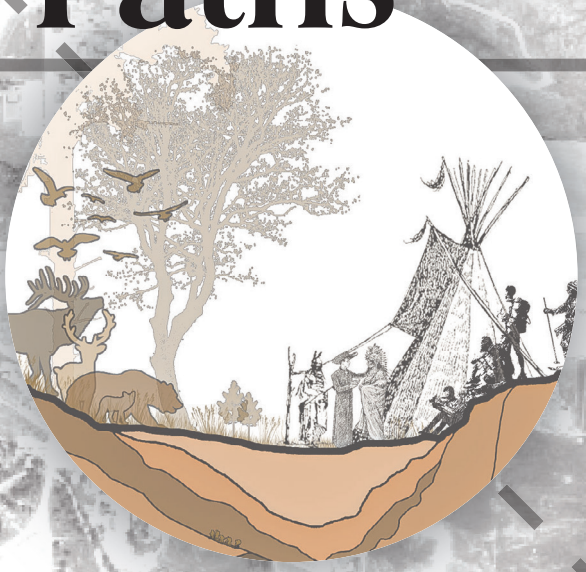
Benjamin Smail North Dakota State University MLA 2023

Crossing Paths

Landscape Planning for Human-Wildlife Balance



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Flathead Indian Reservation, NW Montana

Crossing Paths

Landscape Planning for Human-Wildlife Balance

A Design Thesis Submitted to the Department of Landscape Architecture of North Dakota State University

By

Benjamin J. Smail

In Partial Fulfillment of the Requirements for the Degree of Master of Landscape Architecture

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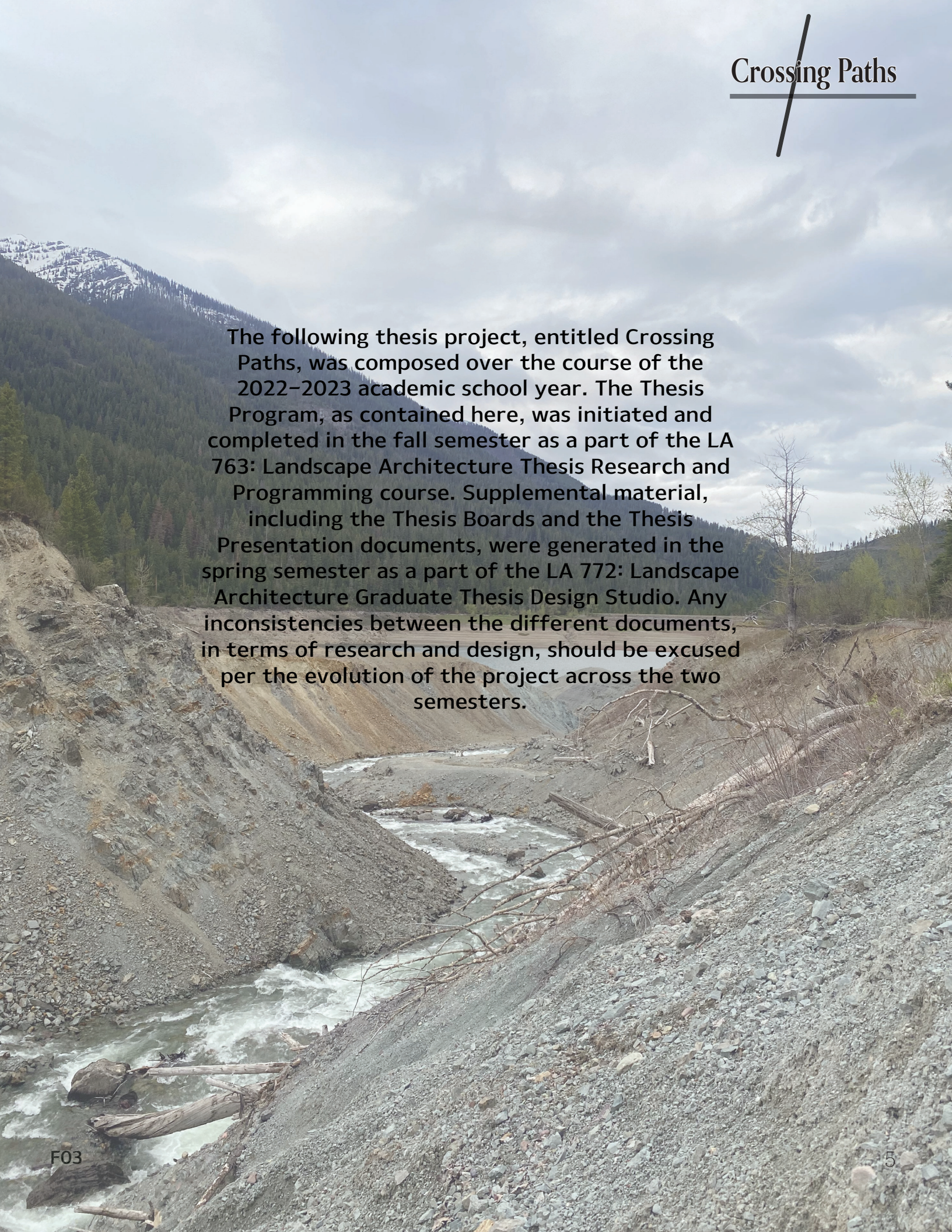

The following thesis project, entitled Crossing Paths, was composed over the course of the 2022-2023 academic school year. The Thesis Program, as contained here, was initiated and completed in the fall semester as a part of the LA 763: Landscape Architecture Thesis Research and Programming course. Supplemental material, including the Thesis Boards and the Thesis Presentation documents, were generated in the spring semester as a part of the LA 772: Landscape Architecture Graduate Thesis Design Studio. Any inconsistencies between the different documents, in terms of research and design, should be excused per the evolution of the project across the two semesters.

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Thesis Abstract

Design methods to reconnect the Salish and Kootenai people, as well as those permitted to visit, to their ancestral lands and historical/cultural sites as well as the safe and efficient movement of native animal species throughout the valley is the goal of this research. Constraints will first be identified in understanding how this reconnection works with the hurdles of current and future urban development, private property, watersheds (historical and current), agriculture, and historical landmarks. Next, typological studies of other efforts in wildlife mobility will be compared with current funding opportunities and their preferences in a 'program matrix'. This program matrix will help stratify the concerns of the research to key in on the most 'important' program elements. Perhaps most importantly, studying the historical trends of documented animal movement throughout the valley, as it responds to the effects of human development, will help identify where key corridors should be implemented. How those corridors relate to the connections desired by people living in the valley, such as tribal lands, cultural/historical sites, and recreation/wilderness areas will be of secondary importance. Lastly, local tribal, state and federal laws will need to be understood in order to identify what land could potentially be acquired and what laws could prohibit such development or what laws might encourage it. With the completion of this research, the alignment of natural corridors shared by both human and native floura/fauna will be mapped. Future projects such as parks, native habitat, residential and commercial development, cultural centers, historical landmarks, family agriculture, and roadway access will be incentivized through design within these corridors. Additionally, the environmental management and operation of these lands would be granted to the Confederated Salish and Katoonai Tribes (CSKT) as they continue to prove their adept ability to manage existing reclaimed lands in the valley.

Thesis Narrative

The settlement of the Mission Valley in the years leading up to the Hellgate Treaty of 1855 set the stage for contested land between the Salish and Katoonai tribes, the US government, and the native floura and fauna. Additionally, water has changed course, animals have gone regionally extinct, critical habitat has been lost, and a native way of life that depends on unrestricted access to the valley land and adjacent mission mountains is near eradication.

