Alberta

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ALBERTA WILDLIFE WATCH PROGRAM

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEP	Alberta Environment and Parks
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
AWW	Alberta Wildlife Watch
ERTA	Environmental Regulatory Tracking Application
GOA	Government of Alberta
GPS	Global Positioning System
HMC	Highway Maintenance Contractor
km	Kilometre
Org. ID	Organization ID
TDRA	TIMS Data Repository Application
TIMS	Transportation Information Management System
%	Percent
±	Plus or minus

DEFINITIONS

Term	Definition
Animal Carcass Data	Animal carcass data collected using the AWW application. An animal carcass report is assumed to represent an animal-vehicle collision.
AWW Application	Smartphone application supported in iOS, Android, and BlackBerry devices.
AWW Mitigation Toolbox	Alberta Transportation's guidebook of AVC mitigation technologies and structures.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.

Term	Definition
Mitigation Data Repository	Map and document storage of AVC mitigations across the provincial highway network.
Organization ID	A unique code given to each company and or organization registered as a Principal Contributor to use the AWW application. The code is provided by Alberta Transportation's Operations Manager (for HMCs) or Alberta Transportation's System Administrators within the Environmental Services Section.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor access) to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

1.0 INTRODUCTION

The Alberta Wildlife Watch (AWW) Program's primary goals are to reduce animal-vehicle collisions (AVCs) on provincial highways, improve driver safety, and minimize the impacts of highways on wildlife populations. The AWW Program allows Alberta Transportation to cost-effectively collect and analyze high-quality data for effective decision making across the provincial highway network.

The AWW Program is a joint project between the Transportation Services Division and Delivery Services staff and was developed with input from Alberta Environment and Parks (AEP) and Red Deer College. The development of the AWW Program is consistent with Alberta Transportation's mandate for managing transportation safety and is a solution to help manage AVCs across Alberta.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);
2. Provide high-quality data for effective decision making;
3. Develop departmental policy & standards; and
4. Allow for innovation and evaluate long term mitigation effectiveness.

The Program goals and its key components are highlighted in a video available at https://youtu.be/zBknpdganB8.

The AWW Program was developed using lessons gathered from a 2008 provincial workshop and was initiated to meet regulatory commitments for twinning Highway 63. In 2008, Alberta Transportation hosted a "Strategies Workshop on the Reduction of Animal-Vehicle Collisions on Alberta's Roadways" (Clevenger et al. 2008). The workshop brought together local and international transportation and wildlife professionals to highlight the current problem with AVCs in Alberta, suggest ways to improve data collection, and discuss considerations for AVC reduction planning and mitigation technologies.

Using lessons gathered from this workshop, the AWW Program was initially developed to satisfy Alberta Transportation's regulatory obligations for twinning Highway 63 and commitments were made to both federal and provincial regulators to monitor and mitigate AVCs. To meet these commitments, Alberta Transportation required a solution to collect accurate AVC data across a large study area, determine where AVC mitigation is required, and evaluate the effectiveness of mitigation applied. The AWW Program considered the various issues with the AVC portfolio in Alberta and built-in solutions to support the Program's core pillars.

The AWW Program was considered a success within the Highway 63 trial area. Consequently, the AWW Program evolved for provincial deployment, and began its provincial launch in 2016. During the next phase Alberta Transportation will continue to develop and enhance the program with a focus on standards development.

2.0 THE PROBLEM: ANIMAL-VEHICLE COLLISIONS IN ALBERTA

Animal-vehicle collisions are a significant problem in Alberta affecting motorist safety and wildlife populations. AVCs represent approximately 50 percent (%) of all reported vehicle accidents on provincial rural highways and result in an average of five human fatalities each year. In 2015, Alberta Transportation estimated that the annual cost of AVCs across the province may have surpassed $280 million per year.

Prior to the development of the AWW Program, Alberta Transportation did not have the ability to accurately track AVCs due to the traditional manual data collection system in place. This hindered Alberta Transportation's ability to determine the true magnitude of the issue, accurately locate Animal Vehicle Collision Prone Locations (AVCPLs), and effectively mitigate site-specific AVC concerns. The traditional approach to collecting AVC data presented challenges of:

1. Under reporting of AVCs: Police reports were the only source of AVC data. Collisions resulting in a human fatality, personal injury, or total property damage of $2,000 or more must be reported to the police in the jurisdiction where the collision occurred. Prior to 2011, the property damage threshold was $1,000 or more. Due to this threshold, it is estimated that over 50% of AVCs were unreported. AVCPL identification is less reliable as a result of under reporting.

2. Spatial inaccuracy in AVC reports: Police accident reports were filed using a paper process with limited ability to accurately record the location of the incident. This resulted in substantial inaccuracies in the accident location. It is estimated that the AVC location data was inaccurate by as much as a few kilometres.

3. Limited species identification: The police accident report lacked consistent species-specific information. Each species interacts with highways and responds to mitigation differently. Therefore, it is important to consider the life history traits of the predominant species involved. Furthermore, AVCs may influence survival and recovery of Species at Risk populations, and the current data inaccuracies inhibited conservation efforts.

4. Manual data entry delays: Traditional AVC data had to be manually entered, which required time and resources, increased the risk of data entry errors, and delayed data availability. It typically required two years after an AVC had occurred for the data to be available.

5. Lack of contextual information: Additional information that would be useful for mitigation design, including live animal sightings, had traditionally not been collected.

In turn, challenges with the traditional AVC data collection methods also affect Alberta Transportation's ability to design and evaluate the effectiveness of mitigation applied. In 2005, Alberta Transportation undertook a study to evaluate the effectiveness of AVC mitigations (EBA 2005). Results from this study were inconclusive due to the quantity and quality of data. Three main challenges limited Alberta Transportation's ability to manage AVCs:

1. AVC reduction considerations were not effectively integrated into Alberta Transportation's project delivery process. Wildlife and wildlife mitigation were considered in the Environmental Evaluation for a given project; however, due to lack of reliable data, mitigation was often difficult to plan.

2. Several mitigation strategies implemented across Alberta have traditionally been ineffective (or the data were inconclusive) at reducing AVCs and improving motorist safety. This was the consensus of local and international transportation and wildlife professionals at the 2008 workshop.

3. Low public awareness of AVCs. Further consideration of additional AVC-related educational programs may be needed.

3.0 THE SOLUTION: ALBERTA WILDLIFE WATCH PROGRAM

3.1 Description

The AWW Program provides a simple and cost-effective solution to resolve the traditional challenges, meet regulatory commitments, and support Alberta Transportation's provincial traffic safety mandate.

The AWW System includes an application and website tool that collects and analyzes AVC-related data in a standardized approach to identify AVCPLs. The AWW Program then provides an automated process to prioritize statistically significant AVCPLs and assess individual AVCPL sites for mitigation feasibility and cost-effectiveness. If mitigation at individual AVCPLs is determined to be feasible the project can proceed to mitigation planning and design. The AWW Program provides a defensible approach for the implementation of mitigation, monitoring, reporting, and information sharing to increase transparency, innovation, and stakeholder engagement. The AWW Program approach also provides a framework to support the development of, and continual improvement to, AVC mitigation policy and standards.

Key features of the AWW Program include (Figure 1):

1. Data Collection (Appendix A): The AWW smartphone application improves the quality of data being collected across the province.

2. Data & User Management and Analyses (Appendix B): The AWW website tool provides a platform to efficiently manage and analyze the AWW data (including the identification of AVCPLs) and manage users.

3. Mitigation Data Repository (Appendix C): Provides an organized and secure site to store, update, and manage AVC-specific mitigations for the province.

4. Mitigation Monitoring and Evaluation (Appendix D): Monitors, evaluates, and reports mitigation performance to determine the effectiveness of mitigation projects and learn from previous experience.

5. Annual Regional and Provincial Reporting (Appendix E): Automatically generates key report details and provides standard templates to facilitate reporting at regional and provincial scales and facilitates mitigation decision making.

6. Stakeholder & Principal Contributor Engagement Plan (Appendix F): Supports the development of and regular engagement with Alberta Transportation's stakeholders and Principal Contributors to enhance the AWW Program and the collection of high quality data.

7. Mitigation Planning and Design (Appendix G): Facilitates the development of and provides mitigation standards and design considerations to support mitigation project planning and design.

8. AWW Program Evaluation (Appendix H): Reviews the AWW Program across the province to ensure progress is being made towards the Programs goals. This review process also supports adaptive management and modernization of the AWW Program, when required.

The AWW Program is a milestone for Alberta Transportation. Not only is it the first operational application to collect high-quality animal carcass and live sightings data throughout the province, it is Alberta Transportation's first comprehensive AVC management program. Details of the AWW Program services and how they meet Alberta Transportation's core pillars are provided in stand-alone Appendices A to H.

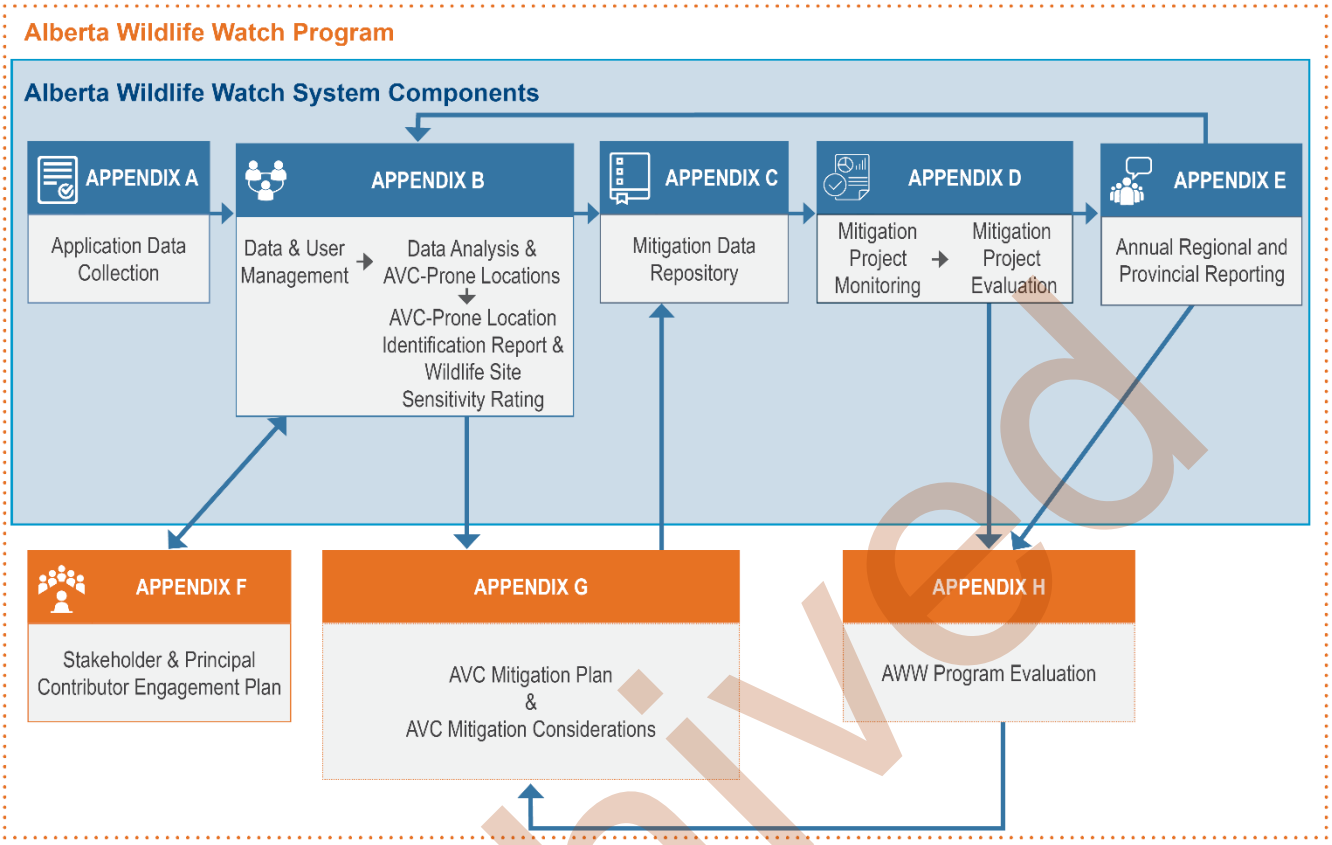

Figure 1: Alberta Wildlife Watch Program Schematic

3.1.1 Summary of AWW Program Services

Alberta Transportation incorporated the 2008 workshop improvement ideas to develop this comprehensive AWW Program that is applicable for the province. Tables 1 and 2 briefly identify how the AWW Program services solve the traditional AVC challenges and meet recommendations from the 2008 workshop, respectively. Further details are provided in Appendices A to H.

Table 1: AWW Program Services

Challenges with Traditional Approach	AWW Program Services
Identifies AVC-prone locations and provides high-quality data for effective decision making: The AWW Program addresses the challenges with the traditional data collection method, and greatly improves the quality and quantity of data collected across the province, at low overall cost.	
▪ Under reporting	▪ Reports both animal carcasses and live animal sightings. Carcasses are representative of an AVC incident and include AVCs that may not have resulted in reportable property damage. Live animal sightings may indicate areas of wildlife movement, where animals are currently able to cross the highway successfully; and ▪ Continues to report animal carcasses and live animal sightings after AVC mitigation applied (i.e., mitigation monitoring).
▪ Spatial inaccuracies	▪ Collects fine-scale location data using the smartphone's onboard Global Positioning System (GPS) (accuracy within ± 10 meters).
▪ Limited species identification	▪ The species identification field is mandatory for report submission; ▪ Includes a species identification guide and range maps built into the application to improve positive identification of the animal; and ▪ Allows photo submission of the animal for data Quality Control, including verification of the species identification.
▪ Manual data entry	▪ Electronically submits the animal carcass and live sighting record automatically into a secured database, which eliminates all manual data entry requirements and reduces common data entry errors.
▪ Data access delay	▪ Available to the AWW Program administrators in near real-time, which significantly reduces the data access delay from two years to mere minutes.
▪ A lack of contextual information	▪ Collects live animal sightings, animal gender, and specific notes and collision details; ▪ Additional contextual information provided within the AWW website tool's interactive map, including (but not limited to) terrain, known wildlife linkage zones, Species at Risk records, and mitigations installed; ▪ Maps and describes mitigations implemented provincially in context to AVCPLs (i.e., Mitigation Data Repository); and ▪ Transitions into Alberta Transportation's Information Management System (TIMS) and Environmental Regulatory Tracking Application (ERTA).
▪ AVC data analyses	▪ Automatically identifies and prioritizes statistically significant AVCPL clusters and high AVC density segments across provincial roads; ▪ Accepts updates to parks and protected areas, important wildlife linkage zones, and other applicable mapping provided by AEP; ▪ Identifies AVCPLs involving large-bodied animals and Species at Risk; ▪ Identifies AVCPLs inside known wildlife linkage areas (i.e., AEP's Key Wildlife and Biodiversity Zones); and ▪ Provides the AWW administrator access to AWW data, maps, and analyses automatically generated by the System.
▪ Low public awareness of the of AVCs	▪ Reports AWW animal carcass statistics as a means of sharing information with relevant stakeholders; ▪ Supports the development of a Stakeholder and Principal Contributor Engagement Plan and automatically generates an annual poster specific to each Contract Maintenance Area displaying the AWW data collected; and ▪ Displays AWW data summaries and maps for public viewing.

Table 1: AWW Program Services

Challenges with Traditional Approach	AWW Program Services
Incorporates departmental AVC mitigation considerations, and supports the decision-making process for capital planning and design: The AWW Program provides a standard AVC mitigation approach across the province and supports the selection of effective mitigation based on mitigation effectiveness monitoring from Alberta. This allows the department to address AVCs across the province in a systematic, cost-effective, and defensible manner.	
▪ AVC mitigation considerations	▪ Includes a standard two-step process to plan and design a mitigation project; ▪ Incorporates departmental design standards and considerations to facilitate mitigation planning and design; ▪ Provides a guidebook of AVC mitigation technologies and structures to consider in Alberta (i.e., AWW Mitigation Toolbox); and ▪ Supports mitigation trials for new applicable research and or innovative solutions.
▪ AVC mitigation monitoring and evaluation	▪ Supports cost-effective monitoring of animal carcass data collected before and after mitigation to evaluate mitigation performance; ▪ Aids in evaluating mitigation performance by mapping and reporting details of AVC mitigations installed in the provincial Mitigation Data Repository; and ▪ Supports the evaluation of mitigations based on standard performance criteria defined by the department.
▪ Long-term Review	▪ Regular review of the overall AWW Program and provincial mitigation performance; ▪ Continues to re-evaluate mitigation performance criteria over time, including recommendations from key stakeholders; and ▪ Influences the department's AWW Program policy and standards, and mitigation design considerations.

Table 2: Checklist of AVC Reduction Strategies Recommended at the 2008 Workshop

AWW Program Addresses	AVC Reduction Strategy Recommendations, 2008 Workshop
I. The Problem with AVCs	
Fully	Inform the public to increase awareness, improve driver safety, and garner funding support for AVC mitigation.
II. Policy and Planning	
Fully	Create a department and inter-department policy addressing AVCs during capital planning.
Partially	Identify a liaison within AEP to assist with policy development to maintain and enhance wildlife habitats during highway planning, construction, and maintenance.
Fully	Look for opportunities within the Government of Alberta (GOA) for inter-jurisdictional bodies that could adopt an AVC reduction mandate, such as the Office of Traffic Safety or the Land-use Framework.
Undeveloped	If a suitable inter-agency committee cannot be found, create an Alberta Linkages Working Group with wildlife, research, insurance, and transportation experts to communicate and provide ongoing guidance to future initiatives.
Fully	Identify collaborative research centers to perform and coordinate research with GOA priorities (e.g., universities, Red Deer College, Western Transportation Institute).
Fully	Focus efforts on two groups of species: 1) those that are a motorist safety concern; and 2) those that are a concern to wildlife management and conservation.
Fully	Conduct a "transportation risk assessment for wildlife" to identify AVC conflict areas and key wildlife

Table 2: Checklist of AVC Reduction Strategies Recommended at the 2008 Workshop

AWW Program Addresses	AVC Reduction Strategy Recommendations, 2008 Workshop
	corridors across the provincial network. This can be developed on a regional basis (i.e., integrated with Land-use Frameworks and associated initiatives).
Fully	At a provincial-scale, prioritize highways (or sections thereof) for mitigation deployment and testing.
Fully	Develop a made-in-Alberta "mitigation toolbox" of proven or emerging technologies for deployment and or testing.
Fully	Identify existing (i.e., scheduled for replacement) or planned bridge files that could serve as wildlife crossing structures.
Fully	Implement AVC mitigation and conduct monitoring to evaluate performance and inform future decision making.
III. Ways to Improve Data Collection	
Fully	Develop and implement standards and policies to collect, report, and manage AVC data.
Fully	Create a wildlife species field guide to assist highway maintenance staff and RCMP with species identification.
Fully	Identify a prototype system (e.g., handheld personal data assistant PDA with GPS capabilities) to collect accurate AVC data. The prototype system should be piloted in test districts/regions.
Fully	Once the piloted prototype (e.g., PDA-GPS) complete and deployed across a greater region, consider: ▪ Procedure(s) to identify errors, retrieve missing data, and verify any unusual data (Huijser et al. 2007). ▪ Spatial accuracy of AVC locations reported. Entering spatial data may lead to the belief that the data are more precise than they actually are, which can have serious consequences when implementing mitigation (Huijser et al. 2007). ▪ Training courses for Alberta Transportation and AEP personnel. ▪ Highway maintenance contracts to hold staff accountable for collecting AVC data.
IV. AVC Reduction	
Fully	Re-examine the effectiveness of existing and planned AVC mitigation.
Fully	Implement only proven AVC mitigation.
Partially	Conduct research on AVC mitigation that is promising but requires further investigation.
Partially	Inform and educate transportation practitioners about AVC mitigations, their performance and guidelines for proper implementation. Provide a training course on effective or promising mitigation to Alberta Transportation Planning and Operations personnel.
Partially	▪ Create a public AVC awareness and reduction education/outreach strategy. Education programs like "Don't Veer for Deer" signs or public service announcements may help raise awareness and educate drivers how to respond in collision situations. ▪ Improve reporting of AVC collision statistics (e.g. annual Collisions Statistics report).

3.1.2 AVC Mitigation Project Analysis

Initiating and planning a mitigation project follows a simplified decision-making process that is critical to the development of cost-effective AVC mitigation projects. To meet this objective, Environmental Services Section has developed a two part process:

1. AVCPL Identification Report
2. AVC Mitigation Plan

Part A: AVCPL Identification Report focuses on specific location(s) of interest and statistically significant AVCPLs. The Wildlife Site Sensitivity Rating (WSSR) governs the process to assess AVCPLs to ensure a mitigation project is feasible. Once the project is determined to be feasible, a mitigation recommendation and cost estimate is provided.

Part B: The AVC Mitigation Plan only proceeds if the AVCPL Identification Report makes the recommendation to proceed and is approved by Alberta Transportation. The AVC Mitigation Plan is developed using site and species specific design considerations, cost effectiveness assessment, and detailed engineering design. This plan forms the framework allowing a tender package to be developed and ultimately the project to be constructed.

3.1.3 Annual Provincial Mitigation Priorities

Priority AVCPLs may be considered for mitigation at three government levels:

1. Project Level Priorities
2. Ministry Level Priorities
3. GoA Level Priorities

Project Level Priorities are AVCPLs that reside within the boundaries of the highway project limits. The project consultant completes the AVCPL Identification Report (Section 1.1.3) to identify feasible mitigation(s) early on in highway project planning. The Region then assesses if the mitigation can be funded. If funds are not available, the proposed mitigation project(s) is submitted for funding consideration at a Ministry Level Priority.

Ministry Level Priorities are set by Environmental Services, Technical Services Branch, based on the annual AWW Regional Reports and are presented as a component within the annual AWW Provincial Report. Ministry Level Priorities identify the mitigation projects of highest importance to Alberta Transportation.

GoA Level Priorities recognize that other GoA ministries have mandates that include the protection of wildlife and habitat connectivity. The AWW program's approach not only addresses Alberta Transportation's mandate but that of other Government of Alberta ministries. Alberta Transportation will consider requests from other ministries to evaluate priorities for potential mitigation.

Once Ministry and GoA Level Priorities are identified the AWW Provincial Annual Report is submitted to the Executive Director of Technical Services Branch for later submission to the Executive Team for consideration.

3.2 AWW Program Development Schedule

The AWW Program started with a trial launch along Highway 63 and 881 to meet federal and provincial regulatory commitments and has since launched provincially. Figure 2 outlines the AWW Program development schedule.

