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THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION



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Victoria F. Sheehan
Commissioner

William Cass, P.E.
Assistant Commissioner

Bureau of Materials & Research
October 21, 2022

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

The Department of Transportation requests placing this item on the Consent Calendar.

Authorize the Department of Transportation to amend a **SOLE SOURCE** Cooperative Project Agreement (CPA) with the Plymouth State University Sponsored Programs Administration (Vendor 315187), Plymouth, New Hampshire by extending the completion date from December 31, 2022, to September 30, 2023, effective upon Governor and Council approval. The original contract for research related to a cooperative investigation to assemble available Wildlife Vehicle Collisions (WVC) data, review mitigation methods, and summarize best management practices was approved by Governor and Council on May 19, 2021, Item #32. No additional funding is involved in this time extension.

EXPLANATION

The Department is collaborating with the Plymouth State University (PSU) to conduct a cooperative research study, "Wildlife Vehicle Collisions (WVC) Data Gathering and Best Management Practices", to review and analyze available sources of information about WVC's in New Hampshire and develop deliverables that will include a mapping interface and a summary of best management practices (BMPS) that have been found to effectively reduce WVCs in the Northeast. PSU is uniquely qualified to conduct this study because of their comprehensive knowledge in sustainable management of ecosystems using Geographic Information System (GIS) tools to assess the impact of land use and how human behavior creates barriers and opportunities for sustainability.

On May 19, 2021, the original CPA was approved by Governor and Council (Item #32, copy of resolution attached). This requested action extends the completion date of this study. The extension is requested to enable the researchers time to complete further work on the prioritization of mitigation sites. The extension will also provide for opportunities for research, information gathering and disseminating of research findings and products by means of conference presentations. All other provisions of the agreement shall remain in effect.

This amended Agreement has been approved by the Attorney General as to form and execution. Copies of the fully executed amendment are on file at the Secretary of State's Office and the Department of Administrative Services, and subsequent to the Governor and Council approval will be on file at the Department of Transportation.

It is respectfully requested that authority be given to amend this Agreement.

Sincerely,

A handwritten signature in blue ink that reads "Victoria F. Sheehan". The signature is written in a cursive style with a large initial "V".

Victoria F. Sheehan
Commissioner

Attachments

AMENDMENT #1 to
COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, Department of Transportation
and the
Plymouth State University of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

The Cooperative Project Agreement, approved by the State of New Hampshire Governor and Executive Council on 5/19/21, item # 32, for the Project titled "Wildlife Vehicle Collisions (WVC) Data Gathering and Best Management Practices (SPR #42372I)," Campus Project Director, Amy Villamagna, is and all subsequent properly approved amendments are hereby modified by mutual consent of both parties for the reason(s) described below:

Purpose of Amendment (Choose all applicable items):

- Extend the Project Agreement and Project Period end date, at no additional cost to the State.
- Provide additional funding from the State for expansion of the Scope of Work under the Cooperative Project Agreement.
- Other:

Therefore, the Cooperative Project Agreement is and/or its subsequent properly approved amendments are amended as follows (Complete only the applicable items):

- Article A. is revised to replace the State Department name of _____ with _____ and/or USNH campus from _____ to _____.
- Article B. is revised to replace the Project End Date of 12/31/22 with the revised Project End Date of 9/30/23, and Exhibit A, article B is revised to replace the Project Period of Governor and Council Approval – 12/31/2022 with Governor and Council Approval – 9/30/2023.
- Article C. is amended to expand Exhibit A by including the proposal titled, " _____ ," dated _____.
- Article D. is amended to change the State Project Administrator to _____ and/or the Campus Project Administrator to _____.
- Article E. is amended to change the State Project Director to _____ and/or the Campus Project Director to _____.
- Article F. is amended to add funds in the amount of \$ _____ and will read:
Total State funds in the amount of \$ _____ have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.
- Article F. is amended to change the cost share requirement and will read:
Campus will cost-share _____ % of total costs during the amended term of this Project Agreement.
- Article F. is amended to change the source of Federal funds paid to Campus and will read:
Federal funds paid to Campus under this Project Agreement as amended are from Grant/Contract/Cooperative Agreement No. _____ from _____ under CFDA# _____. Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New

Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as revised Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

- Article G. is exercised to amend Article(s) of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, as follows:

Article is amended in its entirety to read as follows:
Article is amended in its entirety to read as follows:

- Article H. is amended such that:
 - State has chosen not to take possession of equipment purchased under this Project Agreement.
 - State has chosen to take possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.
- Exhibit A is amended as attached.
- Exhibit B is amended as attached.

