A

Appendix A:

ALP - Master Plan

Reference Master Plan historical documents at the following:
https://bozemanairport.com/reports-and-statistics
The 2020 Master Plan and Addendum can be found approximately half way down the web page.

Appendix B:

Traffic Impact Study

APRIL 2025

PREPARED FOR:
MORRISON-MAIERLE
2880 TECHNOLOGY BLVD
BOZEMAN, MT 59718

PREPARED BY:
HYALITE ENGINEERS, PLLC
2304 N 7TH AVE. SUITE L
BOZEMAN, MT 59715
www.hyaliteeng.com

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT TARMAC TRAIL EXTENSION

TRAFFIC IMPACT STUDY

TABLE OF CONTENTS

LIST OF FIGURES

PURPOSE OF REPORT AND STUDY OBJECTIVES

This traffic impact study summarizes the potential impacts from the proposed Tarmac Trail Extension in Gallatin County, Montana. The content presented in this report is an analysis of the operational and safety conditions of the transportation system in the area, both under current conditions and potential future impacts. Study recommendations and the conclusions presented are intended to provide guidance to the function of the existing intersections, proposed intersections, and the transportation system as a whole.

PROPOSED PROJECT

- ### LOCATION

  The proposed Tarmac Trail Extension project is located in Gallatin County, Montana. The project is bordered by Bozeman Yellowstone International Airport, residential developments, and commercial businesses. Six intersections will be counted for this project:
  - Penwell Bridge Road and Dry Creek Road
  - Airport Road and Tower Road
  - Airport Road and Frontage Road
  - Dollar Drive and Frontage Road
  - Airport Road and Tubb Road
  - Jetway Drive and Tubb Road

  The study also analyzes three proposed intersections along the extension of Tarmac Trail; Frontage Road and Tarmac Trail, Airport Road and Tarmac Trail, and Tarmac Trail and Tubb Road. Figure 1 depicts the site location.

- ### PROJECT DESCRIPTION

  The Tarmac Trail Extension will add a new route on the eastern side of Bozeman Yellowstone International Airport. Sections of Airport Road, Tubb Road, and Baseline Road will be removed with the associated traffic diverted to Tarmac Trail. Figure 1 shows the locations of Tarmac Trail and the roads that will be removed from the project area. There are two projects included as a part of this study. The expansion of the Bozeman Yellowstone International Airport – Future Conditions and the Airport Commercial Major Subdivision; both projects will add traffic to the study area roads and intersections. The airport development will be evaluated utilizing existing traffic generated from the existing airport development at the northwest corner of Frontage Road and Airport Road. This expansion is estimated to increase the traffic for weekday AM peak hour trips by 128 and weekday PM peak hour trips by 141. The Airport Commercial Major Subdivision is proposed to consist of industrial park units. This development is estimated to increase the generated trips to a total of 2516 average weekday trips as well as 263 weekday AM and 263 weekday PM peak hour trips. Figure 2 (Airport Expansion) and Figure 3 (Airport Commercial Major Subdivision) show the proposed site layouts.

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 1

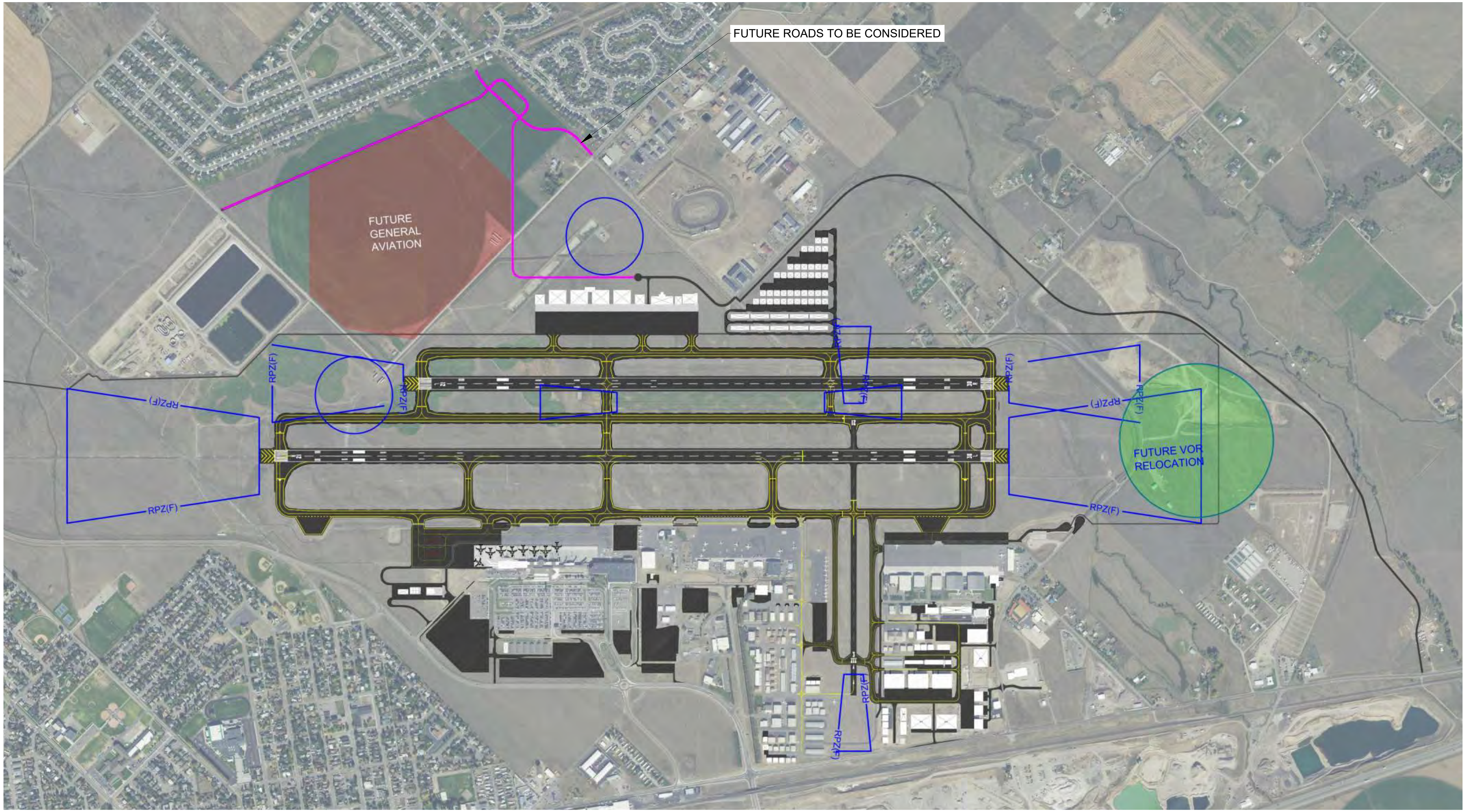
1 SITE LOCATION

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



2 BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT - FUTURE CONDITIONS

SCALE: NTS

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am

N

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 2

3 AIRPORT COMMERCIAL MAJOR SUBDIVISION

SCALE: NTS

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 3

- **DEVELOPMENT HORIZON**

  It is anticipated that the proposed Tarmac Trail Extension will be under design in 2025, following completion of the ongoing Environmental Assessment. For analysis purposes, it is assumed that the buildout year will be 2029 for the completion of this project. It is also assumed that full buildout for the included developments (Airport – Future Conditions and Airport Commercial Major Subdivision) will be 2044 with all projected trips being added to the transportation system at this time.

EXISTING AREA CONDITIONS

- **STUDY AREA**

  - **AREA OF INFLUENCE**

    The impacts to traffic from a development are largely due to its location and size. Traffic impact is also dependent on the characteristics of the surrounding traffic system. The impacts to adjacent traffic systems will generally be in a limited area around the development site. Discussions with review agencies about the study area produced concurrence that it is not anticipated the developments will have significant impacts to areas beyond the proposed intersections included in this study.

  - **STUDY AREA LAND USE**

    The undeveloped land adjacent to the Tarmac Trail Extension currently has no traffic generation. As stated previously, the proposed project is bordered by the Bozeman Yellowstone International Airport, residential developments, and commercial businesses.

- **SITE ACCESSIBILITY**

- TRANSPORTATION NETWORK

The study area for the Tarmac Trail Extension will focus on key intersections near the proposed site. This study includes the following roadways and intersections:

STUDY AREA ROADWAYS

- Penwell Bridge Road
- Dry Creek Road
- Airport Road
- Tower Road
- Frontage Road (S-205)
- Dollar Drive
- Tubb Road
- Jetway Drive
- Proposed Tarmac Trail

STUDY AREA INTERSECTIONS

- Penwell Bridge Road & Dry Creek Road
- Airport Road & Tower Road
- Airport Road & Frontage Road
- Dollar Drive & Frontage Road
- Airport Road & Tubb Road
- Jetway Drive & Tubb Road
- Tarmac Trail & Tubb Road
- Frontage Road & Tarmac Trail
- Airport Road & Tarmac Trail

- PENWELL BRIDGE ROAD

Penwell Bridge Road is a local road that is under the jurisdiction of the City of Belgrade. Presently, Penwell Bridge Road has two travel lanes in the study area. The posted speed limit in the study area is 45 miles per hour (mph).

- DRY CREEK ROAD

Dry Creek Road is under the jurisdiction of the Montana Department of Transportation (MDT) and is classified as a minor arterial. Presently, Dry Creek Road has two travel lanes in the study area and the posted speed limit is 55 mph.

- **AIRPORT ROAD**

  Airport Road is under the jurisdiction of Gallatin County and is classified as a major collector. Presently, Airport Road has two travel lanes in the study area and the posted speed limit is 45 mph. A section of Airport Road will lose through connectivity to the remaining southern section of Airport Road and should be renamed by Gallatin County.

- **TOWER ROAD**

  Tower Road is under the jurisdiction of Gallatin County and is classified as a local road. Presently, Tower Road has two travel lanes in the study area and the posted speed limit is 25 mph.

- **FRONTAGE ROAD (S-205)**

  Frontage Road (S-205) is under the jurisdiction of MDT and is classified as a minor arterial. Presently, Frontage Road has two travel lanes in the study area. The posted speed limit is 50 mph.

- **DOLLAR DRIVE**

  Dollar Drive is a local road that is predominantly within Belgrade city limits. Presently, Dollar Drive has two travel lanes in the study area and the posted speed limit is 25 mph.

- **TUBB ROAD**

  Tubb Road is under the jurisdiction of Gallatin County and is classified as a local road. Presently, Tubb Road has two travel lanes in the study area and the posted speed limit is 35 mph.

- **JETWAY DRIVE**

  Jetway Drive is under the jurisdiction of Gallatin County and is classified as a local road, Presently, Jetway Drive has two travel lanes in the study area and there is no posted speed limit.

- **PROPOSED TARMAC TRAIL**

  The proposed Tarmac Trail is anticipated to run from Tubb Road, intersecting with Airport Road, and terminating at Frontage Road to create a new intersection across from Sundown Creek Road. Tarmac Trail will have two travel lanes and is recommended to have a speed limit of 45 mph. Tarmac Trail will likely have a major collector classification, similar to the existing segment of Airport Road. The speed limit was determined from this classification. The road should be designed with a typical roadway section, coordinating with the City of Belgrade and Gallatin County review agencies.

- PENWELL BRIDGE ROAD & DRY CREEK ROAD

The intersection of Penwell Bridge Road and Dry Creek Road has the characteristics described below:

- Stop-controlled intersection, westbound stop sign
- Westbound Approach (From the East) – (1) Full Movement Lane
- Northbound Approach (From the South) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

- AIRPORT ROAD & TOWER ROAD

The intersection of Airport Road and Tower Road has the characteristics described below:

- Two-way stop-controlled intersection, northbound and southbound stop signs
- Eastbound Approach (From the West) – (1) Full Movement Lane
- Westbound Approach (From the East) – (1) Full Movement Lane
- Northbound Approach (From the South) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

- AIRPORT ROAD & FRONTAGE ROAD

The intersection of Airport Road and Frontage Road has the characteristics described below:

- Stop-controlled intersection, southbound stop sign
- Eastbound Approach (From the West) – (1) Full Movement Lane
- Westbound Approach (From the East) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

- DOLLAR DRIVE & FRONTAGE ROAD

The intersection of Dollar Drive and Frontage Road has the characteristics described below:

- Two-way stop-controlled intersection, northbound and southbound stop signs
- Eastbound Approach (From the West) – (1) Full Movement Lane
- Westbound Approach (From the East) – (1) Full Movement Lane
- Northbound Approach (From the South) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

- AIRPORT ROAD & TUBB ROAD

The intersection of Airport Road and Tubb Road has the characteristics described below:

- Stop-controlled intersection, eastbound stop sign
- Eastbound Approach (From the West) – (1) Full Movement Lane
- Northbound Approach (From the South) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

The intersection of Airport Road and Tubb Road will no longer exist after this project. The sections of Airport Road and Tubb Road are proposed to be removed at this intersection, with a possible driveway to serve the Timothy Lane property to the west of the intersection.

- JETWAY DRIVE & TUBB ROAD

The intersection of Jetway Drive and Tubb Road has the characteristics described below:

- Two-way stop-controlled intersection, eastbound and westbound stop signs
- Eastbound Approach (From the West) – (1) Full Movement Lane
- Westbound Approach (From the East) – (1) Full Movement Lane
- Northbound Approach (From the South) – (1) Full Movement Lane
- Southbound Approach (From the North) – (1) Full Movement Lane

The intersection of Jetway Drive and Tubb Road may require changes to intersection geometry and control devices. Updates to the intersection will be dependent on the layout of the proposed intersection of Tarmac Trail and Tubb Road, which is still early in the design and planning process.

- TARMAC TRAIL & TUBB ROAD

The intersection of Tarmac Trail and Tubb Road will be constructed as a part of this project. The intersection geometry and control devices are still yet to be determined, as it is early in the design and planning process in this area of the development. See the conclusions section of this report for expected design alternatives for the proposed intersection.

- FRONTAGE ROAD & TARMAC TRAIL

The intersection of Frontage Road and Tarmac Trail will be constructed as a part of this project. Therefore, the existing intersection only allows for through movements and access to Sundown Creek Road to the south. Recommended geometry, turning movements, and stop control for the proposed intersection will be analyzed and recommendations can be found in the conclusion section of this report.

- ### AIRPORT ROAD & TARMAC TRAIL

The intersection of Airport Road and Tarmac Trail will be constructed as a part of this project. Therefore, the existing intersection only allows for through movements. Recommended geometry, turning movements, and stop control for the proposed intersection will be analyzed and recommendations can be found in the conclusion section of this report.

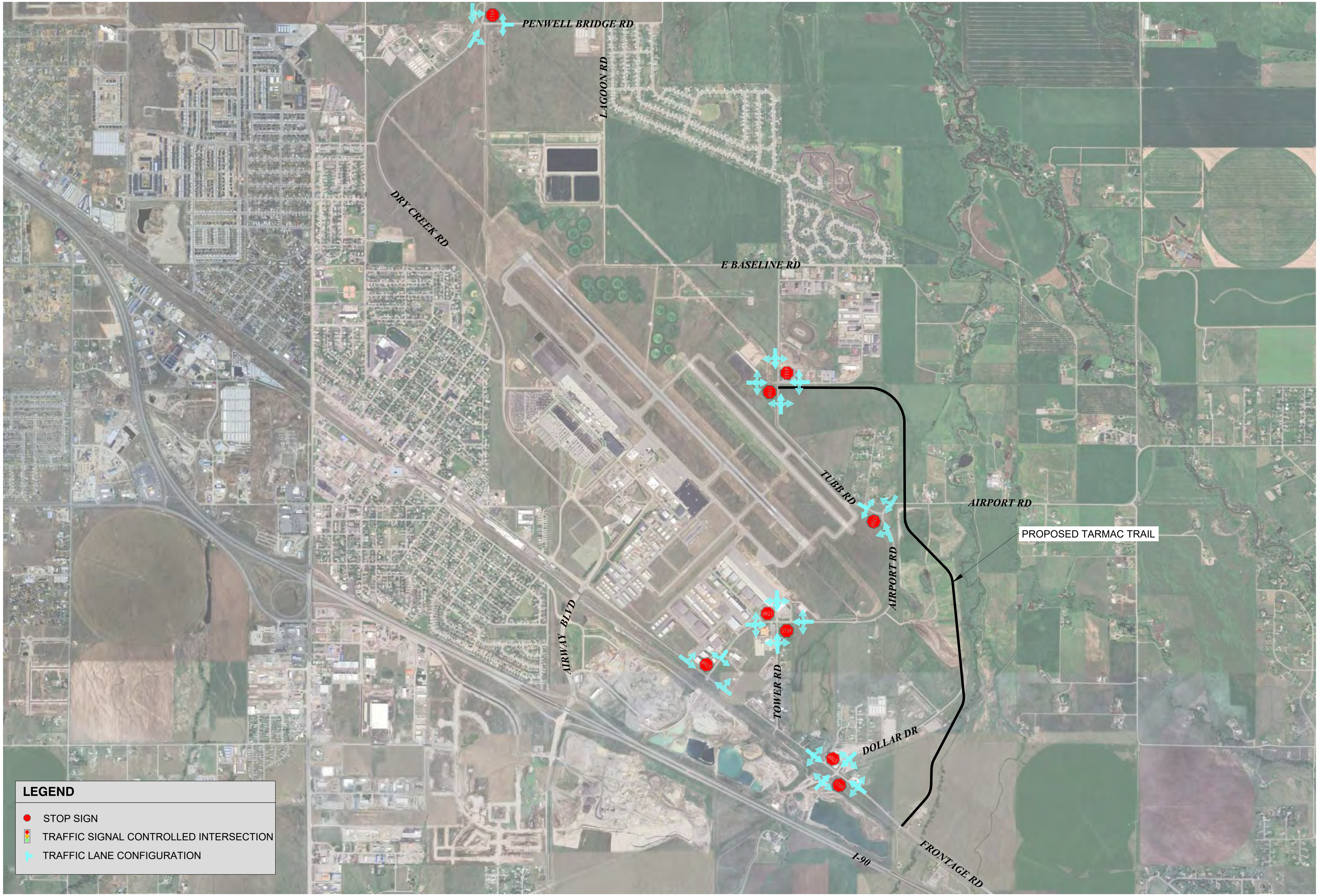
- ### EXISTING STUDY AREA TRANSPORTATION SYSTEM

The existing study area roadways and intersections are shown in Figure 4. Included within the figure is the existing traffic control at each of the study area intersections and the traffic lane configurations.

- ### TRAFFIC VOLUMES

Traffic data for the following intersections; Airport Road and Tower Road, Airport Road and Frontage Road, Frontage Road and Dollar Drive, and Airport Road and Tubb Road was developed through turning movement counts conducted by Hyalite Engineers. Counts were conducted for two-hour periods during the weekday, AM (one hour between 7:00 and 9:00 a.m.), and PM (one hour between 4:00 and 6:00 p.m.) peak periods on Tuesday, June 11, 2024 and Wednesday, June 12, 2024. The counts were averaged for the two days of counts and the peak hour was determined and used in this analysis. Traffic data for the Penwell Bridge Road and Dry Creek Road intersection was developed through turning movement counts conducted by Hyalite Engineers. Counts were conducted for two-hour periods during the weekday, AM (one hour between 7:00 and 9:00 a.m.), and PM (one hour between 4:00 and 6:00 p.m.) peak hours on Tuesday, June 18, 2024 and Wednesday, June 19, 2024. The counts were averaged for the two days of counts and the peak hour was determined and used in this analysis. Traffic data for the Jetway Drive and Tubb Road intersection was developed through turning movement counts conducted by Hyalite Engineers. Counts were conducted for two-hour periods during the weekday, AM (one hour between 7:00 and 9:00 a.m.), and PM (one hour between 4:00 and 6:00 p.m.) peak hours on Tuesday, October 29, 2024 and Wednesday, October 30, 2024. The counts were averaged for the two days of counts and the peak hour was determined and used in this analysis. The counts are provided in Appendix A. Current daily traffic data is summarized in Figure 5.

The traffic volumes collected from the count data were redistributed for the proposed Tarmac Trail Extension, as well as the closure of sections of Airport Road, Tubb Road, and Baseline Road. The expected daily traffic from this redistribution was used to analyze the expected conditions at the existing intersections, as well as the proposed intersections. The expected daily traffic volumes can be found in Figure 6.



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 4

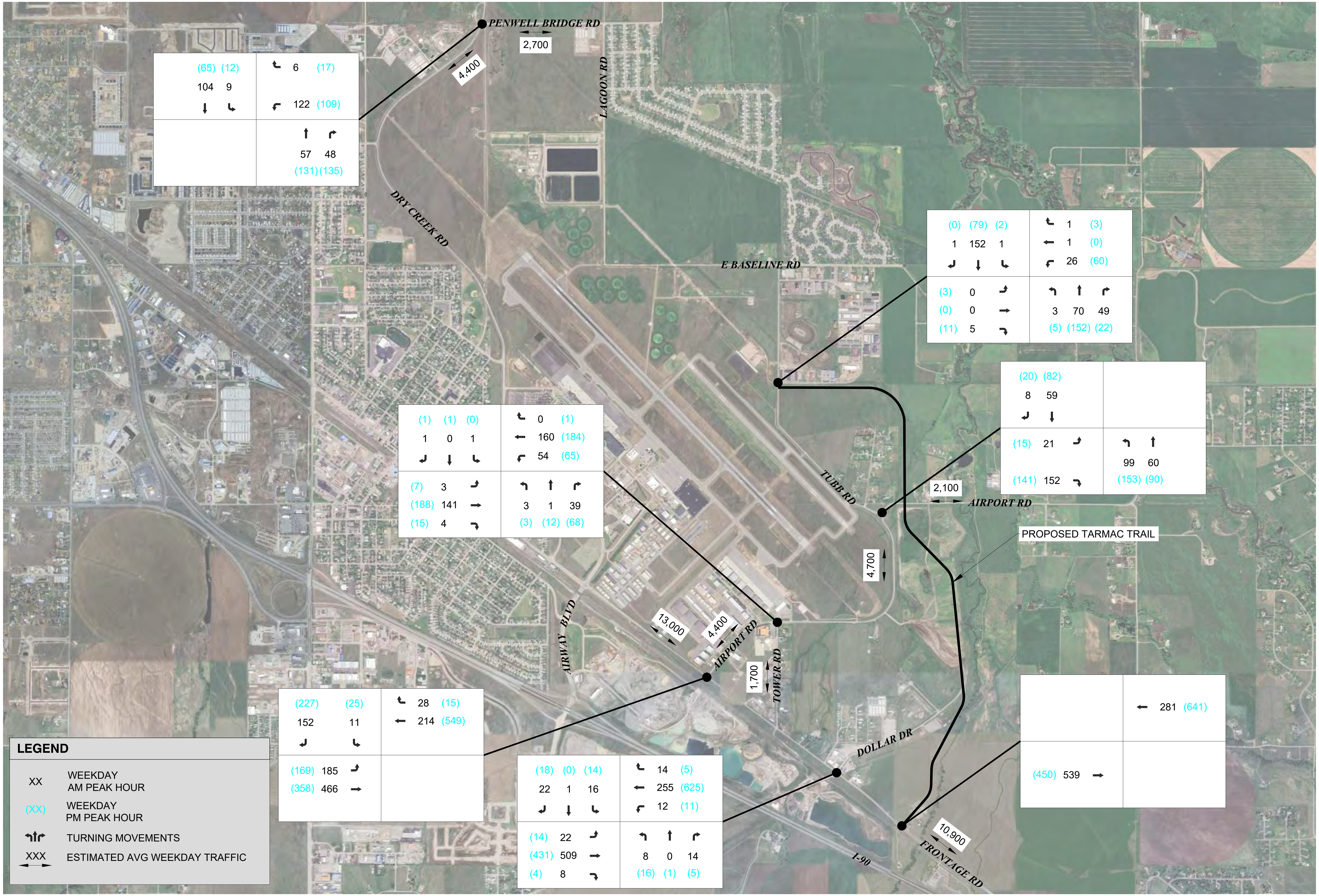
4 EXISTING TRANSPORTATION SYSTEM

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\16253A\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

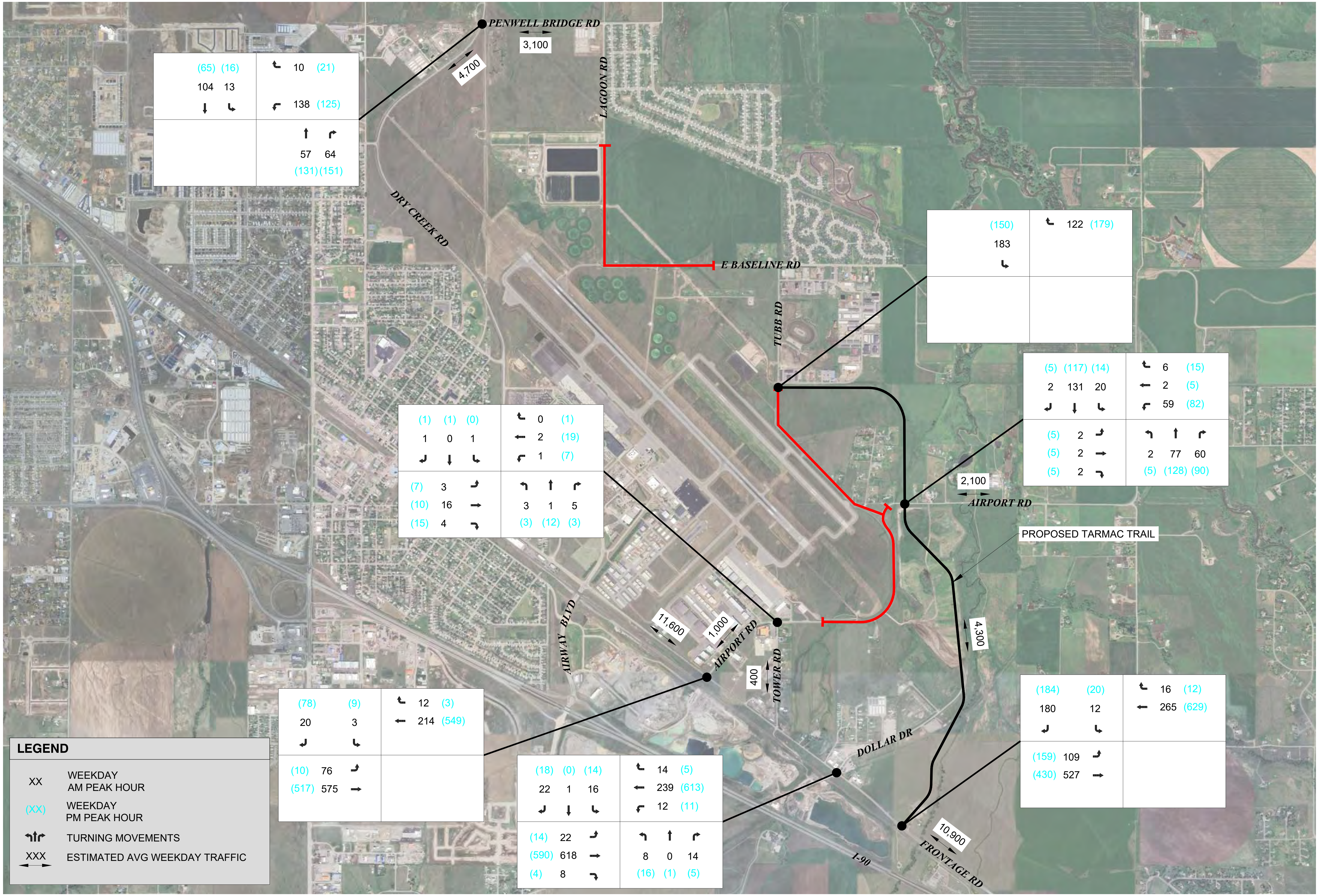
APRIL 2025

FIGURE 5

5 CURRENT DAILY TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 6

6 TARMAC TRAIL EXTENSION EXPECTED DAILY TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am

- PEDESTRIANS & BICYCLISTS

There currently are no facilities available for pedestrians or bicyclists within the study area. The projects included as a part of this study are not developed and the proposed Tarmac Trail Extension is not constructed.

- TRANSIT SYSTEM

Streamline does provide public transportation services in the Belgrade area. There is one route that runs through the study area; however, it is only on Frontage Road and there are no stops near the study intersections. It is not anticipated that this project will have any effects to public transportation routes.

- CRASH EXPERIENCE

Crash data for the study intersections were obtained from MDT for a five-year period from 2019-2023. Below are the accidents seen at each existing study intersection in this time period:

- Penwell Bridge Road & Dry Creek Road: 5 Accidents
- Airport Road & Tower Road: 1 Accident
- Airport Road & Frontage Road: 5 Accidents
- Dollar Drive & Frontage Road: 2 Accidents
- Airport Road & Tubb Road: 1 Accident
- Jetway Drive & Tubb Road: 4 Accidents

This is a relatively low number of accidents at each of the study area intersections. The majority of these accidents occurred during the weekday, predominately in the afternoon, and during winter months. There are no anticipated sight distance issues at any of the study intersections.

PROJECT TRAFFIC

• AIRPORT COMMERCIAL MAJOR SUBDIVISION

Trip generation is a forecast for the number of trips starting or ending at the development site. The trips generated are a function of the type of proposed development on the site and the size of that development. This study uses trip generation rates found in Trip Generation; 11th Edition published by the Institute of Transportation Engineers (ITE) for estimating average vehicle trip ends based on Land Use Code 130 – Industrial Park. Primary purpose trips are those where the project site is the primary destination, which results in a new trip on the roadway. The estimated primary purpose trip generation for the Airport Commercial Major Subdivision is provided in Appendix B. Trip generation from pass-by traffic is not anticipated to have any effect to this site, due to the type of development proposed.

- **BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT – FUTURE CONDITIONS**

Trip generation for the Future Conditions of the Bozeman Yellowstone International Airport was determined from existing data. The data came from a similar development built at the Airport. The observed traffic at the northwest corner of Frontage Road and Airport Road will match what is expected for the expansion on the north side of the airport.

- **BACKGROUND PROJECTS**

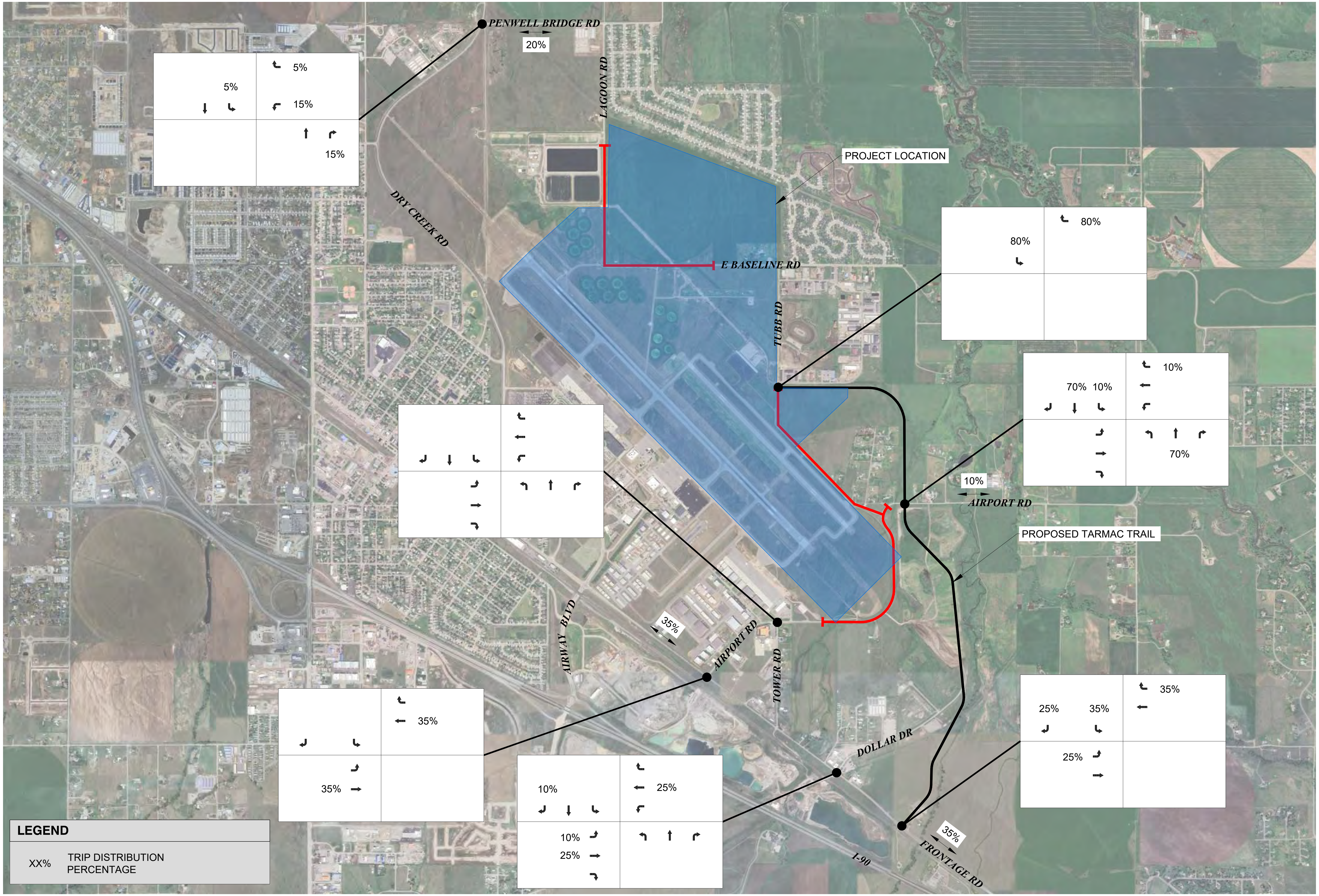
Included in this study is the background traffic from a variety of projects. Due to the time of planning for the scope of this study it was found appropriate to capture some of these projects in a conservative growth rate that applies to each study intersection. These projects are early in planning phases and the scope of the development is undetermined. The background projects in the area include a potential residential development to the east of the study area and the KT Ranch parcel to the north of the study area. However, the Meadowlark Ranch development is currently under construction and is captured in this study. The Meadowlark Ranch Phases 5 & 6 development is on the north end of the study area. This project will have its traffic assigned to the 2029 development horizon, as it is anticipated to reach build-out in that timeframe. Included as a reference, is the Meadowlark Ranch Phases 5 & 6 Traffic Impact Study completed by Sanderson-Stewart in December 2021. The trip generation for this development can be found in their report and is used in this study to capture all expected traffic generated from this development.

- **DEVELOPMENT TRIP DISTRIBUTION**

Trip distribution is identifying the probable directions, routes, and destinations that the development traffic could impact. A variety of methods are used for estimating trip distribution. These include analogy, trip distribution models, areas of influence, origin destination, and surrogate data methods. This study uses a combination of the analogy method. The analogy method bases the distribution of proposed traffic on existing travel patterns and the origin-destination method. Figure 7, Figure 8, and Figure 9 show the primary trip distributions for each of these developments.

- **TRIP ASSIGNMENT**

The trip assignment of development traffic provides the information regarding the level of impacts the site will have on the roadway system. Assignment involves determining the amount of traffic and its movements in the transportation system. Trip assignment must also take in to account the choice of route a driver will take, how existing traffic functions at intersections, and the travel times to and from the site, depending on the route chosen. Figure 10, Figure 11, and Figure 12 show the resulting traffic assignment at the study area intersections for the proposed developments.



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

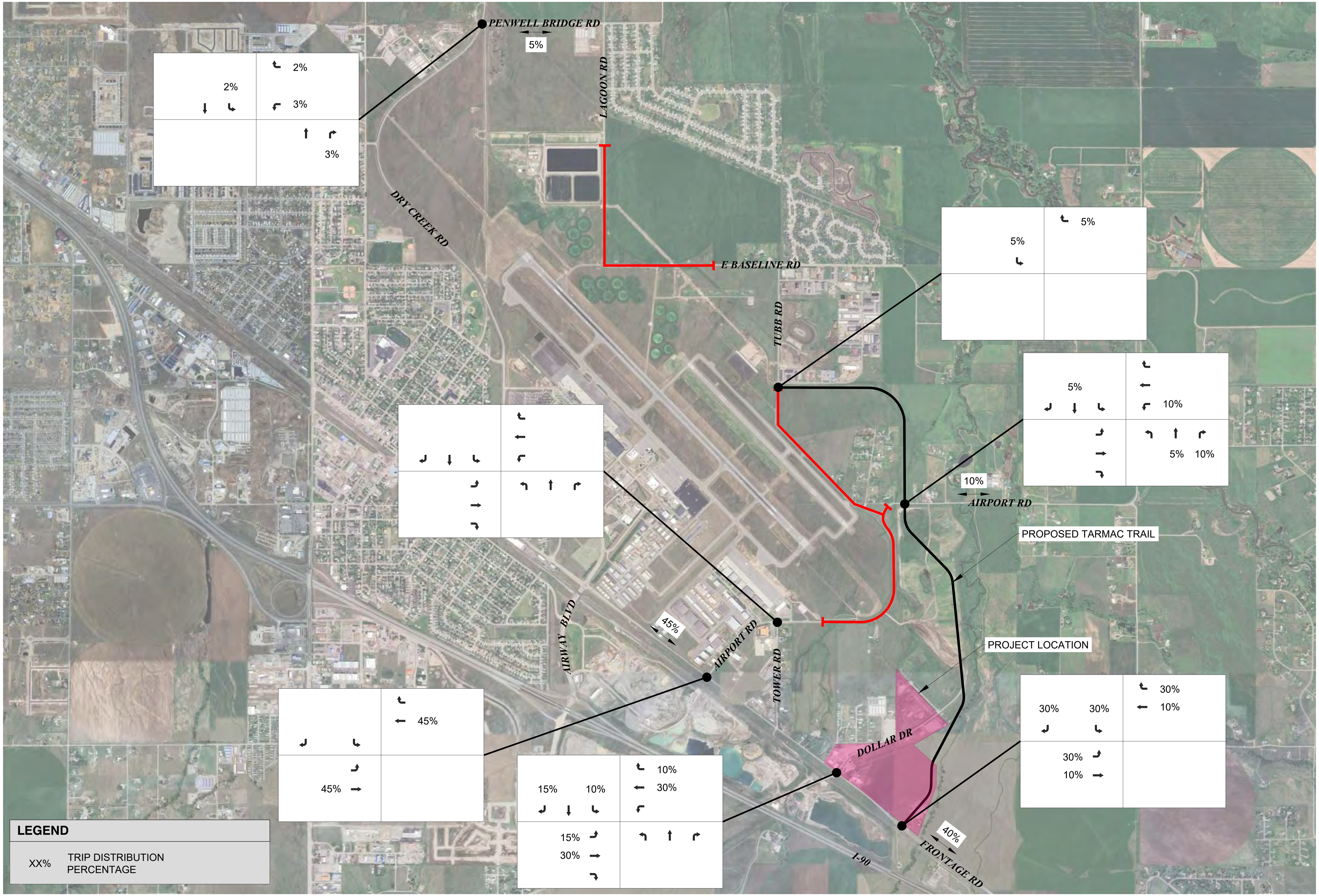
APRIL 2025

FIGURE 7

7 BZN AIRPORT FUTURE CONDITIONS TRIP DISTRIBUTION

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 8

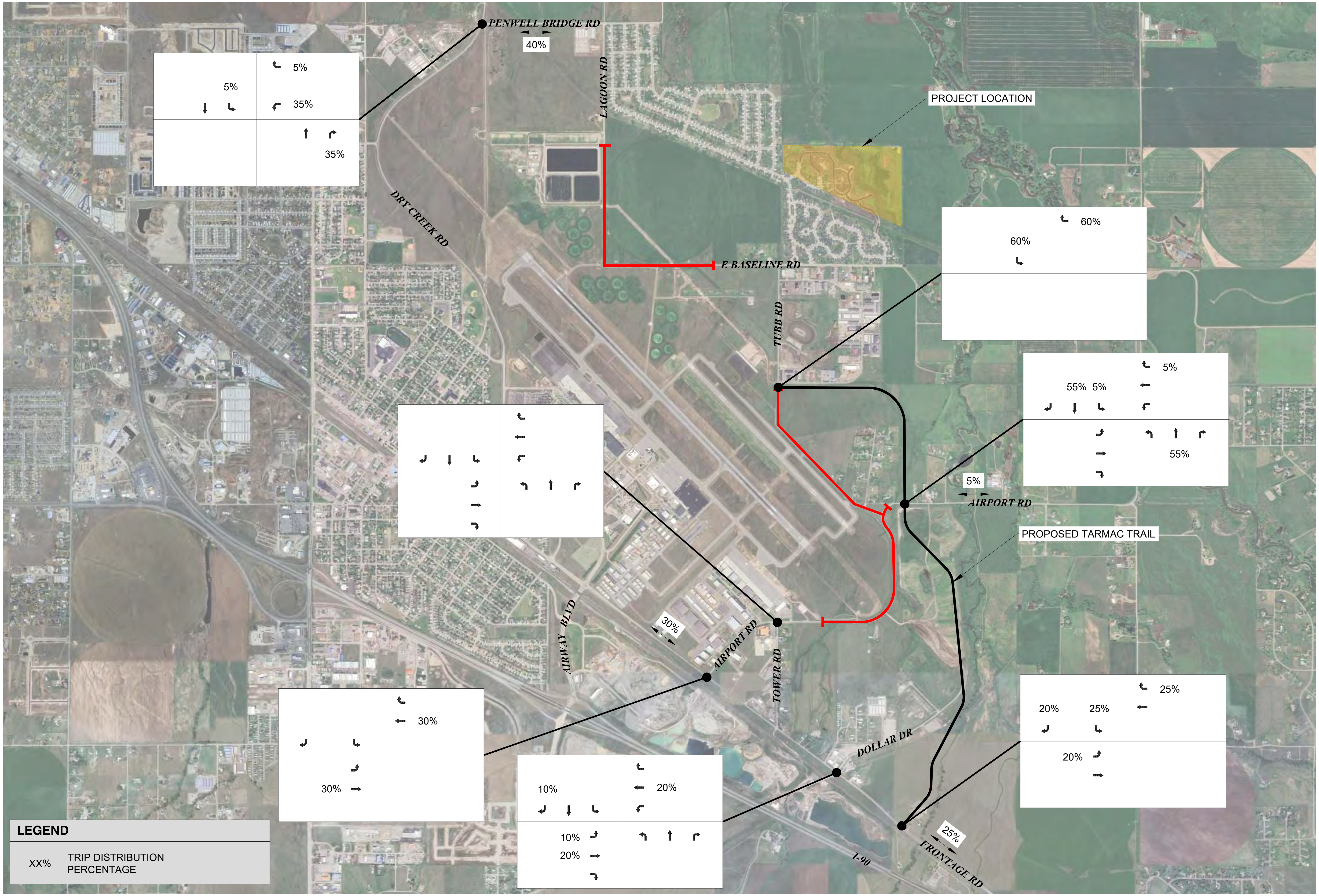
8 AIRPORT COMMERCIAL MAJOR SUBDIVISION TRIP DISTRIBUTION

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

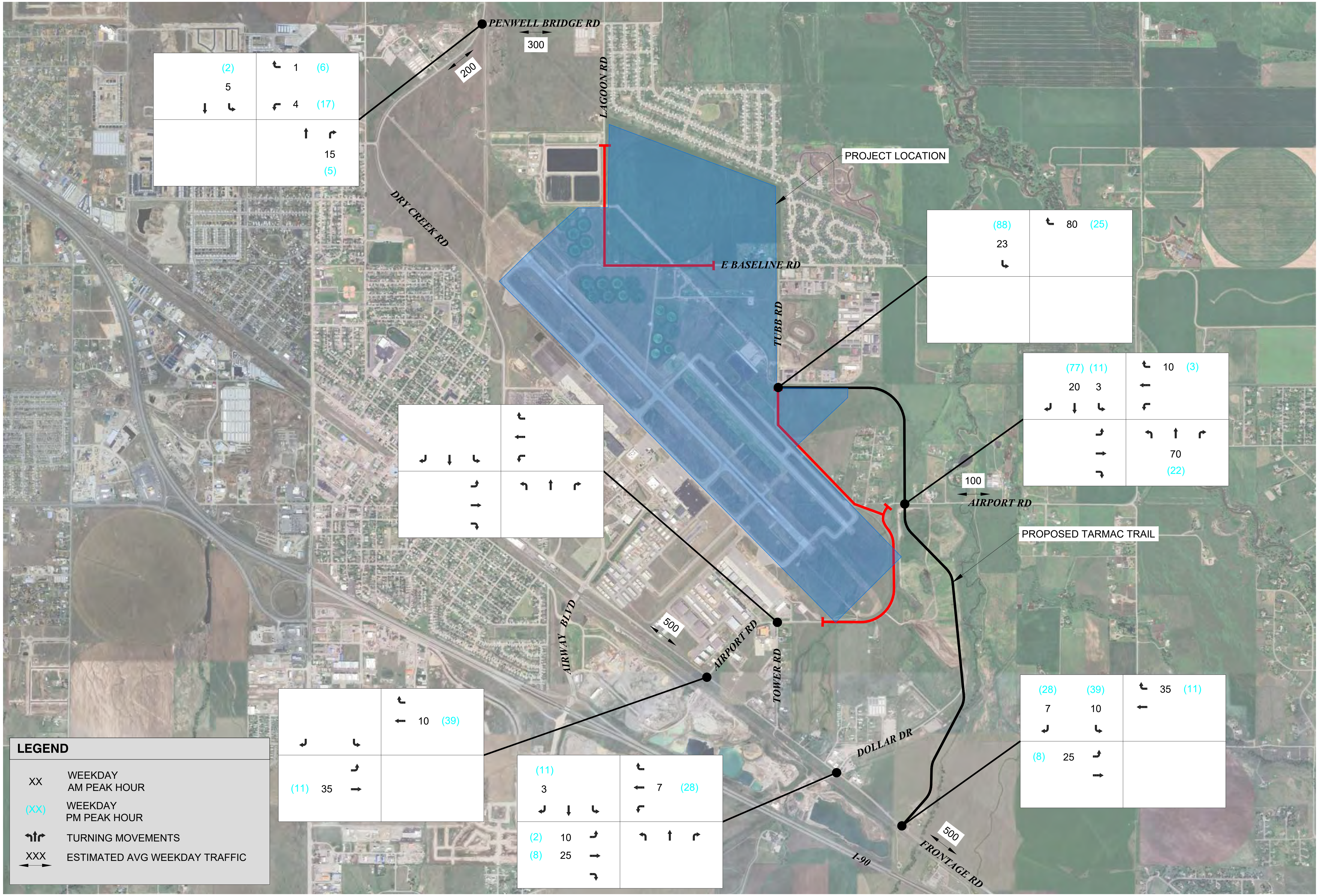
APRIL 2025

FIGURE 9

9 BACKGROUND PROJECT TRIP DISTRIBUTION

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:30am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

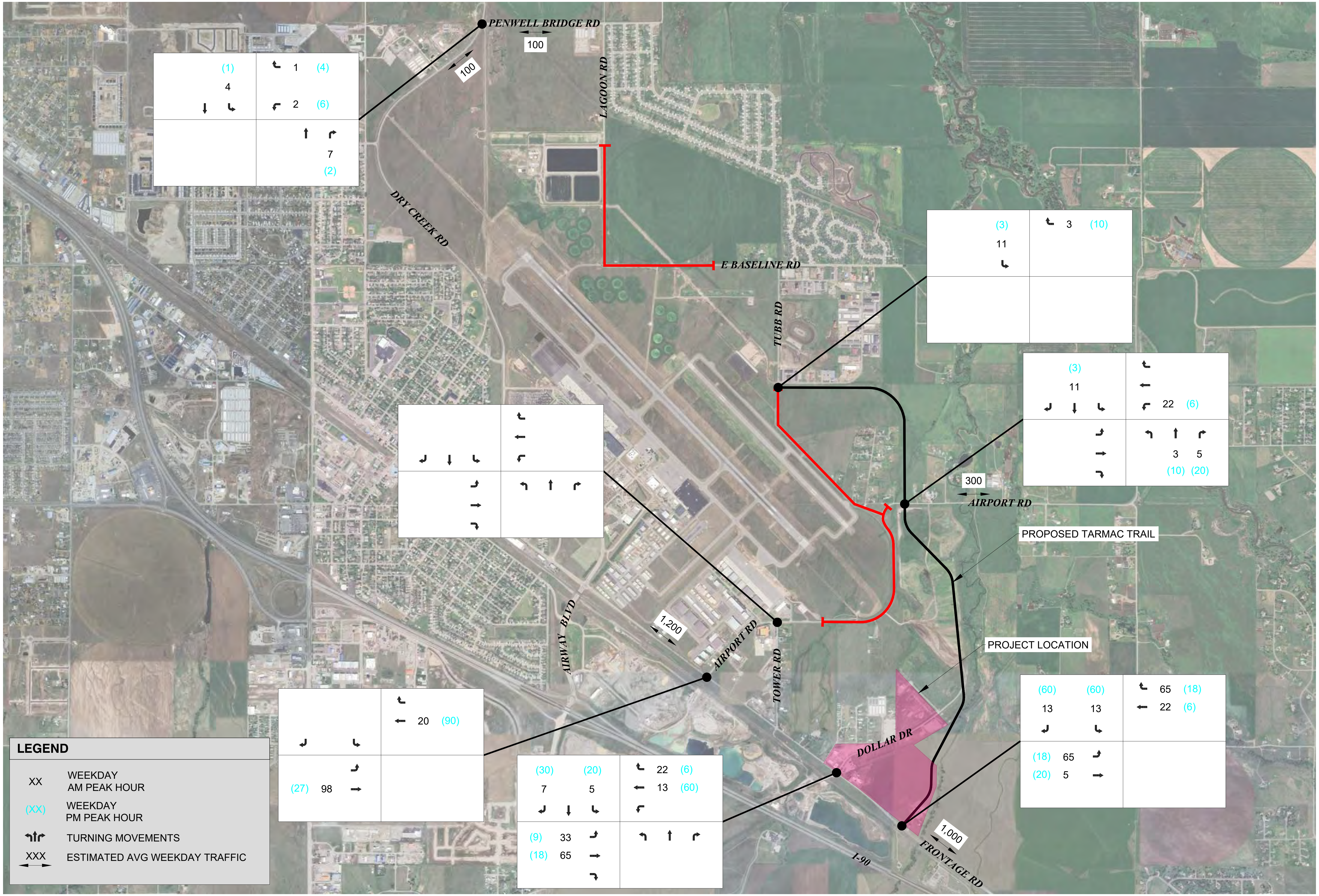
APRIL 2025

FIGURE 10

10 BZN AIRPORT FUTURE CONDITIONS TRAFFIC ASSIGNMENT

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 11

11 AIRPORT COMMERCIAL MAJOR SUBDIVISION TRAFFIC ASSIGNMENT

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 12

12 BACKGROUND PROJECT TRAFFIC ASSIGNMENT

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am

- **PEDESTRIANS & BICYCLISTS**

  Pedestrian and bicycle traffic is currently negligible in the study area, with very little to no forms of these trips being seen at each study intersection. It is expected in the future that these trips will be present in the project area, and safe routes will need to be provided. It is recommended to facilitate connections throughout the project area to future developments and trails that are planned around the subject properties. The Triangle Trails plan recommends a 10-foot shared use path along its route and connections to these trails will need to be provided. Considerations for marked crossings, supplemental signage, traffic calming, or other measures may be necessary in the future. These improvements will allow for the connection to existing infrastructure surrounding the project area in the future.

- **TRANSIT SERVICE**

  No specific improvements are proposed with the Tarmac Trail Extension for transit services.

- **NON-SITE TRAFFIC**

  - **METHOD OF PROJECTION**

    To show the impacts from the development's generated traffic it is required to estimate non-site traffic growth during the same time period in the same horizon. There are three primary ways to typically estimate growth of non-site generated traffic, including the build-up method, the use of transportation plans or models, and the trends or growth rate method.

    The build-up method accounts for traffic growth from approved projects and projects set for approval. Transportation plans or models provide an estimate of volumes for approximately 20 years in the future. The models provide average weekday traffic that converts to peak hour volumes. The conversion can result in conditions that do not match actual conditions on the site. The trends or growth method evaluates the historic traffic growth within a proposed study area. The assumption from this method is that the historic growth rate will continue and have the same impacts on the transportation system.

- **ESTIMATED VOLUMES**

This study evaluates estimated traffic projections for the anticipated 2029 and 2044 development horizons. These estimated background traffic volumes for the 2029 and 2044 development horizon were established by applying the trends or growth rate method.

Estimated average annual growth rates (AAGR) were applied to current daily traffic at the study area intersections for 5 (2029) year and 20 (2044) year traffic projections. The 1-year AAGR percentage was determined to be 2.0%, from a variety of sources and to account for background projects expected in the area. These include the Greater Triangle Area Transportation Plan, the Belgrade Area Long Range Transportation Plan, and data from MDT. Comparing this growth rate with the data from MDT finds that this is a conservative growth rate for the study area. Figure 13 and Figure 15 show the estimated 2029 and 2044 background traffic volumes.

- **TOTAL TRAFFIC**

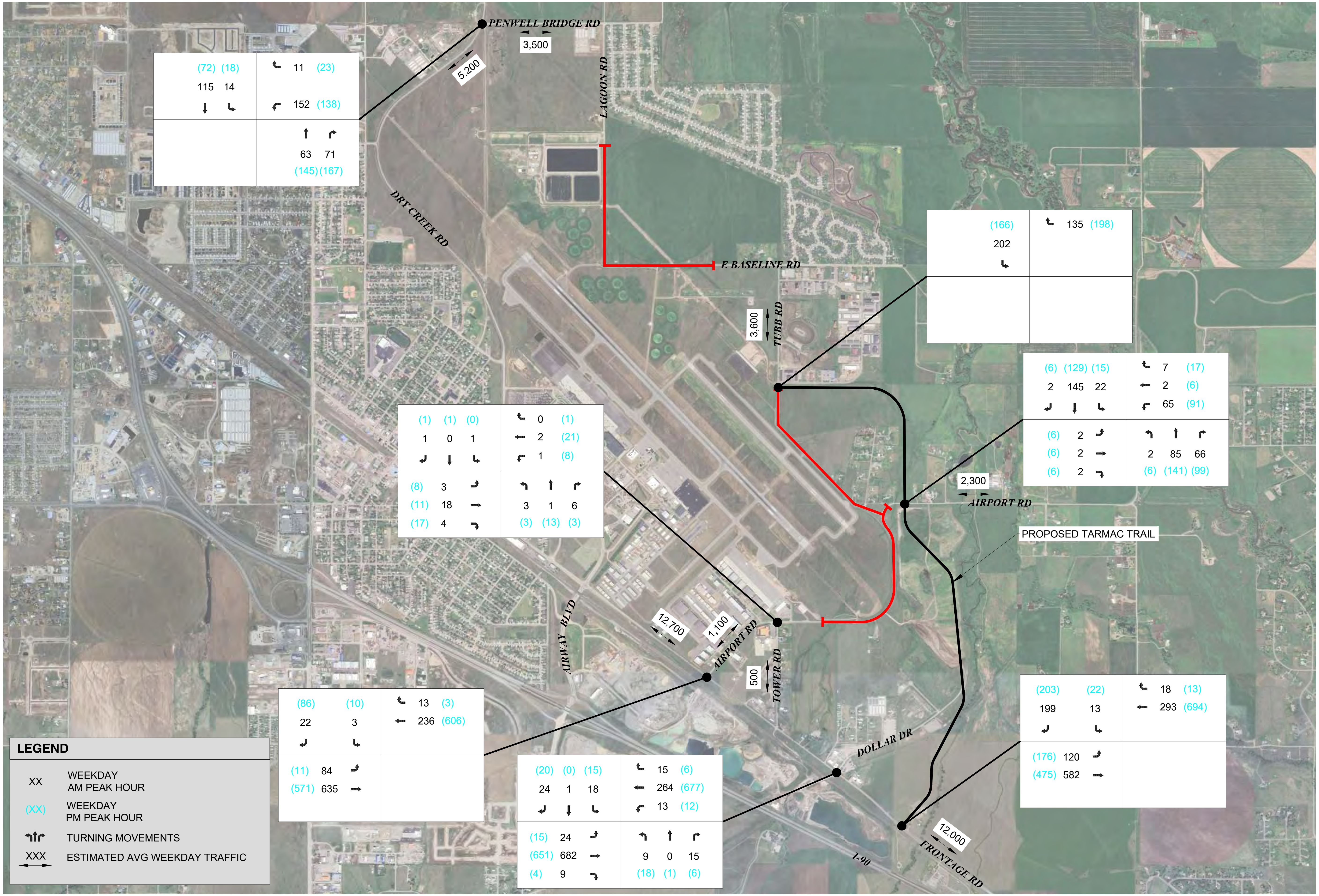
Estimated traffic from the background project (Meadowlark Ranch Phases 5 & 6) was combined with the estimated 2029 background traffic volumes to establish the estimated 2029 total traffic volumes for an impact analysis. Those volumes are shown in Figure 14.

Estimated traffic from the background project (Meadowlark Ranch Phases 5 & 6), Bozeman Yellowstone International Airport – Future Conditions, and the Airport Commercial Major Subdivision were combined with the estimated 2044 background traffic volumes to establish the estimated 2044 total traffic volumes that were used in an impact analysis. Those volumes are shown in Figure 16.

TRANSPORTATION ANALYSES

- **METHODOLOGIES**

This section details the assumptions used and methodologies used in the impact analyses for the Tarmac Trail Extension. It is based on the ITE's Recommended Practices for Transportation Impact Analysis for Site Development. The analyses are used to determine if the project conforms with City of Belgrade, Gallatin County, and Montana Department of Transportation policies and evaluates whether the project's impact is noticeable to the average driver in the study area.



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

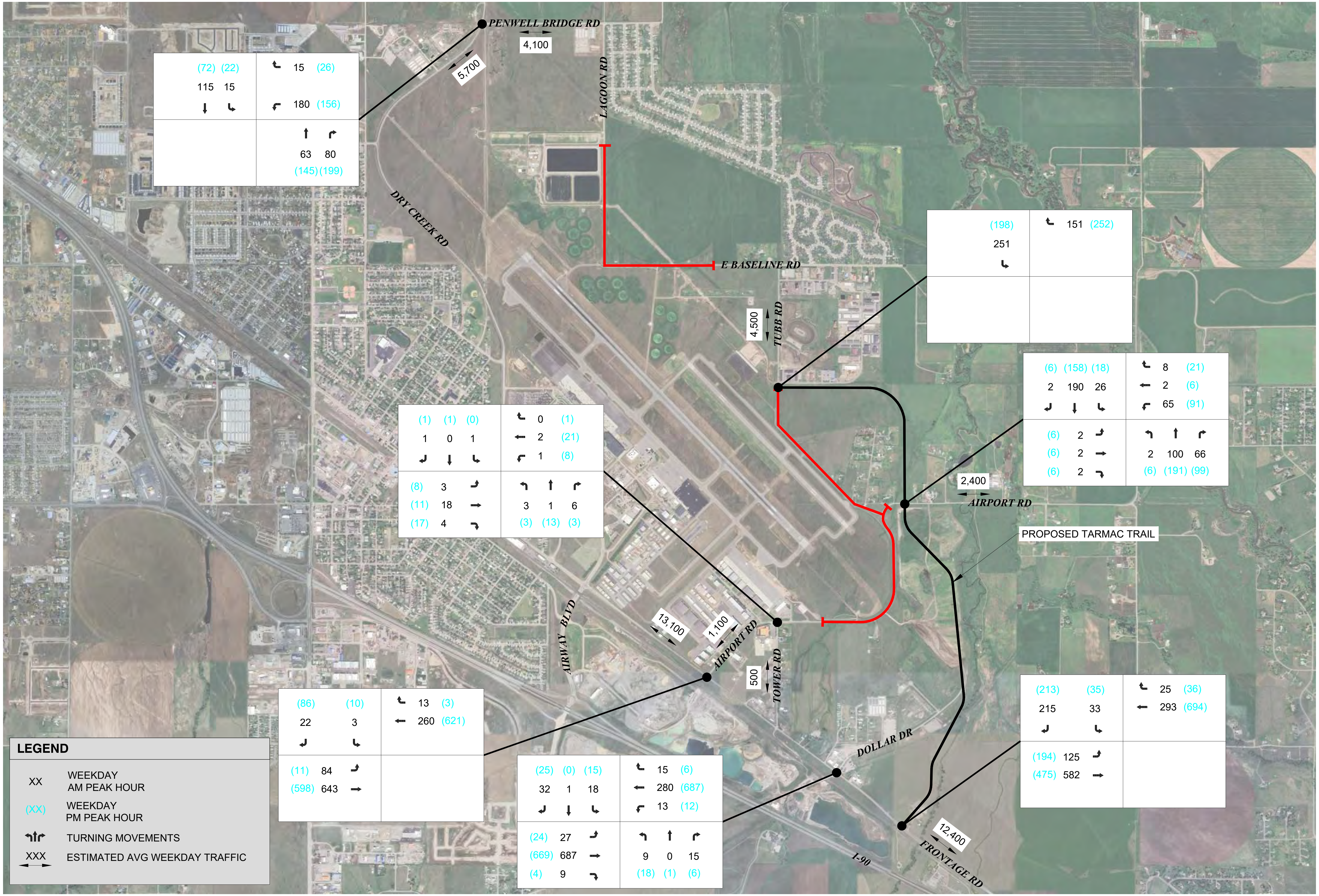
APRIL 2025

FIGURE 13

13 ESTIMATED 2029 BACKGROUND TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

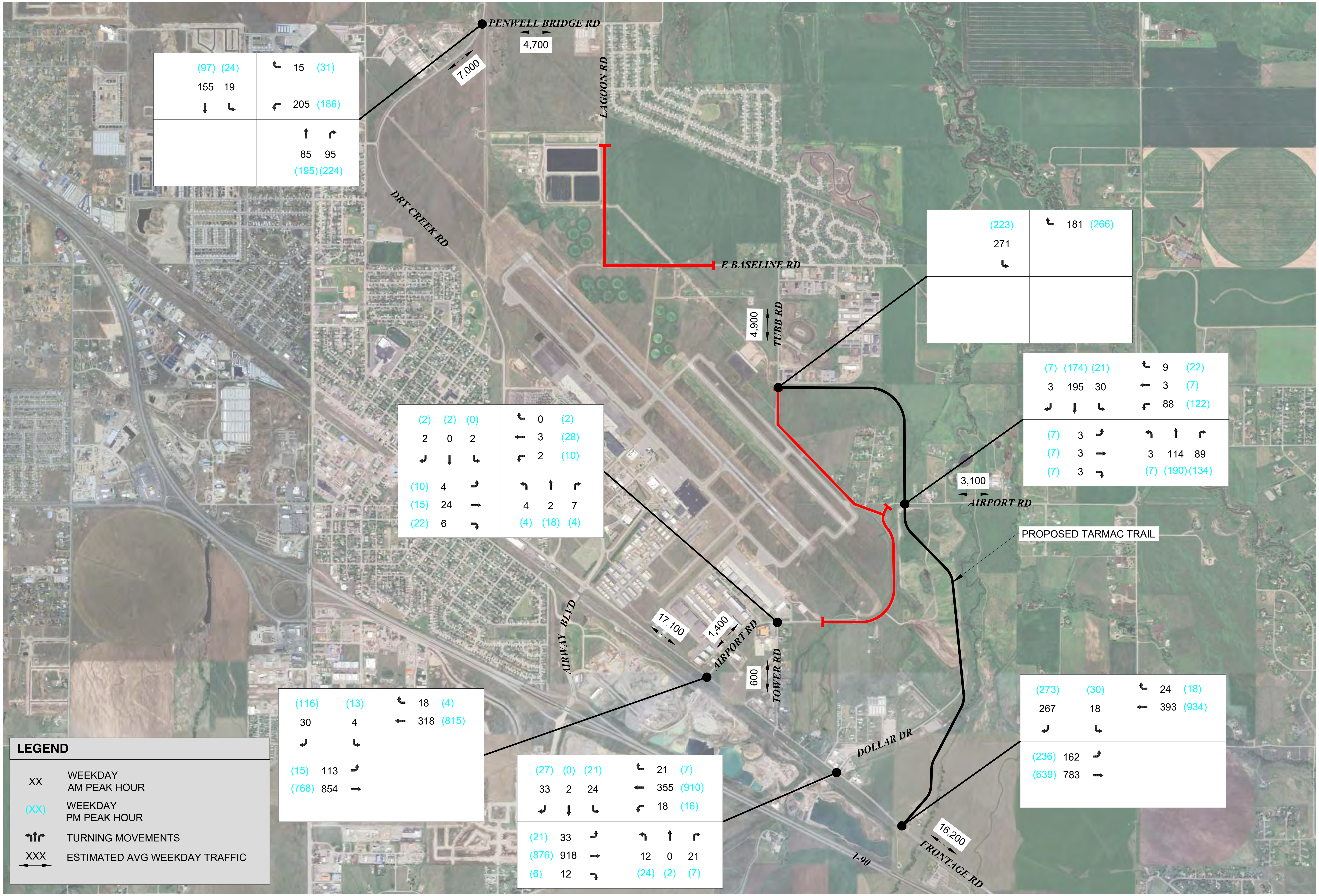
APRIL 2025

FIGURE 14

14 ESTIMATED 2029 TOTAL TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 15

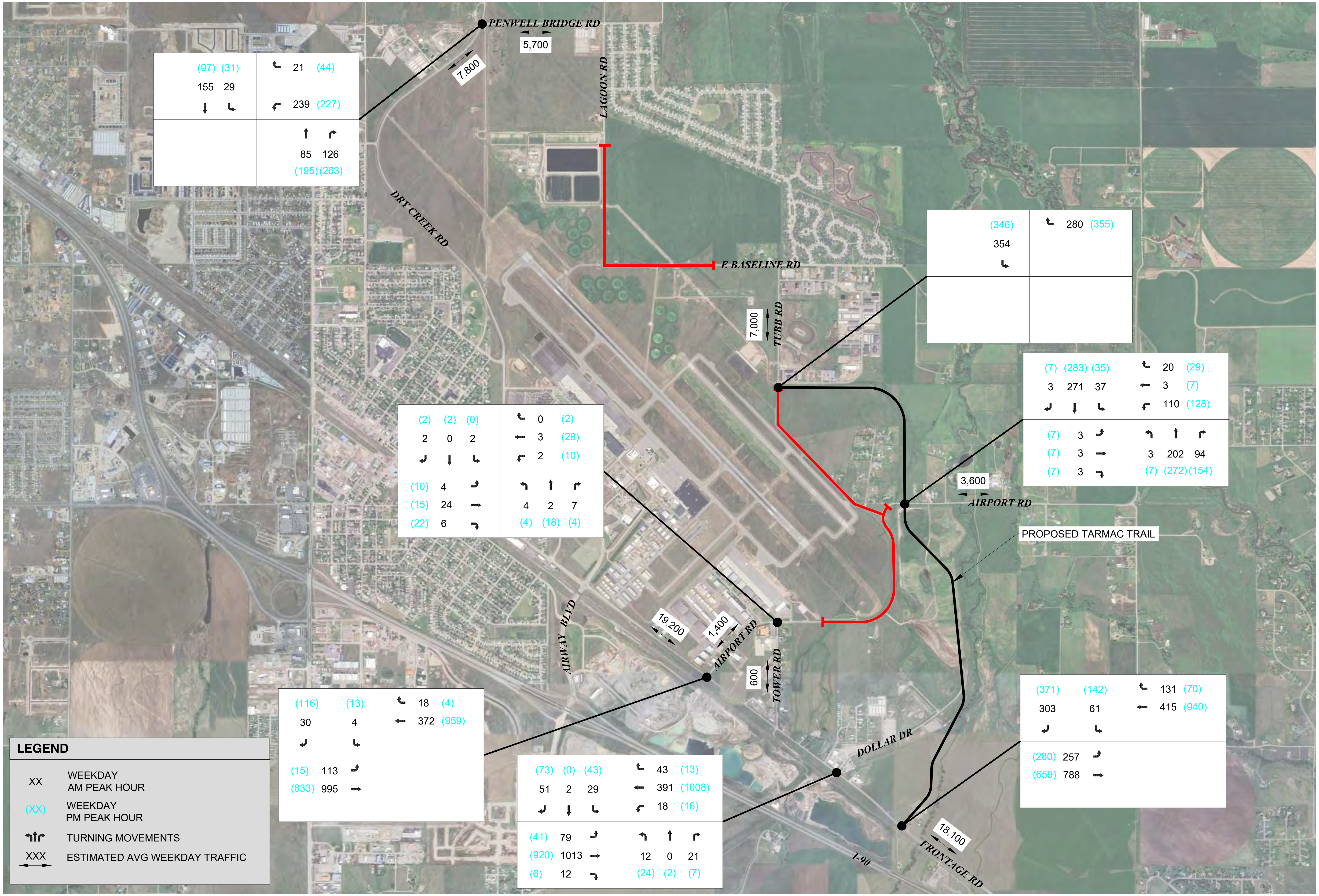
15 ESTIMATED 2044 BACKGROUND TRAFFIC

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 16

16 ESTIMATED 2044 TOTAL TRAFFIC

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am

STUDY SCENARIOS

The following scenarios are presented in this study:

- Existing Conditions
- Tarmac Trail Extension Expected Daily Traffic
- Estimated 2029 Background Traffic
- Estimated 2029 Total Traffic
- Estimated 2044 Background Traffic
- Estimated 2044 Total Traffic

ANALYSIS METHODOLOGIES

The operational conditions of a traffic system are described as "level of service". Level of service (LOS) is a performance measure used to evaluate the effects that include travel speed, volumes, roadway capacity, intersection capacity, delay in travel time, and traffic interruptions. Conditions are displayed as LOS A through LOS F, which represents the best and worst operating conditions, respectively.