Shortly after the Flathead Reservation was established by the Hellgate Treaty of 1855, allotment and redlining of the valley gave access to non-natives to move in and begin development. As a result, small acre family farms and unchecked mining and development went up quickly. The American grid system was adopted for developing new roadway systems.

Many of the large mammals of the Mission Valley historically have moved east and west across the valley from the Flathead river and into the Mission Mountains in pursuit of the many natural resources the valley provides. The Salish and Katoonai people depended on these natural resources just as much. Fishing, hunting, and gathering that often involved travel over long distances through harsh landscape kept these indigenous people sustained for thousands of years. Currently there is no easy way for the people of the Flathead Reservation to access either tribal or public lands. No trails exist except for those within the confines of the few small towns dotted along highway 93, or the minimally maintained backcountry trails of the Mission Mountains.

A severely fragmented valley has cut off this historic mode of travel and seasonal migration for many of the native species of the valley. This hasn't stopped species from making the treacherous journey across farmland, through communities, over fences, and across state highway 93. Some species such as bear have been making themselves comfortable in settled areas feeding on garbage, crops, and even livestock and leading to an increase in potentially harmful human-animal conflicts.

Project Typology

• Ecological Design •

• Reclamation •

• Hydrology •

• Constraint Based Planning •

• Motorway Planning •

• Trail Systems •

Typological Case Study

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Project Typology

- Wildlife Corridors
- Geographical Information Systems (GIS)
- Transportation

Context

The New Mexico Wildlife Corridors Action Plan offers many proposals for strengthening wildlife communication across New Mexico roads. All of these initiatives are regarded as wildlife mitigation strategies. Construction of wildlife passageways, highway exclusion fences, animal escape ramps from enclosed areas, cattle guards and other in-road deterrents, driver warning systems that detect the animals and warn drivers of the danger of wildlife on the road, wildlife crosswalks, and changeable message boards that warn drivers of potential dangers of wildlife on the road are some of these measures.

Big game must be able to move freely throughout the landscape at critical times of the year to seek nourishing food, in order to survive the different seasonal conditions present throughout the West. Recent advances in GIS have made it possible to identify the precise routes taken by animals during these migratory movements, as well as to calculate how much time they spend in stopover habitats—locations along the route key in the procurement of food.

Additionally, studies have shown that human growth can skew ungulate migration patterns. Big-game habitat is being lost as a

Migration Corridors: Connecting Wildlife and People of New Mexico

result of subdivisions, fences, roads, and energy development, which also makes it difficult for these animals to move between the seasonal habitats on which they depend.

Contribution to Thesis

The NM Wildlife Corridors Action Plan document offers an in depth look at research methodology with the use of GIS to map animal movement patterns, collision data, and geographical constraints to the construction of wildlife corridors on all NMDOT roadways. This document will be studied closely when analyzing gathered GIS data for the Mission Valley.

Conclusion

The first state-wide corridors migration act was signed into law by New Mexico Governor Michelle Lujan Grisham in 2019, and continues to be a precedent for future lawmaking in other states.

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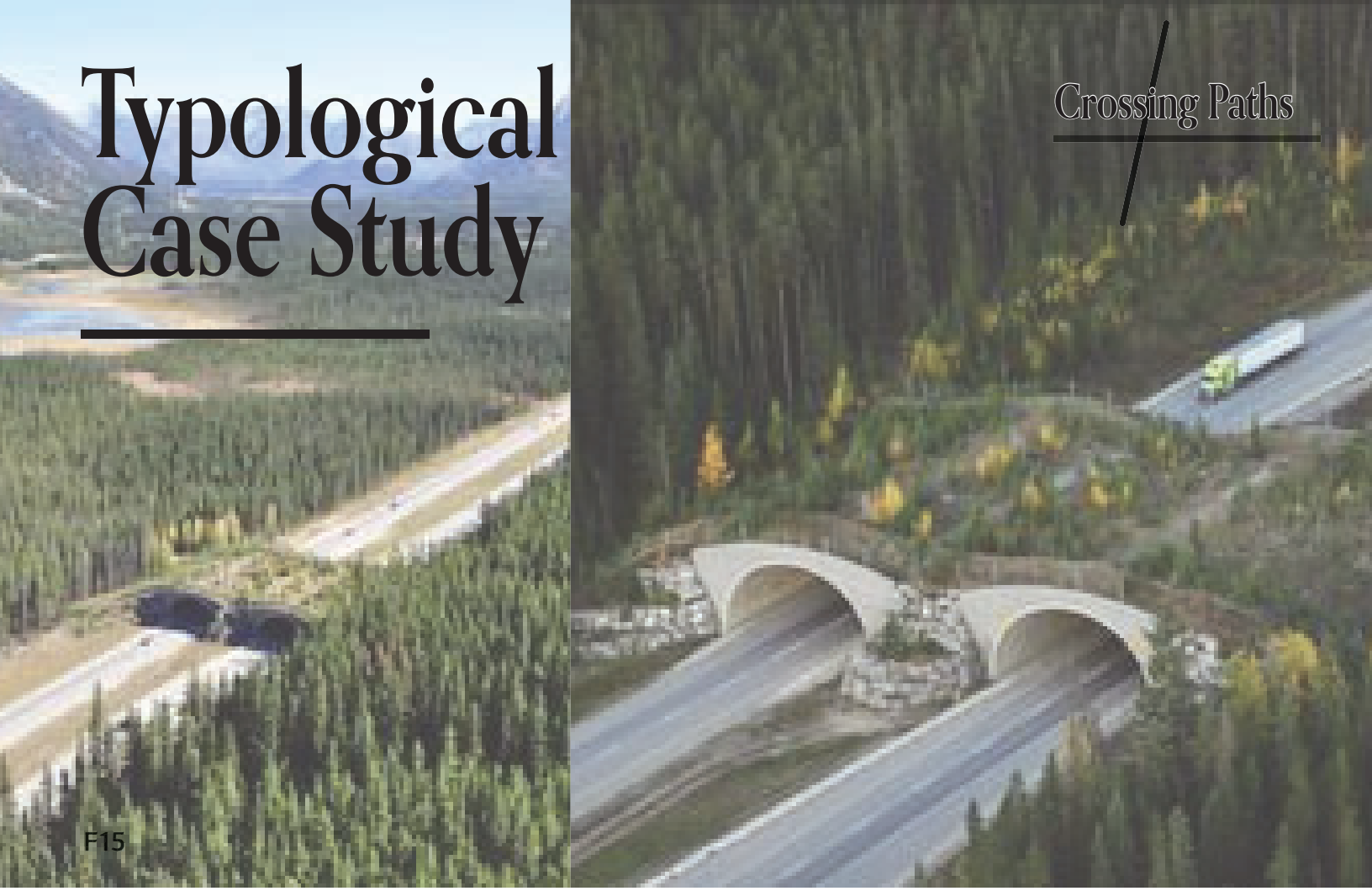
Typological Case Study



Project Typology

- Wildlife Corridors
- Geographical Information Systems (GIS)
- Transportation
- Heavy Civil Construction

Context

A wildlife corridor in Banff, Candada links key habitats and provides safe transit across perilous busy roadways. The initial learning curve animals have to overcome in order to start using these crossings was discovered by researchers based on Parks Canada's monitoring research and in partnership with other universities. Large species like grizzly bears, elk, and deer didn't feel safe enough to use the newly constructed crossings for up to 5 years.