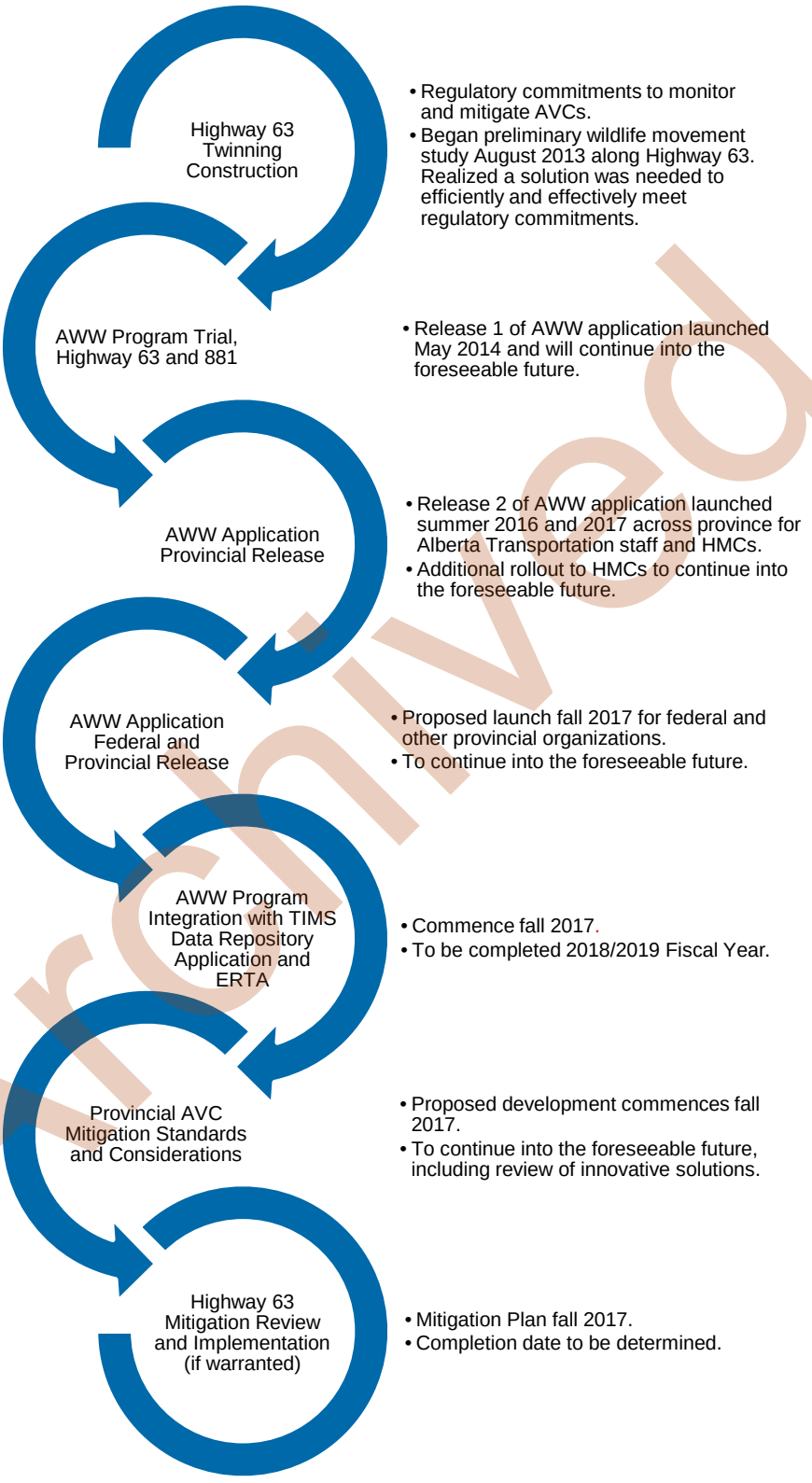

Figure 2: Alberta Wildlife Watch Program Development Schedule

3.3 Alberta Transportation Integration and Management

The AWW website tool is designed to easily integrate into Alberta Transportation's existing systems. Integration will involve moving the existing AWW data into the TIMS Data Repository Application (TDRA) in the 2018/2019 fiscal year (Figure 3). The TDRA is a centralized database of TIMS data, which receives information from multiple applications responsible for performing various operational duties. Once integrated, AWW will become one of many other TIMS applications managed by the Information Management Branch (IMB).

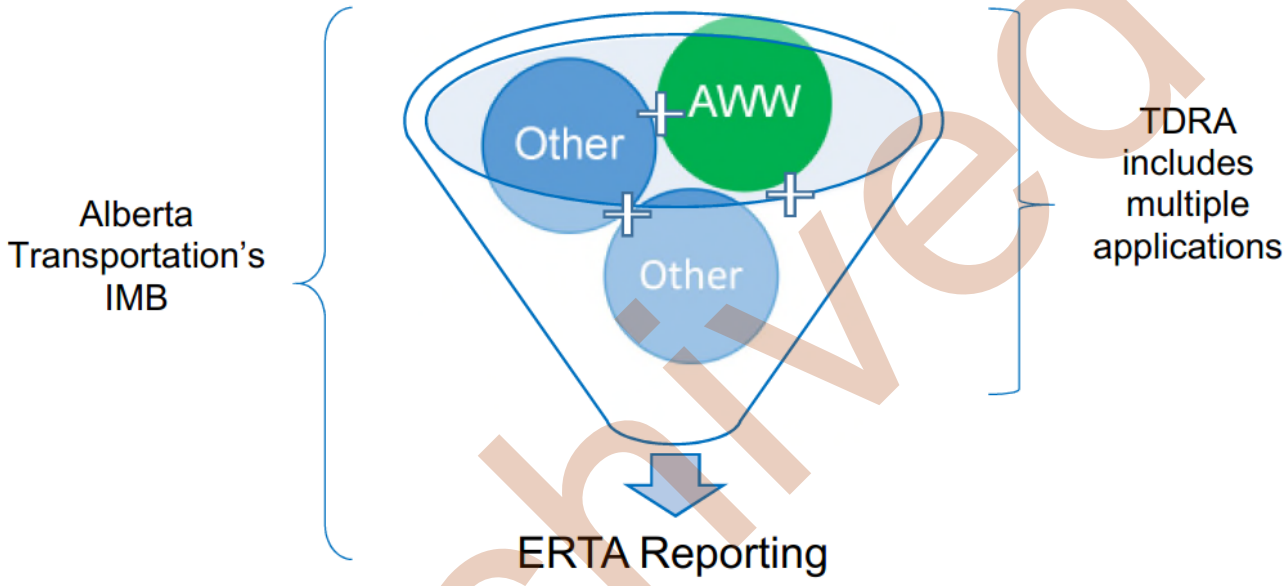

Figure 3: Alberta Wildlife Watch within TIMS and ERTA

Together with the AWW data, the TDRA will house information to better understand factors leading to AVCs, including AVCPLs, traffic volumes, guard rails, culvert structures, watercourses, and additional collision information reported through the Office of Traffic Safety.

The map-based reporting of the AWW application data will be through ERTA. ERTA is an operational application (launched in November 2016; currently in Release 2 development stage) and is part of the enterprise suite of applications.

3.4 AWW Users

Five different users: 1) Principal Contributors, 2) AWW Viewers, 3) Project Users, 4) Regional Administrators, and 5) System Administrators (Figure 4) contribute to, access, and or manage the AWW Program. User access is dependent upon their program authority and their responsibilities within the AWW Program. Each user and their responsibilities are detailed in Appendices A to H.

The AWW application is currently in operation, largely with the participation of the HMCs who are responsible for collecting animal carcass data along provincial highways. The AWW Program is managed by the Environmental Services Section.

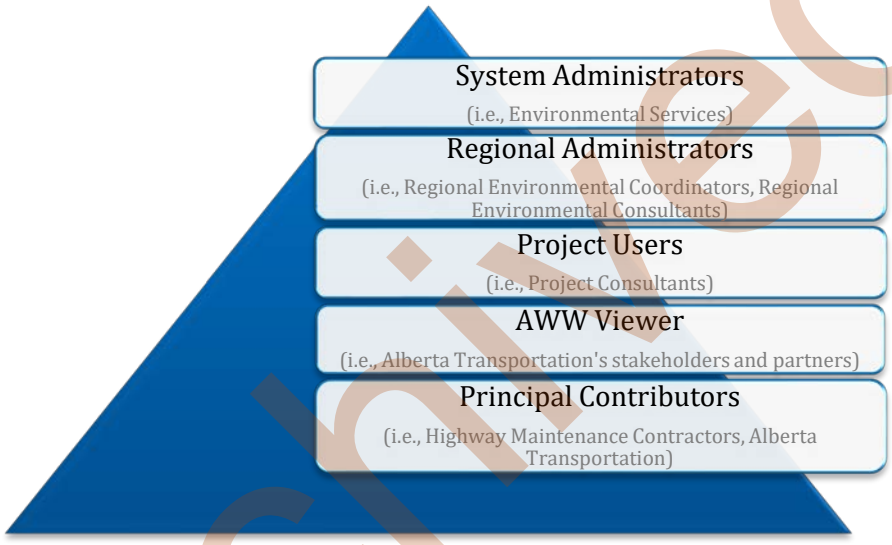

Figure 4: Alberta Wildlife Watch User Structure

The **Environmental Specialist, Technical Services Branch** is the System Administrator and is the primary information contact**.**

3.5 Help Desk

The GOA service desk is the initial point of contact for the AWW application and website tools technical help inquiries. Help desk contact details are below:

Telephone: 1-888-427-1GOA (1462)

Email: goa.servicedesk@gov.ab.ca

4.0 REFERENCES

Clevenger, A.P., A. Ford, S. MacDougall. 2008. Strategies Workshop on the Reduction of Animal-Vehicle Collisions on Alberta's Roadways: Synthesis and Recommendations. Submitted to Alberta Transportation. 41 pp.

EBA Engineering Consultants Ltd (EBA). 2005. Animal Collision Countermeasures on Rural Alberta Highways. Submitted to the Centre for Transportation Engineering and Planning.

Huijser, M.P., J. Fuller, M.E. Wagner, A. Hardy, and A.P. Clevenger. 2007a. Animal-Vehicle Collision Data Collection: A Synthesis of Highway Practice. National Cooperative Highway Research Program. Transportation Research Board. Washington, DC. 117pp.

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Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX A

AWW APPLICATION DATA COLLECTION

AUGUST 2017

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Org. ID	Organization ID
TDRA	TIMS Data Repository Application
TIMS	Transportation Information Management System

DEFINITIONS

Term	Definition
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Traditional Animal-Vehicle Collision Data	This is the traditional police reported data of known animal-vehicle collision incidents.
AWW Application	Smartphone application supported in iOS, Android, and BlackBerry devices.
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Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.
AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);
2. Provide high-quality data for effective decision making;
3. Develop departmental policy & standards; and
4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website (Internet Explorer is not recommended).

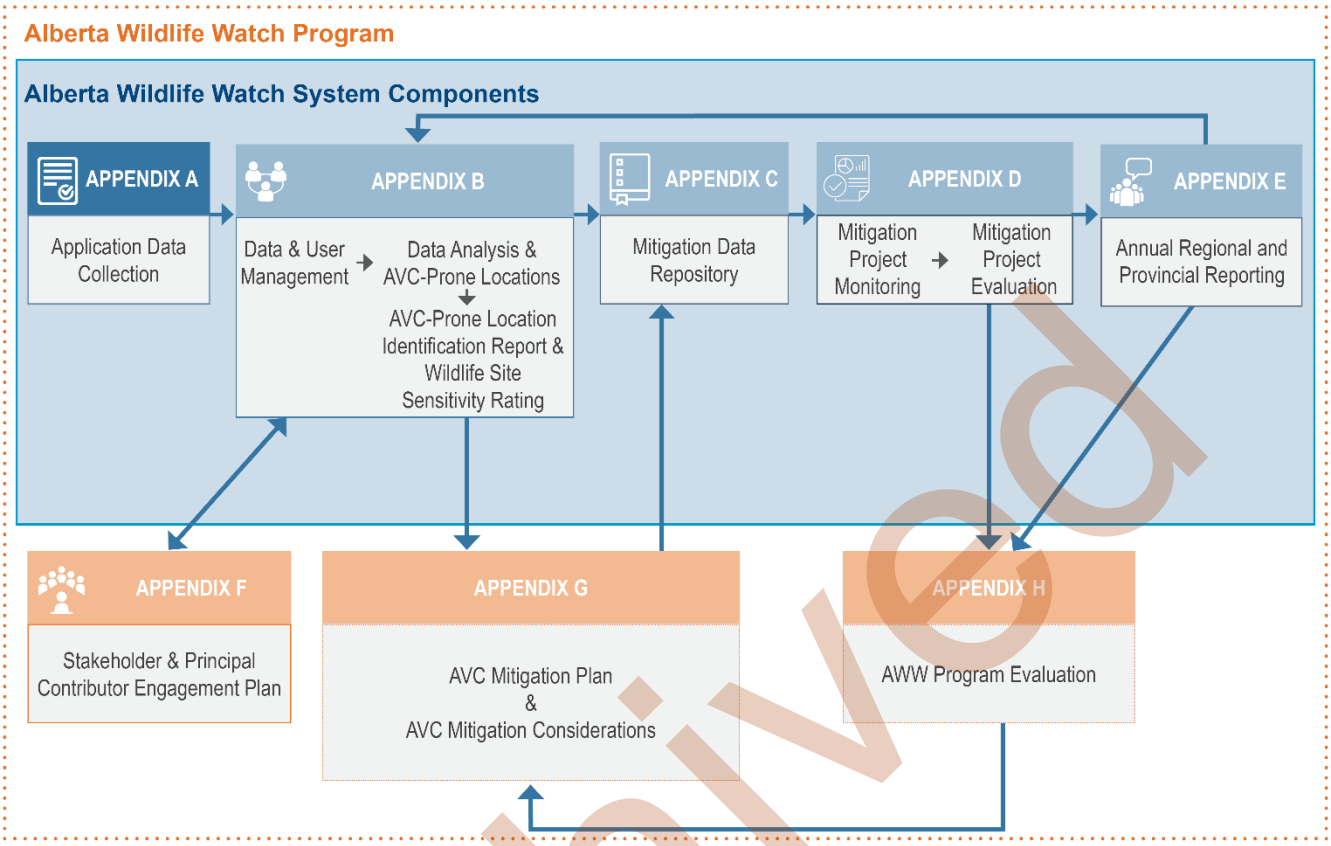


Figure 1: Alberta Wildlife Watch Program Structure

Appendix A: Data Collection

1.0 INTRODUCTION

Collecting high-quality data is a core pillar of the Alberta Wildlife Watch (AWW) Program, as it is the basis for effective provincial animal-vehicle collision (AVC) mitigation decision making and monitoring. The development of the AWW smartphone application is Alberta Transportation's solution to substantially improve the quality of data being collected across the province.

Traditionally, the AVC data collection methods limited the quality and quantity of the data being collected. This restricted its use as a decision-making tool. The traditional AVC data poorly represents the actual number of AVCs occurring across the province, is spatially inaccurate, frequently lacks species documentation, and is unreliable for species identification. Alberta Transportation were thus unable to: 1) quickly access the data for analysis, 2) suitably locate and prioritize provincial animal-vehicle collision prone locations (AVCPLs), 3) confidently choose and justify the most appropriate species-specific mitigation for a given site, and 4) accurately monitor provincial AVC trends and AVC mitigation performance.

The AWW application addresses the shortfalls of the traditional data collection method, and greatly improves the quality and quantity of data collected, at low overall project cost. The AWW application is user-friendly to efficiently and accurately collect animal carcass and live sightings data. The AWW application is currently in operation, largely with the participation of Highway Maintenance Contractors (HMCs) and other Principal Contributors.

2.0 USER ROLES AND RESPONSIBILITIES

The AWW data collection solution is provided through the AWW application; under the responsibility of designated smartphone users (i.e., Principal Contributors). Principal Contributors have the primary responsibility of collecting animal carcass and live animal sightings data and are supported by Regional and System Administrators (Table 1). User access is dependent upon their program authority and their unique identification codes that are determined by a System Administrator.

Table 1: User Responsibilities for Data Collection

User	Access Permission(s)	Data Collection Responsibilities	
		Expand Participation	Collect Data
1. Principal Contributors	Application Tool		✓
2. Regional Administrators	Application & Website Tools		✓
3. System Administrators	Application & Website Tools	✓	✓

Other AWW Program users with no responsibilities for data collection, such as **Project Users and AWW Viewers**, are described in additional appendices, including Appendices B and C.

2.1 Principal Contributors

Principal Contributors currently include HMCs and relevant Government of Alberta staff. Under the AWW Program, their primary responsibility is to collect accurate and consistent animal carcass and live sighting data using the AWW application.

The System Administrator adds new Principal Contributors into the AWW website and provides the Principal Contributors with their unique Organization Identification (Org. ID) code. An Org. ID is usable for all Principal Contributors within that organization (i.e., Alberta Transportation), and is associated with and credits each wildlife record in the database.

2.2 Regional Administrators

Regional Administrators are selected by Alberta Transportation for regional consulting assignments. Individual Regional Administrators gain access to the AWW application using an Org. ID code and the website using an assigned username and password system. Both the Org. ID code and the user name and password are assigned by the System Administrator. Alternatively, the Org. ID may be requested from Alberta Transportation's Environmental Services, Technical Services Branch.

They have the ability to collect live sighting and carcass data using the AWW application; however, Regional Administrators' primary responsibilities include the analyses, management, and reporting of the AWW data described in Appendices B to E.

2.3 System Administrators

System Administrators are responsible for the overall management of the AWW Program and its users, including the AWW application. This role includes access to the entire AWW System and is restricted to Alberta Transportation staff. A primary responsibility is assigning and managing AWW application and website user access for data collection purposes, and expanding participation using the AWW application (i.e., Government of Alberta staff).

3.0 COLLECTING DATA USING THE AWW APPLICATION

AWW is a milestone for Alberta Transportation as it is the first operational application to collect high-quality animal carcass and live sighting data throughout the province. As part of its user-friendly design the AWW application is available in three different platforms: iPhone (iOS 4.0 and later), Android (Android 3.0 and later), and BlackBerry (BlackBerry 10 and later). Access to the application is via the Apple App Store, Google Play Store, and BlackBerry World.

The AWW application provides a standard method to collect data across the province. Its well-thought out design collects the data that will help meet the AWW Program goals. Importantly, it is designed with the needs of Principal Contributors in mind (i.e., easy and safe reporting along highways), and resolves the traditional data collection challenges by:

- Growing the amount of data collected;
- Increasing spatial accuracy;
- Improving species reporting; and
- Storing data in real-time.

3.1 Growing the Amount of Data Collected

Alberta Transportation chose Principal Contributors (e.g., HMCs) to collect animal carcass and live sighting data with the AWW application while carrying out their routine duties. Principal Contributors provide a relatively equal representation of AWW data and data collection effort across the province. Additional Principal Contributors may be approached if it is determined that additional coverage is required to ensure the highest quality data collection.

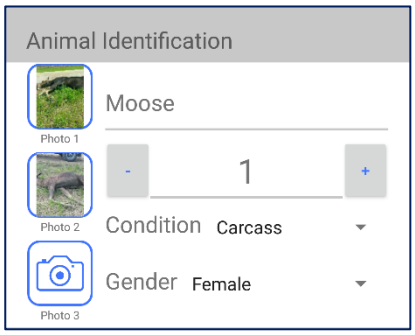
This system of data collection inherently increases the amount of data collected on a regular basis, in the most cost-effective way. By comparison, the traditional data collection approach relied on police reports of AVCs causing $2,000 or more in property damages. Prior to 2011, the reporting limit was $1,000. Due to the monetary reporting threshold, it is estimated that over 50 percent of AVCs went unreported. As a consequence, the true magnitude of AVCs across the province was poorly understood.

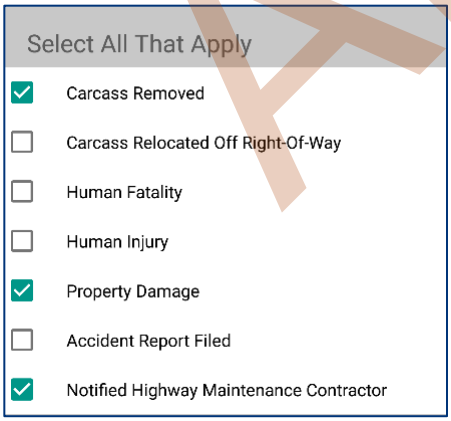
Reporting both animal carcasses and live sightings increases the usefulness of the AWW data. An animal carcass report represents an AVC incident, irrespective of property damages exceeding $2,000. Live animal reports indicate areas of movement, and possibly where animals are currently able to cross the highway successfully.

Additional contextual information about the animal carcass and live sighting is also collected with the AWW application. This provides a finer level of detail appropriate for planning effective AVC mitigation. Additional contextual information includes:

Incident Date and Time: The current date is automatically recorded but may be manually updated by the Principal Contributor. The AWW application also collects the time (i.e., Dawn, Day, Dusk, Dark, Unknown) the animal was hit by a vehicle (if known by the Principal Contributor) or the live animal was seen.

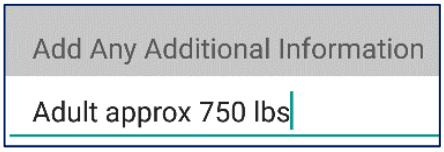
Animal Description and Photo: Additional information about each animal carcass/live sighting is also recorded, including: the number observed, gender (if known), and whether or not the observation was a live animal or an animal carcass. The application also allows Principal Contributors to provide up to three photos of the animal carcass/live animal. The Global Positioning System (GPS) location of each photo is also geotagged to help improve reporting accuracy.





Incident Report: A checklist allows quick identification of information specific to the incident. This includes whether or not the carcass was removed or relocated off the highway right-of-way; if there was a human fatality, human injury, or property damage suspected; if an accident report was filed; and if a HMC was notified to pick up the carcass.

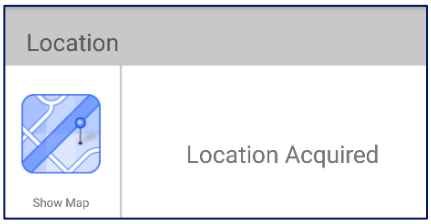
Additional Information: Principal Contributors can manually enter additional information applicable to the report. This may include the species of bird observed (e.g., Great Horned Owl) or the age of the animal (e.g., calf). To date, some Principal Contributors have also recorded the approximate weight of animal carcasses removed from the highway right-of-way.