Control delay determines the LOS for intersections. Control delay is the total elapsed time from when a vehicle stops at the end of a queue to the time the vehicle departs from the stop line. The total elapsed time includes the time required to clear the queue, including deceleration of vehicles from the free flow speed to the speed of vehicles in the queue.

TRAFFIC OPERATIONS

CAPACITY & LEVEL OF SERVICE ANALYSES

Capacity and level of service analyses were performed for the study area intersections for 2024 current daily traffic volumes (Figure 5), Tarmac Trail Extension Expected Daily Traffic (Figure 6), estimated 2029 background traffic volumes (Figure 13), estimated 2029 total traffic volumes (Figure 14), estimated 2044 background traffic volumes (Figure 15), estimated 2044 total traffic volumes (Figure 16), and the recommended improvements. Analyses were performed using the current geometry and control at each of the study area intersections (except for the recommendations) to determine the level of service. The analyses are summarized in the following figures and detailed results are included in Appendix C.

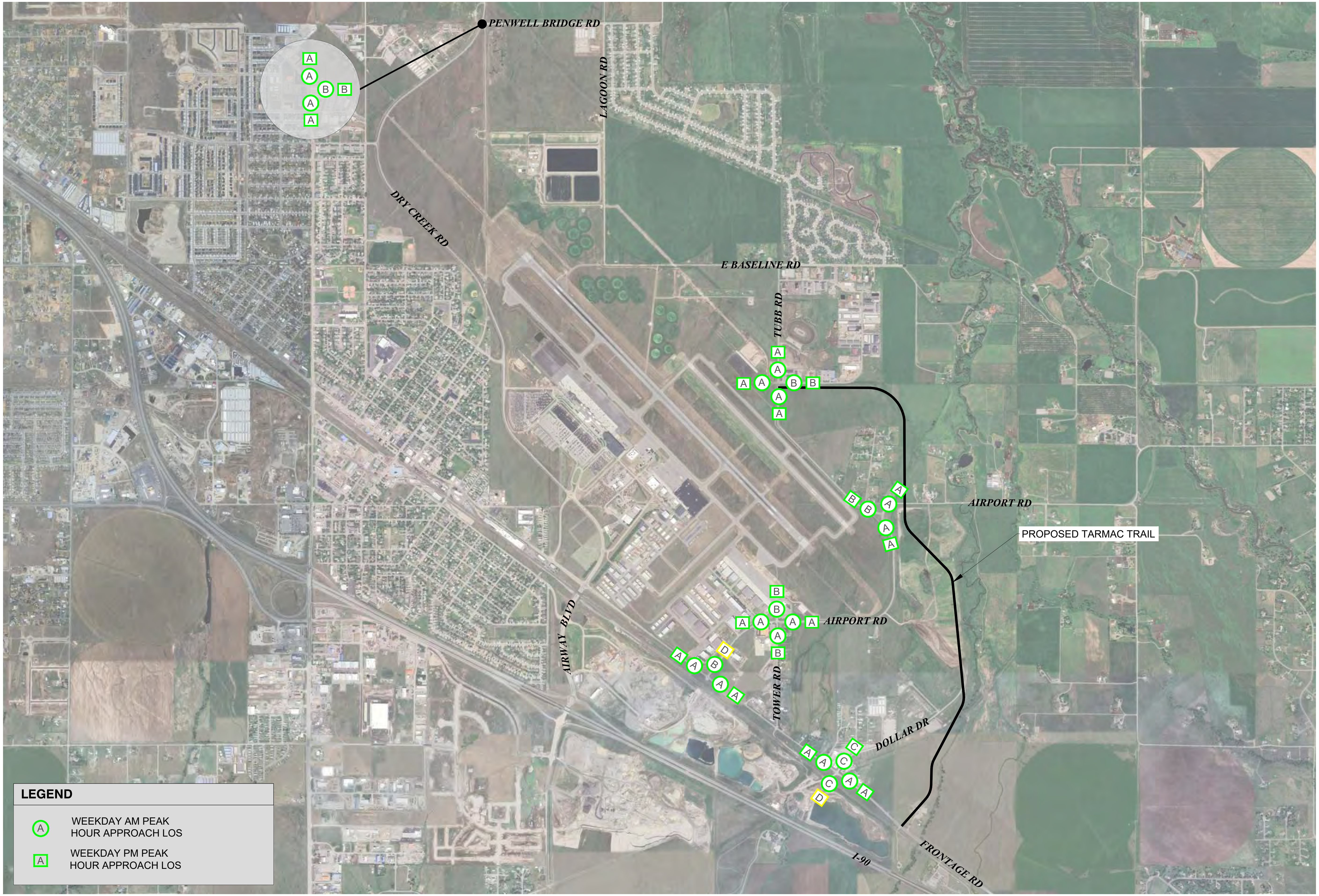
- Figure 17: Traffic Operations Summary for 2024 Existing Conditions
- Figure 18: Traffic Operations Summary for Tarmac Trail Extension Expected Daily Traffic
- Figure 19: Traffic Operations Summary for 2029 Background Traffic
- Figure 20: Traffic Operations Summary for 2029 Total Traffic
- Figure 21: Traffic Operations Summary for 2044 Background Traffic
- Figure 22: Traffic Operations Summary for 2044 Total Traffic
- Figure 23: Traffic Operations Summary for Recommended Improvements

- **TRAFFIC SIGNAL WARRANT ANALYSES**

Traffic signal warrant analyses were performed in accordance with the Manual on Uniform Traffic Control Devices, 11th Edition (MUTCD) and the MDT Traffic Engineering Manual, dated August 2009. There are nine warrants establishing the minimum criteria for an intersection needing traffic signal control. The nine signal warrants are as follows in the MUTCD:

- Warrant #1: Eight-Hour Vehicular Volume
- Warrant #2: Four-Hour Vehicular Volume
- Warrant #3: Peak Hour
- Warrant #4: Pedestrian Volume
- Warrant #5: School Crossing
- Warrant #6: Coordinated Signal System
- Warrant #7: Crash Experience
- Warrant #8: Roadway Network
- Warrant #9: Intersection Near a Grade Crossing

HCS7 Software for MUTCD Signal Warrants was used to perform an analysis for one intersection in the study area. The intersection requiring a signal warrant analysis is Frontage Road and Proposed Tarmac Trail. The traffic volumes used for the analysis for the intersection are included in a spreadsheet (Appendix D). One scenario was looked at to determine if a traffic signal is required at the intersection (Expected Daily Traffic). The traffic volumes of this scenario, as well as other applicable information was entered into the program and the resulting reports are included in Appendix D.



0' 1000' 2000' 3000'
N

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

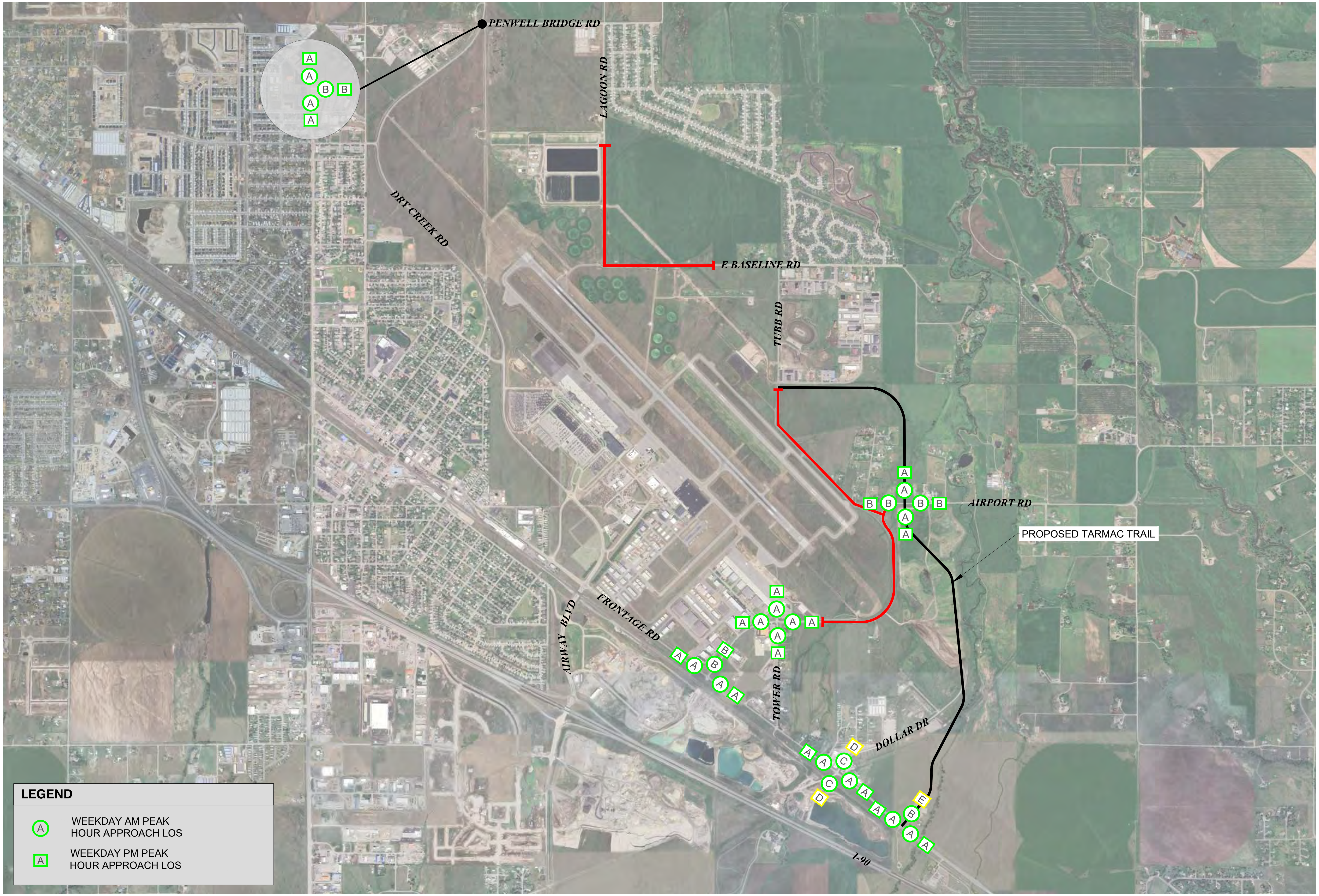
APRIL 2025

FIGURE 17

17 TRAFFIC OPERATIONS SUMMARY FOR 2024 EXISTING CONDITIONS

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 18

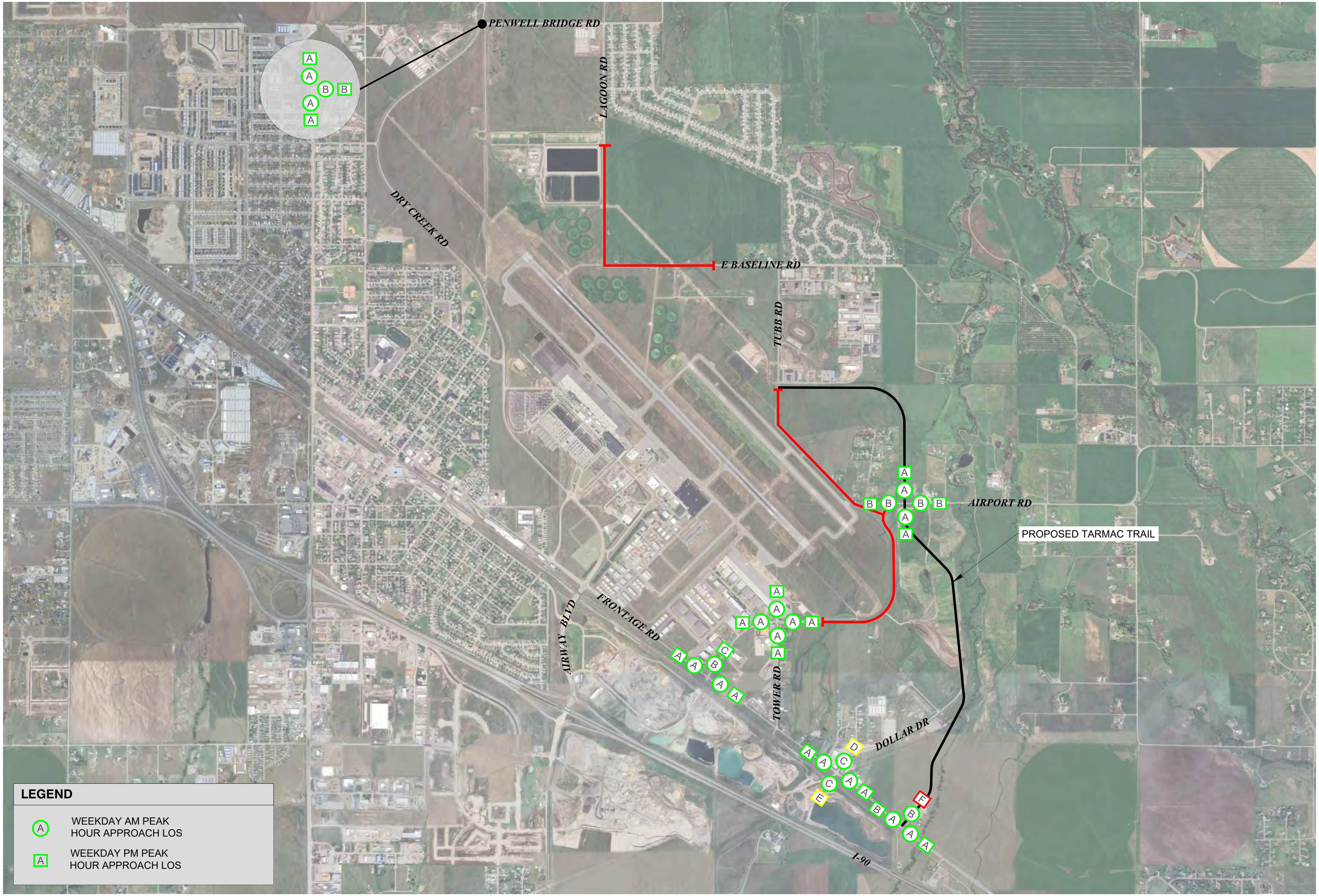
18 TRAFFIC OPERATIONS SUMMARY FOR TARMAC TRAIL EXTENSION EXPECTED DAILY TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION



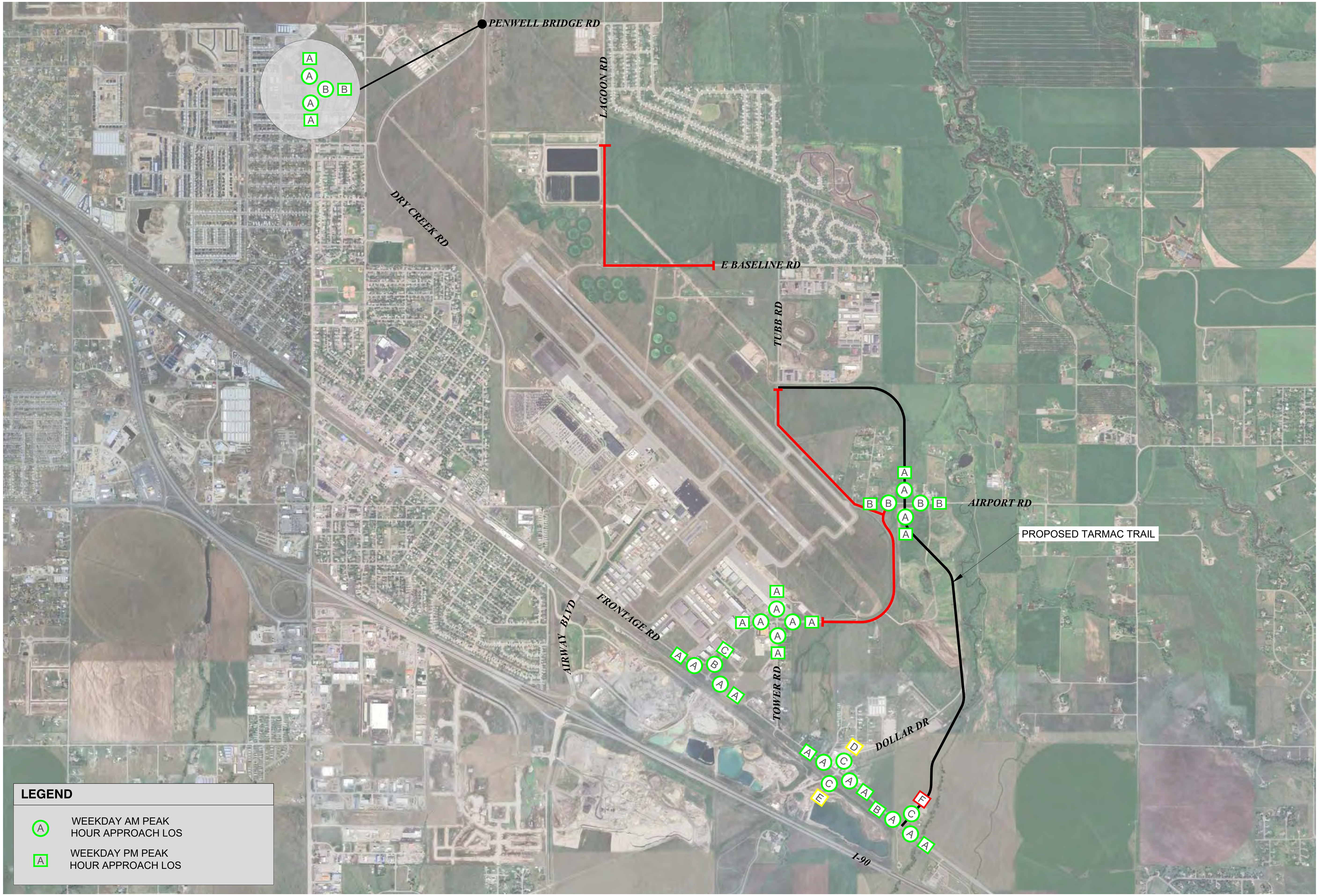
APRIL 2025

FIGURE 19

19 TRAFFIC OPERATIONS SUMMARY FOR 2029 BACKGROUND TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

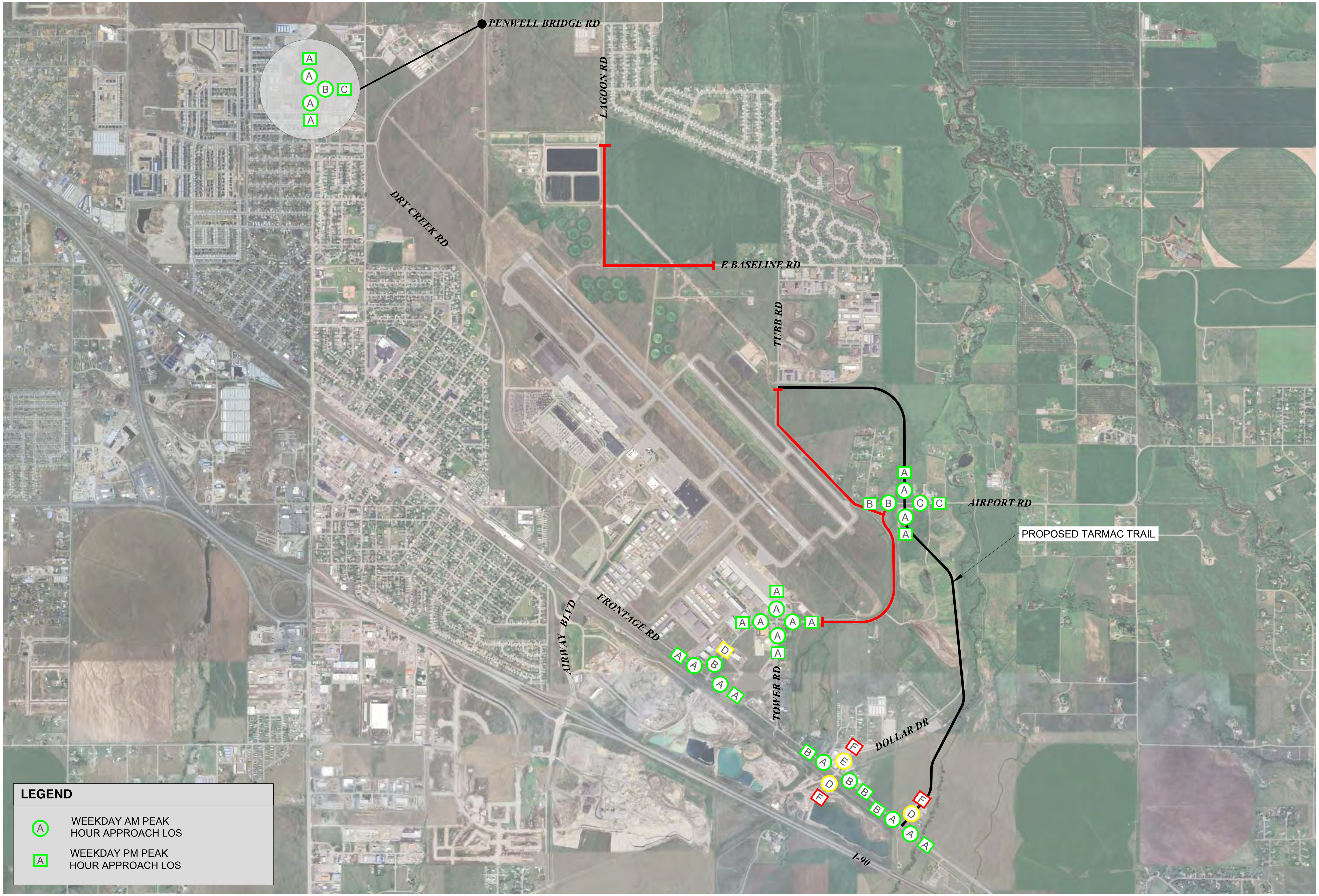
APRIL 2025

FIGURE 20

20 TRAFFIC OPERATIONS SUMMARY FOR 2029 TOTAL TRAFFIC

SCALE: 1" = 2000' on 11x17

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 21

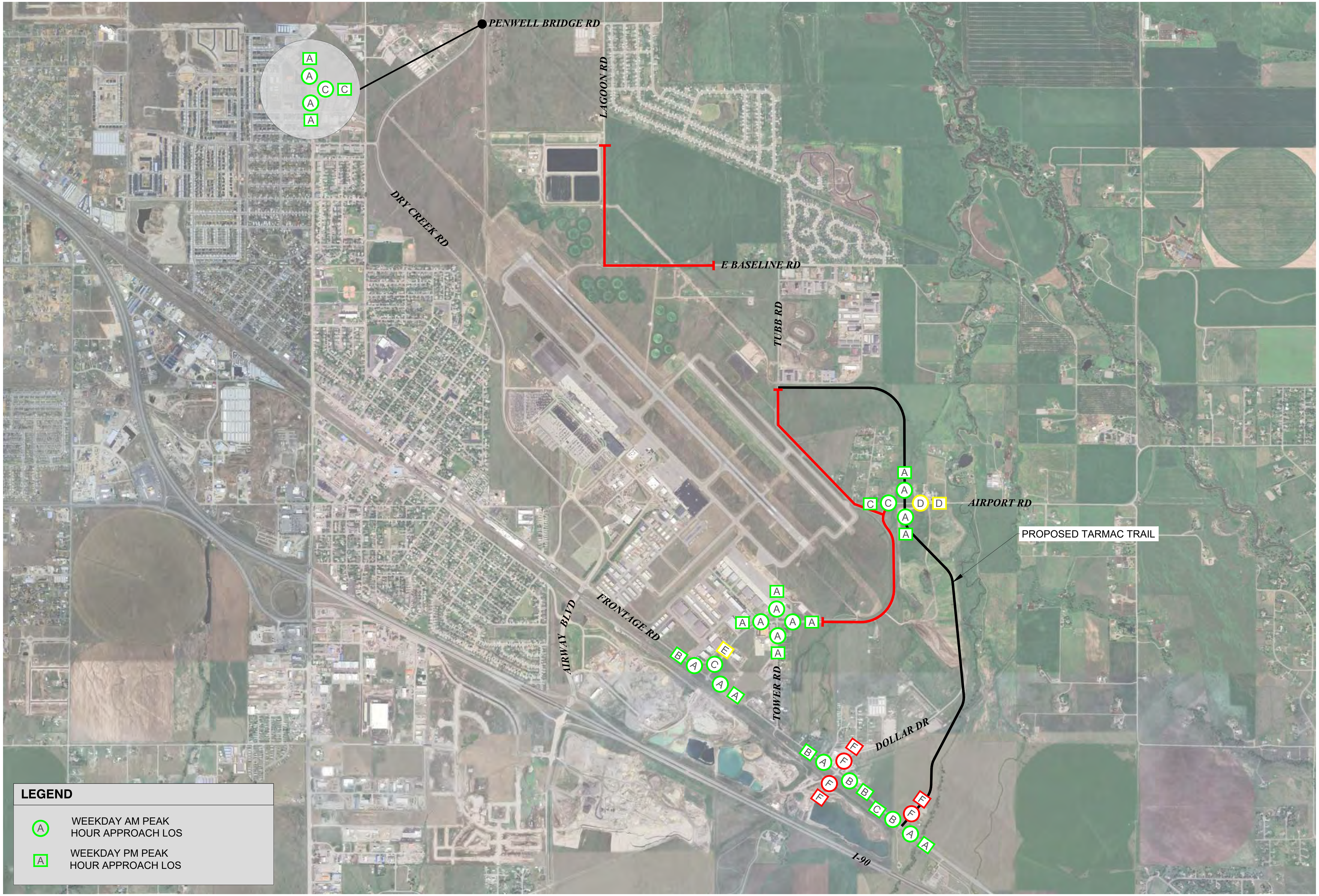
21 TRAFFIC OPERATIONS SUMMARY FOR 2044 BACKGROUND TRAFFIC

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:31am



BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

APRIL 2025

FIGURE 22

22 TRAFFIC OPERATIONS SUMMARY FOR 2044 TOTAL TRAFFIC

SCALE: 1" = 2000' on 11x17

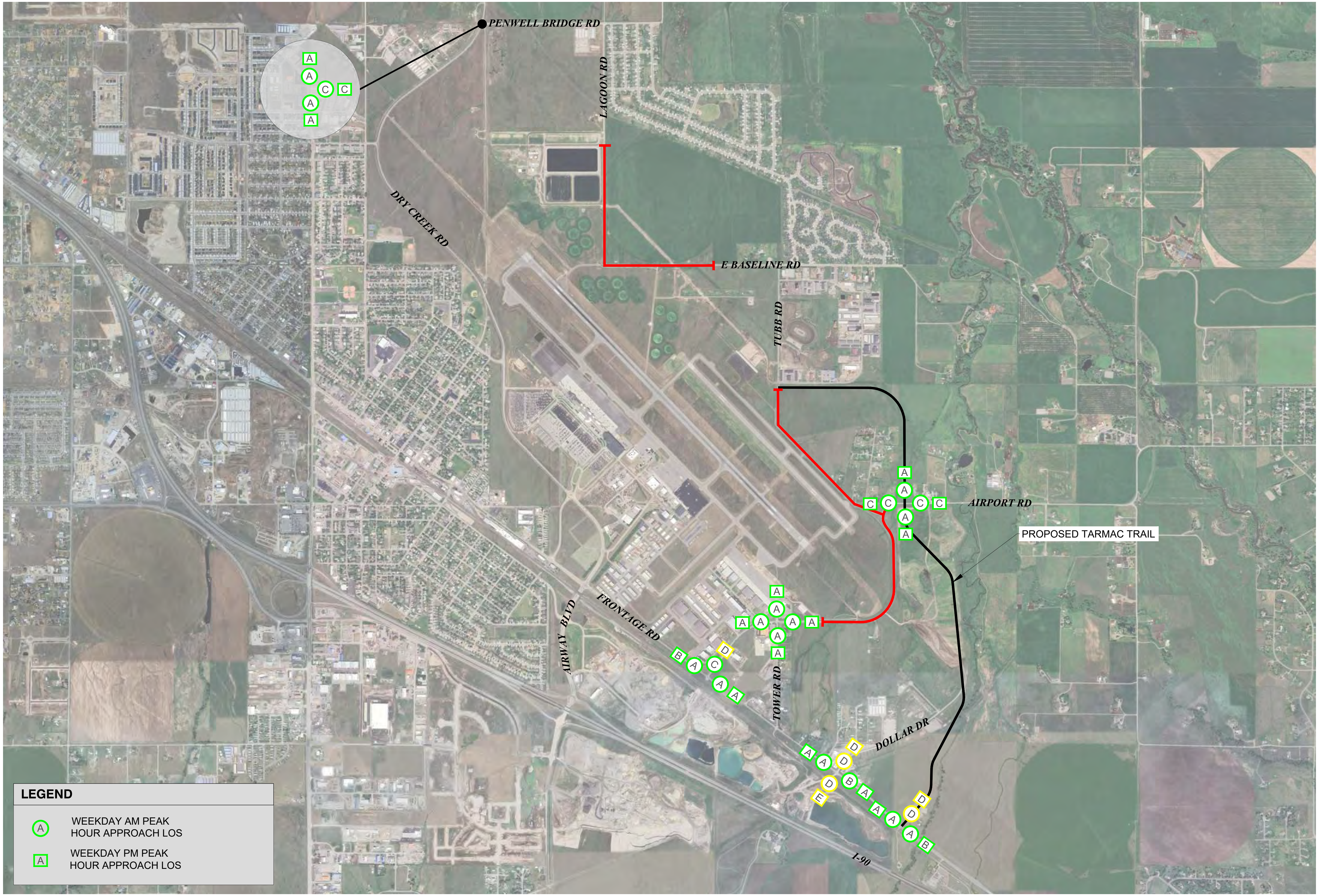
0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:32am

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION



APRIL 2025

FIGURE 23

23 TRAFFIC OPERATIONS SUMMARY FOR RECOMMENDED IMPROVEMENTS (LEVEL OF SERVICE IN 2044)

SCALE: 1" = 2000' on 11x17

0' 1000' 2000' 3000'

N

CAD FILE: M:\162534\Traffic Impact Study\TIS Figures.dwg
Mar 27, 2025 - 8:32am

WARRANT #1: EIGHT-HOUR VEHICULAR VOLUME

Where there is a large volume of intersecting traffic or where traffic on the major street is so heavy that the traffic on the minor street experiences major delays, warrant #1 is used to consider the installation of a traffic control signal. Condition A applies in the case of large intersecting traffic and Condition B applies in the case of major delays in the minor street. If one of these conditions is met, then the criteria for Warrant #1 is satisfied. Results are shown in the HCS7 Report in Appendix D.

WARRANT #2: FOUR-HOUR VEHICULAR VOLUME

Where the volume of intersecting traffic is the main reason to consider installing a traffic control signal, warrant #2 is applied. Results are shown in the HCS7 Report in Appendix D.

WARRANT #3: PEAK HOUR

Warrant #3 is used at a location where traffic for the minor street suffers delay during a minimum of one (1) hour of an average day. Also, the warrant is only applied in unusual cases. These include office complexes, manufacturing, industrial complexes, or high-occupancy vehicle facilities that discharge or attract large amounts of vehicles over a short period of time. There currently are no facilities in the project area that applies to one of these unusual cases and therefore the warrant does not qualify.

WARRANT #4: PEDESTRIAN VOLUME

Where the traffic volume on a major street is so large that pedestrians experience large delays, warrant #4 is applied. Pedestrian counts were low at the study intersections and the intersections are not currently designed to account for pedestrian traffic crossing the major roadway. This warrant does not apply to these intersections; however, the installation of a traffic signal will improve pedestrian traffic at this intersection, if required.

WARRANT #5: SCHOOL CROSSING

Where children crossing the major street near a school is the main reason to consider installing a traffic control signal, warrant #5 is applied. There are no school crossings at the intersection and there is not one currently proposed for this project. Therefore, warrant #5 was not included in this warrant analyses.

WARRANT #6: COORDINATED SIGNAL SYSTEM

Warrant #6 is applied when a traffic signal is needed to promote the progressive movement of traffic and maintain platooning of traffic in a coordinated traffic signal system. This warrant cannot be applied where the spacing of signals is less than 1,000 feet. Warrant #6 is not appropriate for this evaluation due to the traffic volumes observed at the study intersection.

WARRANT #7: CRASH EXPERIENCE

Warrant #7 is applied where the frequency and severity of vehicle crashes is the main reason to consider installing a traffic signal. Crash experience at or near these intersections as discussed earlier in this report and is not deemed to be a major concern.

WARRANT #8: ROADWAY NETWORK

When a traffic control signal is needed to concentrate and organize traffic flow on the roadway network, warrant #8 is applied. This warrant is used where two or more major routes intersect. The intersection does not qualify as the intersecting roads are not a major route. Warrant #8 was not evaluated in this warrant analysis.

WARRANT #9: INTERSECTION NEAR A GRADE CROSSING

Warrant #9 is used at a location where the proximity to the intersection of a grade crossing on an approach controlled by a STOP or YIELD sign is the main reason to install a traffic control signal. There is not a grade crossing within the study intersection. Therefore, warrant #9 was not included in this warrant analysis.

- ### TURN LANE ANALYSES

Turn lane analyses were performed for three intersections as a part of this study. The analyses were performed to determine if a right-turn lane or left-turn lane may be justified for each intersection for high volume turning movements. The three intersections included in these analyses are; Airport Road and Frontage Road, Dollar Drive and Frontage Road, and Frontage Road and Tarmac Trail. The results are shown in Appendix E.

FINDINGS

- ## 2024 EXISTING CONDITIONS

  - ### TRAFFIC OPERATIONS

Traffic Operations Summary for 2024 Existing Conditions			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/B
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/B
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/B/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	B/B/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	B/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	D/A/A
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	C/C/A/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	D/C/A/A
Airport Road & Tubb Road	AM	NB/SB/EB	A/A/B
Airport Road & Tubb Road	PM	NB/SB/EB	A/A/B
Jetway Drive & Tubb Road	AM	NB/SB/WB/EB	A/A/B/A
Jetway Drive & Tubb Road	PM	NB/SB/WB/EB	A/A/B/A

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS D).
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound PM movement (LOS D).
Airport Road and Tubb Road – All movements operate within acceptable levels of service.
Jetway Drive and Tubb Road – All movements operate within acceptable levels of service.

- **TARMAC TRAIL EXTENSION EXPECTED DAILY TRAFFIC**
  - **TRAFFIC OPERATIONS**

Traffic Operations Summary for Tarmac Trail Extension Expected Daily Traffic			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/B
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/B
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	B/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	B/A/A
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	C/C/A/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	D/D/A/A
Frontage Road & Tarmac Trail	AM	SB/WB/EB	B/A/A
Frontage Road & Tarmac Trail	PM	SB/WB/EB	E/A/A
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/B/B
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/B/B

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service.
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound and southbound PM movements (LOS D).
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS E).
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service.

- **2029 ESTIMATED BACKGROUND TRAFFIC**
  - **TRAFFIC OPERATIONS**

Traffic Operations Summary for 2029 Background Traffic			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/B
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/B
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	B/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	C/A/A
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	C/C/A/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	E/D/A/A
Frontage Road & Tarmac Trail	AM	SB/WB/EB	B/A/A
Frontage Road & Tarmac Trail	PM	SB/WB/EB	F/A/B
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/B/B
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/B/B

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service.
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound PM movement (LOS E) and southbound PM movement (LOS D).
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS F).
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service.

- **2029 ESTIMATED TOTAL TRAFFIC**
  - **TRAFFIC OPERATIONS**

Traffic Operations Summary for 2029 Total Traffic			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/B
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/B
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	B/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	C/A/A
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	C/C/A/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	E/D/A/A
Frontage Road & Tarmac Trail	AM	SB/WB/EB	C/A/A
Frontage Road & Tarmac Trail	PM	SB/WB/EB	F/A/B
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/B/B
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/B/B

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service.
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound PM movement (LOS E) and southbound PM movement (LOS D).
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS F).
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service.

- **2044 ESTIMATED BACKGROUND TRAFFIC**
  - **TRAFFIC OPERATIONS**

Traffic Operations Summary for 2044 Background Traffic			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/B
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/C
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	B/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	D/A/A
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	D/E/B/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	F/F/B/B
Frontage Road & Tarmac Trail	AM	SB/WB/EB	D/A/A
Frontage Road & Tarmac Trail	PM	SB/WB/EB	F/A/B
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/C/B
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/C/B

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS D).
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound AM (LOS D) and PM (LOS F) and southbound AM (LOS E) and PM (LOS F) movements.
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound AM (LOS D) and PM (LOS F) movements.
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service.

- ## 2044 ESTIMATED TOTAL TRAFFIC

  - ### TRAFFIC OPERATIONS

Traffic Operations Summary for 2044 Total Traffic			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/C
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/C
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	C/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	E/A/B
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	F/F/B/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	F/F/B/B
Frontage Road & Tarmac Trail	AM	SB/WB/EB	F/A/B
Frontage Road & Tarmac Trail	PM	SB/WB/EB	F/A/C
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/D/C
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/D/C

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS E).
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound AM (LOS F) and PM (LOS F) and southbound AM (LOS F) and PM (LOS F) movements.
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound AM (LOS F) and PM (LOS F) movements.
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the westbound AM (LOS D) and PM (LOS D) movements.

- **RECOMMENDED IMPROVEMENTS**
  - **TRAFFIC OPERATIONS**

Traffic Operations Summary for Recommended Improvements			
Intersection	**Time Period**	**Movement**	**LOS**
Penwell Bridge Road & Dry Creek Road	AM	NB/SB/WB	A/A/C
Penwell Bridge Road & Dry Creek Road	PM	NB/SB/WB	A/A/C
Airport Road & Tower Road	AM	NB/SB/WB/EB	A/A/A/A
Airport Road & Tower Road	PM	NB/SB/WB/EB	A/A/A/A
Airport Road & Frontage Road	AM	SB/WB/EB	C/A/A
Airport Road & Frontage Road	PM	SB/WB/EB	D/A/B
Dollar Drive & Frontage Road	AM	NB/SB/WB/EB	D/D/B/A
Dollar Drive & Frontage Road	PM	NB/SB/WB/EB	E/D/A/A
Frontage Road & Tarmac Trail	AM	SB/WB/EB	D/A/A
Frontage Road & Tarmac Trail	PM	SB/WB/EB	D/B/A
Airport Road & Tarmac Trail	AM	NB/SB/WB/EB	A/A/C/C
Airport Road & Tarmac Trail	PM	NB/SB/WB/EB	A/A/C/C

Penwell Bridge Road and Dry Creek Road – All movements operate within acceptable levels of service.
Airport Road and Tower Road – All movements operate within acceptable levels of service.
Airport Road and Frontage Road – All movements operate within acceptable levels of service, except for the southbound PM movement (LOS D).
Dollar Drive and Frontage Road – All movements operate within acceptable levels of service, except for the northbound AM (LOS D) and PM (LOS E) and southbound AM (LOS D) and PM (LOS D) movements.
Frontage Road and Tarmac Trail – All movements operate within acceptable levels of service, except for the southbound AM (LOS D) and PM (LOS D) movements.
Airport Road and Tarmac Trail – All movements operate within acceptable levels of service.

- **TRAFFIC SIGNAL WARRANT ANALYSES**

  One traffic signal warrant analysis was performed for the intersection of Frontage Road and Tarmac Trail to determine the necessity for installation of a traffic signal. The intersection does warrant a traffic signal for the scenario studied. The analysis was performed for expected daily traffic seen at the intersection, once Tarmac Trail is extended to Frontage Road. The traffic expected at the intersection meets warrants #1 and #2. Since the analysis meets warrant, a traffic signal design should be completed to meet MDT standards. The results of the warrant analysis and the counts used at the intersection can be found in Appendix D.

- **TURN LANE ANALYSES**

  Turn lane analyses were performed for three intersections as a part of this study. The analyses were performed to determine if a right-turn lane or left-turn lane may be justified for each intersection for high volume turning movements. The three intersections included in these analyses are; Airport Road and Frontage Road, Dollar Drive and Frontage Road, and Frontage Road and Tarmac Trail. Results of the analysis of the intersection at Airport Road and Frontage Road demonstrated a right-turn lane may not be justified, while the results of the analysis of the intersections at Dollar Drive and Frontage Road and Frontage Road and Tarmac Trail demonstrated a right-turn lane may be justified. All analyses looked at westbound right-turn lanes at each intersection. It was also determined that left-turn lane treatment should be considered for all three intersections included in these analyses. The results are shown in Appendix E.

- **PEDESTRIANS & BICYCLISTS**

  Pedestrian and bicycle traffic is expected to be negligible in the study area, due to the type of developments being proposed alongside the Tarmac Trail Extension project. However, the project will account for pedestrians and bicyclists to ensure intersection and corridor safety. Considerations for marked crossings, supplemental signage, traffic calming, or other measures may be necessary in the future. These improvements will allow for future connection to existing infrastructure surrounding the project area.

- **TRANSIT SERVICE**

  No specific improvements are proposed with the Tarmac Trail Extension for transit services.

- **COMPLIANCE WITH APPLICABLE LOCAL CODES**

  Any improvements done with the proposed Tarmac Trail Extension must be installed in accordance with Belgrade design standards, Gallatin County standards, and the American Association of State Highway and Transportation Officials guidelines. These guidelines can be found in the most current edition of A Policy on Geometric Design of Highways and Streets, 2018 7th Edition.

CONCLUSIONS & RECOMMENDATIONS

- **STUDY AREA INTERSECTIONS**

  - Analysis of trip generation estimates and traffic operations demonstrate that the Tarmac Trail Extension will impact the traffic system in the area. Based on the analyses, the following are recommended:

    Penwell Bridge Road and Dry Creek Road – No improvements are required for this intersection. The intersection can continue to operate as it does today with no traffic mitigation.

    Airport Road and Tower Road – No improvements are required for this intersection. The intersection can continue to operate as it does today with no traffic mitigation.

    Airport Road and Frontage Road – The Intersection of Airport Road and Frontage Road should include the addition of a right-turn lane for southbound traffic on Airport Road. The right-turn lane should be designed to have a storage length of at least 50 feet. Total traffic on Airport Road will decrease with the closure of the road north of the intersection. However, due to the increase of traffic on Frontage Road, this additional lane will improve the LOS for southbound movements. A left-turn lane should also be considered for traffic turning north from Frontage Road, as it meets the MDT criteria for installation on a 2-lane highway. All proposed improvements to this intersection should only be implemented once Tarmac Trail construction is completed and the new traffic signal is installed at the intersection of Tarmac Trail and Frontage Road. The daily trips on Airport Road will be decreased significantly due to the closure of the road north of this intersection and should be validated once actual usage is further evaluated post Tarmac Trail implementation.

    Dollar Drive and Frontage Road – The intersection of Dollar Drive and Frontage Road has failing LOS for all northbound and southbound movements without any improvements. The decrease in LOS is largely due to the increase of westbound and eastbound through movements due to growth in the surrounding area. Additional northbound and southbound left-turn lanes with a storage length of at least 100 feet are recommended. A right-turn lane for westbound traffic on Frontage Road should also be considered, as it meets the MDT criteria for installation on a 2-lane highway. A left-turn lane should also be considered for traffic turning north from Frontage Road, as it meets the MDT criteria for installation on a 2-lane highway. These improvements to the intersection result in a LOS that no longer fails. The installation of a traffic signal east of this intersection at Frontage Road and Tarmac Trail will give headway for turning movements onto Frontage Road. All proposed improvements to this intersection should only be implemented once Tarmac Trail construction is completed and the new traffic signal is installed at the intersection of Tarmac Trail and Frontage Road.

Tarmac Trail and Tubb Road – The intersection of Tarmac Trail and Tubb Road is included as a new intersection with the Tarmac Trail Extension. The intersection geometry and control devices are still yet to be determined, as it is early in the design and planning process in this area of the development. Currently, it is anticipated that the intersection will meet Tubb Road and Tarmac Trail at a 90-degree angle with no other legs off the intersection. This would create an intersection with no conflict points and it would operate at an acceptable level of service. This condition is shown in this report, with only southbound left turns and westbound right turns. It is also possible that a third leg will be added for eastbound traffic. Eastbound traffic would only access and existing development to the west of the intersection with minimal traffic volumes that can be seen in current traffic counts at the intersection of Jetway Drive and Tubb Road. It is anticipated that this condition would operate within acceptable levels of service. Further, analysis may be required at the intersection if major changes are seen as the planning process moves forward.

Frontage Road and Tarmac Trail – The intersection of Frontage Road and Tarmac Trail is included as a new intersection with the Tarmac Trail Extension. The proposed intersection meets signal warrants for installation of a traffic signal at the time that existing expected traffic is moved to the new intersection. It is recommended that the geometry of the intersection should include a southbound left-turn lane with at least 100 feet of storage, an eastbound left-turn lane with at least 250 feet of storage, and a westbound right-turn lane with at least 250 feet of storage. Once the signal is installed at the intersection, it should operate as an actuated signal with a 90 second cycle length. The signal should have protected left-turns for eastbound traffic. The detailed signal analysis and design considerations can be found in Appendix C.

Airport Road and Tarmac Trail – The intersection of Airport Road and Tarmac Trail is included as a new intersection with the Tarmac Trail Extension. The proposed intersection should operate as a two-way stop-controlled intersection with stop signs for westbound and eastbound movements. A right-turn lane should be considered for westbound traffic to see an acceptable LOS for all movements. The right-turn lane should be designed to have a storage length of at least 50 feet.

- **DESIGN CONSIDERATIONS**

  - Intersections that include MDT routes (Frontage Road) as a leg of the intersection shall be designed to account for WB-67 turning movements, both onto and off the state road.
  - Full right-of-way shall be acquired for the complete build-out of all intersections at the time of construction. It is anticipated that right-of-way will need to be acquired north of Frontage Road to avoid railroad right-of-way that runs along the south side. Railroad right-of-way shall not be impeded upon.
  - Safety improvements should be considered along Frontage Road and Tubb Road in the project area between study intersections. Full corridor buildout will be required in the future and engineering judgement and considerations from the proper review agencies should be accounted for in these area.

- **SITE ACCESSIBILITY**

  - All roadways should be installed in accordance with Belgrade design standards or Gallatin County Standards. If a road has sections proposed through both jurisdictions a consistent roadway typical is recommended.
  - Roadways should be designed for the vehicles that will use the roads in the study area. These include emergency, solid waste, and school bus vehicles.
  - Per the American Association of State Highway and Transportation Officials (AASHTO) standards, adequate sight distance must be preserved at all driveways, intersections, and crosswalks. This is for driver, pedestrian, and bicyclist safety.

REFERENCES

1. American Association of State Highway and Transportation Officials. (August 2012). A Policy on Geometric Design of Highways and Streets, 2018 7th Edition. Washington, DC: Author.
2. Institute of Transportation Engineers. (2005). Transportation Impact Analyses for Site Development: An ITE Proposed Recommended Practice. Washington, DC: Author.
3. Institute of Transportation Engineers. (September 2021). Trip Generation Manual, 11th Edition. Washington, DC: Author.
4. Montana Department of Transportation. (August 2009). Montana Traffic Engineering Manual. Helena, MT: Author.
5. Transportation Research Board. (2016). Highway Capacity Manual, 6th Edition: A Guide for Multimodal Mobility Analysis. Washington, DC: Author.
6. United States Department of Transportation – Federal Highway Administration. (December 2023). Manual on Uniform Traffic Control Devices for Streets and Highways, 11th Edition. Washington DC: Author.
7. Gallatin County. (February 14, 2014). Gallatin County Subdivision Regulations. Bozeman, MT: Author.
8. City of Belgrade. (July 2017). Design Standards and Specifications Policy. Belgrade, MT: Public Works Department.
9. Meadowlark Development, LLC. (December 2021). Meadowlark Ranch Phases V & VI Traffic Impact Study. Belgrade, MT: Sanderson-Stewart.
10. City of Belgrade. (October 2018). Belgrade Long Range Transportation Plan. Belgrade, MT: Robert Peccia & Associates.
11. Gallatin County. (April 2022). Greater Triangle Area Transportation Plan. Gallatin County: Robert Peccia & Associates.

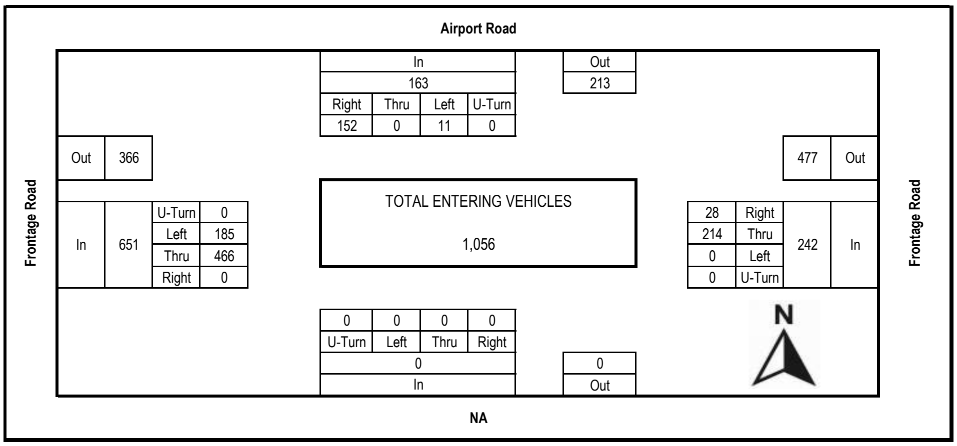
APPENDIX A
TRAFFIC COUNT DATA

Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Airport Road & Frontage Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.92

Groups Printed - Cars, Trucks, Bank3, & Bank4

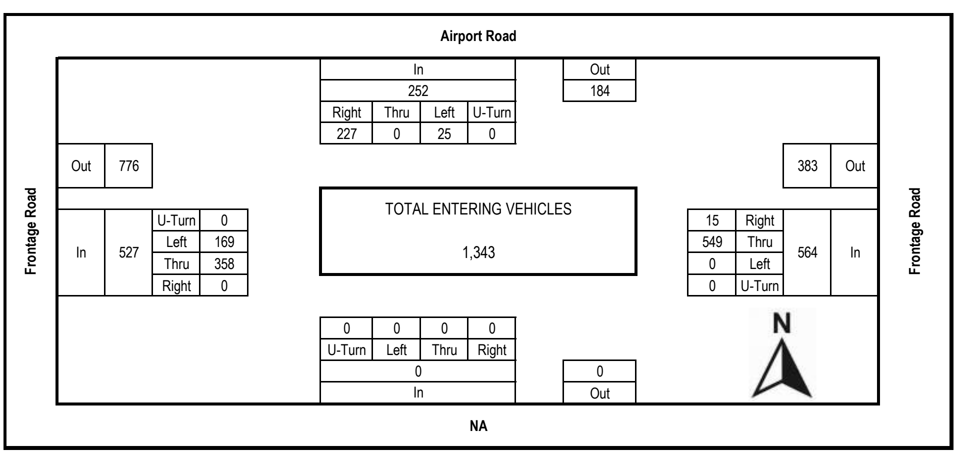
	Frontage Road Eastbound						Frontage Road Westbound						NA Northbound						Airport Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:30 AM	0	36	132	0	0	168	0	0	45	5	0	50	0	0	0	0	0	0	0	4	0	31	0	35	253
7:45 AM	0	52	120	0	0	172	0	0	56	6	0	62	0	0	0	0	0	0	0	2	0	50	0	52	286
8:00 AM	0	52	120	0	0	172	0	0	63	10	0	73	0	0	0	0	0	0	0	2	0	36	0	38	283
8:15 AM	0	45	94	0	0	139	0	0	50	7	0	57	0	0	0	0	0	0	0	3	0	35	0	38	234
Total	0	185	466	0	0	651	0	0	214	28	0	242	0	0	0	0	0	0	0	11	0	152	0	163	1,056
Apprch %	0.0%	28.4%	71.6%	0.0%	0.0%		0.0%	0.0%	88.4%	11.6%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	6.7%	0.0%	93.3%	0.0%		
Total %	0.0%	17.5%	44.1%	0.0%	0.0%	61.6%	0.0%	0.0%	20.3%	2.7%	0.0%	22.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	14.4%	0.0%	15.4%	
Heavy %	0.0%	4.5%	1.9%	0.0%			0.0%	0.0%	5.3%	1.0%			0.0%	0.0%	0.0%	0.0%			0.0%	6.9%	0.0%	5.4%			3.6%



Count Location: Airport Road & Frontage Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.98

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Frontage Road Eastbound						Frontage Road Westbound						NA Northbound						Airport Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
4:45 PM	0	46	96	0	0	142	0	0	115	2	0	117	0	0	0	0	0	0	0	8	0	64	0	72	331
5:00 PM	0	44	91	0	0	135	0	0	130	5	0	135	0	0	0	0	0	0	0	7	0	66	0	73	343
5:15 PM	0	45	82	0	0	127	0	0	158	3	0	161	0	0	0	0	0	0	0	5	0	51	0	56	344
5:30 PM	0	34	89	0	0	123	0	0	146	5	0	151	0	0	0	0	0	0	0	5	0	46	0	51	325
Total	0	169	358	0	0	527	0	0	549	15	0	564	0	0	0	0	0	0	0	25	0	227	0	252	1,343
Apprch %	0.0%	32.1%	67.9%	0.0%	0.0%		0.0%	0.0%	97.3%	2.7%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	9.9%	0.0%	90.1%	0.0%		
Total %	0.0%	12.6%	26.7%	0.0%	0.0%	39.2%	0.0%	0.0%	40.9%	1.1%	0.0%	42.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	0.0%	16.9%	0.0%	18.8%	
Heavy %	0.0%	2.2%	1.6%	0.0%			0.0%	0.0%	2.0%	1.8%			0.0%	0.0%	0.0%	0.0%			0.0%	2.3%	0.0%	2.1%			2.0%

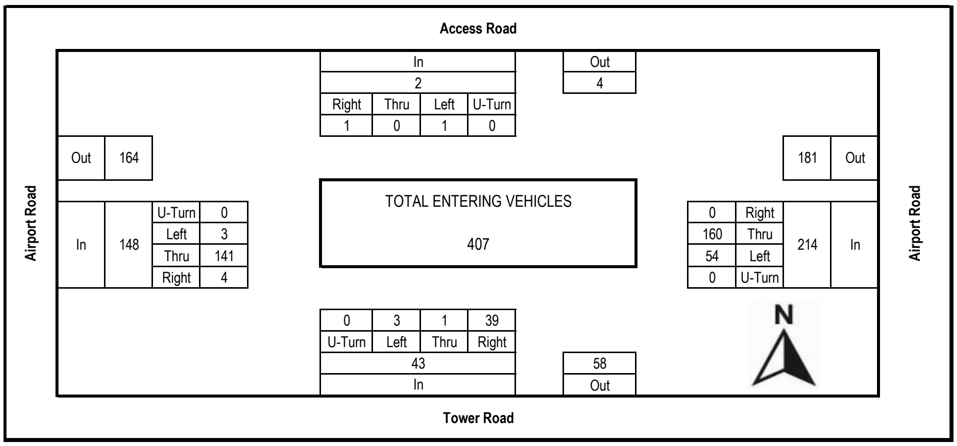


Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Airport Road & Tower Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.88

Groups Printed - Cars, Trucks, Bank3, & Bank4

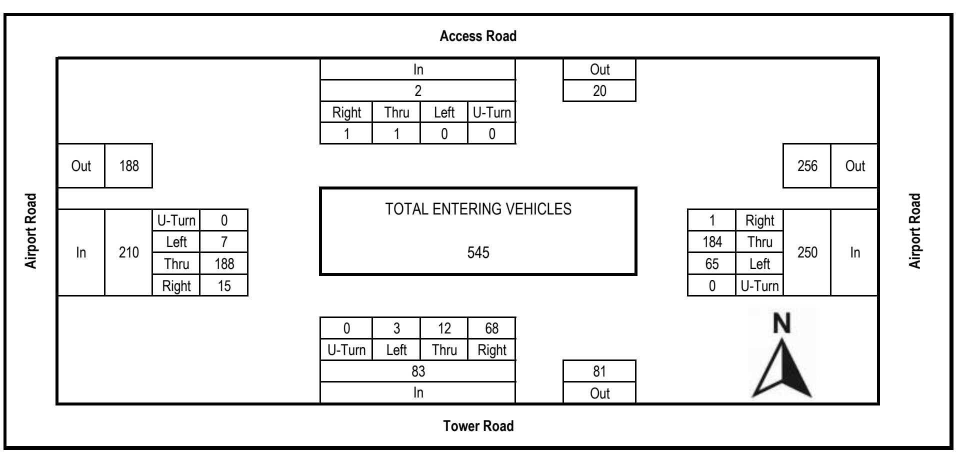
	Airport Road Eastbound						Airport Road Westbound						Tower Road Northbound						Access Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:45 AM	0	0	32	1	0	33	0	19	51	0	0	70	0	1	0	11	0	12	0	0	0	1	0	1	116
8:00 AM	0	1	43	1	0	45	0	12	36	0	0	48	0	1	0	7	0	8	0	0	0	0	0	0	101
8:15 AM	0	1	37	1	0	39	0	11	34	0	0	45	0	0	1	9	0	10	0	0	0	0	0	0	94
8:30 AM	0	1	29	1	0	31	0	12	39	0	0	51	0	1	0	12	0	13	0	1	0	0	0	1	96
Total	0	3	141	4	0	148	0	54	160	0	0	214	0	3	1	39	0	43	0	1	0	1	0	2	407
Apprch %	0.0%	2.0%	95.3%	2.7%	0.0%		0.0%	25.2%	74.8%	0.0%	0.0%		0.0%	7.0%	2.3%	90.7%	0.0%		0.0%	50.0%	0.0%	50.0%	0.0%		
Total %	0.0%	0.7%	34.6%	1.0%	0.0%	36.4%	0.0%	13.3%	39.3%	0.0%	0.0%	52.6%	0.0%	0.7%	0.2%	9.6%	0.0%	10.6%	0.0%	0.2%	0.0%	0.2%	0.0%	0.5%	
Heavy %	0.0%	0.0%	5.6%	0.0%			0.0%	0.0%	5.6%	0.0%			0.0%	0.0%	0.0%	0.7%			0.0%	0.0%	0.0%	50.0%			4.4%



Count Location: Airport Road & Tower Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.96

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Airport Road Eastbound						Airport Road Westbound						Tower Road Northbound						Access Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
4:30 PM	0	2	53	1	0	56	0	19	44	0	0	63	0	1	5	17	0	23	0	0	0	0	0	0	142
4:45 PM	0	4	38	4	0	46	0	14	48	1	0	63	0	0	3	16	0	19	0	0	0	1	0	1	129
5:00 PM	0	1	47	8	0	56	0	22	49	0	0	71	0	1	2	12	0	15	0	0	0	0	0	0	142
5:15 PM	0	0	50	2	0	52	0	10	43	0	0	53	0	1	2	23	0	26	0	0	1	0	0	1	132
Total	0	7	188	15	0	210	0	65	184	1	0	250	0	3	12	68	0	83	0	0	1	1	0	2	545
Apprch %	0.0%	3.3%	89.5%	7.1%	0.0%		0.0%	26.0%	73.6%	0.4%	0.0%		0.0%	3.6%	14.5%	81.9%	0.0%		0.0%	0.0%	50.0%	50.0%	0.0%		
Total %	0.0%	1.3%	34.5%	2.8%	0.0%	38.5%	0.0%	11.9%	33.8%	0.2%	0.0%	45.9%	0.0%	0.6%	2.2%	12.5%	0.0%	15.2%	0.0%	0.0%	0.2%	0.2%	0.0%	0.4%	
Heavy %	0.0%	35.7%	2.9%	0.0%			0.0%	1.8%	3.3%	100.0%			0.0%	0.0%	80.6%	0.7%			0.0%	0.0%	100.0%	0.0%			4.1%

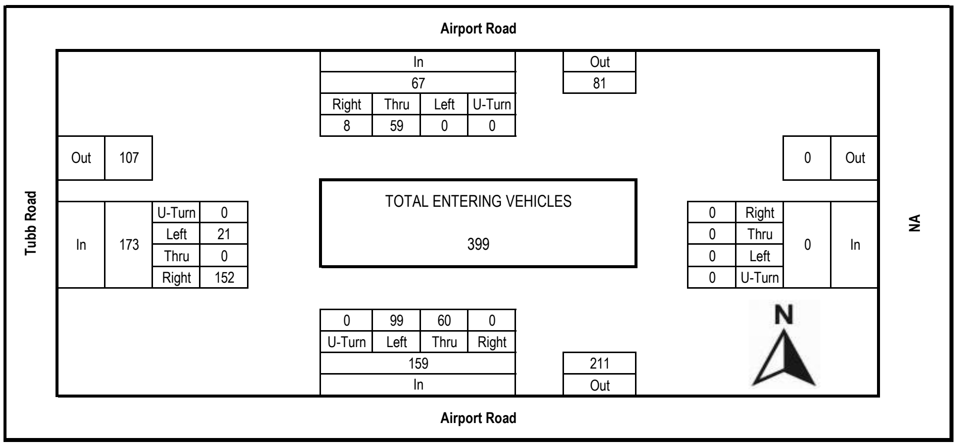


Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Airport Road & Tubb Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.81

Groups Printed - Cars, Trucks, Bank3, & Bank4

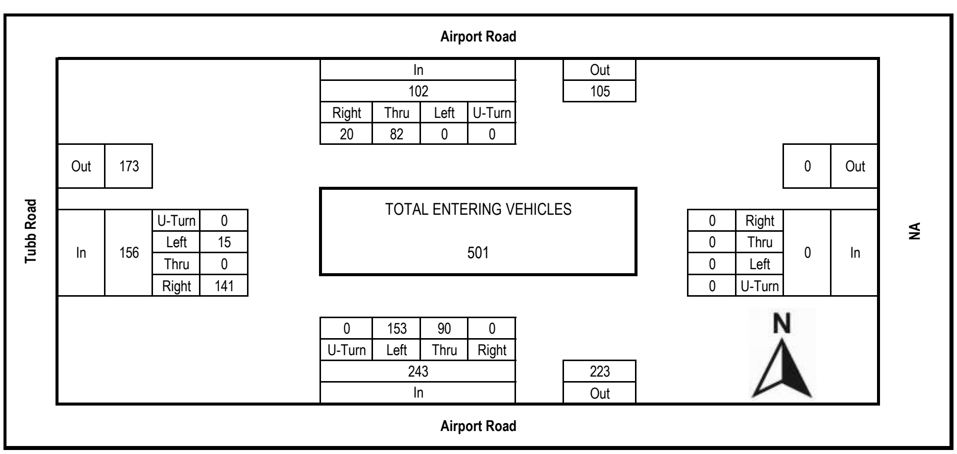
	Tubb Road Eastbound						NA Westbound						Airport Road Northbound						Airport Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:30 AM	0	5	0	33	0	38	0	0	0	0	0	0	0	20	10	0	0	30	0	0	17	3	0	20	88
7:45 AM	0	7	0	50	0	57	0	0	0	0	0	0	0	32	15	0	0	47	0	0	18	1	0	19	123
8:00 AM	0	4	0	36	0	40	0	0	0	0	0	0	0	24	15	0	0	39	0	0	12	2	0	14	93
8:15 AM	0	5	0	33	0	38	0	0	0	0	0	0	0	23	20	0	0	43	0	0	12	2	0	14	95
Total	0	21	0	152	0	173	0	0	0	0	0	0	0	99	60	0	0	159	0	0	59	8	0	67	399
Apprch %	0.0%	12.1%	0.0%	87.9%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	62.3%	37.7%	0.0%	0.0%		0.0%	0.0%	88.1%	11.9%	0.0%		
Total %	0.0%	5.3%	0.0%	38.1%	0.0%	43.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	24.8%	15.0%	0.0%	0.0%	39.8%	0.0%	0.0%	14.8%	2.0%	0.0%	16.8%	
Heavy %	0.0%	0.0%	0.0%	3.1%			0.0%	0.0%	0.0%	0.0%			0.0%	0.8%	7.5%	0.0%			0.0%	0.0%	6.5%	8.8%			3.8%



