

## TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nevada Department of Transportation

### INSTRUCTIONS:

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

<b>Transportation Pooled Fund Program Project #</b> <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i> TPF-5(358)		<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31) 2021	
<b>Project Title:</b> <i>The Wildlife Vehicle Collision (WVC) Reduction and Habitat Connectivity Transportation Pooled-Fund Project Strategic Integration of Wildlife Mitigation into Transportation Procedures</i>			
<b>Name of Project Manager(s):</b> Nova Simpson for Nevada DOT Patricia Cramer, PI	<b>Phone Number:</b> Nova Simpson: 775-888-7035 Patricia Cramer: 435-764-1995	<b>E-Mail</b> <a href="mailto:nsimpson@dot.nv.gov">nsimpson@dot.nv.gov</a> <a href="mailto:cramerwildlife@gmail.com">cramerwildlife@gmail.com</a>	
<b>Lead Agency Project ID:</b> Nevada Dept. of Transportation	<b>Other Project ID (i.e., contract #):</b> Agreement #: P700-18-803	<b>Project Start Date:</b> 12/13/2018	
<b>Original Project End Date:</b> 12/31/2021	<b>Current Project End Date:</b> 6/30/2022	<b>Number of Extensions:</b> 1	

Project schedule status:

On schedule     
  On revised schedule     
  Ahead of schedule     
  Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$146,000.00	\$111,977.73	100 %

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$34,022.27 = 23.3%	\$34,022.27	100 %

**Project Description:**

The *Wildlife Vehicle Collision (WVC) Reduction and Habitat Connectivity* pooled fund study is a collaborative research project through the Transportation Pooled Fund Program. Partners from both the United States and Canada have come together with a common interest in reducing WVC's for the safety of humans and wildlife, as well as restoring habitat connectivity in landscapes fragmented by roadways. Contributing partners currently include Alaska DOT, Arizona DOT, California DOT, Iowa DOT, Michigan DOT, Minnesota DOT, Nevada DOT, New Mexico DOT, Ontario Ministry of Transportation, Oregon DOT, Washington DOT, and Parks Canada. The U.S. Federal Highway Administration - Headquarters is also a partner in this study.

This pooled fund study (PFS) will seek to identify solutions that integrate highway safety and mobility with wildlife conservation and habitat connectivity. The Project: Strategic Integration of Wildlife Mitigation into Transportation Procedures is conducted under Principal Investigator Patricia Cramer and is reported on in this progress report.

Within U.S. states and Canadian provinces, there are few standardized planning processes for considering wildlife in transportation planning, or Best Management Practices (BMP) manuals to instruct personnel at every level how to consider, plan, design, construct, and maintain transportation infrastructure that permits connectivity for wild and domestic animals that could become involved in WVC. This study investigates and makes recommendations on successful procedures that consider and create mitigation solutions to reduce WVC and provide connectivity for wildlife to assist transportation agencies in developing standards at every level.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):****Meetings**

Monthly meetings with Nevada DOT occurred in April and May.

There was a meeting with Partners in April to review final edits to the manual.

The final overall Partners meeting occurred in early June.

A national webinar on this project and manual was held for the world in late June. Over 400 people attended.

See: <https://www.youtube.com/watch?v=XN7ixPWsNBq&feature=youtu.be>

**Publishing**

The Task 1 report, titled: "Final Report on the Strategic Integration of Wildlife Mitigation into Transportation Procedures," was published on the Federal Highways Pooled Fund Study website:

<https://pooledfund.org/Details/Study/610>

The PI's website, [wildlifeconnectivity.org](http://wildlifeconnectivity.org) was published and the webpage for the project was published, with links to reports, articles, and slide shows: <https://www.wildlifeconnectivity.org/national-study-to-integrate-wildlife-into-transportation>

The TRB Committee on Environmental Analysis and Ecology Spring Newsletter published Dr. Cramer's article on the project: <https://environmentalanalysis974038017.wordpress.com/2022/05/06/a-manual-to-include-wildlife-consideration-in-transportation-procedures/>

July 1, Dr. Cramer, Ms. Simpson, and D. Buford authored a FHWA Public Roads magazine article on this project and manual, and submitted it to the editor. The article will appear in the winter 2022-23 volume.

**Deliverables**

The final Manual was submitted June 30<sup>th</sup> on the Microsoft Teams site and OneDrive.

The Final Report was submitted June 30<sup>th</sup> on the Microsoft Teams site and OneDrive.

The Slide shows for both the Partners and the world were uploaded to the Teams Website and a Microsoft OneDrive for the Partners to use, June 29.

A 6-page guide to the slide show presentation for the Partners slide show was also uploaded June 29<sup>th</sup>.

A one-page public announcement/summary of the project and manual was delivered June 30.

**Contract Status**

The contract deliverables were submitted, and the contract is complete.

**Anticipated work next quarter:**

None

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

**Potential Implementation:**

The information generated from this work will be available for U.S. DOT's and Canadian MoT's for assistance in incorporating wildlife concerns into transportation processes.  
It may also be used in the development of the wildlife mitigation projects submitted for funding under the U.S. Bilateral Infrastructure Law.

## TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT):  Nevada DOT

### INSTRUCTIONS:

*Project Managers and/or research project investigators should complete a quarterly progress report for each calendar quarter during which the projects are active. Please provide a project schedule status of the research activities tied to each task that is defined in the proposal; a percentage completion of each task; a concise discussion (2 or 3 sentences) of the current status, including accomplishments and problems encountered, if any. List all tasks, even if no work was done during this period.*

<b>Transportation Pooled Fund Program Project #</b> <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i>  <b>P200-20-803</b>		<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> <b>Permeability of large underpasses to wildlife: Effects of ledges and addition of structure for facilitating movement of small mammals and herpetofauna.</b>			
<b>Name of Project Manager(s):</b> Cheryl Brehme, Jeff Tracey, Robert Fisher	<b>Phone Number:</b> 858-761-8883, 619-225-6457 619-206-5686	<b>E-Mail</b> <a href="mailto:cbrehme@usgs.gov">cbrehme@usgs.gov</a> , <a href="mailto:jatracey@usgs.gov">jatracey@usgs.gov</a> , <a href="mailto:rfisher@usgs.gov">rfisher@usgs.gov</a>	
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> 18 May 2020	
<b>Original Project End Date:</b>	<b>Current Project End Date:</b>	<b>Number of Extensions:</b>	

Project schedule status:

On schedule     
  On revised schedule     
  Ahead of schedule     
  Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$83,127.56	\$83,127.56	100%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$17,336.73 – Approximately 21%	\$17,336.73	100%

**Project Description:**

The Department of Transportation (DOT) currently recommends that structure be added to large underpasses to increase wildlife use and movement, but there are a lack of scientific studies to show the efficacy of this mitigation for small mammals and herpetofauna or potential effects on use by larger species. The USGS has completed two years of Before-After Control-Impact field studies on 8 large upland wildlife underpasses in San Diego County. The objectives of this study are to determine; 1) if small vertebrate species are using these underpasses, 2) if ledges and the addition of structure (rock piles 5m apart along one side of structure) within underpasses facilitate small animal movement and 3) if the addition of structure (rock piles) affect the use rates of medium and large mammals. Using highly sensitive cameras over two years resulted in over 3 million images of which ~200,000 have been reviewed (less than 10% of total). Preliminary analysis indicates that responses to structure and ledges are specific to animal species and groups. This provides substantial training and test data sets to create a machine learning algorithm to classify images by the presence or absence of animals, and a possible second stage of classification to the species level. In order to process all photos, USGS will program a convolutional deep network (DN) to perform supervised species/group classification. Existing classified photos will be used to train the network to predict classes for the remaining ~2.8 million photos. Explanatory models will then be run to compare the relative permeability of underpasses to animal movement and effects of structure on animal activity. The results will inform the design of large underpasses for use by wildlife communities and target species.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**

ResNet50 (ResNet50v2) machine learning model did not perform to expectations when applied to all photos, therefore all classified photos were reviewed by USGS personnel for final analyses.

Data Analyses

- Reviewed and categorized all remaining photos
- Analyzed relative activity of all animal classes outside and inside underpasses- and on ledges
- Analyzed responses of all animal classes to internal structure treatments

