



# Landscape-Scale Prioritization of Wildlife Crossings for Highway Safety



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# Wildlife Crossings for Highway Safety



# Presenters



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Environmental Project  
Manager



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AK Environmental Sciences  
and Planning Lead

# QUESTION: WHAT DO YOU DO?

- Consultant
- DOT or other State Agency
- Federal Agency
- NGO



# QUESTION: WHERE ARE YOU FROM?

- West Coast & Mountains
- Midwest/Southcentral
- East Coast/Southeast
- Alaska



# QUESTION: WHAT IS YOUR EXPERIENCE WITH WILDLIFE CROSSINGS?

- Never heard of them until now
- Driven over or under them
- I saw a dead animal on the road once...
- I've planned or designed them



# Agenda

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- 01** What Are Wildlife Crossings?
- 02** The Case for Landscape Scale
- 03** Opportunities and Challenges
- 04** Case Study: Nevada
- 05** Case Study: Missouri
- 06** Case Study: Nebraska
- 07** Case Study: Alaska
- 08** Discussion and Q&A



# 01 What Are Wildlife Crossings?

# The Problem with Roads

Wildlife-Vehicle Collision



Road as a Barrier /  
Habitat Fragmentation



Future Problem



# Solution #1: Change Animal Behavior



**Vegetation & Roadside Management**



**Population Control**



**Deterrence**



**Habitat Enhancement**

# Solution #2: Change Driver Behavior



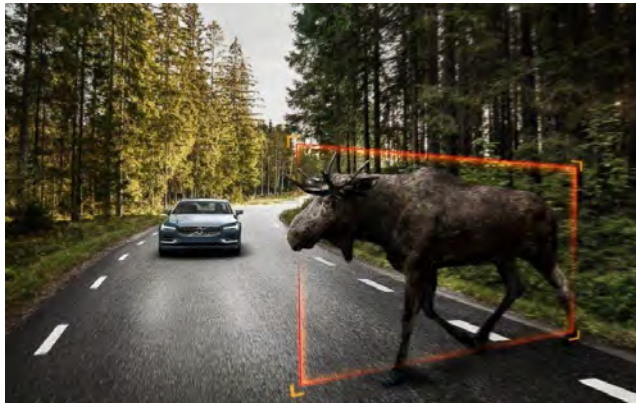
Signage



Lighting



Improve Sightlines



Animal Detection System & At-Grade Crossings



Reduce Travel Speed



Education & Outreach

# Solution #3: Exclude Wildlife From Roadway



**Overpass**



**Underpass**



**Fencing w/ Jump Outs**



**Arboreal Overpass**



**Small Mammal / Herp Underpass**



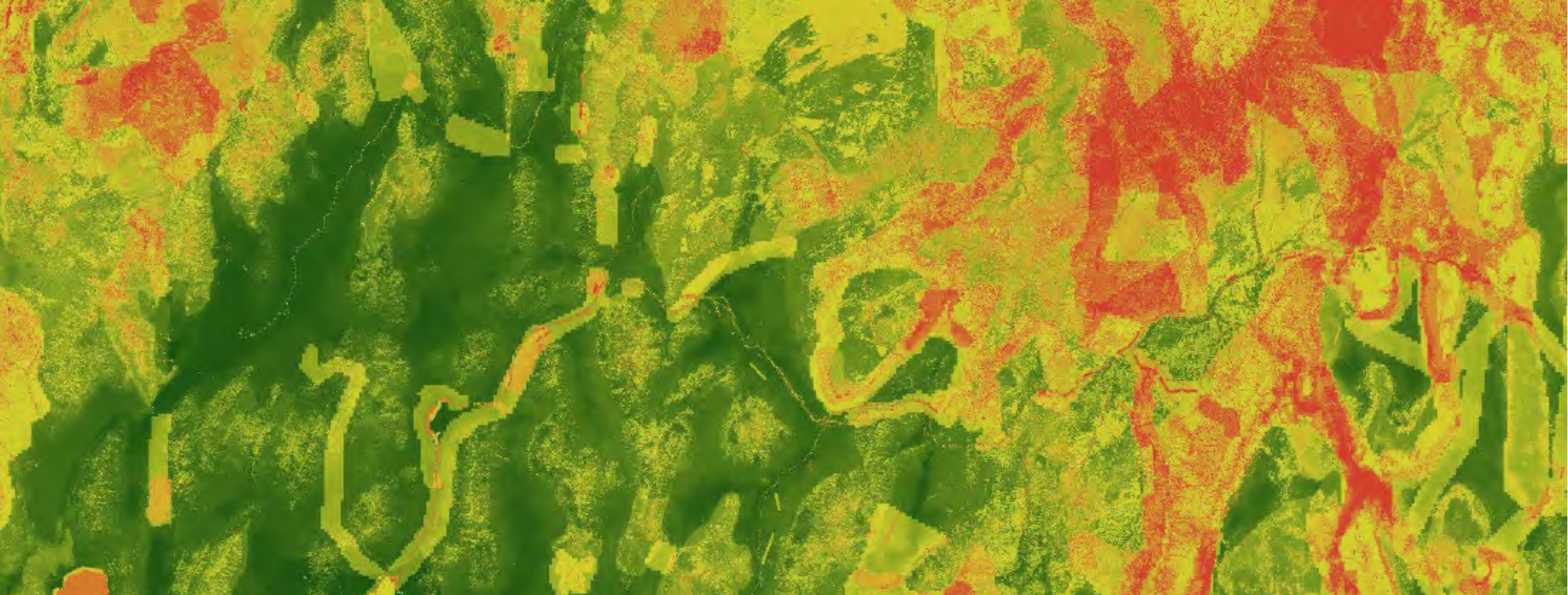
**Expanded Culvert with Aquatics**



**Electrified Mats**



**Cattle/Deer Guards**



**02**

# The Case For Landscape Scale

# Why Start at High Level?



- Provides robust, equitable, and objective prioritization framework
- Creates data-driven list of priority projects
- Supports NEPA analysis
- Supports grant applications
- Ties to Statewide Transportation Improvement Plan (STIP) and other planning
- Low-cost relative to design and construction

# General Approach

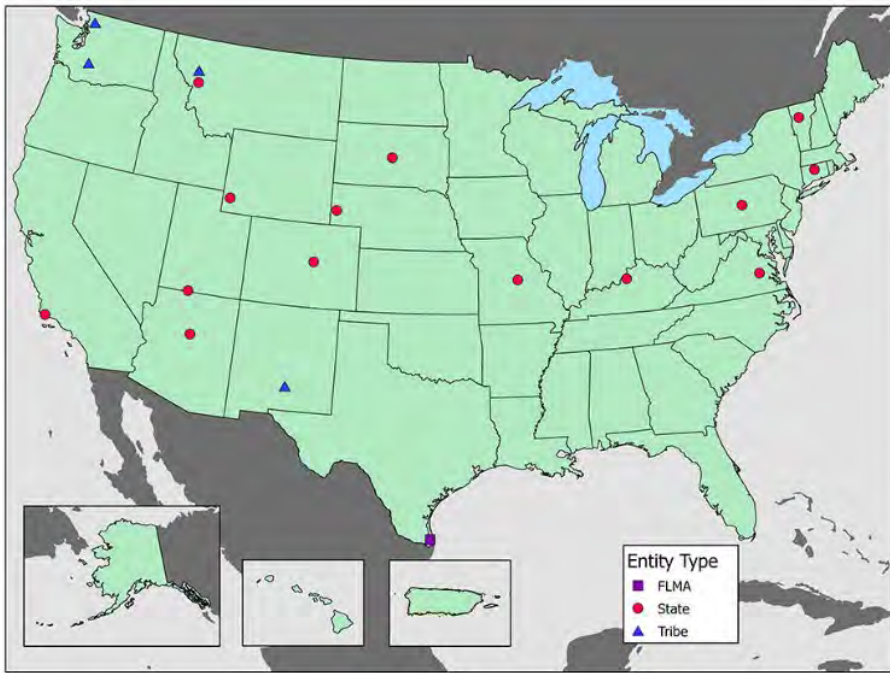
- Stakeholder Input
  - DOT, State wildlife agency, resource management agencies, NGOs, others.
- Identify Focal Species
- Identify and Weight Criteria
- Literature Review & Data Collection:
  - Safety Data: Wildlife-Vehicle Collisions, Carcasses, Crash Severity
  - Ecological Data: Habitat Use, Migration Corridors, “Critical” Habitats
- Run Model and Identify Priorities
- Assess Feasibility, Constructability, Land Security, Resilience
- Identify Solutions and Cost-Benefit Analysis