Count Location: Airport Road & Tubb Road
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.96

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Tubb Road Eastbound						NA Westbound						Airport Road Northbound						Airport Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
4:30 PM	0	3	0	39	0	42	0	0	0	0	0	0	0	37	29	0	0	66	0	0	16	4	0	20	128
4:45 PM	0	4	0	34	0	38	0	0	0	0	0	0	0	32	22	0	0	54	0	0	21	6	0	27	119
5:00 PM	0	4	0	40	0	44	0	0	0	0	0	0	0	38	15	0	0	53	0	0	22	5	0	27	124
5:15 PM	0	4	0	28	0	32	0	0	0	0	0	0	0	46	24	0	0	70	0	0	23	5	0	28	130
Total	0	15	0	141	0	156	0	0	0	0	0	0	0	153	90	0	0	243	0	0	82	20	0	102	501
Apprch %	0.0%	9.6%	0.0%	90.4%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	63.0%	37.0%	0.0%	0.0%		0.0%	0.0%	80.4%	19.6%	0.0%		
Total %	0.0%	3.0%	0.0%	28.1%	0.0%	31.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	30.5%	18.0%	0.0%	0.0%	48.5%	0.0%	0.0%	16.4%	4.0%	0.0%	20.4%	
Heavy %	0.0%	3.4%	0.0%	0.8%			0.0%	0.0%	0.0%	0.0%			0.0%	0.8%	2.1%	0.0%			0.0%	0.0%	3.0%	0.0%			1.4%

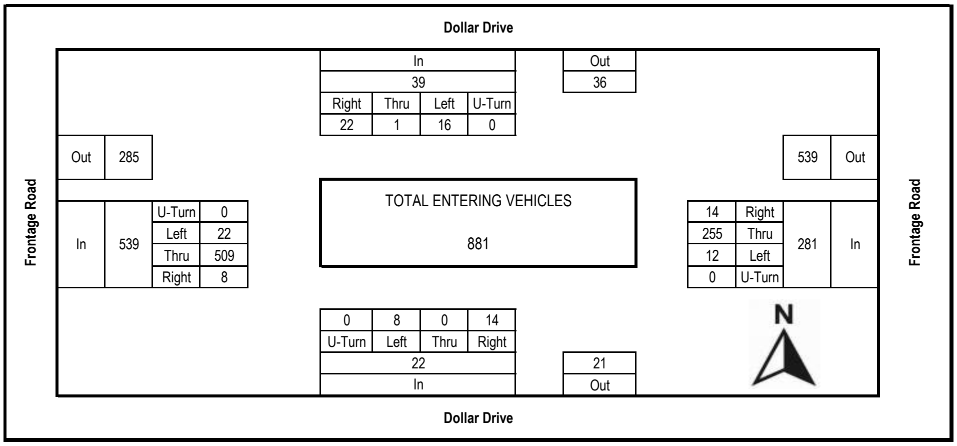


Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Frontage Road & Dollar Drive
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.95

Groups Printed - Cars, Trucks, Bank3, & Bank4

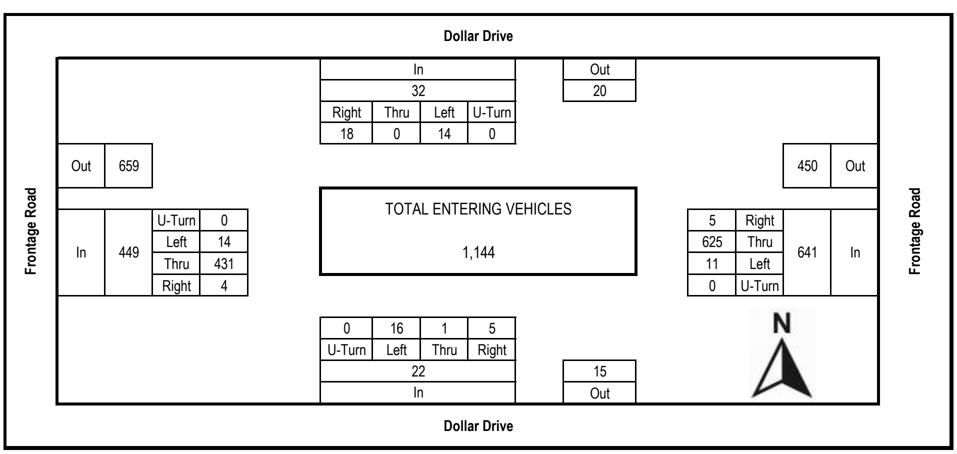
	Frontage Road Eastbound						Frontage Road Westbound						Dollar Drive Northbound						Dollar Drive Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:30 AM	0	7	142	3	0	152	0	1	57	4	0	62	0	2	0	5	0	7	0	2	1	4	0	7	228
7:45 AM	0	6	139	1	0	146	0	5	68	3	0	76	0	1	0	1	0	2	0	2	0	7	0	9	233
8:00 AM	0	4	122	2	0	128	0	4	65	2	0	71	0	4	0	3	0	7	0	7	0	6	0	13	219
8:15 AM	0	5	106	2	0	113	0	2	65	5	0	72	0	1	0	5	0	6	0	5	0	5	0	10	201
Total	0	22	509	8	0	539	0	12	255	14	0	281	0	8	0	14	0	22	0	16	1	22	0	39	881
Apprch %	0.0%	4.1%	94.4%	1.5%	0.0%		0.0%	4.3%	90.7%	5.0%	0.0%		0.0%	36.4%	0.0%	63.6%	0.0%		0.0%	41.0%	2.6%	56.4%	0.0%		
Total %	0.0%	2.5%	57.8%	0.9%	0.0%	61.2%	0.0%	1.4%	28.9%	1.6%	0.0%	31.9%	0.0%	0.9%	0.0%	1.6%	0.0%	2.5%	0.0%	1.8%	0.1%	2.5%	0.0%	4.4%	
Heavy %	0.0%	1.3%	0.7%	56.8%			0.0%	88.5%	1.3%	2.2%			0.0%	75.0%	0.0%	84.1%			0.0%	0.0%	0.0%	8.1%			5.2%



Count Location: Frontage Road & Dollar Drive
Count Date: Tuesday, June 11 & Wednesday, June 12, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.95

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Frontage Road Eastbound						Frontage Road Westbound						Dollar Drive Northbound						Dollar Drive Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
4:45 PM	0	6	113	0	0	119	0	4	130	1	0	135	0	4	1	3	0	8	0	5	0	7	0	12	274
5:00 PM	0	2	119	1	0	122	0	3	138	1	0	142	0	5	0	1	0	6	0	3	0	5	0	8	278
5:15 PM	0	3	97	2	0	102	0	2	185	1	0	188	0	3	0	0	0	3	0	4	0	4	0	8	301
5:30 PM	0	3	102	1	0	106	0	2	172	2	0	176	0	4	0	1	0	5	0	2	0	2	0	4	291
Total	0	14	431	4	0	449	0	11	625	5	0	641	0	16	1	5	0	22	0	14	0	18	0	32	1,144
Apprch %	0.0%	3.1%	96.0%	0.9%	0.0%		0.0%	1.7%	97.5%	0.8%	0.0%		0.0%	72.7%	4.5%	22.7%	0.0%		0.0%	43.8%	0.0%	56.3%	0.0%		
Total %	0.0%	1.2%	37.7%	0.3%	0.0%	39.2%	0.0%	1.0%	54.6%	0.4%	0.0%	56.0%	0.0%	1.4%	0.1%	0.4%	0.0%	1.9%	0.0%	1.2%	0.0%	1.6%	0.0%	2.8%	
Heavy %	0.0%	1.9%	0.9%	71.4%			0.0%	97.7%	1.1%	19.2%			0.0%	43.2%	66.7%	69.4%			0.0%	9.5%	0.0%	0.0%			3.6%

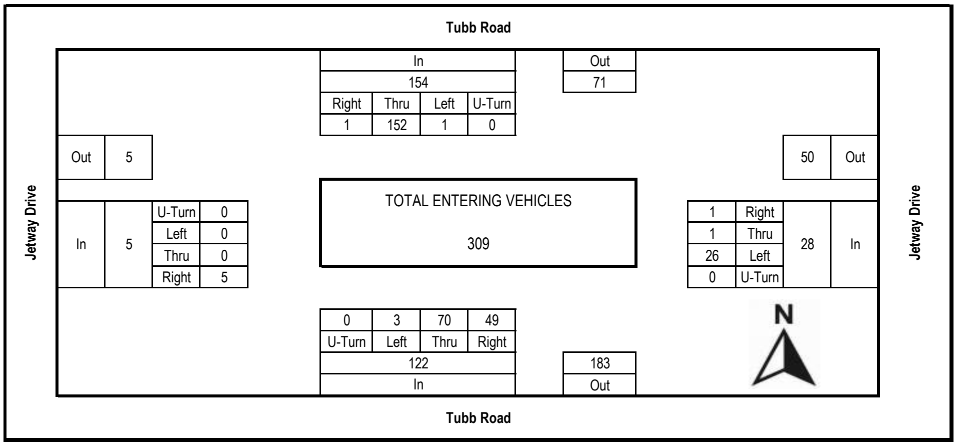


Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Jetway Drive & Tubb Road
Count Date: Tuesday, October 29 & Wednesday, October 30, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.82

Groups Printed - Cars, Trucks, Bank3, & Bank4

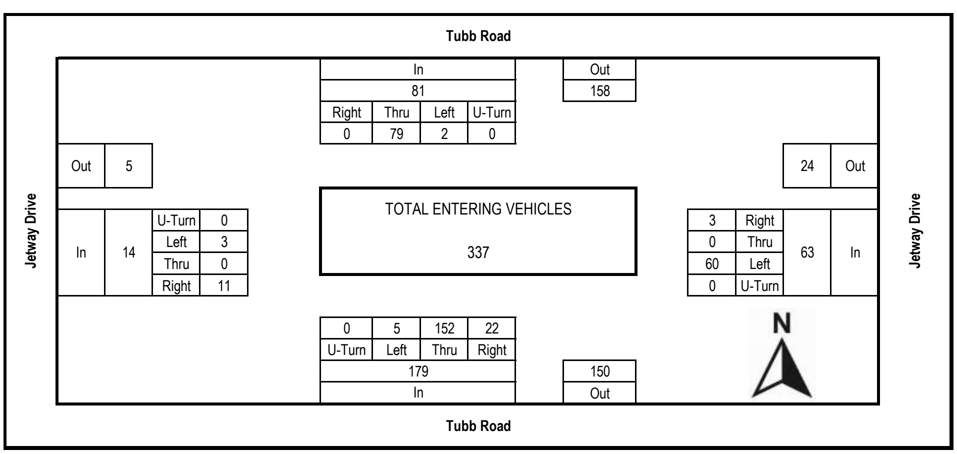
	Jetway Drive Eastbound						Jetway Drive Westbound						Tubb Road Northbound						Tubb Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:30 AM	0	0	0	1	0	1	0	3	0	0	0	3	0	0	16	9	0	25	0	0	47	0	0	47	76
7:45 AM	0	0	0	1	0	1	0	6	1	1	0	8	0	1	19	15	0	35	0	1	49	0	0	50	94
8:00 AM	0	0	0	1	0	1	0	7	0	0	0	7	0	1	16	15	0	32	0	0	29	0	0	29	69
8:15 AM	0	0	0	2	0	2	0	10	0	0	0	10	0	1	19	10	0	30	0	0	27	1	0	28	70
Total	0	0	0	5	0	5	0	26	1	1	0	28	0	3	70	49	0	122	0	1	152	1	0	154	309
Apprch %	0.0%	0.0%	0.0%	100.0%	0.0%		0.0%	92.9%	3.6%	3.6%	0.0%		0.0%	2.5%	57.4%	40.2%	0.0%		0.0%	0.6%	98.7%	0.6%	0.0%		
Total %	0.0%	0.0%	0.0%	1.6%	0.0%	1.6%	0.0%	8.4%	0.3%	0.3%	0.0%	9.1%	0.0%	1.0%	22.7%	15.9%	0.0%	39.5%	0.0%	0.3%	49.2%	0.3%	0.0%	49.8%	
Heavy %	0.0%	0.0%	0.0%	0.0%			0.0%	1.1%	0.0%	0.0%			0.0%	0.0%	6.0%	0.5%			0.0%	0.0%	0.8%	0.0%			1.8%



Count Location: Jetway Drive & Tubb Road
Count Date: Tuesday, October 29 & Wednesday, October 30, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.94

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Jetway Drive Eastbound						Jetway Drive Westbound						Tubb Road Northbound						Tubb Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
4:45 PM	0	0	0	1	0	1	0	13	0	0	0	13	0	1	33	6	0	40	0	0	20	0	0	20	74
5:00 PM	0	1	0	4	0	5	0	17	0	1	0	18	0	2	36	7	0	45	0	0	19	0	0	19	87
5:15 PM	0	1	0	3	0	4	0	10	0	1	0	11	0	2	49	5	0	56	0	1	18	0	0	19	90
5:30 PM	0	1	0	3	0	4	0	20	0	1	0	21	0	0	34	4	0	38	0	1	22	0	0	23	86
Total	0	3	0	11	0	14	0	60	0	3	0	63	0	5	152	22	0	179	0	2	79	0	0	81	337
Apprch %	0.0%	21.4%	0.0%	78.6%	0.0%		0.0%	95.2%	0.0%	4.8%	0.0%		0.0%	2.8%	84.9%	12.3%	0.0%		0.0%	2.5%	97.5%	0.0%	0.0%		
Total %	0.0%	0.9%	0.0%	3.3%	0.0%	4.2%	0.0%	17.8%	0.0%	0.9%	0.0%	18.7%	0.0%	1.5%	45.1%	6.5%	0.0%	53.1%	0.0%	0.6%	23.4%	0.0%	0.0%	24.0%	
Heavy %	0.0%	0.0%	0.0%	0.0%			0.0%	1.3%	0.0%	0.0%			0.0%	0.0%	1.4%	2.1%			0.0%	0.0%	1.3%	0.0%			1.3%

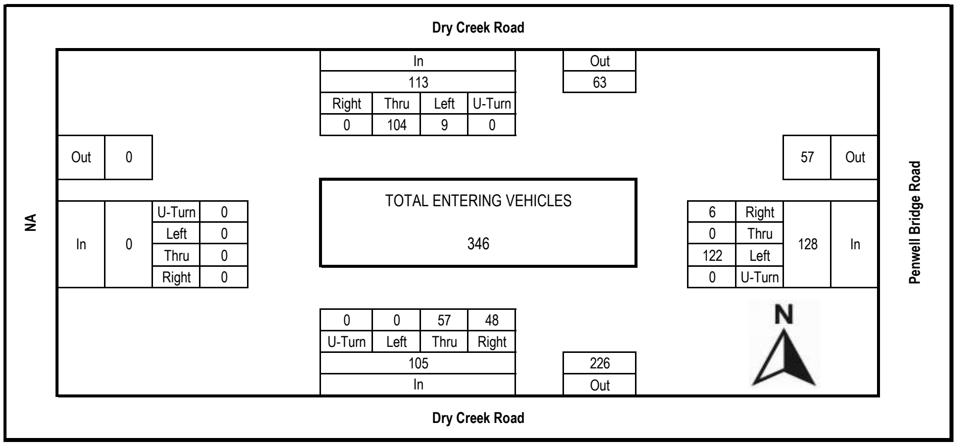


Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Penwell Bridge Road & Dry Creek Road
Count Date: Tuesday, June 18 & Wednesday, June 19, 2024
Count Time Period: Weekday, AM Peak Period
Peak Hour Factor: 0.89

Groups Printed - Cars, Trucks, Bank3, & Bank4

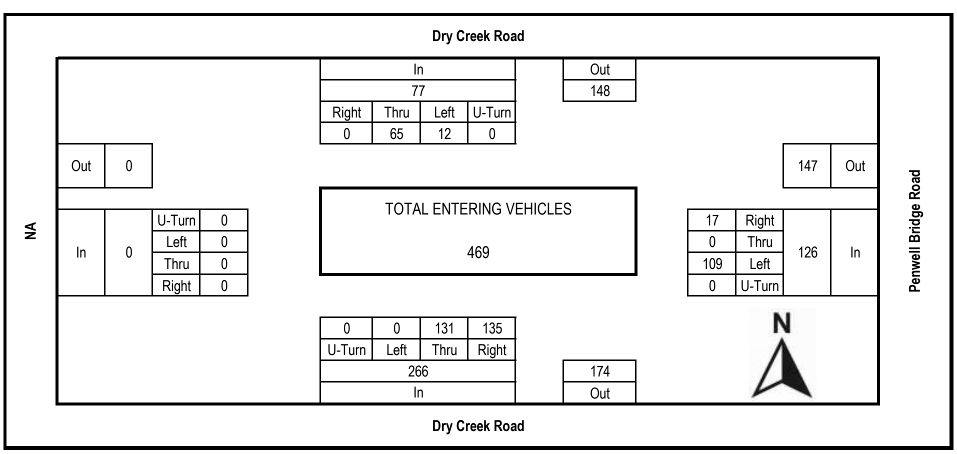
	NA Eastbound						Penwell Bridge Road Westbound						Dry Creek Road Northbound						Dry Creek Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:30 AM	0	0	0	0	0	0	0	38	0	1	0	39	0	0	15	9	0	24	0	3	31	0	0	34	97
7:45 AM	0	0	0	0	0	0	0	36	0	2	0	38	0	0	10	14	0	24	0	3	28	0	0	31	93
8:00 AM	0	0	0	0	0	0	0	25	0	1	0	26	0	0	13	11	0	24	0	1	20	0	0	21	71
8:15 AM	0	0	0	0	0	0	0	23	0	2	0	25	0	0	19	14	0	33	0	2	25	0	0	27	85
Total	0	0	0	0	0	0	0	122	0	6	0	128	0	0	57	48	0	105	0	9	104	0	0	113	346
Apprch %	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	95.3%	0.0%	4.7%	0.0%		0.0%	0.0%	54.3%	45.7%	0.0%		0.0%	8.0%	92.0%	0.0%	0.0%		
Total %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	35.3%	0.0%	1.7%	0.0%	37.0%	0.0%	0.0%	16.5%	13.9%	0.0%	30.3%	0.0%	2.6%	30.1%	0.0%	0.0%	32.7%	
Heavy %	0.0%	0.0%	0.0%	0.0%			0.0%	1.2%	0.0%	11.8%			0.0%	0.0%	6.2%	4.5%			0.0%	8.3%	1.5%	0.0%			2.9%



Count Location: Penwell Bridge Road & Dry Creek Road
Count Date: Tuesday, June 18 & Wednesday, June 19, 2024
Count Time Period: Weekday, PM Peak Period
Peak Hour Factor: 0.95

Groups Printed - Cars, Trucks, Bank3, & Bank4

	NA Eastbound						Penwell Bridge Road Westbound						Dry Creek Road Northbound						Dry Creek Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
5:00 PM	0	0	0	0	0	0	0	27	0	6	0	33	0	0	31	36	0	67	0	3	20	0	0	23	123
5:15 PM	0	0	0	0	0	0	0	26	0	3	0	29	0	0	38	33	0	71	0	3	13	0	0	16	116
5:30 PM	0	0	0	0	0	0	0	27	0	3	0	30	0	0	34	40	0	74	0	3	14	0	0	17	121
5:45 PM	0	0	0	0	0	0	0	29	0	5	0	34	0	0	28	26	0	54	0	3	18	0	0	21	109
Total	0	0	0	0	0	0	0	109	0	17	0	126	0	0	131	135	0	266	0	12	65	0	0	77	469
Apprch %	0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	86.5%	0.0%	13.5%	0.0%		0.0%	0.0%	49.2%	50.8%	0.0%		0.0%	15.6%	84.4%	0.0%	0.0%		
Total %	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	23.2%	0.0%	3.6%	0.0%	26.9%	0.0%	0.0%	27.9%	28.8%	0.0%	56.7%	0.0%	2.6%	13.9%	0.0%	0.0%	16.4%	
Heavy %	0.0%	0.0%	0.0%	0.0%			0.0%	1.1%	0.0%	0.0%			0.0%	0.0%	3.3%	0.6%			0.0%	0.0%	1.8%	0.0%			1.6%



APPENDIX B
TRIP GENERATION ANALYSES

HYALITE

Airport Commercial Subdivision

Traffic Impact Study

Trip Generation Estimate

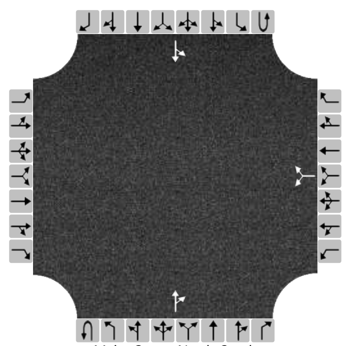
ITE LUC	Land Use	Quantity 1,000 SF GFA	Weekday Morning Peak Hour In 81%	Out 19%	Total	Weekday Evening Peak Hour In 22%	Out 78%	Total	Daily Trips In 50%	Out 50%	
130	Lot 3 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 4 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 5 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 6 Industrial Park	60	17	4	21	5	16	21	102	102	204
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 7 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 8 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 9 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 10 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 11 Industrial Park	90	25	6	31	7	24	31	152	152	304
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 12 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 14 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 15 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 16 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 17 Industrial Park	15	5	1	6	1	5	6	26	26	52
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 18 Industrial Park	15	5	1	6	1	5	6	26	26	52
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 19 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 20 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 21 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 22 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 25 Industrial Park	30	9	2	11	2	9	11	51	51	102
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 26 Industrial Park	60	17	4	21	5	16	21	102	102	204
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 27 Industrial Park	60	17	4	21	5	16	21	102	102	204
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 29 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 30 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
130	Lot 31 Industrial Park	20	6	1	7	2	5	7	34	34	68
			Rate:	*0.34 / 1K SF GFA*		*Rate:*	*0.34 / 1K SF GFA*		*Rate:*	*3.37 / 1K SF GFA*	
	TOTALS:	**740**	**218**	**45**	**263**	**62**	**201**	**263**	**1258**	**1258**	**2516**

APPENDIX C
CAPACITY & LEVEL OF SERVICE ANALYSES

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2024	North/South Street	Dry Creek Road
Time Analyzed	Existing AM	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						122		6			57	48		9	104	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

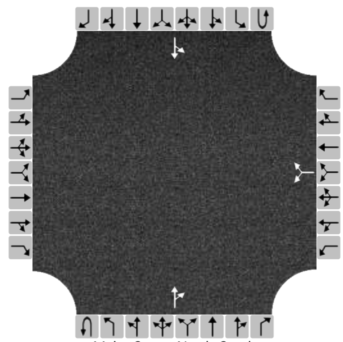
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							144							10		
Capacity, c (veh/h)							760							1464		
v/c Ratio							0.19							0.01		
95% Queue Length, Q_{95} (veh)							0.7							0.0		
Control Delay (s/veh)							10.8							7.5		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					10.8								0.6			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2024	North/South Street	Dry Creek Road
Time Analyzed	Existing PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						109		17			131	135		12	65	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

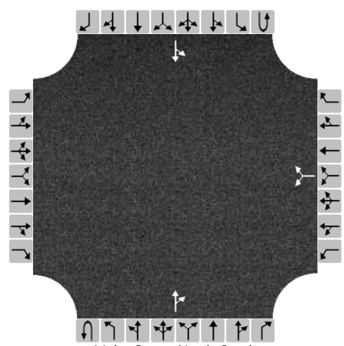
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							133							13		
Capacity, c (veh/h)							697							1277		
v/c Ratio							0.19							0.01		
95% Queue Length, Q_{95} (veh)							0.7							0.0		
Control Delay (s/veh)							11.4							7.8		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					11.4								1.3			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2024	North/South Street	Dry Creek Road
Time Analyzed	Expected AM	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						138		10			57	64		13	104	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

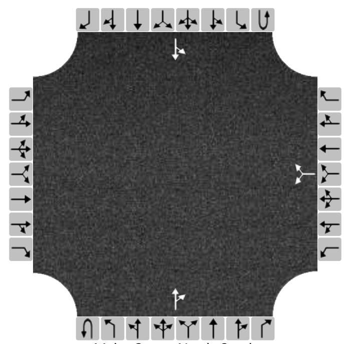
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							166							15		
Capacity, c (veh/h)							744							1442		
v/c Ratio							0.22							0.01		
95% Queue Length, Q_{95} (veh)							0.9							0.0		
Control Delay (s/veh)							11.2							7.5		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					11.2								0.9			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2024	North/South Street	Dry Creek Road
Time Analyzed	Expected PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						125		21			131	151		16	65	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							154							17		
Capacity, c (veh/h)							681							1259		
v/c Ratio							0.23							0.01		
95% Queue Length, Q_{95} (veh)							0.9							0.0		
Control Delay (s/veh)							11.8							7.9		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					11.8								1.6			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

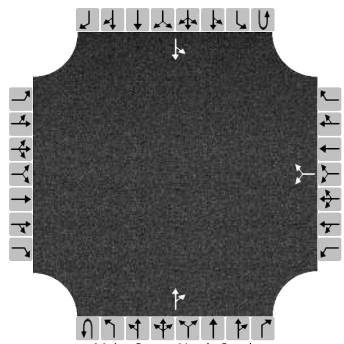
General Information

Analyst	Cody Kerkaert
Agency/Co.	
Date Performed	6/25/2024
Analysis Year	2029
Time Analyzed	Background AM
Intersection Orientation	North-South
Project Description	Tarmac Trail Extension

Site Information

Intersection	Penwell Brdg. & Dry Creek
Jurisdiction	
East/West Street	Penwell Bridge Road
North/South Street	Dry Creek Road
Peak Hour Factor	0.89
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						152		11			63	71		14	115	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	Eastbound U	L	T	R	Westbound U	L	T	R	Northbound U	L	T	R	Southbound U	L	T	R
Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

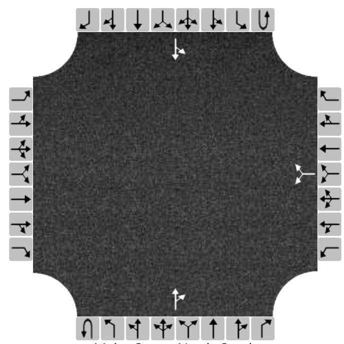
Delay, Queue Length, and Level of Service

	Eastbound U	L	T	R	Westbound U	L	T	R	Northbound U	L	T	R	Southbound U	L	T	R
Flow Rate, v (veh/h)							183							16		
Capacity, c (veh/h)							719							1424		
v/c Ratio							0.25							0.01		
95% Queue Length, Q_{95} (veh)							1.0							0.0		
Control Delay (s/veh)							11.7							7.6		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					11.7								0.9			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2029	North/South Street	Dry Creek Road
Time Analyzed	Background PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						138		23			145	167		18	72	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

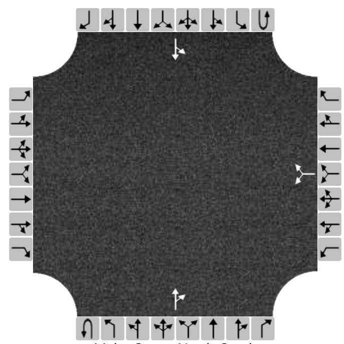
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							169							19		
Capacity, c (veh/h)							651							1226		
v/c Ratio							0.26							0.02		
95% Queue Length, Q_{95} (veh)							1.0							0.0		
Control Delay (s/veh)							12.5							8.0		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					12.5								1.7			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2029	North/South Street	Dry Creek Road
Time Analyzed	Total AM	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						180		15			63	80		15	115	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

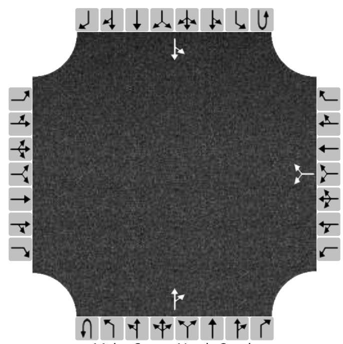
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							219							17		
Capacity, c (veh/h)							714							1412		
v/c Ratio							0.31							0.01		
95% Queue Length, Q_{95} (veh)							1.3							0.0		
Control Delay (s/veh)							12.3							7.6		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					12.3								1.0			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2029	North/South Street	Dry Creek Road
Time Analyzed	Total PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						156		26			145	199		22	72	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

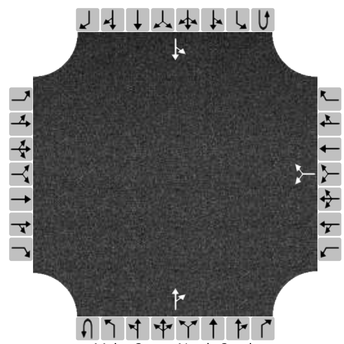
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							192							23		
Capacity, c (veh/h)							628							1191		
v/c Ratio							0.31							0.02		
95% Queue Length, Q_{95} (veh)							1.3							0.1		
Control Delay (s/veh)							13.2							8.1		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					13.2								2.0			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2044	North/South Street	Dry Creek Road
Time Analyzed	Background AM	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						205		15			85	95		19	155	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

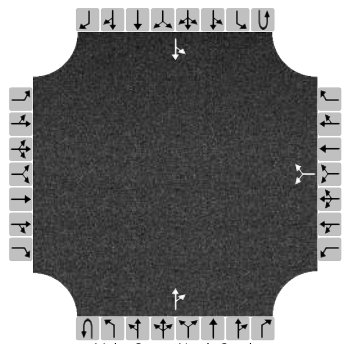
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							247							21		
Capacity, c (veh/h)							634							1364		
v/c Ratio							0.39							0.02		
95% Queue Length, Q_{95} (veh)							1.8							0.0		
Control Delay (s/veh)							14.3							7.7		
Level of Service (LOS)							B							A		
Approach Delay (s/veh)					14.3								1.0			
Approach LOS					B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2044	North/South Street	Dry Creek Road
Time Analyzed	Background PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						186		31			195	224		24	97	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

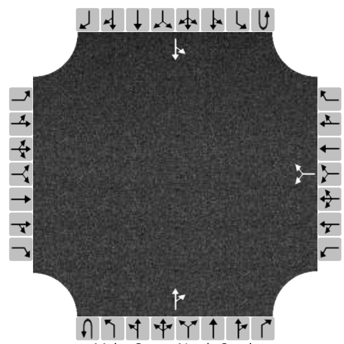
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							228							25		
Capacity, c (veh/h)							553							1114		
v/c Ratio							0.41							0.02		
95% Queue Length, Q_{95} (veh)							2.0							0.1		
Control Delay (s/veh)							16.0							8.3		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)					16.0								1.8			
Approach LOS					C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2044	North/South Street	Dry Creek Road
Time Analyzed	Total AM	Peak Hour Factor	0.89
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						239		21			85	126		29	155	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

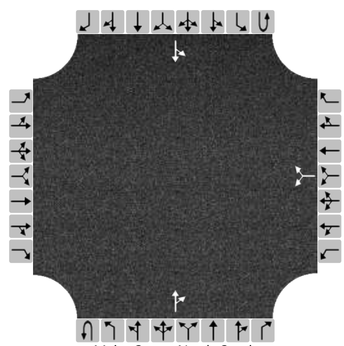
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							292							33		
Capacity, c (veh/h)							599							1324		
v/c Ratio							0.49							0.02		
95% Queue Length, Q_{95} (veh)							2.7							0.1		
Control Delay (s/veh)							16.6							7.8		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)					16.6								1.4			
Approach LOS					C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Penwell Brdg. & Dry Creek
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Penwell Bridge Road
Analysis Year	2044	North/South Street	Dry Creek Road
Time Analyzed	Total PM	Peak Hour Factor	0.95
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

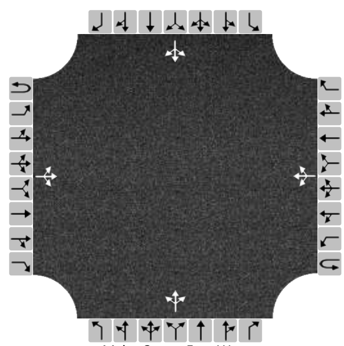
Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume (veh/h)						227		44			195	263		31	97	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized																
Median Type | Storage	Undivided															
Critical and Follow-up Headways																
Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		
Delay, Queue Length, and Level of Service																
Flow Rate, v (veh/h)							285							33		
Capacity, c (veh/h)							528							1075		
v/c Ratio							0.54							0.03		
95% Queue Length, Q_{95} (veh)							3.2							0.1		
Control Delay (s/veh)							19.6							8.5		
Level of Service (LOS)							C							A		
Approach Delay (s/veh)					19.6								2.3			
Approach LOS					C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Tower Road
Time Analyzed	Existing AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	141	4		54	160	0		3	1	39		1	0	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

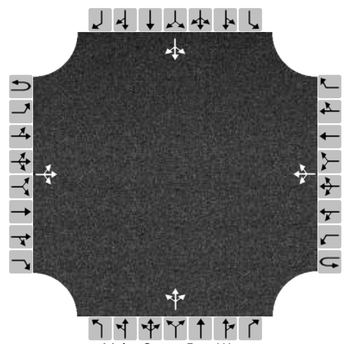
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3				61					49				2	
Capacity, c (veh/h)		1381				1401					812				579	
v/c Ratio		0.00				0.04					0.06				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.1					0.2				0.0	
Control Delay (s/veh)		7.6				7.7					9.7				11.2	
Level of Service (LOS)		A				A					A				B	
Approach Delay (s/veh)	0.2				2.2				9.7				11.2			
Approach LOS									A				B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Tower Road
Time Analyzed	Existing PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		7	188	15		65	184	1		3	12	68		0	1	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

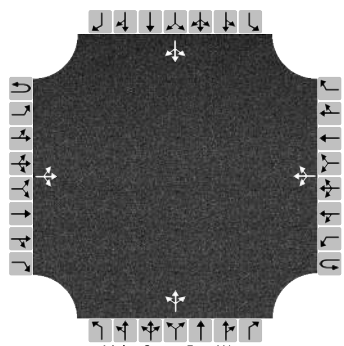
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		7				68					86				2	
Capacity, c (veh/h)		1369				1347					705				553	
v/c Ratio		0.01				0.05					0.12				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.2					0.4				0.0	
Control Delay (s/veh)		7.6				7.8					10.8				11.5	
Level of Service (LOS)		A				A					B				B	
Approach Delay (s/veh)	0.3				2.4				10.8				11.5			
Approach LOS									B				B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Tower Road
Time Analyzed	Expected AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	16	4		1	2	0		3	1	5		1	0	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

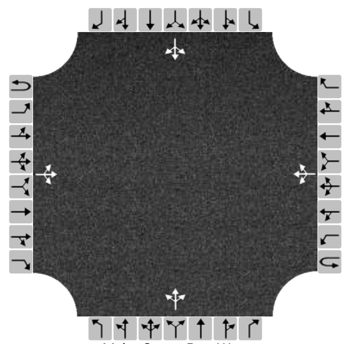
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3				1					10				2	
Capacity, c (veh/h)		1607				1580					997				1013	
v/c Ratio		0.00				0.00					0.01				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.2				7.3					8.6				8.6	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.0				2.4				8.6				8.6			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Tower Road
Time Analyzed	Expected PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		7	10	15		7	19	1		3	12	3		0	1	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

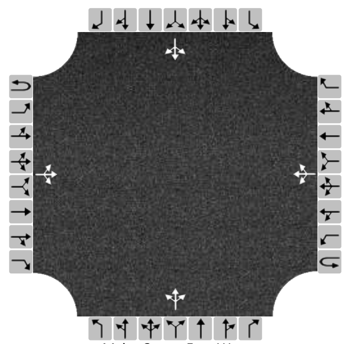
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		7				7					19				2	
Capacity, c (veh/h)		1582				1575					860				911	
v/c Ratio		0.00				0.00					0.02				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.3				9.0	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.6				1.9				9.3				9.0			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Tower Road
Time Analyzed	Background AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	18	4		1	2	0		3	1	6		1	0	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

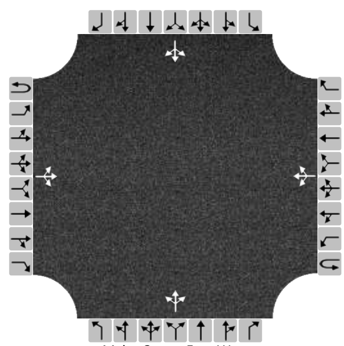
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3				1					11				2	
Capacity, c (veh/h)		1607				1577					999				1011	
v/c Ratio		0.00				0.00					0.01				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.2				7.3					8.6				8.6	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	0.9				2.4				8.6				8.6			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Tower Road
Time Analyzed	Background PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		8	11	17		8	21	1		3	13	3		0	1	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

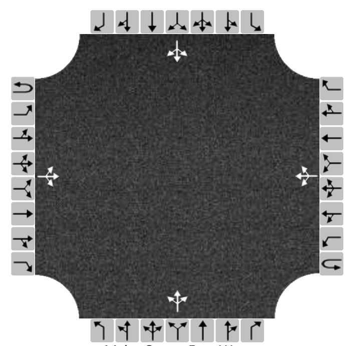
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		8				8					20				2	
Capacity, c (veh/h)		1579				1571					848				903	
v/c Ratio		0.01				0.01					0.02				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.3				9.0	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.7				2.0				9.3				9.0			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Tower Road
Time Analyzed	Total AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	18	4		1	2	0		3	1	6		1	0	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

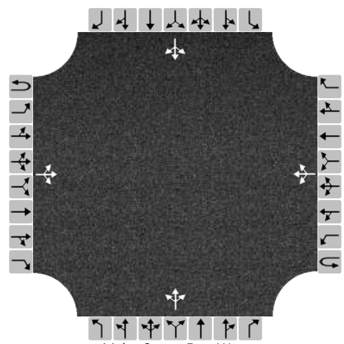
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		3				1					11				2	
Capacity, c (veh/h)		1607				1577					999				1011	
v/c Ratio		0.00				0.00					0.01				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.2				7.3					8.6				8.6	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	0.9				2.4				8.6				8.6			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Tower Road
Time Analyzed	Total PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		8	11	17		8	21	1		3	13	3		0	1	1
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

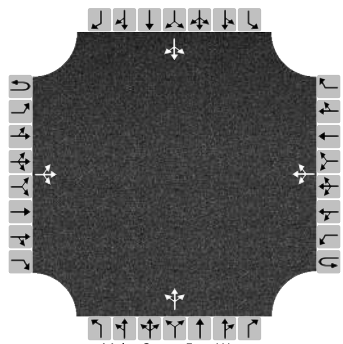
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		8				8					20				2	
Capacity, c (veh/h)		1579				1571					848				903	
v/c Ratio		0.01				0.01					0.02				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.3				9.0	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.7				2.0				9.3				9.0			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Tower Road
Time Analyzed	Background AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		4	24	6		2	3	0		4	2	7		2	0	2
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

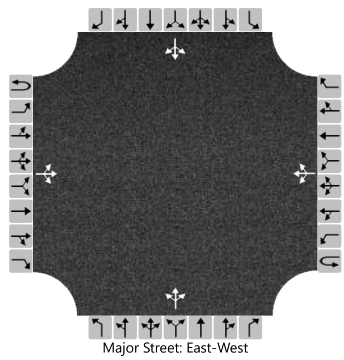
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		5				2					15				5	
Capacity, c (veh/h)		1605				1565					971				996	
v/c Ratio		0.00				0.00					0.02				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.2				7.3					8.8				8.6	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	0.9				2.9				8.8				8.6			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Tower Road
Time Analyzed	Background PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	15	22		10	28	2		4	18	4		0	2	2
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

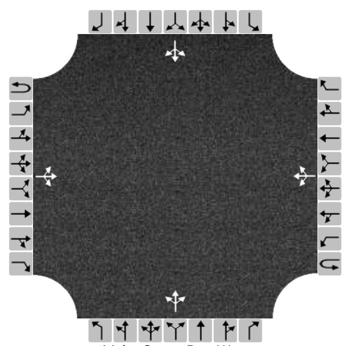
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		10				10					27				4	
Capacity, c (veh/h)		1568				1559					821				881	
v/c Ratio		0.01				0.01					0.03				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.5				9.1	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.6				1.9				9.5				9.1			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Tower Road
Time Analyzed	Total AM	Peak Hour Factor	0.88
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		4	24	6		2	3	0		4	2	7		2	0	2
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

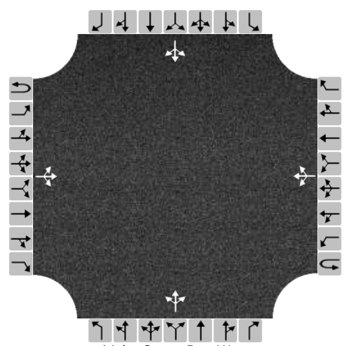
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)		5				2					15				5	
Capacity, c (veh/h)		1605				1565					971				996	
v/c Ratio		0.00				0.00					0.02				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.0				0.0	
Control Delay (s/veh)		7.2				7.3					8.8				8.6	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	0.9				2.9				8.8				8.6			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tower Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Tower Road
Time Analyzed	Total PM	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	15	22		10	28	2		4	18	4		0	2	2
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

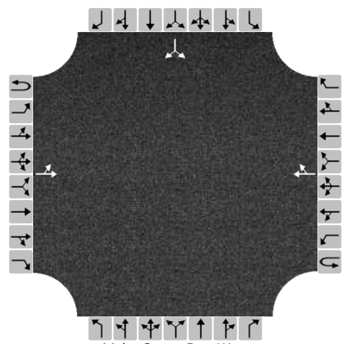
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		10				10					27				4	
Capacity, c (veh/h)		1568				1559					821				881	
v/c Ratio		0.01				0.01					0.03				0.00	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.1				0.0	
Control Delay (s/veh)		7.3				7.3					9.5				9.1	
Level of Service (LOS)		A				A					A				A	
Approach Delay (s/veh)	1.6				1.9				9.5				9.1			
Approach LOS									A				A			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Existing AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		185	466				214	28						11		152
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

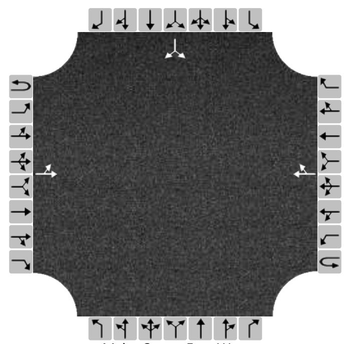
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		201													177	
Capacity, c (veh/h)		1295													633	
v/c Ratio		0.16													0.28	
95% Queue Length, Q_{95} (veh)		0.5													1.1	
Control Delay (s/veh)		8.3													12.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	3.6												12.9			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Existing PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		169	358				549	15						25		227
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

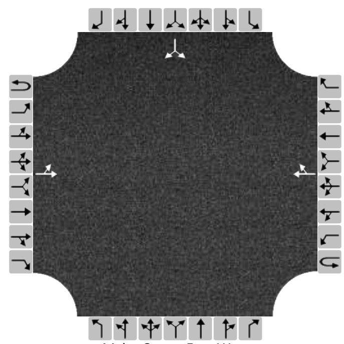
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		172													257	
Capacity, c (veh/h)		998													414	
v/c Ratio		0.17													0.62	
95% Queue Length, Q_{95} (veh)		0.6													4.1	
Control Delay (s/veh)		9.4													26.9	
Level of Service (LOS)		A													D	
Approach Delay (s/veh)	4.4												26.9			
Approach LOS													D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Expected AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		76	575				214	12						3		20
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

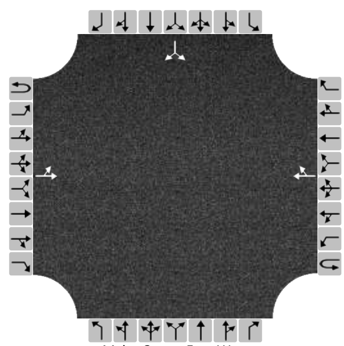
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		83													25	
Capacity, c (veh/h)		1315													606	
v/c Ratio		0.06													0.04	
95% Queue Length, Q_{95} (veh)		0.2													0.1	
Control Delay (s/veh)		7.9													11.2	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	1.6												11.2			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Expected PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		10	517				549	3						9		78
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

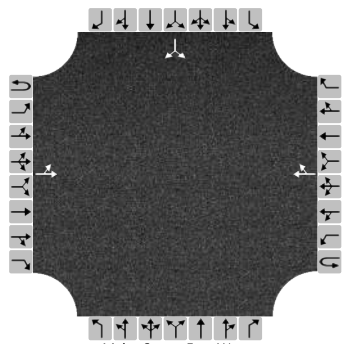
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		10													89	
Capacity, c (veh/h)		1008													464	
v/c Ratio		0.01													0.19	
95% Queue Length, Q_{95} (veh)		0.0													0.7	
Control Delay (s/veh)		8.6													14.6	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	0.3												14.6			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Airport Road
Time Analyzed	Background AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		84	635				236	13						3		22
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

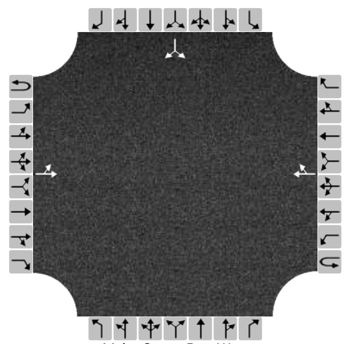
Flow Rate, v (veh/h)		91													27	
Capacity, c (veh/h)		1287													572	
v/c Ratio		0.07													0.05	
95% Queue Length, Q_{95} (veh)		0.2													0.1	
Control Delay (s/veh)		8.0													11.6	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	1.7												11.6			
Approach LOS													B			

 HCS™ TWSC Version 7.9 Generated: 10/18/2024 7:46:26 AM
Airport & Frontage 2029 Bk AM.xtw

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Airport Road
Time Analyzed	Background PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		11	571				606	3						10		86
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

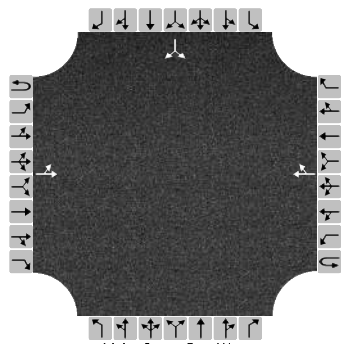
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11													98	
Capacity, c (veh/h)		959													422	
v/c Ratio		0.01													0.23	
95% Queue Length, Q_{95} (veh)		0.0													0.9	
Control Delay (s/veh)		8.8													16.1	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	0.3												16.1			
Approach LOS													C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Airport Road
Time Analyzed	Total AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		84	643				260	13						3		22
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

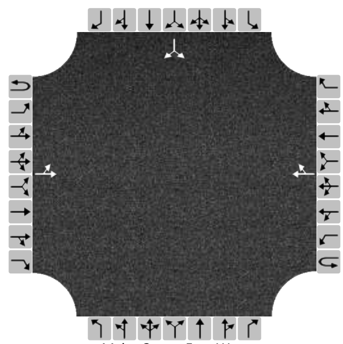
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		91													27	
Capacity, c (veh/h)		1259													549	
v/c Ratio		0.07													0.05	
95% Queue Length, Q_{95} (veh)		0.2													0.2	
Control Delay (s/veh)		8.1													11.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	1.8												11.9			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Airport Road
Time Analyzed	Total PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		11	598				621	3						10		86
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

Delay, Queue Length, and Level of Service

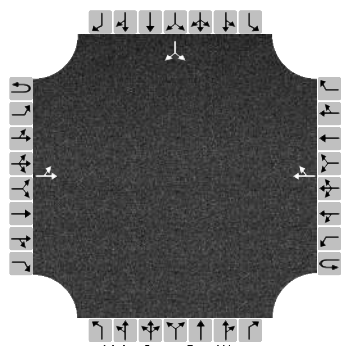
Flow Rate, v (veh/h)		11													98	
Capacity, c (veh/h)		947													409	
v/c Ratio		0.01													0.24	
95% Queue Length, Q_{95} (veh)		0.0													0.9	
Control Delay (s/veh)		8.8													16.5	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	0.3												16.5			
Approach LOS													C			

HCS7 Two-Way Stop-Control Report

General Information

Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Background AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		113	854				318	18						4		30
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

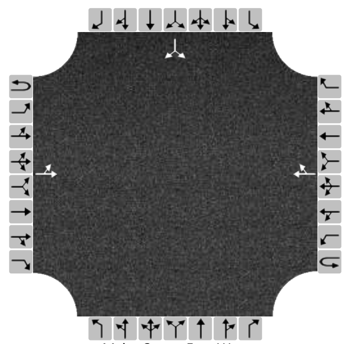
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		123													37	
Capacity, c (veh/h)		1188													408	
v/c Ratio		0.10													0.09	
95% Queue Length, Q_{95} (veh)		0.3													0.3	
Control Delay (s/veh)		8.4													14.7	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	2.6												14.7			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Background PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		15	768				815	4						13		116
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

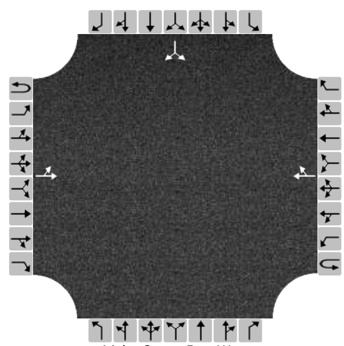
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		15													132	
Capacity, c (veh/h)		798													294	
v/c Ratio		0.02													0.45	
95% Queue Length, Q_{95} (veh)		0.1													2.2	
Control Delay (s/veh)		9.6													26.8	
Level of Service (LOS)		A													D	
Approach Delay (s/veh)	0.5												26.8			
Approach LOS													D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Total AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		113	995				372	18						4		30
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

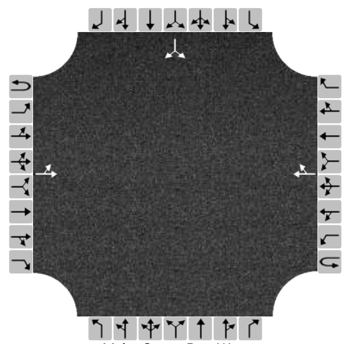
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		123													37	
Capacity, c (veh/h)		1130													323	
v/c Ratio		0.11													0.11	
95% Queue Length, Q_{95} (veh)		0.4													0.4	
Control Delay (s/veh)		8.6													17.6	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	3.0												17.6			
Approach LOS													C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Total PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		15	833				959	4						13		116
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

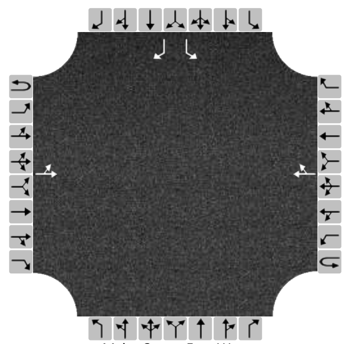
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		15													132	
Capacity, c (veh/h)		703													234	
v/c Ratio		0.02													0.56	
95% Queue Length, Q_{95} (veh)		0.1													3.1	
Control Delay (s/veh)		10.2													38.6	
Level of Service (LOS)		B													E	
Approach Delay (s/veh)	0.6												38.6			
Approach LOS													E			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Recommended Imp. AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		LT						TR						L		R
Volume (veh/h)		113	995				372	18						4		30
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized													No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

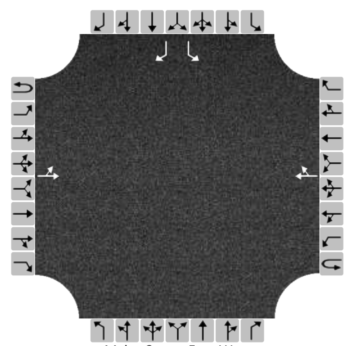
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)		123												4		33
Capacity, c (veh/h)		1130												69		636
v/c Ratio		0.11												0.06		0.05
95% Queue Length, Q_{95} (veh)		0.4												0.2		0.2
Control Delay (s/veh)		8.6												60.6		11.0
Level of Service (LOS)		A												F		B
Approach Delay (s/veh)	3.0												16.8			
Approach LOS													C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Frontage Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Airport Road
Time Analyzed	Recommended Imp. PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		LT						TR						L		R
Volume (veh/h)		15	833				959	4						13		116
Percent Heavy Vehicles (%)		2												2		2
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized													No			
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.12												6.42		6.22
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.22												3.52		3.32

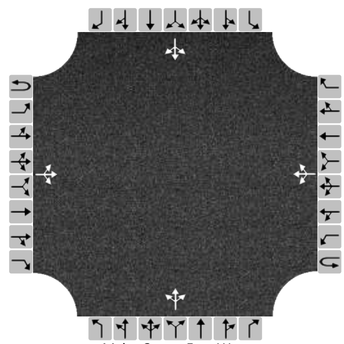
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		15												13		118
Capacity, c (veh/h)		703												77		303
v/c Ratio		0.02												0.17		0.39
95% Queue Length, Q_{95} (veh)		0.1												0.6		1.8
Control Delay (s/veh)		10.2												61.2		24.3
Level of Service (LOS)		B												F		C
Approach Delay (s/veh)	0.6												28.0			
Approach LOS													D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Dollar Drive
Time Analyzed	Existing AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		22	509	8		12	255	14		8	0	14		16	1	22
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

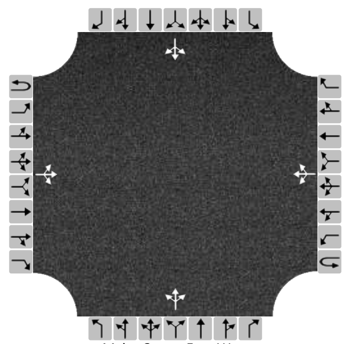
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		23				13					23				41	
Capacity, c (veh/h)		1262				1010					370				396	
v/c Ratio		0.02				0.01					0.06				0.10	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.2				0.3	
Control Delay (s/veh)		7.9				8.6					15.4				15.1	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)	0.5				0.5				15.4				15.1			
Approach LOS									C				C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Dollar Drive
Time Analyzed	Existing PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		14	431	4		11	625	5		16	1	5		14	0	18
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

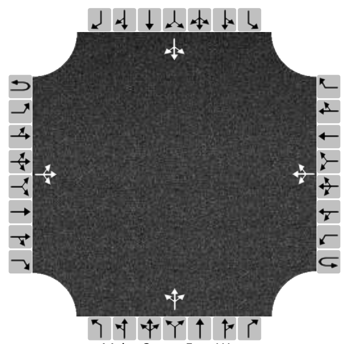
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)		15				12					23				34	
Capacity, c (veh/h)		916				1093					188				253	
v/c Ratio		0.02				0.01					0.12				0.13	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.4				0.5	
Control Delay (s/veh)		9.0				8.3					26.9				21.4	
Level of Service (LOS)		A				A					D				C	
Approach Delay (s/veh)	0.5				0.3				26.9				21.4			
Approach LOS									D				C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Dollar Drive
Time Analyzed	Expected AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		22	618	8		12	239	14		8	0	14		16	1	22
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

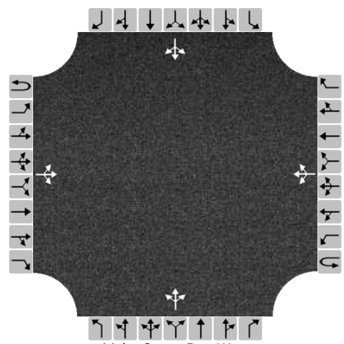
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		23				13					23				41	
Capacity, c (veh/h)		1280				915					317				355	
v/c Ratio		0.02				0.01					0.07				0.12	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.2				0.4	
Control Delay (s/veh)		7.9				9.0					17.2				16.5	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)	0.5				0.5				17.2				16.5			
Approach LOS									C				C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Dollar Drive
Time Analyzed	Expected PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		14	590	4		11	613	5		16	1	5		14	0	18
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

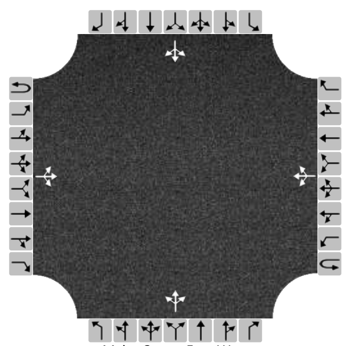
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		15				12					23				34	
Capacity, c (veh/h)		926				947					147				212	
v/c Ratio		0.02				0.01					0.16				0.16	
95% Queue Length, Q_{95} (veh)		0.0				0.0					0.5				0.6	
Control Delay (s/veh)		8.9				8.9					34.1				25.1	
Level of Service (LOS)		A				A					D				D	
Approach Delay (s/veh)	0.4				0.3				34.1				25.1			
Approach LOS									D				D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Dollar Drive
Time Analyzed	Background AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		24	682	9		13	264	15		9	0	15		18	1	24
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

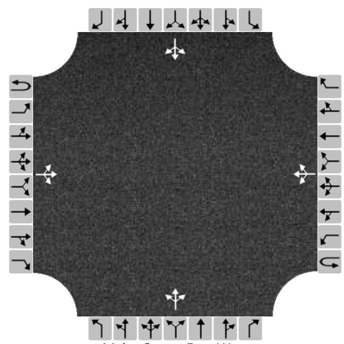
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		25				14					25				45	
Capacity, c (veh/h)		1251				862					274				306	
v/c Ratio		0.02				0.02					0.09				0.15	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.3				0.5	
Control Delay (s/veh)		7.9				9.2					19.5				18.8	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)	0.5				0.6				19.5				18.8			
Approach LOS									C				C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Dollar Drive
Time Analyzed	Background PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		15	651	4		12	677	6		18	1	6		15	0	20
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

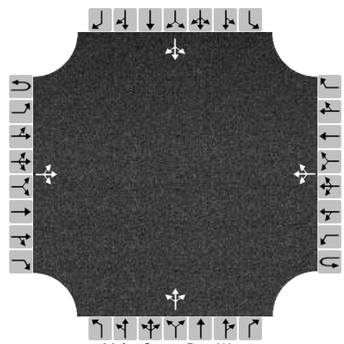
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		16				13					26				37	
Capacity, c (veh/h)		873				896					118				176	
v/c Ratio		0.02				0.01					0.22				0.21	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.8				0.8	
Control Delay (s/veh)		9.2				9.1					43.9				30.7	
Level of Service (LOS)		A				A					E				D	
Approach Delay (s/veh)	0.5				0.4				43.9				30.7			
Approach LOS									E				D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Dollar Drive
Time Analyzed	Total AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		27	687	9		13	280	15		9	0	15		18	1	32
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

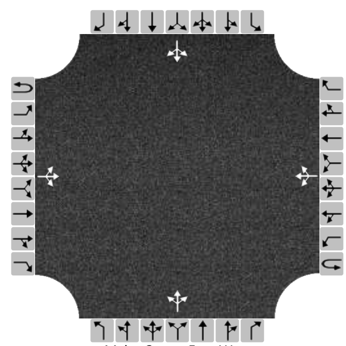
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		28				14					25				54	
Capacity, c (veh/h)		1233				858					262				324	
v/c Ratio		0.02				0.02					0.10				0.17	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.3				0.6	
Control Delay (s/veh)		8.0				9.3					20.2				18.3	
Level of Service (LOS)		A				A					C				C	
Approach Delay (s/veh)	0.6				0.6				20.2				18.3			
Approach LOS									C				C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Dollar Drive
Time Analyzed	Total PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		24	669	4		12	687	6		18	1	6		15	0	25
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

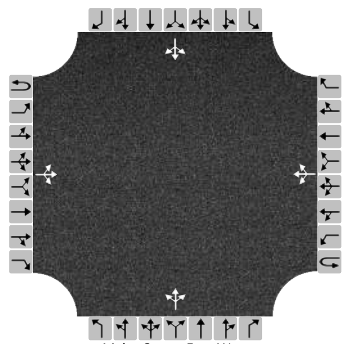
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		25				13					26				42	
Capacity, c (veh/h)		865				881					107				177	
v/c Ratio		0.03				0.01					0.25				0.24	
95% Queue Length, Q_{95} (veh)		0.1				0.0					0.9				0.9	
Control Delay (s/veh)		9.3				9.1					49.5				31.5	
Level of Service (LOS)		A				A					E				D	
Approach Delay (s/veh)	0.8				0.4				49.5				31.5			
Approach LOS									E				D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Background AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		33	918	12		18	355	21		12	0	21		24	2	33
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

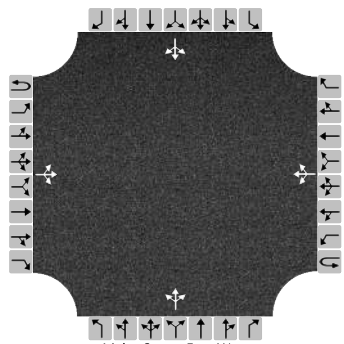
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		35				19					35				62	
Capacity, c (veh/h)		1147				693					160				173	
v/c Ratio		0.03				0.03					0.22				0.36	
95% Queue Length, Q_{95} (veh)		0.1				0.1					0.8				1.5	
Control Delay (s/veh)		8.2				10.3					33.7				37.0	
Level of Service (LOS)		A				B					D				E	
Approach Delay (s/veh)	0.8				0.8				33.7				37.0			
Approach LOS									D				E			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Background PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes


Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		21	876	6		16	910	7		24	2	7		21	0	27
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

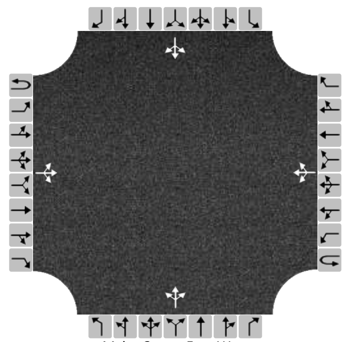
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		22				17					35				51	
Capacity, c (veh/h)		705				728					48				79	
v/c Ratio		0.03				0.02					0.73				0.64	
95% Queue Length, Q_{95} (veh)		0.1				0.1					2.9				2.9	
Control Delay (s/veh)		10.3				10.1					188.1				110.6	
Level of Service (LOS)		B				B					F				F	
Approach Delay (s/veh)	0.9				0.7				188.1				110.6			
Approach LOS									F				F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Total AM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		79	1013	12		18	391	43		12	0	21		29	2	51
Percent Heavy Vehicles (%)		5				5				5	5	5		5	5	5
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.15				4.15				7.15	6.55	6.25		7.15	6.55	6.25
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.25				2.25				3.55	4.05	3.35		3.55	4.05	3.35

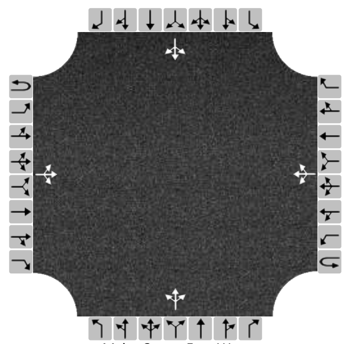
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)		83				19					35				86	
Capacity, c (veh/h)		1088				635					103				123	
v/c Ratio		0.08				0.03					0.34				0.70	
95% Queue Length, Q_{95} (veh)		0.2				0.1					1.3				3.8	
Control Delay (s/veh)		8.6				10.8					57.1				84.4	
Level of Service (LOS)		A				B					F				F	
Approach Delay (s/veh)	2.1				0.9				57.1				84.4			
Approach LOS									F				F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Total PM	Peak Hour Factor	0.95
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		41	920	6		16	1008	13		24	2	7		43	0	73
Percent Heavy Vehicles (%)		4				4				4	4	4		4	4	4
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.14	6.54	6.24		7.14	6.54	6.24
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.54	4.04	3.34		3.54	4.04	3.34

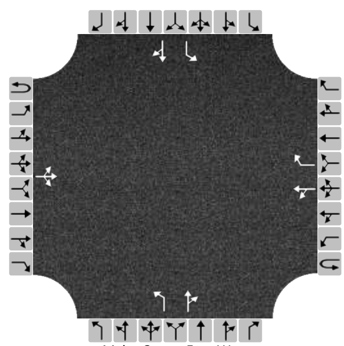
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		43				17					35				122	
Capacity, c (veh/h)		641				700					25				61	
v/c Ratio		0.07				0.02					1.40				1.99	
95% Queue Length, Q_{95} (veh)		0.2				0.1					4.3				11.5	
Control Delay (s/veh)		11.0				10.3					554.3				604.9	
Level of Service (LOS)		B				B					F				F	
Approach Delay (s/veh)	2.0				0.8				554.3				604.9			
Approach LOS									F				F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Recommended Imp. AM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	1		1	1	0		1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		69	903	12		18	381	43		12	0	21		29	2	51
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.13				4.13				7.13	6.53	6.23		7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

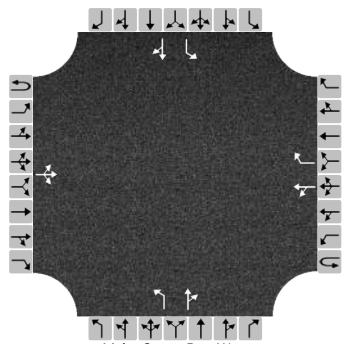
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		70				18				12		21		30		54
Capacity, c (veh/h)		1122				729				74		324		81		545
v/c Ratio		0.06				0.03				0.16		0.07		0.36		0.10
95% Queue Length, Q_{95} (veh)		0.2				0.1				0.6		0.2		1.4		0.3
Control Delay (s/veh)		8.4				10.1				62.8		16.9		72.7		12.3
Level of Service (LOS)		A				B				F		C		F		B
Approach Delay (s/veh)	1.6				0.7				33.6				33.7			
Approach LOS									D				D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Dollar Dr
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Dollar Drive
Time Analyzed	Recommended Imp. PM	Peak Hour Factor	0.98
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	1		1	1	0		1	1	0
Configuration			LTR			LT		R		L		TR		L		TR
Volume (veh/h)		41	650	6		16	750	13		14	2	7		23	0	53
Percent Heavy Vehicles (%)		3				3				3	3	3		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized					Yes											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.13				4.13				7.13	6.53	6.23		7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.23				3.53	4.03	3.33		3.53	4.03	3.33

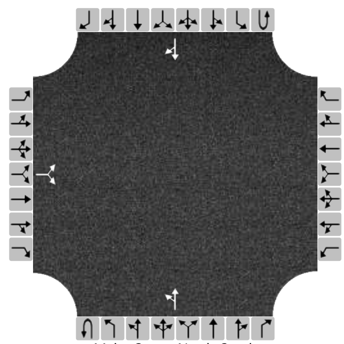
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)		42				16				14		9		23		54
Capacity, c (veh/h)		843				916				70		456		82		401
v/c Ratio		0.05				0.02				0.21		0.02		0.29		0.13
95% Queue Length, Q_{95} (veh)		0.2				0.1				0.7		0.1		1.1		0.5
Control Delay (s/veh)		9.5				9.0				69.7		13.1		66.0		15.4
Level of Service (LOS)		A				A				F		B		F		C
Approach Delay (s/veh)	1.3				0.5				47.5				30.7			
Approach LOS									E				D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tubb Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Tubb Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Existing AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		21		152						99	60				59	8
Percent Heavy Vehicles (%)		4		4						4						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.44		6.24						4.14						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.54		3.34						2.24						