All other terms and conditions of the Cooperative Project Agreement remain unchanged.

This Amendment, all previous Amendments, the Cooperative Project Agreement, and the Master Agreement constitute the entire agreement between State and Campus regarding the Cooperative Project Agreement, and supersede and replace any previously existing arrangements, oral and written; further changes herein must be made by written amendment and executed for the parties by their authorized officials.

This Amendment and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire or other authorized officials approve this Amendment to the Cooperative Project Agreement.

IN WITNESS WHEREOF, the following parties agree to this Amendment # to the Cooperative Project Agreement.

By An Authorized Official of:

University of New Hampshire

Name: Karen Jensen

Title: Director, Pre-Award Compliance

Signature and Date: Karen Jensen

Digitally signed by Karen Jensen

Date: 2022.10.19 10:23:24 -0400

Jensen

By An Authorized Official of: the New Hampshire Office of the Attorney General

Name: EMILY C. GOERING

Title: AAG

Signature and Date: Emily C. Goering 11/9/2022

By An Authorized Official of: NHDOT

Name: PETER STAMNAS

Title: DIRECTOR OF PROJECT DEVELOPMENT

Signature and Date: Peter Starnas 11/3/2022

By An Authorized Official of: the New Hampshire Governor & Executive Council

Name:

Title:

Signature and Date:



Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

G+C #32
Date 5/19/21



William Cass, P.E.
Assistant Commissioner

Bureau of Materials & Research
April 2, 2021

His Excellency, Governor Christopher T. Sununu
and the Honorable Council
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Authorize the Department of Transportation to enter into a **SOLE SOURCE** Cooperative Project Agreement with Plymouth State University Sponsored Programs Administration (Vendor #315187), Plymouth, New Hampshire, for a total fee not to exceed \$100,973.00, for a cooperative investigation to assemble available Wildlife Vehicle Collisions (WVC) data, review mitigation methods, and summarize best management practices effective upon Governor and Council approval through December 31, 2022. 100% Federal Funds.

Funds to support this request are available in the following account for FY 2021 and is contingent upon the availability and continued appropriation of funds in FY 2022, with the ability to adjust encumbrances between State Fiscal Years through the Budget Office, if needed and justified.

04-96-96-962015-3036	<u>FY 2021</u>	<u>FY2022</u>
SPR Research Funds		
046-500464 General Consultants Non-Benefit	\$60,973.00	\$40,000.00

EXPLANATION

The following research study will address an immediate Department need; is unique to New Hampshire's environment and conditions, thereby requiring substantial local experience; and is directly aligned with a particular area of University expertise. In addition, the Principal Investigator is a nationally recognized expert in her field. As such, the proposed work does not lend itself to a selection process that includes private industry or out-of-state organizations, and it is in the Department's and the State's best interest to work directly with Plymouth State University, requiring this **sole source** agreement.

This work is part of the Department's Statewide Planning and Research (SPR) program. The Department of Transportation and Plymouth State University (PSU) have a standing cooperative relationship in transportation research. This relationship has been mutually beneficial, culminating in savings to the State while enhancing work force development and maintaining New Hampshire's position on the leading edge of new technology

Statewide-SPR 423721: Wildlife Vehicle Collisions (WVC) Data Gathering and Best Management Practices

The Department is collaborating with PSU to conduct a cooperative research study, "Wildlife Vehicle Collisions Data Gathering and Best Management Practices". This project will include a review of the sources of information available about WVCs in New Hampshire. Relevant WVC data is gathered and maintained by a variety of entities including but not limited to NH Department of Transportation, NH Fish and Game Department, NH Department of Safety, and also in published and unpublished reports focusing on biological field research. Based on the results of this review process, the project deliverables will include a mapping interface that would identify hot spots of WVCs, a review of WVC mitigation measures, and a summary of best management practices that have been found to effectively reduce WVCs in the Northeast. Communication materials will be developed to highlight the importance of WVC data collection, analysis, and mitigation.