Final Report

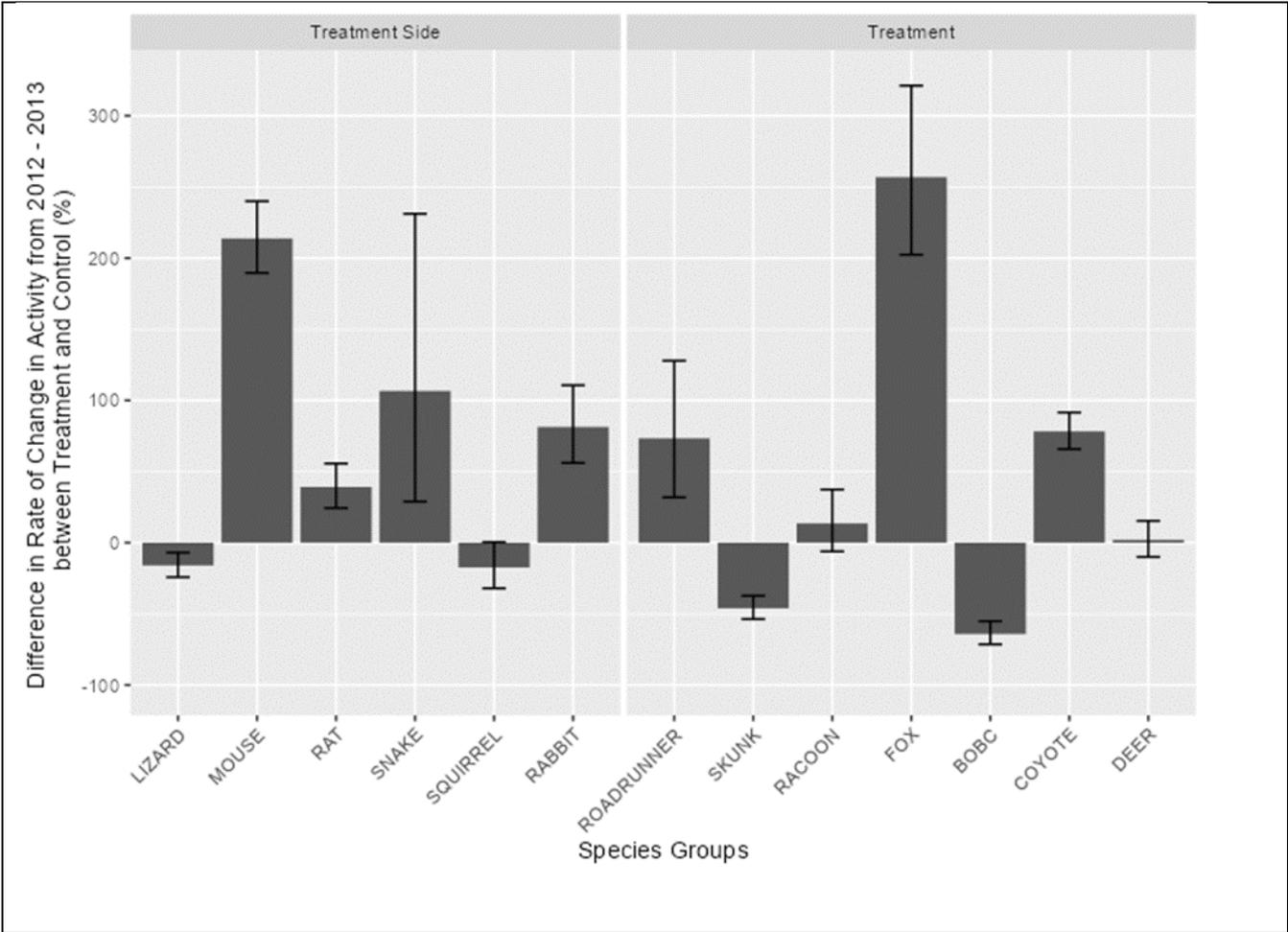
- Wrote and submitted final report

**Anticipated work next quarter:**

- NA

**Significant Results:**

- The addition of structure/cover treatments resulted in a variety of responses from the wildlife community.
- Structure/cover treatments were associated with significant increases in use by mice, rats, rabbits, fox, and coyotes and substantial, but not significant, increase in activity of snakes and roadrunners.
- Skunk and bobcat activity were significantly lower after the addition of structure/cover treatments.
- There were no large or no significant effects of the addition of structure/cover treatments on activity of lizards, squirrels, raccoon, or deer.
- There was very high activity of mice on ledges, where they exist, compared to ground level interior and exterior cameras
- Hypotheses to these responses include direct response to availability of cover, as well as potential predator-prey interactions and alteration of interference competition between predators.



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<b>Transportation Pooled Fund Program Project #</b> <i>(i.e., SPR-2(XXX), SPR-3(XXX) or TPF-5(XXX))</i>  <b>P342-20-803</b>		<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> <b>Research to inform passage spacing for migratory amphibians and to evaluate the effectiveness of an elevated road segment to reduce road mortality and maintain connectivity between wetlands and uplands: Case study with the Yosemite toad.</b>			
<b>Name of Project Manager(s):</b> Cheryl Brehme, Robert Fisher Budget: Curtis Hettich		<b>Phone Number:</b> 619-225-6427 619-225-6422 916-278-9479	
<b>Lead Agency Project ID:</b> Not yet assigned		<b>Other Project ID (i.e., contract #):</b>	
<b>Original Project End Date:</b> 30 June 2022		<b>Current Project End Date:</b> 30 June 2022	
		<b>E-Mail (preferred contact method)</b> <a href="mailto:cbrehme@usgs.gov">cbrehme@usgs.gov</a> , <a href="mailto:rfisher@usgs.gov">rfisher@usgs.gov</a> <a href="mailto:chettich@usgs.gov">chettich@usgs.gov</a>	
		<b>Project Start Date:</b> 10 Sept 2020	
		<b>Number of Extensions:</b>	

Project schedule status: (but see request for 1 week extension to submit draft report)

On schedule       On revised schedule       Ahead of schedule       Behind schedule

**Overall Project Statistics:**

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$120,630.42	\$120,630.42	100%

**Quarterly Project Statistics:**

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$9,556.82 – Approximately 8%	\$9,556.82	100%

**Project Description:**

Many small animals, especially amphibian populations that must migrate between aquatic and terrestrial habitats, are susceptible to negative impacts from roads within their habitat. Narrow tunnels (<1m) under roads connected with barrier fencing are a standard mitigation solution. However, there is recent evidence that tunnel mitigation systems can act to filter migratory movements of species that disperse over large areas and unintentionally cause population decline. This project supports continued field study to determine; 1) the distances that Yosemite toads will move along barrier fencing before they “give up” and move back into the habitat and 2) the efficacy of a novel road crossing prototype for toads and other small wildlife species. The prototype is an 8” high elevated road segment on a US Forest Service road that provides a safe crossing nearly 100’ wide while allowing both light and rain to pass through. Although the prototype is 100’, it can be made to any length. The project includes an assessment by transportation engineers in collaboration with Caltrans to provide insight, guidance, and concept designs for similar crossing solutions that could be implemented on improved roads and highways. The results of this study will inform the minimum distances required between passages to provide permeability for migratory toads to make population level movements across roads. It will also provide a permeability analysis and concept plans for a new passage design that may provide greater connectivity and offer an alternative to below grade tunnels for sensitive amphibians, reptiles, and small mammals.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**Transportation engineering evaluation (Dokken Engineering).

- Reviewed & finalized transportation engineering evaluation and concept designs for ERS on primary roadways.

Sierra NF ERS Field Study/ Data Analyses

- Analyzed updated Yosemite toad movement data.
- Analyzed effectiveness of ERS

Final Report

- Wrote and submitted final report

**Anticipated work next quarter: NA****Significant Results:** (3 levels compared: under ERS, immediately adjacent to ERS, forest habitat)

This research was conducted to; 1) help inform the distances required between crossings to provide high permeability across roads for migratory amphibians (i.e., Yosemite toad), 2) to assess the permeability of a new passage design for amphibians and other small animal species, and 3) to provide engineering evaluation of this concept for primary roads and highways.

1) Although the sample size was low due to severe drought conditions in the last two years of the study and sampling constraints, we found similarities between the fence movement behavior of Yosemite toads and other migratory amphibians. Approximately 90% of toads were estimated to move 20 m or more along the fence, with an average distance of 46 m before “giving up”. These preliminary results suggest that passages spaced within 20m of one another along Yosemite toad migratory pathways are likely to provide connectivity to 90% of the population.