Grizzly bears, elk, moose, and deer prefer high and wide crossings of shorter distances, while black bears and cougars prefer lengthy, low, and narrow crossings, according to research. Certain animals also showed distinct preferences for certain types of wildlife corridors.

Contribution to Thesis

The key importance of this project to the thesis is the post-construction operation data that has been accumulated (Anthony P Clevenger). Strategies in making the bridge crossable for a wide range of species and what has been learned by the longtime operation of this project will help inform design decisions at key roadway crossings.

Migration Corridors:

A Freeway system for local animals

Conclusion

With data spanning 25 years, the bridges' effectiveness has been demonstrated (Anthony P Clevenger). Crossings have decreased interior collisions between wildlife and vehicles by more than 80%. Large carnivore mortality rates are 50–100% lower along highway segments with overpasses and underpasses present. Elk death rates in those same areas are essentially negligible, as opposed to 100 elk-vehicle incidents annually in the mid-1990s. According to Clevenger's research, 11 species of large mammals have visited the buildings in Banff more than 200,000 times. Unexpected species that have visited the structures include red foxes, hoary marmots, boreal toads, wolverines, lynx, garter snakes, and beavers. A 2014 study from Montana State University revealed that the structures are not only used by grizzly bears but also aid in the maintenance of bear populations that are genetically healthy.

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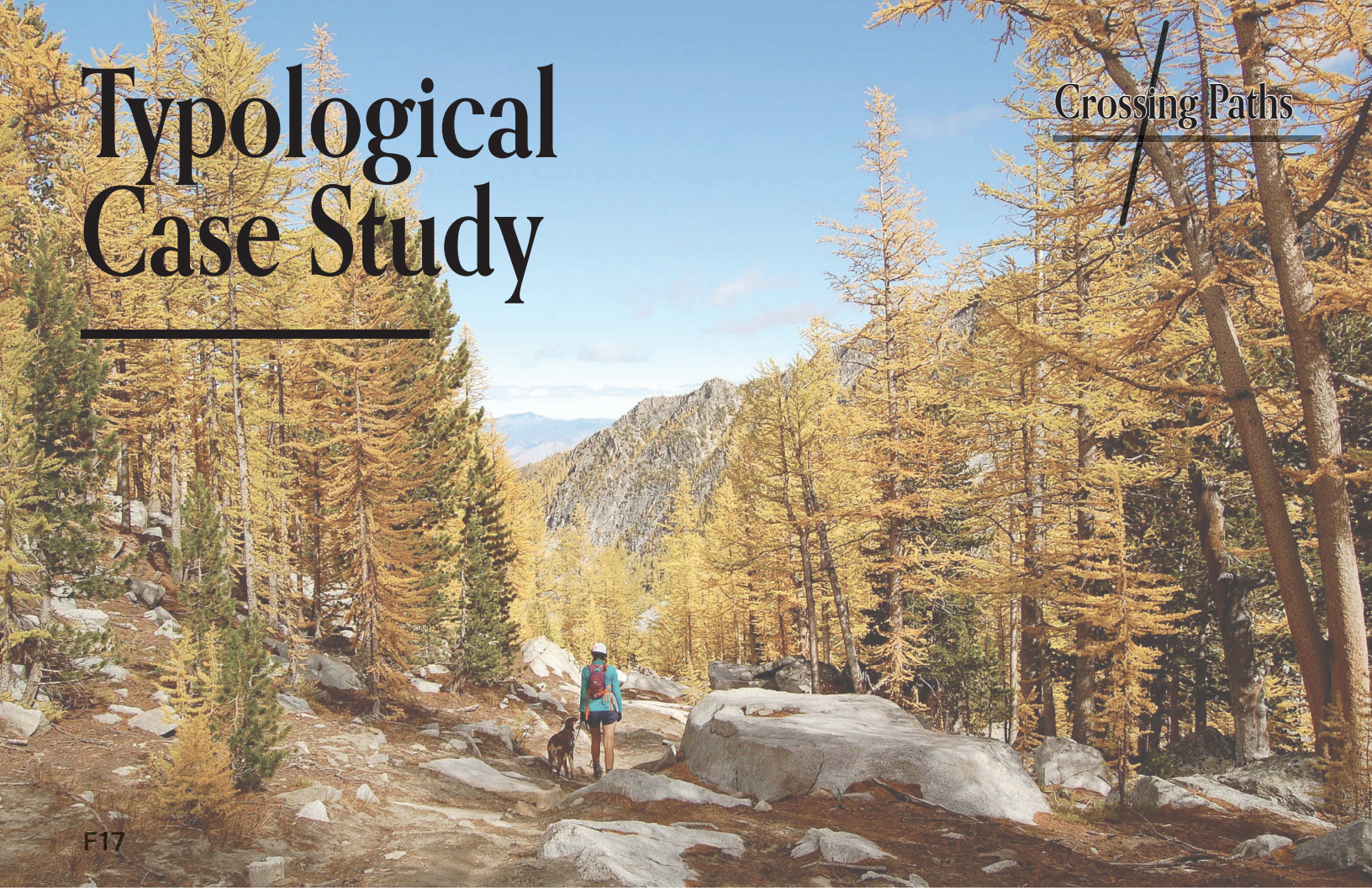
Typological Case Study



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Project Typology

- Non-Motorized Trails
- Community Engaged Design
- Outdoor Recreation
- Urban-Rural Planning

Context

The Greater Libby Area Trails Plan, also known as the Trails Plan, aims to provide a description of recreational opportunities associated with the development and use of trails in and around the City of Libby, Montana. The areas listed in the Trails Plan were chosen based on information gathered from community members and current trail development activity. The trail system serves as a foundation for a stronger economic base in outdoor recreation. A user preference survey was done using popular trail finding apps. This ongoing survey serves as the feedback loop for trail design and future trail improvments.

Contribution to Thesis

This project serves as a great example of how trail projects can be designed to serve the goal of economic growth and community health. Research methodology in surveys and community engagement are outlined in the plan document. Methodology and graphics of trail planning and alignment are also included. Many of the different governement, state, and local agencies involved in this project are outlined and may be shared with this thesis project due to its close proximity.

Greater Libby Area Conceptual Trails Plan

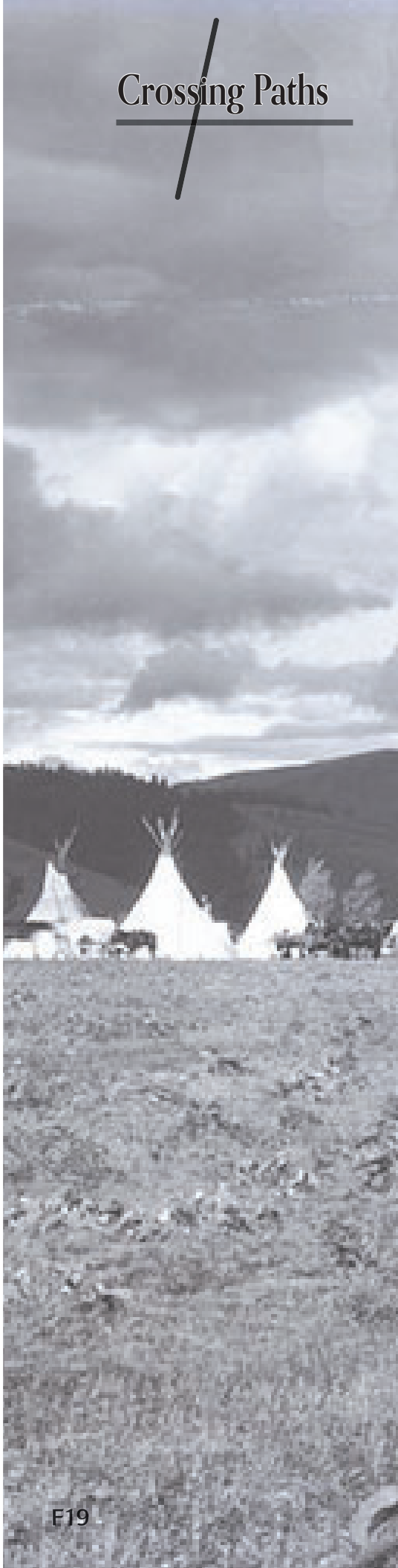
Conclusion

Recreational tourism holds great promise for Libby. This is because of its natural setting as well as the people and organizations that work to make their community better. During the project's research phase, those who were interviewed offered numerous suggestions and descriptions for how Libby's recreational facilities could be improved. These concepts, outlined in the plan document, contribute to Libby's future as a popular recreation destination.