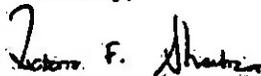
PSU is uniquely qualified to conduct this study because of their comprehensive knowledge in sustainable management of ecosystems using Geographic Information System (GIS) tools to assess the impact of land use and how human behavior creates barriers and opportunities for sustainability. For a total fee not to exceed \$100,973.00 effective upon Governor and Council approval through December 31, 2022, this research will provide a thorough and accurate representation of WVCs supporting higher quality and economical design for NHDOT projects.

The funding is 80% Federal Funds with 20% state match. Turnpike toll credit is being used for the match requirement, effectively using 100% Federal Funds. The Capital Budget Overview Committee approved the use of Turnpike Toll Credits on April 2, 2021.

This Agreement has been approved by the Attorney General as to form and execution. Copies of the fully-executed Agreement are on file at the Secretary of State's Office and the Department of Administrative Services, and subsequent to Governor and Council approval will be on file at the Department of Transportation.

It is respectfully requested that authority be given to enter into this sole-source Agreement for consulting services as outlined above.

Sincerely,



Victoria F. Sheehan
Commissioner

Attachments



Victoria F. Sheehan
Commissioner

THE STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION

**Approved by the Capital Budget
Overview Committee April 2, 2021**



William Cass, P.E.
Assistant Commissioner

Bureau of Materials and Research
February 17, 2021

The Honorable Chairman
Capital Budget Overview Committee
State House
Concord, New Hampshire 03301

REQUESTED ACTION

Pursuant to the provisions RSA 228:12-a, Use of Toll Credits, the Department requests the Capital Budget Overview Committee approve the Department of Transportation's use of Toll Credits to meet funding match requirements for seven (7) proposed research projects as described in the federally approved Department's 2021 State Planning and Research, Part II (SPR2) Work Program. The estimated cost of research related work is \$863,409.70. Based on the estimated cost, the maximum amount of Turnpike Toll Credit needed is \$172,681.94.

EXPLANATION

As part of the Federal-Aid Highway Program, the Federal Highway Administration (FHWA) requires that 2% of the State's apportioned funds be set aside for State Planning and Research activities with 75% dedicated to planning and 25% to research. This is a federally mandated program and these funds can only be used for these purposes. To meet this requirement, the NHDOT's State Planning and Research Part II (SPR2) annual Work Program includes a blend of in-house and contracted research work.

Research activities included in the requested action are undertaken in accordance with federal regulations and state priorities and were selected by the Department's Research Advisory Council and approved by the NH Division Federal Highway Administration. They include the following:

- Crushed Gravel for Shoulder Leveling 304.32
- Use of Drilling Parameters for Enhancing Geotechnical Site Investigations
- Subsurface Investigations for the 21st Century - Advancing our Practices beyond the Borehole
- Water Quality Test Site and Public Outreach at the Sutton Rest Area
- Wildlife Vehicle Collisions Data Gathering and Best Management Practices
- Concrete Slab Jacking
- Bus Stops and Passenger Amenities in Public Highway Right-Of-Ways

Research studies conducted under the SPR2 program have led to numerous gains and innovations in the state's highway and bridge industry, including such successes as improved pavement treatment,

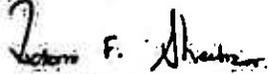
alternative materials and methods for bridge construction and repair, validation of environmental compliance, and forensic analysis of transportation construction activities.

Funding is from the annual State Planning and Research (SPR) program, a mandated federal program set-aside.

The balance of toll credits at the end of federal fiscal year 2020 is \$202.6 million.

Your approval of the above action is respectfully requested.

Sincerely,



Victoria F. Sheehan
Commissioner

Attachments

COOPERATIVE PROJECT AGREEMENT
between the
STATE OF NEW HAMPSHIRE, Department of Transportation
and the
Plymouth State University of the UNIVERSITY SYSTEM OF NEW HAMPSHIRE

- A. This Cooperative Project Agreement (hereinafter "Project Agreement") is entered into by the State of New Hampshire, Department of Transportation, (hereinafter "State"), and the University System of New Hampshire, acting through Plymouth State University, (hereinafter "Campus"), for the purpose of undertaking a project of mutual interest. This Cooperative Project shall be carried out under the terms and conditions of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, except as may be modified herein.
- B. This Project Agreement and all obligations of the parties hereunder shall become effective on the date the Governor and Executive Council of the State of New Hampshire approve this Project Agreement ("Effective date") and shall end on 12/31/22. If the provision of services by Campus precedes the Effective date, all services performed by Campus shall be performed at the sole risk of Campus and in the event that this Project Agreement does not become effective, State shall be under no obligation to pay Campus for costs incurred or services performed; however, if this Project Agreement becomes effective, all costs incurred prior to the Effective date that would otherwise be allowable shall be paid under the terms of this Project Agreement.
- C. The work to be performed under the terms of this Project Agreement is described in the proposal identified below and attached to this document as Exhibit A, the content of which is incorporated herein as a part of this Project Agreement.

