly bears across transportation corridors is by construction of 50 m wildlife overpasses for

movement of breeding females (Ford, Barreto, and Clevenger 2017). The research concludes that highways can be demographic filters to grizzly bear movement and block important population-level gene flow if mitigation is not properly designed. All other crossing structure types, smaller in size did not pass breeding females and family units.

Highway 3 is not within a protected area complex, such as Banff and Yoho National Parks. Within the Crowsnest Pass and Elk River watershed built areas, motorized recreation, natural resource extraction and associated road construction have strong effects on the movements and occurrence of wide-ranging species (Weaver 2013, Lamb et al. 2019, Clevenger et al. 2016). Therefore effective mitigation in the Highway 3 corridor is of extreme importance and will be crucial to large scale transboundary conservation objectives in the Crown of the Continent ecosystem (Weaver 2013; Apps et al. 2016, Lamb et al. 2019). The Highway 3 corridor has also been shown to be a “population density trench” for wolverines, where increasing connectivity across Highway 3 is a transboundary conservation objective among US and Canadian (primarily BC FLNROD) resource management agencies (See Appendix B for grizzly bear and wolverine supporting maps).

Ensuring the overpass is designed to accommodate large carnivores is essential as once mitigation measures are constructed they are in place for a lifespan of 70-80 years. It is unlikely there will be an opportunity to return and modify should the design be inadequate or not function in connectivity populations of wide-ranging fragmentation sensitive species. The onus is on stakeholders and BCMOTI to use the most up to date science to inform planning and design.

Fencing and construction of wildlife overpass is recommended to ensure movement of grizzly bears, wolverines, lynx and wolves through the area. Fencing and overpass construction in this area will also reduce AVCs. Minimum dimension for overpass is 50m wide based on current science (Ford et al. 2017), genetic connectivity of breeding female grizzly bears, and high likelihood of movement of fragmentation-sensitive species through this area. One disadvantage to the proposed location is the close proximity to the CP Railway mainline. The overpass structure would need to span both Highway 3 and CP tracks, increasing the cost of the overpass structure.

Wing fencing will be used to guide wildlife to the overpass and in this important linkage area fencing should be continuous and link neighbouring wildlife crossing structures e.g., Alexander Creek Bridge. Continuous fencing that runs east of the overpass location (ca. 1,000m) will address a high AVC cluster along Highway 3. Each mitigation situation is different and will require a site-specific assessment, but as a general rule, fence ends should terminate at a wildlife crossing structure. If a wildlife crossing cannot be installed at the fence ends, then fences should be designed to terminate in the least suitable location or habitat for wildlife movement—i.e., places wildlife are least likely to cross roads.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a

pair of jump-outs (one on each side of highway) close to the fence end (<100m) and another pair 200-400m from the first pair near fence end.

Priority MES 2: Alexander Creek Bridge

This MES scored second highest in the study area (Figure 14). It was rated high (5) for *Regional Conservation Significance*, *Mitigation Opportunity/Constructability* (5) and *Land Security* (5). It had a moderate score for *Human Safety Risk* (3) for reducing wildlife mortality on Highway 3. The site is within the Alexander-Michel Linkage Area.

Existing infrastructure: There is an open span bridge structure in place on Alexander Creek.

Target species at this site are grizzly bears, wolverines, lynx, wolves, cougar, elk and deer. The site is located in an important North-South wildlife corridor for these species. See Appendix B for grizzly bear and wolverine supporting maps).

Like Alexander-Michel Overpass site, this site is situated in a critically important area of Highway 3 corridor for ensuring regional and continental scale connectivity of wide-ranging fragmentation-sensitive species (grizzly bears, wolverines, lynx, and wolves). Large crossing structures will be the most effective means of mitigating roads for breeding females. Roads without properly designed mitigation will likely filter movement of grizzly bears and have the potential to filter gene flow. Appropriate mitigation at this location will be crucial to large scale transboundary conservation objectives in the Crown of the Continent ecosystem (Weaver 2013, Lamb et al. 2019).

Extensive radio-tracking of grizzly bear movement in the area demonstrates the importance of this area and the bridge is located in one of the most important north-south wildlife corridors. A rifle range is located up valley. This is not likely a negative factor in affecting movements given timing and amount of use and likely habituation to site/disturbance. Additionally the CP Railway is far from the road (~200-300m at this location). A large underpass structures such as this bridge will be the most effective means of mitigating roads for grizzly bears and other sensitive wildlife species. Additional landscaping work, such as shielding and berm construction to reduce traffic noise/lights would improve movement potential.

Wing fencing will be used to guide wildlife to the underpass and in this important linkage area fencing should be continuous and link neighbouring wildlife crossing structures e.g., Alexander-Michel Overpass. Fencing also will reduce AVCs in the area.

Each mitigation situation is different and will require a site-specific assessment, but as a general rule, fence ends should terminate at a wildlife crossing structure. If a wildlife crossing cannot be installed at the fence ends, then fences should be designed to

terminate in the least suitable location or habitat for wildlife movement—i.e., places wildlife are least likely to cross roads.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 3: Old Town Bridge

This site is ranked 3rd in the study area. It was rated high (5) for *Mitigation Opportunity/Constructability* (5) and *Land Security* (5) and rated moderate for *Regional Conservation Significance* (3) and *Human Safety Risk* (3). The site is outside of the defined Linkage Areas (Figure 15). The area between Michel Creek MES and Old Town Bridge represent important habitat for elk, fencing is recommended to tie three sites together (Michel Creek, Old Town Bridge and Loop Bridge) and enable elk movement under existing bridge infrastructure.