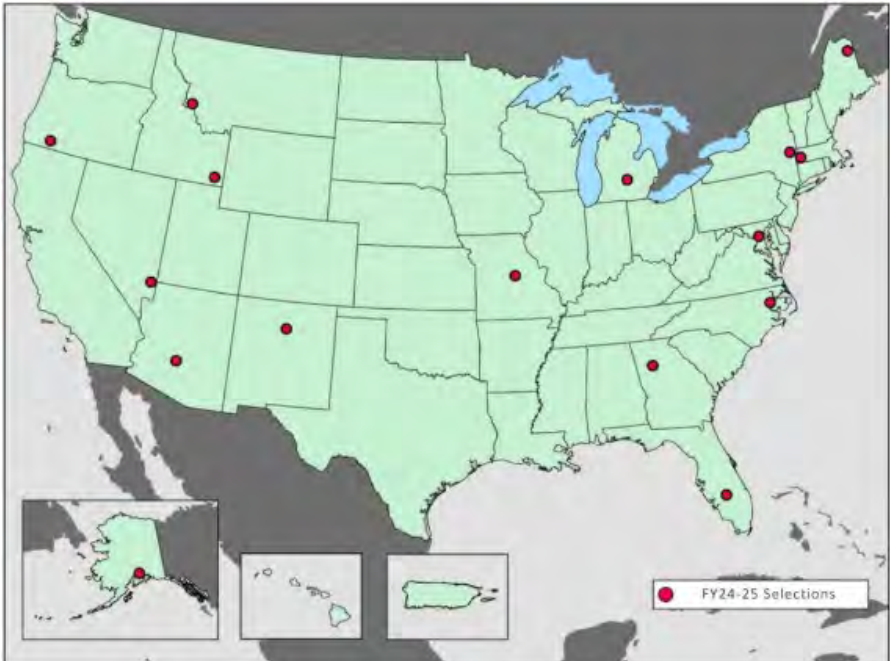


# 03 Opportunities & Challenges

FY 2022-2023



FY 2024-2025

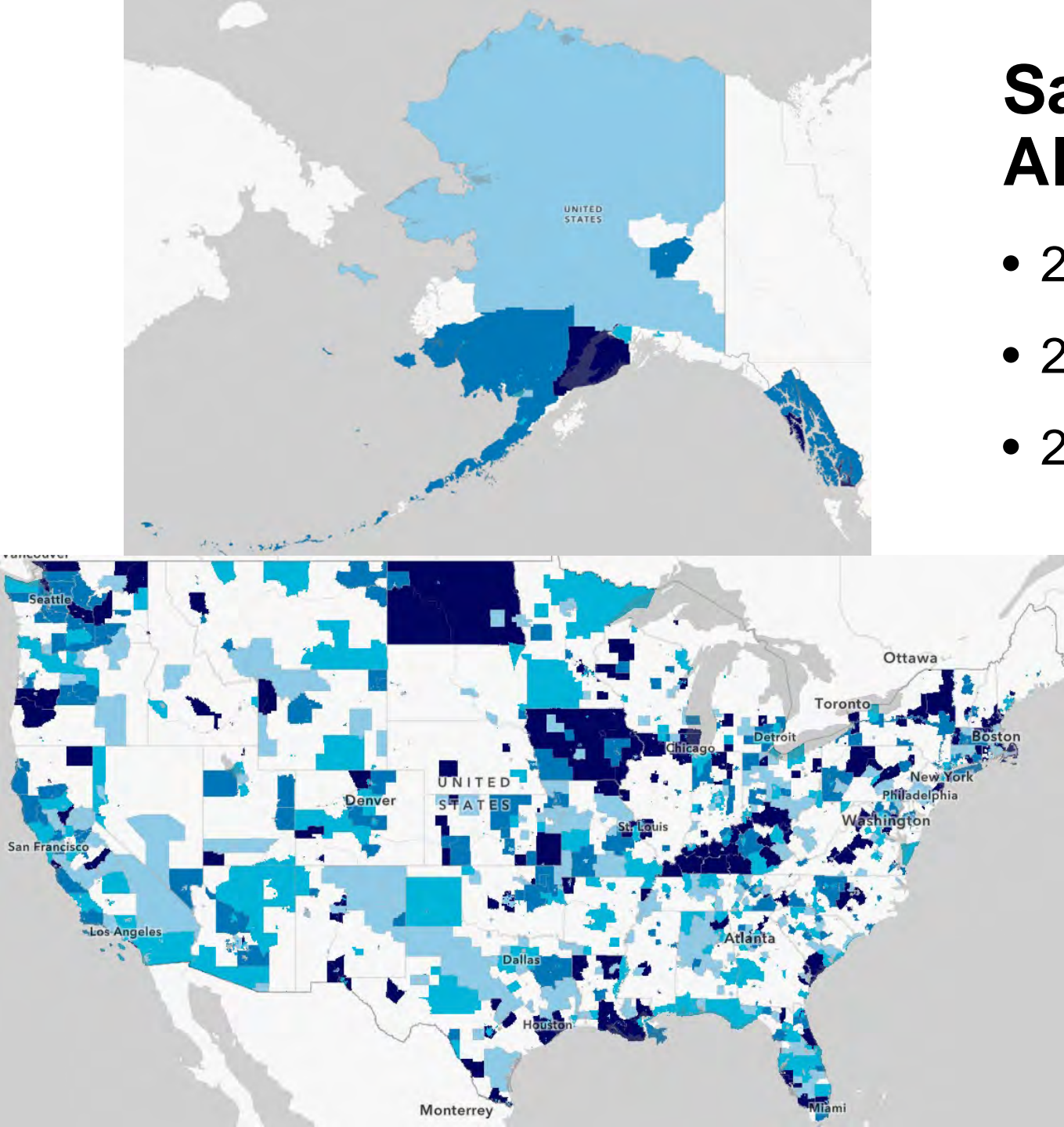


# Wildlife Crossings Pilot Program

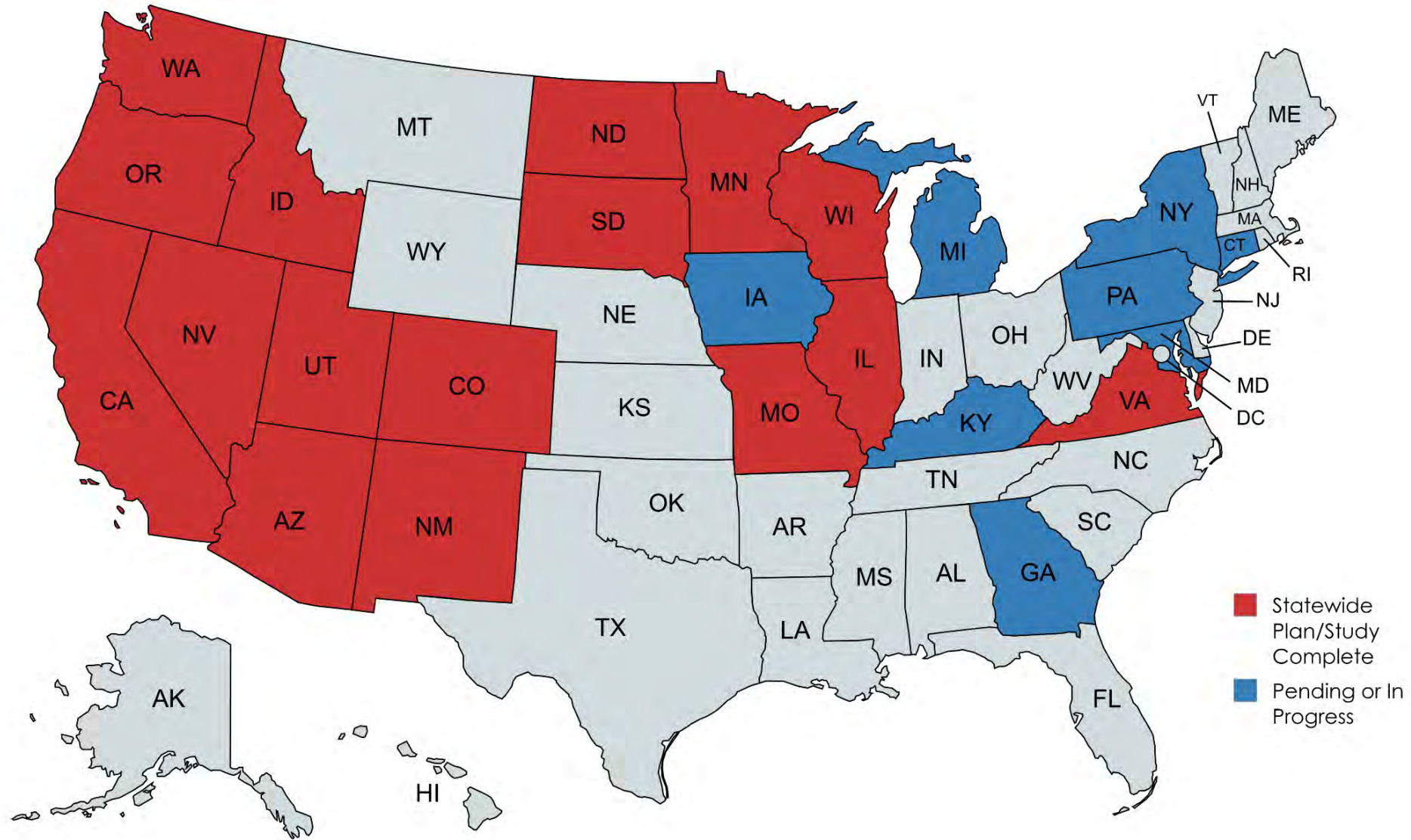
- FY2024-2025 = \$125M and 16 projects
- FY2022-2023 = \$110M and 19 projects
- 3rd NOFO Anticipated Soon!

# Safer Streets and Roads for All Grant Program

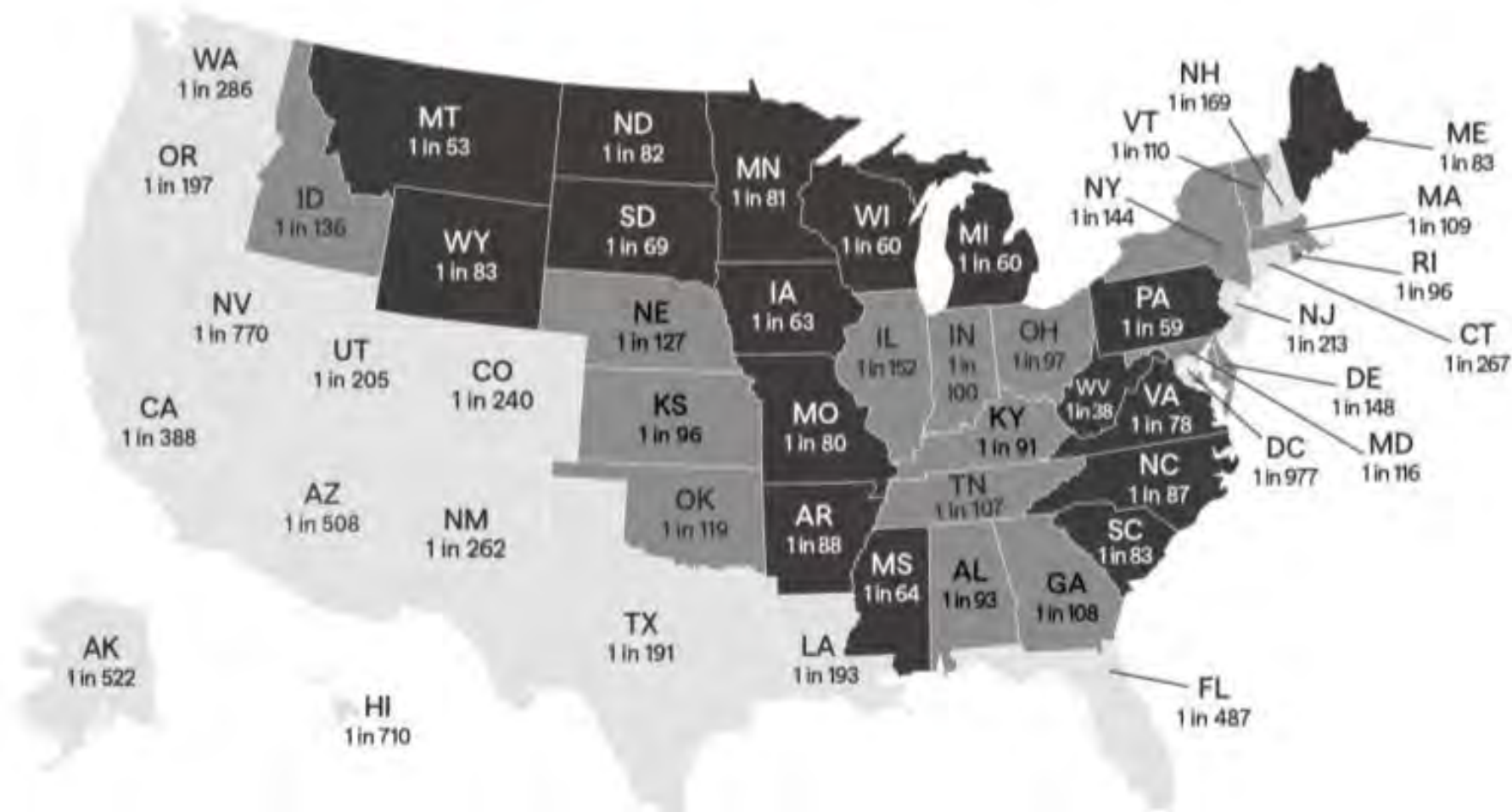
- 2024: \$1.2 billion across 710 awards
- 2025: \$982 million across 521 awards
- 2026: closes in two weeks



# States With and Without Plans or Studies:



## 2022-23 Animal Collision Likelihood by State



July 1, 2022 through June 30, 2023

High Risk States Medium Risk States Low Risk States





**04**

# **Nevada Statewide Wildlife Crossings Prioritization Study**

## PROJECT TEAM



## STAKEHOLDERS



## Approach

- Identify Focal Species
- Develop & Weight Criteria
- Identify and Process Data
- Create Prioritization Surface
- Identify Top 30 Segments
- Incorporate Secondary Criteria
  - Land Use
  - Feasibility
  - Climate Resiliency
  - Upcoming NDOT Projects
- Identify Near-Term Priorities

# Focal Species

- Mule Deer
- Elk
- Pronghorn
- Bighorn Sheep
- Black Bear
- Pygmy Rabbit
- Mojave Desert Tortoise
- Aquatic/Riparian Obligates
- Sagebrush Obligates