Project Title: Wildlife Vehicle Collisions Data Gathering and BMPs (SPR Project No 42372I)

- D. The Following Individuals are designated as Project Administrators. These Project Administrators shall be responsible for the business aspects of this Project Agreement and all invoices, payments, project amendments and related correspondence shall be directed to the individuals so designated.

State Project Administrator

Name: Ann Scholz
Address: NHDOT Bureau of M&R
PO Box 483
5 Hazen Drive
Concord, NH 03302-0483
Phone: 603-271-1659

Campus Project Administrator

Name: Karen Jensen
Address: UNH/Plymouth State University
51 College Road
Durham, NH 03824
Phone: 603-862-2172

- E. The Following Individuals are designated as Project Directors. These Project Directors shall be responsible for the technical leadership and conduct of the project. All progress reports, completion reports and related correspondence shall be directed to the individuals so designated.

State Project Director

Name: Rebecca Martin
Address: NH DOT Bureau of Environment
PO Box 483
7 Hazen Drive
Concord, NH 03302-0483
Phone: 603-271-6781

Campus Project Director

Name: Amy Villamagna
Address: Plymouth State University
17 High Street, MSC#48
Plymouth, NH 03264
Phone: 603-535-2177

F. Total State funds in the amount of \$100,973 have been allotted and are available for payment of allowable costs incurred under this Project Agreement. State will not reimburse Campus for costs exceeding the amount specified in this paragraph.

Check if applicable

Campus will cost-share _____ % of total costs during the term of this Project Agreement.

Federal funds paid to Campus under this Project Agreement are from Grant/Contract/Cooperative Agreement No. N/A from **Federal Highway Administration** under CFDA# 20.205. Federal regulations required to be passed through to Campus as part of this Project Agreement, and in accordance with the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002, are attached to this document as Exhibit B, the content of which is incorporated herein as a part of this Project Agreement.

G. Check if applicable

Article(s) _____ of the Master Agreement for Cooperative Projects between the State of New Hampshire and the University System of New Hampshire dated November 13, 2002 is/are hereby amended to read:

H. State has chosen **not to take** possession of equipment purchased under this Project Agreement.
 State has chosen **to take** possession of equipment purchased under this Project Agreement and will issue instructions for the disposition of such equipment within 90 days of the Project Agreement's end-date. Any expenses incurred by Campus in carrying out State's requested disposition will be fully reimbursed by State.

This Project Agreement and the Master Agreement constitute the entire agreement between State and Campus regarding this Cooperative Project, and supersede and replace any previously existing arrangements, oral or written; all changes herein must be made by written amendment and executed for the parties by their authorized officials.

IN WITNESS WHEREOF, the University System of New Hampshire, acting through the select USNH campus and the State of New Hampshire, have executed this Project Agreement.

By An Authorized Official of:
Plymouth State University
Name: Karen Jensen
Title: Director, Pre-Award
Signature and Date: Karen Jensen 3/26/21

By An Authorized Official of:
Department of Transportation
Name: Peter E. Stamnas
Title: Director of Project Development
Signature and Date: [Signature] 4/14/2021

By An Authorized Official of: the New Hampshire Office of the Attorney General
Name: EMILY C. GOERING
Title: Asst. AG.
Signature and Date: Emily C. Goering 4/26/2021

By An Authorized Official of: the New Hampshire Governor & Executive Council
Name: _____
Title: _____
Signature and Date: [Signature] MAY 19 2021