3.2 Increasing Spatial Accuracy

Increasing the spatial accuracy allows Alberta Transportation to complete fine-scale analyses of where animal-vehicle collisions are occurring. The AWW application provides spatial accuracy within ± 10 metres by using the smartphone's built in GPS. It is designed to automatically record the GPS location and Road Name (if known) at the users' position when submitting the report. Similarly, the AWW application geo-references the location of each photo submitted with the record.

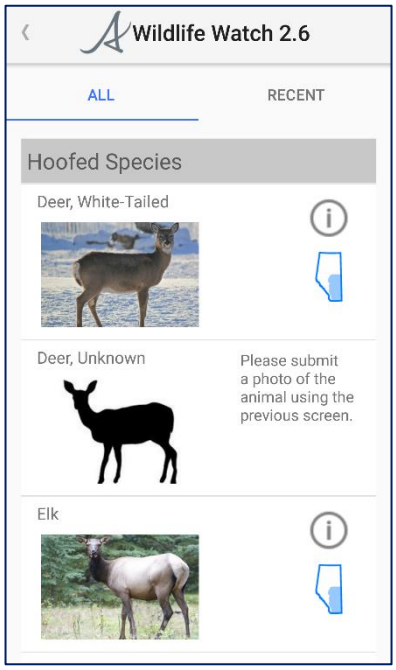
In the traditional reporting system, the location of the AVC was reported as the nearest highway kilometre marker, if known. Improved spatial accuracy allows Alberta Transportation to identify AVCPLs with higher accuracy, and subsequently target mitigation efforts appropriately.



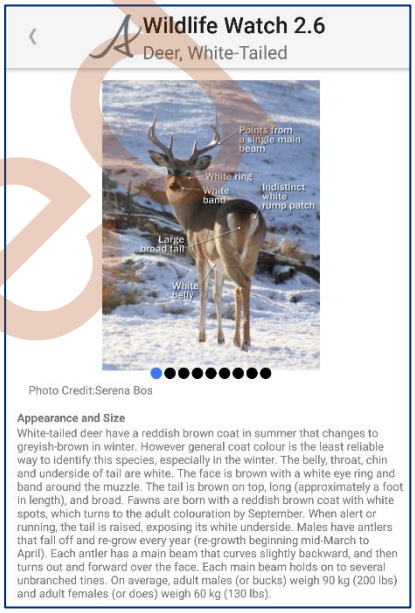
The GPS location continues to update automatically until the report is submitted. Users can also open a map to manually select the location of the observation. Satellite, standard, terrain, or hybrid map options are available to help the user locate local landmarks on the map and increase spatial accuracy of the observation record.

Locational services work in the event that there is no cell signal, or the device has no cell plan. The GPS will acquire the location; however, the manual map entry function will not work without cell signal.

3.3 Improving Species Reporting



Species reporting helps Alberta Transportation understand seasonal and spatial patterns and the species most involved in animal-vehicle collisions. This supports the development of species-specific mitigations. The AWW application improves species reporting and identification. Traditionally, the identification of species was not included in the standard accident report form. Consequently, AVCs were recorded in the TDRA as an "animal strike" with the species infrequently recorded in the comment field.



The AWW application simplifies the recording of provincial animal species. The AWW application provides a well-organized list of main species likely to be observed and recorded by Principal Contributors. Principal Contributors can select provincial species/species groups from a list of all options or, most efficiently, from a shorter list of the ten most recently observed species. The application's quick select button to automatically enter the species name also eliminates spelling errors later in the database. If the species is not on the list, or grouped together, users can manually type in the specific species name in the Additional Information field of the AWW application.

Similarly, the AWW application groups together species that are less likely to be reported/seen (i.e., waterfowl) and those difficult to identify at the species level (i.e., weasel family) by Principal Contributors. This minimizes the number of provincial species/species groups available for Principal Contributors to choose from and facilitates quick selection without being overwhelming to the user.

In addition, the AWW application assists in species identification. It has an embedded electronic species identification guide specific to Alberta. This includes multiple photos that highlight the physical characteristics (i.e., coat colour and pattern) of each species for quick identification. Species range maps are also included as an identification aid.

3.4 Storing Data in Real-time

AWW application records are stored within the smartphone until a network connection is available. Once available, the application record(s) are automatically transferred to a secure database, thereby eliminating the need for manual data entry, and avoiding common data entry and lag-time problems.

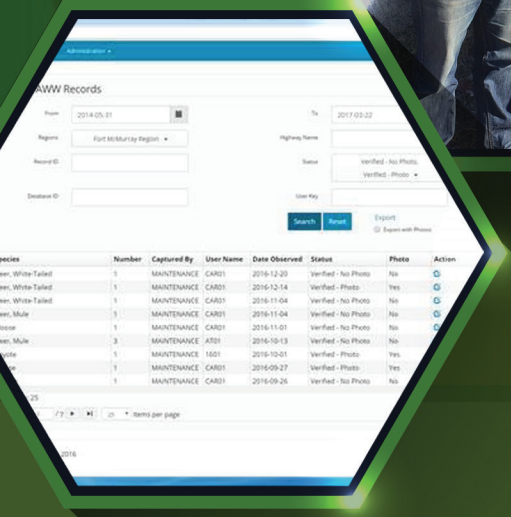
Data from the AWW application is uploaded to the AWW website near live-time. This allows animal carcass and live sighting data to be analyzed in a timely manner. The traditional AVC data can take up to two years for the paper forms for each AVC (with damage ≥ $2,000) to be manually entered into the TIMS Data Repository Application (TDRA).

Quick access to the data allows for more appropriate analysis and timely AVCPL mitigation decision making.

4.0 PREVIEW: DATA & USER MANAGEMENT AND ANALYSIS

Collecting and storing high-quality data is one goal of the AWW Program to help reduce AVCs on provincial highways, improve driver safety, and reduce the impacts of highways on wildlife populations. Subsequent steps to reach all the Program goals are outlined in the following Appendices' documents (Appendices B-H).

Once stored on the AWW website, animal carcass and live sighting data is accessible to Alberta Transportation and other select users. This provides the ability to quality control the data, complete data analyses in a timely manner, and suitably locate and prioritize provincial AVCPLs for mitigation design and tender. These next steps are outlined in Appendix B (*Data & User Management and Analysis*).



Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX B

DATA & USER MANAGEMENT AND ANALYSIS

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEP	Alberta Environment and Parks
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
CMA	Contract Maintenance Area
GPS	Global Positioning System
GoA	Government of Alberta
HMC	Highway Maintenance Contractor
KDE+	Kernel Density Estimate+
Org. ID	Organization ID
TDRA	TIMS Data Repository Application
TIMS	Transportation Information Management System
WSSR	Wildlife Site Sensitivity Rating

DEFINITIONS

Term	Definition
Animal Carcass Data	Animal carcass data collected using the AWW application. An animal carcass report is assumed to represent an animal-vehicle collision.
AWW Application	Smartphone application supported in iOS, Android, and BlackBerry devices.
AWW Dashboard	AWW Program tool to monitor and report AWW data as a snapshot in time. The AWW Dashboard includes clear and concise graphics at the provincial and regional scales to provide an efficient Program checkup.
AWW Mitigation Toolbox	Alberta Transportation's guidebook of AVC mitigation technologies and structures.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.

Term	Definition
Mitigation Data Repository	Map and document storage of AVC mitigations across the provincial highway network.
Organization ID	A unique code given to each company and or organization registered as a Principal Contributor to use the AWW application. The code is provided by Alberta Transportation's Operations Manager (for HMCs) or Alberta Transportation's System Administrators within Environmental Management Services.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website. Limited to Alberta Transportation staff.
User Key	A unique identifier for individual smartphones that is generated by the AWW System.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);
2. Provide high-quality data for effective decision making;
3. Develop departmental policy & standards; and
4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
2 A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

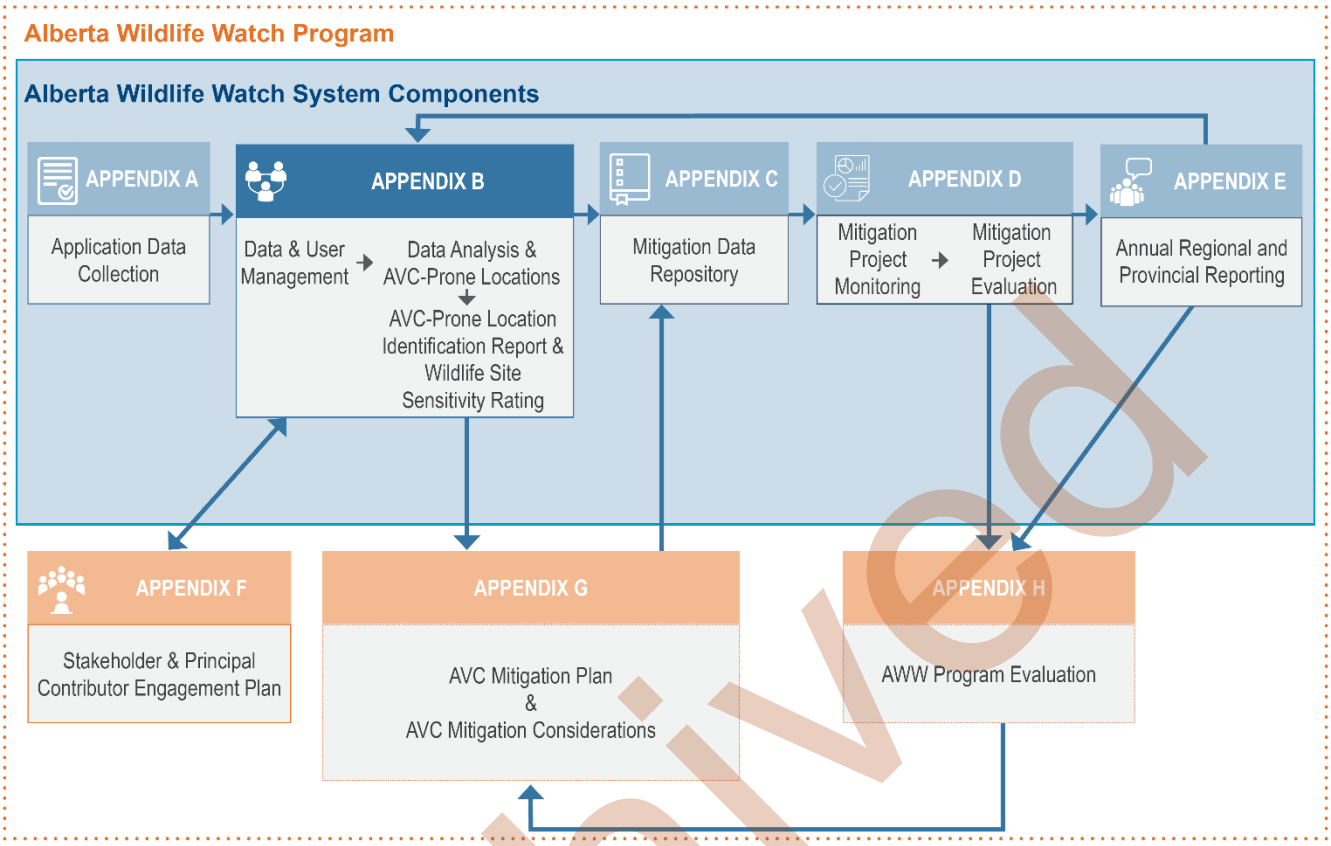


Figure 1: Alberta Wildlife Watch Program Structure

Appendix B: Data & User Management and Analyses

1.0 INTRODUCTION

The development of the Alberta Wildlife Watch (AWW) smartphone application is Alberta Transportation's solution to substantially improve the quality of data being collected across the province (refer to Appendix A). This allows for the data to be quality controlled and analyzed in a timely manner. This is an effective solution to the traditional animal-vehicle collision (AVC) data collection approach.

AVC data is traditionally collected from police reports. Incidents that result in property damage $2,000 or more (prior to 2011 the damage threshold was $1,000), a human fatality, and or human injury are filed using a paper process. This traditional method involves considerable data entry and results in data entry errors and data access delays. Currently, the delay to access the traditional AVC data is two years after an AVC has occurred.

As a result of the delay, AVC reduction considerations are not effectively integrated into Alberta Transportation's project delivery process. Wildlife and wildlife mitigation are considered in the Environmental Evaluation for a given project; however, due to lack of reliable and current data, mitigation is often difficult to plan.

The AWW System solves these challenges by 1) automating the animal carcass and live sighting data entry (as outlined in Appendix A), and 2) providing a platform to efficiently manage and analyze the data (described here in Appendix B). Timely access to the data is improved and the risk of data errors is reduced by the automation and efficient design of the AWW application (i.e., drop down selections). Data collected using the AWW application is automatically submitted to the AWW website once a network connection is available. This allows for near real-time access to the data. Once collected in the field and stored on the AWW System's website, animal carcass and live sighting data is accessible to Alberta Transportation and other selected users. This provides a platform to quality control the data, register and manage select users (i.e., data contributors), and analyze the data. This ensures the highest-quality data, and simple effective analyses.

Reliable and timely access to the data provides Alberta Transportation the ability to locate and prioritize provincial animal-vehicle collision prone locations (AVCPLs). This aids the decision-making process and provides solid justification for mitigating AVCs. Appendix B outlines how the website maintains the integrity and accuracy of the data to ensure high-quality data and effective analyses of AVCPLs by:

1. Managing Data:
    a. Data quality control;
    b. Coach Principal Contributors; and
    c. Integration of other Alberta Transportation information.
2. Managing Users:
    a. Administer user roles and responsibilities; and
    b. Data change history.
3. Analyzing Data using a Provincial Approach (Including the Identification of AVCPLs).

Near real-time access for data analyses provides Alberta Transportation the ability to identify and respond to AVCPLs in a timely manner, synchronize AVC reporting with the annual provincial collision statistics, and effectively engage with stakeholders and the public.

High-quality data is managed and analyzed within the AWW website tool by identified key users. It is their responsibility to ensure quality data is 1) attained/maintained, 2) analyzed, and 3) advanced through the AWW Program.

2.0 USER ROLES AND RESPONSIBILITIES

The AWW website tool efficiently manages multiple users. Three different users 1) **Project Users**, 2) **Regional Administrators**, and 3) **System Administrators** access, manage, and analyze the AWW data (Table1). Each have distinct responsibilities under the data and user management and analyses component (Table 1). For users to view, manipulate, or export certain parts of the AWW website they must have the proper credentials (i.e., username) that are determined by the System Administrator.

Table 1: User Responsibilities for Data/User Management and Analysis

User	Access Permission(s)	Management and Analysis Responsibilities			
		User Management	Data Management	Data Analyses	Public Engagement/ Awareness
1. Project Users	Website Tool			✓ (assigned project(s))	
2. Regional Administrators	Smartphone & Website Tools		✓ (assigned Region(s))	✓	
3. System Administrators	Smartphone & Website Tools	✓	✓	✓	✓

Principal Contributors and **AWW Viewers** are Highway Maintenance Contractors and Alberta Transportation stakeholders and partners. Both users have no responsibilities for AWW data and user management and analyses. Principal Contributors responsibility are outlined in Appendices A and D.

AWW Viewers have no designated responsibilities under the AWW Program; however, have view-only access to the AWW website tool. Once registered by the System Administrator, AWW Viewers are emailed a username and password automatically from the AWW website (email will be sent from info@albertawildlifewatch.ca). AWW Viewer accounts are deactivated by System Administrators upon an agreed upon completion date.

2.1 Project Users

Project Users are Alberta Transportation's project-specific consultants. With view-only access to the AWW data, this user is able to incorporate AWW's data and analyses (including identifying and priority ranking AVCPLs) into their project work. To facilitate project-specific work, Project Users are able to download the AWW database and analyses for all traffic control segments that fall within their project limits. They may then incorporate any required AVC mitigation within, or adjacent to their project. Additional analyses of data may be required outside the AWW website tool.

Once registered by the System Administrator, Project Users are emailed a username and password automatically from the AWW website (email will be sent from info@albertawildlifewatch.ca). Project User accounts are deactivated by Regional Administrators upon project completion.

2.2 Regional Administrators

Regional Administrators are selected by Alberta Transportation for regional consulting assignments. Individual Regional Administrators gain access to the AWW application using an Organization ID (Org. ID) code and the website tool using an assigned username and password system. Both the Org. ID code and the user name and password are assigned by the System Administrator. Alternatively, the Org. ID may be requested from Alberta Transportation's Environmental Services Section, Technical Standards Branch.

Regional Administrators play a primary role within the AWW System. Under the data and user management and analyses component, Regional Administrators' primary responsibilities include 1) data management (i.e., quality control), and 2) data analyses (including identifying and priority ranking AVCPLs). Regional Administrators are also responsible for deactivating Project User accounts when their projects are complete.

2.3 System Administrators

System Administrators are responsible for the overall management of the AWW Program and its users, including the AWW website tool. This role includes access to all AWW data and management systems and is restricted to Alberta Transportation staff. Responsibilities include assigning and managing all other users, registering usernames and passwords for Project Users and Regional Administrators, overseeing data quality control, managing information available from other Alberta Transportation applications, and integrating/sharing data analyses results. Registration of all AWW Program users is completed through the AWW website's *Administration* tab.

3.0 MANAGING DATA

Animal carcass and live sighting data collected using the AWW application are managed within the AWW website tool. Once in the website, the data are reviewed and, where warranted, data quality is further improved. This ensures that data is the highest quality and as reliable as possible when locating and prioritizing provincial AVCPLs. This is achieved by:

- Quality controlling the data;
- Coaching Principal Contributors; and
- Integrating with other Alberta Transportation applications.

Once in the website, data is further protected from loss. Data is backed up on a nightly basis using the Acronis software program.

3.1 Data Quality Control

Animal carcass and live sighting records are automatically uploaded from the AWW application to the website tool. Once in the website, records are initially marked as Pending and are available to Regional Administrators for quality control purposes. This quality control process increases the reliability of the data.

Quality control is completed on the AWW website's *Record Management* tab. Regional Administrators have the ability to view the record, its location, and photo(s) submitted from the AWW application. Updates to the animal species, gender, and condition (animal carcass or live sighting) are permitted during the quality control process. Quality control benefits most when using photo(s) submitted with the record.

Animal carcass and live sighting records and or individual photos may be archived if deemed to be invalid during quality control. Archived items are removed from the database and map layers; however, are retrievable for export and may be restored by a Regional or System Administrator.

To help with the quality control process, an easy drop-down list of pre-identified quality control remarks are provided. This includes the most common errors encountered during the quality control process. An example quality control remark is: *species corrected*. All quality control remarks are automatically included in the AWW database. It is in the database where the true benefit of these pre-identified quality control remarks is most evident. It allows the entire provincial database to be sorted based on a specific data error (i.e., *species corrected*). This simple and effective manipulation to the database allows Regional Administrators to easily identify, manage, and report primary data errors and error rates, and target additional coaching of Principal Contributors.

Uncommon errors, not available in the quality control drop-down list, may be manually entered by the Regional Administrator in the notes section. This manual notes section allows the Regional Administrator to report a cautionary notice. This may be warranted when a species is recorded well outside its known provincial range and a photo was not submitted to verify the observation. These quality control notes are also included in the provincial export database. However, Regional Administrators are responsible for notifying Alberta Transportation of suggested AWW System improvements (i.e., application coaching and or engagement needs).

Once the record is quality checked, the Regional Administrator changes the record status from Pending to Verified- Photo (i.e., verified using a photo record) or Verified-No Photo (i.e., verified without a photo record available). All data, including Pending records, data corrections, and quality control remarks/notes are available for analyses.

The quality control process maximizes data processing efficiency. This includes a streamlined quality control page that 1) displays the applicable record information needed to quickly determine data quality, 2) warns of possible errors, and 3) easily progresses to the next Pending record.

The quality control page is designed specifically to limit three potential data errors:

1. Species identification;
2. Location; and
3. Duplicate records.

The management of these three errors is important to improve data reliability.

3.1.1 Species Identification

Correct species data provides a better understanding of species involved in AVCs, animal movements, and seasonal AVC rates. This allows Alberta Transportation to target mitigation specific to species involved in collisions and manage species at risk. Ultimately, species identification errors in the database have the potential to influence a mitigations effectiveness to reduce AVCs.

The AWW application limits species identification errors by including a species identification guide. Alberta Transportation has also delivered hard copies of the species identification guide as part of the Principal Contributors Engagement Plan (Appendix F). This attempts to reduce the number of species identification errors entering into the database.

Once in the website, species identification is quality checked using the record's photo(s) submitted. Records with on-site photo(s) and correctly identified species are re-classified from Pending to Verified-Photo. Photos showing clear evidence of incorrect species are corrected by the Regional Administrator in the quality control process. Records submitted without photos are re-classified from Pending to Verified-No Photo by the Regional Administrator.

Animal carcasses in particular may be difficult to identify. To aid in species identification, Regional Administrators are able to zoom into the photo. If needed, Regional Administrators are also able to email the photo to a provincial expert for species confirmation (e.g., AEP biologists, Royal Alberta Museum curators).

During the species quality control process using animal photos, Regional Administrators are also able to manually adjust the records' animal gender and age classification. This process also allows records of broad species groupings (e.g., duck species) available on the application to be manually changed to a finer species classification (e.g., Mallard).

3.1.2 Location

Location data directly influences the identification and magnitude of AVCPLs. Accurate location data allows Alberta Transportation to identify mitigation needs, design mitigation appropriate for the entire AVCPL, and effectively monitor mitigation performance.

The AWW application provides spatial accuracy within ± 10 metres by using the smartphone's built in Global Positioning System (GPS). It is designed to automatically record the GPS location at the users' position when submitting the report. Similarly, the AWW application geo-references the location of each photo submitted with the record. This maximizes the location accuracy of the data.

Once in the AWW website, the records and photo location data are available for quality control. The quality control page simplifies the location check by mapping both the record and photo locations together. This allows the Regional Administrator to quickly verify any discrepancies. In addition, a notification alerts the Regional Administrator if the record and photo locations differ by more than 100 metres.

Manual adjustment to the records' location is not permitted. However, a location error notification is saved to the record and entered into the database. This is accomplished during the quality control process and involves selecting a pre-identified quality control remark: *record location ≥100 m from photo location*. Both the record and photo(s) GPS locations are provided in the database for export and further analyses if needed.

3.1.3 Duplicate Record

Duplicate records are defined as multiple AWW application records of the same animal carcass. Large numbers of duplicate carcass records may introduce bias into the AWW database, resulting in an overestimate of the magnitude of AVCs at a particular location. Duplicate live sighting records are considered inherent to the natural movement of wildlife. Multiple live sighting records are not regarded as duplicates within the AWW website tool.