Project Justification

The most dangerous stretch of roadway in Montana for wildlife-vehicle collisions is on U.S. Highway 93 on the northwest side of Flathead Lake, a recent study recorded 357 carcasses on a 10-mile stretch of highway during the fall months between 2010 and 2015. Montana drivers have a one in 58 chance of hitting a deer, elk, or moose in 2016, which represents a 9.1 percent rise over the previous year. They did this by analyzing over 37,000 carcasses gathered on the state's roads over the course of those five years. There is no doubt that the journey animals make across the valley is becoming more dangerous for drivers and animals alike.

The connection of the people of the Flathead Reservation throughout the public and tribal lands of Mission Valley is culturally significant. For many thousands of years, the Salish and Katoonai people thrived in a delicate balance with the valley and its natural resources. While there are no groups of people depending on the area's natural resources today, the significance of people having easy access to the lands of their heritage is great. There is a dark history of the fencing out of the indiginous people from land belonging to them. The Mission Valley has many beautiful public lands and the people would benefit in many ways to have ease of access to these landscapes through trail connections. Currently, no pedestrian trails other than primitive backcountry trails exist. There are a handful of historic and cultural sites throughout the valley that help tell the story of the Flathead people. The importance of these events and historical sites to people of the Mission Valley justifies a redesign of how these places are accessed and experienced.



Project Emphasis

“Integration of sustainable, natural, and scalable strategies in wildlife corridor and crossing design.”

Not every corridor will be created equal. Each will be meant to serve the needs of the species that have been consistently documented in the area. Corridors will not battle the environment but rather coexist with the unique sense of place of the Mission Valley.

“Embrace and protect the cultural resources of the land and build up an entire community/culture/race.”

The environmental wisdom and spirituality of the Flathead people has been demonstrated throughout history. The balance struck with the people and the land before the mass settlement of the valley will be mimicked in new corridor/trail development.

“Incentivizing placemaking through an interconnected mobility network.”

A community connected is a community worth investing in. Opportunities for public spaces, wilderness preserves, small business ventures (such as family farm operations), recreation, and residential development will be incentivized.

Major Project Elements

Designed riperian systems along stream sheds, seasonal snowmelt streams, and pothole prairie habitat may be required. Design decisions that serve for the protection, rehabilitation, and education of the valleys historic agriculural channels and reservoirs.

Wildlife corridors through a wide range of land use including agricultural, residential, industrial and commercial. Wildlife corridors will be designed to mend the fragmentation of the valley and allow animals to more easily adapt to the rapidly changing ecosystem they exist in.

Improvements to the safety and experience of drivers on roadways in the valley. Landbridges and tunnels for pedestrians and/or wildlife. Realignment of key minor roadways as the community shifts away from an agricultural past and towards a more diverse economy with a growing population and density.

Foot trails to connect residents of the valley to the various wild life refuges, recreation areas, and wilderness preserves. Trails and other accessibility elements to cultural resources and tribal lands. Opportunities for vistas, interpretive signage, campgrounds, public facitlities, and safety infrastructure along trails.

User Descriptions

Non-Tribal Members
The diverse groups of urban and rural residents of the Mission Valley. People seeking recreation, breathtaking views, wildlife, or access to natural resources.

Tribal Members
The accessibiliity and protection of tribal only lands, cultural resources, and concerns of the CSKT will be specially considered.

Native Floura+Fauna Species
Migratory mammal species, birds, amphibians and reptiles all depend on the diverse landscape of the Mission Valley/Mountains and will be considered.

Key Floura+Fauna Species
Key species currently managed by the CSKT such as grizzly bears, the non-native american bison, and several migratory waterfowl species will be specially considered.