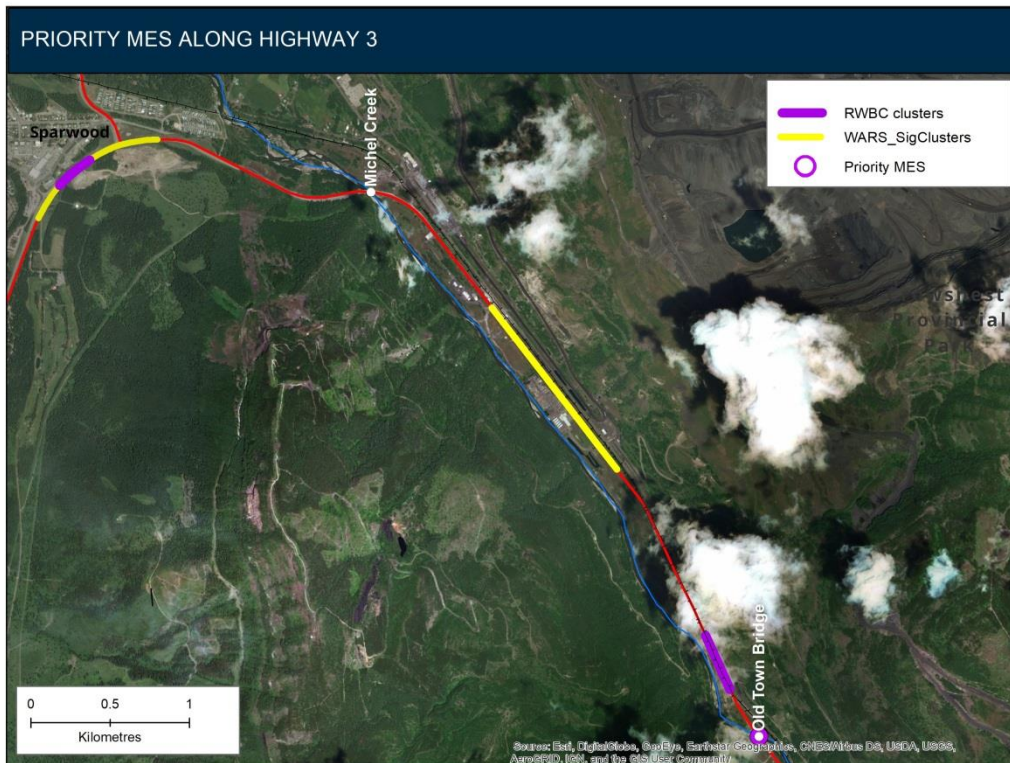


Figure 15: Old Town Bridge Priority MES along Highway 3

Existing infrastructure: A large 3-span bridge structure in place on Alexander Creek.

Target species at this site include elk, deer, grizzly bears, wolverines, lynx and wolves.

Vertical clearance of the bridge structure is approximately 4m, giving ample room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential. The bridge and surrounding location is relatively easy to construct wing-fencing.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures e.g., Loop Bridge and Michel MESs. Fencing will reduce wildlife-vehicle collisions in the area.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 4: West Sparwood 1

This site is ranked 4th in the study area. It was rated moderately high for *Land Security* (4) and *Human Safety Risk* (4) for reducing wildlife mortality on Highway 3. The site had moderate scores for *Mitigation Opportunity/Constructability* (3) and *Regional Conservation Significance* (3). The site is within the Hosmer-Sparwood Linkage Area (Figure 16).



Figure 16: West Sparwood 1 and Hosmer Sparwood 3 Priority MES along Highway 3

Existing infrastructure: None.

Target species at this site include elk, deer, grizzly bears, wolverines, lynx and wolves.

The site is in a good location as in some areas the highway is above grade and provides opportunity for development of an underpass. The local terrain and topography is conducive to underpass construction and there are good opportunities for wing-fencing without access road interruptions. There are some constraints as to how large an underpass can be placed here. Minimum recommended dimension for underpass is 4 m wide x 3.0 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Target species in area utilize culverts of recommended dimensions.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures. Fencing will reduce ACVs in the area.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 5: Hosmer Sparwood 3

This site is ranked 5th overall in the study area (Figure 16). It was rated moderately for *Human Safety Risk* and *Mitigation Opportunity/Constructability* (3) and high for *Land Security* and *Regional Conservation Significance* (4). The site is within the Hosmer-Sparwood Linkage Areas. This site and West Sparwood 1 are both appropriate for mitigating AVCs and facilitating wildlife connectivity. The decision between which of these MESs to implement should be determined by engineering considerations.

Existing infrastructure: None.

Target species at this site include elk, deer, and grizzly bears.

To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife *underpass* is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Both sides of the highway have some fill, however, there are constraints as to how large an underpass can be placed here. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Target species in area utilize culverts of recommended dimensions.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures, if possible.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 6: Loop Bridge

This site is ranked 6th in the study area (Figure 17). It was rated high (5) for *Mitigation Opportunity/Constructability* (5) and *Land Security* (5) and had moderately high scores for *Regional Conservation Significance* (4) and low score for *Human Safety Risk* (2) for reducing wildlife mortality on Highway 3. The site is in the Alexander-Michel Linkage Area.



Figure 17: Loop Bridge is a Priority MES along Highway 3

Existing infrastructure: A large 2-span bridge structure in place on Alexander Creek. Vertical clearance is approximately 3.0-3.5m high giving ample room for wildlife passage.

Target species at this site include elk, deer, grizzly bears, wolverines, lynx and wolves.

There are opportunities at this location for landscaping and earth works to improve movement potential. The bridge and surrounding location is relatively easy to construct wing-fencing. A positive feature is the CP Railway mainline is a good distance away from this site. See Appendix B for grizzly bear supporting map.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures e.g., Old Town Bridge and Michel Creek MESs. Fencing will reduce AVCs in the area.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 7: Elko-Morrissey 1

The site ranked 7th overall and was rated high for *Land Security* (5) and had moderately high for *Regional Conservation Significance* (4). Scores were moderate for *Mitigation Opportunity/Constructability* (3) and *Human Safety Risk* (3) for reducing wildlife mortality on Highway 3. The site is in the Elko to Morrissey Linkage Area.

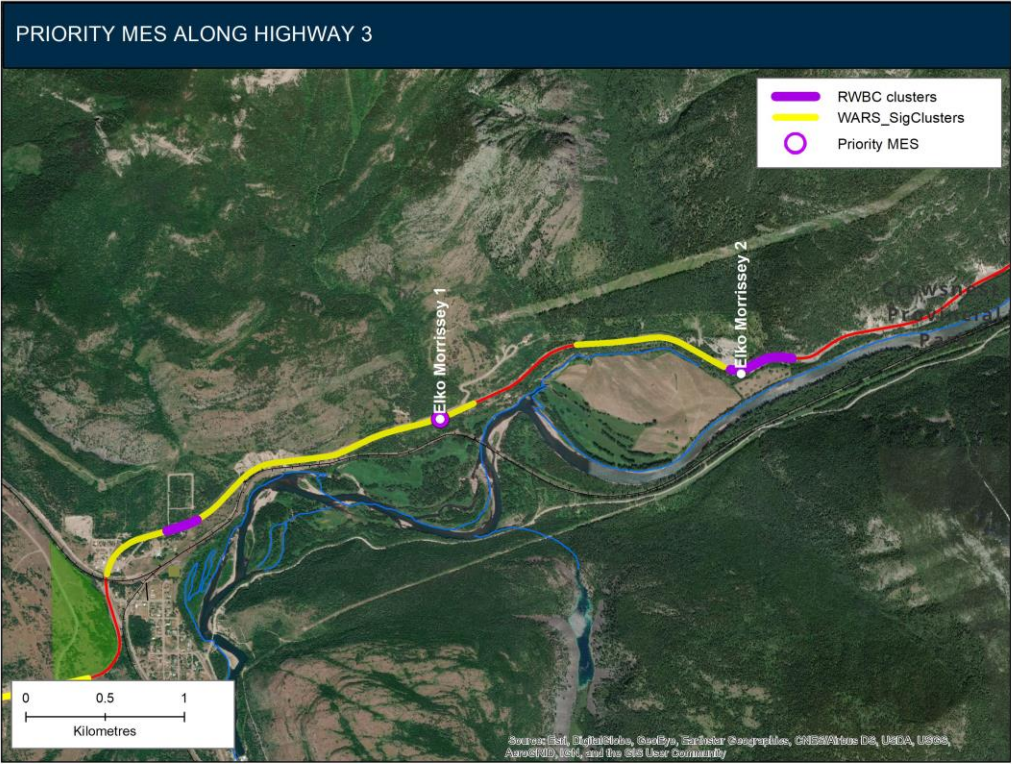


Figure 18: Elko Morrissey 1 is a Priority MES along Highway 3

Existing infrastructure: No infrastructure in place.