The AWW website tool minimizes the risk of duplicate carcass records by restricting AWW application users to Principal Contributors that are primarily highway maintenance contractors and Government of Alberta staff. Any duplicate records submitted are later managed in the AWW website tool as part of the quality control process.

The quality control process includes an automatic approach to help identify potential duplicate carcass records. During the quality control, a notification alerts the Regional Administrator of all AWW records reported within a 500 m radius and within 1 week of each other (i.e., 14 day span; e.g., a record submitted January 15 is matched to observations from January 8 to January 22). These records are considered possible duplicates, irrespective of the animal species and submitting organization, until further evaluated by the Regional Administrator.

To efficiently evaluate possible duplicates, the species, observation date, record identification number, and submitting Organization ID are listed and mapped for each. Any record determined to be a duplicate by the Regional Administrator is archived and removed from the database.

3.2 Coach Principal Contributors

Data quality is also contingent upon the practices of Principal Contributors (i.e., the highway maintenance contractors). The AWW application is designed to be user-friendly; requiring little time to learn and use on a daily basis.

Similarly, a package of various AWW application training materials are provided to Principal Contributors at deployment (refer to Appendix F). These include an introduction video to the AWW Program (available at https://youtu.be/zBknpdganB8), a detailed AWW application user manual, species identification guide, a simple user guide poster, and travel-sized application guide cards. These are found on Alberta Transportation's website under the *Technical Resources* tab http://www.transportation.alberta.ca/6003.htm
Coaching occurs after deployment of the AWW application, on an as-needed basis. It involves directed instruction specific to the Principal Contributor's needs. Regional Administrators are responsible for monitoring and coaching the Principal Contributors, as needed. Principal Contributors are monitored within the AWW website tool using their unique Org. ID's associated with each AWW record. The AWW website tool includes a dashboard summary of Principal Contributor records and error rates. This provides a high-level overview of the system operations and alerts administrators of potential areas of concern. The AWW Dashboard specifically monitors the primary data errors, Principal Contributor submission rates, and application versions in use. This allows Regional Administrators to easily and effectively monitor coaching needs and initiate an applicable coaching approach. The AWW Dashboard is described further in Section 5.4.

The coaching approach (e.g., phone call, letter, in-person training) is determined by the System Administrator and the Principal Contributor Engagement Plan (Appendix F). Factors that determine the coaching approach and schedule, include but not limited to, the severity of the concern and the ease with which coaching is best communicated.

Coaching is a simple, yet effective method to increase data quality.

3.3 Incorporate Other Alberta Transportation Information

The AWW website tool must also remain current by incorporating other available Alberta Transportation information and mapping. This helps maintain data quality throughout operations, and a seamless transition of data/information sharing among Alberta Transportations applications. This is particularly important at the data analyses and project planning stages.

Alberta Transportation's TIMS Data Repository Application (TDRA) is a centralized database which receives provincial highway information from multiple applications. AWW is one of several applications within the TDRA. Integration of the AWW System with the TDRA ensures data reliability and maintains data consistency across Alberta Transportation's applications.

Alberta Transportation's Informatics and Modelling team maintains custodianship of the highway data used by AWW. They update the highway data annually to include highway upgrades, re-alignments, and new road projects. Similarly, traffic control sections are defined and managed by Alberta Transportation's Modelling and Analysis team using Highway segments with uniform traffic volumes. This is completed by taking the current highway control sections and dividing them, if needed, into "Traffic Control Sections". The AWW System uses the highway and traffic control section information and shapefiles as base maps for data analyses. In particular, the AWW website sources snapshot highway, control section, traffic control section, and kilometre point information from the TDRA.

AWW is designed to incorporate the most contemporary information and mapping from the TDRA. Integration of this information is currently completed manually once annually; however, automation is ultimately preferred as it reduces the potential for human error. This ensures data quality is maintained and provides confidence in the AWW data analyses through time.

4.0 MANAGING USERS

The AWW System's data management approach helps improve and maintain high data quality standards. By comparison, the AWW user management approach helps protect the integrity of the AWW data. Protecting the integrity of the data includes processes to reduce the risk of data corruption and data bias and increase the overall reliability of the data. This supports a higher-level of confidence in the data to aid AVCPL mitigation decision-making.

The AWW System's user management approach helps protect the integrity of the data by:

- Limiting user access; and
- Recording data changes in a change history log.

4.1 Limiting User Access

Alberta Transportation protects the integrity of the data by limiting access to the AWW application's Principal Contributors and website tool to designated AWW Viewers, Project Users, and Administrators with the proper credentials. This includes access to both the AWW application and the website tool based on the user's responsibilities. For instance, Principal Contributors must receive an Organization Identification code to open the AWW application. Proper credentials to access the AWW application and website tools are distributed by the System Administrator.

Access to the AWW application is limited to select Principal Contributors to minimize risk of duplicate carcass records[3]. Each Principal Contributors' phone is given a unique User Key identifier when first submits an AWW application record. This User Key identifies an individual smartphone, without identifying the individual person. In exceptional cases, this allows the data collected by an individual Principal Contributor of known concern to be manually archived and removed from the database. This protects the database from bias and increases the overall reliability of the data.

[3] Access to the AWW application is also limited to Principal Contributors with safety plans addressing the safe use of smartphones.

Similarly, each Regional Administrator has a unique username and password to quality control records collected within their Region(s). They have view-only access to records collected elsewhere to protect data integrity. This protects the integrity of the data by reducing the risk of data corruption.

4.2 Data-Change History

A data-change history strengthens the reliability of the data and reduces the risk of the data being subverted. A change history provides a chronological record of individual AWW record updates. The date and time of a change, and the user name of the Administrator are recorded. In addition, the previous and new attribute value for all changed attributes are also recorded. For example, records changed from “Pending” to “Verified-No Photo” are included in the change history.

5.0 ANALYZING DATA

The AWW website tool utilizes several analytical approaches to yield the most accurate and practical solutions for Alberta Transportation. Data analysis within the AWW website is automated, to the extent possible, and relevant to Alberta Transportation’s traffic safety mandate. This includes analyses that can be used to locate and prioritize AVCPLs and determine effective mitigation to improve highway safety.

Wild large-bodied species are the primary target in the AWW analyses, which reflect Alberta Transportation’s highway safety mandate. These targets species (Table 2) pose the highest risk of property damage and human fatalities/injuries when struck. Large-bodied species are selected based on their physical size and weight; and generally, represent species the size of wolves and larger.

Table 2: Alberta Wildlife Watch Large-Bodied Animals

North American Bison	Moose	Unknown Deer Species	Wolf
Mountain Goat	Elk	Woodland Caribou	Grizzly and Black Bear
Bighorn Sheep	Mule and White-Tailed Deer	Pronghorn	Cougar

However, Alberta Transportation recognizes Alberta Environment and Parks (AEPs) mandate to conserve wildlife including species at risk across the province. Traffic and provincial highways can adversely affect wildlife and species at risk populations. Thus, it is important for capital planning and species conservation to consider highway-related and AVCs mitigations for all wildlife. As a result, the AWW website also includes analysis tools to better identify and understand adverse effects highways may have on other wildlife.

All species, including species at risk, are included in the analyses. The AWW application and website tools collect and analyze data primarily on medium and large-bodied species including those listed as Endangered, Threatened, and Special Concern under the federal *Species at Risk Act* (Schedule 1), Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and the Alberta *Wildlife Act* (Table 3). Smaller-bodied species at risk are inconspicuous, and thus inconsistently reported by Principal Contributors. As a result, smaller-bodied species at risk data is unreliable; however, still forms part of the AWW analyses if it is included in the AWW database (i.e., reported by Principal Contributors).

Table 3: Species at Risk Targeted in Alberta Wildlife Watch*

North American Bison	Grizzly Bear	Swift Fox	Prairie Rattlesnake
Woodland Caribou	Wolverine	American Badger	

* Manual updates to the list of species at risk is required annually to incorporate any newly listed species.

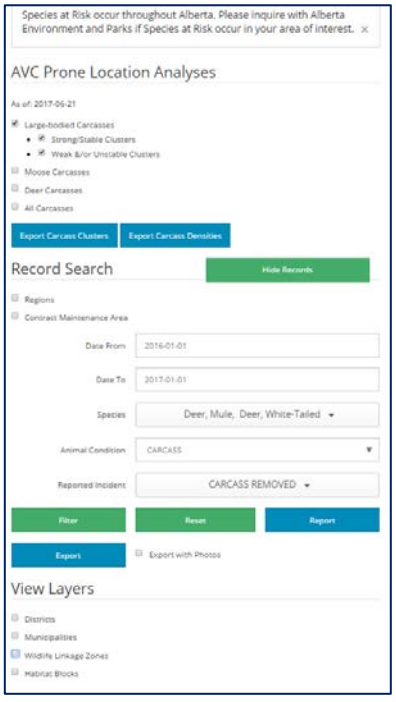
To support Alberta Transportation's traffic safety mandate and species conservation, the AWW website tool analyzes animal carcass and live sighting data using:

1. Interactive mapping;
2. Animal carcass and live sighting data summaries;
3. Animal-vehicle collision prone location analyses;
4. AWW Dashboard; and an
5. Exportable database.

All active AWW data records, including those pending quality control, are included in the data analyses (archived records excluded).

5.1 Interactive Mapping

The AWW website tools interactive map provides visual context and clarification to the data, and cursory analyses of when and where AVCs occur. Maps are an essential component of the AWW website tool. The AWW interactive map provides an effective representation of animal carcass patterns, juxtaposed to surrounding landscape/terrain features and management regions (e.g., Contract Maintenance Areas). This functional map is most beneficial when prioritizing, planning, and mitigating AVCPLs.



Several key features of the AWW interactive map includes data search functions, display of the raw animal carcass and live sighting data, and descriptive and analytical results including the AVCPL analysis. The AWW interactive map allows the user to select a number of data filters to generate and display analyses, including:

- AVCPLs for select species/species groups;
- spatial boundaries (e.g., Region, Contract Maintenance Area, and a user-drawn polygon);
- dates (e.g., start and end dates for data search);
- species (i.e., multi-species selection);
- animal condition (e.g., animal carcass or live sighting); and
- incident details (e.g., carcass removed, human fatality, injury, property damage).

Mapped data is displayed as clusters of raw data, individual record locations, and AVCPL algorithm tools (refer to Sections 5.2 and 5.3). As users zoom into the map, the data clusters recalculate based on the users preferred scale. Hyperlinks from the map connect to record details, analyses, and the database export.

The AWW interactive map also provides additional visual context to the surrounding landscape/terrain features to further support understanding of the data analyses. Surrounding landscape and terrain features often influence animal abundance and where AVCs occur. Open Street Map satellite and terrain visual modes, protected habitat blocks, and wildlife movement linkage zones represent existing landscape/terrain features in AWW. Protected habitat blocks include areas with minimal land development and relatively continuous wildlife habitat. This map layer includes: Provincial Parks and Protected Areas, National Parks, Provincial Wildlife Sanctuaries, and Provincial Special Access Zones. Protected habitat blocks represent natural landscapes that persist through time.

AWW maps wildlife movement linkage zones; identified by Alberta Environmental and Parks (AEP) as Key Wildlife and Biodiversity Zones. These include areas important for overwintering ungulates, principally occurring along major river valleys, and which are intended to represent important local and regional wildlife movement corridors. In addition to public safety concerns around AVCs, Alberta Transportation recognizes AEPs concerns about the landscape level ecological impacts of roads and traffic. Wildlife connectivity is an important part of AEP's mandate to manage the wildlife in the province. Thus, it is important for capital planning and species conservation to consider how wildlife movement corridors or linkage zones intersect with provincial highways. The sharing of data will further support the collaboration between these departments regarding their concerns related to wildlife connectivity at specific highways allowing both ministries to meet their mandates and potentially that of our federal counterparts within Alberta. Known linkage zones are included as a map layer in AWW and the program is soft coded to allow anticipated updates and new mapping, as it becomes available from AEP.

The AWW interactive map of animal carcass and live sighting data is hyperlinked to additional detailed analyses (Sections 5.2 and 5.3). This provides a seamless connection from the mapping component to detailed record analyses.

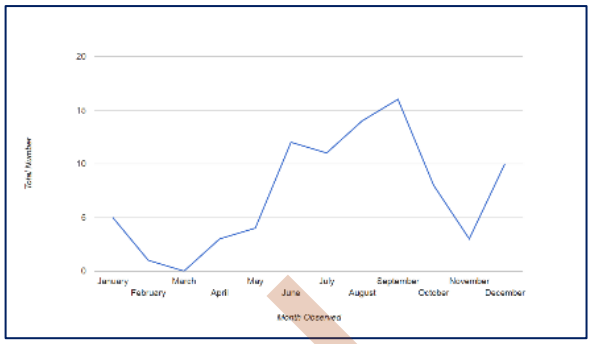
5.2 Animal Carcass and Live Sighting Raw Data Summaries

The raw animal carcass and live sighting data are automatically summarized within the AWW website tool using tables and graphs. These summaries provide simple analyses of the raw data, including the number of records submitted and animal carcasses and live animals.

The raw animal carcass and live sighting data summaries provide an initial understanding of the species most recorded, seasonal and annual trends, and the magnitude and locations of AVC and wildlife movements. Data analyses may be tailored to specific parameters of interest, for instance a species at risk, specific location across the province, date range, or incident report (i.e., suspected property damage). Hyperlinks directly from the interactive map supports these analyses. Summary tables and graphs include:

1. Total number of records submitted;
2. Total number of animal carcasses and/or live sightings;
3. Total of each species and percent representation in the dataset;
4. Total number of records each month; and
5. Total number of records each year.

Raw data summaries are fundamental to the overall understanding of animal carcass and live sightings at various temporal and spatial scales. The AWW website tool then completes further data analyses to locate and prioritize areas needing mitigation to improve highway safety.



5.3 Animal-Vehicle Collision Prone Locations

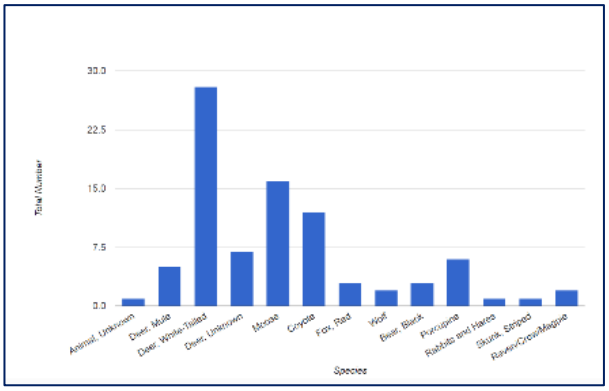
Alberta Transportation's ability to quickly access, analyze, and compare animal carcass data, at a provincial scale, is a critical component of AWW. The AWW animal carcass data, generated from the AWW application, is provided at a sufficient level of detail to identify and prioritize AVCPLs, and determine the magnitude of the issue across Alberta. The AWW website tool automatically performs the cluster and density analyses and maps the results in a simple and informative manner.

Before the analyses begins, the animal carcass data is assigned to a corresponding highway traffic control section. To do so, animal carcasses located (i.e., x,y coordinates) within 75 metres of the highway are forced into the corresponding road traffic control section using a "snap to line" tool. Traffic control sections represent areas along the highway with similar traffic volumes. It is important to have driving conditions (e.g. traffic volume) for each traffic control section as consistent as possible as driver speed and traffic volume all impact the frequency and severity of an AVC.

Once animal carcass data is assigned a traffic control section the AVCPL analysis is initiated. Two animal carcass analyses tools identify and prioritize AVCPLs: 1) animal carcass clusters (Section 5.3.1); and 2) animal carcass density (i.e., animal carcasses/kilometre/year; Section 5.3.2). Statistically significant animal carcass clusters and or highway zones with high animal carcass densities are identified as an AVCPL. This provides Alberta Transportation with a list of AVCPL that may warrant mitigation. This list is then ranked based on strength and stability (the number of animals included in the AVCPL) of each AVCPL, which allows AVC reduction considerations to be effectively integrated into Alberta Transportation's project delivery process.

Analyses may be completed based on four chosen user selected species/species groups. Species/species groupings available for selection are:

1. Moose carcasses;
2. Deer carcasses;
3. Large-bodied animal carcasses; and
4. All reported species carcasses.



These species/species groupings are most applicable to the overall provincial road network. Moose and deer are most commonly reported in AVCs in Alberta. This allows Alberta Transportation to identify species-specific AVCLPs. Similarly, the large-bodied animal carcass filter identifies AVCLPs of highest risk to the travelling public. AVCPLs with all reported species carcasses represent areas that pose the greatest risk to driver safety and species conservation.

Alberta Transportation considered developing a species analysis filter specific to species at risk carcasses within the AWW System. However, at this time, an insufficient number of species at risk carcasses are reported (due to their low populations). As a result, cluster analysis is not the appropriate statistical tool for monitoring species at risk. The locations of all species at risk carcasses are important, and the AWW website tool addresses these by 1) including species at risk carcasses in the "all reported species" analyses, and 2) automatically identifying mapped clusters (regardless of statistical strength) that include a species at risk.

In addition to species/species groupings, a minimum of five years of data is typically required by Alberta Transportation before data analyses is completed. This specified time period will be re-evaluated using the AWW data and AVCPL analyses. For now, a minimum of one year of data along an individual highway is acceptable as a temporary option to begin investigating AVCPLs.

Batch Processing

The AWW website tool automates the analyses, to the extent possible. AVCPL analyses is completed each night as a batch process. Thus saving analyses computation time and providing AVCPL results on an as-needed basis. These standard methods to identify and prioritize AVCPLs is a key component of the AWW System. They provide an easy and reliable method across the province and allows comparisons among years (e.g., mitigation performance monitoring) and similar highways.

5.3.1 Animal Carcass Clusters

Kernel Density Estimate+ (KDE+) software[4] (Bíl et al. 2013[5], 2016[6]) was selected to determine non-random clusters of animal carcass reports or AVCLPs across the province. It enables Alberta Transportation to easily and defensibly 1) identify and 2) prioritize statistically significant animal carcass clusters. KDE+ looks for significant clusters of animal carcasses *within* each traffic control section. Using a Monte Carlo method of repeated random simulations, KDE+ defines clusters above the 95 percentile level within each traffic control section as significant.

KDE+ takes into account a number of factors during the statistical analyses and prioritizing of AVCPLs. Significant clusters are ranked according to a cluster strength (which takes into account factors like the number of carcasses and length of the AVCPL cluster) to help prioritize areas for mitigation. The strongest and most stable clusters are those with a KDE+ strength ≥0.6 and ≥ 5 carcasses/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. Weaker and or unstable clusters are those with a KDE+ strength <0.6 and ≤ 4 carcasses/cluster. Each of the strong and weak/unstable clusters are mapped along respective highway sections. These criteria for strong versus weak clusters will be re-examined and updated after the AWW Program has been running province wide for at least three years.

KDE+ requires two sets of points (i.e., animal carcass data) and line shapefiles (i.e. traffic control sections). Alberta Transportation uses traffic control sections as the line shapefiles because traffic volumes are assumed to be consistent within each section, and they are used for other traffic safety analyses in Alberta. The AWW website tool incorporates existing TDRA traffic control section information and shapefiles (refer to Section 3.3) each year. The traffic control sections are integrated into the AWW System manually, on a yearly basis, to ensure the analysis is being completed using the current network information.

[4] KDE+ software is freely available for download at http://kdeplus.cz/en/download.

[5] Bíl, M., R. Andrášik, and Z. Janoška. 2013. Identification of Hazardous Road Locations of Traffic Accidents by means of Kernel Density Estimation and Cluster Significance Evaluation. Accident Analysis.

[6] Bíl, M., R. Andrášik, T. Svoboda, and J. Sedoník. 2016. The KDE+ software: a tool for effective identification and ranking of animal-vehicle collision hotspots along networks. *Landscape Ecology* 31, 231–237.

On a daily basis, the KDE+ analysis is applied to the entire provincial road network, analyzing only those sections in which new records have been submitted each day. The AWW website tool acts as a current day calculator and calculates the significant collision-prone locations using the current highway length and reported carcasses (i.e., carcasses within 75 metres of the highway are forced to a traffic control section using a “snap to line” tool; carcasses beyond 75 metres from the highway are excluded from the KDE+ analysis). No consideration of historical highway alignment changes are included.

Results from the AVCPL analyses are displayed as map layers on the AWW interactive map based on the filter chosen by the user (e.g., large-bodied animals). Users can manually select a cluster on the map to access the associated summary data and download the cluster shapefiles. Detailed results tables are also provided for review. These tables provide the highway and control section, KDE+ section number, cluster begin and end locations, number of animal carcasses in the cluster, number of species at risk carcasses in cluster, cluster strength, years of data, and if the cluster is located inside a wildlife linkage zone. This KDE+ report table is available in an excel comma separated format, and is customizable by the geo-boundary (i.e., Highway 63).

One strength of the KDE+ method is that it is accessible in GIS. As a result, the data is also available as a shapefile. Additional strengths of the KDE+ clustering method are:

1. Provides reliable cluster identification even when animal carcasses are under-reported (i.e., reporting rates may vary across the province depending on different levels of Principal Contributor effort);

2. Prioritizes cluster areas (e.g., highlights significant clusters, and ranks clusters according to their statistical strength);

3. Provides information about the number of carcasses/cluster and cluster length along the road;

4. Clusters are independent of scale, such that the location and length of clusters do not change (e.g., if the user is viewing a single highway or looking at the entire provincial highway network); and

5. Does not require equal section lengths (as other aggregating methods do; e.g. 100 metre segments) and, therefore is more stable when highway realignments occur.

Despite the many strengths of using the KDE+ methodology, three shortcomings of KDE+ have been identified:

1. KDE+ does not identify areas with a high number of carcass records that are distributed across a larger road zone (non-clustered). As a solution, the AWW System also calculates the animal carcass density (refer to Section 5.3.2).

2. KDE+ cannot be used on Traffic Control Sections that are less than 200 metres in length. As a temporary solution Regional Administrators manually inspect animal carcass records along these sections on an annual basis. AWW maps each of these short sections to ease manual inspections.

3. KDE+ does not recognize animal carcass clusters that may extend over the end of one traffic control section and the beginning of the adjacent section. AWW solves this by: highlighting clusters which occur within 75 metres of the end of a section for further inspection to ensure that an animal carcass cluster which overlaps the end of one traffic control section and the beginning of the adjacent section will not be overlooked. Regional Administrators are required to examine any highlighted clusters within 75 metres of the end of a road segment and report any cluster which may have been missed in the KDE+ analysis.