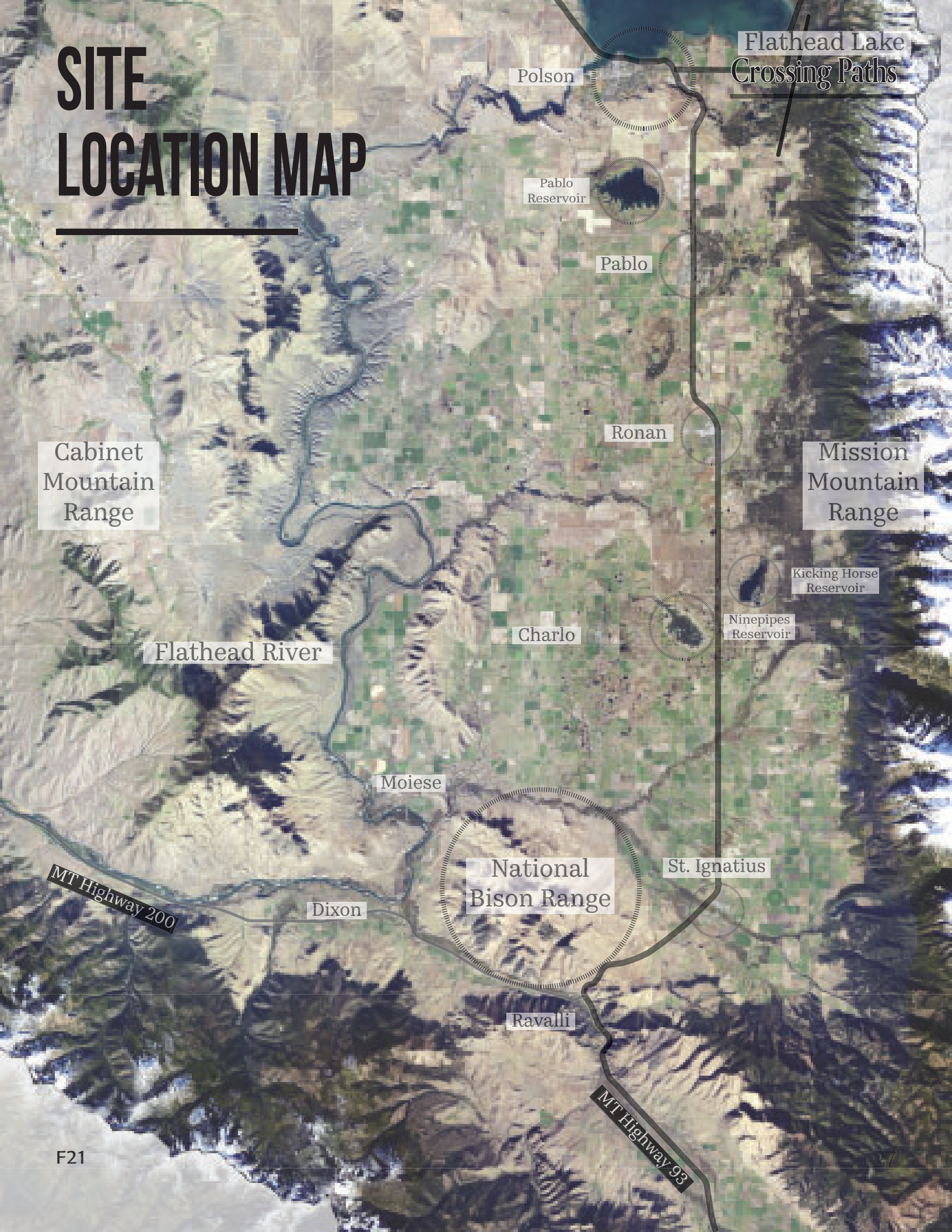

Snyelmn Mq̓ʷmoq̓ʷs
MISSION MTN RANGE

Site Location

The Flathead Reservation

Located about 30 miles north of Missoula, Montana along state highway 93 is the Flathead Reservation. Locally governed by the Confederated Salish and Kootenai Tribes (CSKT), the reservation is 1,938 square miles of land set aside for native peoples in 1855 by the Treaty of Hellgate. There are currently 26 'places' recognized by the Census Bureau, 8 of which are a majority Flathead. After the allotment at the turn of the 20th century, white settlers gained ownership of about 1/2 of, the most fertile, land in the reservation. Over the last two decades since the turn of the century, the CSKT has been buying back many of its lands. The Flathead nations now own about 2/3 of the land on the Flathead Reservation.

SITE LOCATION MAP



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Site Location (Continued)

The People of the Flathead Reservation

The 6,800 modern members of several Salish, Kootenai, and Pend O'Reilles bands that once resided in western Montana, northern Idaho, and eastern Washington in the early 1800s make up the Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation. On the Flathead Reservation, there are approximately 4,000 tribal members, approximately 1,100 Indians from other tribes, and possibly three times as many non-Indians.

The tribal people hunted and collected plants throughout the northwewst, prior to the arrival of Europeans. Tribes worked together twice a year to cross the Continental Divide to hunt the Great Plains buffalo herds. Eventually bringing them back for domestication and later becoming the National Bison Range.

The tribal people gave up their claim to western Montana and northern Idaho in 1855, but they kept their homeland in the Bitterroot Valley. Within a generation, the white government relocated them to the Flathead Reservation, a new homeland located approximately 100 miles northwest in the Lower Flathead River Basin. The white government divided the land among the Indians within another generation and sold the unallocated land—generally the most fertile portions of the valley—to non-Indians as "surplus" land.

The Salish and Kootenai have adapted to a way of life based on ranching, logging, and general wage work after being forced to give up a lot of their land when the reservation was opened to white settlers in 1910. Many of the old methods for making and decorating ceremonial items and clothing have survived. The Salish language is barely survived by a handful of elders.

Members of the tribe have worked to regain economic independence and control over tribal affairs. The Confederated Salish and Kootenai Tribes of the Flathead Indian Reservation (CSKT) was the formal name given to the tribes in 1936. A ten-member tribal council was elected.

As tribal members return to the reservation with professional training in education, business management, psychology, and health sciences, the Tribes' future looks increasingly promising. Many of these young people have combined their desire to serve the tribal community with their technical knowledge acquired off the reservation.

The Salish and Kootenai people are extremely proud of their culture and the land they live on. They continue to work to build the reservation community, uphold the values that will allow them to survive into the 21st century, and maintain their independence.

Project Objectives

Decrease Human-Wildlife Conflicts

More oportunities for migratory animals and adventure seeking humans to safely cross motorways, especially MT state highway 93, will be planned. Limiting dangerous conflicts between human and animals in non-wilderness areas is of high priority.

Streamshed Restoration

Restoration efforts to fulfill this objective include encouraging stream meandering, canopy desnification, and the reintroduction of lost plant species. Creating dense enough habitiat that animal species will feel comfortable using it is key.

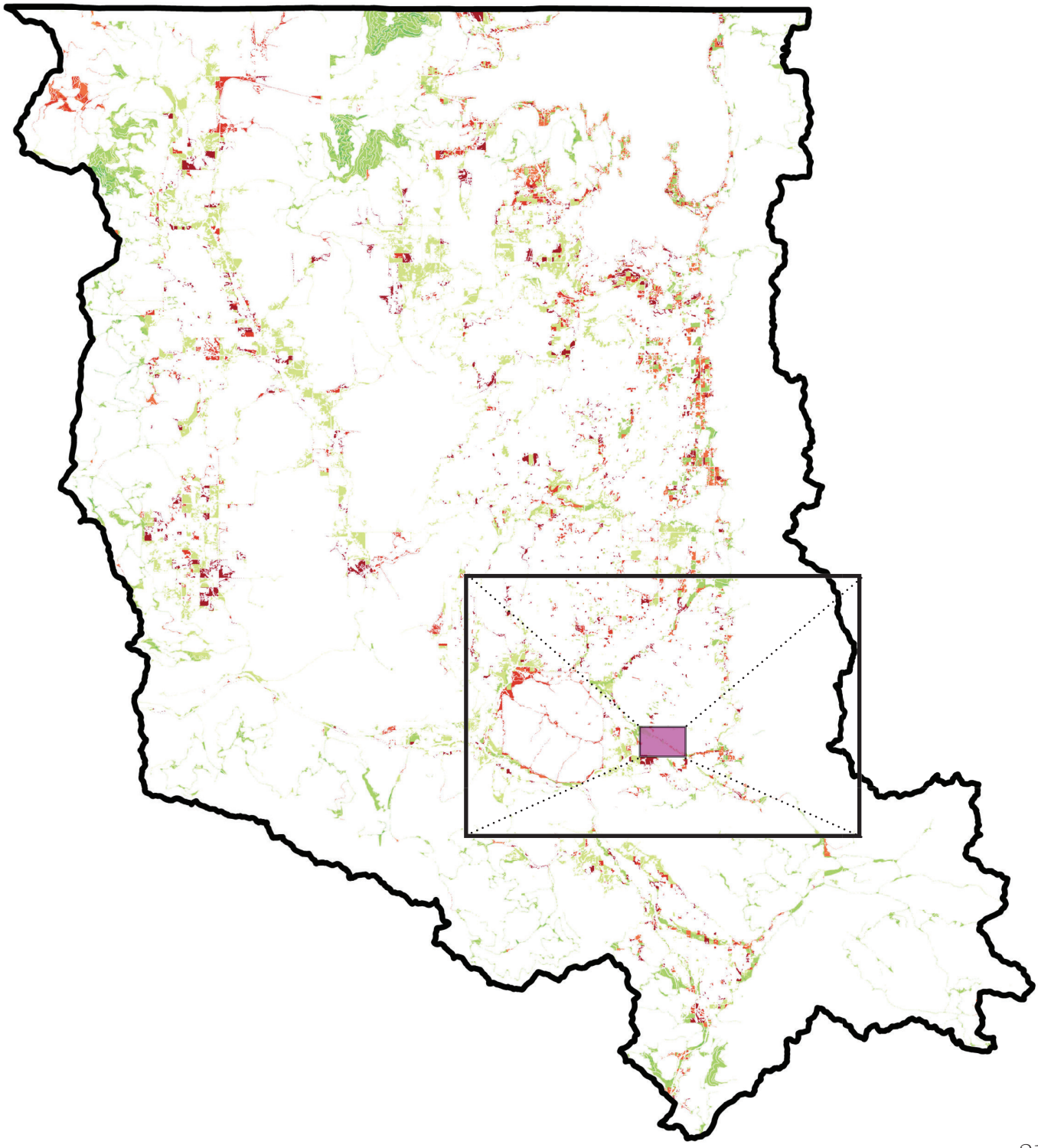
Community Identity

Opportunities to create a stronger representation of community values within the fabric of the built environment will be embraced. The rich history found in the geography of the land and the people that walked them have stories worth sharing.