Target species at this site include elk, deer, cougars, occasionally grizzly bears and wolves. To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife *underpass* is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Both sides of the highway have some fill, however, there are constraints as to how large an underpass can be placed here. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Target species in area utilize culverts of recommended dimensions.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures, if possible.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 8: Trench 4

Ranked 8th overall the site was rated primarily as important for *Human Safety Risk* (4) for reducing wildlife mortality on Highway 3. *Land Security* (3), *Regional Conservation Significance* (3) and *Mitigation Opportunity/Constructability* (3) all had moderate scores. The site is in the Rocky Mountain Trench Linkage Area (Figure 19).

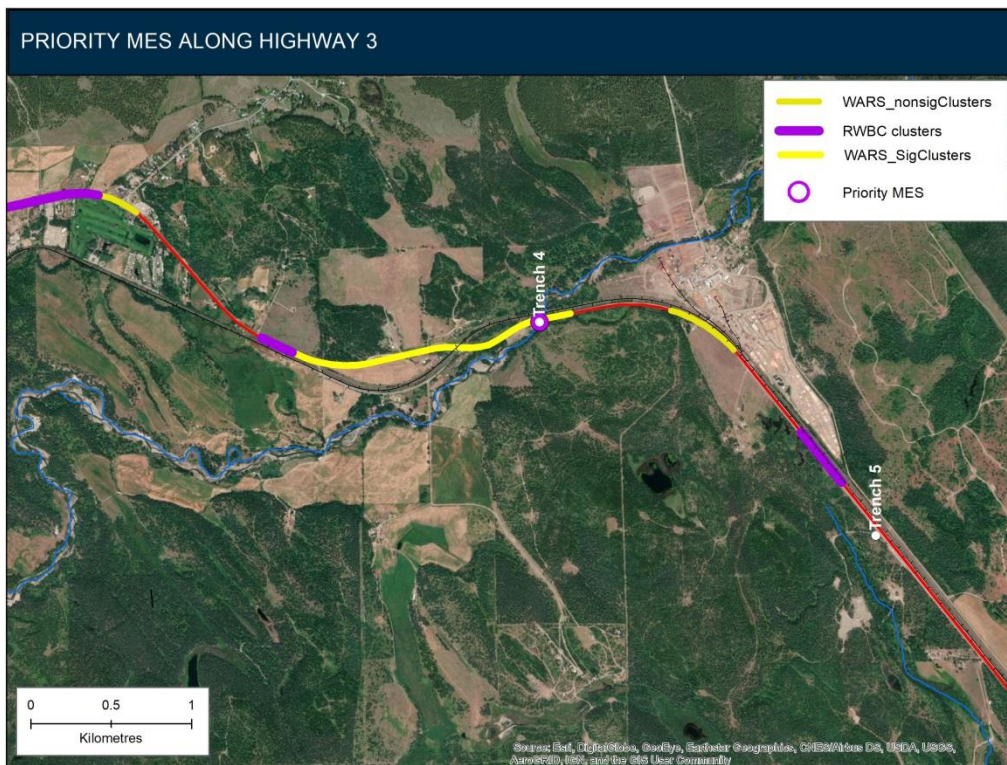


Figure 19: Trench 4 Priority MES along Highway 3

Existing infrastructure: No infrastructure in place.

Target species at this site include elk, deer, cougars, black bears; rarely grizzly bears and wolves.

To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife *underpass* is recommended. Selection of design type is

dependent on terrain, engineering and hydrological constraints. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to moving wildlife, primarily elk and deer, through this area.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures, if possible. If not possible and section has fence ends, an animal-detection system may be considered at fence terminations to warn motorists if animals get inside the fenced right-of-way.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 9: Hosmer

Ranked 9th overall the site was rated primarily important for the *Mitigation Opportunity/Constructability* (5) and *Land Security* (5) aspects. The site had a moderate score for *Human Safety Risk* (3) for reducing wildlife mortality on Highway 3; a moderately low score for *Regional Conservation Significance* (2). The site is in the Hosmer-Sparwood Linkage (Figure 20).



Figure 20: Homer Priority MES along Highway 3

Existing infrastructure: Large span bridge over the Elk River.

Target species at this site include elk, deer, grizzly bears, cougars, black bears and wolves.

To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and adaptation of the bridge is recommended. The Elk River is a natural travel corridor. An easy low-cost solution would consist of funnel fencing to the bridge abutments. Gates would be needed if fenced to allow recreationalist access to river. There is a boat launch on both sides of river and human use could cause some disturbance and affect passage by wildlife under the bridge.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing, to neighbouring bridge structures if possible. If not possible and section has fence ends, an animal-detection system may be considered at fence terminations to warn motorists if animals get inside the fenced right-of-way. We recommend fencing around town of Hosmer to avoid human-wildlife conflicts, and reduce complexity of allowing access to highway through fencing from town.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

Priority MES 10: Fernie-Morrissey 4

Ranked 10th overall the site was rated primarily important for the *Mitigation Opportunity/Constructability* (5) and *Land Security* (5) aspects. The site had a moderate score for *Human Safety Risk* (3) for reducing wildlife mortality on Highway 3; a moderately low score for *Regional Conservation Significance* (2). The site is in the Morrissey to Fernie Linkage (Figure 21).

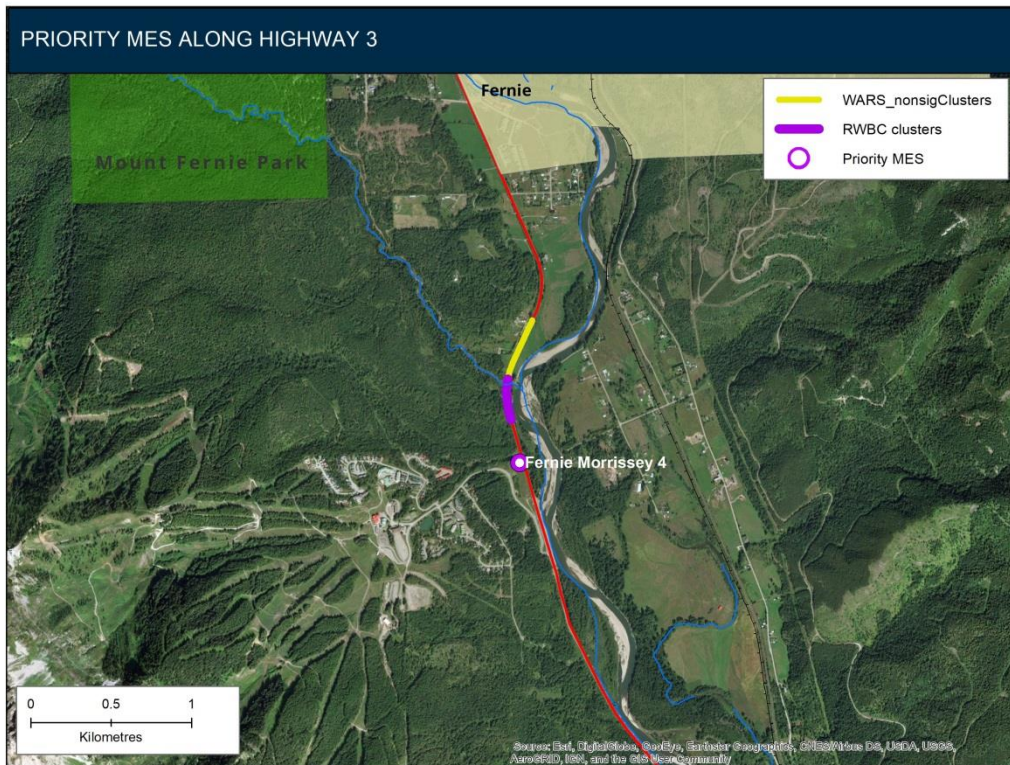


Figure 21: Fernie Morrissey 4 Priority MES along Highway 3

Existing infrastructure: Open span bridge (recently re-constructed in 2019)