2) Initial results of passage permeability showed that the elevated road segment (ERS) crossing has a high potential to provide increased connectivity for Yosemite toads and a wide range of other amphibian, reptile, and small mammal species while greatly reducing road mortality.

3) The ERS concept designs, engineering evaluation and guidance document for primary roads and highways provide a starting point for local and DOT engineers to design and build permanent ERS structure(s) to enhance the movement of small wildlife, particularly for, but not limited to, migrating amphibians over wide stretches of roadway

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

NA

**Potential Implementation:** NA



**Project Description:**

All research modules have been submitted, have been processed, and are active.

Topic	Title	Proposed Budget	PI	Submitted?	Approved by NV?	Active account?
C	Design of Fiber-Reinforced Polymer (FRP) Wildlife Overpass Structures	\$70,000	Rob Ament and Matt Bell	yes	yes	yes
F	Identification of the patterns and processes that result in highway accidents involving elk: Informing the design of effective mitigation strategies in areas where elk is a dominant species	\$20,000	Tony Clevenger	yes	yes	yes
G	Wildlife community and species factors affecting crossing structure use: A continental meta-analysis and a 16-year perspective	\$65,000	Tony Clevenger, Marcel Huijser	yes	yes	yes
H	Jump-out design and measures at fence ends and at access roads	\$115,000	Marcel Huijser	yes	yes	yes
I	Efficacy and cost-savings of fencing and wildlife crossings to reduce wildlife-vehicle collisions in the Bow River Valley, Alberta	\$30,000	Tony Clevenger	yes	yes	yes
X	Economic value select species based on biological conservation	\$90,181.20	Chris Neher and John Duffield (as subcontractors from Bioeconomics)	yes	yes	Yes Subcontract (WTI-Bioeconomics) is also active

**Literature review**

Draft manuscript on costs and benefit analyses mitigation measures submitted on 22 July 2022

**Anticipated work next quarter:**

General:  
Draft manual will be submitted

**Significant Results:**

None

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

**Potential Implementation:**

None



**Project Description**

There are no known FRP wildlife overpasses in North America at this time. The overall objectives of this research project are to identify cost sensitive and environmentally friendly FRP materials and use them in the design of the continent's first FRP wildlife crossing. This structure can then be adapted for use in other locations across North America and will lead to innovation for bicycle and pedestrian crossings over roads. The development and deployment of a structural prototype by this project will help provide technical information that is sorely lacking for such a promising technology.

The project is organized into four tasks: 1) identify and select FRP manufacturers and materials that will contribute to efficient and cost-effective bridge structures; 2) investigate and perform a preliminary design of up to three different wildlife overpass structures using different FRP applications and assure they can meet Caltrans' structural specifications and address wildlife's needs; 3) evaluate the implementation of the selected FRP wildlife overpass structure via cost-benefit, construction and life-cycle metrics; and, 4) disseminate the results, recommendations and conclusions of the investigation.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**

Task 10. Started accumulating new applications of FRP bridges to bike/ped structures that were not identified in the initial literature review. This task also involves the process of adapting the US-97 designs and FRP technology used to bike/ped structures and includes the recommendations of multiuse structures from the WTI Team.

Task 12: We have been compiling the final report. This is taking all the information gathered over the entire project and presenting it in a fluid document.

**Anticipated work next quarter:**

Task 12: Submission of final report. Presentation of final report in the form of a recorded power point presentation.

**Significant Results:**

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

No conflicts.

**Potential Implementation:**

Yes! Caltrans is seeking to build an FRP girder wildlife overpass at the US97 site. They have currently made estimates in their engineering department for the costs of an FRP bridge alongside other traditional methods of construction. They are presenting the findings at a management meeting to identify if the FRP structure is the one they want to pursue.

# I TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT):  Nevada DOT

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<b>Transportation Pooled Fund Program Project #</b> TPF-5(538)		<b>Transportation Pooled Fund Program - Report Period:</b> Quarter 2 (Apr-Jun 2022)	
<b>Project Title:</b> Efficacy and cost-savings of fencing and wildlife crossings to reduce wildlife-vehicle collisions in the Bow River Valley, Alberta			
<b>Name of Project Manager(s):</b> AP Clevenger	<b>Phone Number:</b> 4036881138	<b>E-Mail</b> apclevenger@gmail.com	
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> Jan 2020	
<b>Original Project End Date:</b> Mar 2021	<b>Current Project End Date:</b> 30 June 2022	<b>Number of Extensions:</b> 1	

**Project schedule status:**

Project is completed.

Overall Project Statistics:

<b>Total Project Budget</b>	<b>Total Cost to Date for Project</b>	<b>Percentage of Work Completed to Date</b>
\$30,000	\$27,423.73	90%

## F TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nevada DOT

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<b>Transportation Pooled Fund Program Project #</b> TPF-5(538)		<b>Transportation Pooled Fund Program - Report Period:</b> Quarter 2 (Apr - Jun) 2022	
<b>Project Title:</b> Identification of the Patterns and Processes that Result in Highway Accidents Involving Elk: Informing the Design of Effective Mitigation Strategies in Areas Where Elk is a Dominant Species			
<b>Name of Project Manager(s):</b> AP Clevenger	<b>Phone Number:</b> 4036881138	<b>E-Mail</b> apclevenger@gmail.com	
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> Jan 2020	
<b>Original Project End Date:</b> Dec 2020	<b>Current Project End Date:</b> 30 June 2021	<b>Number of Extensions:</b> 1	