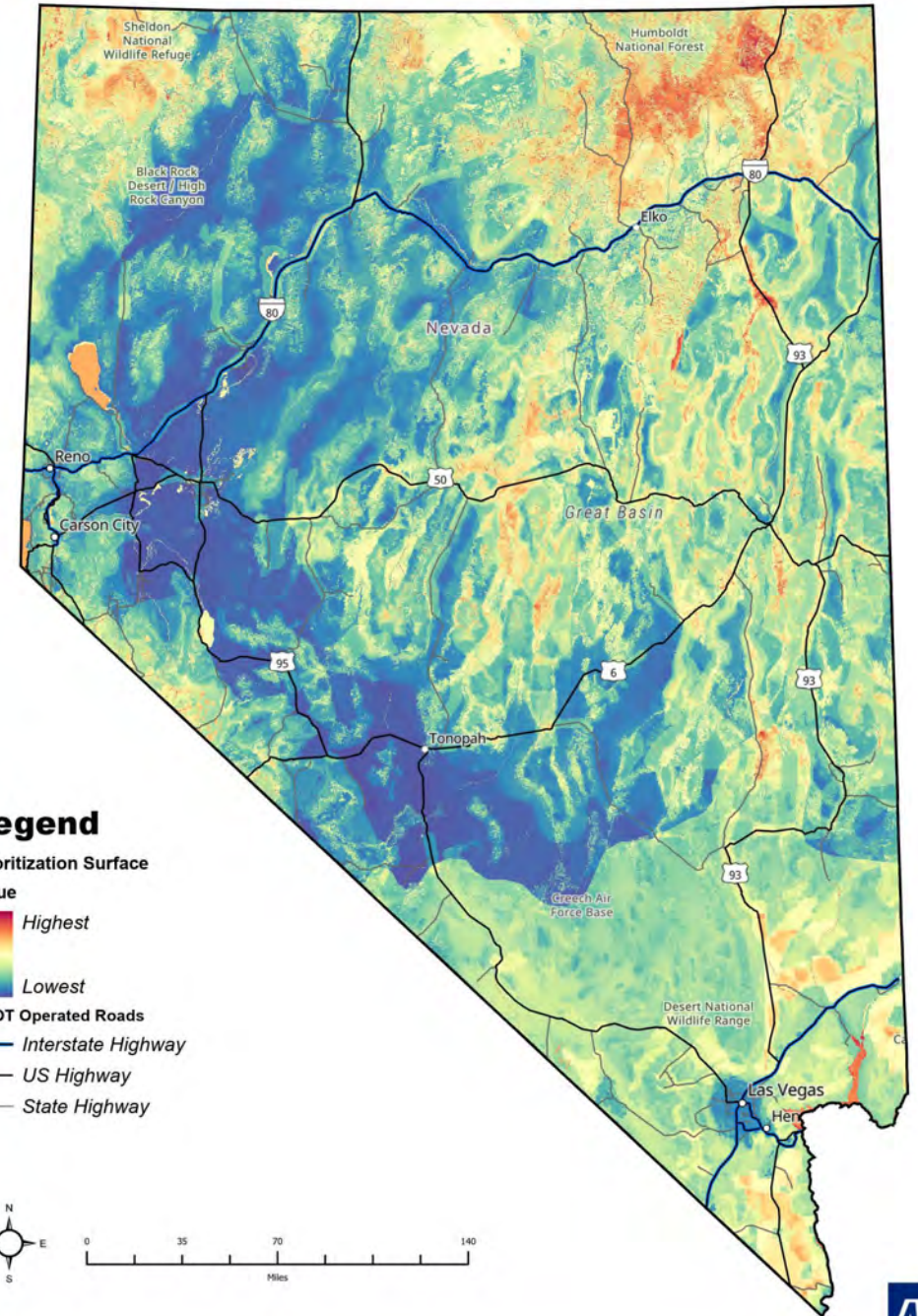
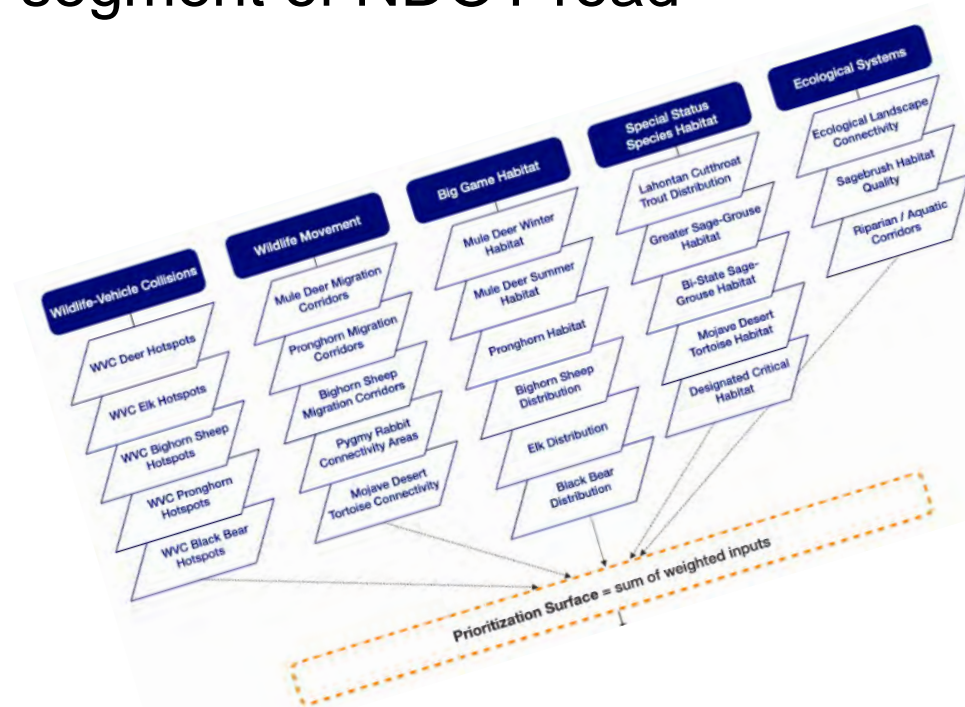
# WVC Hotspot Analyses

- Optimized Hot Spot Analysis (OHSA) Getis-Ord Gi\* Tool in ArcGIS
- 12 years of data (2011-2022)
- ½ mile highway segments
- 1-mile search distance
- OHSA conducted for each species represented in WVC dataset
- 85% Deer WVCs
- Only wildlife (excluded livestock, wild horses, etc.)



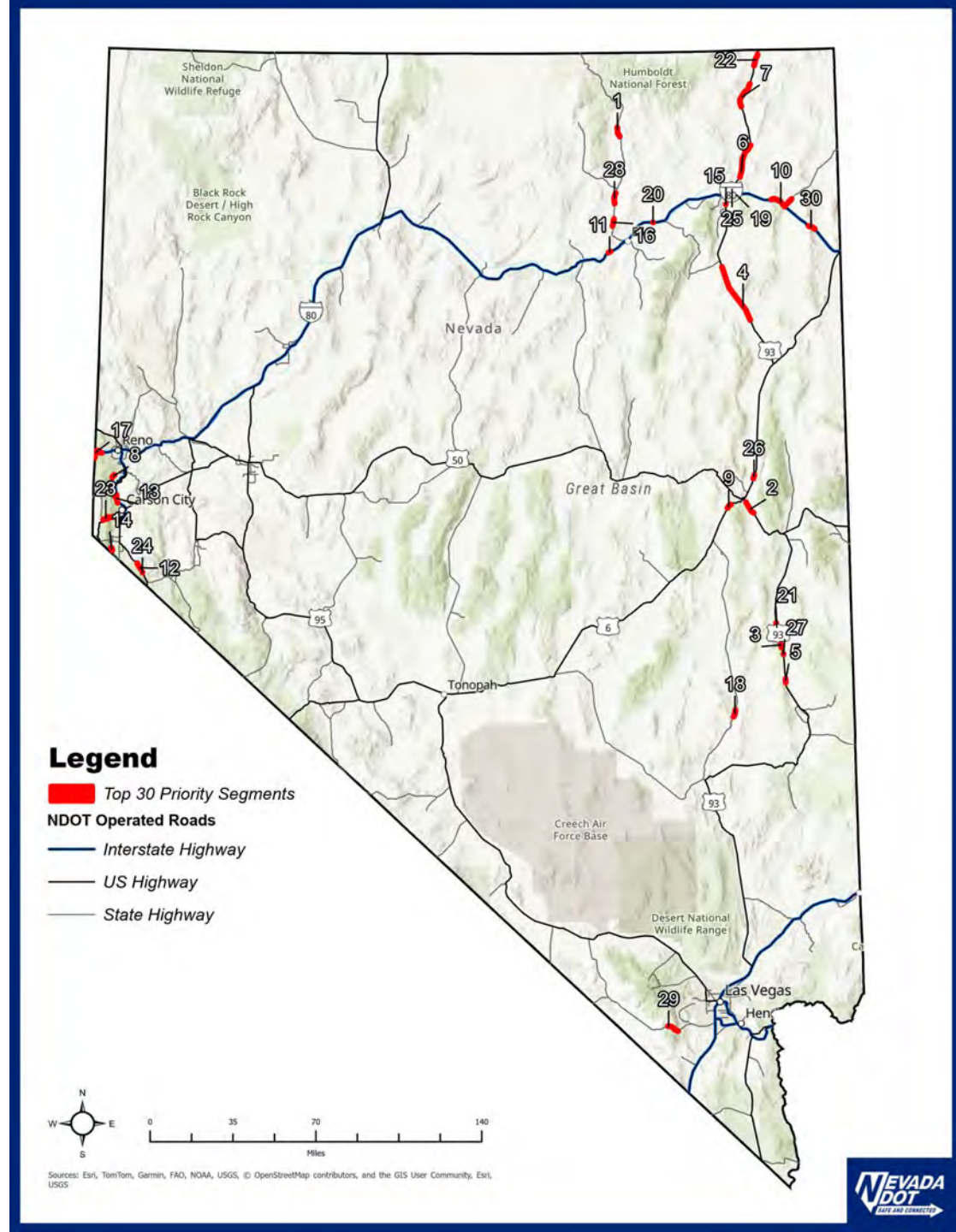
# Prioritization Surface

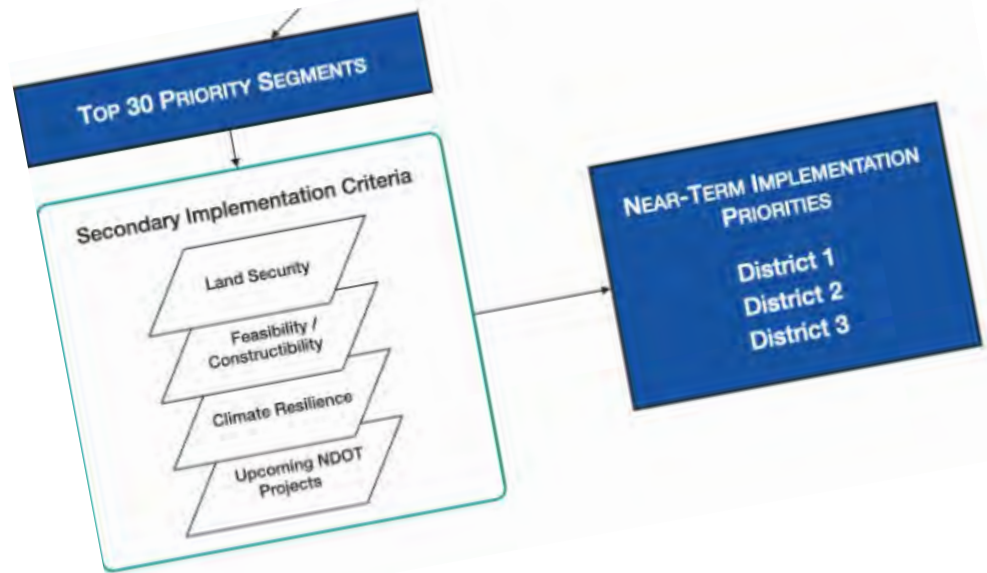
- Weighted Sum of all Criteria
- Statewide Prioritization Map
- Calculated mean cell value for each segment of NDOT road