Target species at this site include elk, deer, cougars, black bears, grizzly bears and wolves.

Vertical clearance of the bridge structure is approximately 2.5 m, giving room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential.

Wing fencing: This site was converted to a wildlife underpass in 2019. Fencing is required to produce meaningful reductions in human-wildlife collisions. We recommend extensive wing fencing to neighbouring bridge structures, if possible. If not possible and section has fence ends, an animal-detection system may be considered at fence terminations to warn motorists if animals get inside the fenced right-of-way.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

4.5 Mitigation Recommendations for Adjusted MESs

MES Hosmer-Sparwood 2

This site is ranked as low priority in the study area. It was rated very high (4) for *Land Security* (4) and low for *Mitigation Opportunity/Constructability* (2) *Regional Conservation Significance* (2) and *Human Safety Risk* (2) for reducing wildlife mortality on Highway 3. The site is within the Hosmer-Sparwood Linkage Areas.

Existing infrastructure: Highway 3 crosses the CP Railway mainline at a large span bridge structure that carries a single track.

Target species at this site include elk, deer, grizzly bears, wolverines, lynx and wolves.

There is good vertical clearance (ca. 6.0 m high) at the CP bridge structure and room on both sides of the CP track giving ample room for wildlife passage. The bridge and surrounding location is relatively easy to construct wing-fencing, thus scoring 4 for Mitigation Opportunity.

One downside to this location is that the underpass would be share movement of trains and wildlife; funneling animals to railway tracks at the underpass. There may be a risk of funneling wildlife movement to bridge/tracks. However the likelihood of wildlife and a train converging at this location is rare. Further, the actual “risk time” animals would be on or near the tracks when trains approach is of short duration and with an easy fast escape route away from RR tracks once out of bridge structure). There are three underpass locations along the Trans-Canada Highway in Banff National Park where fencing funnels wildlife to CP tracks and both wildlife and train passage needs are met at the same location. Research by Gilhooly et al. on the impact of highway mitigation on mortality on the rail indicated for some species (deer sp.) there was an increase in mortality but overall concluded there was no evidence that the spatial distribution of collisions on the railway changed after highway mitigation (Gilhooly et al. 2019).

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing, and if possible, to neighbouring bridge structures at MESs. Fencing will reduce AVCs in the area.

Jump-outs: Jump-outs or escape ramps should be located appropriately to allow animals to escape the right-of-way should they gain access within the fenced area. We recommend a pair of jump-outs (one on each side of highway) close to the fence end (<100 m) and another pair 200-400 m from the first pair near fence end.

5.0 Conclusion

Stakeholders identified four new MES as well as recommended adjustments to the location of 3 MESs along Highway 3. In addition new MES were added along Highway 43 and 93 based on expert knowledge and assessment of WARS and RoadWatchBC datasets.

Criteria for prioritizing MES were simplified and weighted according to results from a weighted average AHP undertaken by stakeholders. Each criterion was then scored from very low, low, moderate, high to very high value for each MES resulting in a prioritized list of MES.

Field visits with transportation engineers and road ecology specialists enabled an update of mitigation recommendations. Mitigation measures and their effectiveness (including cost effectiveness) are described in Clevenger et al. 2010 report and are not outlined in the amendment. A key consideration for implementation of mitigation sites are the identified linkage zones which represent areas on the landscape that should be treated as a mitigation system to reduce AVCs and improve wildlife permeability across Highway 3. Although mitigation measures may be implemented in stages the overall goal should be to link MESs within linkage zones via fencing to ensure most significant value to conservation.

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Appendix A: MES Hot Sheets

Hot Sheets were prepared for the 15 highest ranking MES and describe all site-specific information with regard to mitigation importance, target species, wildlife objectives, and transportation mitigation recommendations. The Hot Sheets are a quick and easy reference that summarizes mitigation opportunities at each MES. The Top 10 MES, covered in the report, are highlighted in red.

MES 01 Summary – Alexander Michel Overpass

Description

Location (UTM): 664679 5502172

Linkage: Alexander-Michel Linkage Area

Species: Grizzly bears, wolverines, lynx and wolves, elk and deer

SCORING

Human safety risk: 4

Land security: 5

Regional/local conservation significance: 5

Transportation mitigation opportunity: 3

TOTAL SCORE: 3.875

RANK: 1

Wildlife objectives

- Reduce current high levels of wildlife–vehicle collisions in this section of highway, primarily deer and moose.
- Provide safe movement for wide-ranging fragmentation-sensitive species across highway, primarily grizzly bears and wolverines.

Existing infrastructure

- None

Target species for mitigation planning

WVC reduction: Common species.

Regional conservation and connectivity: Grizzly bears and wolverines.

Transportation mitigation recommendations

To ensure movement of grizzly bears, wolverines, lynx and wolves through the area fencing and construction of wildlife *overpass* is recommended. Fencing and overpass construction in this area will also help reduce wildlife-vehicle collisions. Minimum dimension for overpass is 50 m wide based on current science, genetic connectivity of breeding female grizzly bears, and high likelihood of movement of fragmentation-sensitive species through this area.

One disadvantage to this location is the close proximity to the CP Railway mainline. The overpass structure would need to span both Highway 3 and CP tracks, increasing the cost of the overpass structure.

Wing fencing will be used to guide wildlife to the overpass and in this important linkage area fencing should be continuous and link neighbouring wildlife crossing structures e.g., Alexander Creek Bridge. Continuous fencing that runs east of the overpass location (ca. 1000m) will address a high wildlife-vehicle collision area.