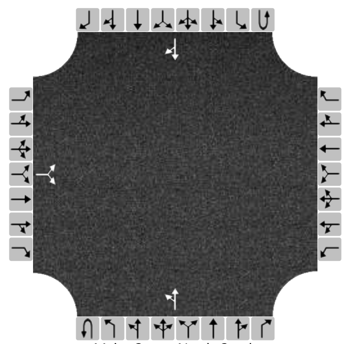
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			214							122						
Capacity, c (veh/h)			894							1502						
v/c Ratio			0.24							0.08						
95% Queue Length, Q_{95} (veh)			0.9							0.3						
Control Delay (s/veh)			10.3							7.6						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	10.3								5.0							
Approach LOS	B															

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tubb Rd
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Tubb Road
Analysis Year	2024	North/South Street	Airport Road
Time Analyzed	Existing PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume (veh/h)		15		141						153	90				82	20
Percent Heavy Vehicles (%)		1		1						1						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.41		6.21						4.11						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.51		3.31						2.21						

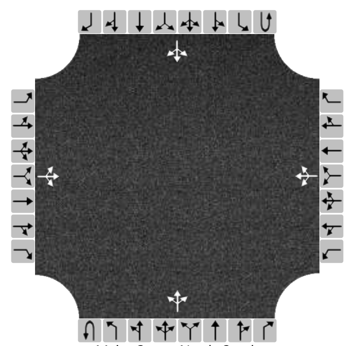
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			163							159						
Capacity, c (veh/h)			874							1491						
v/c Ratio			0.19							0.11						
95% Queue Length, Q_{95} (veh)			0.7							0.4						
Control Delay (s/veh)			10.1							7.7						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	10.1								5.2							
Approach LOS	B															

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Jetway Dr. & Tubb Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Jetway Drive
Analysis Year	2024	North/South Street	Tubb Road
Time Analyzed	Existing AM	Peak Hour Factor	0.82
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		0	0	5		26	1	1		3	70	49		1	152	1
Percent Heavy Vehicles (%)		2	2	2		2	2	2		2				2		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.12	6.52	6.22		7.12	6.52	6.22		4.12				4.12		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.52	4.02	3.32		3.52	4.02	3.32		2.22				2.22		

Delay, Queue Length, and Level of Service

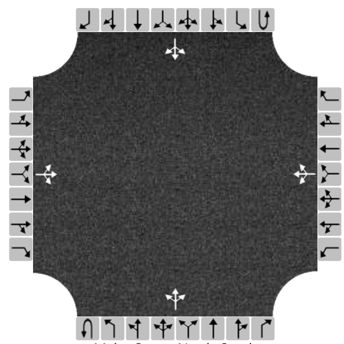
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			6				34			4				1		
Capacity, c (veh/h)			856				638			1388				1437		
v/c Ratio			0.01				0.05			0.00				0.00		
95% Queue Length, Q_{95} (veh)			0.0				0.2			0.0				0.0		
Control Delay (s/veh)			9.2				11.0			7.6				7.5		
Level of Service (LOS)			A				B			A				A		
Approach Delay (s/veh)	9.2				11.0				0.2				0.1			
Approach LOS	A				B											

HCS7 Two-Way Stop-Control Report

General Information / Site Information

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Jetway Dr. & Tubb Rd
Agency/Co.		Jurisdiction	
Date Performed	6/25/2024	East/West Street	Jetway Drive
Analysis Year	2024	North/South Street	Tubb Road
Time Analyzed	Existing PM	Peak Hour Factor	0.94
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	0	11		60	0	3		5	152	22		2	79	0
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Approach	Eastbound				Westbound				Northbound				Southbound			
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

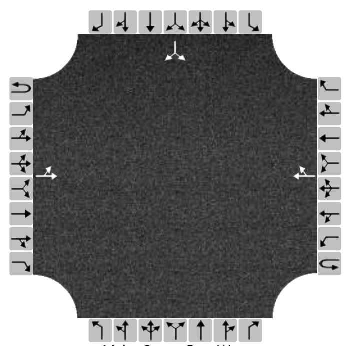
Delay, Queue Length, and Level of Service

Approach	Eastbound				Westbound				Northbound				Southbound			
Flow Rate, v (veh/h)			15				67			5				2		
Capacity, c (veh/h)			892				673			1519				1396		
v/c Ratio			0.02				0.10			0.00				0.00		
95% Queue Length, Q_{95} (veh)			0.1				0.3			0.0				0.0		
Control Delay (s/veh)			9.1				10.9			7.4				7.6		
Level of Service (LOS)			A				B			A				A		
Approach Delay (s/veh)	9.1				10.9				0.2				0.2			
Approach LOS	A				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Proposed Tarmac Trail
Time Analyzed	Expected AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		109	527				265	16						12		180
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

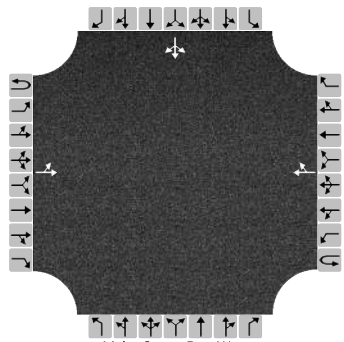
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		118													209	
Capacity, c (veh/h)		1250													633	
v/c Ratio		0.09													0.33	
95% Queue Length, Q_{95} (veh)		0.3													1.4	
Control Delay (s/veh)		8.2													13.5	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	2.3												13.5			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2024	North/South Street	Proposed Tarmac Trail
Time Analyzed	Expected PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LTR	
Volume (veh/h)		159	430				629	12						20	0	184
Percent Heavy Vehicles (%)		3												3	3	3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1	6.5	6.2
Critical Headway (sec)		4.13												7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2												3.5	4.0	3.3
Follow-Up Headway (sec)		2.23												3.53	4.03	3.33

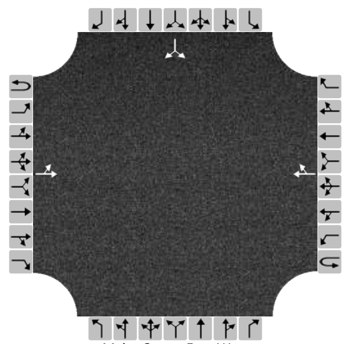
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		173													222	
Capacity, c (veh/h)		895													306	
v/c Ratio		0.19													0.73	
95% Queue Length, Q_{95} (veh)		0.7													5.3	
Control Delay (s/veh)		10.0													42.5	
Level of Service (LOS)		A													E	
Approach Delay (s/veh)	4.6												42.5			
Approach LOS													E			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		120	582				293	18						13		199
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

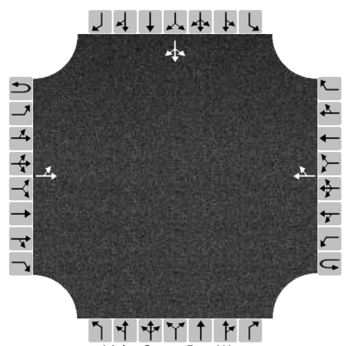
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		130													230	
Capacity, c (veh/h)		1216													591	
v/c Ratio		0.11													0.39	
95% Queue Length, Q_{95} (veh)		0.4													1.8	
Control Delay (s/veh)		8.3													14.9	
Level of Service (LOS)		A													B	
Approach Delay (s/veh)	2.6												14.9			
Approach LOS													B			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LTR	
Volume (veh/h)		176	475				694	13						22	0	203
Percent Heavy Vehicles (%)		3												3	3	3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1	6.5	6.2
Critical Headway (sec)		4.13												7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2												3.5	4.0	3.3
Follow-Up Headway (sec)		2.23												3.53	4.03	3.33

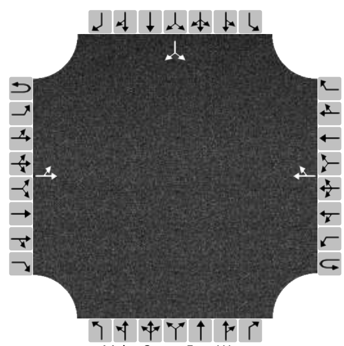
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		191													245	
Capacity, c (veh/h)		841													255	
v/c Ratio		0.23													0.96	
95% Queue Length, Q_{95} (veh)		0.9													8.9	
Control Delay (s/veh)		10.5													88.4	
Level of Service (LOS)		B													F	
Approach Delay (s/veh)	5.3												88.4			
Approach LOS													F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		125	582				293	25						33		215
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

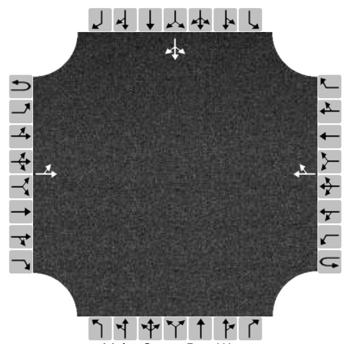
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		136													270	
Capacity, c (veh/h)		1208													486	
v/c Ratio		0.11													0.55	
95% Queue Length, Q_{95} (veh)		0.4													3.3	
Control Delay (s/veh)		8.4													21.2	
Level of Service (LOS)		A													C	
Approach Delay (s/veh)	2.7												21.2			
Approach LOS													C			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LTR	
Volume (veh/h)		194	475				694	36						35	0	213
Percent Heavy Vehicles (%)		3												3	3	3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1	6.5	6.2
Critical Headway (sec)		4.13												7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2												3.5	4.0	3.3
Follow-Up Headway (sec)		2.23												3.53	4.03	3.33

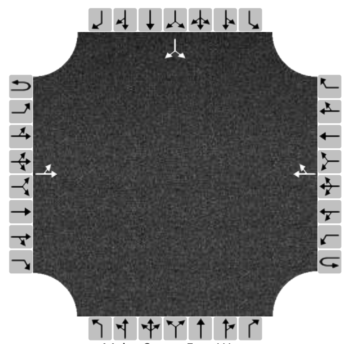
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		211													270	
Capacity, c (veh/h)		823													203	
v/c Ratio		0.26													1.33	
95% Queue Length, Q_{95} (veh)		1.0													15.0	
Control Delay (s/veh)		10.9													223.0	
Level of Service (LOS)		B													F	
Approach Delay (s/veh)	5.9												223.0			
Approach LOS													F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		162	783				393	24						18		267
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

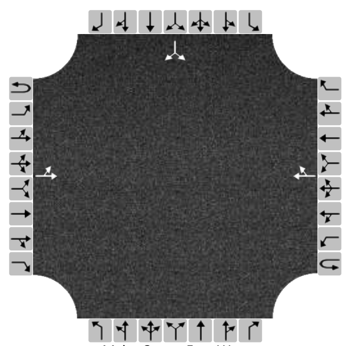
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		176													310	
Capacity, c (veh/h)		1102													425	
v/c Ratio		0.16													0.73	
95% Queue Length, Q_{95} (veh)		0.6													5.8	
Control Delay (s/veh)		8.9													33.1	
Level of Service (LOS)		A													D	
Approach Delay (s/veh)	3.8												33.1			
Approach LOS													D			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		236	639				934	18						30		273
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

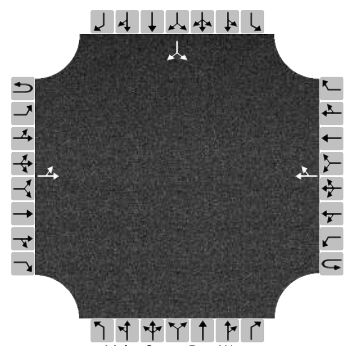
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		257													329	
Capacity, c (veh/h)		668													113	
v/c Ratio		0.38													2.91	
95% Queue Length, Q_{95} (veh)		1.8													31.0	
Control Delay (s/veh)		13.7													943.1	
Level of Service (LOS)		B													F	
Approach Delay (s/veh)	10.0												943.1			
Approach LOS													F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total AM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		257	788				415	131						61		303
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

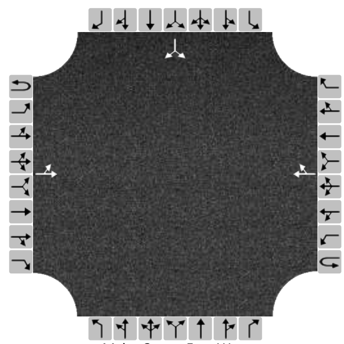
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		279													396	
Capacity, c (veh/h)		978													150	
v/c Ratio		0.29													2.63	
95% Queue Length, Q_{95} (veh)		1.2													34.9	
Control Delay (s/veh)		10.1													800.3	
Level of Service (LOS)		B													F	
Approach Delay (s/veh)	6.7												800.3			
Approach LOS													F			

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Frontage Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/27/2024	East/West Street	Frontage Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total PM	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: East-West

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	0	0		0	1	0
Configuration		LT						TR							LR	
Volume (veh/h)		280	659				940	70						142		371
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

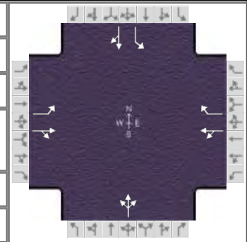
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)		304													558	
Capacity, c (veh/h)		632													25	
v/c Ratio		0.48													22.15	
95% Queue Length, Q_{95} (veh)		2.6													69.6	
Control Delay (s/veh)		15.9													9814.4	
Level of Service (LOS)		C													F	
Approach Delay (s/veh)	13.6												9814.4			
Approach LOS													F			

HCS™ TWSC Version 7.9
Frontage & Tarmac 2044 Tot PM.xtw
Generated: 10/17/2024 2:47:15 PM

HCS7 Signalized Intersection Results Summary

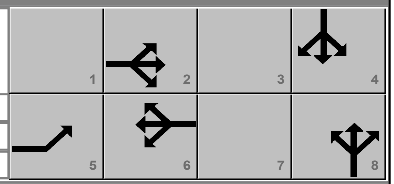
General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst	Cody Kerkaert	Analysis Date	Jul 12, 2024	Area Type	Other
Jurisdiction		Time Period	Recommended AM	PHF	0.92
Urban Street	Frontage Road	Analysis Year	2044	Analysis Period	1> 7:00
Intersection	Frontage Road & Tarma…	File Name	Frontage Rd & Tarmac Dr Rec AM.xus		
Project Description	Tarmac Trail Extension				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	257	788	0	0	415	131	0	0	0	61	0	303

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.1	56.2	14.7	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		7.3		12.0		10.0
Phase Duration, s	11.1	71.3		60.2		0.0		18.7
Change Period, ($Y+R_c$), s	4.0	4.0		4.0		4.0		4.0
Max Allow Headway (*MAH*), s	3.0	0.0		0.0		0.0		3.2
Queue Clearance Time (g_s), s	6.6							14.3
Green Extension Time (g_e), s	0.5	0.0		0.0		0.0		0.4
Phase Call Probability	1.00							1.00
Max Out Probability	0.00							0.00

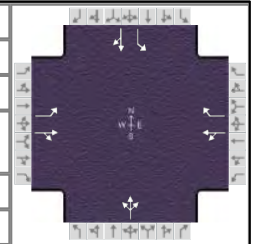
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	279	0			0	77		0		66	221	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1767	0			0	1572		0		1767	1572	
Queue Service Time (g_s), s	4.6	0.0			0.0	1.7		0.0		2.9	12.3	
Cycle Queue Clearance Time (g_c), s	4.6	0.0			0.0	1.7		0.0		2.9	12.3	
Green Ratio (*g/C*)	0.73					0.62				0.16	0.16	
Capacity (*c*), veh/h	688					981				289	257	
Volume-to-Capacity Ratio (*X*)	0.406	0.000			0.000	0.079		0.000		0.229	0.858	
Back of Queue (*Q*), ft/ln (50 th percentile)	26.5	0			0	12.8		0		30.9	120	
Back of Queue (*Q*), veh/ln (50 th percentile)	1.0	0.0			0.0	0.5		0.0		1.2	4.7	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.11	0.00			0.00	0.05		0.00		0.31	0.00	
Uniform Delay (d_1), s/veh	5.4					6.7				32.7	36.6	
Incremental Delay (d_2), s/veh	0.1	0.0			0.0	0.2		0.0		0.1	3.2	
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0		0.0		0.0	0.0	
Control Delay (*d*), s/veh	5.5					6.8				32.9	39.8	
Level of Service (LOS)	A					A				C	D	
Approach Delay, s/veh / LOS	6.9		A	9.0		A	0.0			38.2		D
Intersection Delay, s/veh / LOS	12.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.61	B	2.01	B	2.04	B	1.95	B
Bicycle LOS Score / LOS	2.36	B	1.36	A	0.49	A	0.96	A

 HCS™ Streets Version 7.9 Generated: 10/17/2024 2:51:00 PM

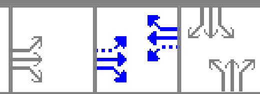
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst	Cody Kerkaert	Analysis Date	Jul 12, 2024	Area Type	Other
Jurisdiction		Time Period	Recommended PM	PHF	0.92
Urban Street	Frontage Road	Analysis Year	2044	Analysis Period	1> 7:00
Intersection	Frontage Road & Tarma…	File Name	Frontage Rd & Tarmac Dr Rec PM.xus		
Project Description	Tarmac Trail Extension				

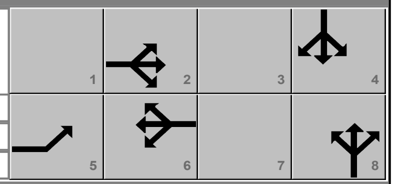


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	280	659	0	0	940	70	0	0	0	142	0	371

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	7.3	59.7	11.0	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	0.0	0.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6		8		4
Case Number	1.0	4.0		7.3		12.0		10.0
Phase Duration, s	11.3	75.0		63.7		0.0		15.0
Change Period, (*Y+R* $_c$), s	4.0	4.0		4.0		4.0		4.0
Max Allow Headway (*MAH*), s	3.0	0.0		0.0		0.0		3.1
Queue Clearance Time (g_s), s	6.5							10.5
Green Extension Time (g_e), s	0.5	0.0		0.0		0.0		0.5
Phase Call Probability	1.00							1.00
Max Out Probability	0.00							0.00

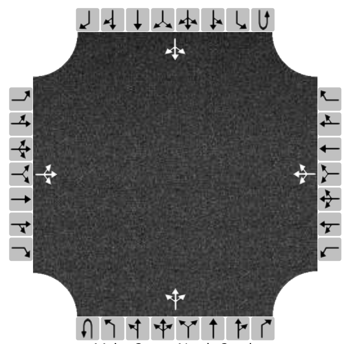
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (*v*), veh/h	304	0			0	33		0		154	153	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1767	0			0	1572		0		1767	1572	
Queue Service Time (g_s), s	4.5	0.0			0.0	0.6		0.0		7.6	8.5	
Cycle Queue Clearance Time (g_c), s	4.5	0.0			0.0	0.6		0.0		7.6	8.5	
Green Ratio (*g/C*)	0.76					0.66				0.12	0.12	
Capacity (*c*), veh/h	354					1038				217	193	
Volume-to-Capacity Ratio (*X*)	0.859	0.000			0.000	0.031		0.000		0.713	0.795	
Back of Queue (*Q*), ft/ln (50 th percentile)	109.5	0			0	4.4		0		82.1	83.8	
Back of Queue (*Q*), veh/ln (50 th percentile)	4.3	0.0			0.0	0.2		0.0		3.2	3.3	
Queue Storage Ratio (*RQ*) (50 th percentile)	0.44	0.00			0.00	0.02		0.00		0.82	0.00	
Uniform Delay (d_1), s/veh	19.8					5.3				38.0	38.4	
Incremental Delay (d_2), s/veh	2.4	0.0			0.0	0.1		0.0		1.6	2.8	
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0		0.0		0.0	0.0	
Control Delay (*d*), s/veh	22.2					5.4				39.6	41.2	
Level of Service (LOS)	C					A				D	D	
Approach Delay, s/veh / LOS	9.7		A	17.9		B	0.0			40.4		D
Intersection Delay, s/veh / LOS	17.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.60	B	2.19	B	2.01	B	1.95	B
Bicycle LOS Score / LOS	2.17	B	2.23	B	0.49	A	1.00	A

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Proposed Tarmac Trail
Time Analyzed	Expected AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	2	2		59	2	6		2	77	60		20	131	2
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

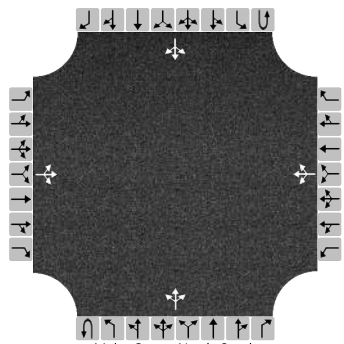
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			7				83			2				25		
Capacity, c (veh/h)			633				604			1402				1396		
v/c Ratio			0.01				0.14			0.00				0.02		
95% Queue Length, Q_{95} (veh)			0.0				0.5			0.0				0.1		
Control Delay (s/veh)			10.8				11.9			7.6				7.6		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.8				11.9				0.1				1.1			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2024	North/South Street	Proposed Tarmac Trail
Time Analyzed	Expected PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		5	5	5		82	5	15		5	128	90		14	117	5
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Approach	Eastbound				Westbound				Northbound				Southbound			
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

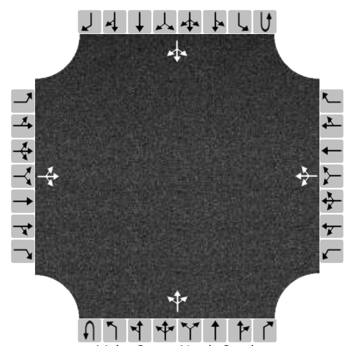
Delay, Queue Length, and Level of Service

Approach	Eastbound				Westbound				Northbound				Southbound			
Flow Rate, v (veh/h)			16				106			5				15		
Capacity, c (veh/h)			644				620			1465				1347		
v/c Ratio			0.02				0.17			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.1				0.6			0.0				0.0		
Control Delay (s/veh)			10.7				12.0			7.5				7.7		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.7				12.0				0.2				0.9			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	2	2		65	2	7		2	85	66		22	145	2
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

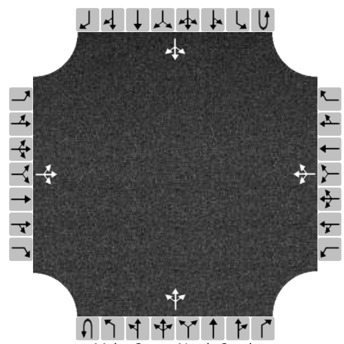
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			7				91			2				27		
Capacity, c (veh/h)			603				574			1382				1376		
v/c Ratio			0.01				0.16			0.00				0.02		
95% Queue Length, Q_{95} (veh)			0.0				0.6			0.0				0.1		
Control Delay (s/veh)			11.0				12.5			7.6				7.7		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	11.0				12.5				0.1				1.1			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		6	6	6		91	6	17		6	121	99		15	129	6
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

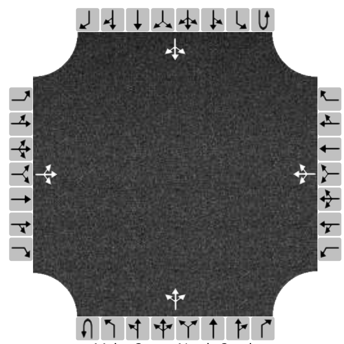
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			19				119			6				16		
Capacity, c (veh/h)			627				605			1449				1345		
v/c Ratio			0.03				0.20			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.1				0.7			0.0				0.0		
Control Delay (s/veh)			10.9				12.4			7.5				7.7		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	10.9				12.4				0.2				0.9			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		2	2	2		65	2	8		2	100	66		26	190	2
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

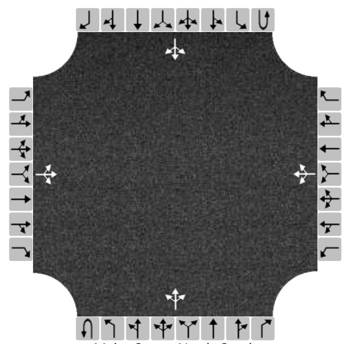
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			7				93			2				32		
Capacity, c (veh/h)			539				508			1318				1355		
v/c Ratio			0.01				0.18			0.00				0.02		
95% Queue Length, Q_{95} (veh)			0.0				0.7			0.0				0.1		
Control Delay (s/veh)			11.8				13.7			7.7				7.7		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	11.8				13.7				0.1				1.1			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2029	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		6	6	6		91	6	21		6	191	99		18	158	6
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

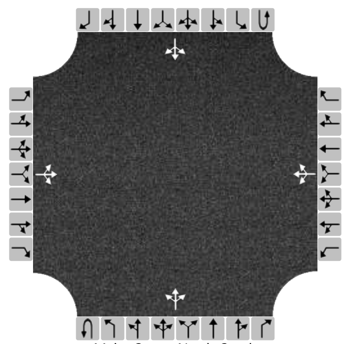
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			19				123			6				19		
Capacity, c (veh/h)			548				521			1412				1265		
v/c Ratio			0.03				0.24			0.00				0.01		
95% Queue Length, Q_{95} (veh)			0.1				0.9			0.0				0.0		
Control Delay (s/veh)			11.8				14.0			7.6				7.9		
Level of Service (LOS)			B				B			A				A		
Approach Delay (s/veh)	11.8				14.0				0.2				0.9			
Approach LOS	B				B											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	3	3		88	3	9		3	114	89		30	195	3
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

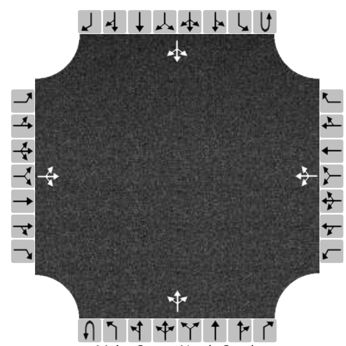
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			11				123			4				37		
Capacity, c (veh/h)			501				463			1310				1303		
v/c Ratio			0.02				0.27			0.00				0.03		
95% Queue Length, Q_{95} (veh)			0.1				1.1			0.0				0.1		
Control Delay (s/veh)			12.3				15.6			7.8				7.8		
Level of Service (LOS)			B				C			A				A		
Approach Delay (s/veh)	12.3				15.6				0.1				1.3			
Approach LOS	B				C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Background PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		7	7	7		122	7	22		7	190	134		21	174	7
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

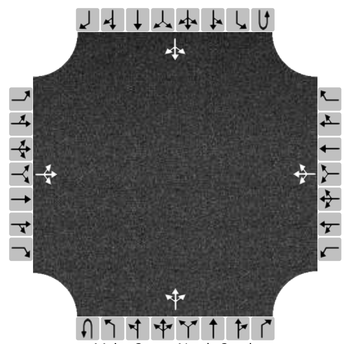
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			22				157			7				22		
Capacity, c (veh/h)			512				479			1392				1227		
v/c Ratio			0.04				0.33			0.01				0.02		
95% Queue Length, Q_{95} (veh)			0.1				1.4			0.0				0.1		
Control Delay (s/veh)			12.4				16.1			7.6				8.0		
Level of Service (LOS)			B				C			A				A		
Approach Delay (s/veh)	12.4				16.1				0.2				1.0			
Approach LOS	B				C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		3	3	3		110	3	20		3	202	94		37	271	3
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

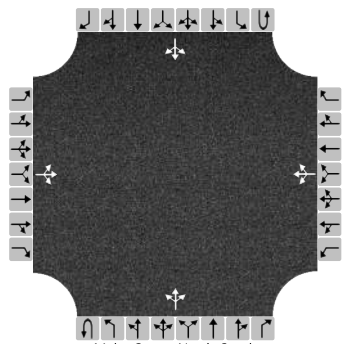
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			11				164			4				46		
Capacity, c (veh/h)			368				339			1210				1182		
v/c Ratio			0.03				0.48			0.00				0.04		
95% Queue Length, Q_{95} (veh)			0.1				2.5			0.0				0.1		
Control Delay (s/veh)			15.1				25.2			8.0				8.2		
Level of Service (LOS)			C				D			A				A		
Approach Delay (s/veh)	15.1				25.2				0.1				1.3			
Approach LOS	C				D											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Total PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		7	7	7		128	7	29		7	272	154		35	283	7
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

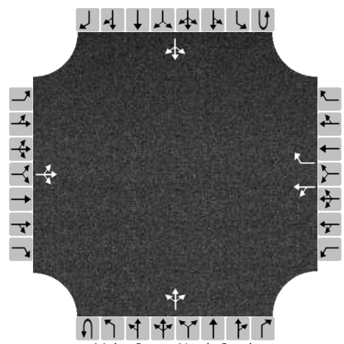
Delay, Queue Length, and Level of Service

	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Flow Rate, v (veh/h)			22				171			7				36		
Capacity, c (veh/h)			365				339			1265				1122		
v/c Ratio			0.06				0.50			0.01				0.03		
95% Queue Length, Q_{95} (veh)			0.2				2.7			0.0				0.1		
Control Delay (s/veh)			15.5				25.9			7.9				8.3		
Level of Service (LOS)			C				D			A				A		
Approach Delay (s/veh)	15.5				25.9				0.2				1.2			
Approach LOS	C				D											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Recommended Imp. AM	Peak Hour Factor	0.81
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	0	1	0	0	0	1	0
Configuration			LTR			LT		R			LTR				LTR	
Volume (veh/h)		3	3	3		110	3	20		3	202	94		37	271	3
Percent Heavy Vehicles (%)		4	4	4		4	4	4		4				4		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.14	6.54	6.24		7.14	6.54	6.24		4.14				4.14		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.54	4.04	3.34		3.54	4.04	3.34		2.24				2.24		

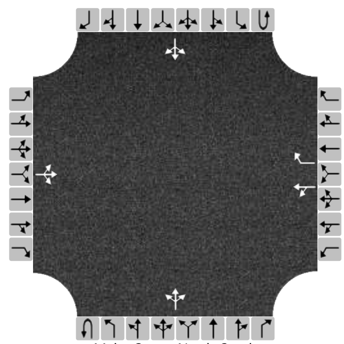
Delay, Queue Length, and Level of Service

	EB U	EB L	EB T	EB R	WB U	WB L	WB T	WB R	NB U	NB L	NB T	NB R	SB U	SB L	SB T	SB R
Flow Rate, v (veh/h)			11			140		25		4				46		
Capacity, c (veh/h)			368			310		728		1210				1182		
v/c Ratio			0.03			0.45		0.03		0.00				0.04		
95% Queue Length, Q_{95} (veh)			0.1			2.2		0.1		0.0				0.1		
Control Delay (s/veh)			15.1			25.8		10.1		8.0				8.2		
Level of Service (LOS)			C			D		B		A				A		
Approach Delay (s/veh)	15.1				23.4				0.1				1.3			
Approach LOS	C				C											

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst	Cody Kerkaert	Intersection	Airport Rd & Tarmac Trl
Agency/Co.		Jurisdiction	
Date Performed	6/19/2024	East/West Street	Airport Road
Analysis Year	2044	North/South Street	Proposed Tarmac Trail
Time Analyzed	Recommended Imp. PM	Peak Hour Factor	0.96
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Tarmac Trail Extension		

Lanes



Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	1	0	0	1	0	0	0	1	0
Configuration			LTR			LT		R			LTR				LTR	
Volume (veh/h)		7	7	7		128	7	29		7	272	154		35	283	7
Percent Heavy Vehicles (%)		1	1	1		1	1	1		1				1		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized					No											
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.11	6.51	6.21		7.11	6.51	6.21		4.11				4.11		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.51	4.01	3.31		3.51	4.01	3.31		2.21				2.21		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			22			141		30		7				36		
Capacity, c (veh/h)			365			306		684		1265				1122		
v/c Ratio			0.06			0.46		0.04		0.01				0.03		
95% Queue Length, Q_{95} (veh)			0.2			2.3		0.1		0.0				0.1		
Control Delay (s/veh)			15.5			26.4		10.5		7.9				8.3		
Level of Service (LOS)			C			D		B		A				A		
Approach Delay (s/veh)	15.5				23.6				0.2				1.2			
Approach LOS	C				C											

APPENDIX D
FRONTAGE ROAD & TARMAC TRAIL SIGNAL WARRANT ANALYSIS

Hyalite Engineers, PLLC
2304 N 7th Ave. Suite L
Bozeman, Montana 59715
P: 4065872781

Count Location: Frontage Road & Proposed Tarmac Trail
Analysis Period: Expected Traffic
Count Time Period: 7 AM to 7 PM

Groups Printed - Cars, Trucks, Bank3, & Bank4

	Fronatage Road Eastbound						Frontage Road Westbound						New Airport Road Northbound						New Airport Road Southbound						
Factor	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	1.000	1.000	1.000	1.000	1.000	Approach	Intersection
Start Time	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	U-Turn	Left	Thru	Right	Ped/Bike	Total	Total
7:00 AM	0	20	84	0	0	104	0	0	39	4	0	43	0	0	0	0	0	0	0	1	0	28	0	29	177
7:15 AM	0	20	112	0	0	132	0	0	62	5	0	66	0	0	0	0	0	0	0	3	0	41	0	45	242
7:30 AM	0	19	151	0	0	170	0	0	58	3	0	61	0	0	0	0	0	0	0	1	0	34	0	35	266
7:45 AM	0	35	147	0	0	182	0	0	71	4	0	75	0	0	0	0	0	0	0	2	0	65	0	67	324
8:00 AM	0	29	144	0	0	173	0	0	87	6	0	93	0	0	0	0	0	0	0	0	0	38	0	38	303
8:15 AM	0	31	110	0	0	141	0	0	75	2	0	77	0	0	0	0	0	0	0	2	0	37	0	39	257
8:30 AM	0	21	113	0	0	134	0	0	77	1	0	78	0	0	0	0	0	0	0	1	0	39	0	40	252
8:45 AM	0	30	92	0	0	121	0	0	92	3	0	96	0	0	0	0	0	0	0	0	0	47	0	47	264
9:00 AM	0	24	97	0	0	121	0	0	66	3	0	69	0	0	0	0	0	0	0	3	0	50	0	53	243
9:15 AM	0	20	110	0	0	129	0	0	65	3	0	68	0	0	0	0	0	0	0	7	0	46	0	53	250
9:30 AM	0	14	81	0	0	95	0	0	66	2	0	69	0	0	0	0	0	0	0	9	0	30	0	38	202
9:45 AM	0	19	71	0	0	90	0	0	107	3	0	110	0	0	0	0	0	0	0	5	0	34	0	40	239
10:00 AM	0	17	94	0	0	111	0	0	75	1	0	76	0	0	0	0	0	0	0	2	0	35	0	38	224
10:15 AM	0	20	87	0	0	107	0	0	92	3	0	95	0	0	0	0	0	0	0	0	0	32	0	32	234
10:30 AM	0	22	84	0	0	106	0	0	68	3	0	71	0	0	0	0	0	0	0	4	0	55	0	60	236
10:45 AM	0	18	72	0	0	90	0	0	87	2	0	90	0	0	0	0	0	0	0	9	0	40	0	49	229
11:00 AM	0	17	89	0	0	106	0	0	69	1	0	69	0	0	0	0	0	0	0	2	0	40	0	42	218
11:15 AM	0	15	90	0	0	105	0	0	105	1	0	106	0	0	0	0	0	0	0	4	0	59	0	63	274
11:30 AM	0	18	92	0	0	110	0	0	109	1	0	110	0	0	0	0	0	0	0	4	0	51	0	55	275
11:45 AM	0	24	86	0	0	110	0	0	80	1	0	81	0	0	0	0	0	0	0	4	0	34	0	39	230
12:00 PM	0	41	104	0	0	146	0	0	74	2	0	75	0	0	0	0	0	0	0	1	0	39	0	40	261
12:15 PM	0	34	83	0	0	117	0	0	90	3	0	93	0	0	0	0	0	0	0	4	0	28	0	32	242
12:30 PM	0	46	88	0	0	134	0	0	93	2	0	96	0	0	0	0	0	0	0	4	0	42	0	46	275
12:45 PM	0	55	85	0	0	140	0	0	92	5	0	97	0	0	0	0	0	0	0	3	0	25	0	28	265
1:00 PM	0	33	101	0	0	134	0	0	86	5	0	91	0	0	0	0	0	0	0	3	0	19	0	22	247
1:15 PM	0	39	97	0	0	137	0	0	90	2	0	91	0	0	0	0	0	0	0	5	0	28	0	32	260
1:30 PM	0	32	102	0	0	134	0	0	87	2	0	90	0	0	0	0	0	0	0	5	0	36	0	40	264
1:45 PM	0	34	96	0	0	130	0	0	98	1	0	99	0	0	0	0	0	0	0	2	0	23	0	26	254
2:00 PM	0	39	91	0	0	131	0	0	76	2	0	78	0	0	0	0	0	0	0	4	0	37	0	41	249
2:15 PM	0	35	91	0	0	126	0	0	99	3	0	102	0	0	0	0	0	0	0	6	0	33	0	39	267
2:30 PM	0	34	98	0	0	132	0	0	114	2	0	115	0	0	0	0	0	0	0	3	0	32	0	36	283
2:45 PM	0	30	78	0	0	108	0	0	104	6	0	109	0	0	0	0	0	0	0	4	0	25	0	29	246
3:00 PM	0	29	84	0	0	113	0	0	86	0	0	86	0	0	0	0	0	0	0	5	0	21	0	26	225
3:15 PM	0	28	120	0	0	148	0	0	105	2	0	106	0	0	0	0	0	0	0	2	0	29	0	31	285
3:30 PM	0	37	106	0	0	142	0	0	90	2	0	91	0	0	0	0	0	0	0	3	0	44	0	47	281
3:45 PM	0	27	104	0	0	132	0	0	113	3	0	116	0	0	0	0	0	0	0	5	0	28	0	32	280
4:00 PM	0	42	74	0	0	117	0	0	110	2	0	113	0	0	0	0	0	0	0	2	0	36	0	39	268
4:15 PM	0	39	91	0	0	131	0	0	138	4	0	142	0	0	0	0	0	0	0	2	0	29	0	32	304
4:30 PM	0	45	115	0	0	160	0	0	99	3	0	102	0	0	0	0	0	0	0	8	0	33	0	41	304
4:45 PM	0	41	110	0	0	152	0	0	133	3	0	137	0	0	0	0	0	0	0	6	0	47	0	53	342
5:00 PM	0	33	108	0	0	141	0	0	138	3	0	141	0	0	0	0	0	0	0	7	0	46	0	53	335
5:15 PM	0	52	104	0	0	156	0	0	186	3	0	190	0	0	0	0	0	0	0	5	0	40	0	44	390
5:30 PM	0	33	119	0	0	152	0	0	168	3	0	171	0	0	0	0	0	0	0	7	0	41	0	49	371
5:45 PM	0	28	67	0	0	95	0	0	122	2	0	124	0	0	0	0	0	0	0	2	0	28	0	31	250
6:00 PM	0	28	82	0	0	110	0	0	110	2	0	112	0	0	0	0	0	0	0	0	0	24	0	24	246
6:15 PM	0	24	85	0	0	110	0	0	108	2	0	111	0	0	0	0	0	0	0	2	0	20	0	23	243
6:30 PM	0	27	66	0	0	93	0	0	79	2	0	82	0	0	0	0	0	0	0	2	0	21	0	23	198
6:45 PM	0	22	50	0	0	72	0	0	70	0	0	70	0	0	0	0	0	0	0	1	0	17	0	18	160
Total	0	1,419	4,606	0	0	6,025	0	0	4,510	122	0	4,632	0	0	0	0	0	0	0	170	0	1,709	0	1,879	12,536
Apprch %	0.0%	23.6%	76.4%	0.0%	0.0%		0.0%	0.0%	97.4%	2.6%	0.0%		0.0%	0.0%	0.0%	0.0%	0.0%		0.0%	9.1%	0.0%	90.9%	0.0%		
Total %	0.0%	11.3%	36.7%	0.0%	0.0%	48.1%	0.0%	0.0%	36.0%	1.0%	0.0%	36.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	13.6%	0.0%	15.0%	

HCS7 Warrants Report

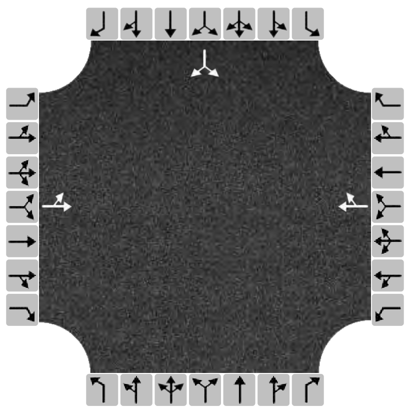
Project Information

Analyst	Cody Kerkaert	Date	7/12/2024
Agency		Analysis Year	Expected Traffic
Jurisdiction		Time Period Analyzed	
Project Description	Frontage Rd & Tarmac Trl Expected Traffic Signal Warrant Analysis		

General

Major Street Direction	East-West	Population < 10,000	No
Starting Time Interval	7	Coordinated Signal System	No
Median Type	Undivided	Crashes (crashes/year)	1
Major Street Speed (mi/h)	50	Adequate Trials of Crash Exp. Alt.	No
Nearest Signal (ft)	3400		

Geometry and Traffic



Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Number of Lanes, N	0	1	0	0	1	0	0	0	0	0	0	0
Lane Usage		LT			TR						LR	
Vehicle Volumes Averages (veh/h)	118	383	0	0	375	10	0	0	0	14	0	142
Pedestrian Averages (peds/h)	0			0			0			0		
Gap Averages (gaps/h)	0			0			0			0		
Delay (s/veh)	0.0			0.0			0.0			0.0		
Delay (veh-hrs)	0.0			0.0			0.0			0.0		

School Crossing and Roadway Network

Number of Students in Highest Hour	0	Two or More Major Routes	No
Number of Adequate Gaps in Period	0	Weekend Counts	No
Number of Minutes in Period	0	5-year Growth Factor (%)	2

Railroad Crossing

Grade Crossing Approach	None	Rail Traffic (trains/day)	0
Highest Volume Hour with Trains	Unknown	High Occupancy Buses (%)	0
Distance to Stop Line (ft)		Tractor-Trailer Trucks (%)	3

HCS7 Warrants Report

Volume Summary

Hour	Major Volume	Minor Volume	Total Volume	Peds/h	Gaps/h	1A (70%)	1A (56%)	1B (70%)	1B (56%)	2 (70%)	3A (70%)	3B (70%)	4A (70%)	4B (70%)
07 - 08	832	177	1009	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
08 - 09	913	163	1076	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
09 - 10	751	183	934	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
10 - 11	745	178	923	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
11 - 12	797	199	996	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
12 - 13	896	146	1042	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
13 - 14	905	120	1025	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
14 - 15	901	145	1046	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
15 - 16	934	136	1070	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
16 - 17	1053	165	1218	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
17 - 18	1170	178	1348	0	0	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No
18 - 19	759	89	848	0	0	No	Yes	Yes	Yes	Yes	No	No	No	No
Total	10656	1879	12535	0	0	11	12	12	12	12	0	11	0	0

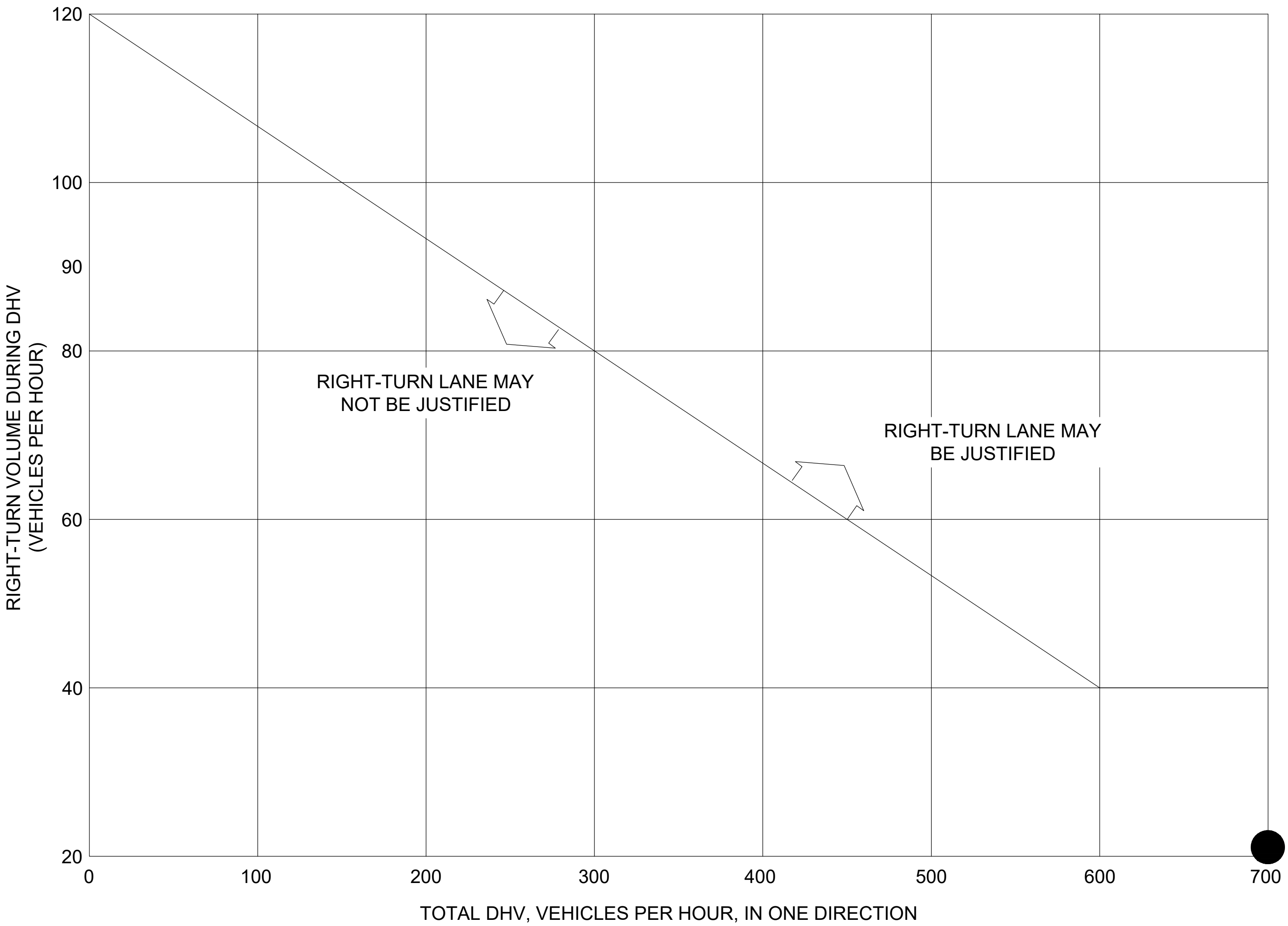
Warrants

Warrant 1: Eight-Hour Vehicular Volume	✔
A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	✓
B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	✓
56% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	✓
Warrant 2: Four-Hour Vehicular Volume	✔
Four-Hour Vehicular Volume (Both major approaches --and-- higher minor approach)	✓
Warrant 3: Peak Hour	✔
A. Peak-Hour Conditions (Minor delay -- and-- minor volume --and-- total volume) --or--	
B. Peak-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	✓
Warrant 4: Pedestrian Volume	
A. Four Hour Volumes --or--	
B. One-Hour Volumes	
Warrant 5: School Crossing	
Gaps Same Period --and--	
Student Volumes	
Nearest Traffic Control Signal (optional)	✓
Warrant 6: Coordinated Signal System	
Degree of Platooning (Predominant direction or both directions)	
Warrant 7: Crash Experience	
A. Adequate trials of alternatives, observance and enforcement failed --and--	
B. Reported crashes susceptible to correction by signal (12-month period) --and--	
C. 56% Volumes for Warrants 1A, 1B, --or-- 4 are satisfied	✓
Warrant 8: Roadway Network	
A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2, or 3) --or--	
B. Weekend Volume (Five hours total)	
Warrant 9: Grade Crossing	
A. Grade Crossing within 140 ft --and--	
B. Peak-Hour Vehicular Volumes	

APPENDIX E
TURN LANE ANALYSES

RIGHT-TURN LANE ANALYSIS

AIRPORT ROAD & FRONTAGE ROAD



CONCLUSION:

THE INTERSECTION OF AIRPORT ROAD & FRONTAGE ROAD MAY NOT BE JUSTIFIED FOR A RIGHT TURN LANE

NOTE:

- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

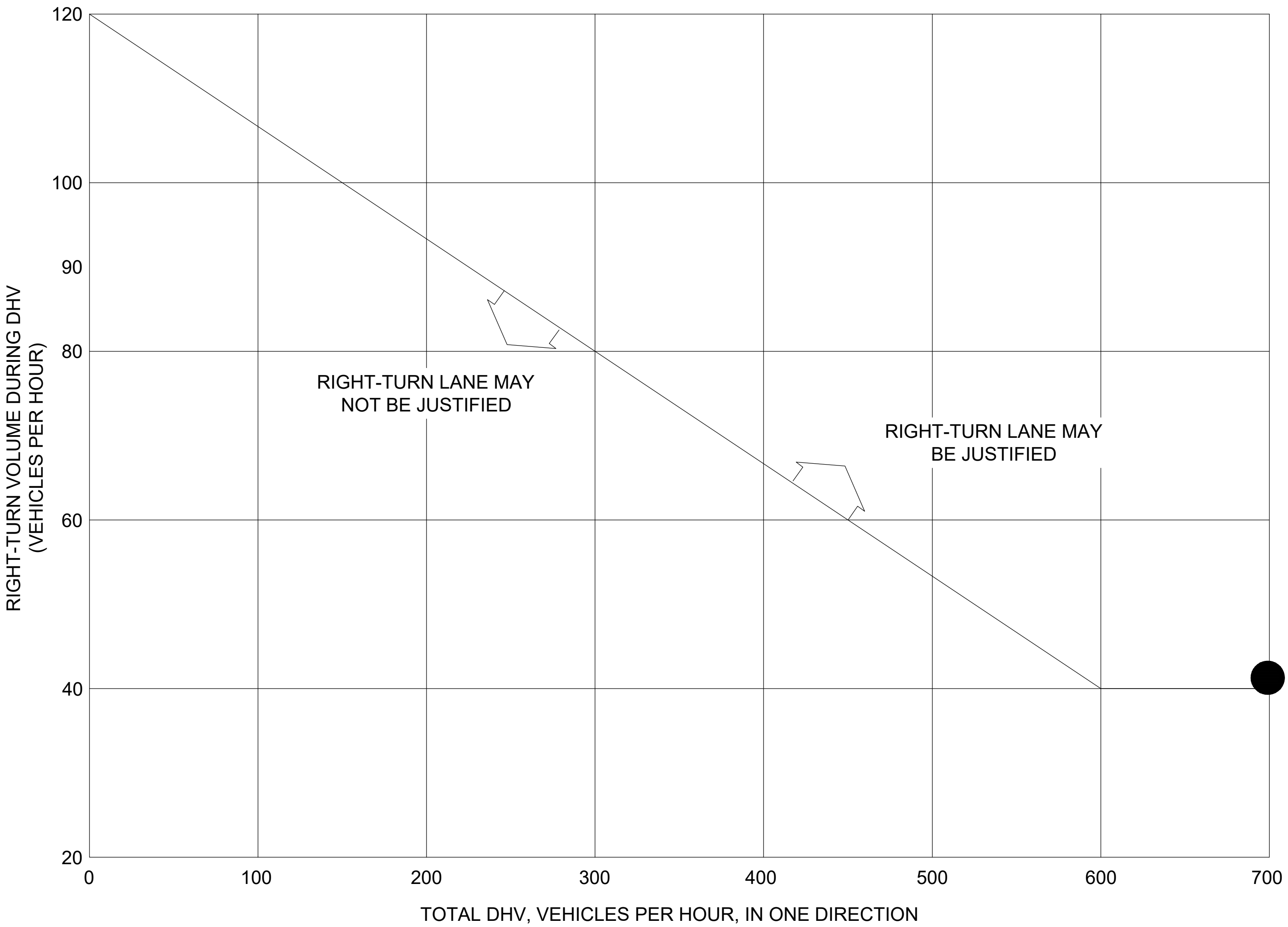
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

DATE :	APRIL 2025
SCALE :	NTS
JOB NUMBER :	162534
SHEET :	1 OF 6

RIGHT-TURN LANE ANALYSIS

DOLLAR DRIVE & FRONTAGE ROAD



CONCLUSION:

THE INTERSECTION OF DOLLAR DRIVE & FRONTAGE ROAD MAY BE JUSTIFIED FOR A RIGHT TURN LANE

NOTE:
- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

M:\162534\Traffic Impact Study\Analysis Figures.dwg

HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

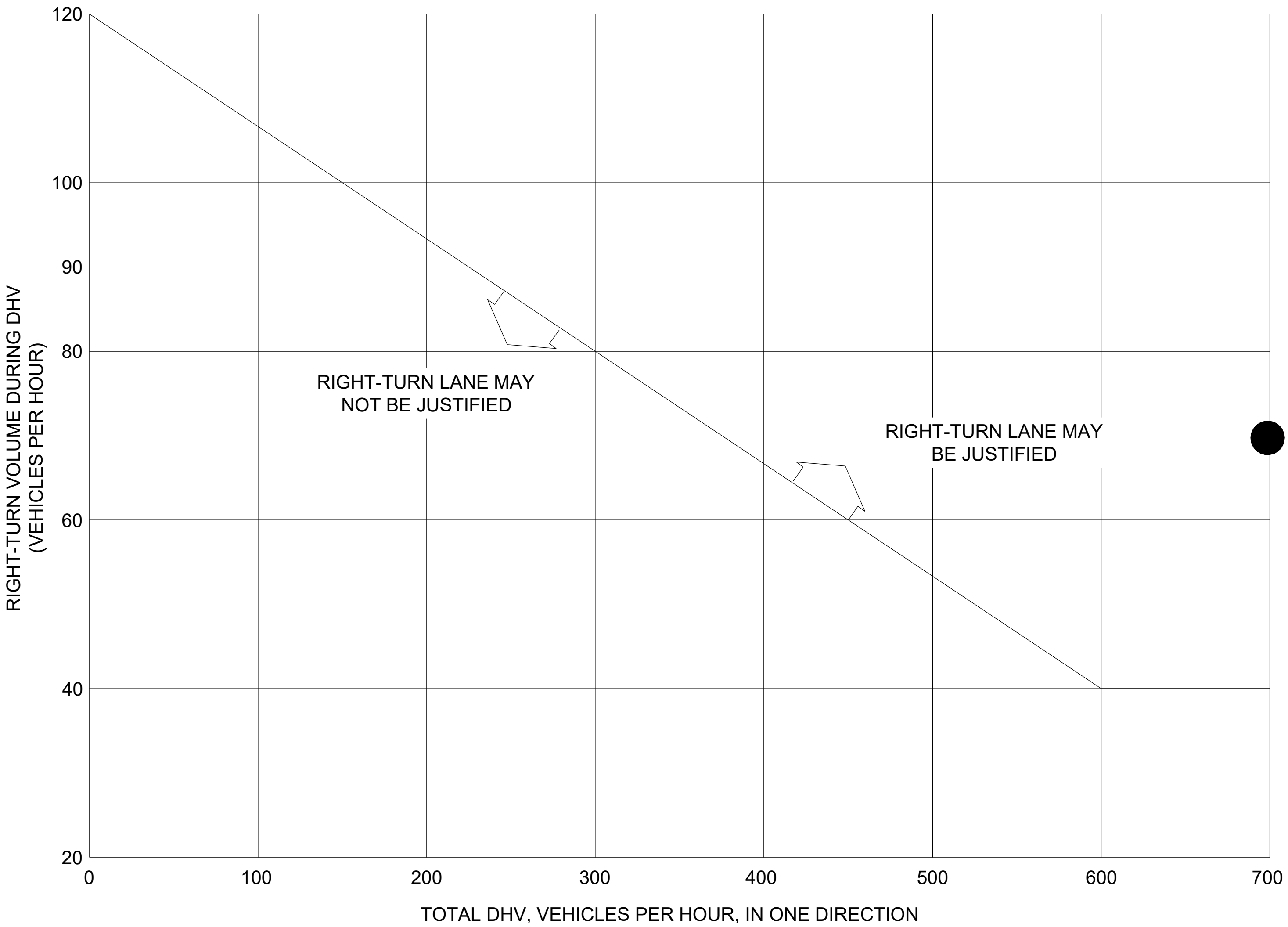
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

DATE :	APRIL 2025
SCALE :	NTS
JOB NUMBER :	162534
SHEET :	2 OF 6

RIGHT-TURN LANE ANALYSIS

FRONTAGE ROAD & TARMAC TRAIL



CONCLUSION:

THE INTERSECTION OF FRONTAGE ROAD & TARMAC TRAIL MAY BE JUSTIFIED FOR A RIGHT TURN LANE

NOTE:
- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

M:\162534\Traffic Impact Study\Analysis Figures.dwg

HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

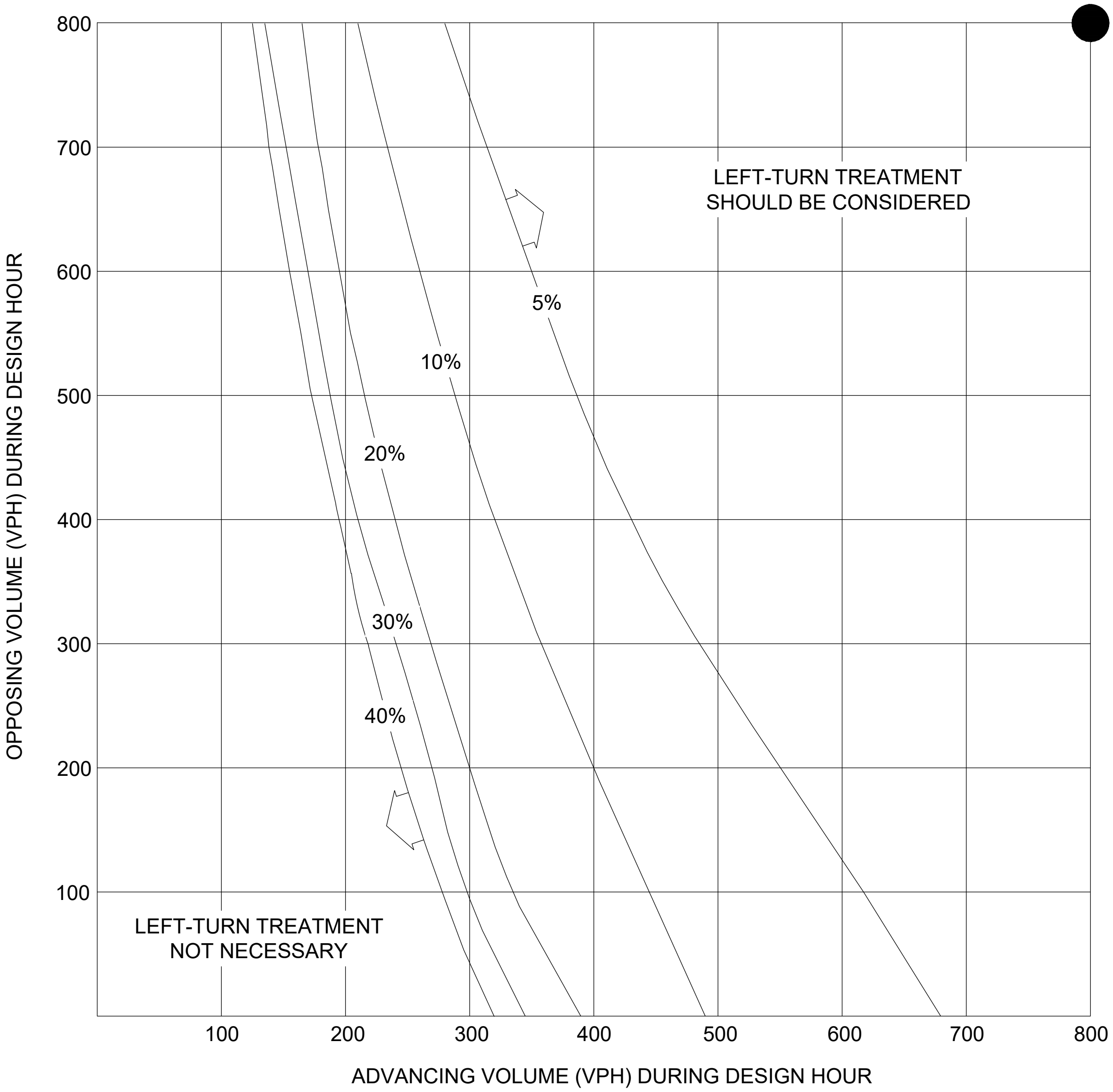
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

DATE :	APRIL 2025
SCALE :	NTS
JOB NUMBER :	162534
SHEET :	3 OF 6

LEFT-TURN LANE ANALYSIS

AIRPORT ROAD & FRONTAGE ROAD



CONCLUSION:

LEFT-TURN TREATMENT SHOULD BE CONSIDERED FOR THE INTERSECTION OF AIRPORT ROAD & FRONTAGE ROAD

NOTE:
- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

M:\162534\Traffic Impact Study\Analysis Figures.dwg

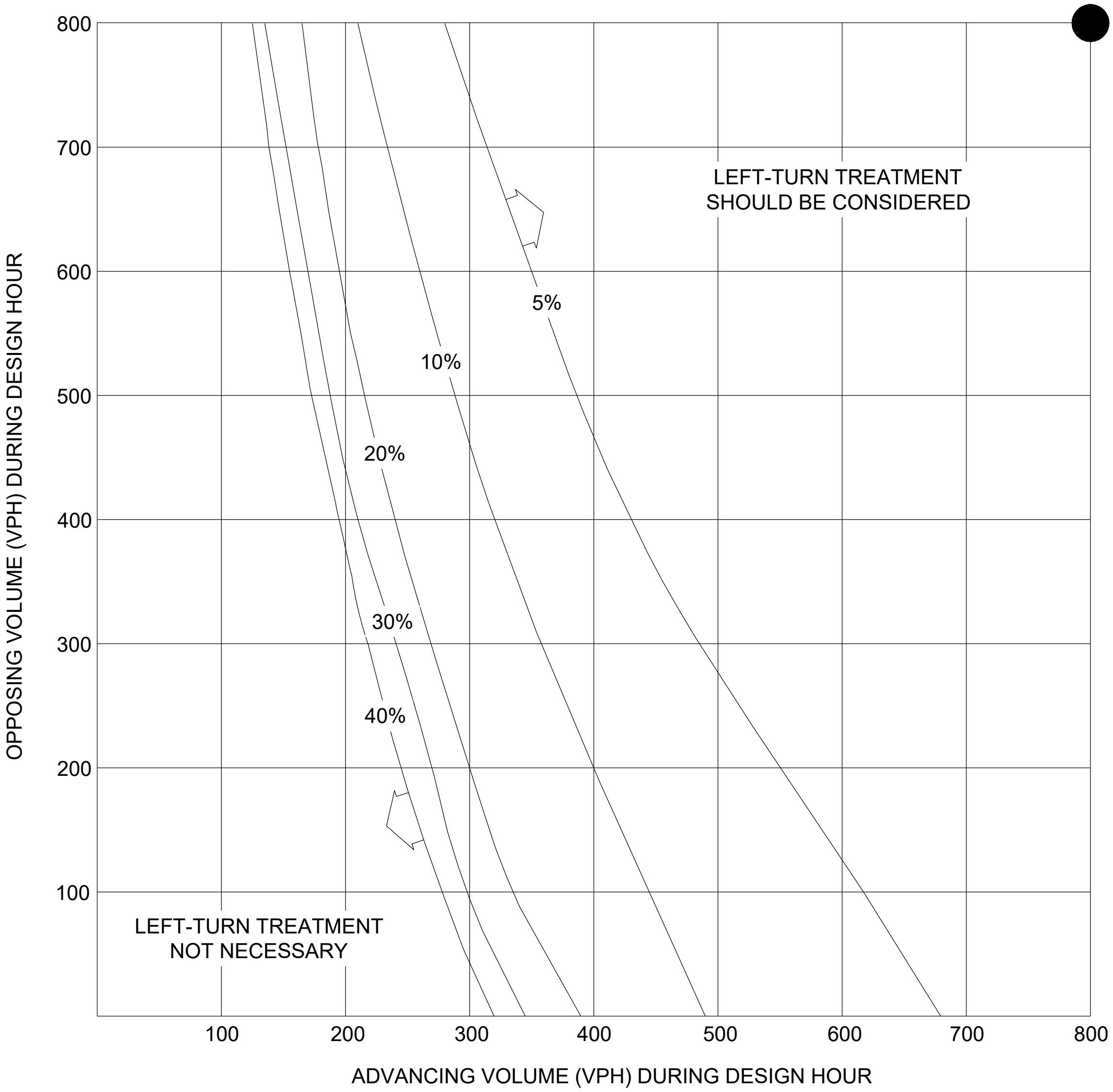
HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT
TARMAC TRAIL EXTENSION

DATE : APRIL 2025
SCALE : NTS
JOB NUMBER : 162534
SHEET : 4 OF 6

LEFT-TURN LANE ANALYSIS

DOLLAR DRIVE & FRONTAGE ROAD



CONCLUSION:

LEFT-TURN TREATMENT SHOULD BE CONSIDERED FOR THE INTERSECTION OF DOLLAR DRIVE & FRONTAGE ROAD

NOTE:

- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

M:\162534\Traffic Impact Study\Analysis Figures.dwg

HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

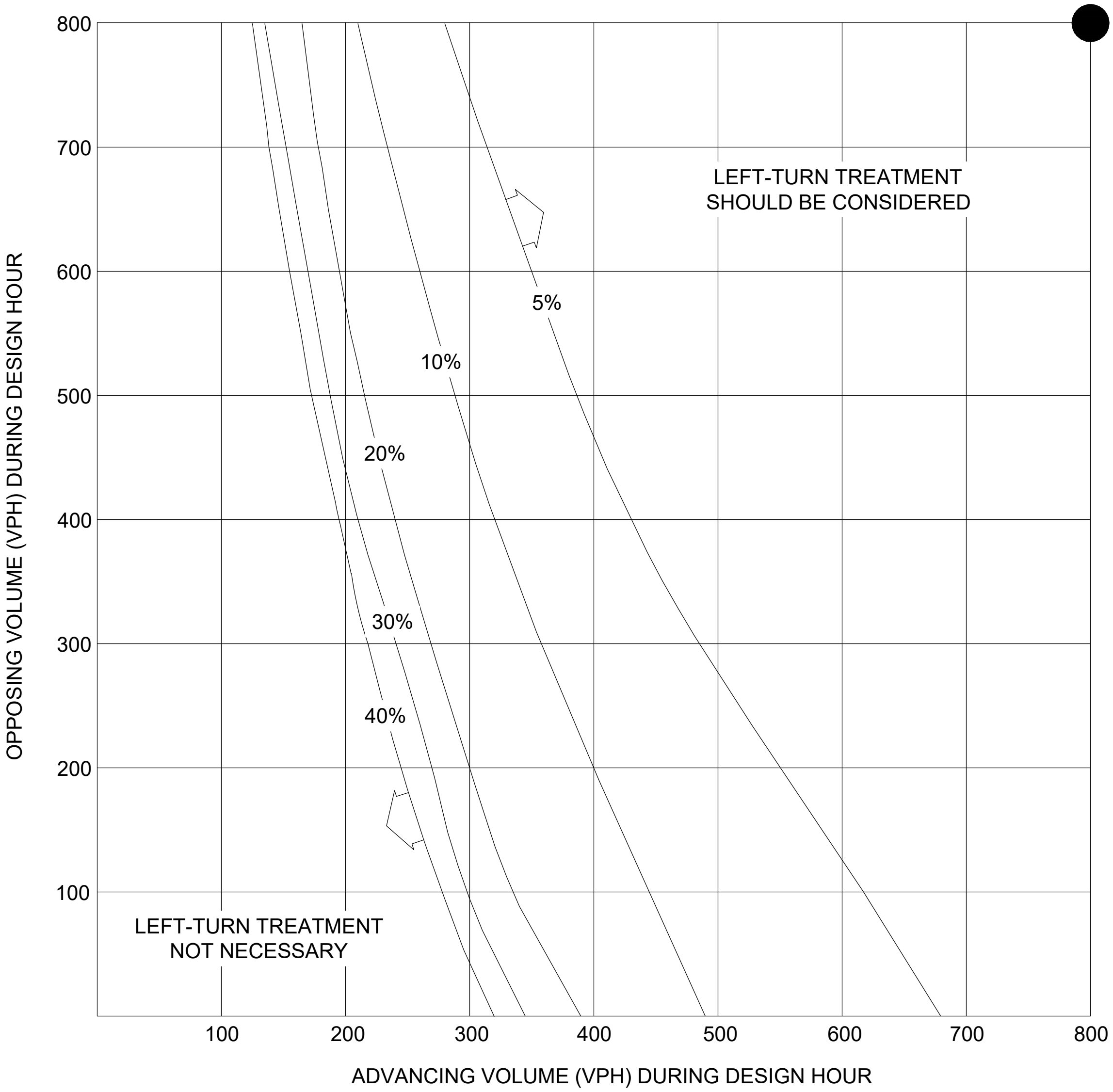
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

TARMAC TRAIL EXTENSION

DATE :	APRIL 2025
SCALE :	NTS
JOB NUMBER :	162534
SHEET :	5 OF 6

LEFT-TURN LANE ANALYSIS

FRONTAGE ROAD & TARMAC TRAIL



CONCLUSION:

LEFT-TURN TREATMENT SHOULD BE CONSIDERED FOR THE INTERSECTION OF FRONTAGE ROAD & TARMAC TRAIL

NOTE:
- UNSIGNALIZED INTERSECTION
- FRONTAGE ROAD IS A 2-LANE HIGHWAY
- SPEED LIMIT IS 50 MPH
- ANALYSIS PERFORMED FOR 2044 FULL-BUILDOUT, PM PEAK HOUR MOVEMENTS

M:\162534\Traffic Impact Study\Analysis Figures.dwg

HYALITE
2304 NORTH 7TH AVENUE STE. L BOZEMAN, MT 59718
PHONE: (406) 587-2781 FAX: (406) 522-9225
WEB: www.hyaliteeng.com

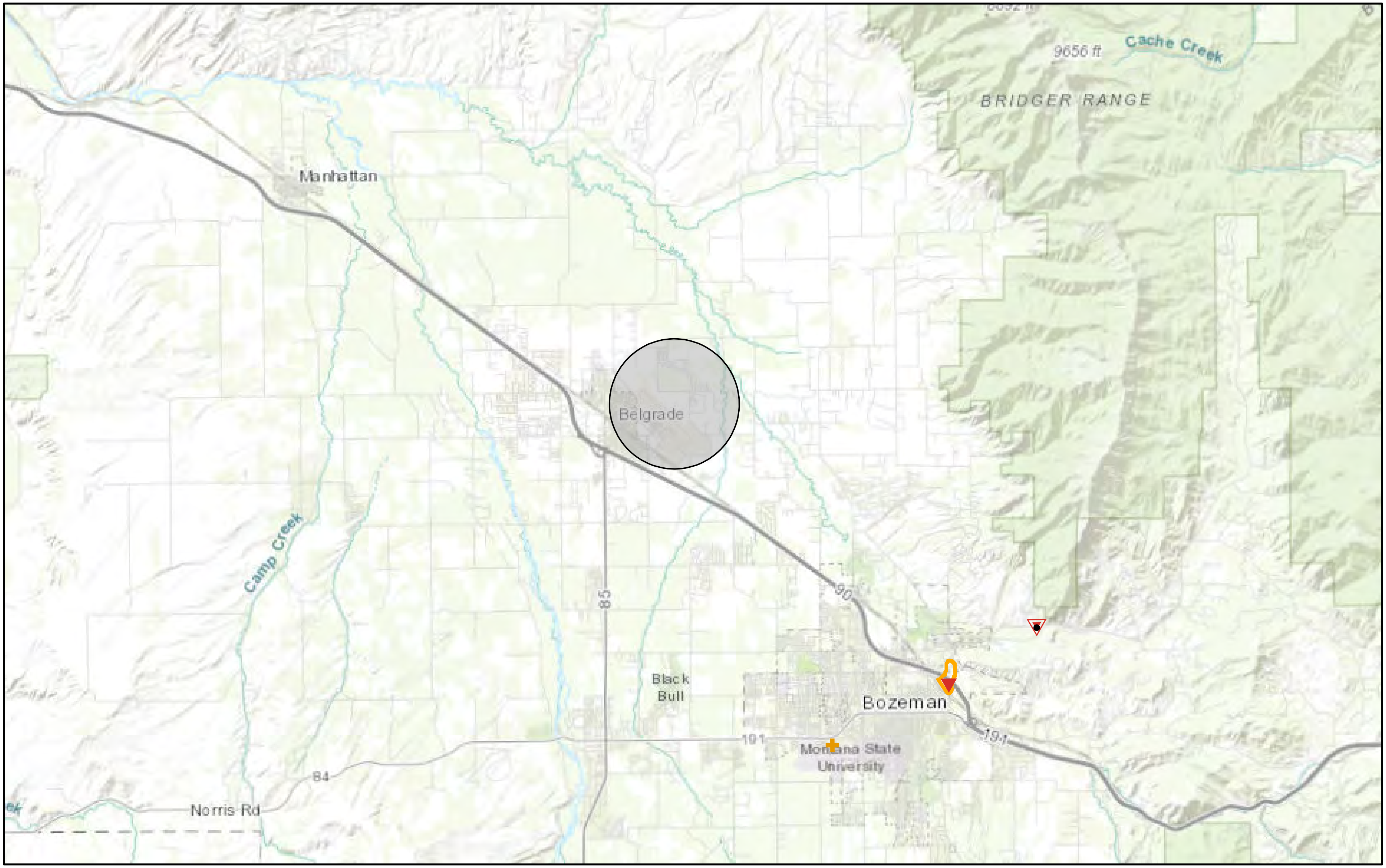
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT
TARMAC TRAIL EXTENSION

DATE :	APRIL 2025
SCALE :	NTS
JOB NUMBER :	162534
SHEET :	6 OF 6

Appendix C:

EPA Socioeconomic Maps

BZN Airport



10/23/2024

Sites

Federal Facility Docket/Superfund Non-NPL

Brownfields Properties

Superfund NPL Sites

State Outlines

Superfund Site Boundaries

1:288,896

0 1.75 3.5 7 mi

0 2.75 5.5 11 km

Bureau of Land Management, Esri Canada, Esri, HERE, Garmin, USGS, NGA, EPA, USDA, NPS

Appendix D:

FEMA - FIRM

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures.** Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov/ or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242,** or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the Gallatin County GIS Department.