# Top 30 Segments

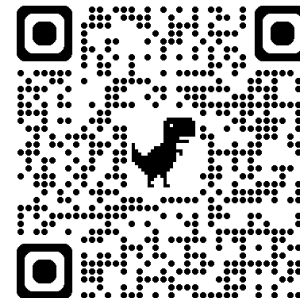
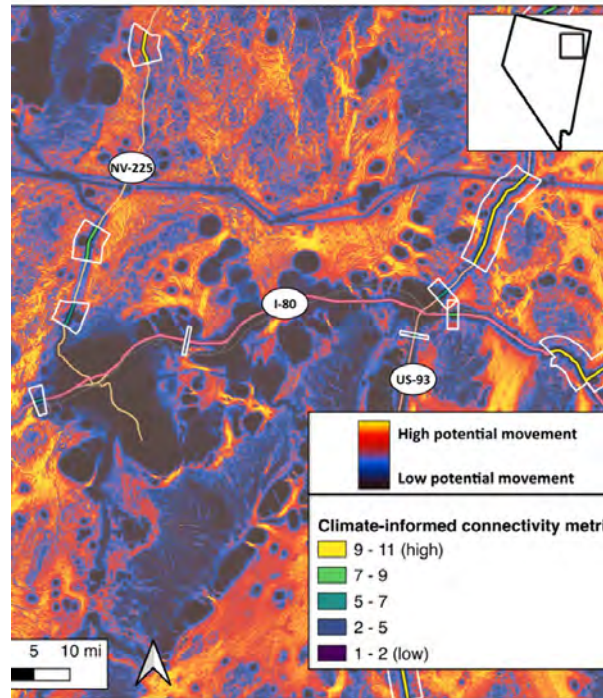
- Top scoring from 76 aggregated segments
- Range from ½ mile to 17 miles in length
- Quantified value for each criteria for each segment





# Secondary Criteria

- Land Security
  - Ownership
  - Resource Extraction
- Feasibility / Constructability
  - Topography
  - Existing Bridges / Culverts
- Upcoming NDOT Projects
- Climate Resilience





**05**

# Missouri Statewide Wildlife Vehicle Collision Study

# Background

- Statewide study
- Diverse stakeholders
- A clear need for data driven prioritization and solutions



Missouri ranked **17<sup>th</sup>** in the nation for WVCs in 2024 and 2025



Missouri has **1.2 million** acres of roadways, medians, shoulders, and adjacent spaces



Missouri has **10,454** culverts and bridges, some of which could be used to funnel wildlife below the road



Missouri has **33,811** miles of highways/interstates/state-maintained roads (7th largest in the nation)



There were **17,609** total WVCs in Missouri from 2019 to 2023



# Approach

- Determine Focal Species
- Create prioritization model and procure spatial data
- Identify top 10 sites
- Propose mitigation solutions
- Benefit Cost Analysis
- Long range transportation plan implementation



# Focal Species

Road Mortality Threat or Documented		
Federally protected or under listing review	MDC heritage data showing "roadkill"	MO species of conservation concern
Alligator snapping turtle	American badger	American badger
Indiana bat	Bald eagle	Eastern Massasauga rattlesnake
Blanding's turtle	Black-tailed jackrabbit	Kirtland's snake
Western chicken turtle	Franklin's ground squirrel	Northern leopard frog
<b>Aquatic organism passage issues</b>	Great Plains toad	Eastern tiger salamander
Niangua darter	Indiana myotis	13-lined ground squirrel
Topeka shiner	Least weasel	<b>MDC focal species</b>
<b>T&amp;E plants dispersed by mammals</b>	Long-tailed weasel	White-tailed deer
Pondberry	Plains spotted skunk	American black bear
	Western foxsnake	Elk
	Western mudsnake	



# Prioritization Model



## Transportation Safety

WVC Hotspots

Crashes/Mi/Yr

Crash Severity

Percentage of Wildlife Crashes



## Ecological

Occupied Habitat

Suitable Habitat

AADT

Streams

MDC Mgt Tiers



## Feasibility

Land Use

Protected Areas

Bridges and Culverts

01

Segment MoDOT  
Roads

02

Sum Criteria Scores  
Per Segment

03

Hot Spot Analysis of  
Sum Criteria

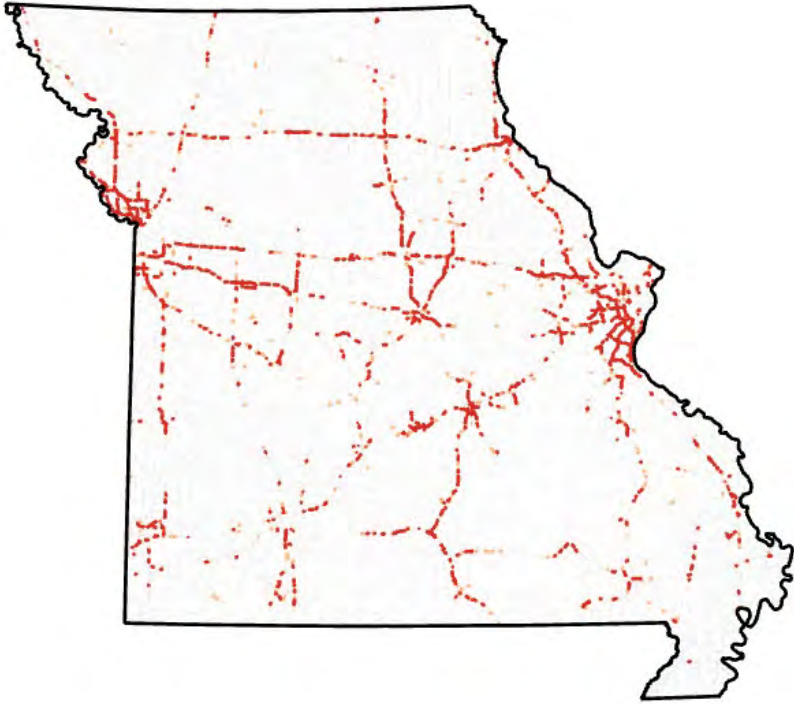
04

Top 100 Review

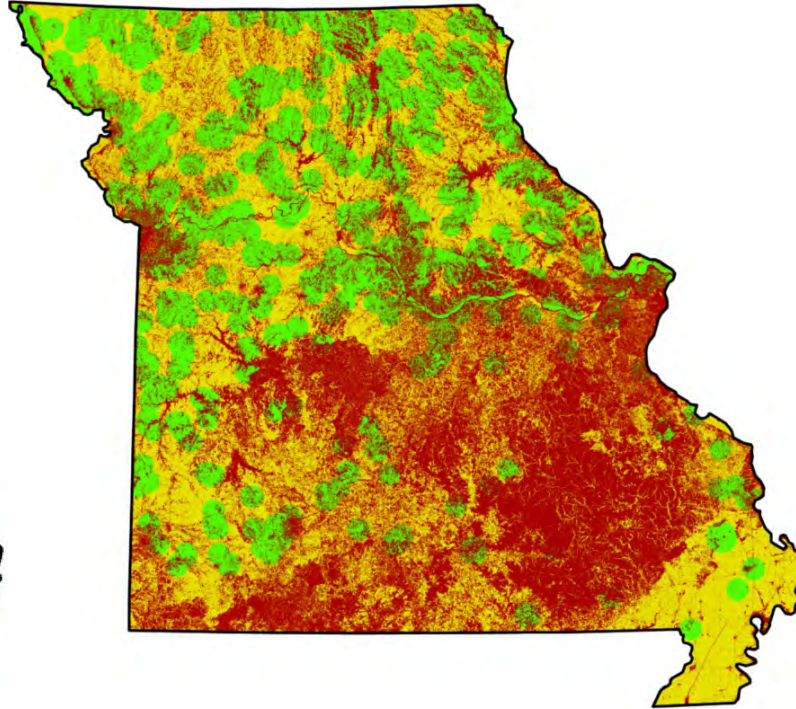
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Top 10

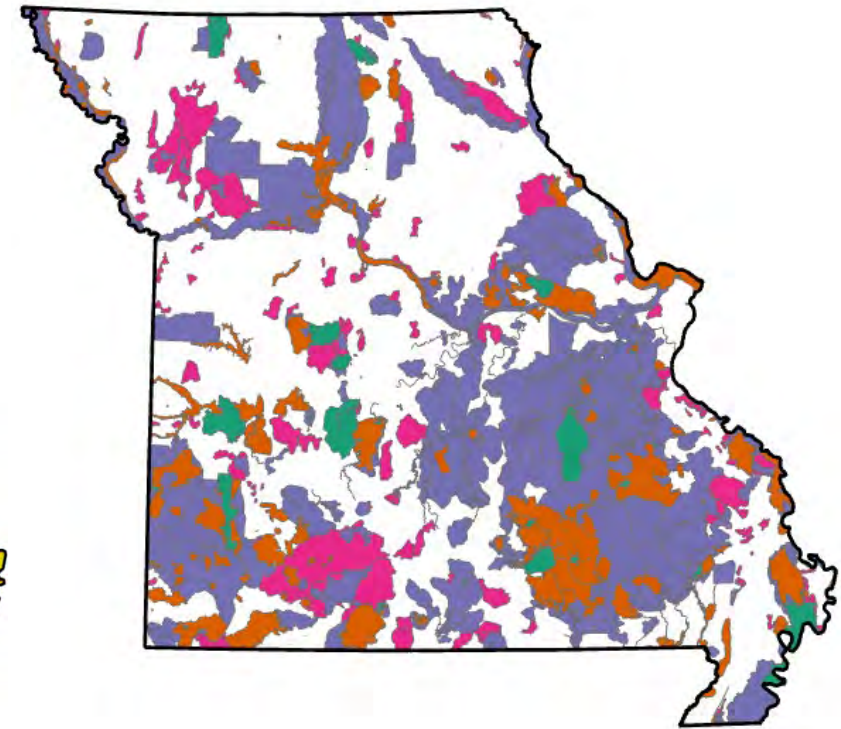
# Spatial Data



Reported WVC  
Hot Spot Analysis



Occupied and Suitable Habitat  
American Badger



MDC Comprehensive  
Conservation Strategy Tiers

# Prioritization Segments

- Results from model identified **627 priority segments** across the state
- Top 100 segments manually reviewed for constructability, land use, and programmed funding.