5.3.2 Animal Carcass Density

Animal carcass densities are a supporting tool for KDE+ analyses to allow comparisons with existing published AVC and AVC mitigation cost-benefit analyses. Many AVCPLs are spatially clustered but not all. Animal carcasses may be observed in a random pattern in homogenous landscapes with similar habitat types and terrain. These homogenous landscapes may not have clearly defined wildlife movement corridors and highway crossing locations. As a result, AVCPLs may extend across a larger road zone representing landscape features.

Animal carcass densities are calculated for highway control sections that are divided into 1 km segments and include the most recent five years of data. Prior to five years of data, the AWW website tool calculates a density with no minimum period of time to allow prompt analyses. Density represents the number of animal carcasses per traffic control section length per year (animal carcass/km/year).

The AWW website tool automatically calculates and reports animal carcass densities across the province. Reports are provided in a succinct table that prioritizes highway control sections. Reports detail the corresponding highway control section, section length, number of animal carcasses, density result, years of data, if species at risk were involved, and if a wildlife linkage zone is present.

The AWW interactive map displays highway control section densities across the province. With the addition of more provincial data, a provincial threshold will be evaluated, and will support comparisons with published AVC mitigation cost-benefit analyses. In the interim, Alberta Transportation considers highway sections with animal carcass densities ≥ 3 carcasses/km/yr. as an AVCPL.

The interactive map is hyperlinked to allow access to summary data specific for each high animal carcass density zone mapped.

Animal carcass density and KDE+ analyses are a complementary solution to identify and prioritize AVCPLs across the province. The AWW website tools data analyses approach meets Alberta Transportations traffic safety mandate and provides an effective solution to prioritize capital planning and justify spending.

5.3.3 AVCPL Location Identification Report

Once AVCPLs are identified using the animal carcass cluster and density analyses, the results are detailed in an AVCPL Identification Report. Each AVCPL is given a priority rank based on the animal carcass cluster/density strength and evaluated for its technical and financial feasibility (refer to Section 5.3.3.1). Recommended mitigation type(s) for all AVCPL mitigation projects determined to be feasible are provided, along with a high-level cost estimate.

5.3.3.1 Wildlife Site Sensitivity Rating

The primary function of a Wildlife Site Sensitivity Rating (WSSR) is to determine if a mitigation project is feasible. The WSSR includes field verification by a Professional Biologist that identifies key site-specific considerations that may affect AVC mitigation options. Examples of site specific considerations include existing highway access, land use changes, adjacent land ownership, topography, water table levels, soil/geotechnical conditions, highway design, and existing highway infrastructure (i.e., bridge structures) that could serve to facilitate and or hinder mitigation. For consistency, the WSSR is prepared utilizing a standardized template for each AVCPL.

The WSSR will be completed for all priority AVCPLs and submitted with the AVCPL Identification Report (Section 5.3.3.) identifying Project Level Priorities[7] and or Annual Regional Report for Ministry and GoA Level Priorities; (Appendix E) to Environmental Services. All AVCPLs where mitigation is determined to be feasible are identified in the Annual Provincial Report (Appendix E) and may advance to mitigation planning and design. AVCPLs where mitigation is determined not to be feasible are recorded in the Mitigation Data Repository (Appendix C).

Project Level Priorities will be required to complete the WSSR for any AVCPL within or adjacent to the project limits. This assessment is independent of the provincial priority. The reports generated by this work will form an appendix to the projects' Environmental Evaluation.

5.4 AWW Dashboard

The AWW Dashboard is an administrative tool that displays the AWW System's key performance indicators at a glance. Data and user management indicators of the AWW Program are provided in clear and concise graphics at the provincial and regional scales to provide an efficient Program checkup.

Regional Administrators are responsible for monitoring the AWW Dashboard regularly for system functionality and Principal Contributor performance.

The AWW Dashboard will provide summary information in four key areas:

1. Provincial Statistics Summary;

2. Regional Statistics Summary;

3. Engagement Monitoring; and

4. Mitigation Summary.

By its nature, the Dashboard is a view-only reporting tool; all information displayed is calculated automatically by the AWW website. All AWW Program users may view but not edit or remove data from the dashboard.

5.5 Export Database

Further data analyses may be completed outside the AWW website by exporting the AWW database. All animal carcass and live sighting records are accessible for export to registered users (i.e., System and Regional administrators, and Project Users), including photos if submitted. The database includes all record details collected using the AWW application, as well as quality control remarks and notes, and the GPS locations of the record and photos.

To support further analysis of the data, the AWW website tool auto-fills several additional database parameters based on the record location. This includes the highway name (if known), control section, Region, District, Municipality, Contract Maintenance Area, and if located inside a known wildlife linkage zone. Similarly, the database auto-fills columns for large-bodied animal and species at risk based on species recorded in Tables 2 and 3.

[7] The Region assesses if Project Level mitigation priorities can be funded. If funds are not available, the proposed mitigation project(s) is submitted for funding consideration at a Ministry Level through the Annual Regional Report.

The database may be exported with or without the photos. Similarly, portions of the database may be exported based on pre-selected parameters (e.g., woodland caribou). The database is provided in an excel comma separated format for easy manipulation and analysis. This allows Alberta Transportation to easily share data with stakeholders.

6.0 PREVIEW: MITIGATION DATA REPOSITORY

Collecting, storing, managing, and analyzing high-quality data are the preliminary steps (Appendices A and B) to reduce AVCs on provincial highways, improve driver safety, and reduce the impacts of highways on wildlife populations. Subsequent steps are outlined in the following Appendices documents (Appendices C-F).

Once stored on the AWW website, animal carcass and live sighting data is accessible to Alberta Transportation and other select users. With this near real-time availability to the data, the AWW website tool supports the ability to quality control the data, register and manage users (i.e., Principal Contributors), and complete data analysis in a timely manner to suitably locate and prioritize provincial AVCPLs for mitigation.

With this knowledge, Alberta Transportation is able to confidently choose the best mitigation for each site and review the relative performance of existing AVC mitigations. The AWW Mitigation Data Repository provides an organized and secure system to store, update, and analyze AVC-specific mitigations across the province. This is outlined in Appendix C (*Mitigation Data Repository*).

Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX C

MITIGATION DATA REPOSITORY

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
ERTA	Environmental Regulatory Tracking Application
TDRA	TIMS Data Repository Application
TIMS	Transportation Information Management System

DEFINITIONS

Term	Definition
AWW Mitigation Toolbox	Alberta Transportation's guidebook of AVC mitigation technologies and structures.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Mitigation Data Repository	Map and document storage of AVC mitigations across the provincial highway network.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.
AWW Program is designed to:

1. Provide high-quality data for effective decision making;
2. Identify AVC-prone locations (AVCPLs);
3. Develop departmental policy & standards; and
4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

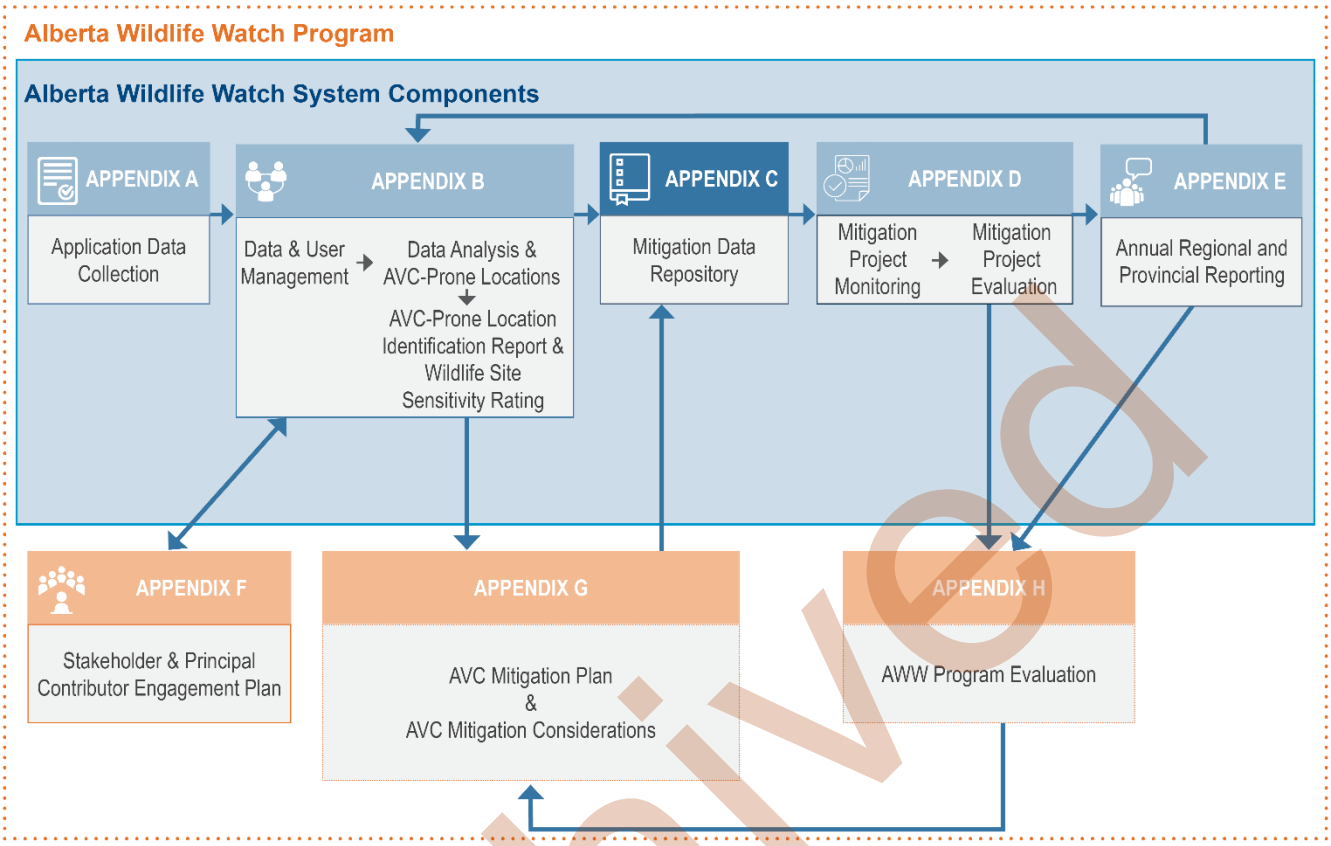

Figure 1: Alberta Wildlife Watch Program Structure

Appendix C: Mitigation Data Repository

1.0 INTRODUCTION

Alberta Transportation has used a number of mitigation techniques to reduce animal-vehicle collisions (AVCs) across Alberta. Prior to 2017, mitigations were implemented entirely at a project-level with limited post-construction monitoring. As a result, mitigation performance was not consistently measured and performance results not readily accessible to support future projects. The lack of a province-wide AVC Mitigation Data Repository resulted in Alberta Transportation not being able to effectively improve its understanding of AVC reduction strategies and further integrate them into project delivery.

Mitigation performance is difficult to monitor and evaluate without reliable data and an appropriate study design prior to mitigation. In 2005, Alberta Transportation attempted to evaluate their provincial AVC mitigations installed. However, the report concluded the effectiveness of Alberta's mitigations were unclear due to data quality issues.

The Alberta Wildlife Watch (AWW) System solves these issues by 1) collecting accurate data (as outlined in Appendix A), 2) supporting a secure platform to quality control and analyze the data to identify and prioritize statistically significant animal-vehicle collision prone locations (AVCPLs; as outlined in Appendix B), and 3) providing an organized and secure Mitigation Data Repository to store, update, and manage AVC-specific mitigations across the province (outlined here in Appendix C).

Appendix C outlines how this centralized data repository offers a support tool to simplify mitigation monitoring and evaluations using a:

1. Provincial AVC mitigation inventory; and
2. Supporting document bank.

Together these two components expedite mitigation monitoring and provide a reference library of AVC mitigations across the province.

All mitigation records from past and future projects will be entered into the AWW Mitigation Data Repository. The streamlined design of the mitigation repository allow users to enter the project specific data with ease, taking advantage of data that is already available within Alberta Transportation's Transportation Information Management System (TIMS) Data Repository Application (TDRA). The AWW website tool is integrated with TDRA, which stores information concerning existing highway structures, including AVC mitigations. This existing information is integrated into the AWW Mitigation Data Repository and updated as mitigation projects occur.

Once initial data entry is complete, records need to be maintained through the course of the mitigation project. Keeping the records up to date is not expected to require significant amounts of time as the AWW System has been designed with the user in mind. Ongoing maintenance of the AWW Mitigation Data Repository will allow for effective mitigation monitoring and evaluation, as outlined in Appendix D. The data also supports ongoing development and analysis of provincial AVC mitigation standards that will further Alberta Transportations understanding and evaluation of mitigation strategies.

2.0 USER ROLES AND RESPONSIBILITIES

Regional Administrators are responsible for monitoring the use of the AWW Mitigation Data Repository, and with **Project Users**, also uploading, updating, and managing the mitigation data and records (Table 1). **System Administrators** provide oversight on user access and all aspects of the AWW Program, including the Mitigation Data Repository.

Table 1: User Responsibilities for Mitigation Data Repository

User	Access Permission(s)	Mitigation Data Repository Responsibilities		
		Enter Existing Mitigations into Inventory	Monitor and Maintain Mitigation Inventory	Store and Manage Mitigation Data Repository
1. Project Users	Website Tool	✓	✓	✓
2. Regional Administrators	Application & Website Tools	✓	✓	✓
3. System Administrators	Application & Website Tools			✓

Principal Contributors and **AWW Viewers** have no responsibilities under the Mitigation Data Repository. These users have limited access to the AWW website tool and include Highway Maintenance Contractors and specific Alberta Transportation stakeholders and partners.

2.1.1 Project Users

Project Users are Alberta Transportation's project-specific consultants. During the completion of the project specific Environmental Evaluation, Project Users will be required to access the AWW System to evaluate projects impacts on wildlife. This evaluation requires the consultant to consider AVC mitigation where appropriate. If mitigation is constructed, Project Users are required to input and maintain AVC mitigation records for their projects in the AWW Mitigation Data Repository.

2.1.2 Regional Administrators

Regional Administrators are selected by Alberta Transportation for regional consulting assignments. Individual Regional Administrators are granted full access to the Mitigation Data Repository, within their contract Region, by the System Administrator. Regional Administrators have view-only access to Regions outside their designated responsibility.

Regional Administrators' play a primary role within the AWW System. Regional Administrators' primary responsibilities for the Mitigation Data Repository include 1) monitoring the input of mitigation records, 2) inputting existing mitigation data and mapping into the inventory, 3) maintaining the mitigation inventory, and 4) maintaining the mitigation record database.

2.1.3 System Administrators

System Administrators are responsible for the overall management of the AWW Program and its users, including the AWW website tool. This role includes access to the entire AWW Mitigation Data Repository and is restricted to Alberta Transportation staff. Access and modifications to the Mitigation Data Repository are allowed. This facilitates the overseeing of users and the overall provincial AVC mitigations.

3.0 PROVINCIAL MITIGATION INVENTORY

The provincial AVC mitigation inventory is a simple map display of polygon and point features, representing the locations where mitigations are installed (e.g., active signs, underpasses, exclusion fencing). Mitigation locations are identified using a map symbol with hyperlinks to site-specific mitigation details (Section 4.0). This provides a seamless connection from the interactive map to the detailed records.

The AVC mitigation inventory is displayed within AWW's interactive map juxtaposed with statistically significant AVCPLs, landscape features/terrain, protected habitat blocks, and known wildlife movement linkage zones (outlined in Appendix B). Displaying mitigation locations with AVCPLs and habitat factors provides visual context and cursory evaluation of site-specific mitigation and mitigation performance.

Project Users and Regional Administrators enter the locations of AVC mitigations into the repository by uploading a shapefile or by hand drawing the location on the AWW interactive map. Shapefiles loaded into the repository are mapped automatically. Based on the location provided, the AWW website tool automatically identifies the nearest community and applicable Contract Maintenance Area, Region, and District. These location attributes are searchable within the supporting document bank (Section 4.0).

4.0 SUPPORTING DOCUMENT BANK

Central repositories, such as the AWW mitigation document bank, provide important document management services for the province. This searchable document bank stores existing and new AVC-specific mitigation records for easy access and evaluation and is hyperlinked from each mitigation identified in the provincial inventory.

The supporting document bank stores AVC mitigation records applicable for mitigation monitoring and performance evaluation. Records include the mitigation structure type and its unique identification number, date installed, surrounding lands, site photos, associated reports (i.e., AVC Mitigation Plan, Wildlife Site Sensitivity Rating), and its shared identification number with Alberta Transportation's Environmental Regulatory Tracking Application (ERTA) Environmental Project. ERTA is an application that feeds back into the TDRA, and acts as a repository of provincial construction projects, regulatory compliance, and environmental document management.

The AWW Mitigation Data Repository simplifies access to records and provides a well-organized foundation that supports mitigation monitoring and mitigation performance evaluations. It is designed to allow Project Users and Regional Administrators to easily and efficiently upload applicable records to the mitigation repository as part of their assignments.

5.0 PREVIEW: MITIGATION MONITORING AND EVALUATION

Collecting, storing, managing, and analyzing high-quality animal carcass and mitigation data are critical steps to reduce AVCs on provincial highways, improve driver safety, and reduce the impacts of highways on wildlife populations. The AWW Mitigation Data Repository is a key storage and organization system for provincial mitigation projects. The records support and expedite mitigation monitoring and performance evaluations, which will be addressed in Appendix D.

The ability to monitor and evaluate mitigation effectiveness is a strength of the AWW System as it allows Alberta Transportation to learn from past projects and inform mitigation practices into the future. This ultimately helps Alberta Transportation make well-informed, cost-effective AVC mitigation decisions across the province.

Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX D

MITIGATION MONITORING AND EVALUATION

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
Org. ID	Organization Identification Code

DEFINITIONS

Term	Definition
AWW Mitigation Toolbox	Alberta Transportation's guidebook of AVC mitigation technologies and structures.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Mitigation Data Repository	Map and document storage of AVC mitigations across the provincial highway network.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Provide high-quality data for effective decision making;

2. Identify AVC-prone locations (AVCPLs);

3. Develop departmental policy & standards; and

4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

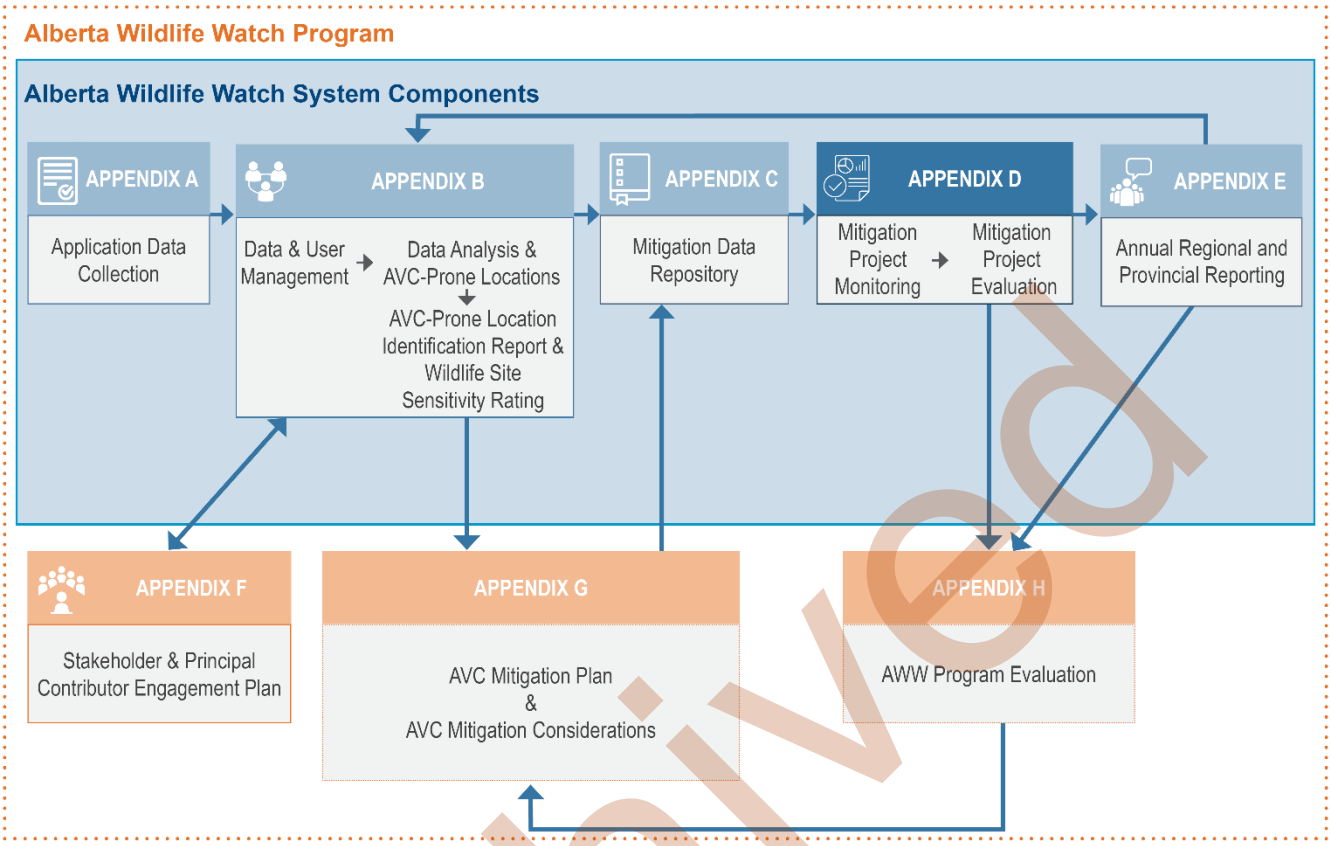


Figure 1: Alberta Wildlife Watch Program Structure

Appendix D: Mitigation Monitoring and Evaluation

1.0 INTRODUCTION

Alberta Transportation is committed to improving driver safety on provincial highways. Mitigating animal-vehicle collisions (AVCs) is critical for ongoing safety improvements. Due to the historic data quality issues, outlined in Appendix A, previous AVC mitigation has been implemented without fully understanding their effectiveness. The historic challenges were identified in 2005 during Alberta Transportation's evaluation of the provincial AVC mitigation projects. The report concluded the effectiveness of Alberta's mitigations were unclear due to data-related issues.

Poor AVC data impedes the scientific evaluation of mitigation effectiveness. The Alberta Wildlife Watch (AWW) System helps solves these issues by 1) collecting accurate data (as outlined in Appendix A), 2) identifying and prioritizing areas requiring mitigation (as outlined in Appendix B), 3) storing and managing mitigation data in the repository (outlined in Appendix C), and 4) monitoring and evaluating mitigation performance which will be addressed in this appendix.