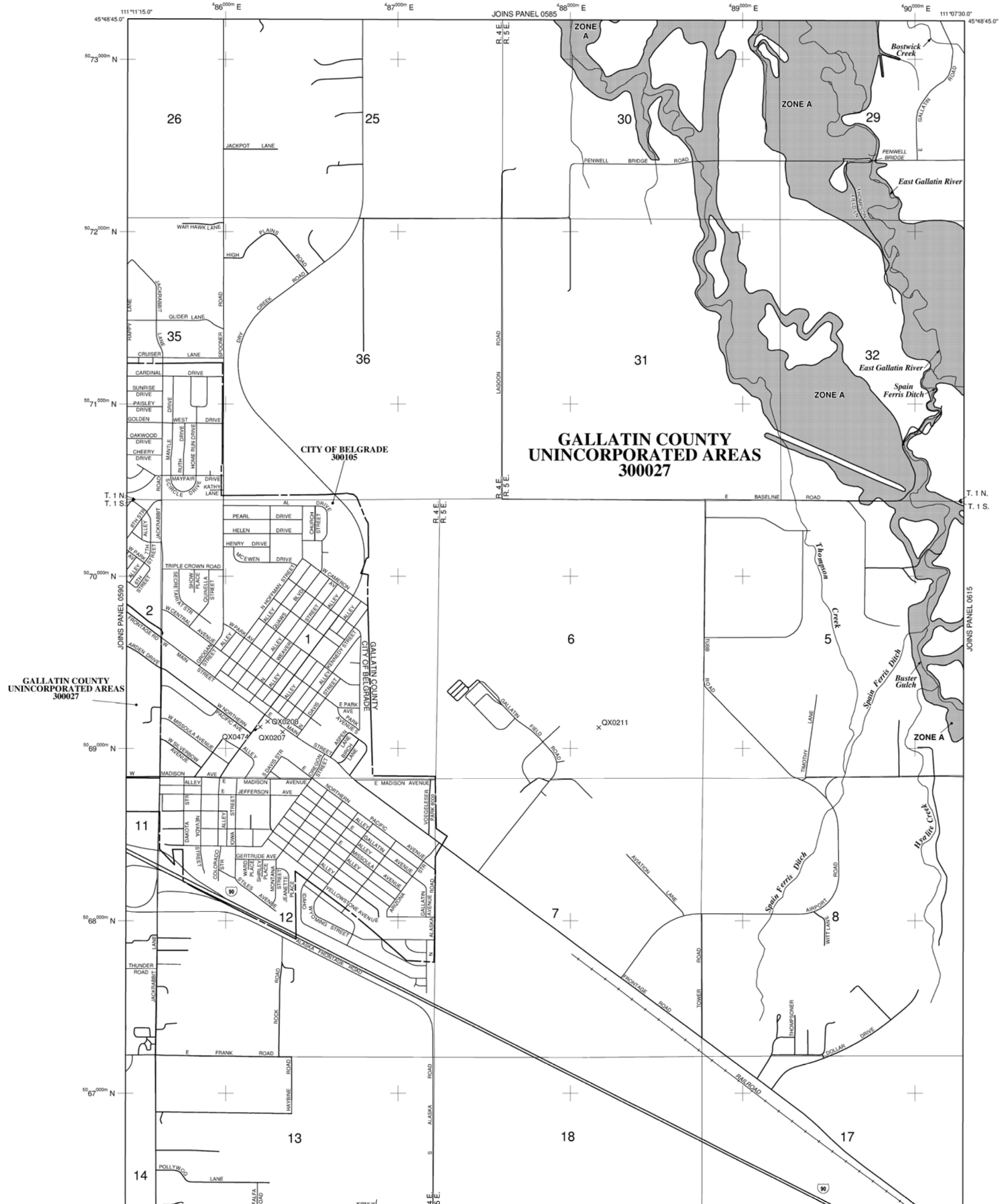
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables *in the Flood Insurance Study report (which contains authoritative hydraulic data)* may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, *a Flood Insurance Study report*, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	Floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
~~ 513 ~~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

(A)——(A)	Cross section line
(23)- - - -(23)	Transect line
97°07'30", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 12
6000000 M	5000-foot grid ticks: Alabama State Plane coordinate system, east zone (FIPSZONE 0101), Transverse Mercator
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 2, 2011
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0595D

FIRM
FLOOD INSURANCE RATE MAP
GALLATIN COUNTY, MONTANA
AND INCORPORATED AREAS

PANEL 595 OF 1725
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
GALLATIN COUNTY	300027	0595	D
BELGRADE, CITY OF	300105	0595	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
30031C0595D

E

Appendix E:

Air Quality and Noise Assessment

CONTENTS

1 INTRODUCTION

The purpose of this report is to provide supporting documentation for the Environmental Assessment (EA) that is being prepared for proposed improvements at Bozeman Yellowstone International Airport (BZN). This document describes the overall approach, methods and results of air quality and noise assessments.

2 AIR QUALITY

The following provides an overview of the regulatory framework for which the air quality assessments were prepared and describes the existing air quality conditions (i.e. the affected environment) within the EA's study area. Potential air quality impacts (i.e. environmental consequences) with the improvements (Proposed Action) and without the improvements (No Action) are presented in this section.

The Clean Air Act (CAA) requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) for air pollutants that are considered harmful to public health and the environment. Additionally, Montana has adopted Montana Ambient Air Quality Standards (MAAQS).

The CAA General Conformity Rule prohibits federal agencies (including the FAA) from permitting or funding projects that do not conform to an applicable State Implementation Plan (SIP). The rule ensures that project-related air pollutant emissions do not contribute to the degradation of air quality conditions in an area.

2.1 NAAQS

The CAA requires the EPA to establish and periodically review NAAQS. There are NAAQS for six "criteria" air pollutants—carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM), and sulfur dioxide (SO_2). There are standards for two sizes of PM—$PM_{2.5}$ which are particles with a diameter of 2.5 microns or less and PM_{10} which are particles with a diameter of 10 microns or less. For some pollutants there are two sets of standards. Primary standards provide protection for the health of the public and secondary standards provide public welfare protection. The NAAQS for the six air pollutants and the averaging periods of the standards are provided in **Table 1**.

Table 1 – National Ambient Air Quality Standards

Pollutant	Primary/ Secondary	Averaging Period	Standard
CO	Primary	8-hour	9 ppm
		1-hour	35 ppm
Pb	Primary and Secondary	Rolling 3-month average	0.15 μg/m^3
NO_2	Primary	1-hour	100 ppb
	Primary and Secondary	1 year	53 ppb
O_3	Primary and Secondary	8-hour	0.070 ppm

PM	$PM_{2.5}$	Primary	1 year	12 µg/m^3
		Secondary		15 µg/m^3
		Primary and Secondary	24-hour	35 µg/m^3
	PM_{10}	Primary and Secondary	24-hour	150 µg/m^3
SO_2		Primary	1-hour	75 ppb
		Secondary	3-hour	0.5 ppm

Note: ppb = parts per billion, ppm = parts per million, and µg/m^3 = micrograms per cubic meter of air. Source: EPA https://www.epa.gov/criteria-air-pollutants/naaqs-table, July 2024.

Source: EPA, National Ambient Air Quality Standards (NAAQS) at https://www.epa.gov/criteria-air-pollutants/naaqs-table, July, 2024

2.2 Air Quality Designation

The EPA designates areas with measured pollutant concentrations which are lower than the NAAQS as being in attainment and areas with pollutant concentrations that exceed the NAAQS is designated nonattainment. Once a nonattainment area meets the NAAQS and the additional re-designation requirements in the CAA, the EPA re-designates the area to be “maintenance”. Areas are designated as unclassifiable when there is lack of sufficient data to form the basis of an attainment status determination. BZN is located in Gallatin County, an area that is designated in attainment of all of the NAAQS.

2.3 CAA Conformity Requirements

The General Conformity Rule of the federal CAA prohibits federal agencies (including the FAA) from permitting or funding projects that do not conform to an applicable SIP. The General Conformity Rule applies only to areas that are designated nonattainment or maintenance. Because BZN is located in an attainment area, the General Conformity requirements of the CAA are not applicable to the Proposed Action.

The CAA also contains a Transportation Conformity Rule that functions similar to the General Conformity Rule. The Transportation Conformity Rule restricts federal funding to highway or transportation projects that do not conform to an applicable SIP. The responsibility of transportation conformity determination is vested in the Federal highway Administration (FHWA) and a state’s Department of Transportation. Because BZN is located in an attainment area, the Transportation Conformity requirements of the CAA are also not applicable to the Proposed Action.

2.4 National Environmental Policy Act (NEPA) Requirements

Section 102(2) of the NEPA requires environmental review of federally funded projects that have the potential to affect the environment irrespective of location (i.e., nonattainment/attainment/maintenance areas). The emission inventories presented in Section 3, which disclose emission levels of the criteria pollutants and/or their precursors with the No Action and Proposed Action alternatives were prepared for the NEPA-required environmental review.

2.5 Potential Air Quality

This section presents and discusses the estimated change in air pollutants and pollutant precursors that would result with the Proposed Action at BZN. For the analysis, the short-term pollutant/pollutant precursor emissions that would result from the construction activities required to implement the improvements as well as long-term emissions with the No Action and Proposed Action alternatives were derived.

2.5.1 Construction Emissions

Construction emissions are temporary and variable depending on project location, duration and level of activity. These emissions include engine exhaust from the operation of construction equipment, vehicles at the site (e.g., scrapers, dozers, delivery trucks, etc.). and vehicles transporting construction workers to and from the site. Additionally, fugitive dust emissions result from site preparation, land clearing, material handling, equipment movement on unpaved areas; and from evaporative emissions that occur during the application of asphalt paving.

The Airport Construction Emissions Inventory Tool (ACEIT)[1] was used to estimate short-term construction emissions associated with the proposed improvements at BZN. The emission inventories were prepared for the criteria air pollutants carbon monoxide (CO) and particulate matter (PM)[10]. Estimates of volatile organic compounds (VOCs) and nitrogen oxides (NO_x), which are precursors to the air pollutant O_3, were also prepared. While ACEIT does not provide emission estimates of nitrogen dioxide (NO_2) or sulfur dioxide (SO_2), the model does provide estimates of NO_X and SO_X emissions of which NO_2 and SO_2 are components, respectively.

Project-specific details (i.e., project types and square footages) were used in the ACEIT to estimate construction activities and equipment/vehicle activity data (e.g., equipment mixes/operating times). **Table 2** lists the construction activities that would be necessary to implement the Proposed Action at BZN. For the purpose of preparing the inventory, construction of the proposed improvements was assumed to begin in the year 2026 and continue through the year 2030. The emissions inventory of CO, PM, VOC, NO_x, and SO_x that would result from construction of the proposed improvements at BZN are provided in **Table 3**. As shown, the greatest level of collective emissions would occur in the year 2026.

Table 2 – Projected Construction Schedule and Activities

Timeframe	Construction/Demolition Activities
2026	Airport Road Demo/Tarmac Trail Construction Taxiway B Extension
2027	Taxiway C Relocation and Extension
2029	Runway 11/29 Extension and Widening
2030	Northside Apron and Taxilanes

Source: Morrison-Maierle, 2024

[1] TRB, ACRP Report 102, Guidance for Estimating Airport Construction Emissions, http://www.trb.org/ACRP/Blurbs/170234.aspx.

Table 3 – Construction Emissions (tons)

Year	CO	NOx	SO2	PM10	PM2.5	VOC
2026	9	4	<1	1	<1	40
2027	7	3	<1	<1	<1	34
2029	3	1	<1	<1	<1	15
2030	5	2	<1	<1	<1	27
Source: Morrison-Maierle, 2024.						

Note: Emission estimates are rounded.
Source: Morrison-Maierle, 2024.

2.5.2 Operational Emissions

The Proposed Action has the potential to change the level emissions associated with the aircraft taxi mode. Because there would be no change in the number of aircraft operations or motor vehicle trips or change in the aircraft fleet mix beyond forecasted growth, the change in operational emissions would only occur from a change in the aircraft taxi travel distances.

Aircraft taxi emissions with and without the Proposed Action were computed using the FAA's Aviation Environmental Design Tool (AEDT), Version 3g[2]. The average time that aircraft would taxi with the No Action and Proposed Action alternatives is provided in **Table 4**. The taxi times were derived an assuming a taxi speed of ten miles-per hour and measured distances to/from the ends of all runways to the intersection of Taxiways A and A3 with and without the Proposed Action.

Table 4: Aircraft Taxi Times

	Taxi Times (minutes)		
Runway End	No Action	Proposed Action	Difference
11	1.92	5.94	4.02
29	7.44	7.44	0
12	5.64	5.64	0
30	6	6	0
3	5.58	5.58	0
21	4.92	4.92	0

Aircraft operation levels were obtained from BZN Flight Tracking System Data and the FAA Operations Network (OpsNet), for current operations and FAA's 2023 Terminal Area Forecast (TAF) for future operations. **Table 5** summarizes the aircraft fleet mix and number of annual aircraft operations modeled in AEDT for the 2023, 2030 and 2035 conditions.

[2] AEDT 3g is the current release version of AEDT. Additional information on AEDT is available at: https://aedt.faa.gov/.

Table 5 Aircraft Fleet Mix and Operations

	Number of Operations		
Aircraft Type	2023	2030	2035
Commercial Jets	**20,181**	**24,373**	**27,003**
B738 - Boeing 737-800	4,867	5,878	6,512
E75L - Embraer 175	3,425	4,136	4,583
B737 - Boeing 737-700	3,006	3,630	4,022
A320 - Airbus A320	2,739	3,308	3,665
B739 - Boeing 737-900	1,960	2,367	2,623
A319 - Airbus A319	1,704	2,058	2,280
A321 - Airbus A321 All Series	1,597	1,929	2,137
B752 - Boeing 757-200	338	408	452
E170 - Embraer 170	194	234	260
B39M - Boeing 737 Max 9	166	200	222
CRJ9 - Bombardier CRJ-900	134	162	179
CRJ7 - Bombardier CRJ-700	50	60	67
Business Jets	**15,204**	**15,544**	**16,070**
CL30 - Bombardier Challenger 300	2,194	2,243	2,319
E55P - Embraer Phenom 300	1,475	1,508	1,559
GLF5 - Gulfstream V/G500	1,317	1,347	1,392
GLF4 - Gulfstream IV/G400	1,070	1,094	1,131
C750 - Cessna Citation X	1,050	1,073	1,110
C56X - Cessna Excel/XLS	1,020	1,043	1,078
C68A - Cessna Citation Latitude	1,020	1,043	1,078
C560 - Cessna Citation V/Ultra/Encore	579	592	612
CJ3 - Cessna Citation CJ3	578	591	611
C680 - Cessna Citation Sovereign	567	580	600
C700 - Cessna Citation Longitude	498	509	526
CRJ2 - Bombardier CRJ-200	497	508	525
C25A - Cessna Citation CJ2	444	454	469
E545 - Embraer EMB-545 Legacy 450	442	452	467
C25C - Cessna Citation CJ4	433	442	457
GLF6 - Gulfstream	392	401	414
F900 - Dassault Falcon 900	282	288	298
LJ45 - Bombardier Learjet 45	263	269	278
C525 - Cessna CitationJet/CJ1	256	261	270
LJ31 - Bombardier Learjet 31/A/B	251	257	265
H25B - BAe HS 125/700-800/Hawker 800	249	255	264
BE40 - Raytheon/Beech Beechjet 400/T-1	239	244	252
E170 - Embraer 170	89	91	94

Multi-engine GA	**8,998**	**9,200**	**9,511**
DA42 - Diamond Twin Star	5,365	5,486	5,671
B190 - Beech 1900/C-12J	801	819	847
BE20 - Beech 200 Super King	645	659	681
AT43 - Aérospatiale/Alenia ATR 42-200/300/320	520	531	549
AC90 - Gulfstream Commander	360	368	380
C340 - Cessna 340	358	366	378
BE9L - Beech King Air 90	326	333	345
B350 - Beech Super King Air 350	234	239	247
AC50 - Aero Commander 500	134	137	142
B58 - Beechcraft Baron	128	131	135
B55 - Beechcraft Baron	127	130	134
Single-engine GA	**83,220**	**85,084**	**87,963**
C172 - Cessna Skyhawk 172/Cutlass	34,957	35,740	36,949
DA20 - Diamond DA 20	32,253	32,975	34,091
DA40 - Diamond Star DA40	3,864	3,951	4,084
C182 - Cessna Skylane 182	3,022	3,090	3,195
PC12 - Pilatus PC-12	2,339	2,391	2,472
PA18 - Piper Cub PA-18	1,820	1,861	1,923
SR20 - Cirrus SR-20	1,214	1,241	1,283
C185 - Cessna Skywagon 185	968	990	1,023
PA28 - Piper Cherokee	649	663	686
SR22 - Cirrus SR 22	561	573	593
C208 - Cessna 208 Caravan	510	521	539
C180 - Cessna 180	468	479	495
KODI - Quest Kodiak	433	443	458
TBM9 - Socata TBM	162	166	172
Helicopters	**307**	**314**	**325**
B407 - Bell 407	173	177	183
AS50 - Aerospatiale AS-550	73	75	78
B429 - Bell 407	61	63	65
Military	**307**	**307**	**307**
L39 - Aero L-139 Albatross	193	193	193
AJET - Dassault/Dornier Alpha Jet	72	72	72
C30J - C-130J Hercules ; Lockheed	42	42	42
Total	**128,217**	**134,822**	**141,178**

Note: Totals may not equal due to rounding

Sources: BZN Flight Tracking System Data, Federal Aviation Administration (FAA) Operations Network (OpsNet), FAA Terminal Area Forecast (TAF)

Table 6 presents the aircraft-related operational emission inventories for the future No Action and Proposed Action conditions. As shown, with the Proposed Action, operational emissions are estimated to increase with the greatest increase being emissions of CO and VOC (an increase of approximately six tons and approximately three tons, respectively in 2035). The increase in emissions would occur because the aircraft taxi times are greater with the proposed lengthening of Runway 11-29.

Table 6: Aircraft Taxi Emissions (tons)

ear	Alternative	CO	PM_{10}	$PM_{2.5}$	VOC	NO_X	SO_X
2030	No Action	201.7	0.5	0.5	38.4	20.4	6.2
	Proposed Action	213.0	0.6	0.6	41.1	21.9	6.7
	Net Difference	**11.3**	**0.1**	**0.1**	**2.7**	**1.5**	**0.5**
2035	No Action	214.6	0.6	0.6	40.1	22.3	6.8
	Proposed Action	221.0	0.6	0.6	42.7	23.9	7.2
	Net Difference	**6.4**	**0.0**	**0.0**	**2.6**	**1.6**	**0.5**

3 NOISE

This section presents the aircraft noise exposure for the existing and future No Action and Proposed Action Alternatives. The noise analysis was prepared to meet the requirements of FAA Order 1050.1F and Order 5050.4B. The following describes the regulatory background, noise analysis methodology, noise model input data, and noise exposure results.

3.1 Regulatory Guidelines and Noise Model

The noise analysis was developed using the FAA's AEDT Version 3g. The AEDT is the required tool to evaluate potential aircraft noise impacts from actions subject to NEPA. The AEDT produces aircraft noise contours that delineate areas of equal day-night average sound level (DNL). The DNL is a 24-hour time-weighted sound level that is expressed in A-weighted decibels (dB). The FAA and other federal agencies use DNL as the primary measure of noise impact because: DNL values correlate well with the results of attitudinal surveys regarding noise; DNL values increase with the duration of noise events; and DNL values account for an increased sensitivity to noise at night by increasing each noise event that occurs during nighttime hours (i.e., 10:00 pm to 6:59 am) by 10dB.

The AEDT works by defining a network of grid points at ground level around an airport. The model then selects the shortest distance from each grid point to each flight track and computes the noise exposure generated by each aircraft operation, along each flight track. Corrections are applied for atmospheric acoustical attenuation, acoustical shielding of the aircraft engines by the aircraft itself, and aircraft speed variations. The noise exposure levels for each aircraft are then summed at each grid location. The cumulative noise exposure levels at all grid points are then used to develop noise exposure contours for selected values (e.g. DNL 65, 70 and 75 dB).

Guidelines regarding the compatibility of land uses within various DNL contour intervals are specified in *Appendix A of 14 Code of Federal Regulations (CFR) Part 150*. As shown in **Table 7**, the FAA identifies, as a function of DNL values, land uses which are compatible and land uses which are not compatible in an airport environs. The FAA has determined that the all the land uses listed in the table are normally compatible with aircraft noise exposure below the DNL 65 dB contour. When evaluating noise and land use compatibility, attention is therefore focused on uses within the DNL 65 dB contour.

Table 7 – FAA Land Use Compatibility Guidelines

Land Use	DNL expressed in dB(A)					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Notes: SLUCM = Standard Land Use Coding Manual, Y (Yes) = Land Use and related structures compatible without restrictions, N (No) = Land Use and related structures are not compatible and should be prohibited, and NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35 = Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.
(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems. (2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low. (3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low. (4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low. (5) Land use compatible provided special sound reinforcement systems are installed. (6) Residential buildings require an NLR of 25. (7) Residential buildings require an NLR of 30. (8) Residential buildings not permitted.

Source: 14 CFR Part 150.

3.2 Existing DNL Contours (2023)

In the development of DNL contours, the AEDT uses both default and airport-specific factors. The default factors include engine noise levels, thrust settings, aircraft arrival and departure flight profiles and aircraft speed. The airport-specific factors include the number of aircraft operations, the type of aircraft, runway use, the assignment of aircraft operations to flight tracks and operational time (day/night) data. This section includes the airport- specific factors used in modeling the existing 2023 DNL contours.

The 2023 annual operations were developed using FAA Operations Network (OPSNET) data. The 2023 aircraft operations by category are provided in **Table 8**. As shown, in 2023 there were 128,217 annual operations (an average of approximately 351 operations per day).

Table 8: 2023 Annual Operations

Itinerant					Local			
Air Carrier	Air Taxi	General Aviation	Military	Total	Civil	Military	Total	Total
19,448	12,081	49,545	389	81,463	46,536	218	46,754	128,217

Source: FAA Operations Network (OSNET)

For the purposes of preparing DNL contours, operational data were segregated by aircraft type. BZN Airport Flight Tracking System data for 2023 was used to develop the AEDT aircraft fleet mix. As required for use in the AEDT, annual aircraft operations were converted to annual average-day operations.

3.3 Existing Conditions (2023)

3.3.1 Runway Definition

BZN has two parallel runways (12-30 and 11-29) spaced 940 feet apart. Runway 12/30 is the longest runway on the airfield at 8,994 feet in length and is 150 feet wide. Runway 11-29 is 5,050 feet long and 75 feet wide. A crosswind runway, (Runway 3-21) is located to the southeast of the parallel runways and is 2,650 feet long and 75 feet wide. Runway 3-21 is used primarily by helicopters and light general aviation aircraft. In addition, a grass strip, 11G-29G is located between Runway 11-29 and 12-30 and is 2,802 feet long and 80 feet wide. **Table 9** provides information on the current runways and lengths at BZN.

Table 9: Runways – Existing Conditions (2023)

Runway	Length (Feet)
12-30	8,994
11-29	5,050
3-21	2,650
11G-29G	2,802

3.3.2 Number of Operations and Fleet Mix

In 2023, there were 128,217 annual operations at BZN. It should be noted that all annual operations in this document reflect calendar year operations. When divided by 365, the result is 351.3 average-annual day operations. Specific aircraft types and times of operation were developed using BZN Airport Flight Tracking System data for 2023. **Table 10** provides a summary of the average annual day operations by aircraft category and time of day that was used for the Existing Conditions (2023). **Table 11** shows the average daily number of arrivals and departures by time of day and individual aircraft type.

Table 10: Summary of Average Annual Day Operations Existing Conditions (2023)

	Arrivals		Departures			
Aircraft Type	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**	**Total**	**Percent of Total**
Commercial Jets	23.3	4.4	24.5	3.1	55.3	15.7%
Business Jets	24.5	0.5	24.1	0.5	49.6	14.1%
Single-engine GA	106.4	1.6	107.9	1.9	217.7	62.0%
Multi-engine GA	12.2	0.8	12.0	0.6	25.7	7.3%
Helicopters	0.6	0.2	0.6	0.2	1.5	0.4%
Military	0.8	0.0	0.8	0.0	1.6	0.4%
Total	**167.6**	**7.5**	**169.9**	**6.3**	**351.3**	**100%**

Note: Totals may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data

Table 11: Average Annual Day Operations by Aircraft Type Existing Conditions (2023)

	Arrivals		Departures			
Aircraft Type	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**	**Total**	**Percent of Total**
Commercial Jets	**23.3**	**4.4**	**24.5**	**3.1**	**55.3**	**15.7%**
A319 - Airbus A319	2.2	0.1	2.2	0.2	4.7	1.3%
A320 - Airbus A320	3.1	0.6	3.1	0.6	7.5	2.1%
A321 - Airbus A321 All Series	1.0	1.2	1.2	1.0	4.4	1.2%
B39M - Boeing 737 Max 9	0.2	0.0	0.2	0.0	0.5	0.1%
B737 - Boeing 737-700	3.4	0.7	3.7	0.5	8.2	2.3%
B738 - Boeing 737-800	5.9	0.8	6.3	0.3	13.3	3.8%
B739 - Boeing 737-900	2.1	0.6	2.3	0.4	5.4	1.5%
B752 - Boeing 757-200	0.1	0.0	0.8	0.0	0.9	0.3%
CRJ7 - Bombardier CRJ-700	0.1	0.0	0.0	0.0	0.1	0.0%
CRJ9 - Bombardier CRJ-900	0.3	0.0	0.1	0.0	0.4	0.1%
E170 - Embraer 170	0.2	0.0	0.3	0.0	0.5	0.2%
E75L - Embraer 175	4.4	0.3	4.7	0.0	9.4	2.7%
Business Jets	**24.5**	**0.5**	**24.1**	**0.5**	**49.6**	**14.1%**
BE40 - Raytheon/Beech Beechjet 400/T-1	0.4	0.0	0.4	0.0	0.8	0.2%
C25A - Cessna Citation CJ2	0.7	0.0	0.7	0.0	1.4	0.4%
C25C - Cessna Citation CJ4	0.7	0.0	0.7	0.0	1.4	0.4%
C525 - Cessna CitationJet/CJ1	0.4	0.0	0.4	0.0	0.8	0.2%
C560 - Cessna Citation V/Ultra/Encore	0.9	0.0	0.9	0.0	1.9	0.5%
C56X - Cessna Excel/XLS	1.7	0.0	1.6	0.0	3.3	0.9%

C680 - Cessna Citation Sovereign	0.9	0.0	0.9	0.0	1.9	0.5%
C68A - Cessna Citation Latitude	1.7	0.0	1.6	0.1	3.3	0.9%
C700 - Cessna Citation Longitude	0.8	0.0	0.8	0.0	1.6	0.5%
C750 - Cessna Citation X	1.7	0.0	1.7	0.0	3.4	1.0%
CJ3 - Cessna Citation CJ3	0.9	0.0	0.9	0.0	1.9	0.5%
CL30 - Bombardier Challenger 300	3.6	0.1	3.5	0.0	7.2	2.0%
CRJ2 - Bombardier CRJ-200	0.8	0.0	0.8	0.0	1.6	0.5%
E170 - Embraer 170	0.1	0.1	0.1	0.0	0.3	0.1%
E545 - Embraer EMB-545 Legacy 450	0.7	0.0	0.7	0.0	1.4	0.4%
E55P - Embraer Phenom 300	2.4	0.0	2.3	0.1	4.8	1.4%
F900 - Dassault Falcon 900	0.4	0.0	0.5	0.0	0.9	0.3%
GLF4 - Gulfstream IV/G400	1.7	0.0	1.7	0.0	3.5	1.0%
GLF5 - Gulfstream V/G500	2.1	0.1	2.1	0.1	4.3	1.2%
GLF6 - Gulfstream	0.6	0.0	0.6	0.0	1.3	0.4%
H25B - BAe HS 125/700-800/Hawker 800	0.4	0.0	0.4	0.0	0.8	0.2%
LJ31 - Bombardier Learjet 31/A/B	0.4	0.0	0.4	0.0	0.8	0.2%
LJ45 - Bombardier Learjet 45	0.4	0.0	0.4	0.0	0.9	0.2%
Multi-engine GA	**12.2**	**0.8**	**12.0**	**0.6**	**25.7**	**7.3%**
AC50 - Aero Commander 500	0.2	0.0	0.1	0.1	0.4	0.1%
AC90 - Gulfstream Commander	0.5	0.0	0.5	0.1	1.0	0.3%
AT43 - Aérospatiale/Alenia ATR 42-200/300/320	0.7	0.0	0.8	0.0	1.5	0.4%
B190 - Beech 1900/C-12J	1.1	0.1	1.1	0.0	2.3	0.7%
B350 - Beech Super King Air 350	0.3	0.0	0.3	0.0	0.7	0.2%
B55 - Beechcraft Baron	0.2	0.0	0.2	0.0	0.4	0.1%
B58 - Beechcraft Baron	0.2	0.0	0.2	0.0	0.4	0.1%
BE20 - Beech 200 Super King	0.8	0.1	0.8	0.1	1.8	0.5%
BE9L - Beech King Air 90	0.4	0.1	0.4	0.0	0.9	0.3%
C340 - Cessna 340	0.5	0.0	0.5	0.0	1.0	0.3%
DA42 - Diamond Twin Star	7.4	0.5	7.2	0.3	15.3	4.4%
Single-engine GA	**106.4**	**1.6**	**107.9**	**1.9**	**217.7**	**62.0%**
C172 - Cessna Skyhawk 172/Cutlass	44.6	0.6	45.7	0.6	91.4	26.0%
C180 - Cessna 180	0.6	0.0	0.6	0.0	1.2	0.3%
C182 - Cessna Skylane 182	3.8	0.0	4.0	0.1	7.9	2.3%
C185 - Cessna Skywagon 185	1.2	0.1	1.2	0.1	2.5	0.7%
C208 - Cessna 208 Caravan	0.6	0.0	0.7	0.0	1.3	0.4%
DA20 - Diamond DA 20	41.5	0.5	42.0	0.4	84.4	24.0%
DA40 - Diamond Star DA40	5.0	0.1	5.0	0.1	10.1	2.9%
KODI - Quest Kodiak	0.6	0.0	0.6	0.0	1.1	0.3%

PA18 - Piper Cub PA-18	2.4	0.0	2.3	0.1	4.8	1.4%
PA28 - Piper Cherokee	0.8	0.0	0.8	0.0	1.7	0.5%
PC12 - Pilatus PC-12	2.8	0.2	2.7	0.4	6.1	1.7%
SR20 - Cirrus SR-20	1.5	0.1	1.5	0.1	3.2	0.9%
SR22 - Cirrus SR 22	0.7	0.0	0.7	0.0	1.5	0.4%
TBM9 - Socata TBM	0.2	0.0	0.2	0.0	0.4	0.1%
Helicopters	**0.6**	**0.2**	**0.6**	**0.2**	**1.5**	**0.4%**
AS50 - Aerospatiale AS-550	0.1	0.0	0.2	0.1	0.4	0.1%
B407 - Bell 407	0.3	0.2	0.3	0.1	0.8	0.2%
B429 - Bell 407	0.1	0.0	0.2	0.0	0.3	0.1%
Military	**0.8**	**0.0**	**0.8**	**0.0**	**1.6**	**0.4%**
AJET - Dassault/Dornier Alpha Jet	0.2	0.0	0.2	0.0	0.3	0.1%
C30J - C-130J Hercules ; Lockheed	0.1	0.0	0.1	0.0	0.2	0.1%
L39 - Aero L-139 Albatross	0.4	0.0	0.5	0.0	0.9	0.3%
Grand Total	**167.6**	**7.5**	**169.9**	**6.3**	**351.3**	**100.0%**

Note: Totals may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data

3.3.3 Runway End Utilization

Average-annual runway end utilization was derived from analysis of BZN Flight Tracking System data. Runway utilization is generally determined by wind speed and wind direction since aircraft tend to depart and arrive into the wind. Runway use percentages were derived for aircraft types and summarized by category. **Table 12** summarizes the percentage of use by each aircraft category on each of the runways at BZN during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) periods.

Table 12: Runway End Utilization – Existing Conditions (2023)

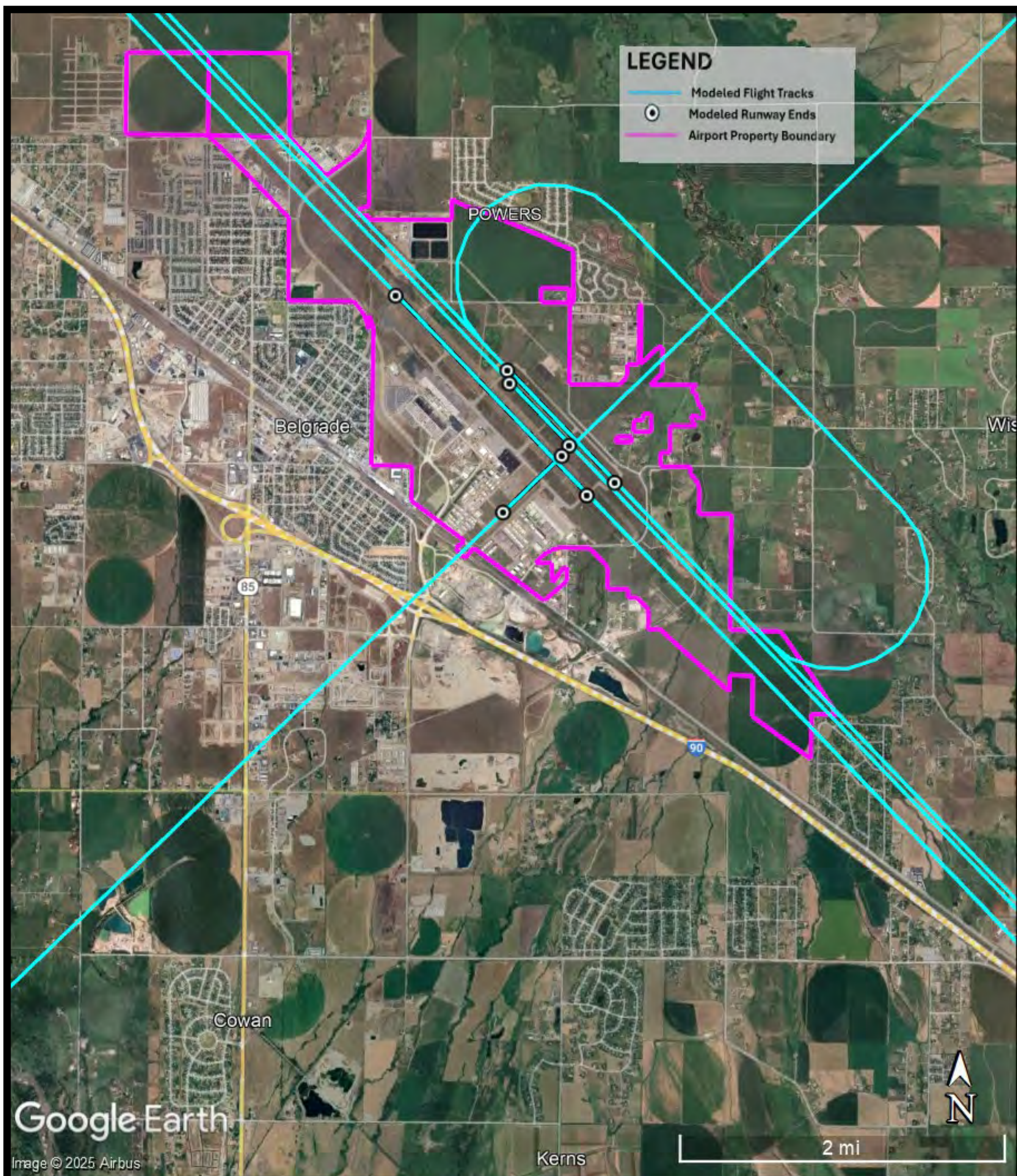
2023 Daytime Arrivals	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	86%	14%	0%	0%	0%	0%	0%	0%	100%
Business Jets	86%	13%	1%	0%	0%	0%	0%	0%	100%
Multi-engine GA	83%	9%	7%	1%	0%	0%	0%	0%	100%
Single-engine GA	31%	3%	57%	5%	0%	1%	3%	0%	100%
Helicopters	20%	2%	26%	2%	43%	6%	1%	0%	100%
Military	81%	19%	0%	0%	0%	0%	0%	0%	100%
2023 Nighttime Arrivals	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	91%	9%	0%	0%	0%	0%	0%	0%	100%
Business Jets	81%	19%	0%	0%	0%	0%	0%	0%	100%
Multi-engine GA	81%	14%	3%	1%	0%	1%	0%	0%	100%
Single-engine GA	45%	14%	27%	4%	3%	3%	3%	0%	100%
Helicopters	5%	18%	24%	21%	0%	14%	0%	18%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%
2023 Daytime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	82%	18%	0%	0%	0%	0%	0%	0%	100%
Business Jets	86%	13%	0%	0%	0%	0%	0%	0%	100%
Multi-engine GA	82%	13%	3%	1%	0%	1%	0%	0%	100%
Single-engine GA	41%	4%	46%	5%	1%	2%	1%	0%	100%
Helicopters	7%	12%	26%	15%	5%	28%	0%	7%	100%
Military	85%	15%	0%	0%	0%	0%	0%	0%	100%
2023 Nighttime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	91%	9%	0%	0%	0%	0%	0%	0%	100%
Business Jets	81%	19%	0%	0%	0%	0%	0%	0%	100%
Multi-engine GA	81%	14%	3%	1%	0%	1%	0%	0%	100%
Single-engine GA	45%	14%	27%	4%	3%	3%	4%	0%	100%
Helicopters	5%	18%	24%	21%	0%	13%	0%	19%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%

Notes: Daytime = 7:00 a.m. – 9:59 p.m., Nighttime = 10:00 p.m. – 6:59 a.m.
Total may not equal due to rounding.
Source: BZN Flight Tracking System data, Morrison-Maierle analysis, 2024.

3.3.4 Flight Tracks

The AEDT uses airport-specific ground tracks and vertical flight profiles to compute three-dimensional flight paths for each modeled aircraft operation. The "default" AEDT vertical profiles, which consist of altitude, speed, and thrust settings, are compiled from data provided by aircraft manufacturers. Aircraft flight tracks utilized by itinerant (arrivals and departures) were modeled straight-in/straight-out in the immediate vicinity of the runway ends. Consolidated touch and go flight tracks typically conducted by small fixed-wing aircraft for training purposes were derived from analysis of radar data from flight tracking data. **Figure 1** shows consolidated AEDT fixed wing departure, arrival and touch and go tracks for each runway.

Figure 1: Consolidated Flight Tracks – Existing Conditions (2023)



3.3.5 Aircraft Weight and Departure Stage Length

Aircraft weight upon departure is a factor in the dispersion of noise because it impacts the rate at which an aircraft is able to climb. Generally, heavier aircraft have a slower rate of climb and a wider dispersion of noise along the flight route. When specific aircraft weights are unknown, the AEDT uses the distance flown to the first stop as a surrogate for the weight, by assuming that the weight has a direct relationship with the fuel load necessary to reach the first destination. The AEDT groups trip lengths into nine stage categories and assigns standard aircraft weights to each stage category. These categories are provided in **Table 13**.

Table 13: Stage Length Categories

Stage Category	Stage Length
1	0-500 nautical miles
2	501-1000 nautical miles
3	1001-1500 nautical miles
4	1501-2500 nautical miles
5	2501-3500 nautical miles
6	3501-4500 nautical miles
7	4501-5500 nautical miles
8	5501-6500 nautical miles
9	6500+ nautical miles

Source: AEDT database, 2024.

Destinations from BZN in 2023 within a stage length of one (1) include Denver, Salt Lake City, Seattle and Portland. Destinations within a stage length of two (2) include Boston, Chicago, Dallas, Houston, Miami, Minneapolis, and Tampa. Destinations within a stage length of three (3) include Minneapolis/St. Paul, Las Vegas, San Francisco, and Los Angeles. Destinations within a stage length of four (4) include New York, Boston and Washington DC. The stage lengths modeled for the Existing Conditions (2023) are based upon a review of Bureau of Transportation Statistics (BTS) data providing aircraft destinations for scheduled departures at BZN. **Table 14** indicates the proportion of the operations that were modeled within each applicable stage length category for the Existing Conditions (2023).

Table 14: State Length Distribution – Existing Conditions (2023)

	Departure Stage Length					
Aircraft Type	**1**	**2**	**3**	**4**	**5**	**Total**
Commercial Jets	50%	27%	19%	4%	0%	100%
Business Jets	99%	1%	0%	0%	0%	100%
Multi-engine GA	100%	0%	0%	0%	0%	100%
Single-engine GA	100%	0%	0%	0%	0%	100%
Helicopters	100%	0%	0%	0%	0%	100%
Military	100%	0%	0%	0%	0%	100%

Note: Total may not equal due to rounding
Source: Bureau of Transportation Statistics (BTS) T-100 Data, Morrison-Maierle Analysis, 2024

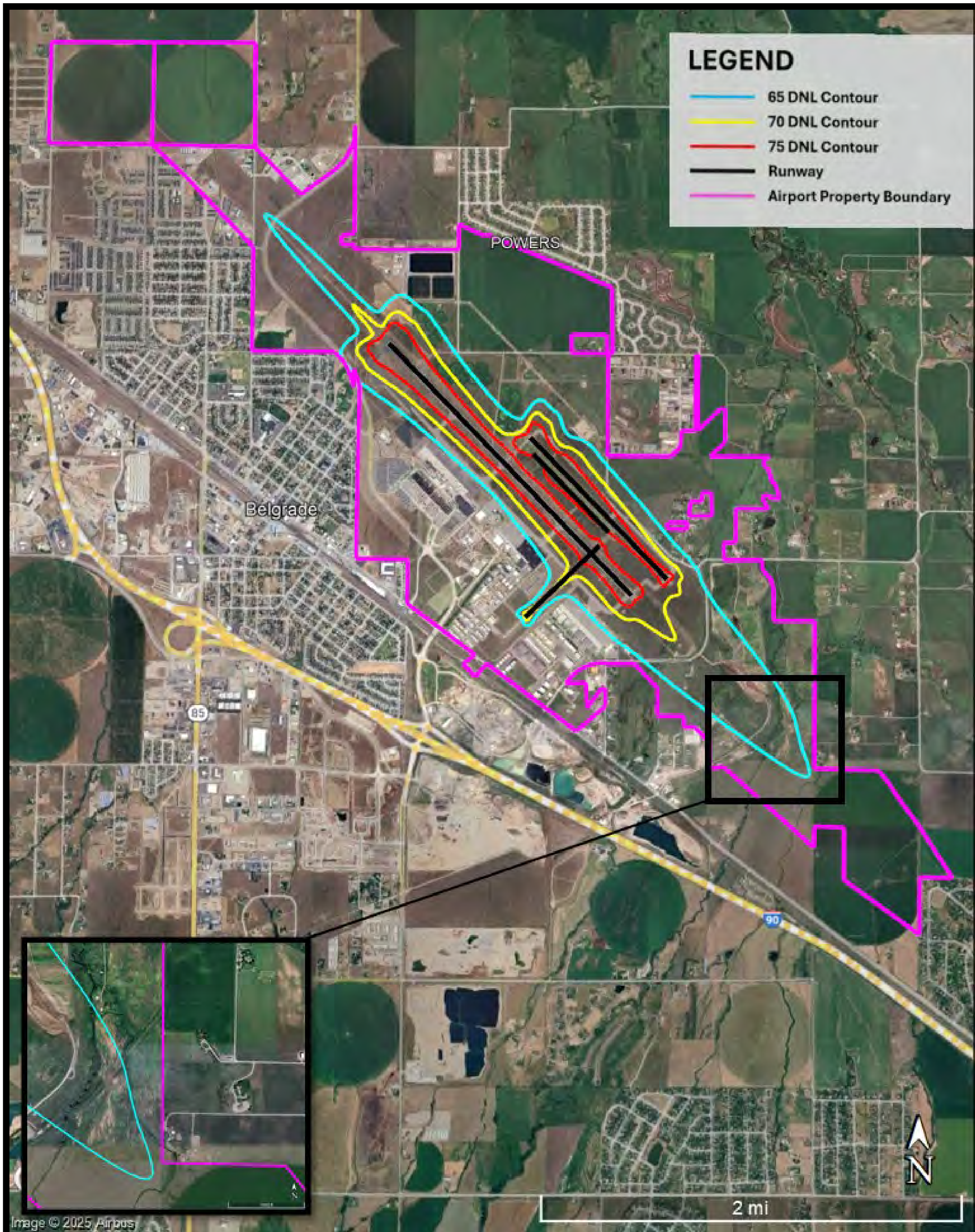
3.3.6 Existing Conditions (2023) Noise Exposure Contour

The 2023 DNL 65-75 dB contours are depicted on **Figure 2**. **Table 15** provides the area that is encompassed within each DNL contour range. As shown, the total area within the DNL 65 dB contour is approximately 1,465 acres. The DNL 65 dB contour primarily remains within the limits of the existing airport property boundary. There are no noise sensitive structures within the noise contour.

Table 15: 2023 DNL Contour Areas

DNL (dB)	Area (Acres)
65 to 70	866
70 to 75	400
75 and Greater	199
Total	**1,465**

Figure 2: 2023 DNL 65-75 dB Contours



Source: Morrison Maierle 2024.

The Proposed Action involves extending and widening Runway 11-29 to accommodate a wider range of the fleet at BZN, as well as expanding the northside General Aviation area. Per FAA Order 1050.1F, "a significant noise impact would occur if the action would increase noise by DNL 1.5 dB or more for a noise sensitive area that is [already] exposed to noise at or above the DNL 65 dB noise exposure level, or that will be exposed at or above the DNL 65 dB level due to a DNL 1.5 dB or greater increase, when compared to the no action alternative for the same timeframe." Noise sensitive areas generally include residential neighborhoods; educational, health, and religious facilities; and cultural and historic sites.

3.4 Future (2030) No Action Alternative

3.4.1 Runway Definition

There would be no change to the airfield configuration (number of runways or their lengths) from the existing conditions to the Future (2030) No Action Alternative. Therefore, the runway definition for the Future (2030) No Action Alternative is expected to remain the same as the existing conditions.

3.4.2 Number of Operations and Fleet Mix

Based on the aircraft activity forecast[3] there would be an increase in aircraft operations from the existing conditions to the Future (2030) No Action Alternative. There is a total of 134,822 annual aircraft operations forecast for 2030 at BZN. When divided by 365, the result is 369.4 average-annual day operations. **Table 16** provides a summary of the average annual day operations by aircraft category and time of day that was used to model the Future (2030) No Action Alternative. **Table 17** shows the average daily number of arrivals and departures by time of day and individual aircraft type.

Table 16: Summary of Average Annual Day Operations – Future (2030) No Action Alternative

	Arrivals		Departures			
Aircraft Type	Daytime	Nighttime	Daytime	Nighttime	Total	Percent of Total
Commercial Jets	28.5	5.4	29.9	3.7	67.5	18.3%
Business Jets	21.0	0.4	20.5	0.5	42.5	11.5%
Single-engine GA	114.0	1.7	114.9	2.0	232.6	63.0%
Multi-engine GA	11.9	0.8	11.7	0.6	25.1	6.8%
Helicopters	0.3	0.1	0.3	0.1	0.9	0.2%
Military	0.4	0.0	0.5	0.0	0.9	0.2%
Total	**176.2**	**8.4**	**177.8**	**6.9**	**369.4**	**100.0%**

Note: Total may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data

[3] FAA Terminal Area Forecast, 2023

Table 17: Average Annual Day Operations by Aircraft Type – Future (2030) No Action Alternative

	Arrivals		Departures			
Aircraft Type	Daytime	Nighttime	Daytime	Nighttime	Total	Percent of Total
Commercial Jets	**28.5**	**5.4**	**29.9**	**3.7**	**67.5**	**18.3%**
A319 - Airbus A319	2.7	0.2	7.7	0.4	11.0	3.0%
A320 - Airbus A320	3.8	0.8	5.7	0.0	10.3	2.8%
A321 - Airbus A321 All Series	1.2	1.5	4.4	0.6	7.7	2.1%
B39M - Boeing 737 Max 9	0.2	0.1	3.8	0.7	4.8	1.3%
B737 - Boeing 737-700	4.1	0.9	2.7	0.5	8.3	2.3%
B738 - Boeing 737-800	7.2	0.9	2.6	0.2	11.0	3.0%
B739 - Boeing 737-900	2.6	0.7	1.4	1.2	5.9	1.6%
CRJ7 - Bombardier CRJ-700	0.1	0.0	0.6	0.0	0.6	0.2%
CRJ9 - Bombardier CRJ-900	0.2	0.0	0.3	0.0	0.5	0.1%
B752 - Boeing 757-200	0.6	0.0	0.2	0.0	0.8	0.2%
E170 - Embraer 170	0.3	0.0	0.2	0.0	0.6	0.1%
E75L - Embraer 175	5.4	0.4	0.1	0.0	5.8	1.6%
Business Jets	**21.0**	**0.4**	**20.5**	**0.5**	**42.5**	**11.5%**
BE40 - Raytheon/Beech Beechjet 400/T-1	0.3	0.0	3.0	0.0	3.4	0.9%
C25A - Cessna Citation CJ2	0.6	0.0	1.9	0.1	2.6	0.7%
C25C - Cessna Citation CJ4	0.6	0.0	1.8	0.1	2.4	0.7%
C525 - Cessna CitationJet/CJ1	0.4	0.0	1.5	0.0	1.8	0.5%
C560 - Cessna Citation V/Ultra/Encore	0.8	0.0	1.4	0.0	2.3	0.6%
C56X - Cessna Excel/XLS	1.4	0.0	1.4	0.0	2.9	0.8%
C680 - Cessna Citation Sovereign	0.8	0.0	1.4	0.0	2.2	0.6%
C68A - Cessna Citation Latitude	1.4	0.0	0.8	0.0	2.2	0.6%
C700 - Cessna Citation Longitude	0.7	0.0	0.8	0.0	1.5	0.4%
C750 - Cessna Citation X	1.5	0.0	0.8	0.0	2.3	0.6%
CJ3 - Cessna Citation CJ3	0.8	0.0	0.7	0.0	1.5	0.4%
CL30 - Bombardier Challenger 300	3.1	0.1	0.7	0.0	3.8	1.0%
CRJ2 - Bombardier CRJ-200	0.7	0.0	0.6	0.0	1.3	0.4%
E170 - Embraer 170	0.1	0.1	0.6	0.0	0.7	0.2%
E545 - Embraer EMB-545 Legacy 450	0.6	0.0	0.6	0.0	1.2	0.3%
E55P - Embraer Phenom 300	2.1	0.0	0.5	0.0	2.7	0.7%
F900 - Dassault Falcon 900	0.4	0.0	0.4	0.0	0.8	0.2%

GLF4 - Gulfstream IV/G400	1.5	0.0	0.4	0.0	1.9	0.5%
GLF5 - Gulfstream V/G500	1.8	0.1	0.4	0.0	2.2	0.6%
GLF6 - Gulfstream	0.5	0.0	0.4	0.0	0.9	0.2%
H25B - BAe HS 125/700-800/Hawker 800	0.3	0.0	0.3	0.0	0.7	0.2%
LJ31 - Bombardier Learjet 31/A/B	0.3	0.0	0.3	0.0	0.7	0.2%
LJ45 - Bombardier Learjet 45	0.4	0.0	0.1	0.0	0.5	0.1%
Multi-engine GA	**11.9**	**0.8**	**11.7**	**0.6**	**25.1**	**6.8%**
AC50 - Aero Commander 500	0.2	0.0	7.0	0.3	7.4	2.0%
AC90 - Gulfstream Commander	0.5	0.0	1.1	0.0	1.6	0.4%
AT43 - Aérospatiale/Alenia ATR 42-200/300/320	0.7	0.0	0.8	0.1	1.6	0.4%
B190 - Beech 1900/C-12J	1.0	0.1	0.7	0.0	1.9	0.5%
B350 - Beech Super King Air 350	0.3	0.0	0.5	0.0	0.8	0.2%
B55 - Beechcraft Baron	0.1	0.0	0.4	0.1	0.7	0.2%
B58 - Beechcraft Baron	0.2	0.0	0.4	0.0	0.6	0.2%
BE20 - Beech 200 Super King	0.8	0.1	0.3	0.0	1.2	0.3%
BE9L - Beech King Air 90	0.4	0.1	0.2	0.0	0.6	0.2%
C340 - Cessna 340	0.5	0.0	0.1	0.1	0.7	0.2%
DA42 - Diamond Twin Star	7.3	0.5	0.2	0.0	7.9	2.1%
Single-engine GA	**114.0**	**1.7**	**114.9**	**2.0**	**232.6**	**63.0%**
C172 - Cessna Skyhawk 172/Cutlass	47.8	0.6	48.6	0.6	97.7	26.4%
C180 - Cessna 180	0.6	0.0	44.7	0.5	45.8	12.4%
C182 - Cessna Skylane 182	4.1	0.0	5.3	0.1	9.5	2.6%
C185 - Cessna Skywagon 185	1.2	0.1	4.2	0.1	5.7	1.5%
C208 - Cessna 208 Caravan	0.7	0.0	2.8	0.4	4.0	1.1%
DA20 - Diamond DA 20	44.4	0.5	2.4	0.1	47.5	12.9%
DA40 - Diamond Star DA40	5.4	0.1	1.6	0.1	7.1	1.9%
KODI - Quest Kodiak	0.6	0.0	1.3	0.1	2.0	0.5%
PA18 - Piper Cub PA-18	2.5	0.0	0.9	0.0	3.4	0.9%
PA28 - Piper Cherokee	0.9	0.0	0.8	0.0	1.7	0.5%
PC12 - Pilatus PC-12	3.0	0.2	0.7	0.0	4.0	1.1%
SR20 - Cirrus SR-20	1.6	0.1	0.7	0.0	2.3	0.6%
SR22 - Cirrus SR 22	0.8	0.0	0.6	0.0	1.4	0.4%
TBM9 - Socata TBM	0.2	0.0	0.2	0.0	0.5	0.1%
Helicopters	**0.3**	**0.1**	**0.3**	**0.1**	**0.9**	**0.2%**

AS50 - Aerospatiale AS-550	0.1	0.0	0.2	0.1	0.3	0.1%
B407 - Bell 407	0.2	0.1	0.1	0.0	0.4	0.1%
B429 - Bell 407	0.1	0.0	0.1	0.0	0.2	0.0%
Military	**0.4**	**0.0**	**0.5**	**0.0**	**0.9**	**0.2%**
AJET - Dassault/Dornier Alpha Jet	0.1	0.0	0.3	0.0	0.4	0.1%
B350 - Beech Super King Air 350	0.0	0.0	0.1	0.0	0.1	0.0%
BE20 - Beech 200 Super King	0.0	0.0	0.1	0.0	0.1	0.0%
C30J - C-130J Hercules ; Lockheed	0.1	0.0	0.0	0.0	0.1	0.0%
C560 - Cessna Citation V/Ultra/Encore	0.0	0.0	0.0	0.0	0.0	0.0%
L39 - Aero L-139 Albatross	0.2	0.0	0.0	0.0	0.3	0.1%
Grand Total	**176.2**	**8.4**	**177.8**	**6.9**	**369.4**	**100.0%**

Note: Total may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data

3.4.3 Runway End Utilization

There would be no anticipated change to how the runways are operated from the existing conditions to the Future (2030) No Action Alternative. While runway end utilization may vary based on weather conditions, it is not possible to predict future weather conditions. Therefore, the runway end utilization for the Future (2030) No Action Alternative is expected to remain the same as the existing conditions.

3.4.4 Flight Tracks

There would be no change to the flight tracks from the existing conditions to the Future (2030) No Action Alternative. Therefore, the flight tracks for the Future (2030) No Action Alternative are expected to remain the same.

3.4.5 Aircraft Weight and Departure Stage Length

Based on recent activity trends, some increase in the proportion of Stage length 2, 3 and 4 flights is anticipated by 2030. The proportion of the operations that were modeled for each stage length modeled for the Future (2030) No Action Alternative are provided in **Table 18**.

Table 18: Stage Length Distribution – Future (2030) No Action Alternative

	Departure Stage Length					
Aircraft Type	**1**	**2**	**3**	**4**	**5**	**Total**
Commercial Jets	46%	29%	20%	5%	0%	100%
Business Jets	98%	2%	0%	0%	0%	100%
Multi-engine GA	100%	0%	0%	0%	0%	100%
Single-engine GA	100%	0%	0%	0%	0%	100%
Helicopters	100%	0%	0%	0%	0%	100%
Military	100%	0%	0%	0%	0%	100%

3.4.6 Future (2030) No Action Alternative Noise Exposure Contour

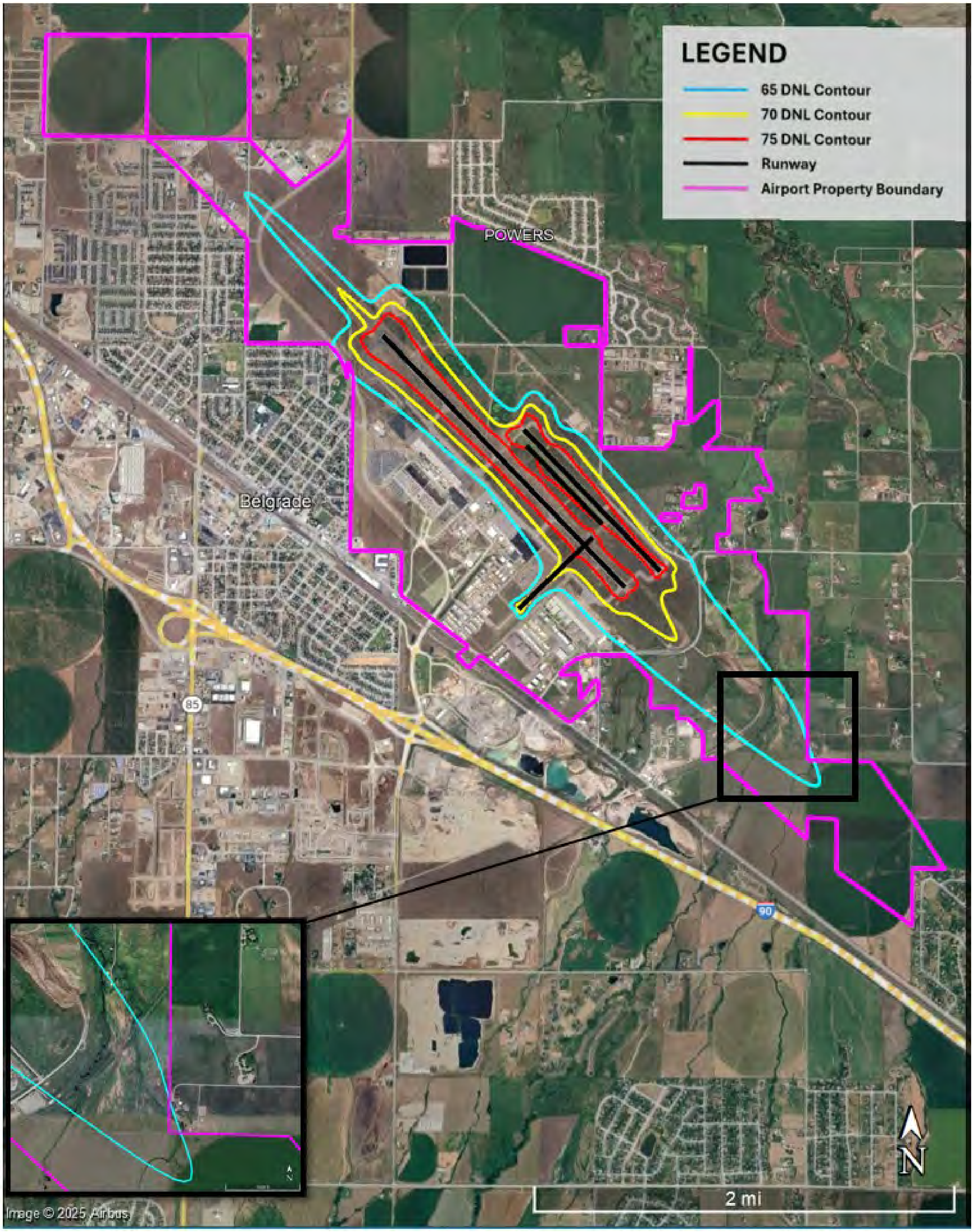
The 2030 No Action DNL 65-75 dB contours are depicted on **Figure 3**. **Table 19** provides the area that is encompassed within each DNL contour range. As shown, the total area within the DNL 65 dB contour is approximately 1,567 acres. The DNL 65 dB contour primarily remains within the limits of the existing airport property boundary. With increased operations, the 2030 contour extends off airport property to the southeast to impact one residential parcel.