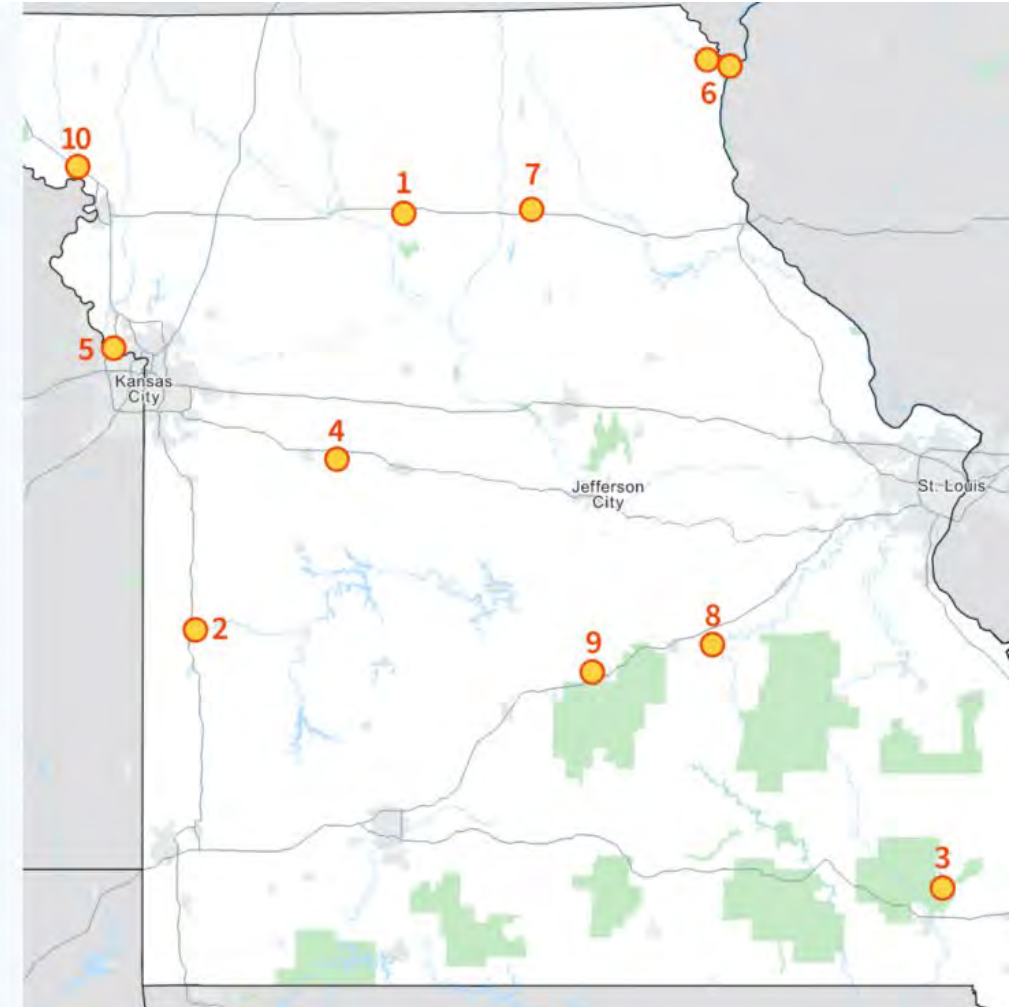


# Top 10 Segments



Based on the team's assessment, the following segments were chosen as the top ten priority segments.

Rank	Segment Name	County	Road	Milepost Start	MP End
1	Pershing State Park	Linn	US-36	83	95
2	Four Rivers Conservation Area (1) and (2)	Vernon	IS-49	107	114
3	Wappapello Reservoir	Wayne	MO-34	35	38
4	Whiteman AFB & Knob Noster State Park	Johnson	RT-DD	4	8.5
5	Parma Woods Shooting Range	Platte	IS-435	0	4
6	Fox River and Buck Run (1)	Clark	MO-27	0	1
6	Fox River and Buck Run (2)	Lewis	US-61	374	377
7	Long Branch State Park	Macon	US-36	122	124
8	Maramec Springs State Park	Crawford	MO-8	6	8.5
9	Roubidoux Creek Conservation Area	Pulaski	MO-17	139	141.5
10	Honey Creek Conservation Area (1) and (2)	Holt	IS-29	70	74



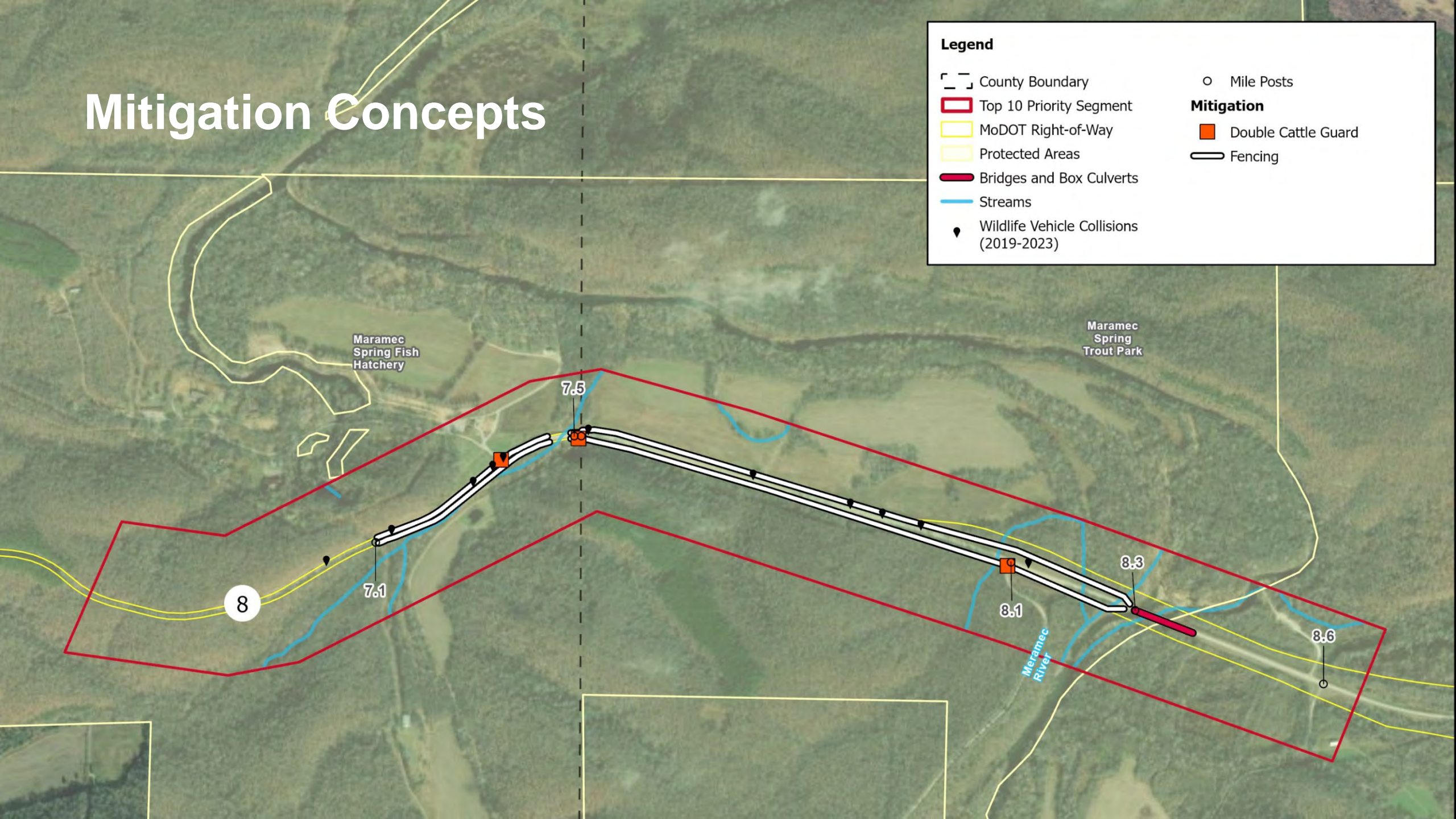
# Top 10 Site Visits



# Mitigation Concepts

## Legend

- County Boundary
- Top 10 Priority Segment
- MoDOT Right-of-Way
- Protected Areas
- Bridges and Box Culverts
- Streams
- Wildlife Vehicle Collisions (2019-2023)
- Mile Posts
- Mitigation**
- Double Cattle Guard
- Fencing



# Benefit Cost Analysis

**Table 6-11: Pershing State Park Benefit Cost Ratio Calculations.**

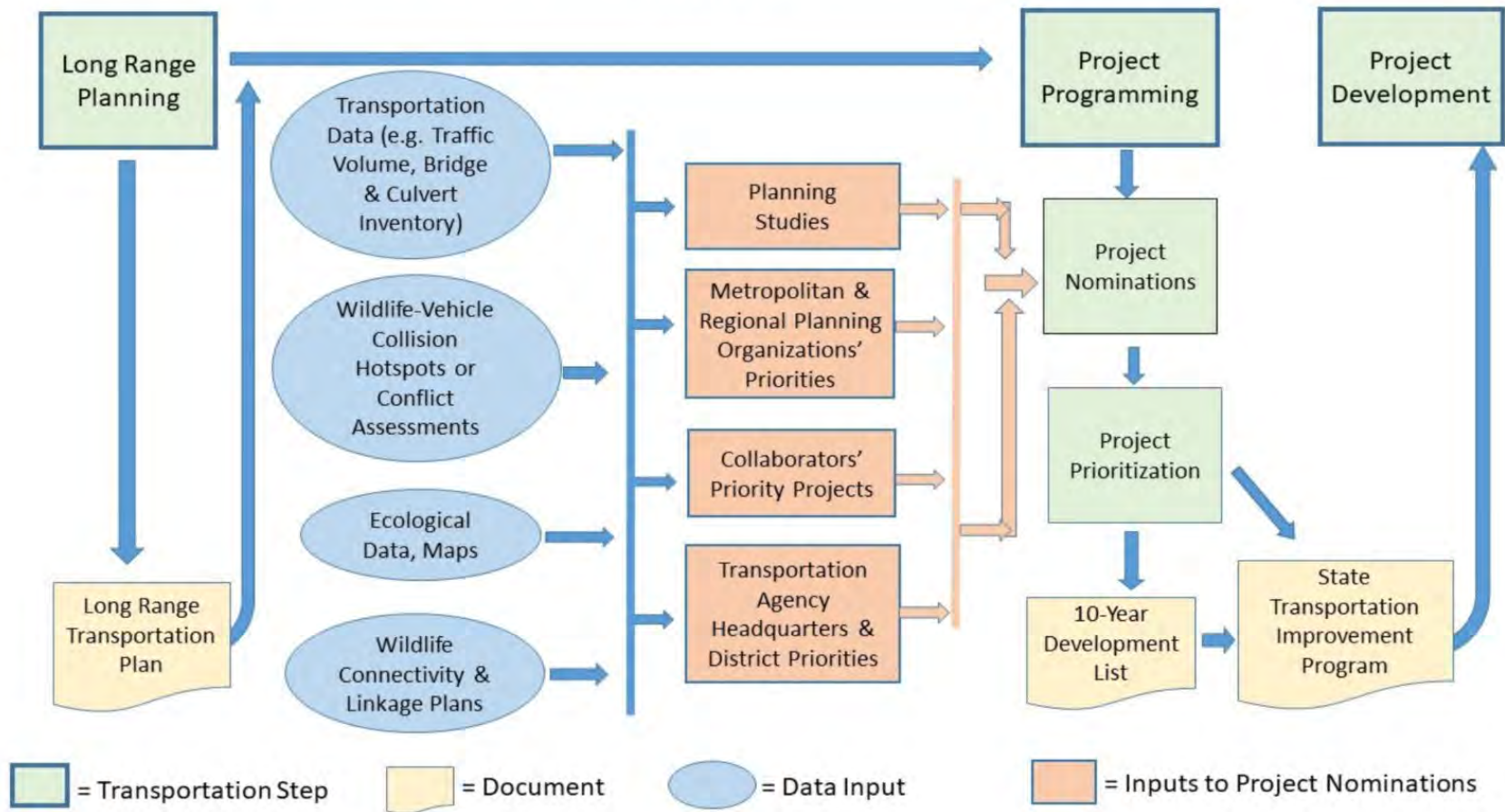
<b>Benefits Formula</b>	<i>(Average Wildlife Crash Costs per Year + Wildlife Value) x Percent Reduction x Years</i>		
Benefits Values	$(366,906 + (2,000 \times 8.8)) \times 0.7 \times 50$		
<b>Costs Formula</b>	<i>Mitigation Infrastructure Costs + (Annual Maintenance Costs x Number of Years)</i>		
Costs Values	$1,682,250 + (1,000 \times 50)$		
<b>Benefits Total</b>	<b>Costs Total</b>	<b>Ratio (B / C)</b>	<b>Payback Period = Costs / Annual Benefit</b>
\$13,457,696	\$1,732,250	7.77	6.44 years