MES 02 Summary – Alexander Creek Bridge	
Description	
Location (UTM): 663589 5502172	
Linkage: Alexander-Michel Linkage Area	
Species: Grizzly bears, wolverines, lynx and wolves, elk and deer	
SCORING	
Human safety risk: 3	
Land security: 5	
Regional/local conservation significance: 5	
Transportation mitigation opportunity: 5	
TOTAL SCORE: 3.875	
RANK: 2	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily deer and moose. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway, primarily grizzly bears and wolverines. 	
Existing infrastructure	
<ul style="list-style-type: none"> • Large double span bridge structure over Alexander Creek. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears and wolverines.	
Transportation mitigation recommendations	
<p>This site is situated in a critically important area of Highway 3 corridor for ensuring regional and continental scale connectivity of wide-ranging fragmentation-sensitive species. Large underpass structures such as this bridge will be the most effective means of mitigating roads for grizzly bears and other sensitive wildlife species. Similarly, with additional landscaping work invested (shielding and berm construction to reduce traffic noise/lights) would improve movement potential.</p> <p><i>Wing fencing</i> will be used to guide wildlife to the overpass and in this important linkage area fencing should be continuous and link neighbouring wildlife crossing structures e.g., Alexander-Michel Overpass.</p>	

MES 03 Summary – Old Town Bridge
Description
Location (UTM): 656876 5507383
Linkage: Outside defined Linkage Areas
Species: Elk, deer, grizzly bears, wolverines, lynx and wolves
SCORING
Human safety risk: 3
Land security: 5
Regional/local conservation significance: 3
Transportation mitigation opportunity: 5
TOTAL SCORE: 3.375
RANK: 3
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current high levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway, primarily grizzly bears and wolverines.
Existing infrastructure
<ul style="list-style-type: none"> • Large 3-span bridge structure over Alexander Creek.
Target species for mitigation planning
WVC reduction: Common species.
Regional conservation and connectivity: Grizzly bears and wolverines.
Transportation mitigation recommendations
<p>This site is situated in an important area of Highway 3 corridor for ensuring regional connectivity of wide-ranging fragmentation-sensitive species and seasonal movements of ungulates. Vertical clearance of the bridge structure is approximately 4 m, giving ample room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential. The bridge and surrounding location is relatively easy to construct wing-fencing.</p> <p><i>Wing fencing</i> is recommended to connect neighbouring bridge structures e.g., Loop Bridge and Michel MESSs. Fencing will reduce wildlife-vehicle collisions in the area.</p>

MES 04 Summary – West Sparwood 1

Description

Location (UTM): 651837 5507497

Linkage: Hosmer-Sparwood Linkage Area

Species: Elk, deer, grizzly bears, wolverines, lynx and wolves

SCORING

Human safety risk: 4

Land security: 4

Regional/local conservation significance: 3

Transportation mitigation opportunity: 3

TOTAL SCORE: 3.285

RANK: 4

Wildlife objectives

- Reduce current high levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer.
- Provide safe movement for wildlife.

Existing infrastructure

- No infrastructure in place.

Target species for mitigation planning

WVC reduction: Primarily elk and deer.

Regional conservation and connectivity: Common species, primarily elk.

Transportation mitigation recommendations

To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife *underpass* is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. There is sufficient fill on road that would enable a large underpass. Minimum recommended dimension for underpass is 4 m wide x 3 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Target species in area utilize culverts of recommended dimensions.

Wing fencing: To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring MES, if possible.

MES 05 Summary – Hosmer-Sparwood 3

Description
Location (UTM):
Linkage: Hosmer-Sparwood Linkage Area
Species: Elk, deer, grizzly bears
SCORING
Human safety risk: 3
Land security: 3
Regional/local conservation significance: 4
Transportation mitigation opportunity: 4
TOTAL SCORE: 3.225
RANK: 5
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current high levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wildlife.
Existing infrastructure
<ul style="list-style-type: none"> • No infrastructure in place.
Target species for mitigation planning
<p>WVC reduction: Primarily elk and deer.</p> <p>Regional conservation and connectivity: Common species, primarily elk.</p>
Transportation mitigation recommendations
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. There is sufficient fill on road that would enable a large underpass. Minimum recommended dimension for underpass is 4 m wide x 3 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Target species in area utilize culverts of recommended dimensions.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring MES, if possible.</p>

MES 06 Summary – Loop Bridge	
Description	
Location (UTM): 660039 5504528	
Linkage: Outside defined Linkage Areas	
Species: Elk, deer, grizzly bears, wolverines, lynx and wolves	
SCORING	
Human safety risk: 2	
Land security: 5	
Regional/local conservation significance: 4	
Transportation mitigation opportunity: 5	
TOTAL SCORE: 3.245	
RANK: 6	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway, primarily grizzly bears and wolverines. 	
Existing infrastructure	
<ul style="list-style-type: none"> • Large 2-span bridge structure over Alexander Creek. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears and wolverines.	
Transportation mitigation recommendations	
<p>This site is situated in an important area of Highway 3 corridor for ensuring regional connectivity of wide-ranging fragmentation-sensitive species and seasonal movements of ungulates. Vertical clearance of the bridge structure is approximately 3-3.5 m, giving ample room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential. The bridge and surrounding location is relatively easy to construct wing-fencing. The CP Railway mainline is a good distance away from this site.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures e.g., Old Town Bridge and Michel Creek MESs. Fencing will reduce wildlife-vehicle collisions in the area.</p>	

MES 07 Summary – Elko – Morrisey 1

Description
Location (UTM): 639082 5463564
Linkage: Elko-Morrisey Linkage Area
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves
SCORING
Human safety risk: 3
Land security: 5
Regional/local conservation significance: 4
Transportation mitigation opportunity: 3
TOTAL SCORE: 3.245
RANK: 7
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway.
Existing infrastructure
<ul style="list-style-type: none"> • None.
Target species for mitigation planning
WVC reduction: Common species.
Regional conservation and connectivity: Grizzly bears, wolves, cougars.
Transportation mitigation recommendations
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Both sides of the highway have some fill, however, there are constraints as to how large an underpass can be placed here. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Common species in area utilize culverts of recommended dimensions.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>

MES 08 Summary – Trench 4	
Description	
Location (UTM): 627783 5470290	
Linkage: Rocky Mountain Trench Linkage Area	
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves	
SCORING	
Human safety risk: 4	
Land security: 3	
Regional/local conservation significance: 3	
Transportation mitigation opportunity: 3	
TOTAL SCORE: 3.195	
RANK: 8	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway. 	
Existing infrastructure	
<ul style="list-style-type: none"> • None. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears, wolves, cougars.	
Transportation mitigation recommendations	
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to moving wildlife, primarily elk and deer, through this area.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>	

MES 09 Summary – Hosmer
Description
Location (UTM): 646735 5494555
Linkage: Hosmer-Sparwood Linkage Area
Species: Elk, deer, cougars, black bears
SCORING
Human safety risk: 3
Land security: 5
Regional/local conservation significance: 2
Transportation mitigation opportunity: 5
TOTAL SCORE: 3.125
RANK: 9
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for a range of species including grizzly bears, cougars, black bears, wolves, elk and deer.
Existing infrastructure
<ul style="list-style-type: none"> • Large span bridge over Elk River.
Target species for mitigation planning
WVC reduction: Common species.
Regional conservation and connectivity: Grizzly bears and wolverines.
Transportation mitigation recommendations
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and adaptation of the bridge is recommended. An easy low-cost solution would consist of funnel fencing to the bridge abutments. Gates would be needed if fenced to allow recreationalist access to river. There is a boat launch on both sides of river and human use could cause some disturbance and affect passage by wildlife under the bridge.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing, to neighbouring bridge structures if possible. If not possible and section has fence ends, an animal-detection system may be considered at fence terminations to warn motorists if animals get inside the fenced right-of-way.</p>