Appendix D outlines how the monitoring and evaluation approach is simplified by:

- Collecting high-quality pre- and post-mitigation animal carcass data (i.e., monitoring); and
- Evaluating and reporting mitigation performance using provincial criteria.

A key strength of the AWW System is it allows Alberta Transportation to continue to learn from past projects and inform mitigation practices into the future. Lessons learned from the mitigation performance evaluations directly influence modifications, if required, to the AWW Mitigation Toolbox. The AWW Mitigation Toolbox is a guidebook of AVC mitigations used to plan and design projects in Alberta (Appendix G).

The AWW program helps Alberta Transportation make well-informed, cost-effective, AVC mitigation decisions into the future.

2.0 USER ROLES AND RESPONSIBILITIES

The AWW System is an efficient program utilized and managed by multiple users. **Principal Contributors** have the primary responsibility to collecting monitoring data. **Project Users** and **Regional and System Administrators** are primarily responsible for evaluating and reporting mitigation performance (Table 1).

Table 1: User Responsibilities for Mitigation Monitoring and Evaluation

User	Access Permission(s)	Mitigation Monitoring and Evaluation Responsibilities	
		Data Collection	Evaluating and Reporting Mitigation Performance
1. Principal Contributors	Application Tool	✓	
2. Project Users	Website Tool		✓
3. Regional Administrators	Application & Website Tools	✓	✓
4. System Administrators	Application & Website Tools		✓

AWW Viewers, specific Alberta Transportation stakeholders and partners, have no responsibilities under the AWW Program including the mitigation monitoring and evaluation component. Once registered by the System Administrator, AWW Viewers are emailed a username and password automatically from the AWW website (email will be sent from info@albertawildlifewatch.ca). This allows AWW Viewers to have view-only access of the Alberta Wildlife Watch website tool. AWW Viewer accounts are deactivated by Regional Administrators upon an agreed upon completion date.

2.1 Principal Contributors

Principal Contributors currently include Highway Maintenance Contractors and relevant Government of Alberta staff, and have work place safety plans addressing the safe use of smartphones. Their primary responsibility is to collect accurate and consistent animal carcass and live sighting data using the AWW application, both before and after mitigation.

2.2 Project Users

Project Users are Alberta Transportation's project-specific consultants. Project Users have primarily view-only access to the AWW website tool to analyze mitigation monitoring and evaluations and incorporate into their project work reports. To facilitate project-specific work, Project Users are able to download the AWW database and mitigation monitoring data for all traffic control segments that fall within their project limits. They may then evaluate mitigation performance within, or adjacent to their project, and upload associated documents to the AWW Mitigation Data Repository (Appendix C).

Once registered by the System Administrator, Project Users are emailed a username and password automatically from the AWW website (email will be sent from info@albertawildlifewatch.ca). Project User accounts are deactivated by Regional Administrators upon project completion.

2.3 Regional Administrators

Regional Administrators' play a primary role within the AWW System. They have the ability to collect live sighting and carcass data using the AWW application; however, Regional Administrators' primary responsibility, as it relates to Appendix D, is to evaluate the performance of mitigations within their contracted Region(s), report mitigation evaluations, and upload associated documents to the Mitigation Data Repository (Appendix C). The Regional Administrators take the summary of this work and include it in the Annual Regional Report.

2.4 System Administrators

System Administrators are responsible for the overall management of the AWW Program and its users, including the AWW website tool. This role includes access to all AWW mitigation monitoring data, evaluations, and associated reports and is restricted to Alberta Transportation staff. Responsibilities include assigning and managing AWW System users and overseeing the overall mitigation monitoring and performance evaluations. Registration of all AWW System users are completed through the AWW website *Administration* tab.

3.0 COLLECTING DATA (MONITORING)

Principal Contributors are responsible for collecting accurate and reliable animal carcass data across the provincial highway network using the AWW application, as outlined in Appendix A. Data collection by Principal Contributors will continue into the future, with no anticipated end date. As a result, animal carcass data will be collected before (i.e., pre-) and after (i.e., post-) mitigation. The AWW System takes advantage of the pre- and post-mitigation data to monitor the effectiveness of AVC mitigation projects. This approach resolves historical concerns with Alberta's pre-mitigation data quality and quantity (Appendix A).

A minimum of three years of pre- and post-mitigation data is required under the AWW Program. AVC's can vary naturally in time and space as animal populations and distributions, traffic volumes, and the surrounding landscapes change. The minimum data requirements collect a baseline of these natural fluctuations.

The AWW application collects both pre- and post- mitigation animal carcass records. Once AVC mitigation is applied, post-mitigation animal carcass data is collected by simply continuing to use the AWW application. Post-mitigation data is then evaluated on a project specific basis (i.e., projects in the AWW Mitigation Data Repository; refer to Appendix C). This uncomplicated, cost-effective monitoring approach is fundamental to understanding if AVCs reductions were realized by the mitigation applied. It allows direct comparisons between the pre- and post- mitigation data, and therefore, provides a robust design to effectively evaluate mitigation performance.

4.0 EVALUATING AND REPORTING MITIGATION PERFORMANCE

With the improved data available through the Alberta Wildlife Watch application it is worthwhile for Alberta Transportation to evaluate and report if mitigation projects are performing effectively and reducing AVCs. Evaluating and reporting mitigation performance allows Alberta Transportation to develop suitable and cost-effective mitigations that are known to reduce AVCs. Therefore, aiding Alberta Transportation's decision-making process and improving driver safety.

The AWW System's evaluation process includes a set of evaluation criteria with which to measure performance. This evaluation criteria provides a consistent approach to evaluate a mitigation project. Evaluating and reporting consistently over time, it also supports a relative comparison between mitigation projects and methods across Alberta. The mitigation methods being proposed are clear, automated to the extent possible, and measurable within a specified period of time.

Evaluation criteria will be reviewed and finalized once provincial AVC mitigation considerations are developed (Appendix G) and a minimum of three years of AWW data is collected across the province. This includes mitigation performance requirements to support both traffic safety and wildlife conservation mitigation performance criteria have been developed and will be continently assessed for suitability.

The mitigation performance criteria compare pre- and post-mitigation results, to a reference (i.e., province or an unmitigated section of the same highway). Both methods follow the principals of a robust Before-After-Control-Impact analysis (BACI)[3]. Using the BACI principals, Alberta Transportation will consider mitigation effective if one of the following is met:

1. The animal carcass cluster strength[4] at a mitigation structure is reduced from pre-mitigation levels for an equivalent period of time (i.e., three years pre- and post-mitigation data, each).

2. The animal carcasses density[4] reported in mitigated zone (e.g., 1 km) is reduced, maintained, or grows at a slower rate than the provincial average.

3. The animal carcasses density reported in a mitigated zone (e.g., 1 km) is reduced, maintained, or grew at a slower rate than a comparable un-mitigated zone along the same highway.

The AWW mitigation performance criteria provide a consistent level of expectations for all AVC mitigations across the province. A minimum of three years of pre- and post-mitigation data is suggested to begin evaluating a mitigation's performance. However, further consideration for when post-mitigation data begins to be evaluated is required. For instance, animals may require additional time post-mitigation to become accustomed to the mitigation. In this case, a mitigation may be erroneously evaluated as unsuccessful if evaluation begins before animals are accustomed to the mitigation. These will be considered for the final performance criteria.

Results from the mitigation performance evaluations are reported annually in AVC Mitigation Project Evaluation Reports.

4.1 AVC Mitigation Project Evaluation Report

A key strength of the AWW System is it allows Alberta Transportation to continue to learn from past projects and inform mitigation practices into the future. Lessons learned from the Mitigation Project Evaluation Reports are identified in the annual Regional and Provincial Reports (Appendix E), and directly influence modifications, if required, to the AWW Mitigation Toolbox.

An AVC Mitigation Project Evaluation Report will be prepared upon completion of each mitigation project (i.e., once post-mitigation data collection is complete). Using the AWW performance criteria outlined herein, this report provides evidence if a mitigation project is performing effectively.

The report is restricted to two pages length to provide a concise document that emphasizes mitigation performance. The report is supported by summary graphs, tables, and figures as appropriate.

Components of the standard template will include, but not limited to:

1. Mitigation project summary (i.e., mitigation project identification number, mitigation type(s), construction start and end dates, location, and target species including Species at Risk);

2. Pre- and post-mitigation animal carcass and AVCPL data;

3. Performance criteria applied;

[3] Roedenbeck, I.A., L. Fahrig, C.S. Findlay, J.E. Houlahan, J.A.G. Jaeger, N. Klar, S. Kramer-Schadt, and E.A. Van der Grift. 2007. The Rauischholzhausen agenda for road ecology. Ecology and Society, 12(1):11. [online] URL: http://www.ecologyandsociety.org/vol12/iss1/art11/

[4] Descriptions of animal carcass cluster analysis strength and animal carcass densities are provided in Appendix B *Data & User Management and Analysis*.

4. Performance evaluation results; and

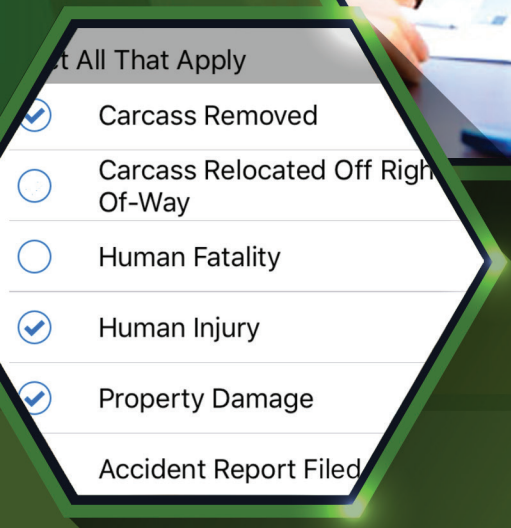
5. Determination of Effectiveness.

Upon completion, the AVC Mitigation Project Evaluation Report is entered into the AWW Mitigation Data Repository. This report is also later summarized as part of the annual Regional and Provincial Reports (Appendix E).

5.0 PREVIEW: ANNUAL REGIONAL AND PROVINCIAL REPORTING

AVCs are reduced and driver safety improved by designing mitigations that perform well across Alberta. The ability to monitor and evaluate Alberta Transportation's mitigation performance is a strength of the AWW System. This helps Alberta Transportation make well-informed, cost-effective, AVC mitigation decisions.

AWW Program reporting, including mitigation monitoring and evaluation results is the most effective method to disseminate information within Alberta Transportation, stakeholders, and project/regional consultants. In addition, reporting of the AWW animal carcass and mitigation performance results demonstrates to stakeholders the actions taken to improve highway safety. This also enhances public education and awareness of AVC's across the province. The AWW Program's annual Regional and Provincial reporting requirements are outlined in Appendix E.



Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX E

ANNUAL REGIONAL AND PROVINCIAL REPORTING

AUGUST 2017

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Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
OTS	Office of Traffic Safety
WSSR	Wildlife Site Sensitivity Rating

DEFINITIONS

Term	Definition
AWW Dashboard	AWW Program tool to monitor and report AWW data as a snapshot in time. The AWW Dashboard includes clear and concise graphics at the provincial and regional scales to provide an efficient Program checkup.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Mitigation Data Repository	Map and document storage of AVC mitigations across the provincial highway network.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);

2. Provide high-quality data for effective decision making;

3. Develop departmental policy & standards; and

4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

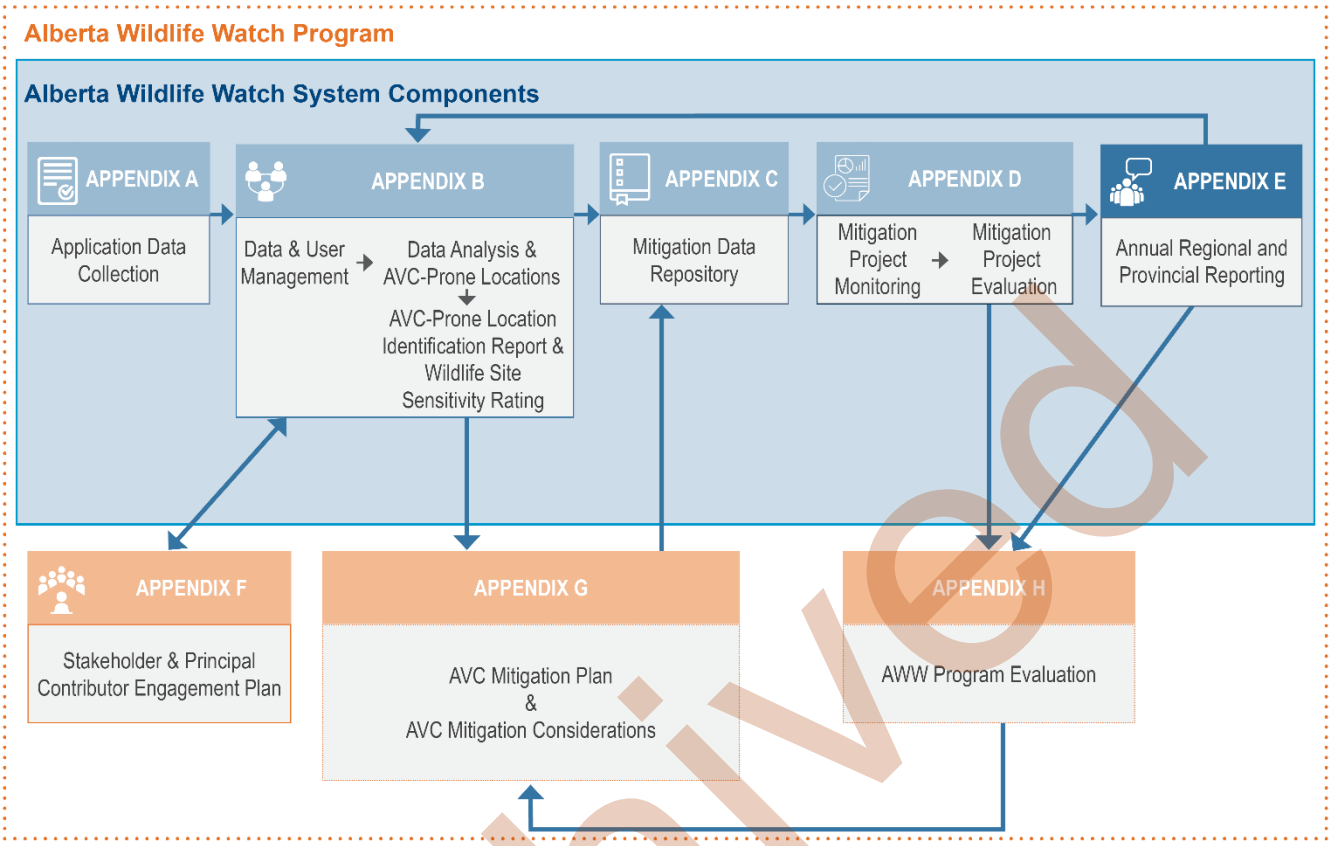

Figure 1: Alberta Wildlife Watch Program Structure

Appendix E: Annual Regional and Provincial Reporting

1.0 INTRODUCTION

The Alberta Wildlife Watch (AWW) Program collects a large amount of animal carcass data, analyzes and evaluates animal-vehicle collision prone locations (AVCPLs), and monitors mitigation performance. Reporting is the most effective method to disseminate important information to advance decision making, share information, and further action.

The AWW System expedites reporting and information sharing by automatically generating key reports using standardized templates. These reports build off the AWW Dashboard (refer to Appendix B) that automatically generates clear and concise Program reporting. The AWW standard report templates and information guidelines maintains readability and clearly conveys regional and provincial information important for decision making. This allows the AWW Program to provide consistency and transparency of the decision-making process, and allows comparison between years, AVCPLs, and mitigation projects.

Annual reports are prepared at both the regional and provincial levels by Alberta Transportation.

2.0 USER ROLES AND RESPONSIBILITIES

The AWW Program collects and disseminates AVCPL information to prioritize, justify, plan, and evaluate mitigation across the province. AWW reports are prepared and utilized by key users, depending on their program authority and responsibilities. **System Administrators**, Alberta Transportation's Regions and Environmental Services Section, will work together to generate annual Regional and Provincial reporting and to disseminate these reports for approval.

Table 1: User Responsibilities for Regional and Provincial Reporting

User	Access Permission(s)	Regional and Provincial Reporting Responsibilities	
		Prepare Regional Reports	Prepare Provincial Reports and Disseminate Information
1. Project User	Website Tool	✓ (specified component(s))	
2. Regional Administrator	Application & Website Tools	✓ (specified component(s))	
3. System Administrators	Application & Website Tools	✓ (interim)	✓

2.1 Principal Contributors and AWW Viewers

Principal Contributors are AWW application users, primarily including Highway Maintenance Contractors. Their primary responsibility is to collect accurate and consistent animal carcass and live sighting data using the AWW application, both before and after mitigation (refer to Appendices A and D). They, along with **AWW Viewers,** have no designated report preparation responsibilities.

2.2 Regional Administrators and Project Users

Regional Administrators and **Project Users** may be responsible for contributing to the Annual Regional Reports. Regional Administrators and Project Users are selected by Alberta Transportation for regional and project-specific consulting assignments, respectively. They may have the responsibility to identify and complete the Wildlife Site Sensitivity Rating (WSSR) as part of their assignments (refer to Appendix G). When complete, these users submit the WSSRs through the AWW website. These reports are then available for the development of the Annual Regional Reports.

2.3 System Administrators

The **System Administrator** from Alberta Transportation's Environmental Services Section is responsible for working with the Regions to prepare and circulate annual Regional and Provincial Reports. Once complete, the annual Provincial Report will be submitted to the Executive Director, Technical Services Branch, for consideration and presentation to the Executive Team.

3.0 AWW ANNUAL REPORTS

AWW annual reports provide an overview of the AWW Program, as well as identify and prioritize AVCPLs for mitigation. These AWW annual reports are the foundation for action. Two separate report types are prepared annually:

1. Regional Reports; and
2. Provincial Report.

These reports provide regional and provincial snapshots of the AWW Program outputs and identifies priority locations for mitigation. Regional Reports present information specific to each Region, whereas, the Provincial Report also offers options and recommendations to support corporate- level decision making.

The content of these annual AWW reports will be standardized to the extent possible. This provides a clear and consistent message and allows for a standardized decision-making framework. This provides Alberta Transportation the ability to track Program progress into the future.

3.1 Annual Regional Report

A Regional Report is prepared for each of the five Regions annually and presented to Alberta Transportation's Regional Directors. This report provides a snapshot of the current state of AVCs within each Region and identifies priority AVCPLs where mitigation may be required. Content is compiled from the AWW System's website tool (particularly the AWW Dashboard and AVCPL analyses; refer to Appendix B) and Alberta Transportation's Office of Traffic Safety (OTS).

The report is restricted to four pages length to provide a concise document that showcases the most critical information. The report is supported by summary graphs, tables, and figures as appropriate. All statistically significant AVCPLs identified within the Region along with any individual Wildlife Site Sensitivity Ratings (Appendix B) will be provided as an appendix to this report. A final prioritized list of all AVCPLs within the Region that have passed the WSSR will be provided.

Components of the standard template will include:

1. Purpose: this is the opening statement that presents the purpose of the Regional Report to focus the reader's expectations.

2. Background: this section provides an overview of the road conditions. Background key information details include:

    a. Provincial animal carcass rate and density for 2 lane low traffic volume, 2 lane high traffic volume, and 4 lane divided roads; and

    b. The Regions total vehicle kilometers travelled.

3. Current Condition: this section specifies the AWW System's AVC and AVCPL data analyses, at a regional scale, to frame mitigation decision making. Key information details include:

    a. Total number of animal carcass records in the Region including Species at Risk and large-bodied animals (i.e., trends (up or down over a five year period));

    b. Total number and kilometres of AVCPL clusters in the Region (i.e., trends over a five year period);

    c. Total number of 1 km highway segments with the highest animal carcass densities (≥5 animal carcasses/km/year; refer to Appendix B for details);

    d. Highways with the highest number of large-bodied and Species at Risk AVCPLs; and

    e. Number of and total kilometres of AVCPL clusters and high density segments that are inside designated wildlife linkage zones in the Region.

4. Principal Contributor Engagement: Principle Contributor key error rates (refer to Appendix B), engagement and training completed (e.g., poster submissions to Principal Contributors, discussion log for troubleshooting), and opportunities for possible improvement.

5. Key Considerations: this section provides a summary of key considerations for mitigation development, and specifically outlines:

    a. Final prioritized list of all large-bodied and Species at Risk AVCPLs (e.g., strongest and most stable statistically significant animal carcass clusters that have passed the WSSR; refer to Appendix B) for mitigation within the Region. Statistically significant clusters and associated WSSRs are provided as an appendix;

    b. Target species for mitigation (based on large-bodied and terrestrial Species at Risk sufficiently reported in the animal carcass cluster and or high density segment); and

    c. Any known factors affecting AVCs in the region.

6. Mitigation Monitoring: this section summarizes the number of AVC mitigations developed in the last five years, performance of mitigation projects in the Region (i.e., AVC Mitigation Project Evaluation Reports (Appendix D)), and recommends mitigation improvements, if warranted.

3.2 Annual Provincial Report

The Provincial AWW AVC Report is a broad summary appropriate for the Minister, Deputy Minister, and Assistant Deputy Minister level review. This report provides a snapshot of the current state of AVC and AVCPLs across the province and includes a prioritized list of AVCPLs that are candidates for mitigation projects. Content is compiled from the Regional Reports (refer to Section 3.1), associated WSSRs (refer to Appendix B), and from AWW Program users. In addition, this report also summarizes the priority projects presented by Alberta Environment and Parks.

The report is restricted to four pages length to provide a concise document that showcases the most critical information. Components of the standard template will include:

1. Purpose: this is the opening statement that presents the purpose of the Provincial Overview to focus the Minister, Deputy Minister, and Assistant Deputy Minister's expectations.

2. Background: this section provides a summary from each of the five Regional Reports. Key information includes each Region's priority AVCPLs where mitigation is considered feasible.

3. Current Condition: this section specifies the AWW System's and AVC and AVCPL data analyses, at a provincial scale, to frame mitigation decision making. Key information details include:

    a. Total number of AVC-related human injuries and fatalities (information provided from the OTS);

    b. AVC estimated annual cost to society (i.e., trends (up or down) over a five year period);

    c. Total number of animal carcasses records in the province (i.e., trends over a five year period);

    d. Total number of Species at Risk animal carcass records in the province (i.e., trends over a five year period);

    e. Provincially prioritized list of AVCPLs that have passed the WSSR, including total number and kilometers of priority AVCPL clusters in the province (i.e., trends over a five year period), and highways with the highest number of priority AVCPLs;

    f. Total number of 1 km highway segments with the highest animal carcass densities (>5 animal carcasses/km/year) in the province;

    g. Number of and total kilometres of priority AVCPL clusters and high density segments that are inside designated wildlife linkage zones in the province; and

    h. Provincially prioritized list of projects from AEP that have passed the WSSR.