**Table 6-48: Maramec Spring State Park Benefit Cost Ratio Calculations, Including Optional Fence Addition.**

<b>Benefits Formula</b>	<i>(Average Wildlife Crash Costs per Year + Wildlife Value) x Percent Reduction x Years</i>		
Benefits Values	$(35,103 + (2,000 \times 2.2)) \times 0.85 \times 50$		
<b>Costs Formula</b>	<i>Mitigation Infrastructure Costs + (Annual Maintenance Costs x Number of Years)</i>		
Costs Values	$777,350 + (1,000 \times 50)$		
<b>Benefits Total</b>	<b>Costs Total</b>	<b>Ratio (B / C)</b>	<b>Payback Period = Costs / Annual Benefit</b>
\$1,678,886	\$827,350	1.19	24.6 years

# Long Range Transportation Planning

Figure 8-11: The LRTP, Programming, and Project Development steps of the transportation planning process.





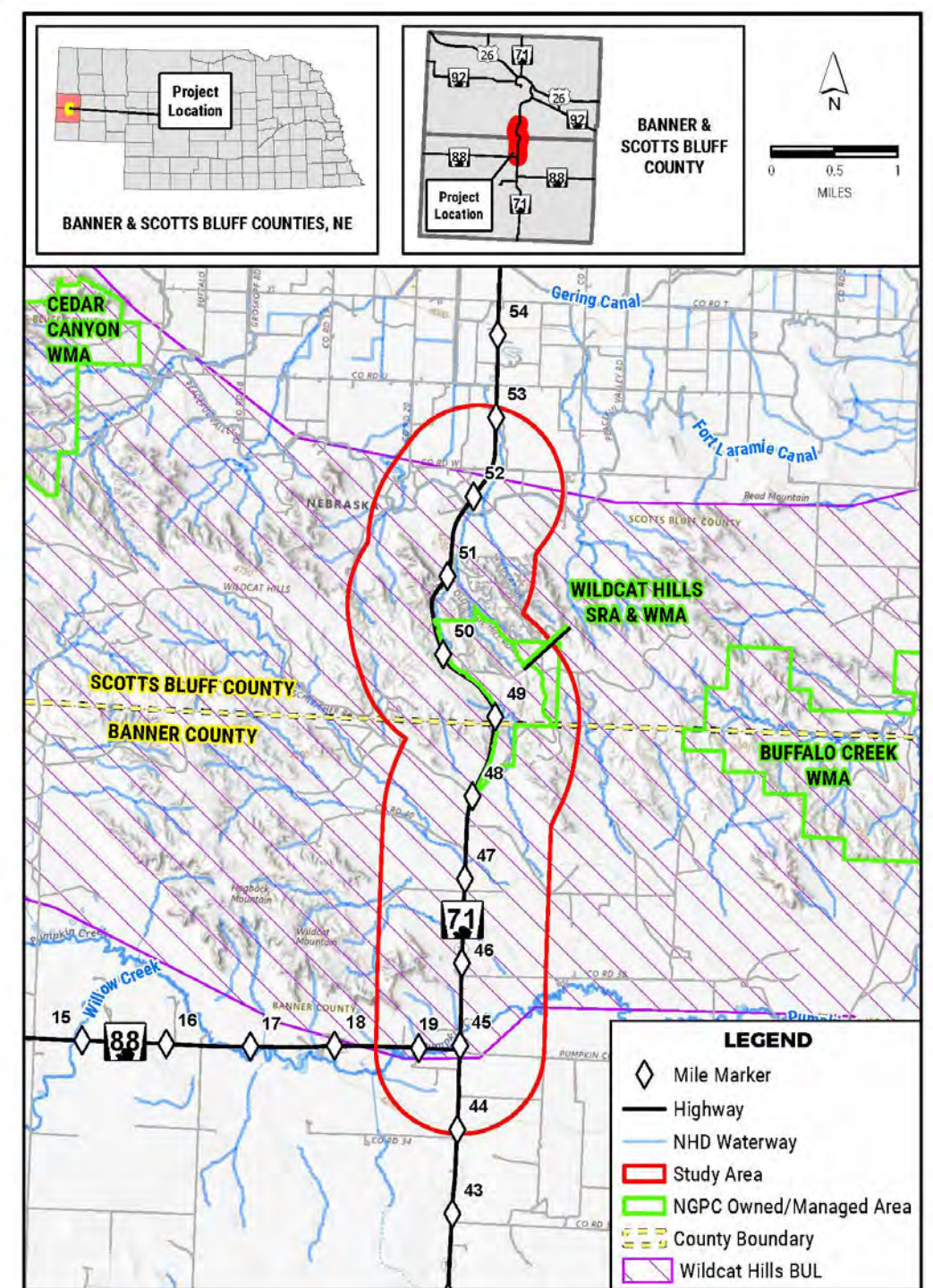
# 05 N-71 Wildlife Feasibility Study

# PARTNERING IMPACT

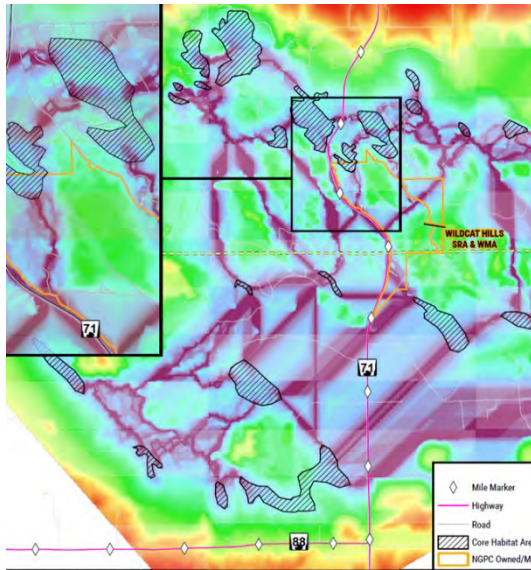


# Feasibility Study Introduction

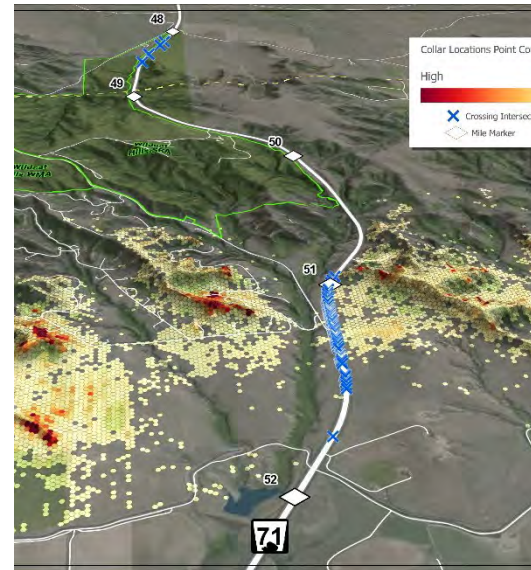
- Focuses on Rocky Mountain bighorn sheep along N-71
  - Additional focal species: Elk, Moose, Mule Deer
- South of Scottsbluff, Nebraska in the Wildcat Hills Biologically Unique Landscape



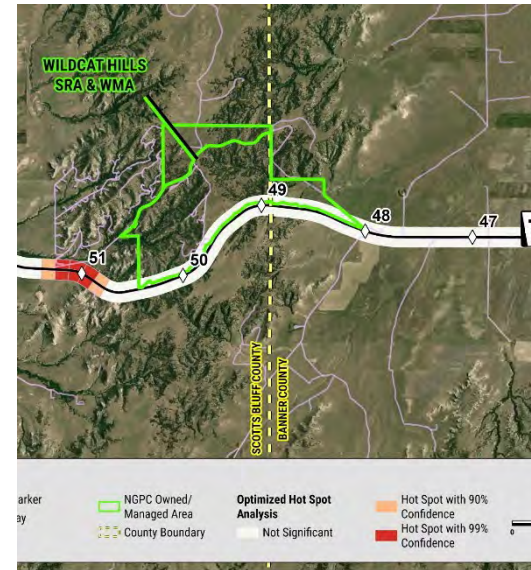
# Spatial Data



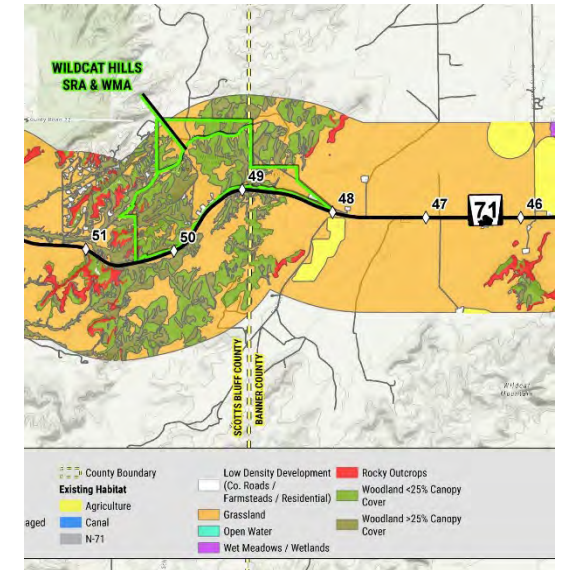
Linkage Mapper



GPS Collar Data



Hotspot Analysis



Habitat



# Rocky Mountain Bighorn Sheep

## Why Rocky Mountain Bighorn Sheep?

- Tier-1 at-risk species (NGPC)
- Economic value ~\$117,594 per sheep
  - (NGPC auction & lottery data)



## Why Nebraska Highway 71

- WVCs concentrated near Wildcat Estates
- Preservation value  $\approx$  \$3.1M (discounted, excludes reproduction value)

*Source: NGPC data and Benefit-Cost Analysis (2026)*

# Wildlife-Vehicle Collisions

Source: N-71 Wildlife Crossing Feasibility Study (2026)

## •Wildlife-Vehicle Collisions

- 22 bighorn deaths, most within the last 3-years
- Total Population: <225

## •Key Findings

- One statistically significant hotspot
- MM 50.90 – 51.40 (Wildcat Estates Entrance)

## •Why this Matters

- ~60% of crashes involve wildlife
- Hotspot confirmed by multiple independent dataset