MES 10 Summary – Fernie - Morrisey 4

Description
Location (UTM): 639490 5481077
Linkage: Morrisey - Fernie Linkage Area
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves
SCORING
Human safety risk: 3
Land security: 5
Regional/local conservation significance: 2
Transportation mitigation opportunity: 5
TOTAL SCORE: 3.125
RANK: 10
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway.
Existing infrastructure
<ul style="list-style-type: none"> • Open span bridge (completed in 2019)
Target species for mitigation planning
WVC reduction: Common species.
Regional conservation and connectivity: Grizzly bears, wolves, cougars.
Transportation mitigation recommendations
<p>Vertical clearance of the bridge structure is approximately 2.5 m, giving room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>

MES 11 Summary – Trench 3	
Description	
Location (UTM): 623974 5470871	
Linkage: Rocky Mountain Trench Linkage Area	
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves	
SCORING	
Human safety risk: 5	
Land security: 2	
Regional/local conservation significance: 3	
Transportation mitigation opportunity: 1	
TOTAL SCORE: 3.105	
RANK: 11	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway. 	
Existing infrastructure	
<ul style="list-style-type: none"> • None. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears, wolves, cougars.	
Transportation mitigation recommendations	
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Steep slopes in this area are some engineering constraints for underpass installation. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to moving wildlife, primarily elk and deer, through this area.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>	

MES 12 Summary – Fernie – Morrissey 2	
Description	
Location (UTM): 643959 5471065	
Linkage: Morrissey - Fernie Linkage Area	
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves	
SCORING	
Human safety risk: 2	
Land security: 5	
Regional/local conservation significance: 4	
Transportation mitigation opportunity: 4	
TOTAL SCORE: 3.055	
RANK: 12	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway. 	
Existing infrastructure	
<ul style="list-style-type: none"> • None. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears, wolves, cougars.	
Transportation mitigation recommendations	
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Both sides of the highway have some fill, however, there are constraints as to how large an underpass can be placed here. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to importance of location for moving wildlife, primarily elk and deer, through this area. Common species in area utilize culverts of recommended dimensions.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>	

MES 13 Summary – Elko – Morrissey 3	
Description	
Location (UTM): 644329 5467206	
Linkage: Elko-Morrissey Linkage Area	
Species: Bighorn sheep.	
SCORING	
Human safety risk: 2	
Land security: 5	
Regional/local conservation significance: 4	
Transportation mitigation opportunity: 4	
TOTAL SCORE: 3.245	
RANK: 13	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily bighorn sheep, also elk and deer. • Provide safe movement for bighorn sheep across highway. 	
Existing infrastructure	
<ul style="list-style-type: none"> • Tunnel over Highway 3. 	
Target species for mitigation planning	
WVC reduction: Bighorn sheep and common species.	
Regional conservation and connectivity: Bighorn sheep primarily.	
Transportation mitigation recommendations	
<p>The tunnel presents a low-cost option to be converted into a wildlife overpass with wildlife fencing in place to funnel bighorn sheep movements to the top of the tunnel. The downhill side of tunnel does not appear to be too steep for sheep to navigate. Tree stand are relatively dense on parts of the tunnel. To ensure safe passage by sheep and secure environment from predators, trees should be thinned or removed to allow good visibility. Dispersed salt may be used to attract sheep to top of overpass in order to facilitate adaptation and use of the structure.</p> <p><i>Wing fencing:</i> To ensure movement of bighorn sheep on the tunnel/overpass we recommend extensive wing fencing to neighbouring bridge structures or to sections of highway where fencing can terminate in locations wildlife are not likely to travel, e.g., vertical rock cuts.</p>	

MES 14 Summary – Michel Creek
Description
Location (UTM): 654429 5510813
Linkage: Outside defined Linkage Areas
Species: Elk, deer, grizzly bears, black bears, wolverines, lynx, cougars and wolves
SCORING
Human safety risk: 2
Land security: 5
Regional/local conservation significance: 3
Transportation mitigation opportunity: 5
TOTAL SCORE: 2.995
RANK: 14
Wildlife objectives
<ul style="list-style-type: none"> • Reduce current high levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway, primarily grizzly bears and wolverines.
Existing infrastructure
<ul style="list-style-type: none"> • Large 3-span bridge structure over Alexander Creek.
Target species for mitigation planning
<p>WVC reduction: Common species.</p> <p>Regional conservation and connectivity: Grizzly bears and wolverines.</p>
Transportation mitigation recommendations
<p>Vertical clearance of the bridge structure is approximately 4 m, giving ample room for wildlife passage. There are opportunities at this location for landscaping and earth works to improve animal movement potential. The bridge and surrounding location is relatively easy to construct wing-fencing.</p> <p><i>Wing fencing</i> is recommended to connect neighbouring bridge structures e.g., Old Town and Loop Bridge MESs. Fencing will reduce wildlife-vehicle collisions in the area. Fencing on south side should extend up to the ‘nose’ or rock knob. Fencing on north side will have to intercept the Teck/Elkview mine road.</p>

MES 15 Summary – Trench 2	
Description	
Location (UTM): 623974 5470871	
Linkage: Rocky Mountain Trench Linkage Area	
Species: Elk, deer, grizzly bears, black bears, wolverines, cougars, lynx and wolves	
SCORING	
Human safety risk: 3	
Land security: 5	
Regional/local conservation significance: 3	
Transportation mitigation opportunity: 3	
TOTAL SCORE: 2.995	
RANK: 15	
Wildlife objectives	
<ul style="list-style-type: none"> • Reduce current levels of wildlife–vehicle collisions in this section of highway, primarily elk and deer. • Provide safe movement for wide-ranging fragmentation-sensitive species across highway. 	
Existing infrastructure	
<ul style="list-style-type: none"> • None. 	
Target species for mitigation planning	
WVC reduction: Common species.	
Regional conservation and connectivity: Grizzly bears, wolves, cougars.	
Transportation mitigation recommendations	
<p>To ensure movement of wildlife through the area and reduce wildlife-vehicle collisions, fencing and construction of wildlife <i>underpass</i> is recommended. Selection of design type is dependent on terrain, engineering and hydrological constraints. Steep slopes in this area are some engineering constraints for underpass installation. Minimum recommended dimension for underpass is 3 m wide x 2.8 m high due to moving wildlife, primarily elk and deer, through this area.</p> <p><i>Wing fencing:</i> To ensure movement of wildlife through the area we recommend extensive wing fencing to neighbouring bridge structures.</p>	