DEPUTY SECRETARY OF STATE

EXHIBIT A

- A. **Project Title:** Wildlife Vehicle Collisions Data Gathering and Best Management Practices (SPR Project No 42372I)
- B. **Project Period:** Governor and Council Approval through 12/31/2022
- C. **Objectives:** We envision this project focusing on four objectives:
- 1) Synthesize literature regarding wildlife-vehicle collisions (WVC) and the efficacy of mitigation strategies
 - 2) Compile WVC, animal carcass (AC), wildlife tracking (wt), hunting tags in NH into database for cross-agency use
 - 3) Map WVC and AC data, develop "hotspot" maps
 - 4) Analyze WVC and AC to build a predictive models to identify mitigation priorities
 - 5) Develop communication materials to highlight the importance of data collection, analysis and mitigation
- D. **Scope of Work:** We describe the scope of work as it relates to each aforementioned objective:
- 1) Synthesize literature regarding wildlife-vehicle collisions (WVC) and the efficacy of mitigation strategies. Huijser et al (2007) conducted an extensive synthesis of animal-vehicle collision data collection in the US and Canada for the National Cooperative Highway Research Program and Rytwinski et al. (2016) furthered the research effort by evaluating the effectiveness of road mitigation efforts at reducing WVC. Our review will include these and other peer-reviewed studies. We will summarize information in four focal areas, with emphasis on ecosystems, roadways, and wildlife similar to NH.
 - a) Data collection (by whom and how) and types (animal carcass, [AC], wildlife-vehicle collision [WVC], wildlife tracking [AT]) (Huijser et al 2007)
 - b) Data analysis (e.g., hotspot mapping, statistical predictive analysis) (Dodd et al. 2007)
 - c) Mitigation strategies to reduce WVC (Dodd et al. 2007, Grossman et al. 2009, Huijser et al. 2009, Ford et al. 2011)
 - d) Efficacy of mitigation strategies (Dodd et al. 2007, Huijser et al. 2009)
 - 2) NH Data compilation. Maps alongside spatial analysis of WVC events and wildlife movement patterns provide powerful decision-support tools that can increase the cost-effectiveness of mitigation measures (Diaz-Varela et al. 2011). The first step toward such is compiling data that exists, identifying data gaps, attempting to fill those gaps in the short and long-term and analyzing patterns. As noted in the Research Project Suggestion Form and reinforced by Huijser et al (2007), relevant AVC data is gathered and maintained by a variety of entities. In NH this includes but may not be limited to NHDOT, NH Fish and Game, NH Dept of Safety. Additional data regarding wildlife crossings (that have not resulted in collisions) may be found in published and unpublished reports focusing on biological field research (e.g. wildlife tracking [WT]; Scarpitti et al. 2005), wildlife sightings (WS), and game harvest registration and check station reports (GH). We will develop a consolidated database that includes relevant information, including data source, date of record, data type, location, spatial resolution. To identify additional characteristics, we will survey NH agencies and organizations that use, or may want to use, this information for decision-making. This database will be prepared to provide a starting point for future data collation and sharing across agencies, therefore we will consult with the data managers at NHDOT and NHFG to ensure it meets the needs.

- 3) WVC Mapping. We will spatialize data compiled and develop an online ArcGIS Map application that enables the user to filter data (e.g. by species) and conduct basic analysis of data. Typologies (i.e., symbology and data classification) for data will be standardized to promote consistency across agency and time. The online viewer will contain WVC and AC data points as well as a "hotspot" layer that will symbolize areas of high WVC frequency (Diaz-Varela et al. 2011, Yang et al. 2019). This online map can be used by various agencies and organizations to view the data. In addition, the underlying map document and data will be shared with NHDOT via a map package which may then be added to the NH Coastal viewer to compliment the Habitat Blocks and Corridors data layer produced by K. Callahan at NH Fish and Game.
- 4) WVC Data analysis. Mapping alone provides a snapshot of where WVC have occurred and their frequency, but analyzing spatial patterns can provide greater insight that enables us to predict area of high WVC probability. Factors that may influence this probability may also influence effectiveness of mitigation strategies. They include traffic volume, posted or prevailing speed, wildlife population density, wildlife movement patterns (Holthorn et al. 2015), driver awareness, time of year/day, road attractiveness, adjacent habitat, roadside vegetation, and integration of mitigation into the landscape (Litvaitis and Tash, 2008). Acknowledging the influence of such factors can enhance our ability to predict and mitigate WVC. Using the data compiled, we will pursue several statistical modelling approaches that may help explain the frequency of WVC and thereby predict/identify areas of high WVC probability based on roadway characteristics (number of lanes, posted speed, sinuosity), adjacent habitat/land cover/land use data, and seasonality (Found and Boyce 2011, Gunson et al. 2011, Lao et al. 2011, Holthorn et al. 2015, Kusta et al. 2017). We will evaluate the potential use of the Habitat Blocks and Corridors data (currently under development by K. Callahan at NH Fish and Game) as an input to this WVC predictive model. The results of these analyses will be reported via figures, tables, and predictive maps. We will evaluate and report the performance of predictive models for use in decision-making and to inform future data collection efforts.
- 5) Develop communication materials to highlight the importance of data collection, analysis and mitigation. As suggested by the Research Project Suggestion Form, we will create the following as desired.
 - a) Online map application as described in Obj 3.
 - b) StoryMap that integrates our findings from Objs 1-4.
 - c) Series of short videos (<6 min each) that can be shared widely that describe why safe wildlife passage is needed, what the data in NH and New England suggests, and options for mitigation.
 - d) Presentation at regional or national conference focusing on transportation and/or wildlife
 - e) Manuscript preparation and submission for peer review