**Project schedule status:**

Project completed 4<sup>th</sup> quarter 2021

**Overall Project Statistics:**

<b>Total Project Budget</b>	<b>Total Cost to Date for Project</b>	<b>Percentage of Work Completed to Date</b>
\$20,000	\$20,000	100%

## G TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nevada DOT

**INSTRUCTIONS:**

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<b>Transportation Pooled Fund Program Project #</b> TPF-5(538)	<b>Transportation Pooled Fund Program - Report Period:</b> Quarter 2 (Apr-Jun) 2022	
<b>Project Title:</b> Long-term Responses of an Ecological Community to Highway Mitigation Measures		
<b>Name of Project Manager(s):</b> AP Clevenger	<b>Phone Number:</b> 4036881138	<b>E-Mail</b> apclevenger@gmail.com
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b> July 2020
<b>Original Project End Date:</b> Mar 2021	<b>Current Project End Date:</b> 30 June 2022	<b>Number of Extensions:</b> 1

**Project schedule status:**

Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$65,000	\$65,000	100%

**Quarterly** Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$39,000 – 60%	\$39,000	100%

**Project Description:**

Crossing structures (CS) in Banff National Park and along US Hwy 93 North in Montana, have been monitored for many years, starting as early as 1996, forming the richest database on CS monitoring in the world. These data provide a unique opportunity to assess long-term changes in CS use by a large mammal community. Such a long-term and data-rich perspective is important to understand how slow-reproducing species interact with CS over time. These datasets come from areas with an intact community of large mammals ranging from rare carnivores like wolverine to more common ungulates like white-tailed deer. It is also characterized by mixed landscapes with agriculture and dispersed houses and roads with high traffic volumes. This combination of a relatively intact wildlife community in an area with substantive variation in human disturbance (Banff relatively low human presence and disturbance; Montana relatively high human presence and disturbance) creates a unique 'reference' condition to understand how highways and large mammals interact. Developing a statistical model to describe the relationship between population size and passage rates at CS has a number of important benefits to management. First, structural attributes of CS that contribute to a greater-than-expected passage rate by wildlife enable planners to more rigorously design species-specific mitigation measures. Second, if a strong association between population size and passage rate at particular sites can be found, then management can use monitoring of these limited areas to infer population trends in the broader study area. Third, detection rates of animals using CS are relatively high given the constricted nature of the passage, so monitoring CS use may be a more economical means of population monitoring than other index-type measures. Thus, the various crossing structures along the TCH can serve as a multi-species "super-transect" if appropriate population size and passage rate associations can be demonstrated. Specifically we are interested in understanding the following questions and will use data sets shown in bold to address each one: 1) What is the effect of different covariates on species use over time? Banff & Montana; 2) What are the effects of design and function of CS on community level metrics? Banff & Montana; 3) Can CS monitoring (counts) be used as an indicator of population abundance? Banff.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**

- Project was completed this Quarter 1 (2022).

**Anticipated work next quarter:**

None

**Significant Results:**

See Potential Implementation

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

None.

**Potential Implementation:**

Our results highlight the value of long-term monitoring for assessing the effectiveness of mitigation measures to reduce wildlife-vehicle collisions and enhance connectivity across major roads. Our work confirms the species-specific nature of measure CS performance – leading to our primary recommendation that a diversity of CS designs be considered an essential part of a well-designed mitigation system for the large mammal fauna of western North America. We found no evidence of a general finding to resolve the debate of few large or many small CS – different species preferred different designs and CS densities. We found non-linear effects of time on passage rates, suggesting that short-term monitoring efforts may fail to accurately portray the ecological benefits of mitigation for populations and ecological communities. As managers rely on CS to offset the impacts of road expansion projects and other disturbances, our work will help inform design and aid in the establishment of robust, long-term performance measures.

## H TRANSPORTATION POOLED FUND PROGRAM QUARTERLY PROGRESS REPORT

Lead Agency (FHWA or State DOT): Nevada Department of Transportation \_\_\_\_\_

**INSTRUCTIONS:**

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<b>Transportation Pooled Fund Program Project #</b>  <i>Wildlife Vehicle Collision (WVC) Reduction and Habitat Connectivity</i> Task 1 – Cost Effective Solutions Transportation Pooled-Fund Project TPF-5(358)	<b>Transportation Pooled Fund Program - Report Period:</b> <input type="checkbox"/> Quarter 1 (January 1 – March 31) 2022 <input checked="" type="checkbox"/> Quarter 2 (April 1 – June 30) <input type="checkbox"/> Quarter 3 (July 1 – September 30) <input type="checkbox"/> Quarter 4 (October 1 – December 31)	
<b>Project Title:</b> Jump-out design and measures at fence ends and at access roads		
<b>Name of Project Manager(s):</b> Dr. Marcel Huijser	<b>Phone Number:</b> 406-543-2377	<b>E-Mail</b> mhuijser@montana.edu
<b>Lead Agency Project ID:</b>	<b>Other Project ID (i.e., contract #):</b>	<b>Project Start Date:</b>
<b>Original Project End Date:</b> 30 Nov 2022	<b>Current Project End Date:</b> 30 Nov 2022	<b>Number of Extensions:</b> 0

Project schedule status:

- On schedule     
  On revised schedule     
  Ahead of schedule     
  Behind schedule

Overall Project Statistics:

Total Project Budget	Total Cost to Date for Project	Percentage of Work Completed to Date
\$115,000	\$115,000	100%

Quarterly Project Statistics:

Total Project Expenses and Percentage This Quarter	Total Amount of Funds Expended This Quarter	Total Percentage of Time Used to Date
\$816.26 (thru Dec) 0.7%	\$816.26	100%

**Project Description:**

- A. Investigate measures aimed at reducing intrusions of large wild mammals, especially carnivores, at gaps in wildlife fences through a literature review and field experiments.
- B. Investigate measures aimed at increasing the use of wildlife jump-outs by deer species (white-tailed deer and mule deer) through a literature review and field experiments.