4. AVC Mitigation and Evaluations: summary of AVC mitigations in operation and construction, mitigation performance results from individual mitigation projects (i.e., complied from AVC Mitigation Project Evaluation Report(s); Appendix D), and the provincial mitigation review (i.e., compiled from the Provincial Mitigation Review Report; Appendix H).

5. Key Consideration: this section outlines any opportunities to increase efficiencies with well-coordinated mitigation projects (i.e., plan two nearby mitigation projects simultaneously) and or mitigation at a specific AVCPL that would yield highest return (e.g., an AVCPL that is easily mitigated).

6. Stakeholder and Principal Contributor Engagement: summary of engagement records and opportunities for possible AWW Program improvement.

7. AWW Program Evaluation and Updates: a summary of the annual AWW Program Review (refer to Appendix H) to highlight long term performance of the AWW Program at a provincial scale and recommendations to date.

8. Next Steps: this section provides recommendations for feasible AVCPL mitigation projects to advance into the planning and design stage (Appendix G), as well as approvals for AWW Program improvements.

4.0 PREVIEW: STAKEHOLDER AND PRINCIPAL CONTRIBUTOR ENGAGEMENT PLAN

The AWW Program collects high-quality data and identifies AVCPLs for mitigation consideration. Reporting is the most effective method to disseminate the information, including priority AVCPLs that may require mitigation consideration. Reporting advances mitigation decision making, as well as a method to share information with and document recommendations from Alberta Transportation's stakeholders and Principal Contributors.

Reporting supports stakeholder and Principal Contributor engagement and maintains a transparent decision-making process, which are addressed in Appendix F.

Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX F
STAKEHOLDER & PRINCIPAL CONTRIBUTOR ENGAGEMENT PLAN

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location
HMC	Highway Maintenance Contractor
Org. ID	Organization Identification Code
TSD	Transportation Services Division

DEFINITIONS

Term	Definition
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);

2. Provide high-quality data for effective decision making;

3. Develop departmental policy & standards; and

4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

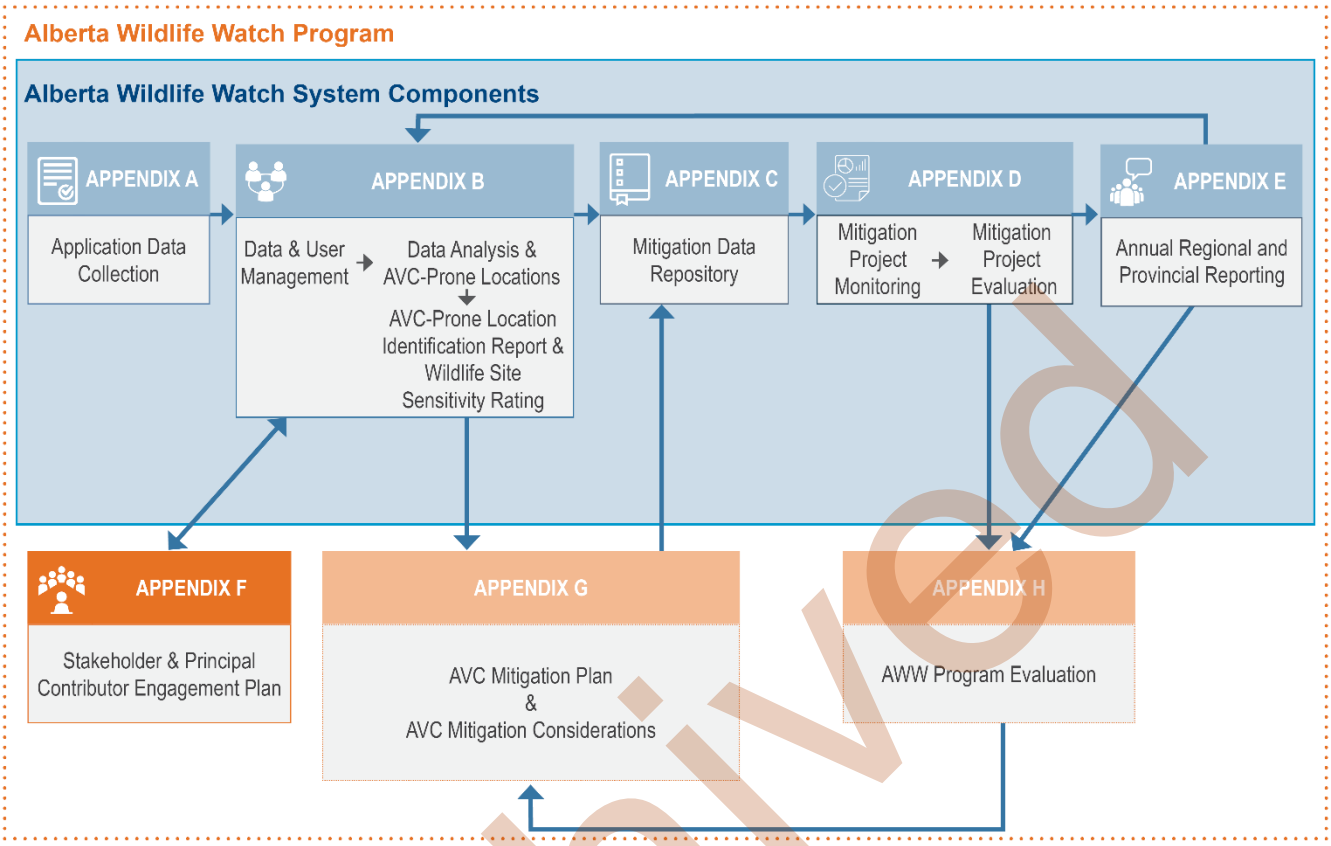

Figure 1: Alberta Wildlife Watch Program Structure

Appendix F: Stakeholder & Principal Contributor Engagement Plan

1.0 INTRODUCTION

Success of the Alberta Wildlife Watch (AWW) Program is dependent upon the consideration of stakeholder insights and the collection of high quality animal carcass and live sighting data collected by Principal Contributors. These support on-going improvements to the AWW Program and maintain high quality standards.

The AWW Stakeholder and Principal Contributor Engagement Plan outlines the process to engage with and maintain stakeholder and Principal Contributor engagement. Alberta Transportation values five basic concepts to engage with stakeholders and Principal Contributors: 1) regular communication, 2) clear roles and responsibilities, 3) open dialogue with parties, 4) reliable sharing of data applicable to their area of interest, and 5) update engagement/training materials as needed. These basic concepts are integrated into Alberta Transportation's Stakeholder and Principal Contributor Engagement Plan (Engagement Plan) and associated Principal Contributor training materials.

2.0 USER ROLES AND RESPONSIBILITIES

Of the various AWW System users, **System Administrators** have the primary responsibility under the Stakeholder and Principal Contributor Engagement Plan (Table 1). **Regional Administrators** play a fundamental role engaging and training Principal Contributors. **Principal Contributors** have a responsibility to participate in and understand the training materials and operate the AWW application safely.

Table 1: User Responsibilities for the Stakeholder & Principal Contributor Engagement Plan

User	Access Permission(s)	Stakeholder & Principal Contributor Engagement Plan Responsibilities		
		Communicate Regularly	Provide/Participate in Engagement	Share Data/Update Plan
1. Principal Contributors	Website Tool	✓	✓	
2. Regional Administrators	Application & Website Tools	✓	✓	✓
3. System Administrators	Website Tool	✓	✓	✓

AWW Viewers and Project Users have no designated responsibilities under the Engagement Plan. These are AWW website tool users with primarily view-only access. These include specific Alberta Transportation stakeholders, partners, and project-specific consultants. AWW Viewers have no responsibilities under the whole AWW Program; however, Project Users incorporate AWW data into their project-specific work (refer to Appendices B, D, and E).

2.1 Principal Contributors

Principal Contributors currently include HMCs and relevant Government of Alberta staff. Under the AWW Program, their primary responsibility is to collect accurate and consistent animal carcass and live sighting data using the AWW application, to participate in engagement and training, and operate the AWW application safely.

The System Administrator adds new Principal Contributors into the AWW website and provides the Principal Contributors with their unique Organization Identification (Org. ID) code. An Org. ID is usable for all Principal Contributors within that organization (i.e., Alberta Transportation), and is associated with and credits each wildlife record in the database.

2.2 Regional Administrators

Regional Administrators are selected by Alberta Transportation for regional consulting assignments. Individual Regional Administrators gain access to the AWW application using an Org. ID code and the website using an assigned username and password system. Both the Org. ID code and the user name and password are assigned by the System Administrator.

Regional Administrators' have the ability to collect live sighting and carcass data using the AWW application. However, Regional Administrators will regularly communicate with Principal Contributors within their contract Region and execute the training and engagement plan using the materials developed by the System Administrator. Their focus is to summarize and share AWW data collected within their Regions to the Principal Contributors and suggest opportunities to update the Engagement Plan to the System Administrator.

2.3 System Administrators

System Administrators are responsible for the overall management of the AWW Program and its users, including the AWW Stakeholder and Principal Contributor Engagement Plan. This role includes access to all AWW data and user management systems and is restricted to Alberta Transportation staff. As it relates to the Engagement Plan the System Administrator is responsible for the development of the plan including any required engagement tools (i.e. AWW engagement video), engagement with stakeholders, maintenance of the stakeholder engagement record, and updates/maintenance to the Engagement Plan and or AWW Program.

Additional responsibilities include assigning and managing AWW System users, and registration of all AWW System users through the AWW website *Administration* tab.

3.0 PRINCIPAL CONTRIBUTOR ENGAGEMENT AND TRAINING MATERIALS

Data quality is contingent upon the cooperation from Principal Contributors using the AWW application across the province. Data quality is supported by engaging with and providing multiple training options and tools to the Principal Contributors.

3.1 Communication

The deployment of the AWW application is launched to Principal Contributors by the System Administrator. This initial launch includes an introduction to the AWW application, its goals, and user responsibilities. Regular follow-up telephone calls and in-person informal meetings occur, at a minimum, annually to discuss application use, suggested upgrades, and respond to any questions relating to the application and or the AWW Program.

Additional informal meetings (in-person and or telephone) may evolve into bi-annual engagement sessions to maintain the working relationship and encourage consistent data collection.

3.2 Data Sharing

To encourage Principal Contributors continued cooperation and reinforce the benefit of data collection, the AWW website tool automatically customizes a poster for each Contract Maintenance Area (CMA) (total of 32 unique posters available by January 1 each year). Customized posters are scheduled for delivery once the minimum number of years of data have been collected (i.e., three years, expected in 2020).

This engagement poster provides a summary of the last three years of AWW data collected within each area, and includes 1) a map, 2) photos, and 3) summary graphs and tables. The posters are in a professional design template and are print quality appropriate for wall mounting.

Program support will come from both Environmental Services Section and the Regional Environmental Coordinators. Each Regional Administrator is responsible for printing and distributing the poster for their contract area annually. Previous years posters are archived within the AWW website and available to the public for download.

3.3 Engagement Materials

Engagement material is developed to provide explicit rationale and benefits to both parties. The AWW Program's engagement material provides clear instructions, rationale for the AWW Program, and the AWW Program's benefits to various parties.

Alberta Transportation developed a short (five minute) video as the primary engagement approach. This video was developed to introduce AWW to Principal Contributors, including the:

- primary goals of the AWW Program;
- benefits to both society and Principal Contributors; and
- how Alberta Transportation uses the data collected by Principal Contributors to reduce AVCs and improve motorists' safety.

Alberta Transportation's engagement video is available at: https://youtu.be/zBknpdganB8.

3.4 Training Materials

To further support and provide training to Principal Contributors, Alberta Transportation has developed additional tools. Training materials range from detailed user manuals to simple highlights of key operating practices. These straightforward materials are provided with screenshots of the application to visually display content and instructions.

Training materials include:

1. Detailed AWW Smartphone Application User Guide: this guide details the AWW application setup, operation, and troubleshooting. It is provided to Principal Contributors in hard copy, is available online (http://www.transportation.alberta.ca/6020.htm), and on the AWW application (Wi-Fi connection required). The online guide is provided to Principal Contributors at launch, and the hard copy is later mailed as follow-up engagement.

2. Wall poster: the wall poster provides quick tips to operate the AWW application including their unique Organization Identification code. This quick-tips, poster, guide is provided in hard copy after launch as follow-up engagement. It is also available online at http://www.transportation.alberta.ca/Content/docType29/Production/AWW_App_Guide_Poster.pdf.

3. AWW Wildlife Identification Guide: clearly describes and highlights key wildlife species identification attributes for easy field verification. Species range maps are also provided to improve positive identification of the animal. The AWW Wildlife Identification Guide is available in hard copy, online (http://www.transportation.alberta.ca/Content/docType253/Production/AWWWildlifeGuide.pdf), and on the application. The hard copy guide is mailed to Principal Contributors after launch as follow-up engagement.

4. Engagement Cards: engagement cards are quick AWW application operating tips available on a keychain, appropriate to put in each vehicle. These are provided after launch as part of ongoing engagement and training.

5. Government of Alberta HelpDesk Contact: the HelpDesk contact is provided at launch of the AWW application. The HelpDesk contact is also provided in the detailed User Guide, wall poster, and engagement cards.

4.0 STAKEHOLDER ENGAGEMENT

Alberta Transportation realizes the importance of stakeholder collaboration to ensure that the AWW Program considers all aspects of animal-vehicle collisions. Input gathered from these discussions is used as the basis of continual improvement to the AWW Program. Stakeholders include federal and provincial ministries, as well as non-governmental organizations that have a direct interest in protecting wildlife from vehicle collisions.

Engaging stakeholders in dialogue will allow Alberta Transportation to understand the issues that matter most to them and to consider these during decision making. These discussions will be focused to the AWW Program and any concerns raised with respect to site-specific AVCPLs will be directed to the relevant Region with Alberta Transportation for attention. The System Administrator will maintain an annual list of stakeholder engagements as well as any improvements to the AWW Program resulting from these discussions.

5.0 PREVIEW: MITIGATION PLANNING AND DESIGN

Well informed mitigation decisions arise from accurate data and analysis, and structured planning and design. The AWW Program includes a formalized AVC mitigation planning and design approach to simplify decision making and to ensure mitigation projects are cost effective and reduce AVCs.

The AWW Program acts as a clearing-house of standard AVC mitigation considerations, as they are developed, to facilitate mitigation planning and design. The AWW Program's clearing-house will be a living resource with standards being added and updated, as prepared, and innovations advance. The AWW Program's AVC mitigation planning and design components are outlined in Appendix G.

Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX G

MITIGATION PLANNING AND DESIGN

AUGUST 2017

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Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-vehicle Collision
AVCPL	Animal-vehicle Collision Prone Location
GoA	Government of Alberta
Org. ID	Organization Identification
TOR	Terms of Reference
WSSR	Wildlife Site Sensitivity Rating

DEFINITIONS

Term	Definition
AWW Mitigation Toolbox	Alberta Transportation's guidebook of AVC mitigation technologies and structures.
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);

2. Provide high-quality data for effective decision making;

3. Develop departmental policy & standards; and

4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.

[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

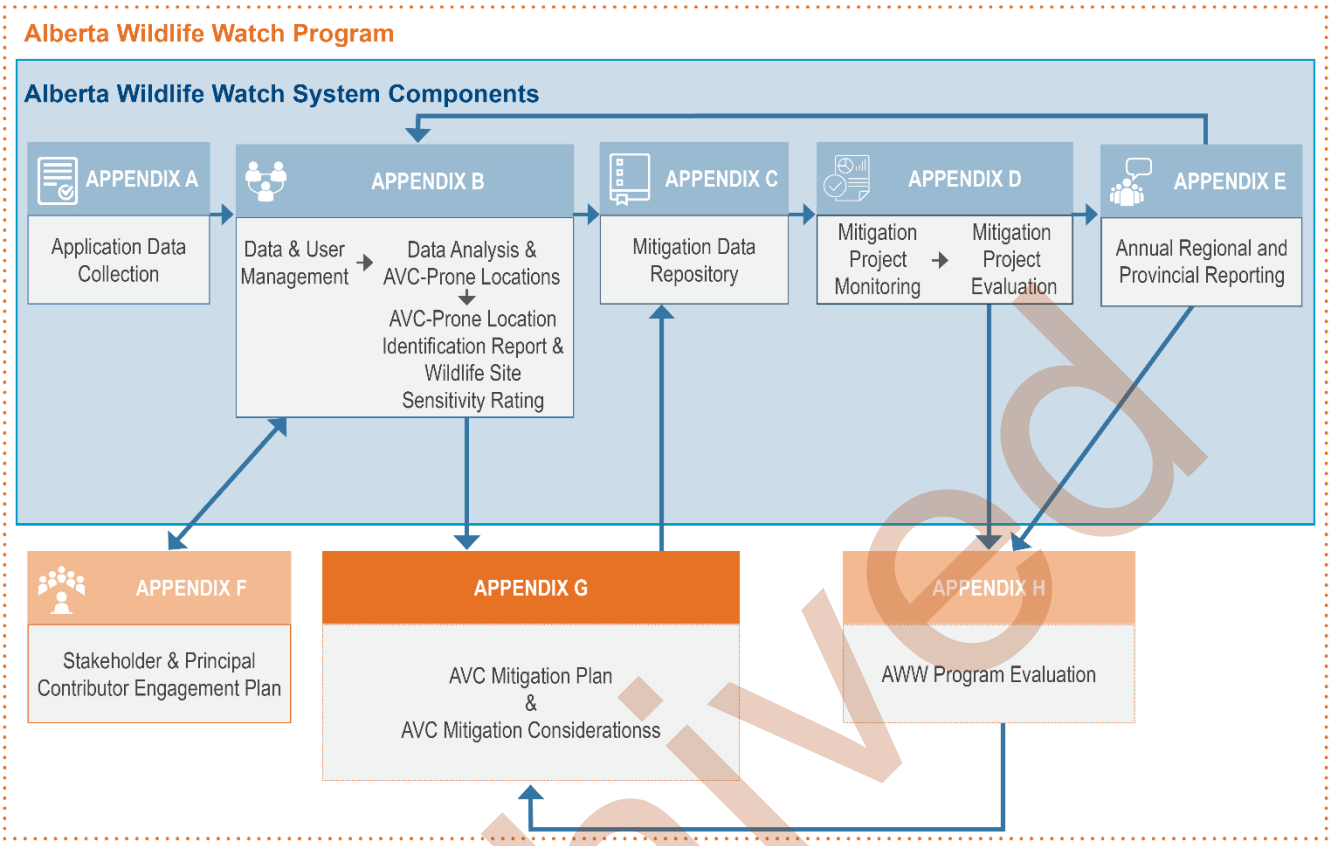

Figure 1: Alberta Wildlife Watch Program Structure

Appendix G: Mitigation Planning and Design

1.0 INTRODUCTION

Alberta Transportation works to ensure that the transportation system enables Alberta's economic, social, and environmental vitality. The Alberta Wildlife Watch (AWW) Program is one of Alberta Transportation's many approaches to meet their mandate.

AWW improves motorists' safety on provincial highways by identifying animal-vehicle collision (AVC)-prone locations (AVCPLs) and supporting mitigation using best and innovative technologies. Mitigation is planned and designed using an AVC Mitigation Plan and following standard mitigation design considerations. These provide a reliable and cost-effective approach for the province to support decision making.

AVC mitigation planning is initiated once a priority AVCPL is identified and determined to be feasible (i.e., technically and financially; Appendix B). AVCPLs that are considered technically and financially feasible in the Wildlife Site Sensitivity Rating (WSSR; Appendix B) are presented in a prioritized list, and once approved by Alberta Transportation's Executive Team, progress to a mitigation project design and tender stage in conformance to a Terms of Reference (TOR). In the TOR's detailed planning and design stage mitigation options are identified, evaluated, and designed. Standardized mitigation designs, provided by Alberta Transportation, ensures Alberta Transportation's mitigation design considerations are incorporated in the planning and design process.

This formalized approach provides consistency with each AVC mitigation project to ensure cost-effective mitigations are developed that result in AVCs reductions.

2.0 USER ROLES AND RESPONSIBILITIES

System Administrators have primary responsibility to develop the AWW planning and design standard documents (Table 1). Once developed, **Regional Administrators** and **Project Users** have the responsibility to incorporate into their project work (Table 1).

Table 1: User Responsibilities for Mitigation Planning and Design

User	Access Permission(s)	Mitigation Planning and Design Responsibilities		
		Develop/Update Mitigation Documents	Provide Access to Mitigation Documents	Incorporate into Project Work
1. Project User	Website Tool			✓
2. Regional Administrators	Application & Website Tools			✓
3. System Administrators	Website Tool	✓	✓	✓

Two additional AWW System users, **AWW Viewers and Principal Contributors**, have no designated responsibilities under mitigation planning and design. These users include specific Alberta Transportation stakeholders, partners, and Highway Maintenance Contractors (HMCs) with no to limited access to the AWW website tool.

2.1 Project User

Project Users are Alberta Transportation's project-specific consultants. With primarily view-only access to the AWW website tool, this user is able to view annual reports, access the raw database, and carry out additional analyses to incorporate into their own project reporting (i.e., Environmental Evaluations and AVCPL Identification Report). Using the mitigation planning and design tools, they may then incorporate appropriate AVC mitigation within, or adjacent to their project. Project Users are responsible for the preparation of select mitigation planning and design reports (i.e., Wildlife Site Sensitivity Rating Report, AVC Mitigation Plan) appropriate within or adjacent to their project. They are also able to upload their own mitigation project reports into the AWW website tool.

Once registered by the System Administrator, Project Users are emailed a username and password automatically from the AWW website (email will be sent from info@albertawildlifewatch.ca). Project User accounts can be deactivated by Regional Administrators.

2.2 Regional Administrators

Regional Administrators are selected by Alberta Transportation for regional consulting assignments. Individual Regional Administrators gain access to the AWW application using an Organization Identification (Org. ID) code and the website tool using an assigned username and password system. Both the Org. ID code and the user name and password are assigned by the System Administrator.

Like Project Users, Regional Administrators' have a primary responsibility to use the AWW Program's mitigation planning and design tools, and have access to the AWW reports, raw database, and ability to carry out additional analyses to incorporate into their own project reporting.