Supporting literature

- Clark, D. E., Fulton, G., Ontengco, J. B., Lachance, T., & Sutton Jr, J. E. (2019). Moose-Motor Vehicle Collision: A Continuing Hazard in Northern New England. *Journal of the American College of Surgeons*, 228(6), 941-947.
- Clevenger, A. P., & Huijser, M. P. (2011). *Wildlife crossing structure handbook: design and evaluation in North America* (No. FHWA-CFL-TD-11-003). United States: Federal Highway Administration, Central Federal Lands Highway Division.
- Diaz-Varela, E. R., Vazquez-Gonzalez, I., Marey-Pérez, M. F., & Álvarez-López, C. J. (2011). Assessing methods of mitigating wildlife-vehicle collisions by accident characterization and spatial analysis. *Transportation research part D: transport and environment*, 16(4), 281-287.

- Found, R., & Boyce, M. S. (2011). Predicting deer-vehicle collisions in an urban area. *Journal of environmental management*, 92(10), 2486-2493.
- Ford, A. T., Clevenger, A. P., Huijser, M. P., & Dibb, A. (2011). Planning and prioritization strategies for phased highway mitigation using wildlife-vehicle collision data. *Wildlife Biology*, 17(3), 253-265.
- Grosman, P. D., J. A. G. Jaeger, P. M. Biron, C. Dussault, and J.-P. Ouellet. 2009. Reducing moose-vehicle collisions through salt pool removal and displacement: an agent-based modeling approach. *Ecology and Society* 14(2): 17. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art17/>
- Gunson, K. E., Mountrakis, G., & Quackenbush, L. J. (2011). Spatial wildlife-vehicle collision models: A review of current work and its application to transportation mitigation projects. *Journal of environmental management*, 92(4), 1074-1082.
- Hothorn, T., Müller, J., Held, L., Möst, L., & Mysterud, A. (2015). Temporal patterns of deer-vehicle collisions consistent with deer activity pattern and density increase but not general accident risk. *Accident Analysis & Prevention*, 81, 143-152.
- Huijser, M. P., Wagner, M. E., Hardy, A., Clevenger, A. P., & Fuller, J. A. (2007). Animal-vehicle collision data collection throughout the United States and Canada.
- Huijser, M. P., Kociolek, A. V., McGowen, P. T., Ament, R., Hardy, A., & Clevenger, A. P. (2007). Wildlife-vehicle collision and crossing mitigation measures: a toolbox for the Montana Department of Transportation.
- Kušta, T., Keken, Z., Ježek, M., Holá, M., & Šmíd, P. (2017). The effect of traffic intensity and animal activity on probability of ungulate-vehicle collisions in the Czech Republic. *Safety science*, 91, 105-113.
- Lao, Y., Zhang, G., Wu, Y. J., & Wang, Y. (2011). Modeling animal-vehicle collisions considering animal-vehicle interactions. *Accident Analysis & Prevention*, 43(6), 1991-1998.
- Mountrakis, G., & Gunson, K. (2009). Multi-scale spatiotemporal analyses of moose-vehicle collisions: a case study in northern Vermont. *International Journal of Geographical Information Science*, 23(11), 1389-1412.
- Scarpitti, D., Habeck, C., Musante, A. R., & Pekins, P. J. (2005). Integrating habitat use and population dynamics of moose in northern New Hampshire. *Alces*, 41, 25-35.
- van der Ree, R., D. Heinze, M. McCarthy, and I. Mansergh. 2009. Wildlife tunnel enhances population viability. *Ecology and Society* 14(2): 7. [online] URL: <http://www.ecologyandsociety.org/vol14/iss2/art7/>
- van der Ree, R., Jaeger, J. A., van der Grift, E. A., & Clevenger, A. P. (2011). Effects of roads and traffic on wildlife populations and landscape function: road ecology is moving toward larger scales. *Ecology and society*, 16(1).