Credit: Missoulian

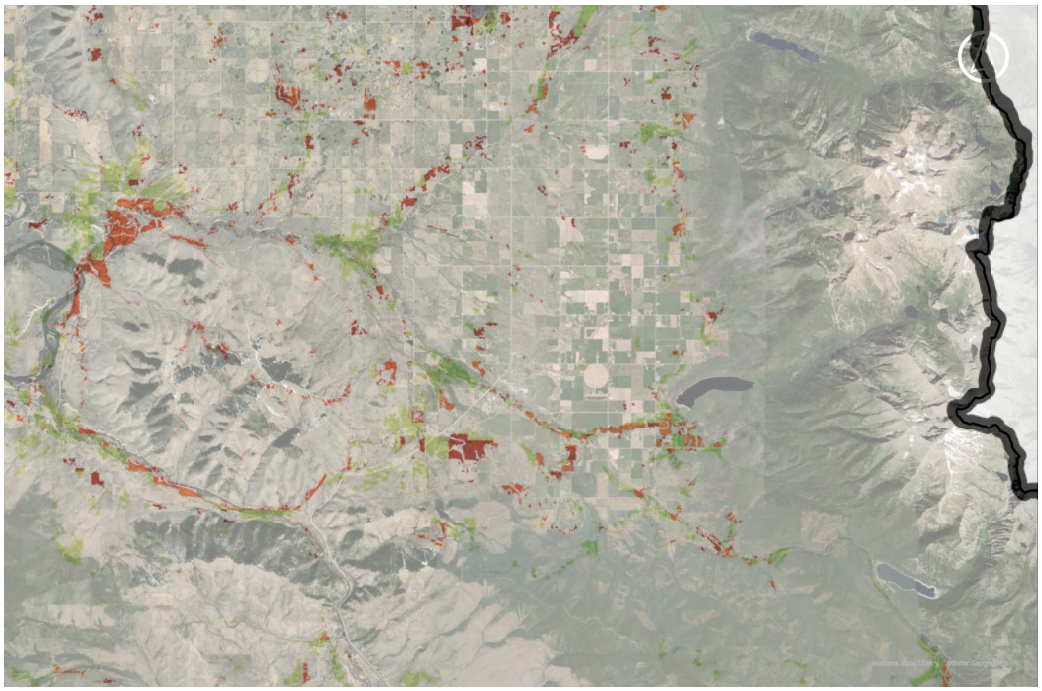
Research

Corridor Suitability



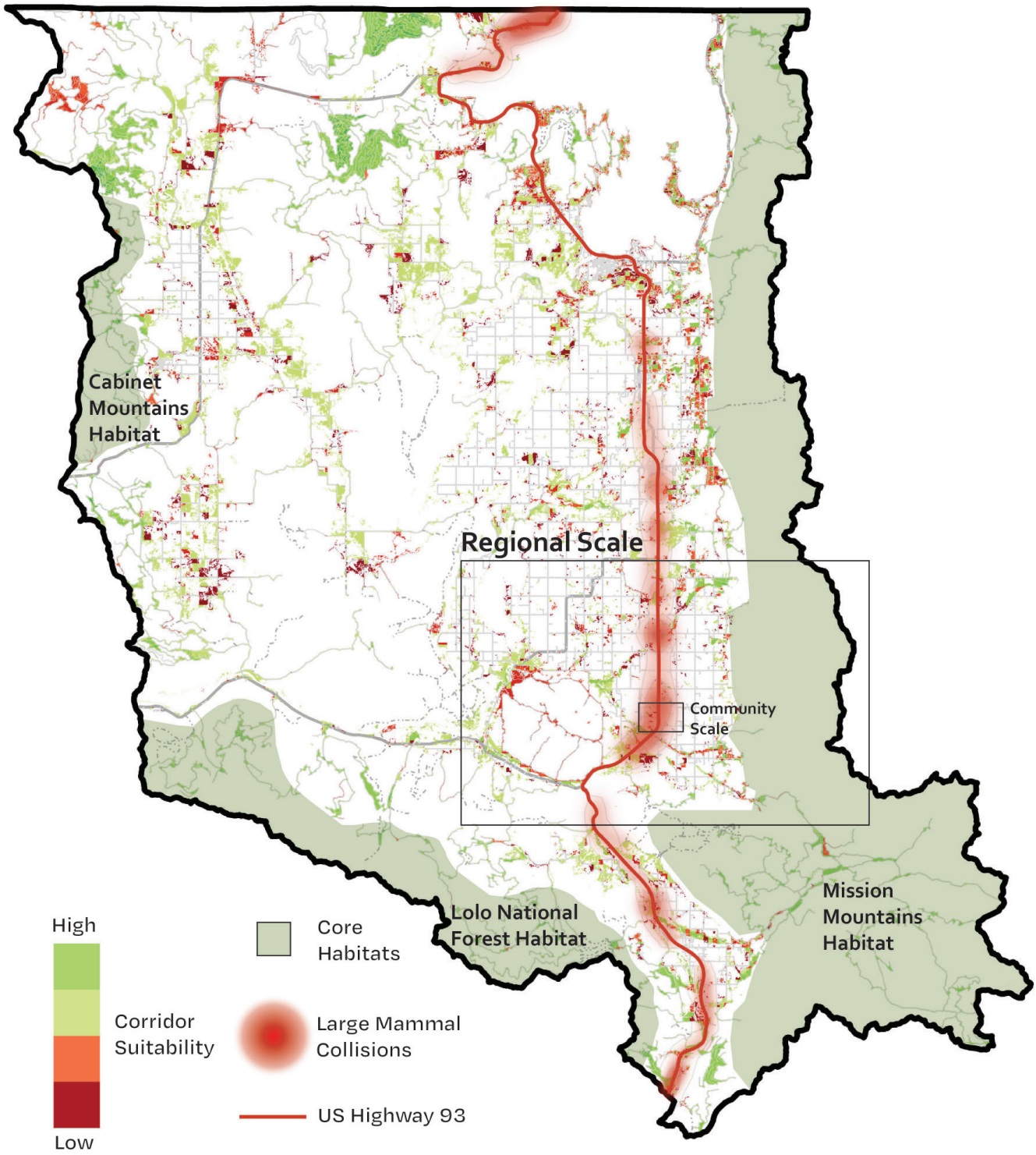
Site Selection

St. Ignatius, Mission



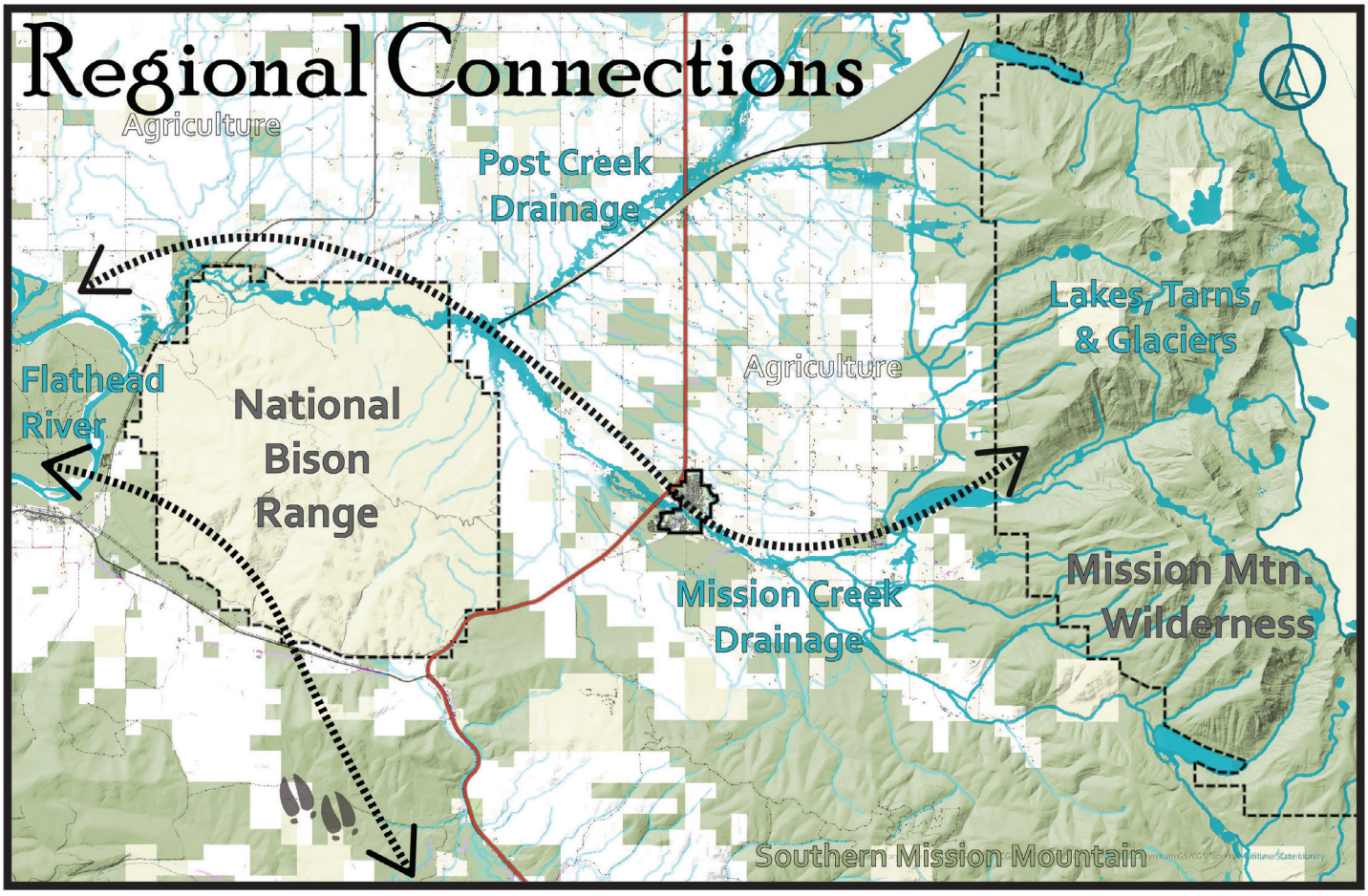
A Fragmented Valley

Research Results



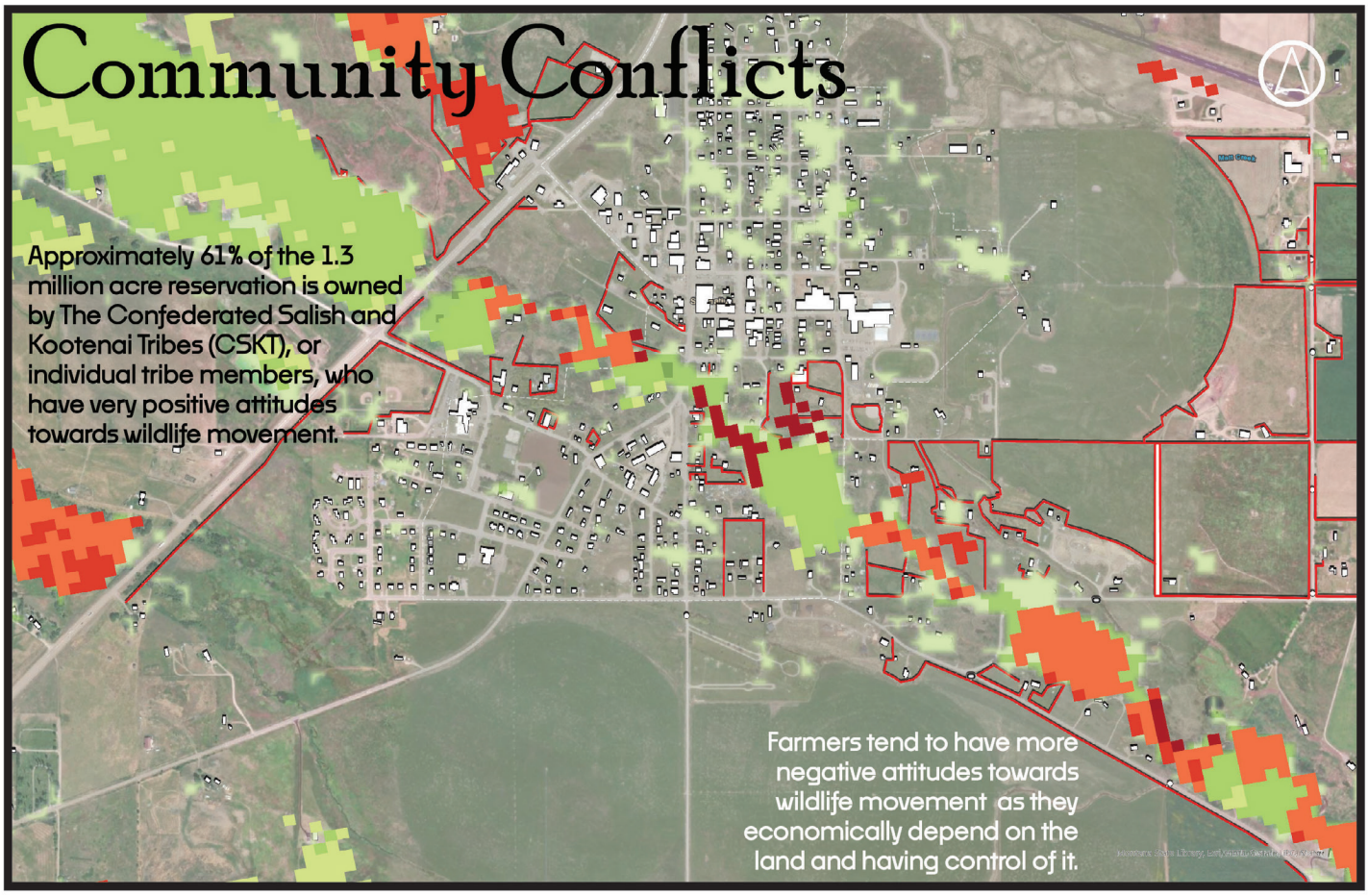
Regional Scale

Site Selection



Community Scale

Site Selection



Corridor Suitability Study

Low High

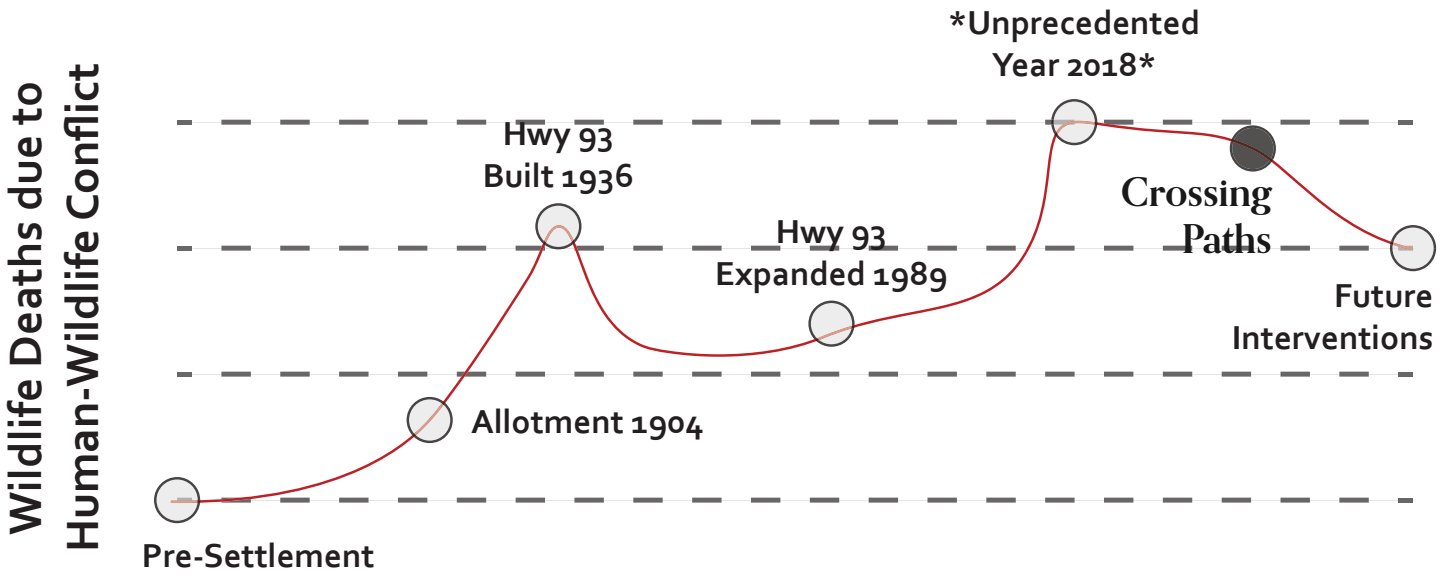
Existing Fencing

Building Footprints

Landscape Judgement

How

How do past interventions (existing crossings on Hwy 93) compare to the pre-settlement conditions, how does this change over time? How do the existing conditions (pre-settlement) compare to the limits of design intervention? Furthermore, how can cummulative benefits be seen in the future from continued interventions?



Findings

By recognizing the mistakes of past actions in the Mission Valley, we have moved towards a more responsible approach to city planning and land stewardship. The construction of a wildlife corridor and overpass structure is a prime example of how we are learning from our past mistakes and taking proactive steps to promote responsible development practices that prioritize the protection of natural habitats and wildlife. By setting this precedent, we can continue to move in a positive direction towards a healthier and more sustainable future for the Mission Creek Corridor and the Mission Valley ecosystem as a whole.

Landscape Performance

Objective 1: Decrease Instances of Human-Wildlife Conflict

The construction of a wildlife corridor and overpass structure through the heart of St. Ignatius along the Mission Creek could effectively reduce human and wildlife conflicts in the area. By providing a safe and designated path for wildlife to cross over the busy highway and through the town core, the corridor and overpass structure could reduce the risk of vehicle collisions with large animals such as undulates, grizzly bears, and wolves, which could cause injury or fatalities to both humans and animals. Safety is also increased with the inclusion of wildlife monitoring techniques. This improved safety for both humans and wildlife and fostered coexistence between the two populations.