Once registered by the System Administrator, Regional Administrators are emailed a username and password automatically from the AWW website (email sent from info@albertawildlifewatch.ca).

2.3 System Administrators

System Administrators are responsible for the overall management and development of the AWW Program and its users, including mitigation planning and design components. Registration of all AWW System users are completed through the AWW website *Administration* tab. This role includes full access to all AWW Program components, including the AWW website tool, and is restricted to Alberta Transportation staff. Responsibilities include assigning and managing AWW System users, and developing, storing, and updating the AVC mitigation planning and design components.

3.0 DESIGN AND TENDER MITIGATION PROJECTS

Alberta Transportation's approach to planning and designing AVC mitigation projects is straightforward and transparent. Alberta Transportation has developed The Environmental Evaluation TOR which also addresses AVC mitigation projects. This TOR provides a standard to plan, evaluate, design, build, and monitor a feasible mitigation project at a priority AVCPL.

The TOR is available on the Environmental Services at the following link:

http://www.transportation.alberta.ca/6003.htm

The AWW Program's AVC Mitigation Design and Tender approach includes an AVC Mitigation Plan and associated AWW Mitigation Toolbox. Together these assists in the development of mitigation project planning and design, and directly influence the types of AVC mitigations developed across the province. In return, the performance of mitigation projects (refer to Appendix D) inform mitigation consideration updates. This feedback loop allows best-performing AVC mitigations to be developed across the province and supports a process to maintain current standards and specifications.

An example mitigation project process, including AWW Program's step-wise approach to planning and design and AWW user roles and responsibilities, is provided in Figure 2. Each step in this process is required to plan and design a mitigation project that is cost-effective and reduces AVCs in Alberta.

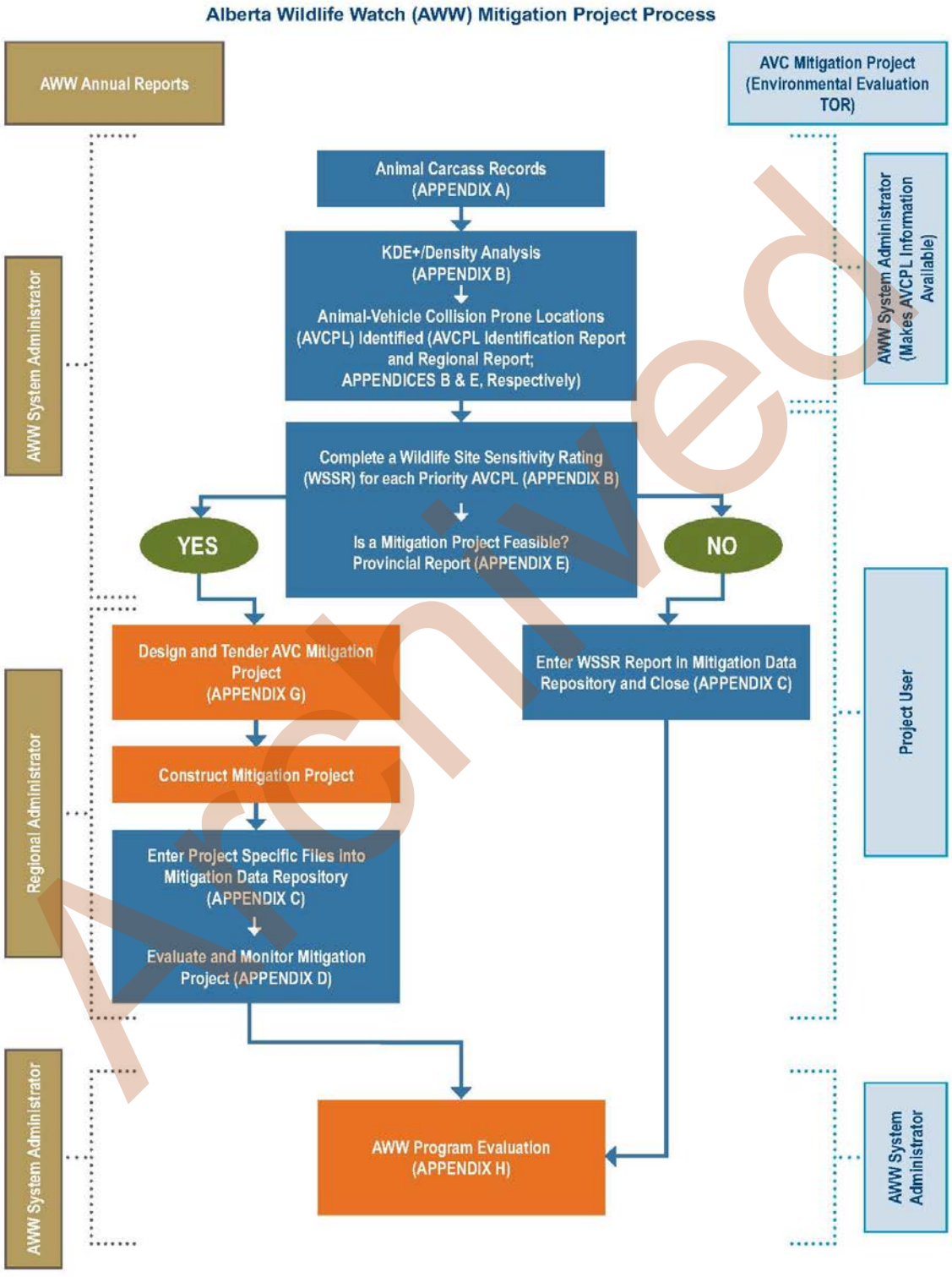

Figure 2: Example AVC Mitigation Project Process

3.1 AVC Mitigation Plan

Upon Alberta Transportation's approval of a mitigation project, the AVC Mitigation Plan is completed during the mitigation planning and design stage. This plan outlines available mitigation options and innovations with substantial likelihood of success at site-specific AVCPLs.

Each mitigation option considers the target species, seasonality of the collisions, cost-benefit, expected mitigation service life, and estimate of construction, maintenance, and replacement costs. Mitigation(s) presented in the AVC Mitigation Plan are selected from the AWW Mitigation Toolbox (Section 3.2) and follow Alberta Transportation's design standards. This allows Alberta Transportation to effectively select the most appropriate mitigation to best meet their traffic safety mandate.

The AVC Mitigation Plan also provides a summary of site-specific conditions using the AWW System data, existing reports (e.g., Wildlife Site Sensitivity Rating report), and the surrounding landscape (e.g., Key Wildlife and Biodiversity Zones (refer to Appendix B), Regional Land Use Plans) to provide best mitigation options.

3.2 AVC Mitigation Toolbox

A strength of the AWW Program is its ability to store provincial AVC mitigation planning and design considerations within the same system that collects, analyzes, prioritizes, inventories, evaluates, monitors, and reports AVC's across the province (Appendices A to F). Housing these documents within the AWW System ensures consultants have ready access to the most up-to-date information to support AVC mitigation project design goals. This also allows Alberta Transportation to learn from the mitigation performance evaluations and make ongoing improvements to mitigation designs.

The AWW Program provides AVC mitigation options to support the selection of effective mitigation. This expedites project planning and design and allows Alberta Transportation to cost-effectively plan and design mitigation known to perform well in the province therefore, aiding Alberta Transportation's decision-making process. These AVC mitigation options help to deliver Alberta Transportation's traffic safety goals while providing reasonable expectations for mitigation performance across Alberta.

An AVC Mitigation Toolbox, specific for Alberta, is incorporated as part of the AWW Program. This toolbox includes proven and AVC mitigation standards and is straightforward in design. It is a support tool and technical reference to help Alberta Transportation plan and design appropriate mitigation. It also provides pros and cons of each mitigation option, known performance efficiencies, and example cost-benefit thresholds appropriate for Alberta. The Mitigation Toolbox is a living resource and will be updated as mitigations are proven effective (or ineffective; refer to Appendix D) in Alberta. This allows Alberta Transportation to advance the provincial state of knowledge using contemporary AVC research.

The AVC Mitigation Toolbox avoids future work redundancies and helps detect mitigation information or knowledge gaps. AVC mitigations provided will be applicable to meet Alberta Transportation's mandate and categorized into the following:

1. Those that attempt to influence driver behaviour; and
2. Those that attempt to influence animal behaviour.

Table 2 provides some example AVC mitigations to be considered for the province. Table 2 is not a comprehensive list of all optional AVC mitigations applicable for the AWW Mitigation Toolbox nor a recommendation of use.

Associated mitigation design standards to be developed may include:

- Animal Detection System design considerations and best management practices;
- Brushing and mowing guidelines to reduce AVCs, road salt alternative guidelines;
- AVC speed zone reduction guidelines;
- Road salt alternatives guidelines;
- Wildlife exclusion design considerations; and
- Wildlife crossing structure design including overpasses, underpasses, and at-grade crossings.

Table 2: Example Animal-Vehicle Collision Mitigations

Existing Mitigation	Optional Mitigation Available
Mitigations that Influence Driver Behaviour	
Driver behaviour is influenced passively using education initiatives, signage, and warning systems.	
▪ Wildlife Vehicle Collision Awareness Week. Led by Alberta Environment and Parks; and ▪ Over-sized signage at AVCPLs.	▪ Driver safety programs (e.g., Wildlife Hazard Warning System, a warning sign coding system based on hazard level by Dr. Leonard Sielecki); ▪ Animal detection systems; and ▪ Speed reduction considerations.
Mitigations that Influence Animal Behaviour	
These mitigations influence wildlife movement and behaviour. They deter wildlife from approaching and/or crossing the highway (e.g., exclusion fencing) or directing wildlife to a safer location to cross (e.g., overpass).	
▪ Bridge design to accommodate wildlife underpass; and ▪ Wildlife exclusion fencing.	▪ Vegetation clearing and mowing at AVCPLs; ▪ Wildlife overpass/underpass; and ▪ Boulder aprons (e.g., rip-rap outside of clear zone to reduce risk to motorists).

4.0 PREVIEW: AWW PROGRAM EVALUATION

Collecting, storing, managing, and analyzing high-quality animal carcass and mitigation data are critical steps to reduce AVCs on provincial highways, improve driver safety, and reduce the impacts of highways on wildlife populations. AVCs are reduced and driver safety improved by designing mitigations that perform well across Alberta.

The ability to evaluate the long-term performance of the AWW Program at a provincial scale is a key strength. This helps Alberta Transportation ensure the mitigation projects developed help support the overall provincial objectives and goals and demonstrates to the public actions taken to improve provincial highway safety. The AWW Program's provincial evaluation approach is outlined in Appendix H.

Alberta

ALBERTA WILDLIFE WATCH PROGRAM

APPENDIX H

AWW PROGRAM EVALUATION

AUGUST 2017

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ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
AWW	Alberta Wildlife Watch
AVC	Animal-Vehicle Collision
AVCPL	Animal-Vehicle Collision Prone Location

DEFINITIONS

Term	Definition
AWW Program	The Program developed to identify and prioritize animal-vehicle collision prone locations, identify cost-effective mitigation, and to evaluate mitigation performance. The Program includes four components: 1) the AWW System, 2) Alberta Transportation's Mitigation Planning and Design Standards, 3) User Engagement Plan, and 4) Annual Review.
AWW System	Collects, manages, analyzes, and reports AWW data, identifies and prioritizes AVC mitigation locations, and evaluates mitigation performance.
AWW Viewer	Alberta Transportation's stakeholders and partners with view only access to the AWW website tool.
Principal Contributor	An AWW application user that has been identified as critical for the acquisition of animal carcass and live sighting data. Principal Contributors are Highway Maintenance Contractors and Government of Alberta staff.
Project User	Alberta Transportation's project-specific consultants with primarily view-only (restricted editor) access to the AWW website tool.
Regional Administrator	An AWW website tool manager for designated Region(s). Example Regional Administrators are those with an Alberta Transportation regional consulting assignment.
System Administrator	A supervisor for the AWW application and website tools. Limited to Alberta Transportation staff.

Alberta Wildlife Watch Program Overview

Animal-vehicle collisions (AVCs) are a significant problem in Alberta affecting motorist safety and wildlife populations. Alberta Transportation designed the Alberta Wildlife Watch (AWW) Program as a solution to reduce AVCs on provincial highways improve driver safety and minimize the impacts of highways on wildlife populations. The AWW Program and its goals are highlighted in a video available at https://youtu.be/zBknpdganB8.

AWW Program is designed to:

1. Identify AVC-prone locations (AVCPLs);

2. Provide high-quality data for effective decision making;

3. Develop departmental policy & standards; and

4. Allow for innovation and evaluate long term mitigation effectiveness.

High-quality data is collected using the AWW application[1]. Data analyses to identify and prioritize statistically significant AVCPLs are automatically performed on the AWW website tool[2]. Together, the AWW application and website tools support the decision-making process for AVC mitigation.

AVCPLs identified are prioritized for mitigation and evaluated for feasibility. Once approved for mitigation, Alberta Transportation's Terms of Reference for AVC mitigation projects outline the design and tender process including the development of an AVC Mitigation Plan. Alberta Transportation's mitigation standards and considerations are incorporated into planning and design to ensure each mitigation project contributes to the Program goals. Once a mitigation project is complete, the applicable mitigation construction reports and AVCPL records are stored and mapped in the Mitigation Data Repository. This builds an AVC mitigation inventory that is linked to the AWW data and AVCPL analyses (animal carcass data collected before and after the mitigation project) to facilitate mitigation performance monitoring. Its effectiveness at reducing AVCs is evaluated using standardized performance criteria.

Over time, standard performance of the overall AWW Program and provincial mitigations are evaluated to ensure continued alignment with the AWW Program's goals. Lessons learned from this long-term review influences Alberta Transportation's mitigation standards, construction and innovation, evaluation criteria, and all System components.

Figure 1 displays the AWW Program structure.

1 Smartphone application for iOS, Android, and BlackBerry devices.
[2] A modern browser, such as Chrome, is required for the website tool (Internet Explorer is not recommended).

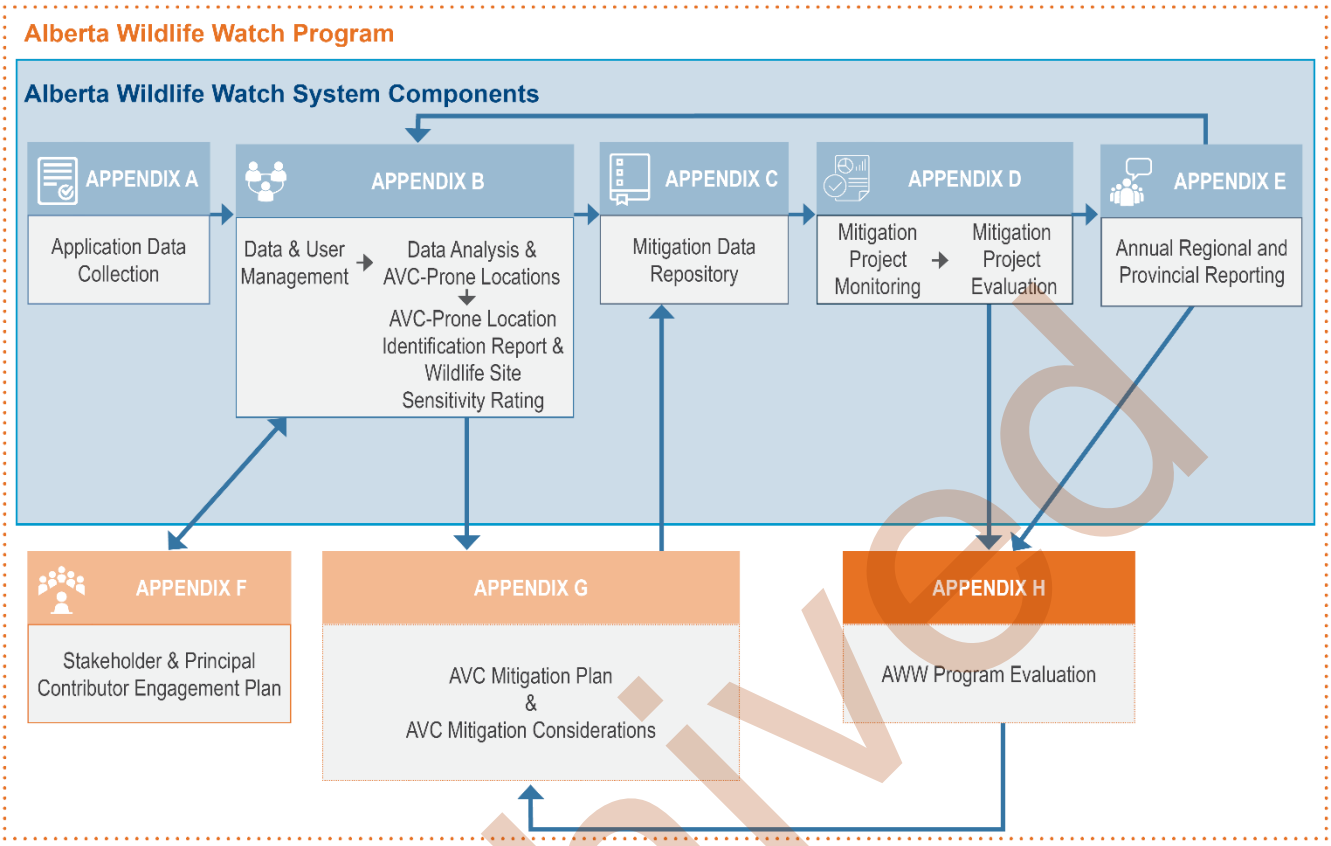

Figure 1: Alberta Wildlife Watch Program Structure

Appendix H: AWW Program Evaluation

1.0 INTRODUCTION

Alberta Wildlife Watch (AWW) Program is a comprehensive decision support tool to promote motorist safety and wildlife conservation across Alberta. It allows Alberta Transportation to collect, analyze, mitigate, and monitor animal-vehicle collisions (AVCs) and AVC mitigation efficiently and effectively over time (refer to Appendices A to G). It also includes a process for the long-term review of AVC mitigation at the provincial scale, as well as regular evaluation of the AWW Program itself as outlined in this Appendix.

The AWW Program evaluation is a high-level assessment of the AWW Program, and its AVC mitigation, to ensure progress is being made towards the Programs goals. This annual process supports adaptive management and modernization, when required, to the AWW Program. This includes making updates to AVC mitigation design considerations based on lessons learnt within Alberta and future innovations.

Results from the AWW Program evaluation are summarized in the annual AWW Provincial Report (refer to Appendix E).

2.0 USER ROLES AND RESPONSIBILITIES

System Administrators have the responsibility to complete the annual evaluation (Table 1). Feedback from the four additional AWW System users, **AWW Viewers, Principal Contributors, Project Users**, and **Regional Administrators** will be used to support and generate the ongoing improvements to the AWW Program.

Table 1: User Responsibilities for Provincial Review

User	Access Permission(s)	Provincial Review Responsibilities		
		Provide Feedback/Support	AWW Program Review	Provincial Mitigation Review
1. AWW Viewers	Website Tool	✓		
2. Principal Contributors	Application Tool	✓		
3. Project Users	Website Tool	✓		
4. Regional Administrators	Application & Website Tools	✓		
5. System Administrators	Website Tool	✓	✓	✓

2.1 System Administrators

System Administrators are responsible for the overall management and development of the AWW Program and its users, including the annual AWW Program evaluation. This role includes overall responsibility to modify and or replace existing AWW Program components and is restricted to Alberta Transportation staff. Responsibilities include assigning and managing AWW System users, consulting with stakeholders all AWW users for feedback, conducting the AWW Program and provincial mitigation reviews, and modernizing/updating the AWW Program components as required.

Additional System Administrator responsibilities for the AWW Program are outlined in Appendices A-G.

2.2 All Other AWW Users

All other AWW users, including **AWW Viewers, Principal Contributors, Project Users**, and **Regional Administrators** are responsible for consulting with the System Administrator annually during the annual evaluations and providing applicable feedback for improvements and or modernization. Feedback requests will be submitted to email addresses of the AWW Program registered users.

3.0 ANNUAL EVALUATION

Regular and consistent evaluation of the AWW Program ensures that it functions most efficiently and as intended. This also facilitates the development and or adaptive management of the AWW mitigation considerations to ensure it remains current with new technologies and policy updates.

Alberta Transportation implements a step-wise process for straightforward annual Program evaluations. This includes a high-level check on the main AWW Program components, consultation with stakeholders and Principal Contributors, Project Users, and Regional Administrators for opportunities to modernize/improve, and a process to modify existing components.

3.1 Alberta Wildlife Watch Program Evaluation

The AWW Program is a living resource. With regular evaluation, the AWW Program can most effectively meet the overall Programs goals.

The AWW Program evaluation is simple check-list of the main AWW Program components for review and discussion with the AWW users and Alberta Transportation stakeholders. Opportunities to improve key components of the AWW Program are highlighted. The AWW Program evaluation is provided as an attachment to the annual AWW Provincial report for Alberta Transportation's Executive Team's review and consideration (refer to Appendix E).

All major AWW Program components will be assessed, including:

1. AWW data collection (Appendix A);
2. Data & User Management (Appendix B);
3. Mitigation Data Repository (Appendix C);
4. Mitigation Project Monitoring and Evaluation (Appendix D);

5. AWW Annual Regional and Provincial Reporting (Appendix E);
6. Stakeholder and Principal Contributor Engagement Plan (Appendix F);
7. AVC Mitigation Planning and Design (Appendix G); and
8. The overall AWW Program Evaluation (this appendix).

3.2 Provincial Mitigation Review

The AWW Program supports mitigation and mitigation evaluation projects by 1) collecting accurate data (as outlined in Appendix A), 2) identifying and prioritizing areas requiring mitigation (Appendix B), 3) storing and managing mitigation data in the repository (Appendix C), and 4) monitoring and evaluating mitigation project performance (Appendix D). AVC Mitigation Project Evaluations, as outlined in Appendix D, are completed at the project scale (i.e., small spatial and short temporal scales).

In contrast, the Provincial Mitigation Review is a long-term performance evaluation of AVC mitigations at a provincial scale. For simplicity, it remains as a high-level check to be conducted once annually to evaluate if overall AVC mitigations are improving motorist safety across the province. The Provincial Mitigation Review is provided as an attachment to the annual AWW Provincial Report (refer to Appendix E).

Alberta Transportation is developing provincial performance measures to simplify this mitigation review. This includes an AWW Dashboard (refer to Appendix B) that provides a simple snapshot of these performance measures for easy provincial evaluation. Performance measures will include, but not limited to:

- a return on investment (e.g., percent reduction of AVC-related direct and indirect costs);
- provincial AVC-related human fatality and injury trends; and
- total number of provincial AVCs over time.

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