Appendix B: Carnivore Movement Supporting Maps

Michel Alexander Linkage

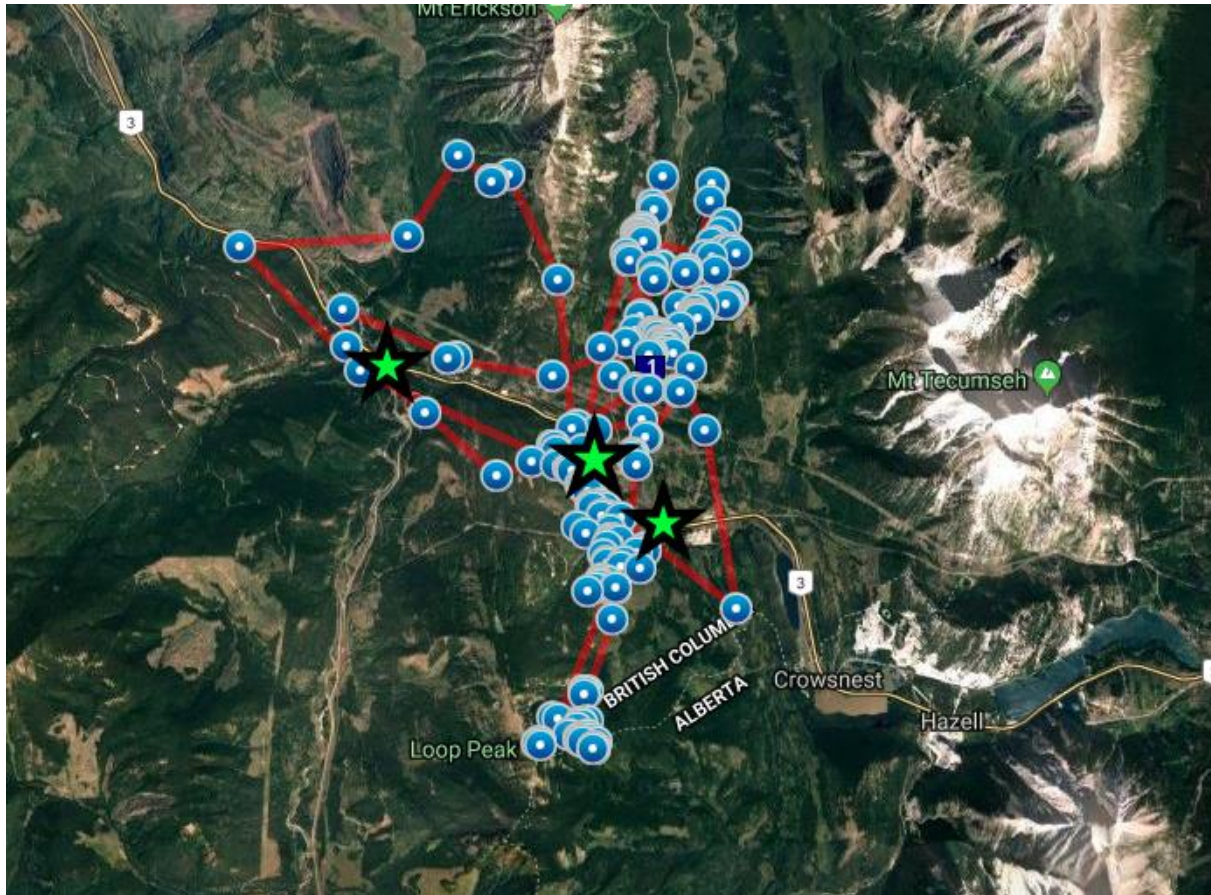


Figure 22: Grizzly bear GPS radiotelemetry data in Michel Alexander Linkage. MES locations marked in green.

Hosmer to Sparwood Linkage

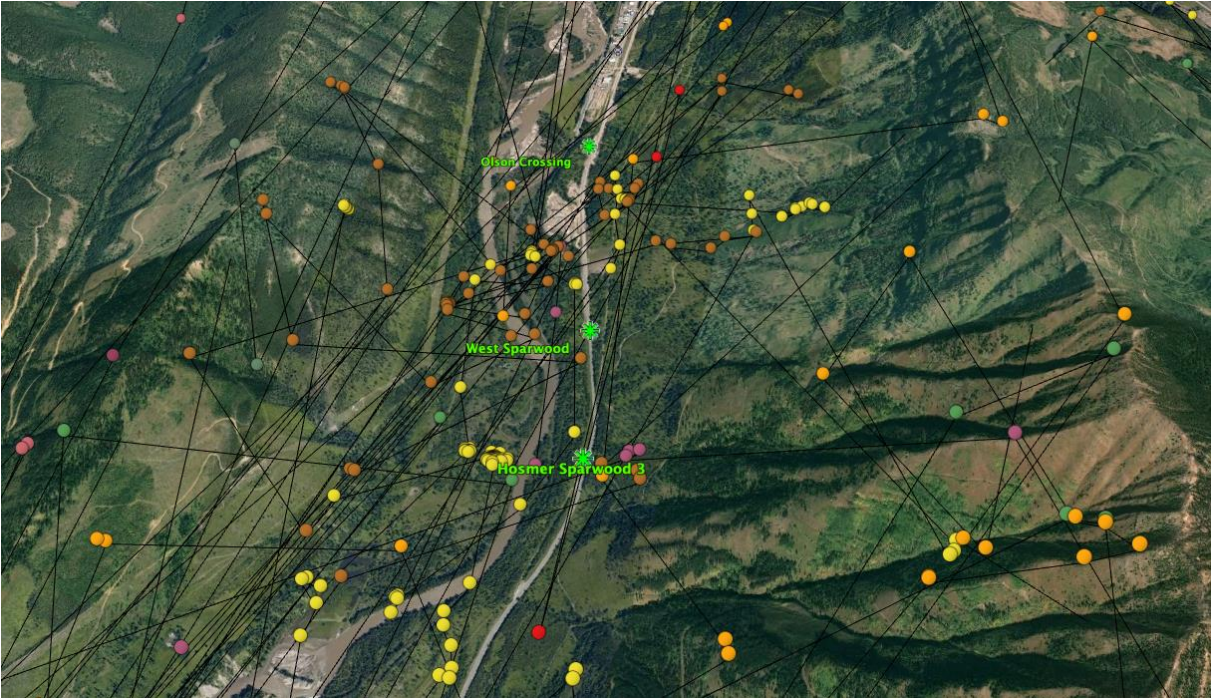


Figure 23: Grizzly bear radiotelemetry data in the Hosmer to Sparwood Linkage. MES locations marked in green (Olson Crossing is now called West Sparwood 2 and West Sparwood is now West Sparwood 1).