**Progress this Quarter (includes meetings, work plan status, contract status, significant progress, etc.):**

A1 Literature review  
Draft completed

B1 Literature review  
Completed

**Field experiments**

A2a. Electrified cattle guards at access roads, Parks Canada.

Sunshine and Compound road:

1. The WTI cameras have been installed at Sunshine and Compound road (12 Aug 2020).
2. The cameras were not installed in front of guards, but behind, looking to the area in front.
3. Animals entering the zone 2 m before the electrified area will trigger the cameras.
4. From 2 Sep onwards the cameras have restricted hours because traffic volume was too high to allow 24/7 operation, so now it is 17:00-8:00 (daylight saving time) for both locations.
5. Camera settings 5 images per trigger, no quiet time (rapidfire), high sensitivity
6. 8 Oct 2020: steel plates were installed in front of electrified barriers (completes installation).
7. The 2 ft grounding plate for Compound Road was damaged and was removed on or before 20 Oct. Re-installation will likely be in spring. The Sunshine grounding plate will also be deferred. They both need metal strips installed to protect them from snow plows. These strips have not yet arrived, and so the grounding plates were unprotected when there was the 1<sup>st</sup> major snow fall (October 14) when it got damaged. So, even though, the wildlife guards are turned on they will not work as well without the grounding plate, nor were they intended to be nearly as effective during the winter (i.e. snow covered). Ground plates and strips will be installed in the spring.
8. Guards filled up with snow in February, not functional, as expected. From Dan Rafla: the accumulation of snow, salt, gravel, etc. between the negative and positive charge cause it to short, or the guard can be completely covered. There has also been connection break, but it has since been repaired.
9. 14 Jul 21: Grounding plates have still not been installed because of lack of funding (Pers. com. Dan Rafla).
10. 14 Jul 21: During the winter, the wiring was not able to withstand the vibrations from vehicles and gravel/salt that fell between the pipes. Wires have since been repaired with the wiring redone to more robust standard (Pers. com. Dan Rafla).
11. 14 Jul 21: Hours of operation for cameras, which were from 5pm to 8am, have been extended from 4pm to 10am. In addition, a 2<sup>nd</sup> camera was added at Sunshine, facing 90 degrees to the road, and two meters away from the wildlife guard (Pers. com. Dan Rafla).
12. 14 Jul 21: No known intrusions except for a black bear from last fall (Pers. com. Dan Rafla).
13. End Sep 2021: Grounding plates were installed on both locations (Pers. com. Dan Rafla). This completes the



#### Lake O'Hara

Images reviewed 1-6 Oct : No animals

Guard turned on again on April 17, 2021

15 July 21: guard is operational.

#### Lake Louise

Camera post not installed yet, will be spring 2021

15 July 21: Parks Canada is still working on getting the Lake Louise camera installed, hopefully soon (Pers. com. Jón Stuart-Smith).

15 July 21: guard is operational.

20 Oct 2021: Camera installed ((Pers. com. Terry Larsen, Parks Canada)

A2b. Electrified mats at fence ends, Thompson Falls.

Camera at west fence end was installed 30 Sep 2020

Coyote approached, did not cross



Camera at east fence end required a new post in the clear zone.

Camera at east fence end required a new post in the clear zone.

A right-of-way encroachment permit was obtained from MDT on 8 Oct 2020.

Post and camera were installed on 27 Oct 2020.

2 wt-deer left the fenced road section, walking/running over guard.

1 of them appeared to have been shocked, the other not.

Multiple elk and w-t deer walked in and out of the fenced road corridor early February, apparently without being shocked. MDT and the manufacturer were alerted again.

The manufacturer is now sending Marcel a voltage meter to check voltage (should arrive mid-April).

However, it seems that MDT may have put the guards at 50% power since installation, against the recommendation of the manufacturer (recommendation is 100%).

In June 2021 it was confirmed that the voltage is set too low on the electric mats (between 4.2-4.8kV). This was reported to MDT, and MDT has stated that they intend to increase the power to the settings recommended by the manufacturer.

WTI observed on 28 Aug 2021 that the voltage was increased to 9.6-10kV (this is what it should have been all along). So far, MDT has not been able to report what date the voltage was increased.

The mats were disabled by MDT in Nov 2021. The eastern mat was switched on again a few months later. The western mat remains turned off because of crumbling concrete between the metal strips, presumably because the bridge abutment has settled, and there is now a change in slope where the bridge connects to the electrified mat, causing vehicles to exercise excessive stress on the pavement.