Objective 2: Improve Riperian Habitat Connectability and Health

Objective two was met by implementing a comprehensive plan to reclaim and remediate degraded areas within the approximately 1,400-acre study area. Specifically, 178 acres of riparian corridor were reclaimed, 35 acres of contaminated land were remediated, and there were increases in forested corridors, wetland pothole prairies, and dry prairies by 29%, 34%, and 3%, respectively. These efforts helped to restore and preserve the natural habitats of the Mission Mountains and promote a healthy and sustainable ecosystem.

Objective 3: Enhance the Public's Access to Experience the Native Landscape

Objective three was met by expanding recreational opportunities in the area. This was achieved through the creation of a 0.5-mile wildlife-monitored nature trail, a 3.75-mile trail spur connecting to the Mission Reservoir, and an additional 45 miles of wilderness trails. Furthermore, there was a 10% increase in programmable public space, offering more opportunities for outdoor recreation and community engagement. These improvements helped to promote appreciation and understanding of the natural environment and wildlife in the Mission Mountains while providing increased access to recreational activities for locals and visitors alike.

A Plan for Dissemination

Community Engagement

Using ESRI's storymap feature, the design intent and ideas can be spread easily with a QR code for engagement.

Engagement with the CSKT environmental managment office, forestry office, and the Salish & Kootenai College is important.

Dissemination through community events.

A presentation to the Tribal Council.

Potential Funding Sources

a) Confederated Salish and Kootenai Tribes
b) Montana DOT
c) Tribal Grants
d) Montana Conservation Corps
e) EPA Superfund Sites

Project Reflections