# CONCEPTUAL DESIGNS

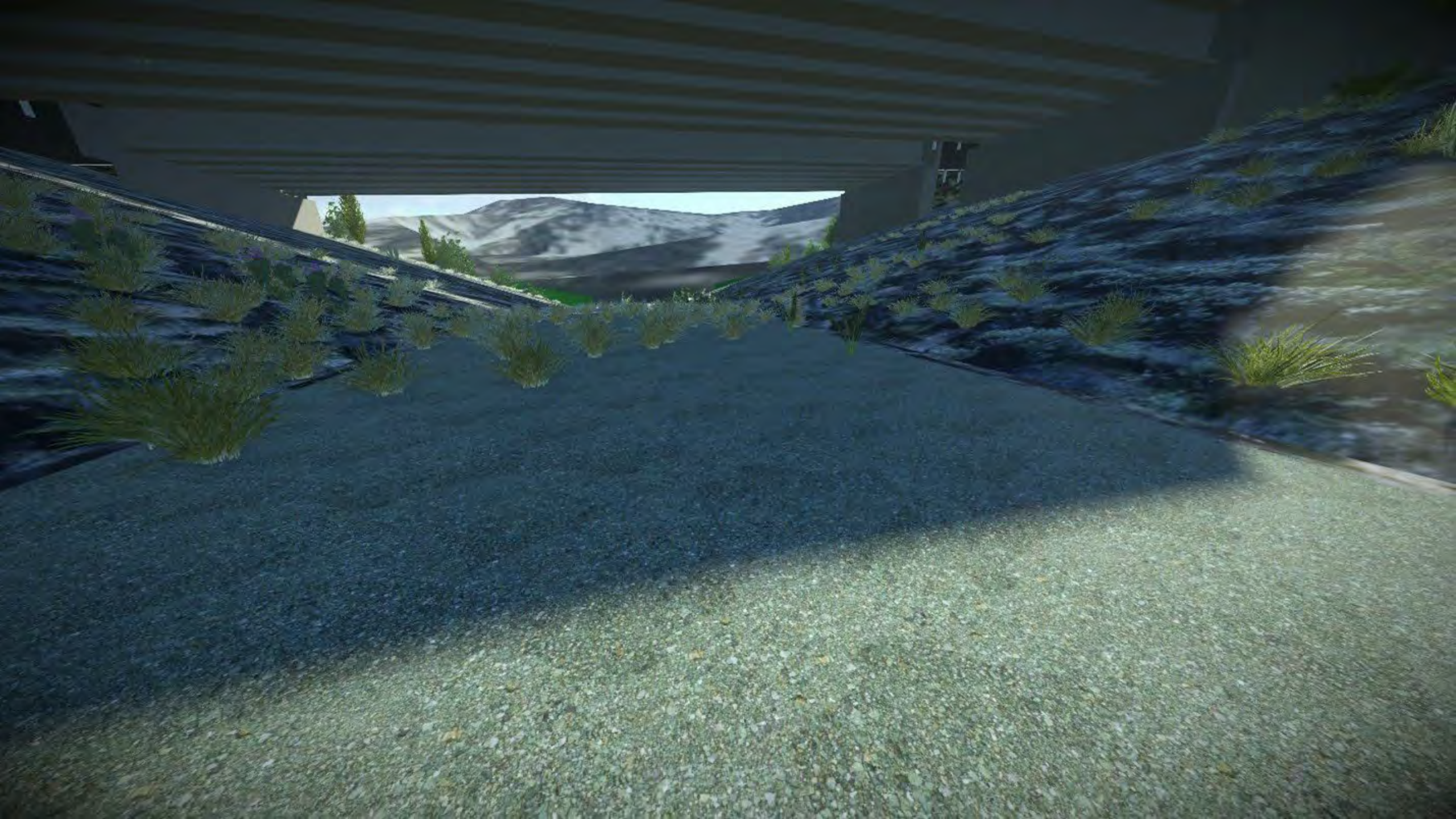












# Benefit-Cost Analysis

## Return on Investment

Alternative	Capital Cost	Benefit-Cost Ratio	Net Present Value	Internal Rate of Return
Overpass	\$5.9M	1.1	\$0.6M	7.9%
At-grade + ADDWS <sup>1</sup>	\$4.8M	1.3	\$1.5M	9.8%
Underpass	\$5.4M	1.2	\$1.0M	8.7%

<sup>1</sup>Animal Detection and Driver Warning System



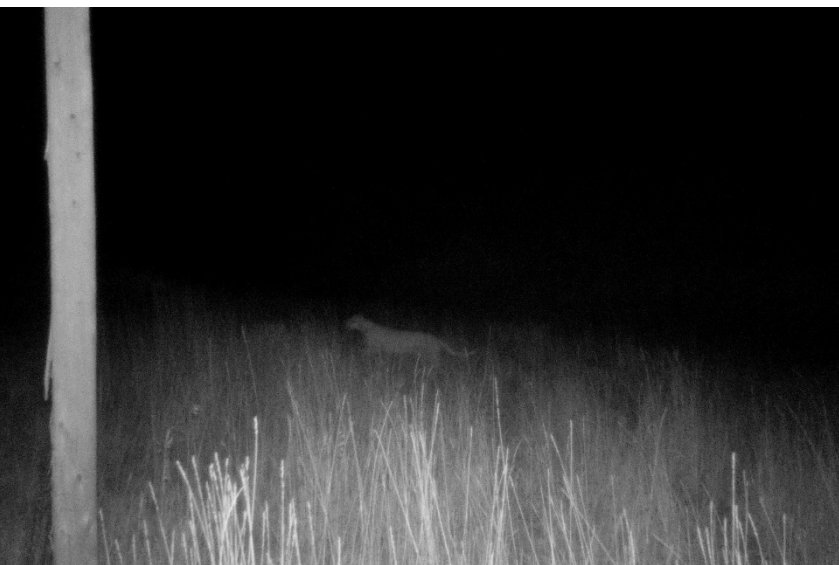
## **Next Steps: Spring–Fall 2026**

### **Evaluate Measures and Connectivity**

- Assess additional cost-effective fencing solutions
- At-grade and near-term options

### **Finalize and Deliver**

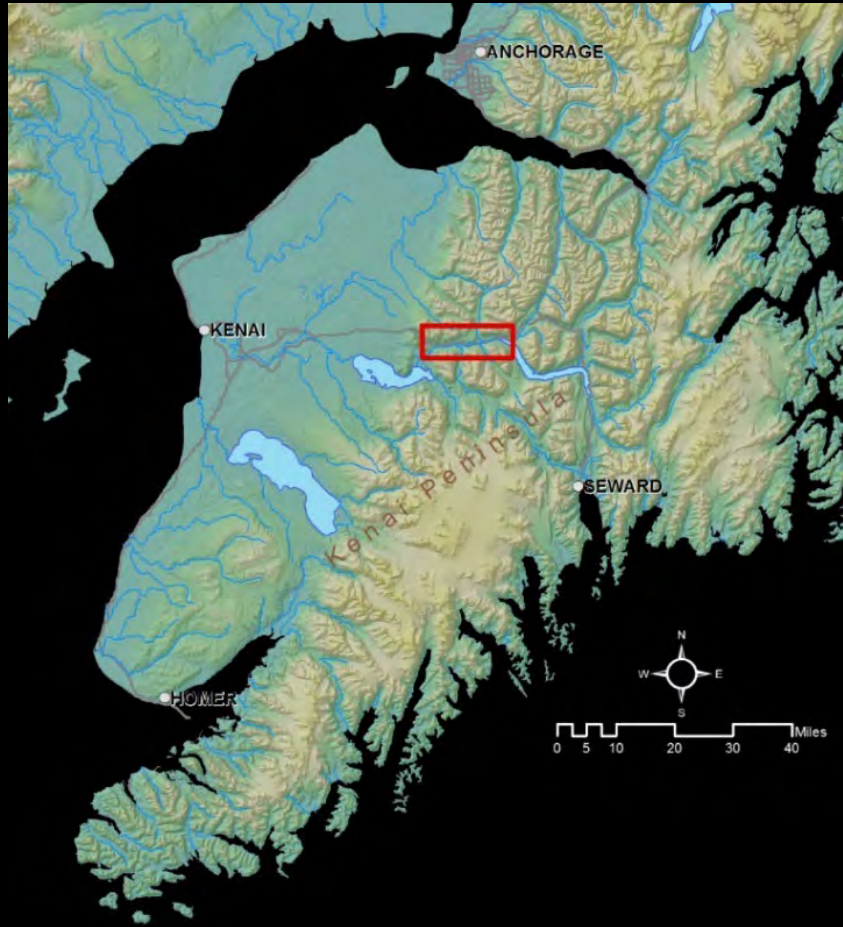
- Update benefit-cost analysis
- Document findings and recommendations





**Sterling Highway Milepost 45-60**

# STUDY AREA



- Broad mountain valley
- Highly productive fishery
- Extensive seasonal recreation
- Small, but growing community
- Surrounded by public lands
- Intersected by 'major' highway...

# Sterling Highway Milepost 45-60

- Project Ongoing Since Early 1980s
- Record of Decision Signed in May 2018
- Phased construction began in 2020

## Project Objectives:

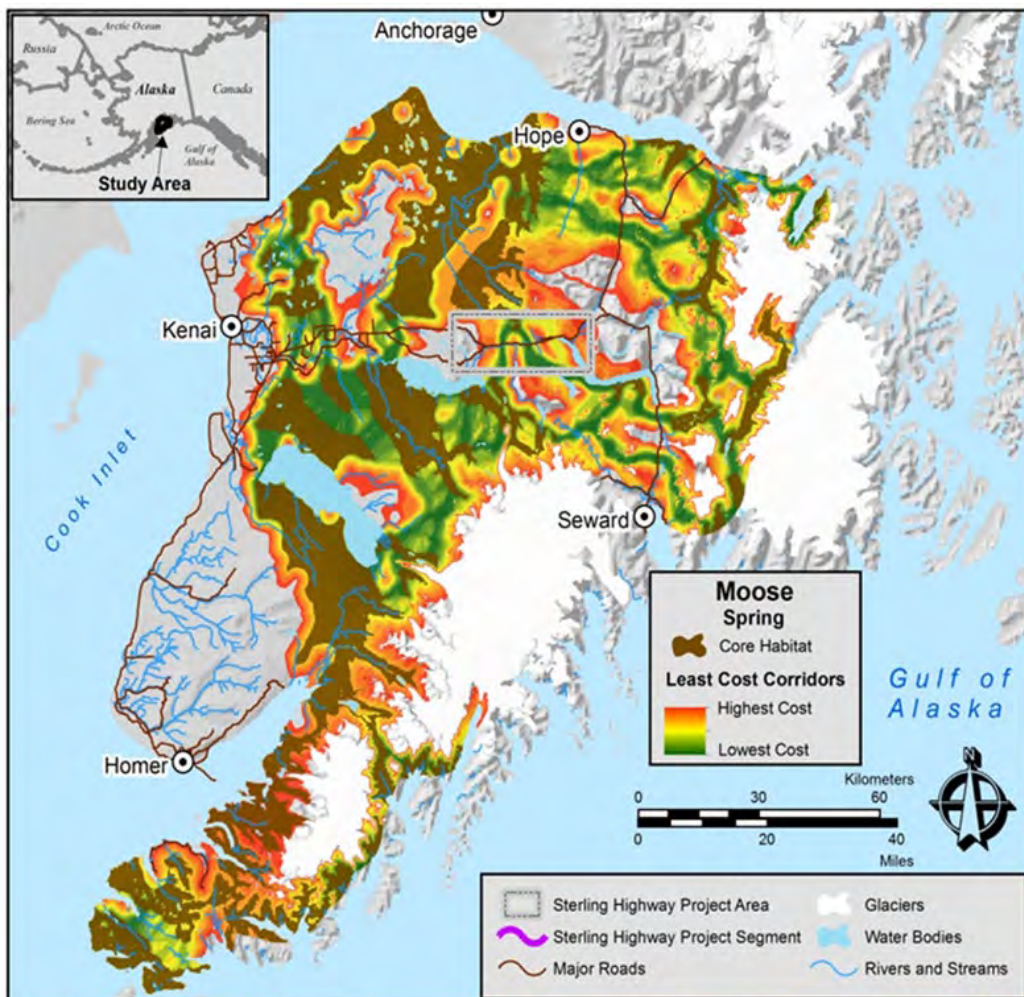
- Reduce Congestion
- Meet Current Highway Standards
- Improve Safety