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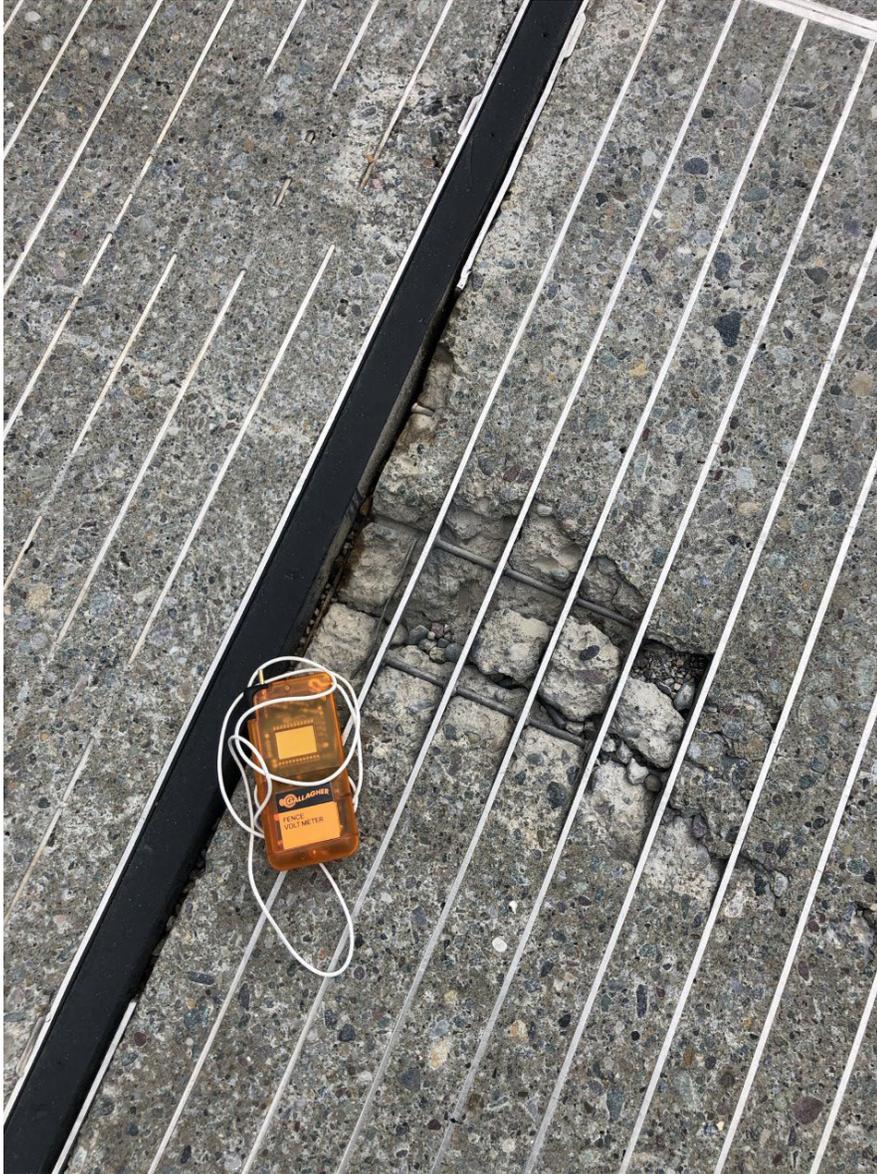
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CAM102

RECONYA

27 Oct 2021: Observed damaged concrete in the electrified barrier. MDT and Crosstek are assessing this.



End Nov and end Dec 2021: no voltage at the 2 guards for unknown reason.

Power was turned on early 2022 again

Western mat is now half covered in asphalt to combat the crumbling concrete (only 50% of mat is functional).

A2d. Different types of gates at gaps in electric wildlife fence, Dixon Melon Farm.

- The images have been interpreted and the data have been entered in a database (through Nov 2021).
- Summary statistics and graphs have been made.
- An abstract was submitted to the 2021 ICOET conference, and it was accepted for a podium presentation (virtual conference).
- Crosstek installed a drive-over electrified barrier 4-6 Aug 2021. This replaced the “drive-over wires” barrier. So far 3 bears approached, none crossed.



- So far, far fewer bears have been observed at the gates and at the fence in 2021 than in 2020 (about 95% reduction). It seems that the barriers have been so effective (since end season 2020) that the bears no longer show up... I think the bears think it is a waste of time.
- Farmer reports no or negligible melon loss due to bears in 2021.
- The project was presented at ICOET 2021 on 28 Sep.
- Data have been analyzed, report 100% written up, draft was submitted 9 June 2022.

B2. Modifications to 10 Jump-outs, US93N Montana.

- Candidate jump-outs have been identified along US93N. 4 are known to receive relatively high use by mule deer, 6 are known to receive relatively high use by white-tailed deer.

The current height of the ten jump-outs selected for this project. EV=Evaro, HH= Ravalli Hill.

Area	#	Height	
		ft	cm
EV	14	6' 8.5"	204
EV	17	6' 0"	183
EV	19	6' 8"	203
EV	20	6' 0"	183
EV	21	6' 1.5"	187
EV	23	5' 6"	168
RH	26	5' 11"	180
RH	27	6' 0"	183
RH	28	5' 9"	175
RH	29	5' 11"	180

- Permission has been obtained for the modifications (from MDT) and for the research (from CSKT).
- MDT will assist with equipment in lowering (after agreement between MDT and WTI-MSU) is signed.
- MDT – WTI agreement was signed in Dec 2020.
- MDT – CSKT agreement was signed early January 2021.
- Permission was obtained from MDT to lower the jump-outs to 5 ft with 18 inch bar on

31 Mar 2021.

- Locate for buried lines was completed on Sat 10 Apr.
- All 10 jump-outs have been lowered to exactly 5 ft (4 in Ravalli on 21 Apr 2021; 6 in Evaro on 4 May 2021). Soil was scraped from the top and deposited at the bottom to achieve a height of 5 ft. The landing area was made level, about 6 ft from the face of the jump-outs. MDT assisted with personnel, a bobcat and a backhoe.



- All 10 jump-outs were equipped with an 18-inch barrier above the ground (rebar) on 18 May 2021.



- All 10 jump-outs had cameras installed on 28 May 2021.