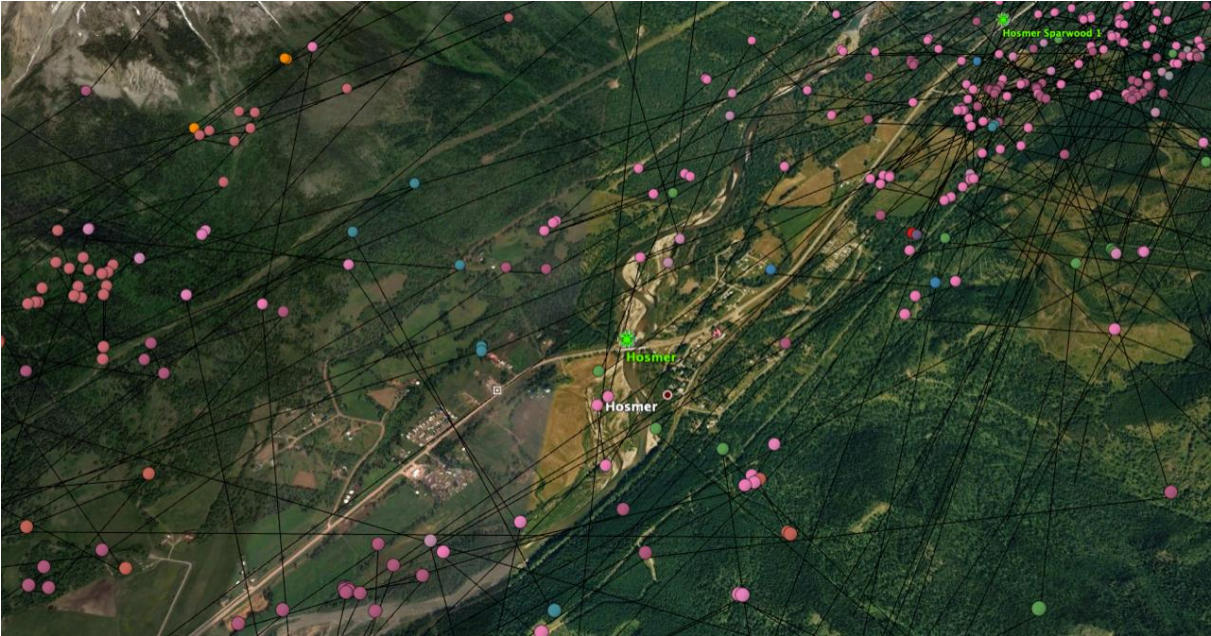


Figure 24: Grizzly bear radiotelemetry data in the Hosmer to Sparwood Linkage. MES locations marked in green.

Morrissey to Fernie Linkage

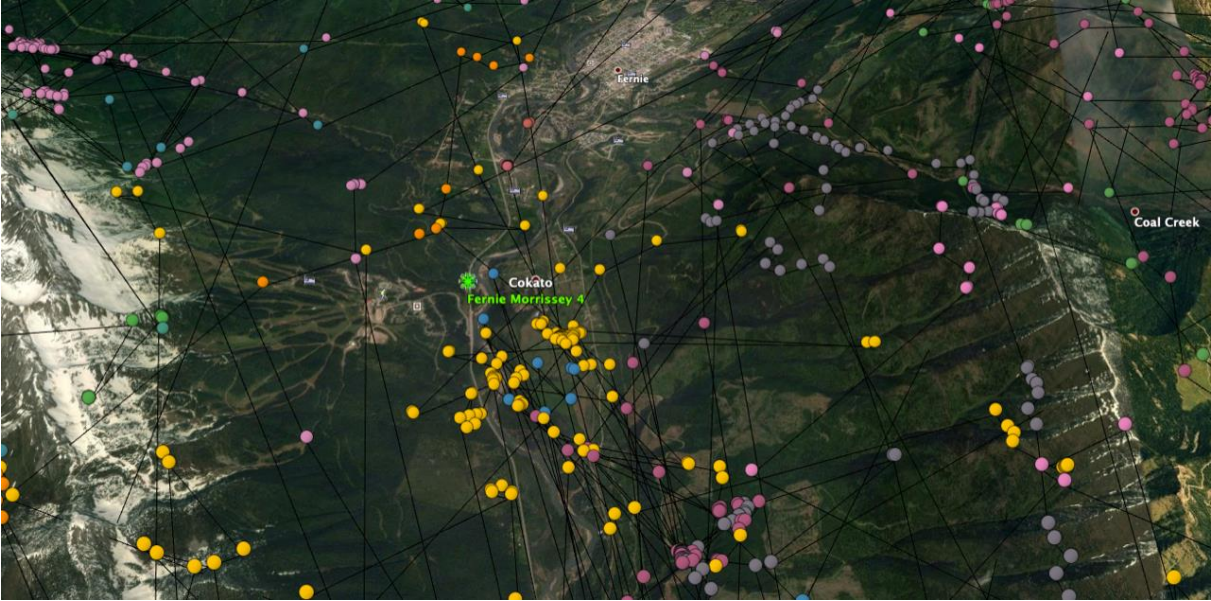


Figure 25: Grizzly bear radiotelemetry data in the Morrissey to Fernie Linkage. MES location marked in green.

Elko Morrissey Linkage

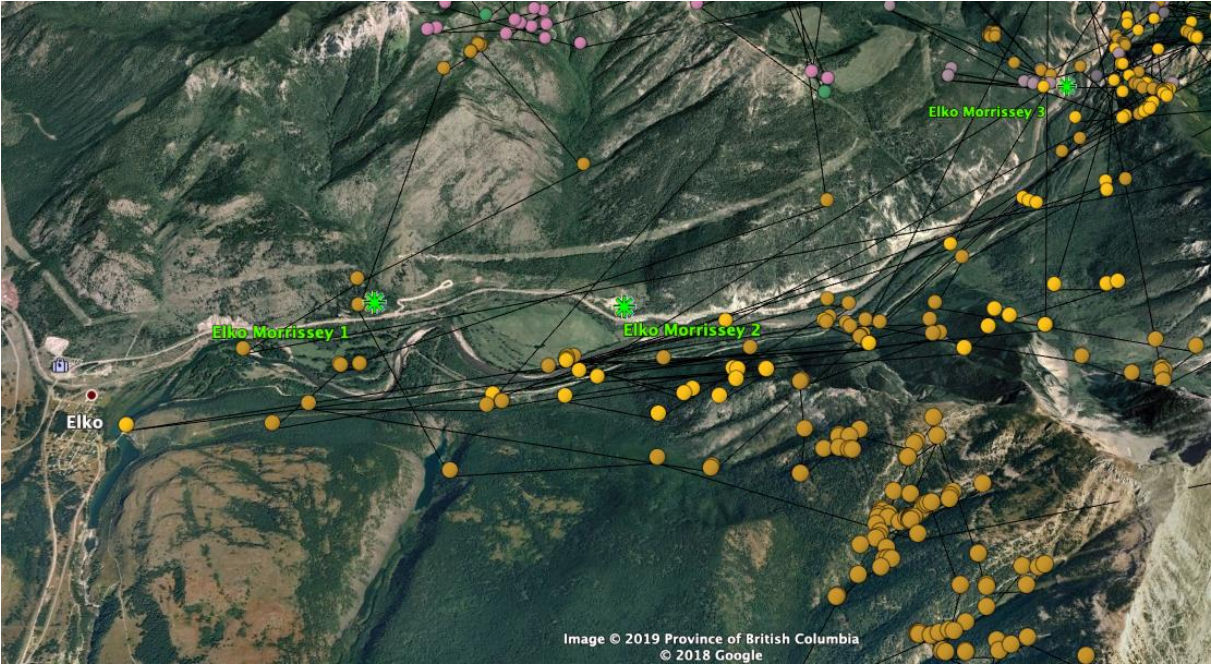


Figure 26: Grizzly bear radiotelemetry data in the Elko to Morrissey Linkage. MES locations marked in green.