Table 19: 2030 No Action DNL Contour Areas

DNL (dB)	Area (Acres)
65 to 70	934
70 to 75	421
75 and Greater	212
Total	**1,567**

Source: Morrison-Maierle analysis, 2024

Figure 3: 2030 No Action DNL 65-75 dB Contours



Source: Morrison Maierle 2024.

3.5 Future (2030) Proposed Action

3.5.1 Runway Definition

As described in the EA, the Proposed Action would require an extension of 2,430 feet to Runway 11-29 for a total length of 7,480 feet. **Table 20** provides the runway definitions modeled for the Future (2030) Proposed Action.

Table 20: Runways – Future (2030) Proposed Action

Runway	Length (Feet)
12-30	8,994
11-29	7,480
3-21	2,650
11G-29G	2,802

3.5.2 Number of Operations and Fleet Mix

Because future activity forecasts are demand-based, there would be no change to the forecasted number of aircraft operations or fleet mix as a result of implementing the Proposed Action. Therefore, the number of aircraft operations and fleet mix for the Future (2030) No Action Alternative would remain the same for the Future (2030) Proposed Action. Based on the aircraft activity forecast, there is a total of 134,822 aircraft operations forecast for 2030 at BZN. When divided by 365, the result is 369.4 average-annual day operations.

3.5.3 Runway End Utilization

As a result of implementing the proposed action, Runway 11-29 would be suitable for use by larger and faster aircraft. Assuming a shift of portions of the larger and faster categories of the fleet from Runway 12-30 to Runway 11-29, runway use percentages were derived for aircraft types and summarized by category. **Table 21** summarizes the percentage of use by each aircraft category on each of the runways at BZN during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) periods.

Table 21: Future (2030) Proposed Action

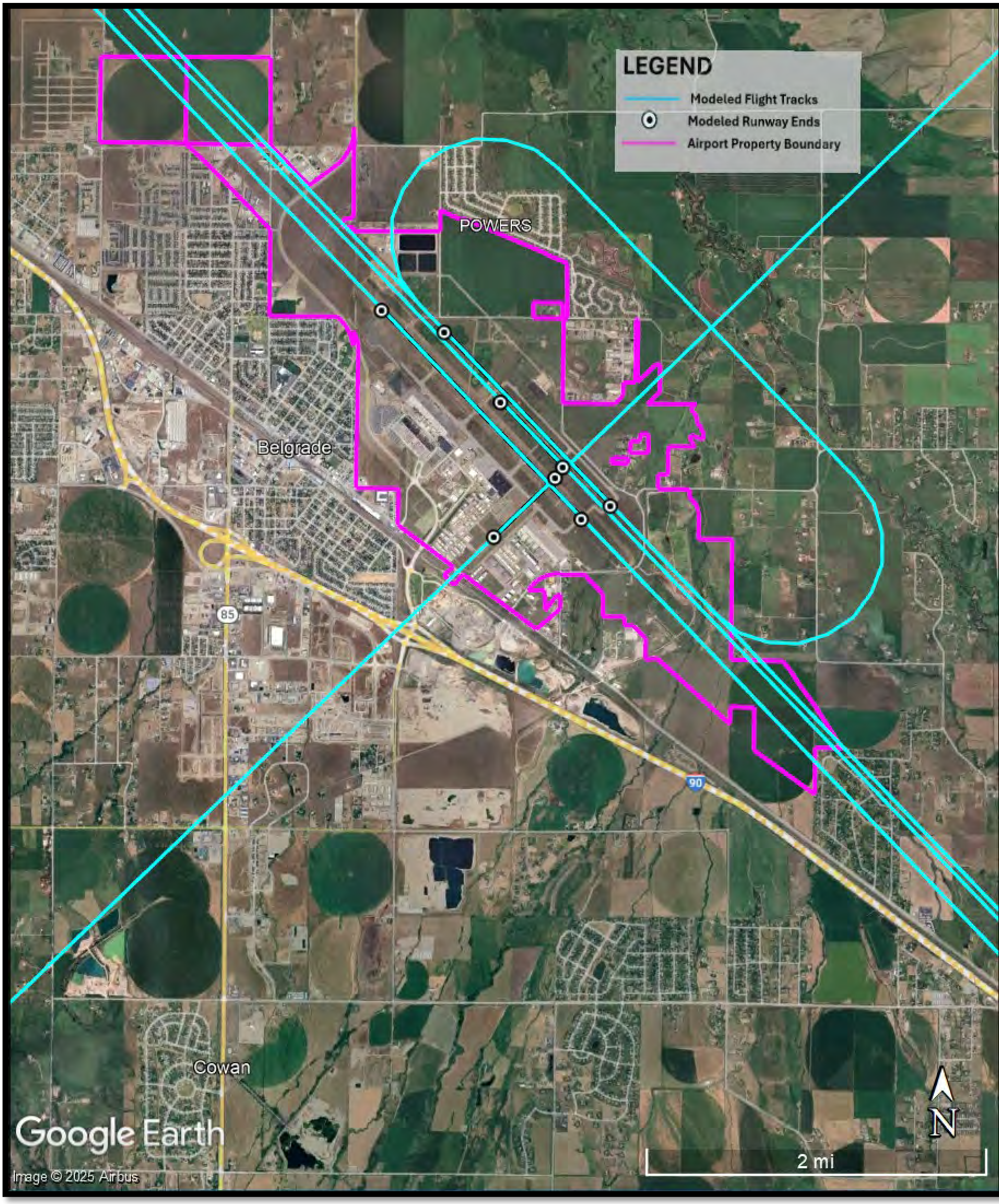
2030 Daytime Arrivals	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	84%	14%	2%	0%	0%	0%	0%	0%	100%
Business Jets	77%	12%	10%	1%	0%	0%	0%	0%	100%
Multi-engine GA	75%	8%	15%	2%	0%	0%	0%	0%	100%
Single-engine GA	23%	2%	65%	6%	0%	1%	3%	0%	100%
Helicopters	20%	2%	26%	2%	43%	6%	1%	0%	100%
Military	81%	19%	0%	0%	0%	0%	0%	0%	100%
2030 Nighttime Arrivals	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	89%	9%	2%	0%	0%	0%	0%	0%	100%
Business Jets	73%	17%	8%	2%	0%	0%	0%	0%	100%
Multi-engine GA	73%	13%	11%	2%	0%	1%	0%	0%	100%
Single-engine GA	34%	11%	38%	8%	3%	3%	3%	0%	100%
Helicopters	5%	18%	24%	21%	0%	14%	0%	18%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%
2030 Daytime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	80%	18%	2%	0%	0%	0%	0%	0%	100%
Business Jets	77%	12%	9%	1%	0%	0%	0%	0%	100%
Multi-engine GA	74%	12%	11%	2%	0%	1%	0%	0%	100%
Single-engine GA	31%	3%	56%	6%	1%	2%	1%	0%	100%
Helicopters	7%	12%	26%	15%	5%	28%	0%	7%	100%
Military	85%	15%	0%	0%	0%	0%	0%	0%	100%
2030 Nighttime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	89%	9%	2%	0%	0%	0%	0%	0%	100%
Business Jets	73%	17%	8%	2%	0%	0%	0%	0%	100%
Multi-engine GA	73%	13%	11%	3%	0%	0%	0%	0%	100%
Single-engine GA	34%	11%	38%	8%	3%	3%	4%	0%	100%
Helicopters	5%	18%	24%	21%	0%	13%	0%	19%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%

Notes: Daytime = 7:00 a.m. – 9:59 p.m., Nighttime = 10:00 p.m. – 6:59 a.m.
Total may not equal due to rounding.
Source: Morrison-Maierle analysis, 2024

3.5.4 Flight Tracks

As a result of implementing the Proposed Action, the threshold of Runway 11 would be 2,430 feet northwest of the existing threshold of Runway 11. It is anticipated that the flight tracks for the lengthened Runway 11-29 would also be 2,430 feet northwest of the existing Runway 11-29. Flight tracks were shifted 2,430 feet northwest of the existing Runway 11-29 within AEDT for modeling. **Figure 4** shows consolidated AEDT fixed wing departure, arrival and touch and go tracks for each runway.

Figure 4: Consolidated Flight Tracks – Proposed Action (2030 & 2035)



3.5.5 Aircraft Weight and Departure Stage Length

No change to the number of aircraft operations or fleet mix would occur as a result of implementing the Proposed Action. The number of aircraft operations and fleet mix for the Future (2030) No Action Alternative would remain the same for the Future (2030) Proposed Action. The departure stage lengths for the Future (2030) Proposed Action are expected to remain the same as Future (2030) No Action Alternative. The AEDT model was used to determine aircraft weights for the specific airframe, destination, and runway length available.

3.5.6 Future (2030) Proposed Action Noise Exposure Contour

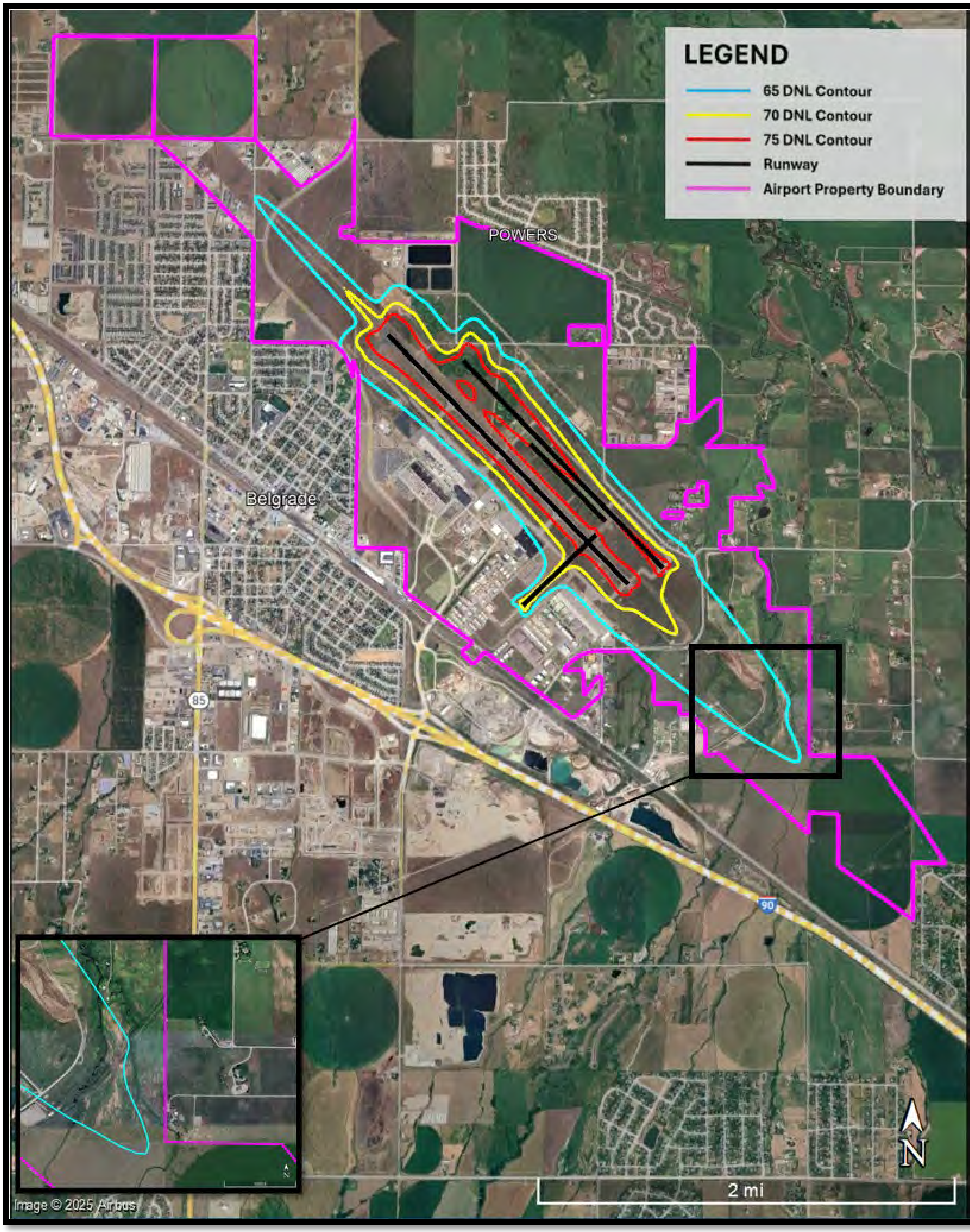
The 2030 Proposed Action DNL 65-75 dB contours are depicted on **Figure 5**. **Table 22** identifies the areas within the DNL contour ranges. As shown, the total area within the DNL 65 dB contour is approximately 1,606 acres. The DNL 65 dB contour primarily remains within the limits of the airport property boundary. With the relocation of the threshold of Runway 11 to the northwest, the DNL 65 dB noise contour shifts northwest and does not impact the residential property to the southeast as compared with the 2030 No Action Alternative. No new noise sensitive land uses or other noise sensitive structures are introduced to the DNL 65 dB noise contour as a result of the Proposed Action in 2030 as compared to the No Action Alternative.

Table 22: 2030 Proposed Action DNL Contour Areas

DNL (dB)	Area (Acres)
65 to 70	938
70 to 75	452
75 and Greater	216
Total	**1,606**

Source: Morrison-Maierle Analysis, 2024

Figure 5: 2030 Proposed Action DNL 65-75 dB Contours



Source: Morrison-Maierle, 2024.

3.6 Future (2035) No Action Alternative

3.6.1 Runway Definition

There would be no change to the airfield configuration (number of runways or their lengths) from the Future (2030) No Action Alternative to the Future (2035) No Action Alternative. Therefore, the runway definition for the Future (2035) No Action Alternative is expected to remain the same as the Future (2030) No Action Alternative and the existing conditions.

3.6.2 Number of Operations and Fleet Mix

Based on the aircraft activity[4] forecast, there would be an increase in operations from the Future (2030) No Action Alternative to the Future (2035) No Action Alternative. There is a total of 141,178 annual aircraft operations forecast for 2035 at BZN. When divided by 365, the result is 386.8 average-annual day operations. **Table 23** provides a summary of the average annual day operations by aircraft category and time of day that was used to model the Future (2035) No Action Alternative. **Table 24** shows the average daily number of arrivals and departures by time of day and individual aircraft type.

Table 23: Summary of Average Annual Day Operations - Future (2035) No Action Alternative

	Arrivals		Departures			
Aircraft Type	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**	**Total**	**Percent of Total**
Commercial Jets	29.9	5.6	31.3	3.9	70.7	18.3%
Business Jets	22.0	0.4	21.5	0.5	44.5	11.5%
Single-engine GA	119.4	1.8	120.3	2.1	243.5	63.0%
Multi-engine GA	12.5	0.9	12.3	0.6	26.3	6.8%
Helicopters	0.3	0.1	0.4	0.1	0.9	0.2%
Military	0.5	0.0	0.5	0.0	0.9	0.2%
Total	**184.6**	**8.8**	**186.2**	**7.2**	**386.8**	**100.0%**

Note: Total may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data, Morrison-Maierle Analysis, 2024

[4]FAA 2023 Terminal Area Forecast (TAF)

Table 24: Average Annual Day Operations by Aircraft Type – Future (2035) No Action Alternative

	Arrivals		Departures			
Aircraft Type	**Daytime**	**Nighttime**	**Daytime**	**Nighttime**	**Total**	**Percent of Total**
Commercial Jets	**29.9**	**5.6**	**31.3**	**3.9**	**70.7**	**18.3%**
A319 - Airbus A319	2.8	0.2	8.1	0.4	11.5	3.0%
A320 - Airbus A320	4.0	0.8	6.0	0.0	10.8	2.8%
A321 - Airbus A321 All Series	1.3	1.5	4.7	0.6	8.0	2.1%
B39M - Boeing 737 Max 9	0.2	0.1	4.0	0.8	5.1	1.3%
B737 - Boeing 737-700	4.3	1.0	2.9	0.5	8.7	2.3%
B738 - Boeing 737-800	7.6	1.0	2.7	0.2	11.5	3.0%
B739 - Boeing 737-900	2.7	0.8	1.5	1.3	6.2	1.6%
CRJ7 - Bombardier CRJ-700	0.1	0.0	0.6	0.0	0.7	0.2%
CRJ9 - Bombardier CRJ-900	0.2	0.0	0.3	0.0	0.6	0.1%
B752 - Boeing 757-200	0.6	0.0	0.3	0.0	0.9	0.2%
E170 - Embraer 170	0.3	0.0	0.2	0.0	0.6	0.1%
E75L - Embraer 175	5.6	0.4	0.1	0.0	6.1	1.6%
Business Jets	**22.0**	**0.4**	**21.5**	**0.5**	**44.5**	**11.5%**
BE40 - Raytheon/Beech Beechjet 400/T-1	0.3	0.0	3.1	0.0	3.5	0.9%
C25A - Cessna Citation CJ2	0.6	0.0	2.0	0.1	2.7	0.7%
C25C - Cessna Citation CJ4	0.6	0.0	1.8	0.1	2.6	0.7%
C525 - Cessna CitationJet/CJ1	0.4	0.0	1.5	0.0	1.9	0.5%
C560 - Cessna Citation V/Ultra/Encore	0.8	0.0	1.5	0.0	2.4	0.6%
C56X - Cessna Excel/XLS	1.5	0.0	1.4	0.0	3.0	0.8%
C680 - Cessna Citation Sovereign	0.8	0.0	1.4	0.0	2.3	0.6%
C68A - Cessna Citation Latitude	1.5	0.0	0.8	0.0	2.3	0.6%
C700 - Cessna Citation Longitude	0.7	0.0	0.8	0.0	1.6	0.4%
C750 - Cessna Citation X	1.5	0.0	0.8	0.0	2.4	0.6%
CJ3 - Cessna Citation CJ3	0.8	0.0	0.7	0.0	1.6	0.4%
CL30 - Bombardier Challenger 300	3.2	0.1	0.7	0.0	4.0	1.0%
CRJ2 - Bombardier CRJ-200	0.7	0.0	0.6	0.0	1.4	0.4%
E170 - Embraer 170	0.1	0.1	0.6	0.0	0.8	0.2%
E545 - Embraer EMB-545 Legacy 450	0.6	0.0	0.6	0.0	1.3	0.3%
E55P - Embraer Phenom 300	2.2	0.0	0.5	0.0	2.8	0.7%
F900 - Dassault Falcon 900	0.4	0.0	0.4	0.0	0.8	0.2%
GLF4 - Gulfstream IV/G400	1.6	0.0	0.4	0.0	2.0	0.5%
GLF5 - Gulfstream V/G500	1.9	0.1	0.4	0.0	2.3	0.6%

GLF6 - Gulfstream	0.5	0.0	0.4	0.0	0.9	0.2%
H25B - BAe HS 125/700-800/Hawker 800	0.4	0.0	0.4	0.0	0.7	0.2%
LJ31 - Bombardier Learjet 31/A/B	0.4	0.0	0.3	0.0	0.7	0.2%
LJ45 - Bombardier Learjet 45	0.4	0.0	0.1	0.0	0.5	0.1%
Multi-engine GA	**12.5**	**0.9**	**12.3**	**0.6**	**26.3**	**6.8%**
AC50 - Aero Commander 500	0.2	0.0	7.3	0.3	7.8	2.0%
AC90 - Gulfstream Commander	0.5	0.0	1.2	0.0	1.7	0.4%
AT43 - Aérospatiale/Alenia ATR 42-200/300/320	0.8	0.0	0.8	0.1	1.7	0.4%
B190 - Beech 1900/C-12J	1.1	0.1	0.8	0.0	1.9	0.5%
B350 - Beech Super King Air 350	0.3	0.0	0.5	0.0	0.9	0.2%
B55 - Beechcraft Baron	0.2	0.0	0.5	0.1	0.7	0.2%
B58 - Beechcraft Baron	0.2	0.0	0.4	0.0	0.7	0.2%
BE20 - Beech 200 Super King	0.8	0.1	0.3	0.0	1.2	0.3%
BE9L - Beech King Air 90	0.4	0.1	0.2	0.0	0.7	0.2%
C340 - Cessna 340	0.5	0.0	0.1	0.1	0.7	0.2%
DA42 - Diamond Twin Star	7.6	0.5	0.2	0.0	8.3	2.1%
Single-engine GA	**119.4**	**1.8**	**120.3**	**2.1**	**243.5**	**63.0%**
C172 - Cessna Skyhawk 172/Cutlass	50.1	0.7	50.9	0.6	102.3	26.4%
C180 - Cessna 180	0.7	0.0	46.8	0.5	48.0	12.4%
C182 - Cessna Skylane 182	4.3	0.0	5.6	0.1	9.9	2.6%
C185 - Cessna Skywagon 185	1.3	0.1	4.4	0.1	5.9	1.5%
C208 - Cessna 208 Caravan	0.7	0.0	3.0	0.4	4.1	1.1%
DA20 - Diamond DA 20	46.5	0.5	2.5	0.1	49.8	12.9%
DA40 - Diamond Star DA40	5.6	0.1	1.7	0.1	7.5	1.9%
KODI - Quest Kodiak	0.6	0.0	1.3	0.1	2.1	0.5%
PA18 - Piper Cub PA-18	2.6	0.0	0.9	0.0	3.6	0.9%
PA28 - Piper Cherokee	0.9	0.0	0.8	0.0	1.8	0.5%
PC12 - Pilatus PC-12	3.2	0.2	0.7	0.0	4.2	1.1%
SR20 - Cirrus SR-20	1.7	0.1	0.7	0.0	2.5	0.6%
SR22 - Cirrus SR 22	0.8	0.0	0.6	0.0	1.5	0.4%
TBM9 - Socata TBM	0.2	0.0	0.2	0.0	0.5	0.1%
Helicopters	**0.3**	**0.1**	**0.4**	**0.1**	**0.9**	**0.2%**
AS50 - Aerospatiale AS-550	0.1	0.0	0.2	0.1	0.3	0.1%
B407 - Bell 407	0.2	0.1	0.1	0.0	0.4	0.1%
B429 - Bell 407	0.1	0.0	0.1	0.0	0.2	0.0%

Military	**0.5**	**0.0**	**0.5**	**0.0**	**0.9**	**0.2%**
AJET - Dassault/Dornier Alpha Jet	0.1	0.0	0.3	0.0	0.4	0.1%
B350 - Beech Super King Air 350	0.0	0.0	0.1	0.0	0.1	0.0%
BE20 - Beech 200 Super King	0.0	0.0	0.1	0.0	0.1	0.0%
C30J - C-130J Hercules ; Lockheed	0.1	0.0	0.0	0.0	0.1	0.0%
C560 - Cessna Citation V/Ultra/Encore	0.0	0.0	0.0	0.0	0.0	0.0%
L39 - Aero L-139 Albatross	0.3	0.0	0.0	0.0	0.3	0.1%
Grand Total	**184.6**	**8.8**	**186.2**	**7.2**	**386.8**	**100.0%**

Note: Total may not equal due to rounding
Daytime = 7:00am - 9:59pm, Nighttime = 10:00pm - 6:59am
Source: Federal Aviation Administration Operations Network (OpsNet) data, BZN Flight Tracking System Data, Morrison-Maierle Analysis, 2024

3.6.3 Runway End Utilization

There would be no anticipated change to the how the runways are operated from the Future (2030) No Action Alternative to the Future (2035) No Action Alternative. Therefore, the runway end utilization for the Future (2035) No Action Alternative is expected to remain the same as the Future (2030) No Action Alternative and the existing conditions.

3.6.4 Flight Tracks

There would be no anticipated change to flight tracks from the Future (2030) No Action Alternative to the Future (2035) No Action Alternative. Therefore, the flight tracks for the Future (2035) No Action Alternative are expected to remain the same.

3.6.5 Aircraft Weight and Departure Stage Length

The proportion of the operations that were modeled for each stage length modeled for the Future (2035) No Action Alternative are provided in **Table 25**.

Table 25: Stage Length Distribution – Future (2035) No Action Alternative

	Departure Stage Length					
Aircraft Type	**1**	**2**	**3**	**4**	**5**	**Total**
Commercial Jets	45%	30%	20%	5%	0%	100%
Business Jets	97%	3%	0%	0%	0%	100%
Multi-engine GA	100%	0%	0%	0%	0%	100%
Single-engine GA	100%	0%	0%	0%	0%	100%
Helicopters	100%	0%	0%	0%	0%	100%
Military	100%	0%	0%	0%	0%	100%

Note: Total may not equal due to rounding
Source: Bureau of Transportation Statistics (BTS) T-100 Data, Morrison-Maierle Analysis, 2024

3.6.6 Future (2035) No Action Alternative Noise Exposure Contour

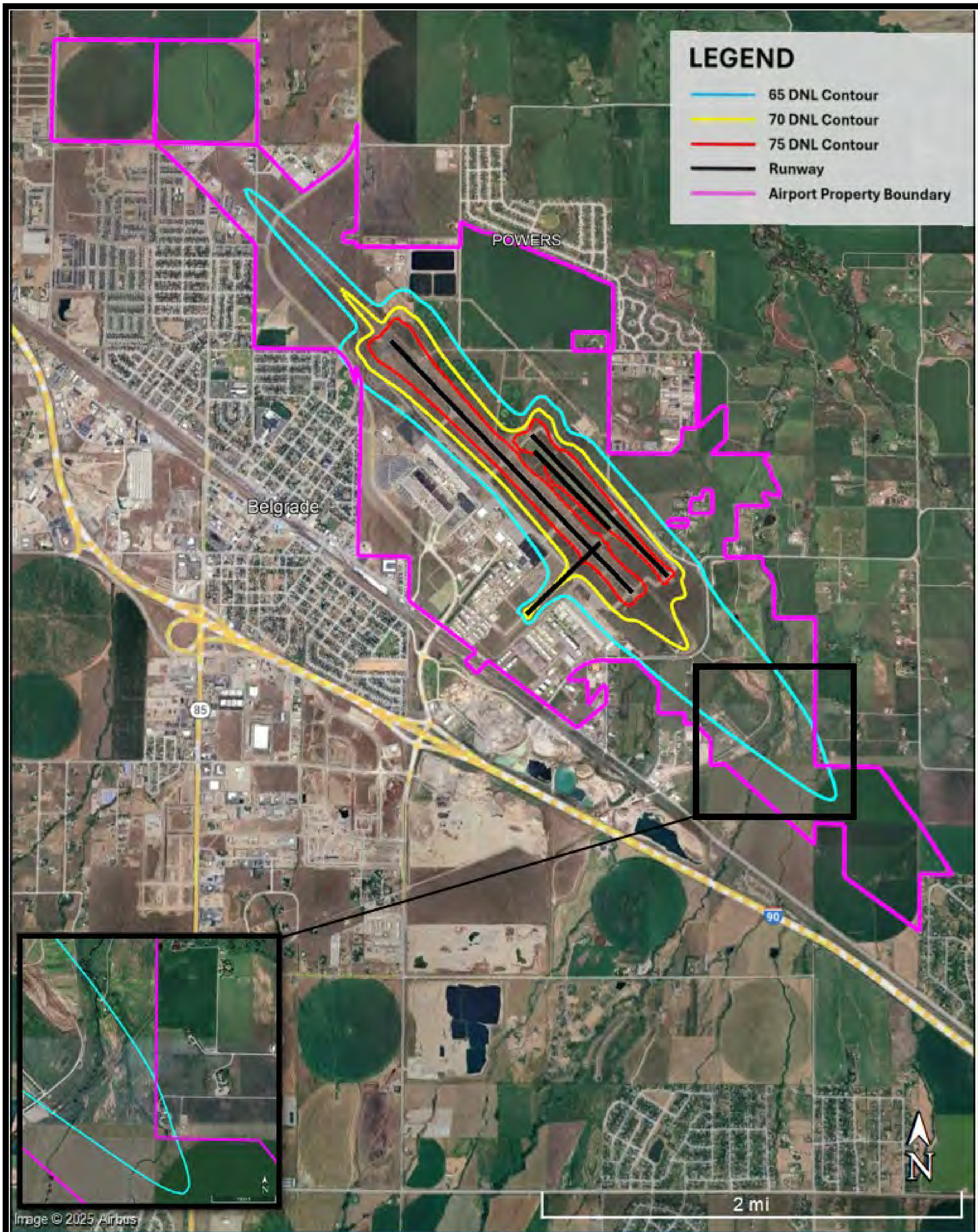
The 2035 No Action DNL 65-75 dB contours are depicted on **Figure 6**. **Table 26** provides the area that is encompassed within each DNL contour range. As shown, the total area within the DNL 65 dB contour is approximately 1,631 acres. The DNL 65 dB contour primarily remains within the limits of the existing airport property boundary. As with the 2030 No Action Alternative, with increased operations, the 2035 contour extends off airport property to the southeast to impact one additional residential parcel.

Table 26: 2035 No Action DNL Contour Areas

DNL (dB)	Area (Acres)
65 to 70	977
70 to 75	434
75 and Greater	220
Total	**1,631**

Source: Morrison-Maierle Analysis, 2024.

Figure 6: 2035 No Action DNL 65-75 dB Contours



Source: Morrison-Maierle Analysis, 2024

3.7 Future (2035) Proposed Action

3.7.1 Runway Definition

The runway definitions for the Future (2035) Proposed Action are expected to remain the same as the Future (2030) Proposed Action.

3.7.2 Number of Operations and Fleet Mix

There would be no change to the number of aircraft operations or fleet mix as a result of implementing the Proposed Action. Therefore, the number of aircraft operations and fleet mix for the Future (2035) No Action Alternative would remain the same for the Future (2035) Proposed Action. Based on the aircraft activity forecast, there is a total of 141,178 annual aircraft operations forecast for 2035 at BZN. When divided by 365, the result is 386.8 average-annual day operations.

3.7.3 Runway End Utilization

As a result of implementing the proposed action, Runway 11-29 would be suitable for use by larger and faster aircraft. Assuming a shift of portions of the larger and faster categories of the fleet from Runway 12-30 to Runway 11-29, runway use percentages were derived for aircraft types and summarized by category **Table 27** summarizes the percentage of use by each aircraft category on each of the runways at BZN during the daytime (7:00 a.m. – 9:59 p.m.) and nighttime (10:00 p.m. – 6:59 a.m.) periods.

Table 27: Future (2035) Proposed Action

2035 Daytime Arrivals	12	30	11	29	3	21	11G	29G	Total
Commercial Jets	83%	13%	3%	1%	0%	0%	0%	0%	100%
Business Jets	62%	9%	25%	4%	0%	0%	0%	0%	100%
Multi-engine GA	60%	6%	30%	4%	0%	0%	0%	0%	100%
Single-engine GA	12%	1%	76%	7%	0%	1%	3%	0%	100%
Helicopters	20%	2%	26%	2%	43%	6%	1%	0%	100%
Military	81%	19%	0%	0%	0%	0%	0%	0%	100%
2035 Nighttime Arrivals	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	87%	9%	4%	0%	0%	0%	0%	0%	100%
Business Jets	58%	14%	23%	5%	0%	0%	0%	0%	100%
Multi-engine GA	58%	10%	26%	5%	0%	1%	0%	0%	100%
Single-engine GA	17%	5%	55%	13%	3%	3%	3%	0%	100%
Helicopters	5%	18%	24%	21%	0%	14%	0%	18%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%
2035 Daytime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	79%	17%	3%	1%	0%	0%	0%	0%	100%
Business Jets	62%	9%	25%	4%	0%	0%	0%	0%	100%
Multi-engine GA	59%	9%	26%	5%	0%	1%	0%	0%	100%
Single-engine GA	15%	2%	72%	8%	1%	2%	1%	0%	100%
Helicopters	7%	12%	26%	15%	5%	28%	0%	7%	100%
Military	85%	15%	0%	0%	0%	0%	0%	0%	100%
2035 Nighttime Departures	**12**	**30**	**11**	**29**	**3**	**21**	**11G**	**29G**	**Total**
Commercial Jets	87%	9%	4%	0%	0%	0%	0%	0%	100%
Business Jets	58%	14%	23%	5%	0%	0%	0%	0%	100%
Multi-engine GA	58%	10%	26%	6%	0%	0%	0%	0%	100%
Single-engine GA	17%	5%	55%	13%	3%	3%	4%	0%	100%
Helicopters	5%	18%	24%	21%	0%	13%	0%	19%	100%
Military	0%	0%	0%	0%	0%	0%	0%	0%	0%

Notes: Daytime = 7:00 a.m. – 9:59 p.m., Nighttime = 10:00 p.m. – 6:59 a.m.
Total may not equal due to rounding.
Source: Morrison-Maierle analysis, 2024

3.7.4 Flight Tracks

As a result of implementing the Proposed Action, the threshold of Runway 11 would be 2,430 feet northwest of the existing threshold of Runway 11. It is anticipated that the flight tracks for the lengthened Runway 11-29 would also be 2,430 feet northwest of the existing Runway 11-29. Flight tracks were shifted 2,430 feet northwest of the existing Runway 11-29 within AEDT for modeling the Proposed Action in both 2030 and 2035. **Figure 4** shows consolidated AEDT fixed wing departure, arrival and touch and go tracks for each runway for the Proposed Action in 2030 and 2035.

3.7.5 Aircraft Weight and Departure Stage Length

No change to the number of aircraft operations or fleet mix would occur as a result of implementing the Proposed Action. The departure stage lengths for the Future (2035) Proposed Action are expected to remain the same as Future (2035) No Action Alternative. Therefore, aircraft weight and departure stage lengths for the Future (2035) Proposed Action is expected to remain the same as the Future (2035) No Action Alternative. The AEDT model was used to determine aircraft weights for the specific airframe, destination, and runway length available.

3.7.6 Future (2035) Proposed Action Noise Exposure Contour

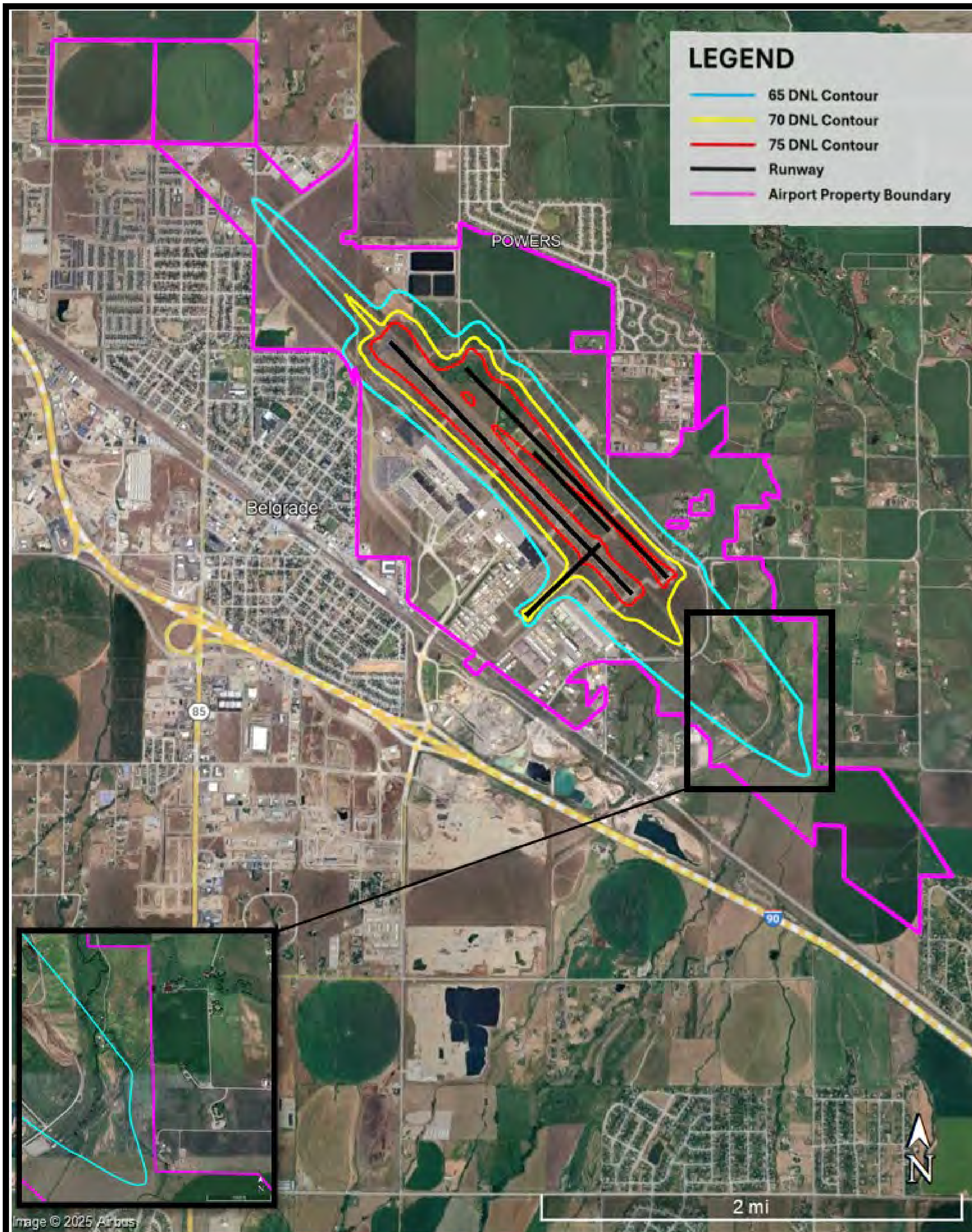
The 2035 Proposed Action DNL 65-75 dB contours are depicted on **Figure 5**. **Table 27** identifies the areas within the DNL contour ranges. As shown, the total area within the DNL 65 dB contour is approximately 1,683 acres. The DNL 65 dB contour primarily remains within the limits of the airport property boundary. With the relocation of the threshold of Runway 11 to the northwest under the Proposed Action, the DNL 65 dB noise contour shifts northwest and does not impact the residential property to the southeast as compared with the 2035 No Action Alternative. No new noise sensitive land uses or other noise sensitive structures are introduced to the DNL 65 dB noise contour as a result of the Proposed Action in 2035 as compared to the No Action Alternative.

Table 27: 2035 Proposed Action DNL Contour Areas

DNL (dB)	Area (Acres)
65 to 70	982
70 to 75	466
75 and Greater	235
Total	**1,683**

Source: Morrison-Maierle Analysis, 2024.

Figure 7: 2035 Proposed Action DNL 65-75 dB Contours



Source: Morrison-Maierle Analysis, 2024

3.8 Mitigation

Because no noise sensitive areas would experience a DNL 1.5 dB increase at or above DNL 65 dB in 2030 or 2035 as a result of the Proposed Action, no aircraft noise-related mitigation is required for the proposed improvements.

Appendix F:

Wildlife (USFWS IPaC, MNHP ESR)

PO Box 201800 • 1201 11th Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • tel 406.444.5363 • https://mtnhp.org

February 6, 2024

Faith Doty
Morrison-Maierle
2880 Technology Blvd W
Bozeman, MT 59715

Dear Faith Doty,

Thank you for your request for Natural Heritage information for Bozeman Yellowstone International Airport, 850 Gallatin Field Rd, Belgrade, MT 59714. Included with this letter is an Environmental Summary report PDF and a companion Excel workbook summarizing information managed in the Montana Natural Heritage Program's (MTNHP) databases for: (1) species occurrences; (2) other observed species without Species Occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys (organized efforts following a protocol capable of detecting one or more species); (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; and (8) biological reports associated with plant and animal observations. The PDF report contains introductory materials and limitations associated with the use of each of these data types, a list of additional information resources, data use terms and conditions, and suggested contacts. The Excel workbook contains worksheets for each data type that can be easily sorted to summarize particular information needs. In addition to these materials, we have included a compilation of one page snapshots containing general description, habitat, spatial and temporal distribution, and conservation status information for each species listed in the species occurrence, other observed species, and other potential species sections of the Environmental Summary report. These three field guide compilations are excerpted from the full accounts found on the Montana Field Guide https://fieldguide.mt.gov for general reference use and, if desired, as appendices to environmental review documents.

Please keep in mind the following when using and interpreting the enclosed information:

(1) This information is intended for distribution or use only within your department, agency, or business. Please see the Data Use Terms and Conditions in the Environmental Summary report PDF for additional guidelines.

(2) Our minimum search area for standard information requests consists of the requested area buffered by an additional mile in order to capture records that may be immediately adjacent to the requested area. Please let us know if a buffer greater than 1 mile would be of use to your efforts.

(3) Additional information on animal, plant, and lichen species and ecological systems in Montana is available on the Montana Field Guide at https://fieldguide.mt.gov/

(4) In addition to the information you receive from us, we encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located (see Environmental Summary report PDF).

I hope the enclosed information is helpful to you. Please feel free to contact me at the phone or email address below if you have any questions, require additional information, or have suggestions for how we could improve our information resources.

Sincerely,

Bryce A. Maxell

Bryce A. Maxell
Montana Natural Heritage Program
(406) 444-3989
bmaxell@mt.gov

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Montana Ecological Services Field Office
585 Shephard Way, Suite 1
Helena, MT 59601-6287
Phone: (406) 449-5225 Fax: (406) 449-5339

In Reply Refer To: 06/21/2024 21:10:48 UTC
Project Code: 2024-0022613
Project Name: Bozeman Yellowstone International Airport EA and CATEX

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

https://www.fws.gov/sites/default/files/documents/endangered-species-consultation-handbook.pdf

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts, see https://www.fws.gov/program/migratory-bird-permit/what-we-do.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures, see https://www.fws.gov/library/collections/threats-birds.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit https://www.fws.gov/partner/council-conservation-migratory-birds.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- USFWS National Wildlife Refuges and Fish Hatcheries
- Bald & Golden Eagles
- Migratory Birds
- Wetlands

OFFICIAL SPECIES LIST

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

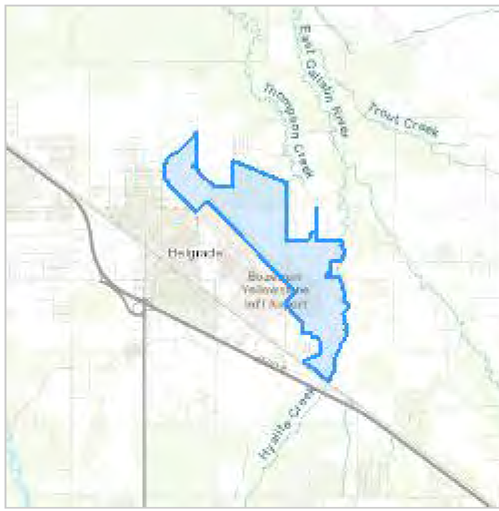
This species list is provided by:

Montana Ecological Services Field Office
585 Shephard Way, Suite 1
Helena, MT 59601-6287
(406) 449-5225

PROJECT SUMMARY

Project Code: 2024-0022613
Project Name: Bozeman Yellowstone International Airport EA and CATEX
Project Type: Airport - Maintenance/Modification
Project Description: 2024/25 AIP improvements
Project Location:

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@45.7774169,-111.13922085259384,14z



Counties: Gallatin County, Montana

ENDANGERED SPECIES ACT SPECIES

There is a total of 5 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

MAMMALS

NAME	STATUS
Canada Lynx *Lynx canadensis* Population: Wherever Found in Contiguous U.S. There is **final** critical habitat for this species. Your location does not overlap the critical habitat. Species profile: https://ecos.fws.gov/ecp/species/3652	Threatened
Grizzly Bear *Ursus arctos horribilis* Population: U.S.A., conterminous (lower 48) States, except where listed as an experimental population There is **proposed** critical habitat for this species. Species profile: https://ecos.fws.gov/ecp/species/7642	Threatened
North American Wolverine *Gulo gulo luscus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5123	Threatened

INSECTS

NAME	STATUS
Monarch Butterfly *Danaus plexippus* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

FLOWERING PLANTS

NAME	STATUS
Ute Ladies'-tresses *Spiranthes diluvialis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/2159	Threatened

CRITICAL HABITATS

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

YOU ARE STILL REQUIRED TO DETERMINE IF YOUR PROJECT(S) MAY HAVE EFFECTS ON ALL ABOVE LISTED SPECIES.

USFWS NATIONAL WILDLIFE REFUGE LANDS AND FISH HATCHERIES

Any activity proposed on lands managed by the National Wildlife Refuge system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

THERE ARE NO REFUGE LANDS OR FISH HATCHERIES WITHIN YOUR PROJECT AREA.

BALD & GOLDEN EAGLES

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act[1] and the Migratory Bird Treaty Act[2].

Any person or organization who plans or conducts activities that may result in impacts to bald or golden eagles, or their habitats[3], should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Bald and Golden Eagle Protection Act of 1940.
2. The Migratory Birds Treaty Act of 1918.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

There are likely bald eagles present in your project area. For additional information on bald eagles, refer to Bald Eagle Nesting and Sensitivity to Human Activity

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Jan 1 to Aug 31
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

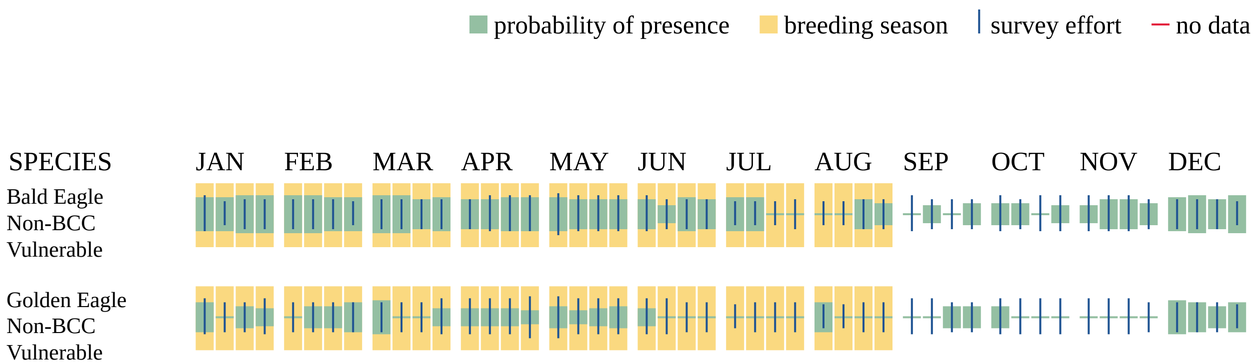
Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season ( )
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

MIGRATORY BIRDS

Certain birds are protected under the Migratory Bird Treaty Act[1] and the Bald and Golden Eagle Protection Act[2].

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats[3] should follow appropriate regulations and consider implementing appropriate conservation measures, as described in the links below. Specifically, please review the "Supplemental Information on Migratory Birds and Eagles".

---

1. The Migratory Birds Treaty Act of 1918.
2. The Bald and Golden Eagle Protection Act of 1940.
3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, see the PROBABILITY OF PRESENCE SUMMARY below to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Bald Eagle *Haliaeetus leucocephalus* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1626	Breeds Jan 1 to Aug 31
Black Tern *Chlidonias niger surinamenisis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3093	Breeds May 15 to Aug 20
Bobolink *Dolichonyx oryzivorus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9454	Breeds May 20 to Jul 31
Broad-tailed Hummingbird *Selasphorus platycercus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/11935	Breeds May 25 to Aug 21
California Gull *Larus californicus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10955	Breeds Mar 1 to Jul 31
Calliope Hummingbird *Selasphorus calliope* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9526	Breeds May 1 to Aug 15
Cassin's Finch *Haemorhous cassinii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15

NAME	BREEDING SEASON
Clark's Grebe *Aechmophorus clarkii* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10575	Breeds Jun 1 to Aug 31
Evening Grosbeak *Coccothraustes vespertinus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9465	Breeds May 15 to Aug 10
Franklin's Gull *Leucophaeus pipixcan* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10567	Breeds May 1 to Jul 31
Golden Eagle *Aquila chrysaetos* This is not a Bird of Conservation Concern (BCC) in this area, but warrants attention because of the Eagle Act or for potential susceptibilities in offshore areas from certain types of development or activities. https://ecos.fws.gov/ecp/species/1680	Breeds Jan 1 to Aug 31
Lesser Yellowlegs *Tringa flavipes* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9679	Breeds elsewhere
Lewis's Woodpecker *Melanerpes lewis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9408	Breeds Apr 20 to Sep 30
Long-eared Owl *asio otus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3631	Breeds Mar 1 to Jul 15
Olive-sided Flycatcher *Contopus cooperi* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Pinyon Jay *Gymnorhinus cyanocephalus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9420	Breeds Feb 15 to Jul 15
Rufous Hummingbird *Selasphorus rufus* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/8002	Breeds Apr 15 to Jul 15

NAME	BREEDING SEASON
Western Grebe *aechmophorus occidentalis* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/6743	Breeds Jun 1 to Aug 31
Willet *Tringa semipalmata* This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/10669	Breeds Apr 20 to Aug 5
Williamson's Sapsucker *Sphyrapicus thyroideus nataliae* This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA https://ecos.fws.gov/ecp/species/11995	Breeds May 1 to Jul 31

PROBABILITY OF PRESENCE SUMMARY

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read "Supplemental Information on Migratory Birds and Eagles", specifically the FAQ section titled "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Green bars; the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during that week of the year.

Breeding Season (■)
Yellow bars; liberal estimate of the timeframe inside which the bird breeds across its entire range.

Survey Effort (|)
Vertical black lines; the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps.

No Data (–)
A week is marked as having no data if there were no survey events for that week.

■ probability of presence ■ breeding season | survey effort – no data

SPECIES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Bald Eagle
Non-BCC
Vulnerable

Black Tern
BCC Rangewide
(CON)

Bobolink
BCC Rangewide
(CON)

Broad-tailed
Hummingbird
BCC Rangewide
(CON)

California Gull
BCC Rangewide
(CON)

Calliope
Hummingbird
BCC Rangewide
(CON)

Cassin's Finch
BCC Rangewide
(CON)

Clark's Grebe
BCC Rangewide
(CON)

Evening Grosbeak
BCC Rangewide
(CON)

Franklin's Gull
BCC Rangewide
(CON)

Golden Eagle
Non-BCC
Vulnerable

Lesser Yellowlegs
BCC Rangewide
(CON)

SPECIES JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

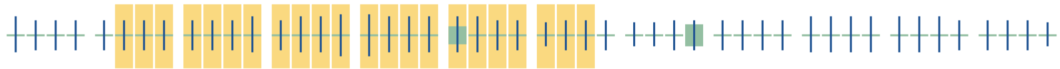
Lewis's
Woodpecker
BCC Rangewide
(CON)

Long-eared Owl
BCC Rangewide
(CON)

Olive-sided
Flycatcher

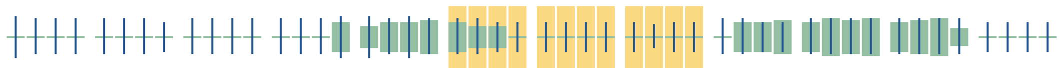
BCC Rangewide
(CON)

Pinyon Jay
BCC Rangewide
(CON)



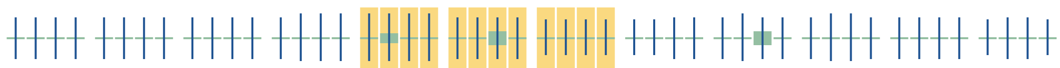
Rufous
Hummingbird
BCC Rangewide
(CON)

Western Grebe
BCC Rangewide
(CON)



Willet
BCC Rangewide
(CON)

Williamson's
Sapsucker
BCC - BCR



Additional information can be found using the following links:

- Eagle Management https://www.fws.gov/program/eagle-management
- Measures for avoiding and minimizing impacts to birds https://www.fws.gov/library/collections/avoiding-and-minimizing-incidental-take-migratory-birds
- Nationwide conservation measures for birds https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf
- Supplemental Information for Migratory Birds and Eagles in IPaC https://www.fws.gov/media/supplemental-information-migratory-birds-and-bald-and-golden-eagles-may-occur-project-action

WETLANDS

Impacts to NWI wetlands and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local U.S. Army Corps of Engineers District.

Please note that the NWI data being shown may be out of date. We are currently working to update our NWI data set. We recommend you verify these results with a site visit to determine the actual extent of wetlands on site.

RIVERINE

- R3UBG
- R4SBCx
- R4SBC

FRESHWATER POND

- PUSAx

IPAC USER CONTACT INFORMATION

Agency: Private Entity
Name: Faith Doty
Address: 2880 Technology Blvd W
City: Bozeman
State: MT
Zip: 59715
Email fdoty@m-m.net
Phone: 4069226772

LEAD AGENCY CONTACT INFORMATION

Lead Agency: Federal Aviation Administration

You have indicated that your project falls under or receives funding through the following special project authorities:

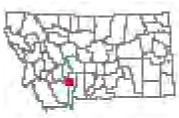
- BIPARTISAN INFRASTRUCTURE LAW (BIL) (OTHER)

Environmental Summary

MONTANA STATE LIBRARY

NATURAL HERITAGE PROGRAM mtnhp.org

1201 11th Ave ▫ P.O. Box 201800 ▫ Helena, MT 59620-1800 ▫ fax 406-444-0266 ▫ phone 406-444-3989

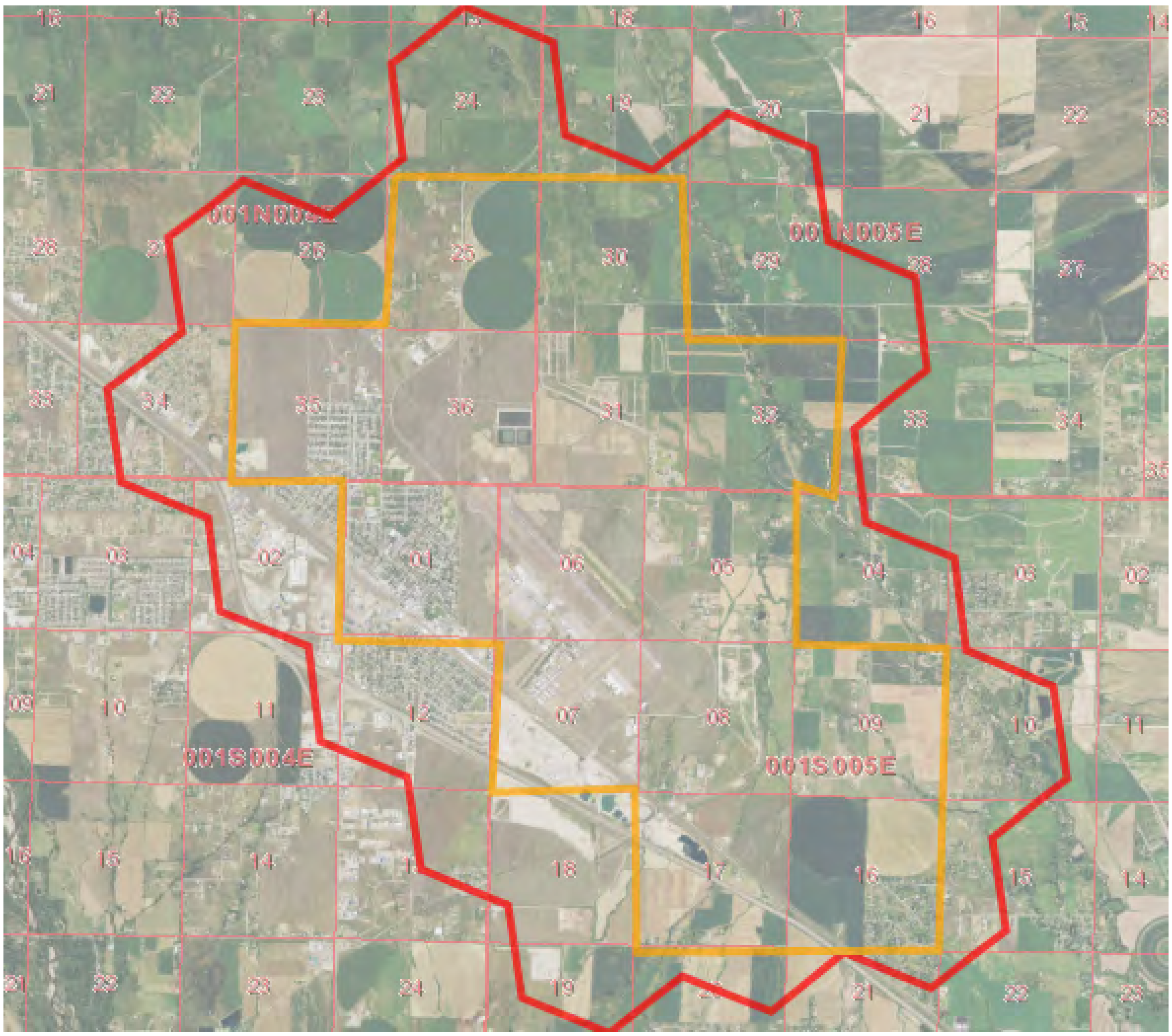


Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Summarized by:

24PRVT0210 - Bozeman Airport

(Custom Area of Interest)



Suggested Citation

Montana Natural Heritage Program. Environmental Summary Report.

for Latitude 45.73445 to 45.83431 and Longitude -111.08835 to -111.21614. Retrieved on 2/6/2024.

The Montana Natural Heritage Program is part of the Montana State Library's Natural Resource Information System. Since 1985, it has served as a neutral and non-regulatory provider of easily accessible information on Montana's species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. The program is part of the NatureServe network that is composed of over 60 member programs across North America that work to provide current and comprehensive distribution and status information on species and biological communities.

MONTANA STATE LIBRARY NATURAL HERITAGE PROGRAM

NatureServe

Table of Contents

Introduction to Environmental Summary Report

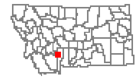
Environmental Summary Reports from the Montana Natural Heritage Program (MTNHP) provide information on species and biological communities to inform all stakeholders in environmental review, permitting, and planning processes. For information on environmental permits in Montana, please see permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Index of Environmental Permits for Montana and our Suggested Contacts for Natural Resource Management Agencies. The report for your area of interest consists of introductory and related materials in this PDF and an Excel workbook with worksheets summarizing information managed in the MTNHP databases for: (1) species occurrences; (2) other observed species without species occurrences; (3) other species potentially present based on their range, presence of associated habitats, or predictive distribution model output if available; (4) structured surveys that follow a protocol capable of detecting one or more species; (5) land cover mapped as ecological systems; (6) wetland and riparian mapping; (7) land management categories; and (8) biological reports associated with plant and animal observations. If your area of interest corresponds to a statewide polygon layer (e.g., watersheds, counties, or public land survey sections) information summaries in your report will exactly match those boundaries. However, if your report is for a custom area, users should be aware that summaries do not correspond to the exact boundaries of the polygon they have specified, but instead are a summary across a layer of hexagons intersected by the polygon they specified as shown on the report cover. Summarizing by these hexagons which are one square mile in area and approximately one kilometer in length on each side allows for consistent and rapid delivery of summaries based on a uniform grid that has been used for planning efforts across North America.