Preliminary data (through 8 June) showed that

- a. No deer jumped down (about n=3 groups), This is not good.
- b. No deer jumped up (about n=10 groups). This is good.
- c. 1 black bear climbed down
- d. 1 coyote jumped down

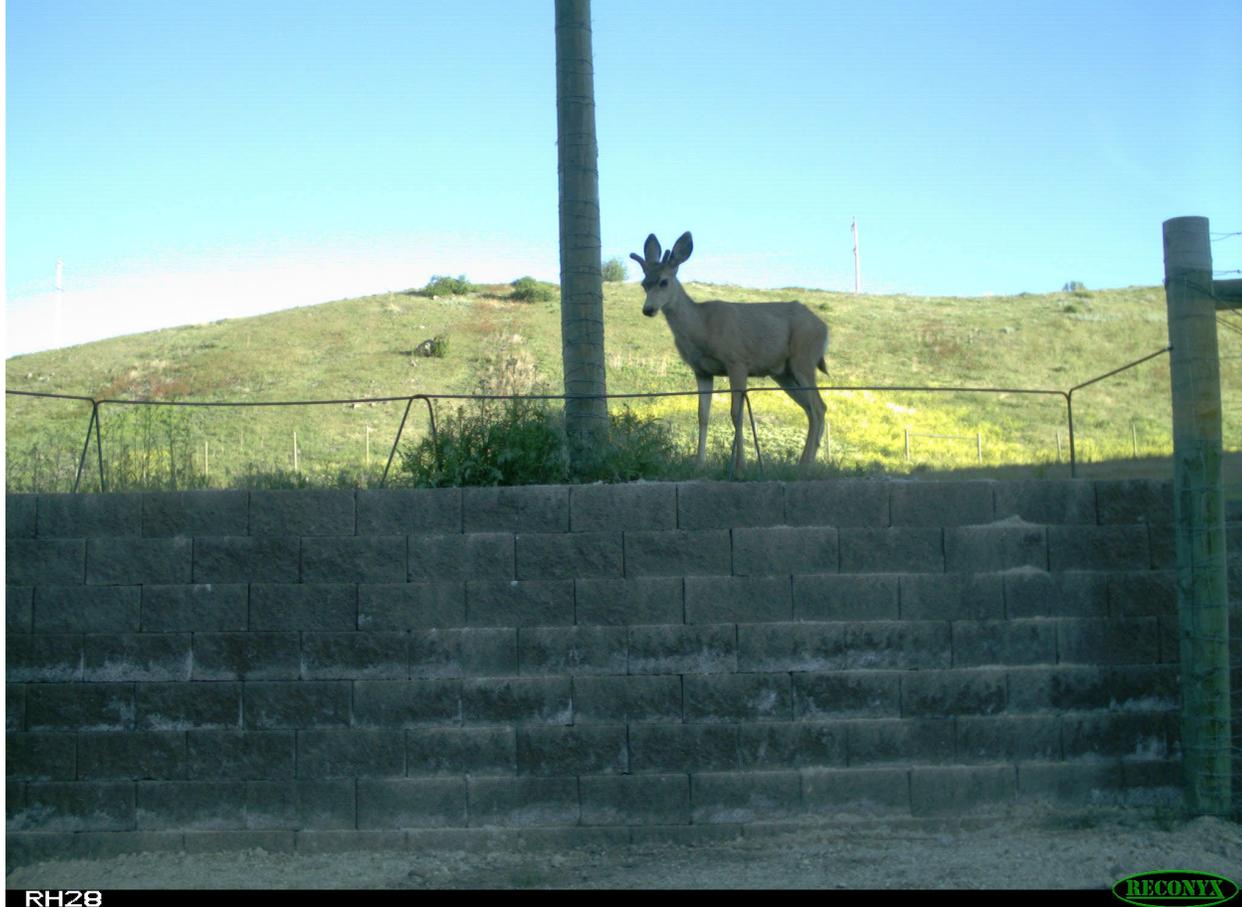
While since June 8 some mule deer and a white-tailed deer did jump down, the results were disappointing.

The majority of the animals that jumped down first stepped over the bar with their front feet.

Therefore, at half the jump-outs, the rebar was lowered 3 inches.

At the other half, the rebar was set back from 12 to 15 inches and with the original height of 18 inches.

Draft report was submitted 5 July 2022.

**Anticipated work next quarter:**

## General:

1. Finalize electrified barrier report
2. Finalize jump-out report

**Significant Results:**

The low-cost electrified barriers at the Dixon melon farm seem promising as (after modifications) they seem to be a very substantial barrier to black bears.

The jump-outs have been made about twice as effective for mule deer.

No improvements yet for white-tailed deer though... more experiments are required for white-tailed deer, but the project has ended. More funding would be very useful though.

**Circumstance affecting project or budget. (Please describe any challenges encountered or anticipated that might affect the completion of the project within the time, scope and fiscal constraints set forth in the agreement, along with recommended solutions to those problems).**

Positive:

Funding from MDT for 2 electrified barriers and permission to lower selected jump-outs along Hwy 93N has been obtained. This will supplement the effort of the pooled fund study related to electrified barriers and jump-outs. One of the barriers was installed in Nov 2021.

**Negative:**

- Covid-19 increased expenses related to transportation.
- The electrified guards in Canada need protection from snow plows. The protective equipment was not available early enough before winter started. Equipment was only installed end Sep 2021.
- The passage of deer and elk at east side of Thompson Falls is very concerning. I am hoping that it is because the voltage was set too low (lower than manufacturer recommended). Evaluation is ongoing.

**Potential Implementation:**

The low-cost electrified barriers at the Dixon melon farm seem promising as (after modifications) they seem to be a very substantial barrier to black bears. Two sites along a real highway are now considered for implementation of these types of barriers (see above).

It is important to follow the recommendations of the manufacturer (and not deviate by setting lower voltage, as seems to be case at Thompson Falls).