E. Deliverables Schedule: Project Period May 2021-Dec 2022)

Quarterly summary reports will be submitted at the end of each three-month calendar year. The research group will meet with the Technical Advisory Group (TAG) quarterly or at major milestones.

May- August 2021

- Collect WVC, AC, WT, WS, GH data from NH agencies, organizations, and universities (A.Villamagna summer salary and undergrad research assistant)
- Create database for cross-agency data sharing (H.Kim summer salary and undergrad research assistant)
- Spatialize all data and create a series of static maps and begin development of ArcGIS Map Application for online viewing. (H.Kim summer salary and undergrad research assistant)

August -Dec 2021

- Conduct literature review and synthesis (A.Villamagna supplemental salary and undergrad research assistant)
- Collect ancillary data (e.g. traffic volume, adjacent habitat and land cover, wildlife population density) (A.Villamagna course release and undergrad research assistant)
- Continue mapping and spatial analysis efforts (A.Villamagna supplemental salary, H. Kim, undergrad research assistant)

January -March 2022

- Statistical analysis of WVC and potential predictive factors (A.Villamagna and E. Laflamme course release and undergrad assistant)
- Evaluation of predictive model (A.Villamagna and E. Laflamme course release and undergrad assistant)
- Identify priority roadways based on data-driven maps and predictive model results (A.Villamagna and E. Laflamme course release and undergrad assistant)
- Development of ArcGIS Story Map draft (H.Kim and undergrad research assistants)

April -Dec 2022

- Write the final technical report to NHDOT (all involved)
- Present StoryMap deliverable (H. Kim and undergrad research assistant)
- Develop short videos (A. Villamagna summer salary)
- Prepare manuscript for peer review (A. Villamagna course release and summer salary)
- Present results at regional or national conference (A. Villamagna summer salary)

Note- We will prepare in-progress reports and engage in meetings with technical advisory group as advised.

F. Budget and Invoicing Instructions:

Project Title: Wildlife Vehicle Collisions Data Gathering and BMPs

Project Director: Amy Villamagna

Budget Period 3: 5/1/2021 - 12/31/2022

Budget Items	State Funding	Cost Sharing	Total
1. Salaries & Wages	\$49,570	0	\$49,570
2. Employee Fringe Benefits	\$12,229	0	\$12,229
3. Travel	\$4,500	0	\$4,500
4. Supplies and Services	\$3,000	0	\$3,000
5. Equipment	\$0	0	\$0
6. Facilities & Admin Costs	\$31,674	0	\$31,674
Subtotals	\$100,973	0	\$100,973
Total Project Costs:	\$100,973		

Campus will submit invoices to State on regular Campus invoice forms no more frequently than monthly and no less frequently than quarterly. Invoices will be based on actual project expenses incurred during the invoicing period, and shall show current and cumulative expenses by major cost categories. State will pay Campus within 30 days of receipt of each invoice. Campus will submit its final invoice not later than 60 days after the Project Period end date. State may withhold 10% of funds until receipt of final report from PSU. State will provide final payment within 30 days of receipt of the accepted final report.

EXHIBIT B

This Project Agreement is funded under a Grant/Contract/Cooperative Agreement to State from the Federal sponsor specified in Project Agreement article F. All applicable requirements, regulations, provisions, terms and conditions of this Federal Grant/Contract/Cooperative Agreement are hereby adopted in full force and effect to the relationship between State and Campus, except that wherever such requirements, regulations, provisions and terms and conditions differ for INSTITUTIONS OF HIGHER EDUCATION, the appropriate requirements should be substituted (e.g., OMB Circulars A-21 and A-110, rather than OMB Circulars A-87 and A-102). References to Contractor or Recipient in the Federal language will be taken to mean Campus; references to the Government or Federal Awarding Agency will be taken to mean Government/Federal Awarding Agency or State or both, as appropriate.

Special Federal provisions are listed here: None or Uniform Guidance issued by the Office of Management and Budget (OMB) in lieu of Circulars listed in paragraph above.