It is important to acknowledge that there is always more that can be done. One area of potential improvement is the design of the overpass bridge itself, particularly with regards to reducing the amount of concrete used in its construction. By exploring alternative materials and design approaches, we can potentially reduce the environmental impact of construction projects while still meeting their functional requirements. Another area of improvement in the design would be the phasing required in land acquisition, as well as the stages that a recovering forest system would go through. As learned in the case studies, animals can take many years to adjust to a new crossing structure and be comfortable using it. It was found that large mammals can take up to 5 years to adjust, while medium mammals take up to 3 years, and small mammals less than a year. A useful research study to the project would also be how animals would be able to adjust to the new native environment and what Landscape Architecture could do to shorten those times.

I learned a lot about large scale planning and GIS analysis in the completion of this project. I felt that I had a tough time getting from the large Reservation Scale to the Site Design Scale. There were several key decisions made when zooming in to the site location that I found difficult to make. Making these decisions more confidently as to not waste time is something I will take with me for the future. However, I discovered I love projects at this scale. Furthermore, I learned the importance of site research and analysis at the contextual scale. I

Resources Cited

Publications

Canadian Geographic
Wild Montana
Audobaun Society
Siftings | Jens Jensen

Websites

http://www.flatheadwatershed.org
http://www.missionvalleymuseums.org
https://wildmontana.org
https://csktribes.org
https://www.skc.edu
https://fwp.mt.gov/conservation/wildlife-management/wildlife-migration/history
https://flatheadbeacon.com/2020/09/28/matriarch-mission-valley/
https://www.montana.edu/news/15109/safe-passages
https://www.mtmemory.org/
https://www.anatomicallycorrect.org/jensjensenexhibition.htm
https://www.tclf.org/pioneer/jens-jensen

Databases

Montana Department of Transportation
NDSU Library
ESRI Open Source GIS Data
Lake County GIS
USDA Research Data Archive

Documents

Greater Libby Area Conceptual Trails Plan

New Mexico Wildlife Corridors Action Plan