In presenting this information, MTNHP is working towards assisting the user with rapidly assessing the known or potential species and biological communities, land management categories, and biological reports associated with the report area. Users are reminded that this information is likely incomplete and may be inaccurate as surveys to document species are lacking in many areas of the state, species' range polygons often include regions of unsuitable habitat, methods of predicting the presence of species or communities are constantly improving, and information is constantly being added and updated in our databases. **Field verification by professional biologists of the absence or presence of species and biological communities in a report area will always be an important obligation of users of our data. Users are encouraged to only use this environmental summary report as a starting point for more in depth analyses and are encouraged to contact state, federal, and tribal resource management agencies for additional data or management guidelines relevant to your efforts. Please see the Appendix for introductory materials to each section of the report, additional information resources, and a list of relevant agency contacts.**

MONTANA STATE LIBRARY
NATURAL HERITAGE PROGRAM
A program of the **Montana State Library's Natural Resource Information System**

Legend

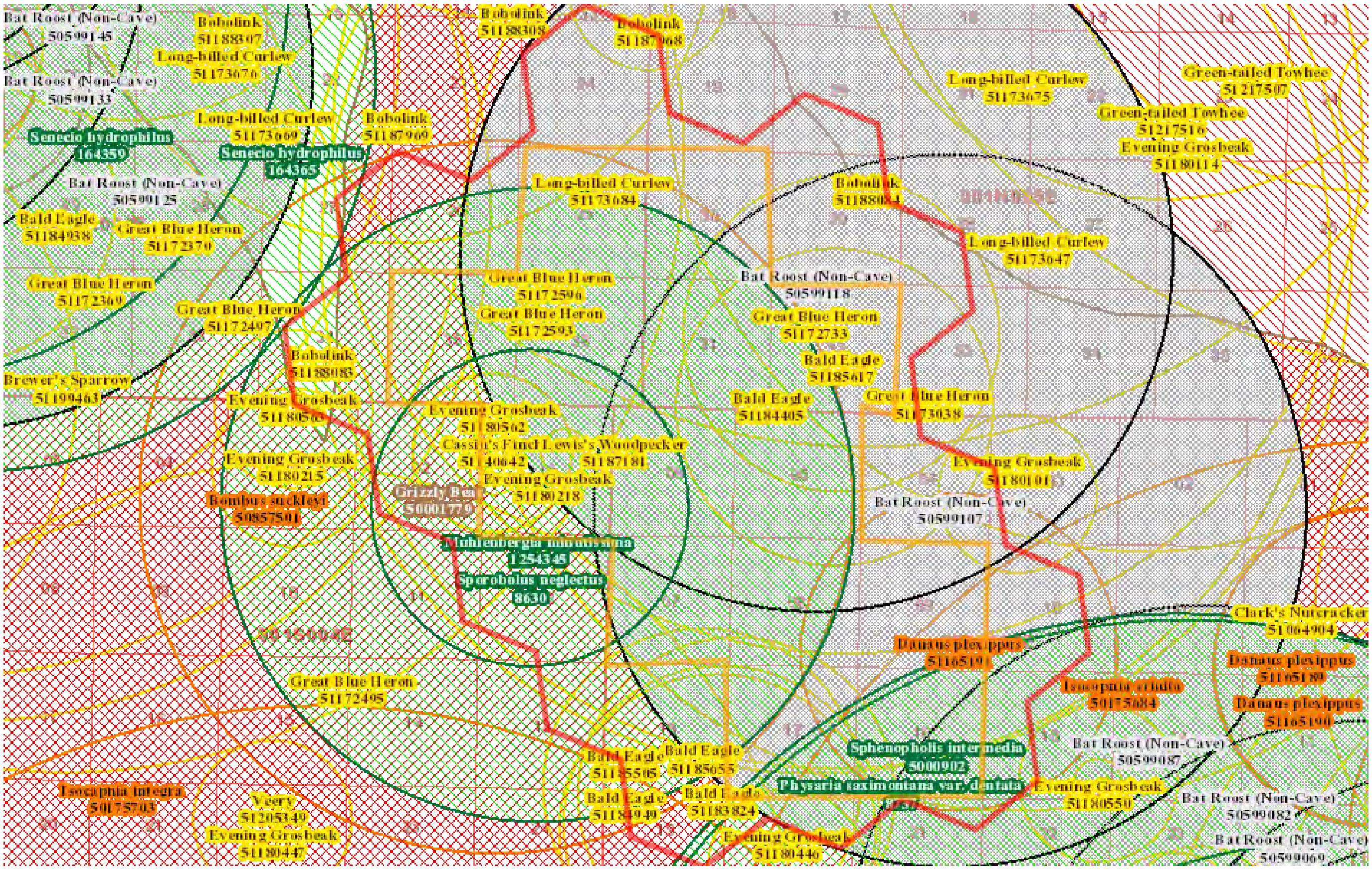
Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historical	



Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Native Species

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*
Filtered by:
Native Species reports are filtered for Species with MT Status = Species of Concern, Special Status, Important Animal Habitat, Potential SOC



Species Occurrences

Species	USFWS Sec7	# SO	# Obs	Predicted Model	Range
V - **Muhlenbergia minutissima** *(Annual Muhly)* SOC		1			Y
V - **Sporobolus neglectus** *(Small Dropseed)* SOC		1	+		Y
V - **Senecio hydrophilus** *(Alkali-marsh Ragwort)* SOC		1	+		Y
I - **Danaus plexippus** *(Monarch)* SOC		1	1		S

V - Muhlenbergia minutissima *(Annual Muhly)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S3** Plant Threat Score: **No Known Threats**

Predicted Models: N 72% Suitable (native range) (deductive)

V - Sporobolus neglectus *(Small Dropseed)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S1S2** Plant Threat Score: **No Known Threats**

Delineation Criteria Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation. (Last Updated: Jan 29, 2021)

Predicted Models: N 32% Suitable (native range) (deductive)

V - Senecio hydrophilus *(Alkali-marsh Ragwort)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G5** State: **S3** Plant Threat Score: **No Known Threats**

Predicted Models: N 8% Suitable (native range) (deductive)

I - Danaus plexippus *(Monarch)* SOC

View in Field Guide **View Predicted Models** **View Range Maps**

Species of Concern - Native Species Global: **G4** State: **S2S3** USFWS: **C** USFS: **Sensitive - Migratory in Forests (BD, BRT, KOOT)**

Delineation Criteria Confirmed breeding area based on the presence of a resident animal of any age/stage. Point observation location is buffered by a minimum distance of 2,000 meters in order to encompass documented travel distances of some butterfly species as well as adjacent habitat likely to support other individuals and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Nov 02, 2023)

Predicted Models: O 24% Optimal (inductive), M 52% Moderate (inductive), L 24% Low (inductive)

I - Bombus suckleyi *(Suckley Cuckoo Bumble Bee)* SOC 1 Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G2G3** State: **S1**

Delineation Criteria Confirmed breeding area based on the presence of a resident animal of any age. Point observation location is buffered by a minimum distance of 1700 meters in order to encompass the home range of the individual as well as adjacent habitat likely to support other individuals and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jun 22, 2022)

Predicted Models: M 88% Moderate (inductive), L 12% Low (inductive)

B - Bobolink *(Dolichonyx oryzivorus)* SOC 6 2 + S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** FWP SWAP: **SGCN3** PIF: **3**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 150 meters in order to conservatively encompass male territory size reported for the species and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 28, 2023)

Predicted Models: M 32% Moderate (inductive), L 40% Low (inductive)

B - Evening Grosbeak *(Coccothraustes vespertinus)* SOC 7 7 Y W M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 1,000 meters in order to encompass the maximum foraging distance from nests reported for the species and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 28, 2023)

Predicted Models: M 24% Moderate (inductive), L 28% Low (inductive)

B - Long-billed Curlew *(Numenius americanus)* SOC 3 S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA; BCC11** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 200 meters in order to approximate the breeding territory size reported for the species in Idaho and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 22, 2023)

Predicted Models: M 12% Moderate (inductive), L 88% Low (inductive)

B - Bald Eagle *(Haliaeetus leucocephalus)* SSS 6 76 + Y

View in Field Guide View Predicted Models View Range Maps
Special Status Species - Native Species Global: **G5** State: **S4** USFWS: **BGEPA; MBTA** USFS: **Sensitive - Known in Forests (LOLO)** BLM: **SENSITIVE** PIF: **2**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 2,000 meters in order to be conservative about encompassing the breeding territory and area commonly used for renesting. Only nesting observations with a locational uncertainty of 1,000 meters or less will be used to delineate a nesting area. (Last Updated: Dec 28, 2023)

Predicted Models: M 8% Moderate (inductive), L 44% Low (inductive)

B - Great Blue Heron *(Ardea herodias)* SOC 8 37 + Y S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3**

Delineation Criteria Confirmed nesting area buffered by a minimum distance of 6,500 meters in order to be conservative about encompassing the areas commonly used for foraging near the breeding colony and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 22, 2023)

Predicted Models: M 4% Moderate (inductive), L 80% Low (inductive)

B - Lewis's Woodpecker *(Melanerpes lewis)* SOC 1 1 S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA; BCC10; BCC17** USFS: **Species of Conservation Concern in Forests (HLC)** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **2**

Delineation Criteria Confirmed breeding area based on the presence of a nest, chicks, or territorial adults during the breeding season. Point observation location is buffered by a minimum distance of 300 meters in order to encompass the likely foraging area used by breeding adults around the nest tree and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Dec 28, 2023)

Predicted Models: L 24% Low (inductive)

M - Grizzly Bear *(Ursus arctos)* SOC 1 Y H

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** USFWS: **LT** BLM: **THREATENED** FWP SWAP: **SGCN2-3**

Delineation Criteria Species Occurrence polygons represent areas delineated by the U.S. Fish and Wildlife Service (USFWS) that encompass both home ranges and potential transitory movements based on verified sightings. Within these areas, the USFWS wants project proponents to consider whether the species â€œmay be presentâ€ when evaluating the potential impacts of a project and to work with the USFWS to develop and implement best management practices to minimize or eliminate project effects on the species. (Last Updated: Dec 22, 2023)

Predicted Models: L 12% Low (inductive)

B - Cassin's Finch *(Haemorhous cassinii)* SOC 2 8 Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA; BCC10** FWP SWAP: **SGCN3** PIF: **3**

Delineation Criteria Observations with evidence of breeding activity buffered by a minimum distance of 300 meters in order to be conservative about encompassing the courtship and foraging distance from nesting areas and otherwise buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Jun 30, 2023)

Predicted Models: L 4% Low (inductive)

I - Isocapnia crinita *(Hooked Snowfly)* SOC 1 + Not Assessed Y

View in Field Guide View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2**

Delineation Criteria Confirmed breeding area based on the presence of a resident animal of any age. Point observation location is buffered by a minimum distance of 100 meters in order to encompass the home range of the individual as well as adjacent habitat likely to support other individuals and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Mar 22, 2016)

I - Isocapnia integra *(Alberta Snowfly)* SOC 1 + Not Assessed Y

View in Field Guide View Range Maps
Species of Concern - Native Species Global: **G4G5** State: **S2**

Delineation Criteria Confirmed breeding area based on the presence of a resident animal of any age. Point observation location is buffered by a minimum distance of 100 meters in order to encompass the home range of the individual as well as adjacent habitat likely to support other individuals and otherwise is buffered by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Mar 22, 2016)

V - Physaria saximontana var. dentata *(Rocky Mountain Twinpod)* SOC

1	+	Not Assessed	Y

View in Field Guide **View Range Maps**

Species of Concern - Native Species Global: **G3T3** State: **S3** Plant Threat Score: **No Known Threats** CCVI: **Moderately Vulnerable**

Delineation Criteria Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation. (Last Updated: Aug 09, 2023)

V - Sphenopholis intermedia *(Slender Wedgegrass)* PSOC

1	+	Not Assessed

View in Field Guide

Potential Species of Concern - Native Species Global: **G5** State: **S3S4**

Delineation Criteria Individual occurrences are generally based upon a discretely mapped area provided by an observer and are not separated by any pre-defined distance. Individual clusters of plants mapped at fine spatial scales (separated by less than approximately 25-50 meters) may be grouped together into one occurrence if they are not separated by distinct areas of habitat or terrain features. Point observations are buffered to encompass any locational uncertainty associated with the observation. (Last Updated: Aug 23, 2017)

O - Bat Roost (Non-Cave) *(Bat Roost (Non-Cave))* IAH

3	Not Assessed

View in Field Guide

Important Animal Habitat - Native Species Global: **GNR** State: **SNR**

Delineation Criteria Confirmed area of occupancy based on the documented presence of adults or juveniles of any bat species at non-cave natural roost sites (e.g. rock outcrops, trees), below ground human created roost sites (e.g. mines), and above ground human created roost sites (e.g., bridges, buildings). Point observation locations are buffered by a distance of 4,500 meters in order to encompass the 95% confidence interval for nightly foraging distance reported for Townsendâ€™s Big-eared Bat (a resident Montana bat Species of Concern) and otherwise by the locational uncertainty associated with the observation up to a maximum distance of 10,000 meters. (Last Updated: Oct 22, 2019)

Legend

Model Icons	Habitat Icons	Range Icons	Num Obs
N Suitable (native range)	C Common	Y Native / Year-round	Count of obs with 'good precision' (<=1000m)
O Optimal Suitability	O Occasional	S Summer	+ indicates additional 'poor precision' obs (1001m-10,000m)
M Moderate Suitability		W Winter	
L Low Suitability		M Migratory	
I Suitable (introduced range)		N Non-native	
		H Historical	

Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Native Species

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*
Filtered by:
Native Species reports are filtered for Species with MT Status = Species of Concern, Special Status, Important Animal Habitat, Potential SOC

Other Observed Species

Species	USFWS Sec7	# Obs	Predicted Model	Range
B - Hooded Merganser *(Lophodytes cucullatus)* PSOC		3		Y M
M - North American Porcupine *(Erethizon dorsatum)* PSOC		+		Y
B - American White Pelican *(Pelecanus erythrorhynchos)* SOC		25 +		S M
B - White-faced Ibis *(Plegadis chihi)* SOC		1		S M
B - Rufous Hummingbird *(Selasphorus rufus)* PSOC		1		S M
B - Barrow's Goldeneye *(Bucephala islandica)* PSOC		1 +		Y W M
B - Ferruginous Hawk *(Buteo regalis)* SOC		2 +		S M
B - Loggerhead Shrike *(Lanius ludovicianus)* SOC		1		S M
B - Sharp-tailed Grouse *(Tympanuchus phasianellus)* SOC		+		Y
B - Trumpeter Swan *(Cygnus buccinator)* SOC		6		Y M
B - Black-crowned Night-Heron *(Nycticorax nycticorax)* SOC		+		S M
A - Northern Leopard Frog *(Lithobates pipiens)* SOC		1		Y

B - Hooded Merganser *(Lophodytes cucullatus)* PSOC
View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2**
Predicted Models: O 4% Optimal (inductive), M 64% Moderate (inductive), L 32% Low (inductive)

M - North American Porcupine *(Erethizon dorsatum)* PSOC
View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** FWP SWAP: **SGIN**
Predicted Models: M 76% Moderate (inductive), L 24% Low (inductive)

B - American White Pelican *(Pelecanus erythrorhynchos)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: M 72% Moderate (inductive), L 28% Low (inductive)

B - White-faced Ibis *(Plegadis chihi)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 72% Moderate (inductive), L 24% Low (inductive)

B - Rufous Hummingbird *(Selasphorus rufus)* PSOC
View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G4** State: **S4B** USFWS: **MBTA; BCC10** PIF: **3**
Predicted Models: M 48% Moderate (inductive), L 44% Low (inductive)

B - Barrow's Goldeneye *(Bucephala islandica)* PSOC
View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **2**
Predicted Models: M 12% Moderate (inductive), L 88% Low (inductive)

B - Ferruginous Hawk *(Buteo regalis)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 8% Moderate (inductive), L 80% Low (inductive)

B - Loggerhead Shrike *(Lanius ludovicianus)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 4% Moderate (inductive), L 76% Low (inductive)

B - Sharp-tailed Grouse *(Tympanuchus phasianellus)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **SX,S4** FWP SWAP: **SGCN1** PIF: **2**
Predicted Models: L 96% Low (inductive)

B - Trumpeter Swan *(Cygnus buccinator)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**
Predicted Models: L 84% Low (inductive)

B - Black-crowned Night-Heron *(Nycticorax nycticorax)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 56% Low (inductive)

A - Northern Leopard Frog *(Lithobates pipiens)* SOC
View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S1,S4** USFS: **Sensitive - Suspected in Forests (KOOT, LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN1**
Predicted Models: L 32% Low (inductive)

B - Green-tailed Towhee *(Pipilo chlorurus)* SOC 2 S M

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 16% Low (inductive)

B - Pinyon Jay *(Gymnorhinus cyanocephalus)* SOC + Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G3** State: **S3** USFWS: **MBTA; BCC10; BCC17** FWP SWAP: **SGCN3**
Predicted Models: L 12% Low (inductive)

B - Golden Eagle *(Aquila chrysaetos)* SOC 27 + Y

View in Field Guide **View Predicted Models** **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **BGEPA; MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: L 4% Low (inductive)

B - American Goshawk *(Accipiter atricapillus)* SOC 2 Not Assessed Y W M

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **2**

B - Brown Creeper *(Certhia americana)* SOC 2 Not Assessed Y

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **1**

B - Clark's Nutcracker *(Nucifraga columbiana)* SOC 6 Not Assessed Y

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **MBTA** USFS: **Species of Conservation Concern in Forests (FLAT)** FWP SWAP: **SGCN3** PIF: **3**

V - Mimulus nanus *(Dwarf Purple Monkeyflower)* SOC + Not Assessed Y

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S2S3** USFS: **Sensitive - Known in Forests (BRT)** **Species of Conservation Concern in Forests (CG)** Plant Threat Score: **High - Low**
CCVI: **Extremely Vulnerable**

B - Burrowing Owl *(Athene cunicularia)* SOC + Not Assessed S M

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G4** State: **S3B** USFWS: **MBTA; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

B - Varied Thrush *(Ixoreus naevius)* SOC 1 Not Assessed S M

View in Field Guide **View Range Maps**
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**

B - Tennessee Warbler *(Leiothlypis peregrina)* PSOC 1 Not Assessed M

View in Field Guide **View Range Maps**
Potential Species of Concern - Native Species Global: **G5** State: **S3S4B** USFWS: **MBTA**

Legend

Model Icons
N Suitable (native range)
O Optimal Suitability
M Moderate Suitability
L Low Suitability
I Suitable (introduced range)

Habitat Icons
C Common
O Occasional

Range Icons
Y Native / Year-round
S Summer
W Winter
M Migratory
N Non-native
H Historical

Num Obs
Count of obs with 'good precision' (<=1000m)
+ indicates additional 'poor precision' obs (1001m-10,000m)

Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Native Species

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*
Filtered by:
Native Species reports are filtered for Species with MT Status = Species of Concern, Special Status, Important Animal Habitat, Potential SOC

Other Potential Species

USFWS Sec7 | Predicted Model | Range

B - Broad-tailed Hummingbird *(Selasphorus platycercus)* PSOC
S M

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4B** USFWS: **MBTA; BCC10** FWP SWAP: **SGIN**
Predicted Models: O 20% Optimal (inductive), M 32% Moderate (inductive), L 32% Low (inductive)

B - Yellow-billed Cuckoo *(Coccyzus americanus)* SOC
S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **PS: LT; MBTA** BLM: **THREATENED** FWP SWAP: **SGCN3, SGIN** PIF: **2**
Predicted Models: O 16% Optimal (inductive), M 48% Moderate (inductive), L 24% Low (inductive)

B - Black-necked Stilt *(Himantopus mexicanus)* SOC
S M

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: O 8% Optimal (inductive), M 8% Moderate (inductive), L 48% Low (inductive)

M - Wyoming Ground Squirrel *(Urocitellus elegans)* PSOC
Y

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4**
Predicted Models: M 76% Moderate (inductive), L 24% Low (inductive)

M - Dwarf Shrew *(Sorex nanus)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2S3** FWP SWAP: **SGCN2-3**
Predicted Models: M 64% Moderate (inductive), L 36% Low (inductive)

V - Impatiens aurella *(Pale-yellow Jewel-weed)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** Plant Threat Score: **No Known Threats**
Predicted Models: M 56% Moderate (inductive), L 44% Low (inductive)

V - Potentilla plattensis *(Platte Cinquefoil)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** Plant Threat Score: **No Known Threats** CCVI: **Highly Vulnerable**
Predicted Models: M 56% Moderate (inductive), L 12% Low (inductive)

M - Merriam's Shrew *(Sorex merriami)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: M 52% Moderate (inductive), L 48% Low (inductive)

V - Dichanthelium acuminatum *(Panic Grass)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2S3** Plant Threat Score: **Unknown**
Predicted Models: M 52% Moderate (inductive), L 24% Low (inductive)

M - Uinta Ground Squirrel *(Urocitellus armatus)* PSOC
Y

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4** FWP SWAP: **SGIN**
Predicted Models: M 52% Moderate (inductive), L 20% Low (inductive)

B - Short-eared Owl *(Asio flammeus)* PSOC
Y

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S4** USFWS: **MBTA; BCC11; BCC17** PIF: **3**
Predicted Models: M 40% Moderate (inductive), L 48% Low (inductive)

V - Eleocharis rostellata *(Beaked Spikerush)* SOC
Y

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFS: **Species of Conservation Concern in Forests (CG, FLAT, HLC)** Plant Threat Score: **Unknown**
CCVI: **Less Vulnerable**
Predicted Models: M 40% Moderate (inductive), L 28% Low (inductive)

R - Snapping Turtle *(Chelydra serpentina)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native/Non-native Species - (depends on location or taxa)   Global: **G5** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN**
Predicted Models: M 20% Moderate (inductive), L 72% Low (inductive)

R - Western Milksnake *(Lampropeltis gentilis)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G5** State: **S2** BLM: **SENSITIVE** FWP SWAP: **SGCN2**
Predicted Models: M 12% Moderate (inductive), L 72% Low (inductive)

B - Veery *(Catharus fuscescens)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: M 8% Moderate (inductive), L 84% Low (inductive)

B - Ovenbird *(Seiurus aurocapilla)* PSOC

View in Field Guide   View Predicted Models   View Range Maps
Potential Species of Concern - Native Species   Global: **G5** State: **S4B** USFWS: **MBTA** PIF: **3**
Predicted Models: M 8% Moderate (inductive), L 40% Low (inductive)

V - Spiranthes diluvialis *(Ute Ladies'-tresses)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G2G3** State: **S1S2** USFWS: **LT** Plant Threat Score: **High** CCVI: **Extremely Vulnerable**
Predicted Models: M 4% Moderate (inductive), L 40% Low (inductive)

V - Primula incana *(Mealy Primrose)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G5** State: **S3** Plant Threat Score: **High** CCVI: **Highly Vulnerable**
Predicted Models: M 4% Moderate (inductive), L 24% Low (inductive)

M - Preble's Shrew *(Sorex preblei)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G4** State: **S3** FWP SWAP: **SGCN3**
Predicted Models: M 4% Moderate (inductive), L 4% Low (inductive)

B - Black-billed Cuckoo *(Coccyzus erythropthalmus)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G5** State: **S3B** USFWS: **MBTA; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN** PIF: **2**
Predicted Models: L 100% Low (inductive)

M - Hoary Bat *(Lasiurus cinereus)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G3G4** State: **S3B** BLM: **SENSITIVE** FWP SWAP: **SGCN3**
Predicted Models: L 92% Low (inductive)

M - Long-legged Myotis *(Myotis volans)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G4G5** State: **S3**
Predicted Models: L 72% Low (inductive)

M - Little Brown Myotis *(Myotis lucifugus)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G3G4** State: **S3** USFS: **Sensitive - Known in Forests (BD, BRT, KOOT)** FWP SWAP: **SGCN3**
Predicted Models: L 68% Low (inductive)

B - Common Poorwill *(Phalaenoptilus nuttallii)* PSOC

View in Field Guide   View Predicted Models   View Range Maps
Potential Species of Concern - Native Species   Global: **G5** State: **S4B** USFWS: **MBTA** FWP SWAP: **SGIN** PIF: **3**
Predicted Models: L 68% Low (inductive)

M - Silver-haired Bat *(Lasionycteris noctivagans)* PSOC

View in Field Guide   View Predicted Models   View Range Maps
Potential Species of Concern - Native Species   Global: **G3G4** State: **S4**
Predicted Models: L 64% Low (inductive)

B - Black Tern *(Chlidonias niger)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G4G5** State: **S3B** USFWS: **MBTA; BCC10; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 64% Low (inductive)

M - Spotted Bat *(Euderma maculatum)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G4** State: **S3** BLM: **SENSITIVE** FWP SWAP: **SGCN3, SGIN**
Predicted Models: L 60% Low (inductive)

B - Sage Thrasher *(Oreoscoptes montanus)* SOC

View in Field Guide   View Predicted Models   View Range Maps
Species of Concern - Native Species   Global: **G4** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 60% Low (inductive)

M - Canada Lynx *(Lynx canadensis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3** USFWS: **LT; CH** BLM: **THREATENED** FWP SWAP: **SGCN3**
Predicted Models: L 56% Low (inductive)

V - Carex crawei *(Crawe's Sedge)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2S3** Plant Threat Score: **Low**
Predicted Models: L 52% Low (inductive)

V - Ranunculus hyperboreus *(High Northern Buttercup)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **S3S4**
Predicted Models: L 52% Low (inductive)

B - American Bittern *(Botaurus lentiginosus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **3**
Predicted Models: L 48% Low (inductive)

B - Greater Sage-Grouse *(Centrocercus urophasianus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S2** USFS: **Sensitive - Known in Forests (BD)** **Species of Conservation Concern in Forests (CG)** BLM: **SENSITIVE** FWP SWAP: **SGCN2** PIF: **1**
Predicted Models: L 44% Low (inductive)

V - Stellaria crassifolia *(Fleshy Stitchwort)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** Plant Threat Score: **No Known Threats**
Predicted Models: L 44% Low (inductive)

M - Long-eared Myotis *(Myotis evotis)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3**
Predicted Models: L 40% Low (inductive)

V - Castilleja gracillima *(Slender Indian Paintbrush)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S2** Plant Threat Score: **Low** CCVI: **Highly Vulnerable**
Predicted Models: L 40% Low (inductive)

M - Western Spotted Skunk *(Spilogale gracilis)* PSOC

View in Field Guide View Predicted Models View Range Maps
Potential Species of Concern - Native Species Global: **G5** State: **SU** FWP SWAP: **SGIN**
Predicted Models: L 32% Low (inductive)

B - Brewer's Sparrow *(Spizella breweri)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S3B** USFWS: **MBTA** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **2**
Predicted Models: L 32% Low (inductive)

V - Erigeron linearis *(Linear-leaf Fleabane)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G5** State: **S2** Plant Threat Score: **Low** CCVI: **Less Vulnerable**
Predicted Models: L 24% Low (inductive)

B - Harlequin Duck *(Histrionicus histrionicus)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native Species Global: **G4** State: **S2B** USFWS: **MBTA** USFS: **Sensitive - Known in Forests (BD, KOOT, LOLO)** **Sensitive - Migratory in Forests (BRT)** FWP SWAP: **SGCN2** PIF: **1**
Predicted Models: L 20% Low (inductive)

F - Yellowstone Cutthroat Trout *(Oncorhynchus clarkii bouvieri)* SOC

View in Field Guide View Predicted Models View Range Maps
Species of Concern - Native/Non-native Species - (depends on location or taxa) Global: **G5T4** State: **S2** BLM: **SENSITIVE** FWP SWAP: **SGCN2**
Predicted Models: I 12% Suitable (introduced range) (deductive)

M - Wolverine *(Gulo gulo)* SOC

View in Field Guide View Range Maps
Species of Concern - Native Species Global: **G4** State: **S3** USFWS: **LT** USFS: **Sensitive - Known in Forests (LOLO)** BLM: **SENSITIVE** FWP SWAP: **SGCN3**

B - Sprague's Pipit *(Anthus spragueii)* SOC

View in Field Guide View Range Maps
Species of Concern - Native Species Global: **G3G4** State: **S3B** USFWS: **MBTA; BCC11; BCC17** BLM: **SENSITIVE** FWP SWAP: **SGCN3** PIF: **1**

A program of the **Montana State Library's Natural Resource Information System**

Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Structured Surveys

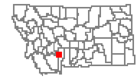
Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*

The Montana Natural Heritage Program (MTNHP) records information on the locations where more than 80 different types of well-defined repeatable survey protocols capable of detecting an animal species or suite of animal species have been conducted by state, federal, tribal, university, or private consulting biologists. Examples of structured survey protocols tracked by MTNHP include: visual encounter and dip net surveys for pond breeding amphibians, point counts for birds, call playback surveys for selected bird species, visual surveys of migrating raptors, kick net stream reach surveys for macroinvertebrates, visual encounter cover object surveys for terrestrial mollusks, bat acoustic or mist net surveys, pitfall and/or snap trap surveys for small terrestrial mammals, track or camera trap surveys for large mammals, and trap surveys for turtles. Whenever possible, photographs of survey locations are stored in MTNHP databases.

MTNHP does not typically manage information on structured surveys for plants; surveys for invasive species may be a future exception.

Within the report area you have requested, structured surveys are summarized by the number of each type of structured survey protocol that has been conducted, the number of species detections/observations resulting from these surveys, and the most recent year a survey has been conducted.

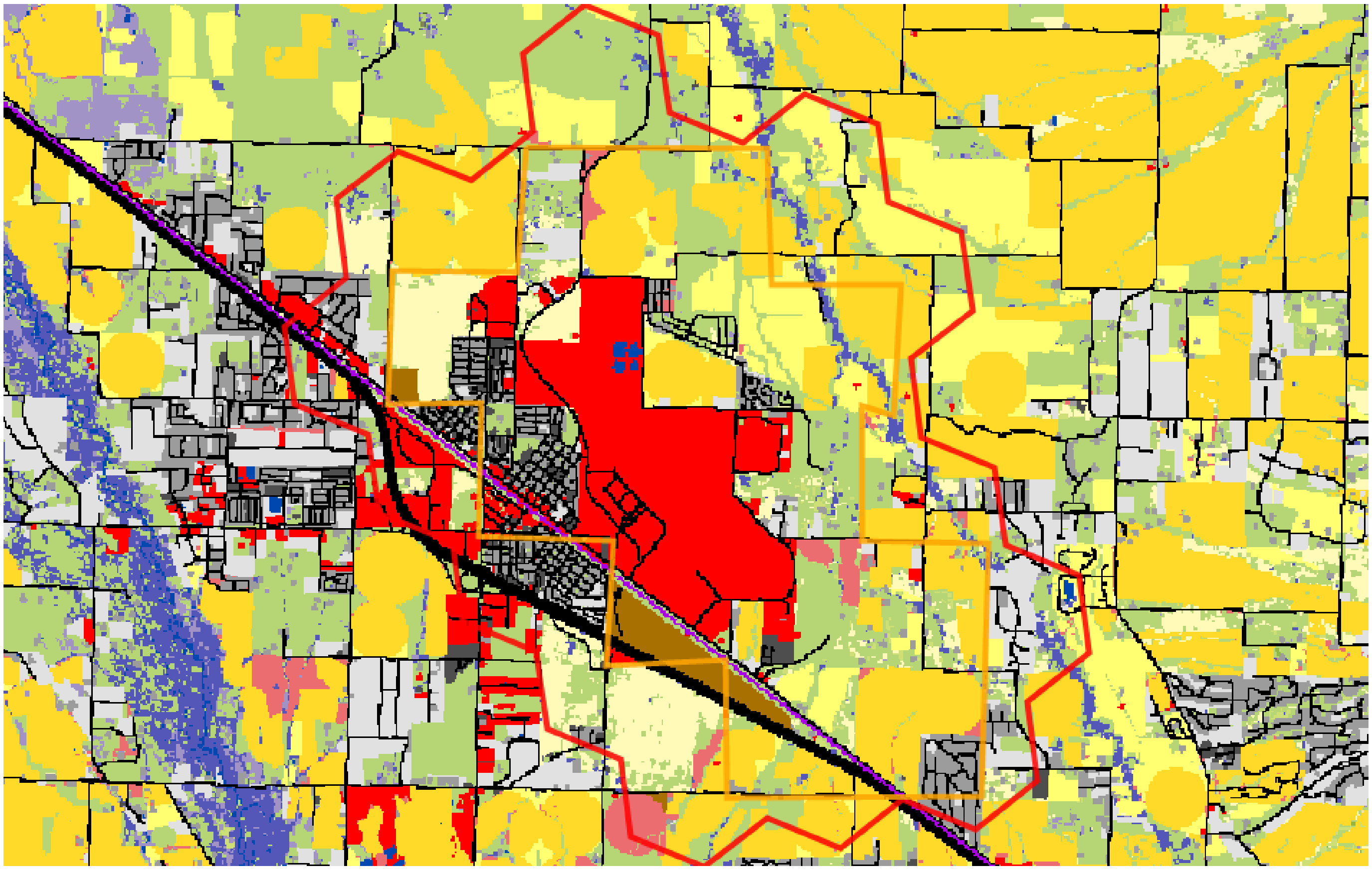
B-Bald Eagle Nest *(Bald Eagle Nest Survey)*	**Survey Count**: 10	**Obs Count**: 9	**Recent Survey**: 2014
E-Eastern Heath Snail *(Eastern Heath Snail Survey)*	**Survey Count**: 2	**Obs Count**:	**Recent Survey**: 2012
E-Invasive Mussel Plankton Tow *(Plankton tows for veligers of Invasive Mussels)*	**Survey Count**: 3	**Obs Count**:	**Recent Survey**: 2018
E-Japanese Beetle Trapping *(Japanese Beetle Trapping Surveys)*	**Survey Count**: 18	**Obs Count**:	**Recent Survey**: 2018
E-Kicknet *(Kicknet Collection Survey for Invasive Mussels and Snails)*	**Survey Count**: 3	**Obs Count**:	**Recent Survey**: 2018
E-Noxious Weed, Road-based *(Noxious Weed Road-based Visual Surveys)*	**Survey Count**: 32	**Obs Count**: 107	**Recent Survey**: 2004
E-Visual Aquatic Invasives *(Visual Encounter Surveys for Aquatic Invasives on Shorelines or Underwater)*	**Survey Count**: 6	**Obs Count**: 2	**Recent Survey**: 2022
F-Fish Other Survey *(Fish Other Survey (FWP Survey Type))*	**Survey Count**: 1	**Obs Count**: 2	**Recent Survey**: 1959
I-Aquatic Invert Lotic Dipnet *(Invertebrate Lotic Site Dipnet and Visual Encounter Survey)*	**Survey Count**: 2	**Obs Count**: 14	**Recent Survey**: 2010
I-Bumble Bee *(Bumble Bee Collection Surveys)*	**Survey Count**: 2	**Obs Count**: 2	**Recent Survey**: 2011
M-Bat Roost (Active Season) *(Bat Roost (Active Season) Survey)*	**Survey Count**: 2	**Obs Count**: 2	**Recent Survey**: 2019
M-SMammal Snap/Sherman/Pitfall *(Small Mammal Snap, Sherman, and Pitfall Trap Survey)*	**Survey Count**: 1	**Obs Count**: 7	**Recent Survey**: 2009
P-Algal scraping *(Algal Scraping)*	**Survey Count**: 7	**Obs Count**: 346	**Recent Survey**: 2015

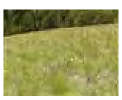


Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Land Cover

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*





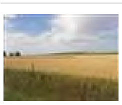
21% (*3,313* Acres)

Grassland Systems

Montane Grassland

Rocky Mountain Lower Montane, Foothill, and Valley Grassland

This grassland system of the northern Rocky Mountains is found at lower montane to foothill elevations in mountains and valleys throughout Montana. These grasslands are floristically similar to Big Sagebrush Steppe but are defined by shorter summers, colder winters, and young soils derived from recent glacial and alluvial material. They are found at elevations from 548 - 1,650 meters (1,800-5,413 feet). In the lower montane zone, they range from small meadows to large open parks surrounded by conifers; below the lower treeline, they occur as extensive foothill and valley grasslands. Soils are relatively deep, fine-textured, often with coarse fragments, and non-saline. Microphytic crust may be present in high-quality occurrences. This system is typified by cool-season perennial bunch grasses and forbs (>25%) cover, with a sparse shrub cover (<10%). Rough fescue (*Festuca campestris*) is dominant in the northwestern portion of the state and Idaho fescue (*Festuca idahoensis*) is dominant or co-dominant throughout the range of the system. Bluebunch wheatgrass (*Pseudoroegneria spicata*) occurs as a co-dominant throughout the range as well, especially on xeric sites. Western wheatgrass (*Pascopyrum smithii*) is consistently present, often with appreciable coverage (>10%) in lower elevation occurrences in western Montana and virtually always present, with relatively high coverages (>25%), on the edge of the Northwestern Great Plains region. Species diversity ranges from a high of more than 50 per 400 square meter plot on mesic sites to 15 (or fewer) on xeric and disturbed sites. Most occurrences have at least 25 vascular species present. Farmland conversion, noxious species invasion, fire suppression, heavy grazing and oil and gas development are major threats to this system.



20% (*3,211* Acres)

Human Land Use

Agriculture

Cultivated Crops

These areas used for the production of crops, such as corn, soybeans, small grains, sunflowers, vegetables, and cotton, typically on an annual cycle. Agricultural plant cover is variable depending on season and type of farming. Other areas include more stable land cover of orchards and vineyards.

No Image

15% (*2,355* Acres)

Human Land Use

Developed

Commercial / Industrial

Businesses, industrial parks, hospitals, airports; utilities in commercial/industrial areas.

9% (*1,369* Acres)

Human Land Use
Agriculture

Pasture/Hay

These agriculture lands typically have perennial herbaceous cover (e.g. regularly-shaped plantings) used for livestock grazing or the production of hay. There are obvious signs of management such as irrigation and haying that distinguish it from natural grasslands. Identified CRP lands are included in this land cover type.

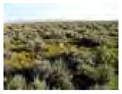
No Image

8% (*1,346* Acres)

Human Land Use
Developed

Other Roads

County, city and or rural roads generally open to motor vehicles.



8% (*1,277* Acres)

Shrubland, Steppe and Savanna Systems
Sagebrush Steppe

Big Sagebrush Steppe

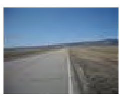
This widespread ecological system occurs throughout much of central Montana, and north and east onto the western fringe of the Great Plains. In central Montana, where this system occurs on both glaciated and non-glaciated landscapes, it differs slightly, with more summer rain than winter precipitation and more precipitation annually. Throughout its distribution, soils are typically deep and non-saline, often with a microphytic crust. This shrub-steppe is dominated by perennial grasses and forbs with greater than 25% cover. Overall shrub cover is less than 10 percent. In Montana and Wyoming, stands are more mesic, with more biomass of grass, and have less shrub diversity than stands farther to the west, and 50 to 90% of the occurrences are dominated by Wyoming big sagebrush with western wheatgrass (*Pascopyrum smithii*). Japanese brome (*Bromus japonicus*) and cheatgrass (*Bromus tectorum*) are indicators of disturbance, but cheatgrassis typically not as abundant as in the Intermountain West, possibly due to a colder climate. The natural fire regime of this ecological system maintains a patchy distribution of shrubs, preserving the steppe character. Shrubs may increase following heavy grazing and/or with fire suppression. In central and eastern Montana, complexes of prairie dog towns are common in this ecological system.

5% (*863* Acres)

Human Land Use
Developed

Low Intensity Residential

Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-50% of total cover. These areas most commonly include single-family housing units in rural and suburban areas. Paved roadways may be classified into this category.



4% (*612* Acres)

Human Land Use
Developed

Developed, Open Space

Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Impervious surfaces account for less than 20% of total cover. This category often includes highway and railway rights of way and graveled rural roads.

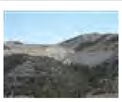
No Image

2% (*317* Acres)

Human Land Use
Developed

Interstate

National Highway System (NHS) limited access highways and their shoulders and rights of way.



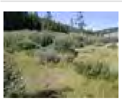
2% (*289* Acres)

Human Land Use
Mining and Resource Extraction

Quarries, Strip Mines and Gravel Pits

Areas of extractive mining activities with significant surface expression in the form of pits, service roads, and permanently installed processing machinery

---



2% (*280* Acres)

Wetland and Riparian Systems
Floodplain and Riparian

Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland

This ecological system is found throughout the Rocky Mountain and Colorado Plateau regions. In Montana, it ranges from approximately 945 to 2,042 meters (3,100 to 6,700 feet), characteristically occuring as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. It is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and on immediate streambanks. It can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. In some locations, occurrences extend into moderately high intermountain basins where the adjacent vegetation is sage steppe. Dominant trees may include boxelder maple (*Acer negundo*), narrowleaf cottonwood (*Populus angustifolia*), Plains cottonwood (*Populus deltoides*), Douglas-fir (*Pseudotsuga menziesii*), peachleaf willow (*Salix amygdaloides*), or Rocky Mountain juniper (*Juniperus scopulorum*). Dominant shrubs include Rocky Mountain maple (*Acer glabrum*), thinleaf alder (*Alnus incana*), river birch (*Betula occidentalis*), redoiser dogwood (*Cornus sericea*), hawthorne (*Crataegus spp*.), chokecherry (*Prunus virginiana*), skunkbush sumac (*Rhus trilobata*), Drummondâ€™s willow (*Salix drummondiana*), sandbar willow (*Salix exigua*), Pacific willow (*Salix lucida*), rose (*Rosa* species), silver buffaloberry (*Shepherdia argentea*), or snowberry (*Symphoricarpos* species). Exotic trees of Russian olive (*Elaeagnus angustifolia*) and saltcedar (*Tamarix* species) may invade some stands in southeastern and south-central Montana.

2% (*273* Acres)

Recently Disturbed or Modified
Introduced Vegetation

Introduced Upland Vegetation - Annual and Biennial Forbland

Land cover is significantly altered/disturbed by introduced annual and biennial forbs. Natural vegetation types are no longer recognizable. Typical species that dominate these areas are knapweed, oxeye daisy, Canada thistle, leafy spurge, pepperweed, and yellow sweetclover.

Additional Limited Land Cover

1% (*155 Acres*) High Intensity Residential

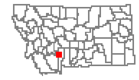
1% (*103 Acres*) Railroad

1% (*98 Acres*) Major Roads

<1% (*59 Acres*) Rocky Mountain Subalpine-Montane Mesic Meadow

<1% (*36 Acres*)	Alpine-Montane Wet Meadow
<1% (*28 Acres*)	Open Water
<1% (*4 Acres*)	Emergent Marsh
<1% (*0 Acres*)	Aspen Forest and Woodland

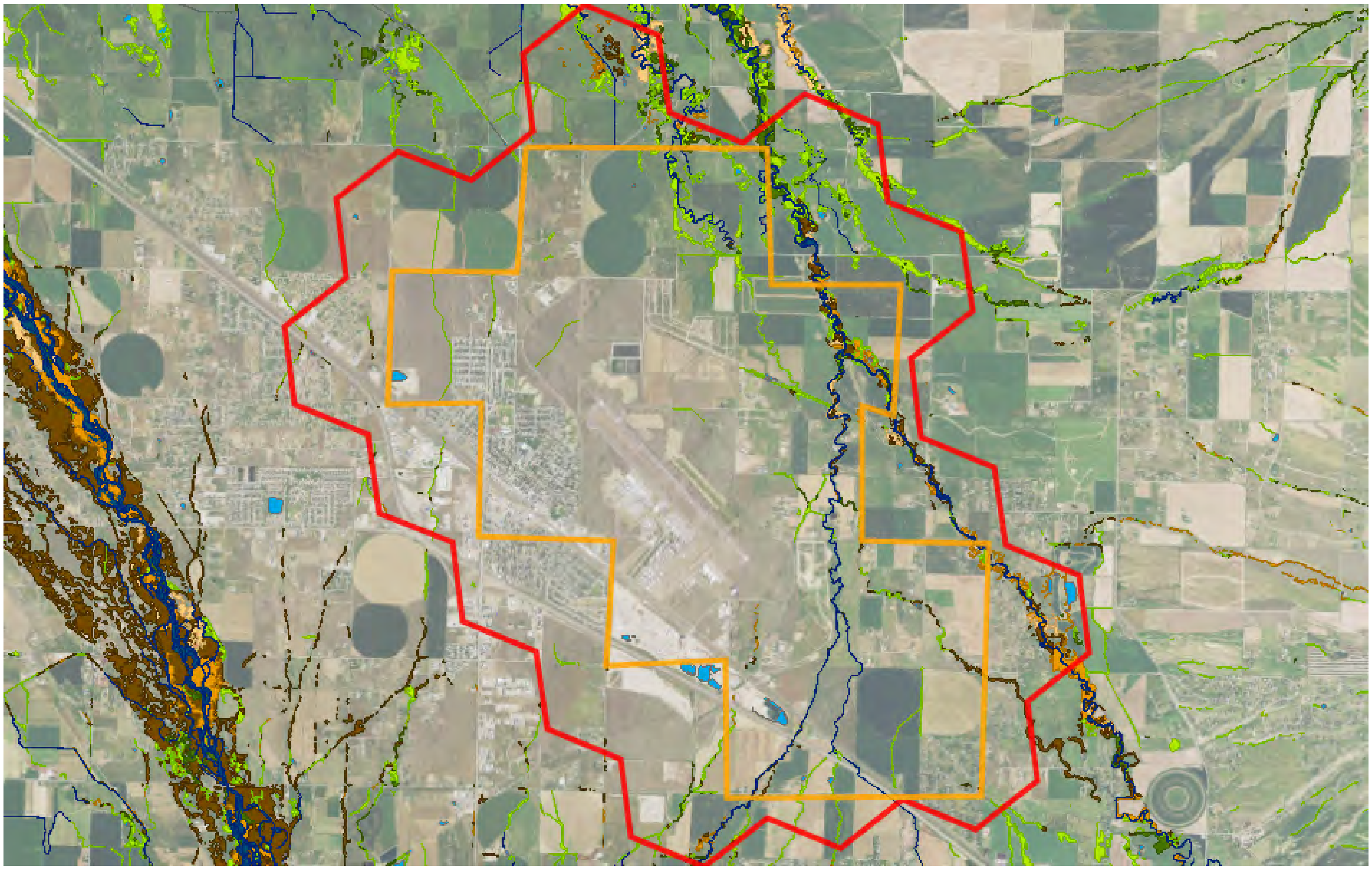
A program of the **Montana State Library's Natural Resource Information System**



Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Wetland and Riparian

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*



Wetland and Riparian Mapping

P - Palustrine

UB - Unconsolidated Bottom

F - Semipermanently Flooded	14 Acres	
x - Excavated	**14 Acres**	**PUBFx**
G - Intermittently Exposed	12 Acres	
x - Excavated	**12 Acres**	**PUBGx**

P - Palustrine, UB - Unconsolidated Bottom
Wetlands where mud, silt or similar fine particles cover at least 25% of the bottom, and where vegetation cover is less than 30%.

AB - Aquatic Bed

F - Semipermanently Flooded	20 Acres	
(no modifier)	**1 Acres**	**PABF**
h - Diked/Impounded	**2 Acres**	**PABFh**
x - Excavated	**17 Acres**	**PABFx**
G - Intermittently Exposed	7 Acres	
x - Excavated	**7 Acres**	**PABGx**

P - Palustrine, AB - Aquatic Bed
Wetlands with vegetation growing on or below the water surface for most of the growing season.

US - Unconsolidated Shore

C - Seasonally Flooded	2 Acres	
(no modifier)	**2 Acres**	**PUSC**
x - Excavated	**<1 Acres**	**PUSCx**

P - Palustrine, US - Unconsolidated Shore
Wetlands with less than 75% areal cover of stones, boulders, or bedrock. AND with less than 30% vegetative cover AND the wetland is irregularly exposed due to seasonal or irregular flooding and subsequent drying.

EM - Emergent

A - Temporarily Flooded	252 Acres	
(no modifier)	**227 Acres**	**PEMA**
x - Excavated	**25 Acres**	**PEMAx**
C - Seasonally Flooded	53 Acres	
(no modifier)	**37 Acres**	**PEMC**
x - Excavated	**16 Acres**	**PEMCx**
F - Semipermanently Flooded	<1 Acres	
x - Excavated	**<1 Acres**	**PEMFx**

P - Palustrine, EM - Emergent
Wetlands with erect, rooted herbaceous vegetation present during most of the growing season.

SS - Scrub-Shrub

P - Palustrine, SS - Scrub-Shrub
Wetlands dominated by woody vegetation less than 6 meters

(20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

A - Temporarily Flooded — 76 Acres

(no modifier)	**73 Acres**	**PSSA**
x - Excavated	**3 Acres**	**PSSAx**

C - Seasonally Flooded — 4 Acres

(no modifier)	**4 Acres**	**PSSC**
x - Excavated	**<1 Acres**	**PSSCx**

R - Riverine (Rivers)

2 - Lower Perennial

UB - Unconsolidated Bottom

G - Intermittently Exposed — 18 Acres

(no modifier)	**18 Acres**	**R2UBG**

R - Riverine (Rivers), 2 - Lower Perennial, UB - Unconsolidated Bottom
Stream channels where the substrate is at least 25% mud, silt or other fine particles.

3 - Upper Perennial

UB - Unconsolidated Bottom

G - Intermittently Exposed — 20 Acres

(no modifier)	**20 Acres**	**R3UBG**

H - Permanently Flooded — 38 Acres

(no modifier)	**38 Acres**	**R3UBH**

R - Riverine (Rivers), 3 - Upper Perennial, UB - Unconsolidated Bottom
Stream channels where the substrate is at least 25% mud, silt or other fine particles.

US - Unconsolidated Shore

A - Temporarily Flooded — 8 Acres

(no modifier)	**8 Acres**	**R3USA**

C - Seasonally Flooded — 4 Acres

(no modifier)	**4 Acres**	**R3USC**

R - Riverine (Rivers), 3 - Upper Perennial, US - Unconsolidated Shore
Shorelines with less than 75% areal cover of stones, boulders, or bedrock and less than 30% vegetation cover. The area is also irregularly exposed due to seasonal or irregular flooding and subsequent drying.

4 - Intermittent

SB - Stream Bed

C - Seasonally Flooded — 5 Acres

(no modifier)	**1 Acres**	**R4SBC**
x - Excavated	**4 Acres**	**R4SBCx**

R - Riverine (Rivers), 4 - Intermittent, SB - Stream Bed
Active channel that contains periodic water flow.

Rp - Riparian

1 - Lotic

SS - Scrub-Shrub

(no modifier)	**88 Acres**	**Rp1SS**

Rp - Riparian, 1 - Lotic, SS - Scrub-Shrub
This type of riparian area is dominated by woody vegetation that is less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.

FO - Forested

(no modifier)	**109 Acres**	**Rp1FO**

Rp - Riparian, 1 - Lotic, FO - Forested
This riparian class has woody vegetation that is greater than 6 meters (20 feet) tall.

EM - Emergent

(no modifier)	**55 Acres**	**Rp1EM**

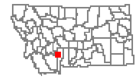
Rp - Riparian, 1 - Lotic, EM - Emergent
Riparian areas that have erect, rooted herbaceous vegetation during most of the growing season.

2 - Lentic

SS - Scrub-Shrub

(no modifier)	**1 Acres**	**Rp2SS**

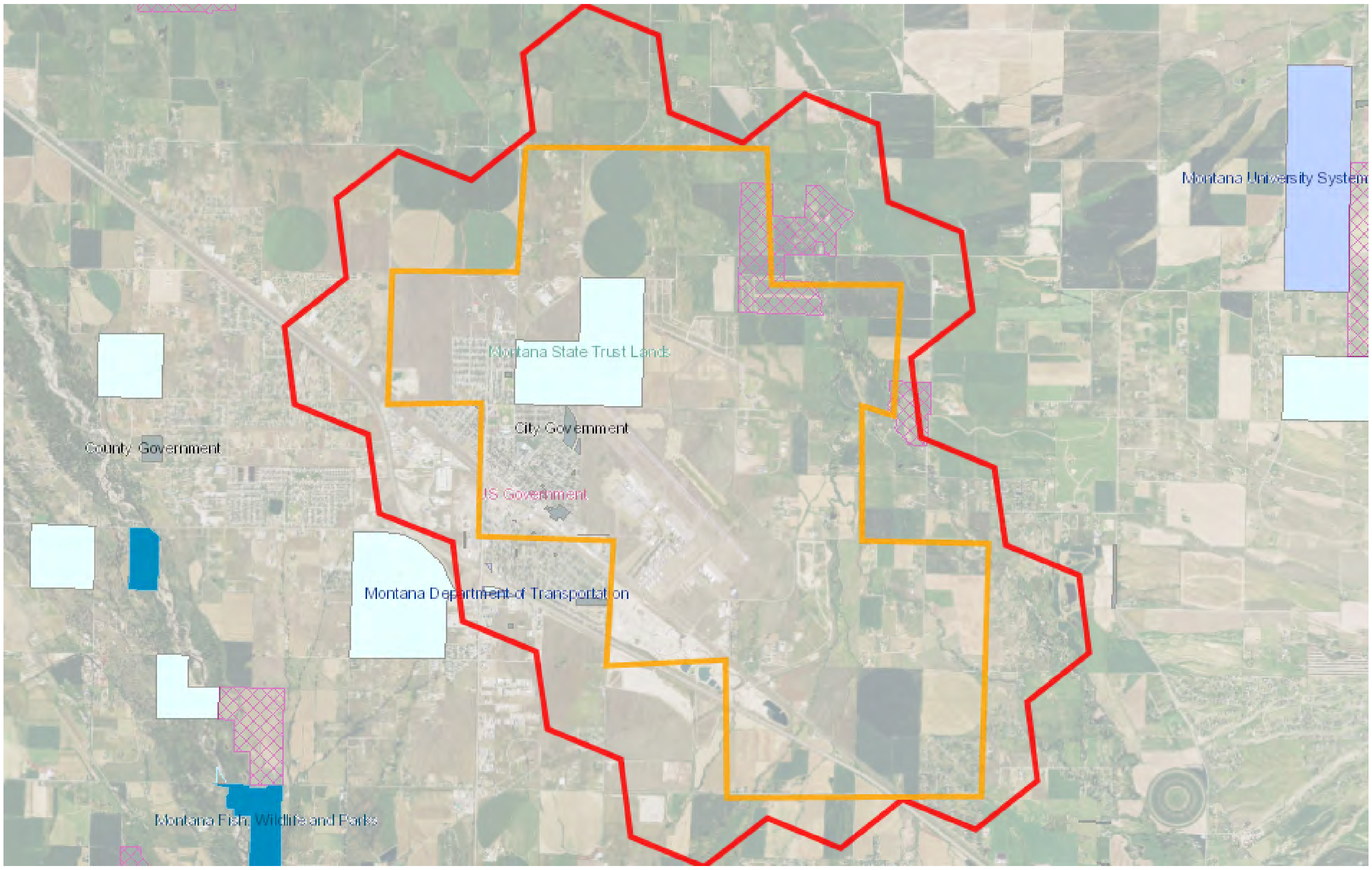
Rp - Riparian, 2 - Lentic, SS - Scrub-Shrub
This type of riparian area is dominated by woody vegetation that is less than 6 meters (20 feet) tall. Woody vegetation includes tree saplings and trees that are stunted due to environmental conditions.



Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Land Management

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*



Land Management Summary

	Ownership	Tribal	Easements	Other Boundaries (possible overlap)
Public Lands	**538 Acres (3%)**			
Federal	1 Acres (<1%)			
US Government	1 Acres (<1%)			
US Government Owned	1 Acres (<1%)			
State	497 Acres (3%)			
Montana State Trust Lands	491 Acres (3%)			
MT State Trust Owned	491 Acres (3%)			
Montana Department of Transportation	6 Acres (<1%)			
MTDOT Owned	6 Acres (<1%)			
Local	40 Acres (<1%)			
Local Government	40 Acres (<1%)			
Local Government Owned	40 Acres (<1%)			
Conservation Easements			**432 Acres (3%)**	
Private			432 Acres (3%)	
Montana Land Reliance			373 Acres (2%)	
Gallatin Valley Land Trust			59 Acres (<1%)	
Private Lands or Unknown Ownership	**15,018 Acres (94%)**			

Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Biological Reports

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*

Within the report area you have requested, citations for all reports and publications associated with plant or animal observations in Montana Natural Heritage Program (MTNHP) databases are listed and, where possible, links to the documents are included.

The MTNHP plans to include reports associated with terrestrial and aquatic communities in the future as allowed for by staff resources. If you know of reports or publications associated with species or biological communities within the report area that are not shown in this report, please let us know: mtnhp@mt.gov

- Greater Yellowstone Coordinating Committee. ***GYA Weed Mapping Update and Database Augmentation***. 2000-04.
- Hodgson, J.R. 1970. Ecological distribution of Microtus montanus and Microtus pennsylvanicus in an area of geographic sympatry in southwestern Montana. Ph.D. Dissertation. Bozeman, Montana: Montana State University. 65 p.

MONTANA STATE LIBRARY
NATURAL HERITAGE PROGRAM
A program of the **Montana State Library's Natural Resource Information System**

Legend

Model Icons: N Suitable (native range); O Optimal Suitability; M Moderate Suitability; L Low Suitability; I Suitable (introduced range)
Habitat Icons: C Common; O Occasional
Range Icons: N Non-native
Num Obs: Count of obs with 'good precision' (<=1000m); **+** indicates additional 'poor precision' obs (1001m-10,000m)

Latitude	Longitude
45.73445	-111.08835
45.83431	-111.21614

Invasive and Pest Species

Summarized by: **24PRVT0210 - Bozeman Airport** *(Custom Area of Interest)*

	# Obs	Predicted Model	Range

Aquatic Invasive Species

V - Iris pseudacorus *(Yellowflag Iris)* N2A/AIS — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: M 52% Moderate (inductive), L 48% Low (inductive)

V - Potamogeton crispus *(Curly-leaf Pondweed)* N2B/AIS — # Obs: 1 — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2B - Aquatic Invasive Species - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: L 60% Low (inductive)

V - Nymphaea odorata *(American Water-lily)* AIS — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Aquatic Invasive Species - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: I 48% Suitable (introduced range) (deductive)

I - Faxonius virilis *(Virile Crayfish)* AIS — # Obs: 2 — Predicted Model: Not Assessed — Range: N

View in Field Guide | View Range Maps
Aquatic Invasive Species - Native/Non-native Species - (depends on location or taxa) — Global: **G5** State: **S5**

Noxious Weeds: Priority 1A

V - Isatis tinctoria *(Dyer's Woad)* N1A — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: O 64% Optimal (inductive), M 32% Moderate (inductive), L 4% Low (inductive)

V - Centaurea solstitialis *(Yellow Starthistle)* N1A — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: O 52% Optimal (inductive), M 36% Moderate (inductive), L 12% Low (inductive)

V - Taeniatherum caput-medusae *(Medusahead)* N1A — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1A - Non-native Species — Global: **G4G5** State: **SNA**
Predicted Models: L 60% Low (inductive)

Noxious Weeds: Priority 1B

V - Lythrum salicaria *(Purple Loosestrife)* N1B — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **G5** State: **SNA**
Predicted Models: O 16% Optimal (inductive), M 56% Moderate (inductive), L 28% Low (inductive)

V - Polygonum cuspidatum *(Japanese Knotweed)* N1B — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNRTNR** State: **SNA**
Predicted Models: O 8% Optimal (inductive), M 32% Moderate (inductive), L 36% Low (inductive)

V - Polygonum x bohemicum *(Bohemian Knotweed)* N1B — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNA** State: **SNA**
Predicted Models: M 4% Moderate (inductive), L 12% Low (inductive)

V - Echium vulgare *(Blueweed)* N1B — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 84% Low (inductive)

V - Cytisus scoparius *(Scotch Broom)* N1B — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 1B - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: L 32% Low (inductive)

Noxious Weeds: Priority 2A

V - Rhamnus cathartica *(Common Buckthorn)* N2A — Range: N

View in Field Guide | View Predicted Models | View Range Maps
Noxious Weed: Priority 2A - Non-native Species — Global: **GNR** State: **SNA**
Predicted Models: O 24% Optimal (inductive), M 48% Moderate (inductive), L 24% Low (inductive)

V - **Ventenata dubia** *(Ventenata)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: O 8% Optimal (inductive), M 92% Moderate (inductive)

V - **Iris pseudacorus** *(Yellowflag Iris)* N2A/AIS

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Aquatic Invasive Species - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 52% Moderate (inductive), L 48% Low (inductive)

V - **Ranunculus acris** *(Tall Buttercup)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **G5** State: **SNA**
Predicted Models: M 36% Moderate (inductive), L 64% Low (inductive)

V - **Lepidium latifolium** *(Perennial Pepperweed)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 4% Moderate (inductive), L 84% Low (inductive)

V - **Hieracium aurantiacum** *(Orange Hawkweed)* N2A

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2A - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: L 60% Low (inductive)

Noxious Weeds: Priority 2B

V - **Lepidium draba** *(Whitetop)* N2B 32

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: O 56% Optimal (inductive), M 44% Moderate (inductive)

V - **Berteroa incana** *(Hoary False-alyssum)* N2B 5

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: O 12% Optimal (inductive), M 48% Moderate (inductive), L 40% Low (inductive)

V - **Centaurea diffusa** *(Diffuse Knapweed)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: O 4% Optimal (inductive), M 84% Moderate (inductive), L 12% Low (inductive)

V - **Linaria dalmatica** *(Dalmatian Toadflax)* N2B 1

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**
Predicted Models: O 4% Optimal (inductive), M 60% Moderate (inductive), L 36% Low (inductive)

V - **Convolvulus arvensis** *(Field Bindweed)* N2B 12

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: O 4% Optimal (inductive), M 56% Moderate (inductive), L 40% Low (inductive)

V - **Cynoglossum officinale** *(Common Hound's-tongue)* N2B 6

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 96% Moderate (inductive), L 4% Low (inductive)

V - **Centaurea stoebe** *(Spotted Knapweed)* N2B 71

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 88% Moderate (inductive), L 12% Low (inductive)

V - **Tanacetum vulgare** *(Common Tansy)* N2B 5

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 48% Moderate (inductive), L 52% Low (inductive)

V - **Cirsium arvense** *(Canada Thistle)* N2B 26

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **G5** State: **SNA**
Predicted Models: M 44% Moderate (inductive), L 56% Low (inductive)

V - **Euphorbia virgata** *(Leafy Spurge)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 44% Moderate (inductive), L 56% Low (inductive)

V - **Linaria vulgaris** *(Yellow Toadflax)* N2B

View in Field Guide View Predicted Models View Range Maps
Noxious Weed: Priority 2B - Non-native Species Global: **GNR** State: **SNA**
Predicted Models: M 32% Moderate (inductive), L 68% Low (inductive)

V - Acroptilon repens *(Russian Knapweed)* N2B

View in Field Guide   View Predicted Models   View Range Maps
Noxious Weed: Priority 2B - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 96% Low (inductive)

V - Leucanthemum vulgare *(Oxeye Daisy)* N2B

View in Field Guide   View Predicted Models   View Range Maps
Noxious Weed: Priority 2B - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 96% Low (inductive)

V - Potentilla recta *(Sulphur Cinquefoil)* N2B

View in Field Guide   View Predicted Models   View Range Maps
Noxious Weed: Priority 2B - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 88% Low (inductive)

V - Tamarix ramosissima *(Salt Cedar)* N2B

View in Field Guide   View Predicted Models   View Range Maps
Noxious Weed: Priority 2B - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 80% Low (inductive)

V - Potamogeton crispus *(Curly-leaf Pondweed)* N2B/AIS   1

View in Field Guide   View Predicted Models   View Range Maps
Noxious Weed: Priority 2B - Aquatic Invasive Species - Non-native Species   Global: **G5**   State: **SNA**
Predicted Models: L 60% Low (inductive)

Regulated Weeds: Priority 3

V - Bromus tectorum *(Cheatgrass)* R3   1

View in Field Guide   View Predicted Models   View Range Maps
Regulated Weed: Priority 3 - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: M 68% Moderate (inductive), L 32% Low (inductive)

V - Elaeagnus angustifolia *(Russian Olive)* R3

View in Field Guide   View Predicted Models   View Range Maps
Regulated Weed: Priority 3 - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 56% Low (inductive)

Biocontrol Species

I - Mecinus janthinus *(Yellow Toadflax Stem-boring Weevil)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: O 56% Optimal (inductive), M 12% Moderate (inductive), L 4% Low (inductive)

I - Aphthona lacertosa *(Brown-legged Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: M 68% Moderate (inductive), L 24% Low (inductive)

I - Mecinus janthiniformis *(Dalmatian Toadflax Stem-boring Weevil)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: M 60% Moderate (inductive), L 40% Low (inductive)

I - Oberea erythrocephala *(Red-headed Leafy Spurge Stem Borer)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: M 52% Moderate (inductive), L 32% Low (inductive)

I - Aphthona nigriscutis *(Black Dot Leafy Spurge Flea Beetle)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: M 20% Moderate (inductive), L 28% Low (inductive)

I - Cyphocleonus achates *(Knapweed Root Weevil)* BIOCNTRL

View in Field Guide   View Predicted Models   View Range Maps
Biocontrol Species - Non-native Species   Global: **GNR**   State: **SNA**
Predicted Models: L 44% Low (inductive)

I - Hyles euphorbiae *(Spurge Hawkmoth)* BIOCNTRL   1   Not Assessed

View in Field Guide   View Range Maps
Biocontrol Species - Non-native Species   Global: **G5**   State: **SNA**

Introduction to Montana Natural Heritage Program

MONTANA STATE LIBRARY
NATURAL HERITAGE PROGRAM

PO Box 201800 • 1201 11th Avenue • Helena, MT 59620-1800 • fax 406.444.0266 • phone 406.444.3989 • mtnhp.org

Introduction

The Montana Natural Heritage Program (MTNHP) is Montana's source for reliable and objective information on Montana's native species and habitats, emphasizing those of conservation concern. MTNHP was created by the Montana legislature in 1983 as part of the Natural Resource Information System (NRIS) at the Montana State Library (MSL). MTNHP is "a program of information acquisition, storage, and retrieval for data relating to the flora, fauna, and biological community types of Montana" (MCA 90-15-102). MTNHP's activities are guided by statute as well as through ongoing interaction with, and feedback from, principal data source agencies such as Montana Fish, Wildlife, and Parks, the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation, the Montana University System, the US Forest Service, and the US Bureau of Land Management. Since the first staff was hired in 1985, the Program has logged a long record of success, and developed into a highly respected, service-oriented program. MTNHP is widely recognized as one of the most advanced and effective of over 60 natural heritage programs that are distributed across North America.

Vision

Our vision is that public agencies, the private sector, the education sector, and the general public will trust and rely upon MTNHP as the source for information and expertise on Montana's species and habitats, especially those of conservation concern. We strive to provide easy access to our information to allow users to save time and money, speed environmental reviews, and make informed decisions.

Core Values

- We endeavor to be a single statewide source of accurate and up-to-date information on Montana's plants, animals, and aquatic and terrestrial biological communities.
- We actively listen to our data users and work responsively to meet their information and training needs.
- We strive to provide neutral, trusted, timely, and equitable service to all of our information users.
- We make every effort to be transparent to our data users in setting work priorities and providing data products.

Confidentiality

All information requests made to the Montana Natural Heritage Program are considered library records and are protected from disclosure by the Montana Library Records Confidentiality Act (MCA 22-1-11).

Information Managed

Information managed at the Montana Natural Heritage Program is botanical, zoological, and ecological information that describes the distribution (e.g., observations, structured surveys, range polygons, predicted habitat suitability models), conservation status (e.g., global and state conservation status ranks, including threats), and other supporting information (e.g., accounts and references) on the biology and ecology of species and biological communities.

Data Use Terms and Conditions

- Montana Natural Heritage Program (MTNHP) products and services are based on biological data and the objective interpretation of those data by professional scientists. MTNHP does not advocate any particular philosophy of natural resource protection, management, development, or public policy.
- MTNHP has no natural resource management or regulatory authority. Products, statements, and services from MTNHP are intended to inform parties as to the state of scientific knowledge about certain natural resources, and to further develop that knowledge. The information is not intended as natural resource management guidelines or prescriptions or a determination of environmental impacts. MTNHP recommends consultation with appropriate state, federal, and tribal resource management agencies and authorities in the area where your project is located.
- Information on the status and spatial distribution of biological resources produced by MTNHP are intended to inform parties of the state-wide status, known occurrence, or the likelihood of the presence of those resources. **These products are not intended to substitute for field-collected data, nor are they intended to be the sole basis for natural resource management decisions.**
- MTNHP does not portray its data as exhaustive or comprehensive inventories of rare species or biological communities. **Field verification of the absence or presence of sensitive species and biological communities will always be an important obligation of users of our data.**
- MTNHP responds equally to all requests for products and services, regardless of the purpose or identity of the requester.
- Because MTNHP constantly updates and revises its databases with new data and information, products will become outdated over time. Interested parties are encouraged to obtain the most current information possible from MTNHP, rather than using older products. We add, review, update, and delete records on a daily basis. Consequently, we strongly advise that you update your MTNHP data sets at a minimum of every four months for most applications of our information.
- MTNHP data require a certain degree of biological expertise for proper analysis, interpretation, and application. Our staff is available to advise you on questions regarding the interpretation or appropriate use of the data that we provide. See Contact Information for MTNHP Staff
- The information provided to you by MTNHP may include sensitive data that if publicly released might jeopardize the welfare of threatened, endangered, or sensitive species or biological communities. This information is intended for distribution or use only within your department, agency, or business. Subcontractors may have access to the data during the course of any given project, but should not be given a copy for their use on subsequent, unrelated work.
- MTNHP data are made freely available. Duplication of hard-copy or digital MTNHP products with the intent to sell is prohibited without written consent by MTNHP. Should you be asked by individuals outside your organization for the type of data that we provide, please refer them to MTNHP.
- MTNHP and appropriate staff members should be appropriately acknowledged as an information source in any third-party product involving MTNHP data, reports, papers, publications, or in maps that incorporate MTNHP graphic elements.
- Sources of our data include museum specimens, published and unpublished scientific literature, field surveys by state and federal agencies and private contractors, and reports from knowledgeable individuals. MTNHP actively solicits and encourages additions, corrections and updates, new observations or collections, and comments on any of the data we provide.
- MTNHP staff and contractors do not enter or cross privately-owned lands without express permission from the landowner. However, the program cannot guarantee that information provided to us by others was obtained under adherence to this policy.

Suggested Contacts for Natural Resource Management Agencies

As required by Montana statute (MCA 90-15), the Montana Natural Heritage Program works with state, federal, tribal, nongovernmental organizations, and private partners to ensure that the latest animal and plant distribution and status information is incorporated into our databases so that it can be used to inform a variety of permitting and planning processes and management decisions. We encourage you to contact state, federal, and tribal resource management agencies in the area where your project is located and review the permitting overviews by the Montana Department of Environmental Quality, the Montana Department of Natural Resources and Conservation and the Index of Environmental Permits for Montana for guidelines relevant to your efforts. In particular, we encourage you to contact the Montana Department of Fish, Wildlife, and Parks for the latest data and management information regarding hunted and high-profile management species and to use the U.S. Fish and Wildlife Service's Information Planning and Consultation (IPAC) website regarding U.S. Endangered Species Act listed Threatened, Endangered, or Candidate species.