# Approach

- Select focal species
- Landscape-scale wildlife movement corridors for focal species
- Prioritize corridors with high movement and high potential effects
- Develop alternatives for highest priority areas
- Solicit input on placement and design





# Habitat use and movement modeling

## Six Focal Species:

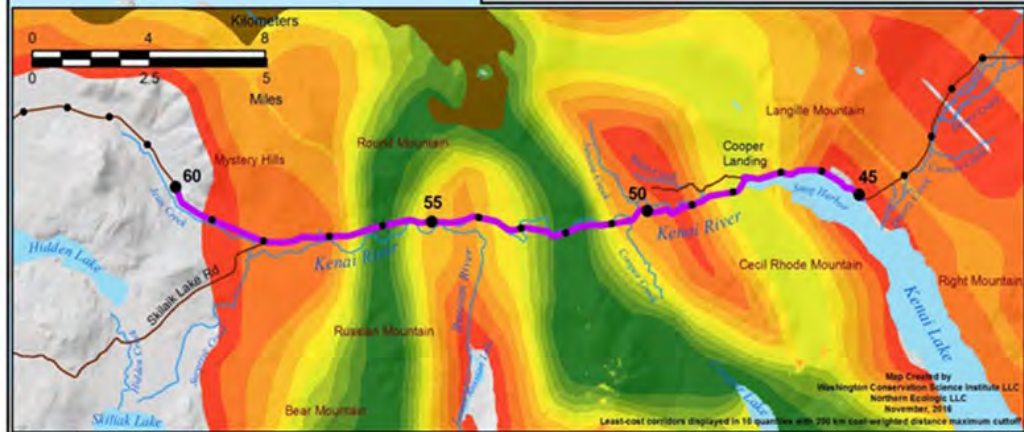
- Brown and Black Bear
- Moose
- Wolverine
- Dall Sheep
- Canada Lynx

## Model Inputs (availability varied by species):

- Resource selection functions, least cost corridors, and circuit theory
- Telemetry data
- Land cover
- Buildings, trails, and roads
- Anadromous streams
- Topography (slope, aspect, etc.).

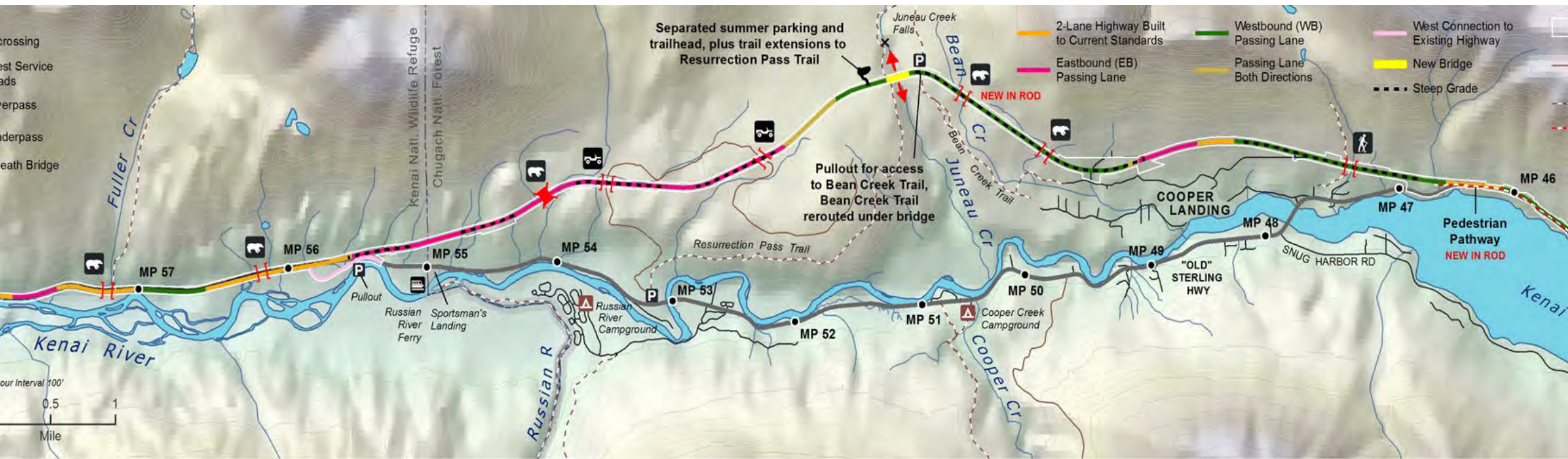
## Model Outputs:

- Habitat Quality
- Least Cost Corridors
- Pinch Points



# Final Supplemental EIS and ROD

- 4 undercrossings
- 1 wildlife bridge (first in Alaska)
- Long-span bridge
- Oversized culverts for hydrology to facilitate wildlife movement





# 02

## Wildlife Movement Study

# Purpose

- Refine final wildlife crossing locations
- Determine crossing-specific fencing needs
- Future development and recreation conflicts
- Monitor wildlife use before and during construction
- Develop performance standards



# Methods

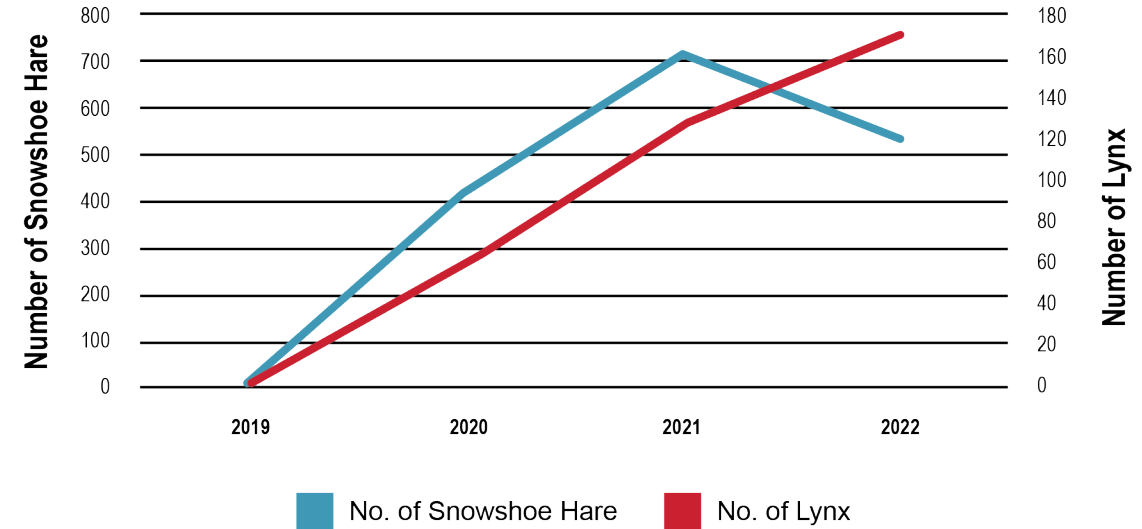
- 44 camera traps at six crossing areas
- Sets of paired cameras north and south of alignment
- Placed along well-established game trails
- Document tracks during winter



# Results

- Three full years of data collected
- Species using each crossing area
- Crossing potential
- Major game trails
- Impact of construction
- Species-prey dynamics

### Snowshoe Hare and Lynx Sightings by Year







# 03

## Agency Coordination and Crossing Design

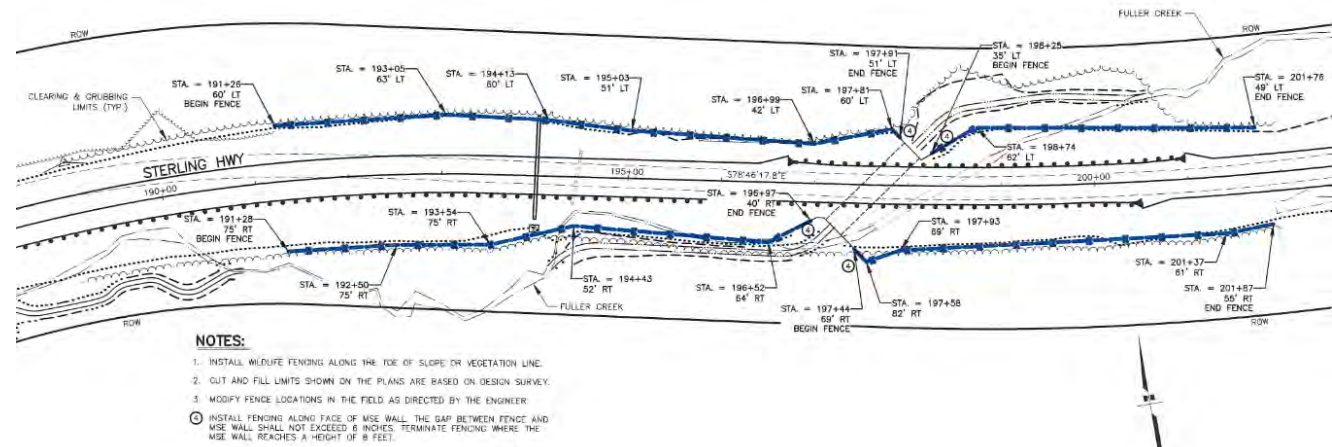
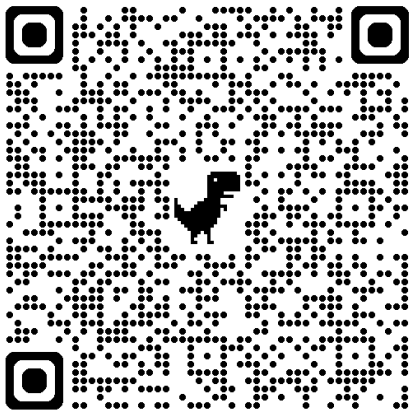
# Agency Coordination

- Working Groups
- Site Visits
- ArcGIS Online webmap
- Lessons Learned



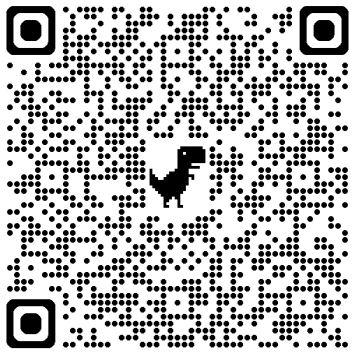
# Fuller Creek Undercrossing

- Bears and smaller wildlife
- Must accommodate Fuller Creek
- Fencing site visit
- 10' x 22' opening
- MSE headwalls
- Potential hiking and sportfishing conflicts



# MP 56.3 Undercrossing

- High use bear corridor
- Reduce impacts to important Kenai River wetlands and side channels
- Accommodates a small stream
- Approx. 11' x 21' opening
- Additional fencing along Kenai River
- Documented brown bear use in first spring



# Takeaways



Statewide approach better if hotspots are unknown or poorly studied



Corridor or project specific projects if there is a good amount of data or known hotspots

- Being opportunistic and incorporating them into existing projects, when feasible



Important to identify stakeholders and provide opportunity for input in either approach



Strong political support because these studies tie back to public safety



Potential funding opportunities, federal and state level