For your convenience, we have compiled a list of relevant agency contacts and links below:

Montana Fish, Wildlife, and Parks

Fish Species	Zachary Shattuck zshattuck@mt.gov (406) 444-1231 or Eric Roberts eroberts@mt.gov (406) 444-5334
American Bison Black-footed Ferret Black-tailed Prairie Dog Bald Eagle Golden Eagle Common Loon Least Tern Piping Plover Whooping Crane	Kristina Smucker KSmucker@mt.gov (406) 444-5209
Grizzly Bear Greater Sage Grouse Trumpeter Swan Big Game Upland Game Birds Furbearers	Brian Wakeling brian.wakeling@mt.gov (406) 444-3940
Managed Terrestrial Game Data	Adam Messer – MFWP GIS Coordinator amesser@mt.gov (406) 444-0095
Fisheries Data and Nongame Animal Data	Adam Messer – MFWP GIS Coordinator amesser@mt.gov (406) 444-0095
Wildlife and Fisheries Scientific Collector's Permits	https://fwp.mt.gov/buyandapply/commercialwildlifeandscientificpermits/scientific Kristina Smucker for Wildlife ksmucker@mt.gov (406) 444-5209 Dave Schmetterling for Fisheries dschmetterling@mt.gov (406) 542-5514
Fish and Wildlife Recommendations for Subdivision Development	Stevie Burton stevie.burton@mt.gov (406) 594-7354 See https://fwp.mt.gov/conservation/living-with-wildlife/subdivision-recommendations
Regional Contacts 	Region 1 (Kalispell) (406) 752-5501 fwprg12@mt.gov Region 2 (Missoula) (406) 542-5500 fwprg22@mt.gov Region 3 (Bozeman) (406) 577-7900 fwprg3@mt.gov Region 4 (Great Falls) (406) 454-5840 fwprg42@mt.gov Region 5 (Billings) (406) 247-2940 fwprg52@mt.gov Region 6 (Glasgow) (406) 228-3700 fwprg62@mt.gov Region 7 (Miles City) (406) 234-0900 fwprg72@mt.gov

Montana Department of Agriculture
General Contact Information: https://agr.mt.gov/About/Office-Locations/Office-Locations-and-Field-Offices
Noxious Weeds: https://agr.mt.gov/Noxious-Weeds

Montana Department of Environmental Quality
Permitting and Operator Assistance for all Environmental Permits: https://deq.mt.gov/Permitting

Montana Department of Natural Resources and Conservation
Overview of, and contacts for, licenses and permits for state lands, water, and forested lands:
https://dnrc.mt.gov/Permits-Services

Stream Permitting (310 permits) and an overview of various water and stream related permits (e.g., Stream Protection Act 124, Federal Clean Water Act 404, Federal Rivers and Harbors Act Section 10, Short-term Water Quality Standard for Turbidity 318 Authorization, etc.).
https://dnrc.mt.gov/Licenses-and-Permits/Stream-Permitting

Wildfire Resources: https://dnrc.mt.gov/Forestry/Wildfire

Bureau of Land Management

Montana Field Office Contacts:

Billings	(406) 896-5013
Butte	(406) 533-7600
Dillon	(406) 683-8000
Glasgow	(406) 228-3750
Havre	(406) 262-2820
Lewistown	(406) 538-1900
Malta	(406) 654-5100
Miles City	(406) 233-2800
Missoula	(406) 329-3914

United States Army Corps of Engineers
Montana Regulatory Office for federal permits related to construction in water and wetlands
https://www.nwo.usace.army.mil/Missions/Regulatory-Program/Montana/ (406) 441-1375

United States Environmental Protection Agency
Environmental information, notices, permitting, and contacts https://www.epa.gov/mt
Gateway to state resource locators https://www.envcap.org/srl/index.php

United States Fish and Wildlife Service
Information Planning and Conservation (IPAC) website: https://ipac.ecosphere.fws.gov
Montana Ecological Services Field Office: https://www.fws.gov/office/montana-ecological-services (406) 449-5225

United States Forest Service

Regional Office – Missoula, Montana Contacts			
Wildlife Program Leader	Tammy Fletcher	tammy.fletcher2@usda.gov	(406) 329-3086
Wildlife Ecologist	Cara Staab	cara.staab@usda.gov	(406) 329-3677
Aquatic Ecologist	Justin Jimenez	justin.jimenez@usda.gov	(435) 370-6830
TES Program	Lydia Allen	lydia.allen@usda.gov	(406) 329-3558
Interagency Grizzly Bear Coordinator	Scott Jackson	scott.jackson@usda.gov	(406) 329-3664
Regional Botanist	Amanda Hendrix	amanda.hendrix@usda.gov	(651) 447-3016
Regional Vegetation Ecologist	Mary Manning	marry.manning@usda.gov	(406) 329-3304
Invasive Species Program Manager	Michelle Cox	michelle.cox2@usda.gov	(406) 329-3669

Tribal Nations

[Assiniboine & Gros Ventre Tribes – Fort Belknap Reservation]
[Assiniboine & Sioux Tribes – Fort Peck Reservation]
[Blackfeet Tribe - Blackfeet Reservation]
[Chippewa Creek Tribe - Rocky Boy's Reservation]
[Crow Tribe – Crow Reservation]
[Little Shell Chippewa Tribe]
[Northern Cheyenne Tribe – Northern Cheyenne Reservation]
[Salish & Kootenai Tribes - Flathead Reservation]

Natural Heritage Programs and Conservation Data Centers in Surrounding States and Provinces
Alberta Conservation Information Management System
British Columbia Conservation Data Centre
Idaho Natural Heritage Program
North Dakota Natural Heritage Program
Saskatchewan Conservation Data Centre
South Dakota Natural Heritage Program
Wyoming Natural Diversity Database

Invasive Species Management Contacts and Information

Aquatic Invasive Species
Montana Fish, Wildlife, and Parks Aquatic Invasive Species staff
Montana Department of Natural Resources and Conservation's Aquatic Invasive Species Grant Program
Montana Invasive Species Council (MISC)
Western Montana Conservation Commission

Noxious Weeds
Montana Weed Control Association Contacts Webpage
Montana Biological Weed Control Coordination Project
Montana Department of Agriculture - Noxious Weeds
Montana Weed Control Association
Montana Fish, Wildlife, and Parks - Noxious Weeds
Montana State University Integrated Pest Management Extension
Integrated Noxious Weed Management after Wildfires
Fire Management and Invasive Plants

Introduction to Native Species

Within the report area you have requested, separate summaries are provided for: (1) Species Occurrences (SO) for plant and animal Species of Concern, Special Status Species (SSS), Important Animal Habitat (IAH) and some Potential Plant Species of Concern; (2) other observed non Species of Concern or Species of Concern without suitable documentation to create Species Occurrence polygons; and (3) other non-documented species that are potentially present based on their range, predicted suitable habitat model output, or presence of associated habitats. Each of these summaries provides the following information when present for a species: (1) the number of Species Occurrences and associated delineation criteria for construction of these polygons that have long been used for considerations of documented Species of Concern in environmental reviews; (2) the number of observations of each species; (3) the geographic range polygons for each species that the report area overlaps; (4) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (5) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (6) a variety of conservation status ranks and links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers below or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document native and introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are restricted by budgets, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species and biological communities will always be an important obligation of users of our data.**

If you are aware of observation datasets that the MTNHP is missing, please report them to the Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov If you have animal or plant observations that you would like to contribute, you can also submit them via Excel spreadsheets, geodatabases, iNaturalist, or a Survey123 form. Various methods of data submission are reviewed in this playlist of videos: https://www.youtube.com/playlist?list=PLRaydtZpHu2qOHPoSPq9cnM9uXGmEXACx

Observations

The MTNHP manages information on several million animal and plant observations that have been reported by professional biologists and private citizens from across Montana. The majority of these observations are submitted in digital format from standardized databases associated with research or monitoring efforts and spreadsheets of incidental observations submitted by professional biologists and amateur naturalists. At a minimum, accepted observation records must contain a credible species identification (i.e. appropriate geographic range, date, and habitat and, if species are difficult to identify, a photograph and/or notes on key identifying features), a date or date range, observer name, locational information (ideally with latitude and longitude in decimal degrees), notes on numbers observed, and species behavior or habitat use (e.g., is the observation likely associated with reproduction). Bird records are also required to have information associated with date-appropriate breeding or overwintering status of the species observed. MTNHP reviews observation records to ensure that they are mapped correctly, occur within date ranges when the species is known to be present or detectable, occur within the known seasonal geographic range of the species, and occur in appropriate habitats. MTNHP also assigns each record a locational uncertainty value in meters to indicate the spatial precision associated with the record's mapped coordinates. Only records with locational uncertainty values of 10,000 meters or less are included in environmental summary reports and number summaries are only provided for records with locational uncertainty values of 1,000 meters or less.

Species Occurrences

The MTNHP evaluates plant and animal observation records for species of higher conservation concern to determine whether they are worthy of inclusion in the Species Occurrence (SO) layer for use in environmental reviews; observations not worthy of inclusion in this layer include long distance dispersal events, migrants observed away from key migratory stopover habitats, and winter observations. An SO is a polygon depicting what is known about a species occupancy from direct observation with a defined level of locational uncertainty and any inference that can be made about adjacent habitat use from the latest peer-reviewed science. If an observation can be associated with a map feature that can be tracked (e.g., a wetland boundary for a wetland associated plant) then this polygon feature is used to represent the SO. Areas that can be inferred as probable occupied habitat based on direct observation of a species location and what is known about the foraging area or home range size of the species may be incorporated into the SO. Species Occurrences generally belong to one of the following categories:

Plant Species Occurrences

A documented location of a specimen collection or observed plant population. In some instances, adjacent, spatially separated clusters are considered subpopulations and are grouped as one occurrence (e.g., the subpopulations occur in ecologically similar habitats, and their spatial proximity likely allows them to interbreed). Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Plant SO's are only created for Species of Concern and Potential Species of Concern.

Animal Species Occurrences

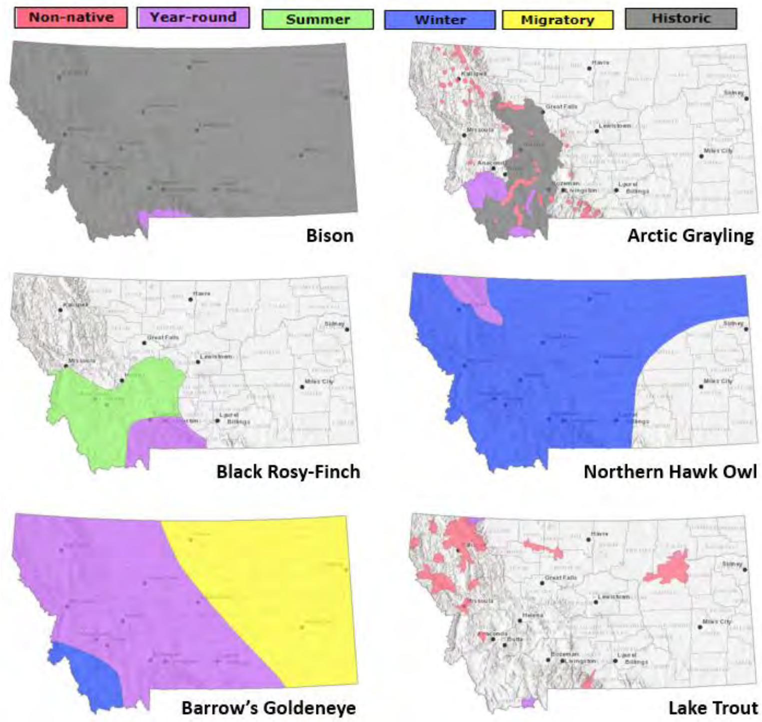
The location of a verified observation or specimen record typically known or assumed to represent a breeding population or a portion of a breeding population. Animal SO's are generally: (1) buffers of terrestrial point observations based on documented species' home range sizes; (2) buffers of stream segments to encompass occupied streams and immediate adjacent riparian habitats; (3) polygonal features encompassing known or likely breeding populations (e.g., a wetland for some amphibians or a forested portion of a mountain range for some wide-ranging carnivores); or (4) combinations of the above. Tabular information for multiple observations at the same SO location is generally linked to a single polygon. Species Occurrence polygons may encompass some unsuitable habitat in some instances in order to avoid heavy data processing associated with clipping out habitats that are readily assessed as unsuitable by the data user (e.g., a point buffer of a terrestrial species may overlap into a portion of a lake that is obviously inappropriate habitat for the species). Animal SO's are only created for Species of Concern and Special Status Species (e.g., Bald Eagle).

Other Occurrence Polygons

These include significant biological features not included in the above categories, such as Important Animal Habitats like bird rookeries and bat roosts, and peatlands or other wetland and riparian communities that support diverse plant and animal communities.

Geographic Range Polygons

Geographic range polygons are still under development for most plant and invertebrate species. Native year-round, summer, winter, migratory and historic geographic range polygons as well as polygons for introduced populations have been defined for most vertebrate animal species for which there are enough observations, surveys, and knowledge of appropriate seasonal habitat use to define them (see examples to left). These native or introduced range polygons bound the extent of known or likely occupied habitats for non-migratory and relative sedentary species and the regular extent of known or likely occupied habitats for migratory and long-distance dispersing species; polygons may include unsuitable intervening habitats. For most species, a single polygon can represent the year-round or seasonal range, but breeding ranges of some colonial nesting water birds and some introduced species are represented more patchily when supported by data. Some ranges are mapped more broadly than actual distributions in order to be visible on statewide maps (e.g., fish).



Predicted Suitable Habitat Models

Predicted habitat suitability models have been created for plant and animal Species of Concern and are undergoing development for non-Species of Concern. For species for which models have been completed, the environmental summary report includes simple rule-based associations with streams for aquatic species and seasonal habitats for game species as well as mathematically complex Maximum Entropy models (Phillips et al. 2006, Ecological Modeling 190:231-259) constructed from a variety of statewide biotic and abiotic layers and presence only data for individual species for most terrestrial species. For the Maximum Entropy models, we reclassified 90 x 90-meter continuous model output into suitability classes (unsuitable, low, moderate, and optimal) then aggregated that into the one square mile hexagons used in the environmental summary report; this is the finest spatial scale we suggest using this information in management decisions and survey planning. Full model write ups for individual species that discuss model goals, inputs, outputs, and evaluation in much greater detail are posted on the MTNHP's Predicted Suitable Habitat Models webpage. Evaluations of predictive accuracy and specific limitations are included with the metadata for models of individual species. **Model outputs should not be used in place of on-the-ground surveys for species. Instead model outputs should be used in conjunction with habitat evaluations to determine the need for on-the-ground surveys for species.** We suggest that the percentage of predicted optimal and moderate suitable habitat within the report area be used in conjunction with geographic range polygons and the percentage of commonly associated habitats to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning.

Associated Habitats

Within the boundary of the intersected hexagons, we provide the approximate percentage of commonly or occasionally associated habitat for vertebrate animal species that regularly breed, overwinter, or migrate through the state; a detailed list of commonly and occasionally associated habitats is provided in individual species accounts in the Montana Field Guide We assigned common or occasional use of each of the ecological systems mapped in Montana by: (1) using personal knowledge and reviewing literature that summarizes the breeding, overwintering, or migratory habitat requirements of each species; (2) evaluating structural characteristics and distribution of each ecological system relative to the species' range and habitat requirements; (3) examining the observation records for each species in the state-wide point observation database associated with each ecological system; and (4) calculating the percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system to get a measure of numbers of observations versus availability of habitat. Species that breed in Montana were only evaluated for breeding habitat use, species that only overwinter in Montana were only evaluated for overwintering habitat use, and species that only migrate through Montana were only evaluated for migratory habitat use. In general, species were listed as associated with an ecological system if structural characteristics of used habitat documented in the literature were present in the ecological system or large numbers of point observations were associated with the ecological system. However, species were not listed as associated with an ecological system if there was no support in the literature for use of structural characteristics in an ecological system, even if point observations were associated with that system. Common versus occasional association with an ecological system was assigned based on the degree to which the structural characteristics of an ecological system matched the preferred structural habitat characteristics for each species as represented in the scientific literature. The percentage of observations associated with each ecological system relative to the percent of Montana covered by each ecological system was also used to guide assignment of common versus occasional association.

We suggest that the percentage of commonly associated habitat within the report area be used in conjunction with geographic range polygons and the percentage of predicted optimal and moderate suitable habitat from predictive models to generate lists of potential species that may occupy broader landscapes for the purposes of landscape-level planning. Users of this information should be aware that land cover mapping accuracy is particularly problematic when the systems occur as small patches or where the land cover types have been altered over the past decade. Thus, particular caution should be used when using the associations in assessments of smaller areas (e.g., evaluations of public land survey sections).

Introduction to Land Cover

Land Use/Land Cover is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The layer records all Montana natural vegetation, land cover and land use, classified from satellite and aerial imagery, mapped at a scale of 1:100,000, and interpreted with supporting ground-level data. The baseline map is adapted from the Northwest ReGAP (NWGAP) project land cover classification, which used 30m resolution multi-spectral Landsat imagery acquired between 1999 and 2001. Vegetation classes were drawn from the Ecological System Classification developed by NatureServe (Comer et al. 2003). The land cover classes were developed by Anderson et al. (1976). The NWGAP effort encompasses 12 map zones. Montana overlaps seven of these zones. The two NWGAP teams responsible for the initial land cover mapping effort in Montana were Sanborn and NWGAP at the University of Idaho. Both Sanborn and NWGAP employed a similar modeling approach in which Classification and Regression Tree (CART) models were applied to Landsat ETM+ scenes. The Spatial Analysis Lab within the Montana Natural Heritage Program was responsible for developing a seamless Montana land cover map with a consistent statewide legend from these two separate products. Additionally, the Montana land cover layer incorporates several other land cover and land use products (e.g., MSDI Structures and Transportation themes and the Montana Department of Revenue Final Land Unit classification) and reclassifications based on plot-level data and the latest NAIP imagery to improve accuracy and enhance the usability of the theme. Updates are done as partner support and funding allow, or when other MSDI datasets can be incorporated. Recent updates include fire perimeters and agricultural land use (annually), energy developments such as wind, oil and gas installations (2014), roads, structures and other impervious surfaces (various years): and local updates/improvements to specific ecological systems (e.g., central Montana grassland and sagebrush ecosystems). Current and previous versions of the Land Use/Land Cover layer with full metadata are available for download from the Montana State Library's GIS Data List More information on the land cover layer is available at: https://msl.mt.gov/geoinfo/msdi/land_use_land_cover/

Within the report area you have requested, land cover is summarized by acres of Level 1, Level 2, and Level 3 Ecological Systems.

Literature Cited

Anderson, J.R. E.E. Hardy, J.T. Roach, and R.E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. U.S. Geological Survey Professional Paper 964.

Comer, P., D. Faber-Langendoen, R. Evans, S. Gawler, C. Josse, G. Kittel, S. Menard, M. Pyne, M. Reid, K. Schulz, K. Snow, and J. Teague. 2003. Ecological systems of the United States: A working classification of U.S. terrestrial systems. NatureServe, Arlington, VA.

Introduction to Wetland and Riparian

Within the report area you have requested, wetland and riparian mapping is summarized by acres of each classification present. Summaries are only provided for modern MTNHP wetland and riparian mapping and not for outdated (NWI Legacy) or incomplete (NWI Scalable) mapping efforts; described here. MTNHP has made all three of these datasets and associated metadata available for separate download on the Montana Wetland and Riparian Framework web page.

Wetland and Riparian mapping is one of 15 Montana Spatial Data Infrastructure framework layers considered vital for making statewide maps of Montana and understanding its geography. The wetland and riparian framework layer consists of spatial data representing the extent, type, and approximate location of wetlands, riparian areas, and deep water habitats in Montana.

Wetland and riparian mapping is completed through photointerpretation of 1-m resolution color infrared aerial imagery acquired from 2005 or later. A coding convention using letters and numbers is assigned to each mapped wetland. These letters and numbers describe the broad landscape context of the wetland, its vegetation type, its water regime, and the kind of alterations that may have occurred. Ancillary data layers such as topographic maps, digital elevation models, soils data, and other aerial imagery sources are also used to improve mapping accuracy. Wetland mapping follows the federal Wetland Mapping Standard and classifies wetlands according to the Cowardin classification system of the National Wetlands Inventory (NWI) (Cowardin et al. 1979, FGDC Wetlands Subcommittee 2013). Federal, State, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands differently than the NWI. Similar coding, based on U.S. Fish and Wildlife Service conventions, is applied to riparian areas (U.S. Fish and Wildlife Service 2009). These are mapped areas where vegetation composition and growth is influenced by nearby water bodies, but where soils, plant communities, and hydrology do not display true wetland characteristics. **These data are intended for use at a scale of 1:12,000 or smaller. Mapped wetland and riparian areas do not represent precise boundaries and digital wetland data cannot substitute for an on-site determination of jurisdictional wetlands.**

See detailed overviews, with examples, of both wetland and riparian classification systems and associated codes as a storymap and companion guide

Literature Cited

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBS-79/31. Washington, D.C. 103pp.

Federal Geographic Data Committee. 2013. Classification of wetlands and deepwater habitats of the United States. FGDC-STD-004-2013. Second Edition. Wetlands Subcommittee, Federal Geographic Data Committee and U.S. Fish and Wildlife Service, Washington, D.C.

U.S. Fish and Wildlife Services. 2009. A system for mapping riparian areas in the western United States. Division of Habitat and Resource Conservation, Branch of Resource and Mapping Support, Arlington, Virginia.

Introduction to Land Management

Within the report area you have requested, land management information is summarized by acres of federal, state, and local government lands, tribal reservation boundaries, private conservation lands, and federal, state, local, and private conservation easements. Acreage for "Owned", "Tribal", or "Easement" categories represents non-overlapping areas that may be totaled. However, "Other Boundaries" represents managed areas such as National Forest boundaries containing private inholdings and other mixed ownership which may cause boundaries to overlap (e.g. a wilderness area within a forest). Therefore, acreages may not total in a straight-forward manner.

Because information on land stewardship is critical to effective land management, the Montana Natural Heritage Program (MTNHP) began compiling ownership and management data in 1997. The goal of the Montana Land Management Database is to manage a single, statewide digital data set that incorporates information from both public and private entities. The database assembles information on public lands, private conservation lands, and conservation easements held by state and federal agencies and land trusts and is updated on a regular basis. Since 2011, the Information Management group in the Montana State Library's Digital Library Division has led the Montana Land Management Database in partnership with the MTNHP.

Public and private conservation land polygons are attributed with the name of the entity that owns it. The data are derived from the statewide Montana Cadastral Parcel layer Conservation easement data shows land parcels on which a public agency or qualified land trust has placed a conservation easement in cooperation with the landowner. The dataset contains no information about ownership or status of the mineral estate. For questions about the dataset or to report errors, please contact the Montana Natural Heritage Program at (406) 444-5363 or mtnhp@mt.gov. You can download various components of the Land Management Database and view associated metadata at the Montana State Library's GIS Data List at the following links:

Public Lands
Conservation Easements
Private Conservation Lands
Managed Areas

Map features in the Montana Land Management Database or summaries provided in this report are not intended as a legal depiction of public or private surface land ownership boundaries and should not be used in place of a survey conducted by a licensed land surveyor. Similarly, map features do not imply public access to any lands. The Montana Natural Heritage Program makes no representations or warranties whatsoever with respect to the accuracy or completeness of this data and assumes no responsibility for the suitability of the data for a particular purpose. The Montana Natural Heritage Program will not be liable for any damages incurred as a result of errors displayed here. Consumers of this information should review or consult the primary data and information sources to ascertain the viability of the information for their purposes.

Introduction to Invasive and Pest Species

Within the report area you have requested, separate summaries are provided for: Aquatic Invasive Species, Noxious Weeds, Agricultural Pests, Forest Pests, and Biocontrol species that have been documented or potentially occur there based on the predicted suitability of habitat. Definitions for each of these invasive and pest species categories can be found on our Species Status Codes page.

Each of these summaries provides the following information when present for a species: (1) the number of observations of each species; (2) the geographic range polygons for each species, if developed, that the report area overlaps; (3) predicted relative habitat suitability classes that are present if a predicted suitable habitat model has been created; (4) the percent of the report area that is mapped as commonly associated or occasionally associated habitat as listed for each species in the Montana Field Guide; and (5) links to species accounts in the Montana Field Guide. Details on each of these information categories are included under relevant section headers under the Introduction to Native Species above or are defined on our Species Status Codes page. In presenting this information, the Montana Natural Heritage Program (MTNHP) is working towards assisting the user with rapidly determining what invasive and pest species have been documented and what species are potentially present in the report area. We remind users that this information is likely incomplete as surveys to document introduced species are lacking in many areas of the state, information on introduced species has only been tracked relatively recently, the MTNHP's staff and resources are limited, and information is constantly being added and updated in our databases. **Thus, field verification by professional biologists of the absence or presence of species will always be an important obligation of users of our data.**

If you are aware of observation or survey datasets for invasive or pest species that the MTNHP is missing, please report them to the Program Coordinator bmaxell@mt.gov Program Botanist apipp@mt.gov or Senior Zoologist dbachen@mt.gov If you have animal or plant observations that you would like to contribute, you can also submit them via Excel spreadsheets, geodatabases, iNaturalist, or a Survey123 form. Various methods of data submission are reviewed in this playlist of videos:
https://www.youtube.com/playlist?list=PLRaydtZpHu2qOHPoSPq9cnM9uXGmEXACx

Additional Information Resources

MTNHP Staff Contact Information

Montana Field Guide

MTNHP Species of Concern Report - Animals and Plants

MTNHP Species Status Codes - Explanation

MTNHP Predicted Suitable Habitat Models (for select Animals and Plants)

MTNHP Request Information page

Montana Cadastral

Montana Code Annotated

Montana Fisheries Information System

Montana Fish, Wildlife, and Parks Subdivision Recommendations

Montana GIS Data Layers

Montana GIS Data Bundler

Montana Greater Sage-Grouse Project Submittal Site

Montana Ground Water Information Center

Montana Index of Environmental Permits, 21st Edition (2018)

Montana Environmental Policy Act (MEPA)

Montana Environmental Policy Act Analysis Resource List

Laws, Treaties, Regulations, and Agreements on Animals and Plants

Montana Spatial Data Infrastructure Layers

Montana State Historic Preservation Office Review and Compliance

Montana Stream Permitting: a guide for conservation district supervisors and others

Montana Water Information System

Montana Web Map Services

National Environmental Policy Act

Penalties for Misuse of Fish and Wildlife Location Data (MCA 87-6-222)

U.S. Fish and Wildlife Service Information for Planning and Consultation (Section 7 Consultation)

Web Soil Survey Tool

Appendix G:

Wildlife Hazard Assessment

RECEIVED FEB 07 2014

0761.114

U.S. Department
of Transportation

Federal Aviation Administration

Northwest Mountain Region
Colorado, Idaho, Montana
Oregon, Utah, Washington,
Wyoming

1601 Lind Avenue, S. W.
Renton, Washington 98057-4056

January 24, 2014

Mr. Brian Sprenger
Airport Manager
Bozeman Yellowstone International Airport
850 Gallatin Field Road, Suite #6
Bozeman, MT 59714

Dear Mr. Brian Sprenger:

We have reviewed and approved the final Wildlife Hazard Assessment (WHA), dated January 2014, prepared by Airport Wildlife Consultants. Please provide an electronic copy of the final approved WHA.

The WHA has recommended that a Wildlife Hazard Management Plan (WHMP) be developed. The reference was made in the WHA on pages 1 and 30, Chapter 4c Recommendations. **"Develop a Wildlife Hazard Management Plan."** We determined that a WHMP will be required (139.337(e). *"When the Administrator determines that a wildlife hazard management plan is needed, the certificate holder shall formulate and implement a plan using the wildlife hazard assessment as a basis. The plan shall--. . ."*

Attached is the CertAlert 97-09 "Wildlife Hazard Management Plan Outline" to assist in developing a WHMP. Provide a DRAFT copy of your WHMP for review and approval.

If you have any questions, please call me at (425) 227-1621.

Sincerely,

Lynn Deardorff
Airport Certification Safety Inspector

Cc:
Diane Stilson, HLN-622
Airport Wildlife Consultants, LLC, 4735 E Melanie Dr., Cave Creek, AZ

Mark Maierle, P.E.
2880 Technology Blvd. W., PO Box 1113
Bozeman, MT 59771

Wildlife Hazard Assessment
May 2012 – April 2013

Submitted to

Bozeman Yellowstone International Airport
850 Gallatin Field Road
Belgrade, MT 59714

Submitted by

And

Morrison Maierle Inc.
Scott Bell, Principal
2880 Technology Blvd. W.
Bozeman, MT
Phone: 406-587-0721
E-Mail: sbell@m-m.net

Airport Wildlife Consultants LLC
Steven D. Fairaizl, SeniorBiologist
4735 E Melanie Dr
Cave Creek, AZ
Phone 480-993-9357
E-Mail: steveandgale@awcphx.com

January 2014

Executive Summary:

The Bozeman Yellowstone International Airport (BZN) initiated a Wildlife Hazard Assessment (WHA) based on the presence of wildlife attractants within five miles of the airport, the presence of wildlife species known to be hazardous to aviation, and the occurrence of a Federal Aviation Administration (FAA) defined Triggering Event. BZN retained Morrison Maierle and Airport Wildlife Consultants in 2012 to conduct a WHA according to FAA standards and guidelines outlined in 14 CFR § 139.337. The WHA was conducted by a Qualified Biologist as defined in Advisory Circular 150/5200-36A. Steve Fairaizl of Airport Wildlife Consultants was the Qualified Wildlife Biologist for this study. Steve's qualifications and experience were documented during the RFP process that awarded this contract. In addition, Steve is listed on Embry Riddle's list of qualified biologists.

The WHA was a twelve month study designed to identify wildlife attractants and hazardous wildlife species as defined in Advisory Circular 150/5200-33B. This WHA includes a discussion of the Triggering Event that initiated the WHA, status of adjoining land uses, results of the twelve month wildlife survey, a hazard analysis, and recommendations. Based on the wildlife survey data collected, the Qualified Biologist concluded that the Belgrade Waste Water Treatment Plant, Canada geese, crows and bald eagles feeding in the AOA, and illegal dumping of big game carcasses pose the primary wildlife hazards at BZN. Based on the results of the WHA, AWC recommends development of a Wildlife Hazard Management Plan at BZN.

List of Acronyms

AC—Advisory Circular
AOA—Aircraft Operating Area
AWC –Airport Wildlife Consultants
BZN--Bozeman Yellowstone International Airport
CFR—Code of Federal Regulations
FAA—Federal Aviation Administration
WHA—Wildlife Hazard Assessment
WHMP—Wildlife Hazard Management Plan

Chapter 1: Introduction:
Chapter 1a. WHA Overview

Since the earliest history of flight in the United States, aircraft collisions with wildlife have occurred. The first reported strike occurred during a flight by Orville Wright on September 7 1905 when a bird was struck and killed during a flight over a cornfield in Ohio. As air traffic has increased, the magnitude of the problem of wildlife strikes has increased to the point that, during the last 20 years, at least 210 civilian aircraft have been destroyed by these types of accidents (Dolbeer 2009). It is important to note that in part, the problem of airstrikes is related to increases in many species of large bird populations that has occurred in North America (Dolbeer and Eschenfelder 2003).

Although wildlife strikes have been an important economic problem for decades, public awareness of the issue was relatively low. This all changed when US Airways Flight 1549 ingested Canada geese after take-off from LaGuardia Airport in New York (NTSB 2009). When the plane was able to safely land in the Hudson River with no loss of life, the media coverage of the event greatly heightened public awareness of the issue. After this incident, as part of the FAA's effort to improve air operation safety, the agency issued Cert Alert No. 09-10, which required all Part 139 airports that have had a triggering event, to conduct a Wildlife Hazard Assessment (WHA).

Morrison and Maierle Inc. and Airport Wildlife Consultants$_{LLC}$ (AWC) were retained by the Gallatin Airport Authority to conduct a WHA the Bozeman Yellowstone International Airport. Initiation of the WHA was based on the presence of wildlife attractants within five miles of the airport, the presence of wildlife species known to be hazardous to aviation, and the occurrence of a Federal Aviation Administration (FAA) defined Triggering Event.

As defined in the Federal Aviation Administration (FAA) Advisory Circular 150/5200-33B, a wildlife hazard means a potential for a damaging aircraft collision with wildlife on or near an airport. Therefore, by definition, all airports have a wildlife hazard(s).

Key components of this WHA include:

- Identification of wildlife attractants known to occur within a 5-mile radius of BZN.
- Identification of the presence and seasonal distribution of species known to be wildlife hazards.
- Determination of which species pose the greatest risk to aircraft operations at BZN.
- Recommendation of mitigation measures to allow BZN to manage and minimize wildlife hazards.

A WHA is a comprehensive, detailed study and evaluation of factors contributing to wildlife hazards at and within a 5-mile radius of the airport. A qualified airport wildlife biologist (Advisory Circular 150/5200-36A) accomplishes this process by collecting systematic, quantitative data using on-site observations and wildlife surveys and combining current airport information with relevant information such as historical strike data and an evaluation of maintenance, patrol and wildlife mitigation procedures. Specific to the conduct of a WHA, 14 CFR Part 139.337 states: (c) The wildlife hazard assessment required in paragraph (b) of this section must be conducted by a qualified wildlife damage management biologist (AC 150/ 5200-36A) who has professional training and/or experience in wildlife hazard management at airports or an individual working under direct supervision of such an individual. AWC's Senior Biologist, Steve Fairaizl, was the qualified biologists assigned to the BZN WHA

The airports FAA Certification Inspector is the individual who approves the WHA which is prepared and submitted by the Qualified Biologist. The Certification Inspector uses 14 CFR Part 139.337 (c)(1-5) as the checklist to ensure the WHA complies with all FAA regulations. This regulation requires that a wildlife hazard assessment must contain at least the following components:

(1) An analysis of the events or circumstances that prompted the assessment.
(2) Identification of the wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.
(3) Identification and location of features on and near the airport that attract wildlife.
(4) A description of wildlife hazards to air carrier operations.
(5) Recommended actions for reducing identified wildlife hazards to air carrier operations.

The WHA is conducted for a minimum of four seasons or twelve months to adequately assess the seasonal patterns of birds and other wildlife using the airport and surrounding area during an annual cycle. Specifically, the WHA is undertaken to sample bird and mammal species occurrence and frequency, seasonal and behavioral patterns, and locations of wildlife activity and attractants in relation to the airport. This completed assessment includes all of the necessary elements of a WHA as outlined in 14 CFR § 139.337 and also includes prioritized recommendations for mitigating the hazardous wildlife attractants identified.

Chapter 1.B. BZN History of Wildlife Strikes and the Triggering Event

BZN runways are monitored daily by airport personnel for foreign object debris, including dead wildlife. Airport staff drives the entire length of the runway, either on the runway or along the runway or taxiway, to accomplish searches. Any strikes or bird remains are identified and recorded in airport logbooks and entered into the FAA National Wildlife Strike Database.

Guidelines for reporting of wildlife strikes have been established in the FAA Advisory Circular 150/5200-32B, which defines a wildlife strike as:

- A pilot reports striking 1 or more birds or other wildlife;
- Aircraft maintenance personnel identify aircraft damage as having been caused by a wildlife strike;
- Personnel on the ground report seeing an aircraft strike 1 or more birds or other wildlife;

- Bird or other wildlife remains, whether in whole or in part, are found within 250 feet of a runway centerline, unless another reason for the animal's death is identified; or
- An animal's presence on the airport had a significant negative effect on a flight (i.e., aborted takeoff, aborted landing, high-speed emergency stop, and aircraft left pavement area to avoid collision with animal).

To develop an understanding of the history of wildlife strikes at BZN and relate those data to the wildlife survey data obtained during this WHA, we searched the National Wildlife Strike Database maintained by the FAA for the period of 1990 through 2012. Between 1990-2012, 15 strikes were reported at BZN (Table 1). These strikes involved bird species known to be hazardous to aviation including waterfowl and hawks. Of the 15 total strikes, 2 struck more than two birds.

FAA regulations codified in 14 CFR § 139.337 define a triggering event as:

- An air carrier aircraft experiences multiple wildlife strikes;
- An air carrier aircraft experience substantial damage from striking wildlife;
- An air carrier aircraft experiences an engine ingestion of wildlife; or
- Wildlife of a size or in numbers, capable of causing an event described in the bullets above is observed to have access to any airport flight pattern or aircraft movement

The wildlife strikes recorded at BZN meet criteria one and four defining triggering events as outlined in 14 CFR § 139.337.

Table 1. Birds strikes at BZN 1990-2012.

Year	Species	# Involved
2001	Unknown	
2005	Unknown	
2006	Unknown	
2006	Ducks	2-10
2008	Unknown	
2008	Unknown	
2008	Unknown	2-10
2008	Unknown	
2008	Unknown	
2009	Unknown	
2010	Barn Swallow	
2010	Unknown	
2010	Barn Swallow	2-10
2011	Unknown	
2012	Coopers Hawk	
2012	Rough Legged Hawk	

Chapter1.C. Airport History

Bozeman Yellowstone International, also known as Gallatin Field, is a public use airport located seven miles northwest of the central business district of Bozeman, in Gallatin County. It is owned by the Gallatin Airport Authority. The airport is situated in Belgrade, Montana and serves Bozeman, Big Sky, southwest Montana, Yellowstone National Park and Montana State University.

This airport is included in the National Plan of Integrated Airport Systems for 2011–2015, which categorized it as a *primary commercial service* facility (more than 10,000 enplanements per year). As per Federal Aviation Administration (FAA) records, the airport had 349,550 passenger boardings (enplanements) in calendar year 2008, 343,754 enplanements in 2009, and 364,521 in 2010.

In 2011, a new terminal expansion was opened, adding three new gates and more retail concessions. Most recently, Gallatin Field was renamed Bozeman Yellowstone International Airport, in an attempt to encourage travelers to use the airfield for access to Yellowstone National Park. International flights were permitted after the set-up of a US Customs and Border Patrol facility, funded in cooperation with Signature Flight Support and the Yellowstone Club.

Bozeman Yellowstone International Airport covers an area of 2,481 acres at an elevation of 4,473 feet above mean sea level. It has three runways: 12/30 is 8,994 by 150 feet with an asphalt surface; 3/21 is 2,650 by 75 feet with an asphalt surface; 11/29 is 3,197 by 80 feet with a turf surface.

For the 12-month period ending January 1, 2011, the airport had 72,447 aircraft operations, an average of 198 per day: 75% general aviation, 15% air taxi, 10% scheduled commercial, and <1% military. At that time there were 280 aircraft based at this airport: 78% single-engine, 6% multi-engine, 9% jet, 3% helicopter, and 4% glider.

Air Traffic Control handled 73,749 aircraft operations in 2011, up 1.8% over 2010. General aviation accounts for 76% of Bozeman Yellowstone International's aircraft operations. Scheduled passenger and cargo airline service accounts for approximately 17% and corporate jet operations account for 7%.

Chapter 2: Gallatin County Comprehensive Plan

The Gallatin County Growth Policy Resource Document #**5:** Growth-Conservation Areas Program Gallatin County Growth Policy “A Shared Vision for a New Century” was adopted May 15, 2001. Conservation Areas were designated by modeling GIS information for agriculture, hydrology and wildlife habitat. The counties use of wildlife habitat, deciduous forests, riparian areas, and big game winter range to create conservation areas has the potential to inadvertently create FAA defined wildlife attractants.

CHAPTER 3 RESULTS OF WILDLIFE SURVEYS

FAA regulations codified in 14 CFR § 139.337 require a WHA, in part, to:

(1) Identify wildlife species observed and their numbers, locations, local movements, and daily and seasonal occurrences.
(2) Identify and locate features on and near the airport that attract wildlife.
(3) Describe wildlife hazards to air carrier operations.

The wildlife surveys conducted as part of the WHA at BZN were designed to comply with these requirements. The following is a discussion of the methods used to conduct the wildlife surveys.

Chapter 3a 1: Survey Methodology

In accordance with FAA recognition of potential aviation hazards, survey points were chosen to include:

- Points at which aircraft would be below critical altitudes for bird strikes,
- Points that address various habitats or wildlife attractants on and near the airfield and,
- Points that include movement corridors by which hazardous wildlife would be attracted into the flight path and to the area surrounding the airfield.

The first step in selection of the survey points for the BZN WHA was to obtain aerial photos of the region, which allowed us to develop an understanding of the area within the five-mile separation distance around the airport. In particular, we were able to obtain information on the locations of FAA defined wildlife attractants such as agricultural areas, and urban ornamental landscaping.

In March 2012, AWC traveled to Bozeman Yellowstone International Airport to conduct the project setup which resulted in the establishment of survey routes and survey points. The field surveys for this study were conducted from May 2012 through April 2013. The sampling design was based on FAA AC 150/5200-33B (Hazardous Wildlife Attractants on or near Airports), which defines several habitat types that the FAA identifies as wildlife attractants. AWC followed the US Fish and Wildlife Service National Breeding Bird Survey protocol (Robbins et al. 1967, Droege 1990). This survey protocol allows establishment of survey routes or transects through each of the FAA defined wildlife attractants. Survey points were established at regular intervals along the routes, usually at ½ to 1 mile intervals. At each survey point, a five-minute count, commonly referred to as a time area count, was conducted and each bird or flock of birds observed with an ¼ mile radius of the survey point was identified to the lowest taxon possible and data recorded on a standardized data sheet. The data were entered into Excel spreadsheets within a week of data collection and tabulated as to total number of birds observed by taxon. All data entry was hand verified with the original data sheet to ensure accuracy of the entry.

During this project kick off and setup, a total of 39 sample locations were selected that represent five of the six FAA defined wildlife attractants plus the Aircraft Operating Area (AOA) (Table 2).

Table 2. Number of survey points in each wildlife attractant route.

Wildlife Attractant	Number of Survey Points
Spoil Pile	3
Wetlands	6
Agriculture	15
Water Management Facilities	2
Urban Landscaping	5
Aircraft Operations Area	8
Total	39

This sampling scheme accounts for 39 individual survey points and duplicates counts by censusing points twice per month for a total of 78 points per month, allowing AWC to achieve repeat sampling as recommended in the FAA manual *Wildlife Hazard Management at Airports*. Surveys were conducted for four days during the first week of each month for 12 consecutive months. Sites were surveyed in the mornings (AM) during the first two days of the week and in the afternoon (PM) during the next two days of the week. During the first survey of each month, sites were surveyed in the mornings (AM) starting around sunrise and concluding near noon. During the second survey of each month, the same sites were surveyed in the afternoon (PM) staring near 2:00 PM and concluding near sunset. This survey protocol accounted for the FAA requirement to evaluate morning, mid-day, and evening wildlife activity periods. Of the two monthly surveys, AM and PM, the highest count was used for data analysis as this represents the greatest wildlife hazard at that point in time.

A GIS based map was prepared showing the locations of all 39 survey points (Appendix A). The 10,000 foot and five mile separation distances are represented by a circle drawn from the center of the airport.

Wildlife species observed were grouped into guilds (Serveringhaus 1981). For our purposes, we used that guild concept suggested by Root (1967) where a guild is a group of organisms that exploit the available environmental resources in a similar way. When grouped according to species, the sample size was often too small for effective analyses; therefore, development of guilds improved the interpretation of the data. Moreover, the guilds we selected tend to loosely correspond to taxonomic classifications traditionally used. Gulls and Canada geese were listed individually because of the history these species have in major bird strikes.

Based upon the data collected during the BZN WHA, we selected the following guilds:

Gulls and Canada Geese- These two species of birds were recorded and analyzed as separate guilds because of their extensive history in wildlife strikes. Gulls are responsible for more damage to aircraft than any other species and Canada Geese are responsible for more human fatalities than any other species.

Specific hazards posed by gulls to aircarrier operations: Gulls are medium-sized birds that prefer open areas near water. They are often observed forming large flocks where food in present. They commonly loaf on airport movement areas during heavy rain events.

Specific hazards posed by Canada geese are well documented. These birds are responsible for significant damage to aircraft and several accidents which resulted in the loss of life. This was also the species responsible for the aircraft crash into the Hudson River in 2009.

Waterfowl- For the purposes of this study, this guild consists of Ducks, Swans, Loons, Coots, and Grebes. Waterfowl are generally medium to large birds that feed on a variety of aquatic sources including vegetation, insects, and fish. They are most often associated with water, but some species (e.g., Geese) graze in short grass on or near airport properties. Many of the species are migratory and are most abundant during spring and fall migrations.

Specific hazards posed by waterfowl to aircarrier operations: Waterfowl are medium to large-sized birds that can pose a significant threat to aircraft as individuals. However, these birds often form larger flocks during migrations causing an increase in risk to aircraft collisions. Foraging preferences can put these birds in close proximity to aircraft movement areas where wet areas are located.

Doves and Pigeons- Doves and Pigeons are small to medium sized birds. These are common grainivores that are abundant in urban and rural areas throughout the state of Montana. They are robust flyers, gregarious (flocking) in nature, and prefer warm open habitats. They tend to nest in or on tall structures such as trees and buildings.

Specific hazards posed by doves and pigeons to aircarrier operations: Doves are a small-sized bird that does not pose a large threat to aircraft as individuals; however, these birds are known to flock during the non-nesting season. The greatest risk with the morning dove comes from their preference for open habitat and bare areas. Therefore, not only do these birds flock, but they feed, roost, and loaf on movement areas putting them at a greater risk of an aircraft collision. Pigeons are typically seen roosting on rooftops, under bridges, on building ledges, under canopies and other sheltered structures and feed on grains, seeds, insects as well as garbage. Pigeons are not typically found within the movement area and pose a low risk to aircraft at BZN.

Hawks and Owls- This guild consists of raptors such as Bald Eagles, Screech-owls, Great Horned Owls, Barn Owls, Nighthawks, Red-tailed Hawks, Cooper's Hawks, Rough Legged Hawks, Sharp-shinned Hawks, and the American Kestrel. The larger Hawks and Owls feed on medium to small mammals and the smaller Hawks and Owls feed on small rodents, birds, and insects. Most live in trees or tall structures such as towers, barns, and buildings.

Specific hazards posed by raptors to aircarrier operations: These species are typically found flying solo or in pairs and pose significant threat to aircraft due to their large size.

Vultures - Although turkey vultures are often considered raptors, they have been separated out for the purposes of this study. These large birds soar at high altitudes, congregate in flocks, and feed on carrion as opposed to most raptors that feed on live prey items. Most vultures roost on power poles and high voltage transmission towers. Vultures can sometimes be seen in larger numbers and are generally observed soaring or hunting in flight; therefore, have a greater risk of colliding with aircraft.

Corvids - This guild includes American crows, magpies, and Common ravens. Members of this guild fly solitarily or in flocks and commonly forage in agricultural fields, open spaces, and at landfills.

Blackbirds - We considered this guild to consist of great-tailed grackles, red-winged blackbirds, Brewer's blackbirds, European starlings, and brown-headed cowbirds. They frequent areas with water and forage near livestock feeding and agriculture fields. Most of these species were also abundant in urban settings in this study area.

Specific hazards posed by corvids and blackbirds to aircarrier operations: Crows and Grackles are typically larger birds and could cause significant damage if struck. They are not commonly found in large flocks; however, they will form large congregations in the fall and throughout winter. During the nesting season (February to May) they are seen in pairs or in small family groups. These species are highly intelligent and are able to avoid most collisions with aircraft. They are also rarely seen soaring at high elevations with aircraft and frequently observed scavenging for carcasses. Blackbirds and Starlings do not pose a threat to aircraft as individuals but the risk comes from their flocking behaviors. A bird strike involving a flock could have serious consequences.

Shorebirds- This guild consists of Killdeer, Bitterns, Plovers, Cranes, Stilts, Avocets, and Sandpipers. These birds are often found along shorelines, in irrigated agricultural fields and near standing water, foraging and wading into the water. Shorebirds feed on a variety of animals including invertebrates, frogs, and fish.

Specific hazards posed by shorebirds to aircarrier operations: Shorebirds are medium-sized birds that do not pose a significant threat to aircraft as individuals. However, these birds do often form larger flocks during winter months causing an increase in risk to aircraft collisions. Tendencies of these birds to prefer open habitats with bare ground make movement areas at airports attractive.

Fish Eating Birds- This guild consists of Pelicans, Cormorants, Herons, and Egrets. These birds are often found along shorelines in wetlands, drainage ditches, lakes, and ponds. As the name implies, these birds feed mostly on fish and aquatic invertebrates.

Specific hazards posed by fish eating birds to aircarrier operations: Herons and egrets can be of high risk to aircraft due to their large size and slow, low flying behaviors. These birds are of highest risk during migration periods when these species are known to form large flocks.

Ground birds- This guild consists of small to medium sized birds that spend most of their time on the ground and only fly short distances in the air, typically low to the ground but will flush wildly and fly for short distances when startled. These birds include Horned Larks, Meadowlarks, Sparrows, Swallows, Robins, Martins, Eastern and Western Kingbirds, and Mockingbirds. These birds forage and loaf on the ground, but they also perch and roost in trees.

This guild also encompassed songbirds which consisted of small perching birds including, but not limited to Warblers, Hummingbirds, Woodpeckers, Flickers, Flycatchers, and Shrikes. These birds tend to be associated with shrubs, trees and dense foliage. Larks however, are found in open spaces such as grasslands and along runways. Swallows are slender aerialists with long, pointed wings. Many species colonize, and will build mud nests under eaves and bridges, whereas, the other swallows nest in banks, trees, and cavities of rocks. Nests are typically reused yearly.

Specific hazards posed by ground birds to aircarrier operations: Ground Birds do not pose a threat to aircraft as individuals. The risk comes from their flocking behaviors. A bird strike involving a flock of Ground Birds could have serious consequences.

In addition to the avian portion of this WHA, small mammal trapping and density transects were conducted for five nights during the wildlife surveys completed in 2012 to determine the relative density of small mammals on the AOA. Small mammal trapping was conducted using 12 snap traps set for four nights during August and September of 2012, for a total of 48 trap nights.

Large mammal surveys were conducted monthly at the same survey points established for bird counts. All large mammals were identified to species and recorded onto the data sheets. Spotlight surveys were also conducted in August, 2012 and January 2013 by driving the perimeter road inside the AOA and searching for mammals.

Owl surveys were conducted in the early morning hours on the night of the spotlight survey. The survey was conducted by playing vocalization tapes.

Chapter 3a 2: Habitat Description

The entire area inside the fence at BZN has been graded and seeded with native grass. Grass is mowed to a height of 2-6 inches during the summer months. There are no trees on the airfield. The northern end of the airfield is irrigated with treated effluent from the Belgrade sewer treatment plant. A drainage ditch in the southern part of the airfield that runs west to east conveys stormwater off site. Two retention basins on the northern end of the airfield collect spring runoff and stormwater for short periods of time.

Chapter 3b. Results:

Chapter 3b.1 Survey Routes:

Spoil Pile Route: This route encompassed two sand and gravel mines which contained large bodies of water with islands. Three survey points were established on this route.

Wetland Route: This route surveyed natural wetlands along drainages north of the airport and required 6 survey points.

Agriculture Route: Located at agricultural fields north and east of the airport. Alfalfa fields and small grains dominated the agricultural crops raised on private property surrounding the airport. There were also several small pastures used for cattle grazing. This route consisted of 15 survey points.

Water Management Facility Route: This route was composed of the Belgrade Waste Water Treatment Plant and a partially constructed waste water treatment facility in a housing development west of BZN. This route was composed of 2 survey points.

Urban Ornamental Landscaping Route: Encompassed one park and two grain elevators. This route consisted of 5 survey points.

Aircraft Operations Area Route: Encompassed the Aircraft Operations Area. A total of 8 survey points were located at one mile intervals around the airport. BZN does not have an established perimeter road around the AOA. Therefore this route was surveyed from county roads outside the AOA. One survey point was set in front of the main terminal building to assess the wildlife population associated with airport structures.

Chapter 3b.2 General Results

As indicated, avian surveys were conducted twice per month beginning in May 2012 and concluding in April 2013. During these surveys, a total of 25,672 birds were counted (Table 3). Seasonal distribution was observed in the waterfowl guild corresponding to a population increase caused by winter migration.

Table 3. Total wildlife observed along each wildlife attractant route.

	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan 13	Feb 13	Mar 13	Apr 13	Total
Spoil Pile	108	153	122	68	164	512	175	498	76	41	146	152	2215
Water Man Facility	90	203	160	123	92	256	594	743	69	66	163	151	2710
AG	225	451	490	793	1015	1149	215	297	269	384	291	416	5995
Urban	224	148	202	116	472	275	227	349	245	182	143	102	2685
Wetlands	91	183	311	248	541	522	2186	4147	281	1146	835	240	10731
AOA	77	107	191	206	266	123	63	30	54	74	75	70	1336
Total	815	1245	1476	1554	2550	2837	3460	6064	994	1893	1653	1131	25672

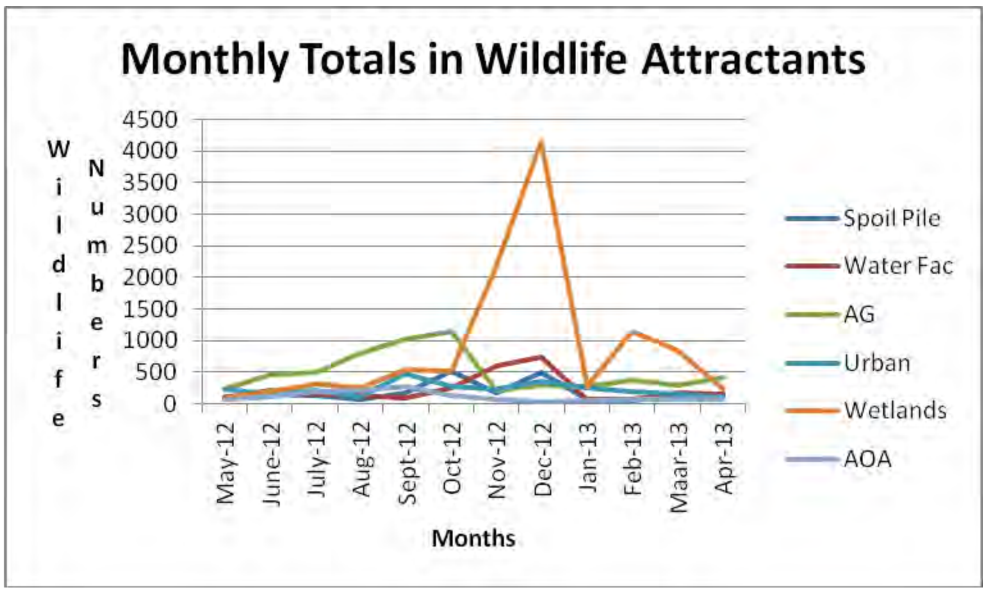


Figure 1. Total wildlife observed along each wildlife attractant route.

In addition to determining the seasonal pattern and wildlife attractants for the total number of birds observed during the BZN WHA, we also analyzed the data to determine which guilds were most prevalent in the study area. Of the guilds within the study area, two were clearly the most abundant including waterfowl and Canada geese which constituted 44% and 17% of the total respectively (Table 4).

Table 4. Total wildlife numbers by guild along each wildlife attractant route.

	Spoil Pile	Water Man Fac	AG	Urban	Wetland	AOA	Total	% Total
Gulls	12	3	0	0	29	0	44	0%
C. Geese	1196	731	944	31	1251	139	4292	17%
Waterfowl	545	1456	301	14	8676	47	11039	44%
Dove/Pigeon	24	1	452	1534	0	89	2100	8%
Hawk Owls	29	2	128	6	39	49	253	1%
Blackbirds	175	155	2401	480	182	387	3780	15%
Vultures	0	0	0	0	0	0	0	0%
Crows/Ravens	43	271	557	108	68	299	1346	5%
Shorebirds	63	40	28	1	171	25	328	1%
Ground Birds	81	48	883	511	287	291	2101	8%
Fish Eating	47	3	4	0	28	4	86	0%
Sandhill Crane	0	0	297	0	0	6	303	1%
Total	2215	2710	5698	2685	10731	1330	25369	100%

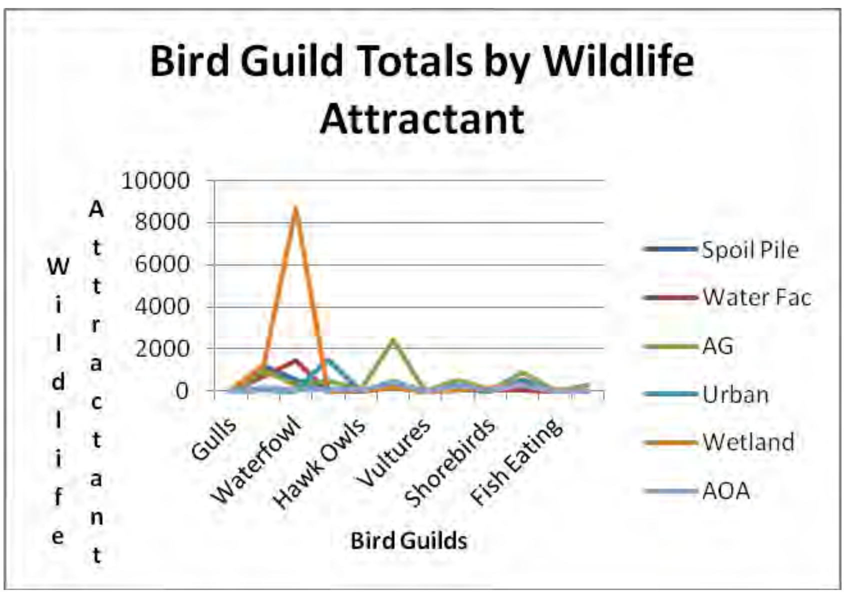


Figure 2. Total guild counts in each wildlife attractant.

Chapter 3b.2 Individual Survey Results for Wildlife Attractant Routes.

To identify potential wildlife attractants within the 5-mile radius of BZN we searched the area for the following wildlife attractants or habitat classifications as described in FAA AC 5200-33b as follows:

1. Ornamental landscaping – Urban areas including parks and golf courses
2. Wetlands
3. Agriculture – farmlands and grazing areas
4. Landfills or Transfer Stations
5. Dredge or Spoil Piles
6. Water Management Facilities

During the development phase of the BZN WHA, we determined that five of the six wildlife attractants occurred within 5 miles of BZN. Landfills or Transfer Stations were not detected. A sixth category was included, which was the AOA at BZN.

Chapter 3b.2a: Spoil Pile route survey results.

This route consisted of three survey points located approximately 1-2 miles south of BZN. These sites are two active sand and gravel mines whose pits have reached a depth that taps the ground water table. As a result, both pits contain large bodies of water. There is no vegetation surrounding the ponds.

Surveys at this Wildlife Attractant recorded a total of 2,215 birds during the year long WHA (Table 5 and Figure 3). Canada geese accounted for 1,196 or 54% of the total birds recorded. Canada geese also exhibited a seasonal distribution at these sites, with numbers peaking in fall. The fall peaks were likely due to the excellent post molting staging habitat created by the large ponds and a influx of winter migratants. There was no sign of Canada goose nesting activity at these site.

Table 5. Spoil Pile Route Survey Results

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	1	0	0	0	0	11	0	0	0	0	0	12
C. Geese	39	11	2	1	95	471	134	392	3	7	4	37	1196
Waterfowl	40	30	25	16	19	15	14	102	68	17	130	69	545
Dove Pigeon	0	0	0	2	0	0	1	2	3	7	8	1	24
Hawk Owls	1	0	4	2	6	0	3	2	2	3	2	4	29
Blackbirds	20	22	30	2	42	14	3	0	0	0	1	41	175
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	5	7	0	12	1	4	6	0	0	7	1	0	43
Shorebirds	1	60	2	0	0	0	0	0	0	0	0	0	63
Ground Birds	1	7	45	27	0	1	0	0	0	0	0	0	81
Fish Eating	1	15	14	6	1	7	3	0	0	0	0	0	47
Sandhill Cranes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	108	153	122	68	164	512	175	498	76	41	146	152	2215

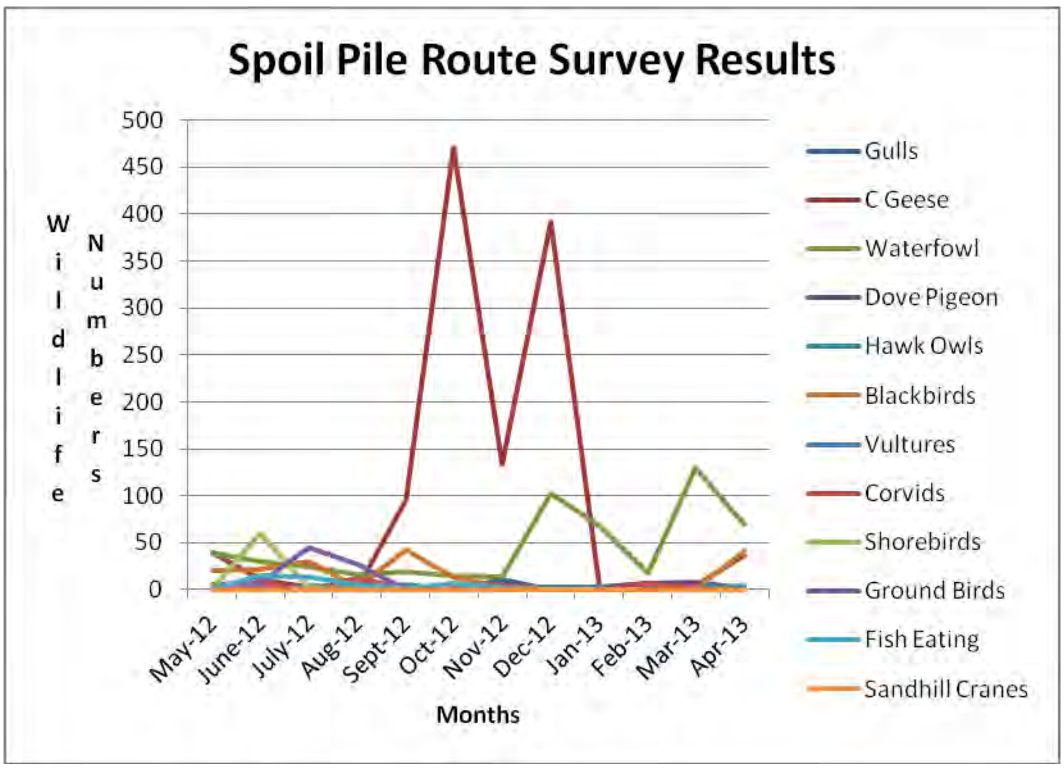


Figure 3. Spoil Pile Route Survey Results

Chapter 3b.2b: Water Management Facilities

This route consisted two survey points at the City of Belgrade Waste Water Treatment Plant located adjacent to the NW corner of BZN This Facility consisted of three shallow settling ponds that provided isolated roosting and nesting habitat for Canada geese and waterfowl. Canada geese were observed flying from this site to feed in irrigated hay fields on BZN and the bird flight line did intersect the approach and departure corridor for aircraft using BZN. Both waterfowl and Canada geese exhibited a seasonal distribution at this site with numbers peaking in the fall corresponding to winter migration.

A total of 2,710 birds were observed along this route (Table 6 and Figure 4). Waterfowl, mostly winter migrant ducks, accounted for 1,456 or 54% of the birds recorded at this site. Canada geese accounted for 731 or 27% of the total and were actively nesting at this site.

Table 6. Water Management Facilities Route Survey Results.

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	1	2	0	0	0	0	0	0	0	0	0	3
C. Geese	20	4	7	0	0	12	344	316	0	2	8	18	731
Waterfowl	47	116	92	70	57	136	247	423	40	39	142	47	1456
Dove Pigeon	1	0	0	0	0	0	0	0	0	0	0	0	1
Hawk Owls	0	0	0	1	0	0	0	0	0	0	1	0	2
Blackbirds	0	12	0	3	2	68	0	0	0	0	0	70	155
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	18	28	30	41	33	35	3	1	29	25	12	16	271
Shorebirds	3	34	0	0	0	3	0	0	0	0	0	0	40
Ground Birds	1	8	28	8	0	0	0	3	0	0	0	0	48
Fish Eating	0	0	1	0	0	2	0	0	0	0	0	0	3
Sandhill Cranes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	90	203	160	123	92	256	594	743	69	66	163	151	2710

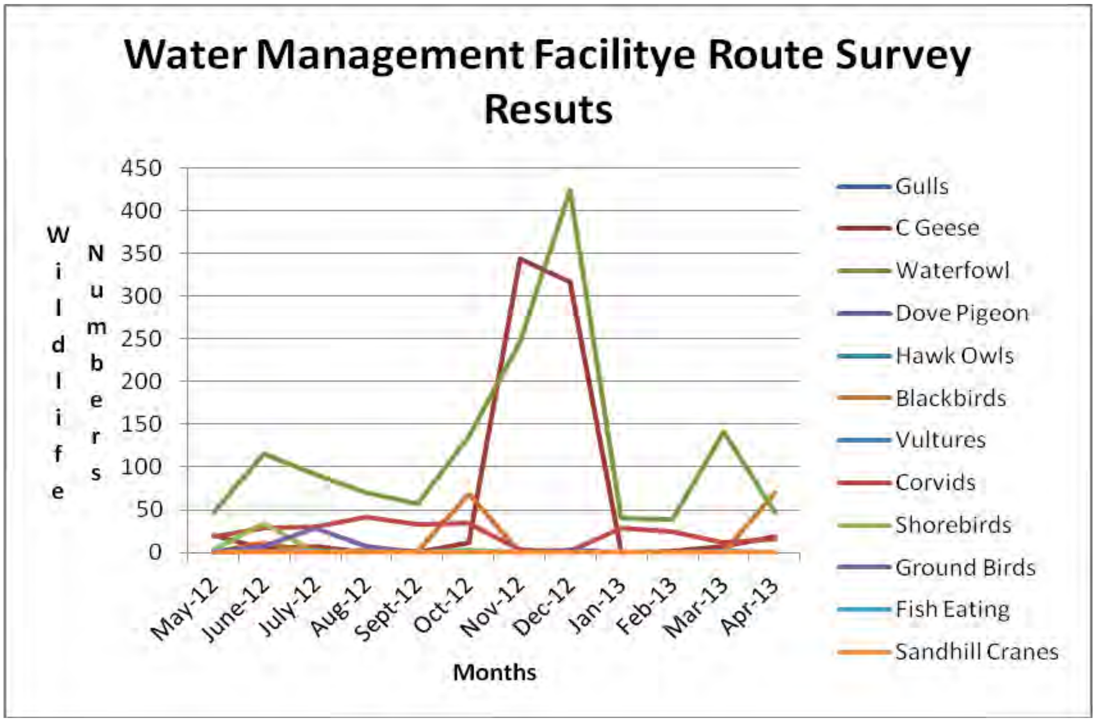


Figure 4. Water Management Facility Route Survey Results.

Chapter 3b.2c: Agriculture Route Results

This route consisted of 15 survey points in agricultural fields surrounding BZN, with the dominant crop being irrigated alfalfa with some corn, wheat, and barley. A total of 5,995 birds were observed along this route (Table 7 and Figure 5). Migratory birds recorded along this route exhibited a seasonal distribution peaking in the fall, which corresponds to winter migration. Blackbirds accounted for 2,401 or 40% of the total birds recorded along this route. Canada geese accounted for 944 or 16% of the total birds recorded along this route. These numbers of geese were likely attracted to the excellent food source provided by harvested agricultural fields in the fall. Ravens accounted for 557 or 9% of the total.

Table 7. Agriculture Route Survey Results

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Geese	50	0	0	19	179	201	37	140	97	116	66	39	944
Waterfowl	26	5	10	20	1	0	3	0	34	28	4	170	301
Dove Pigeon	6	27	12	84	0	0	67	24	11	125	54	42	452
Hawk Owls	8	6	7	9	7	7	7	13	18	12	25	9	128
Blackbirds	65	306	278	462	502	434	43	32	67	38	105	69	2401
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	19	42	46	54	45	73	35	39	41	61	35	67	557
Shorebirds	1	18	0	9	0	0	0	0	0	0	0	0	28
Ground Birds	34	44	133	108	193	276	23	49	1	4	2	16	883
Fish Eating	0	2	0	0	0	0	0	0	0	0	0	2	4
Sandhill Cranes	16	1	4	28	88	158	0	0	0	0	0	2	297
Total	225	451	490	793	1015	1149	215	297	269	384	291	416	5995

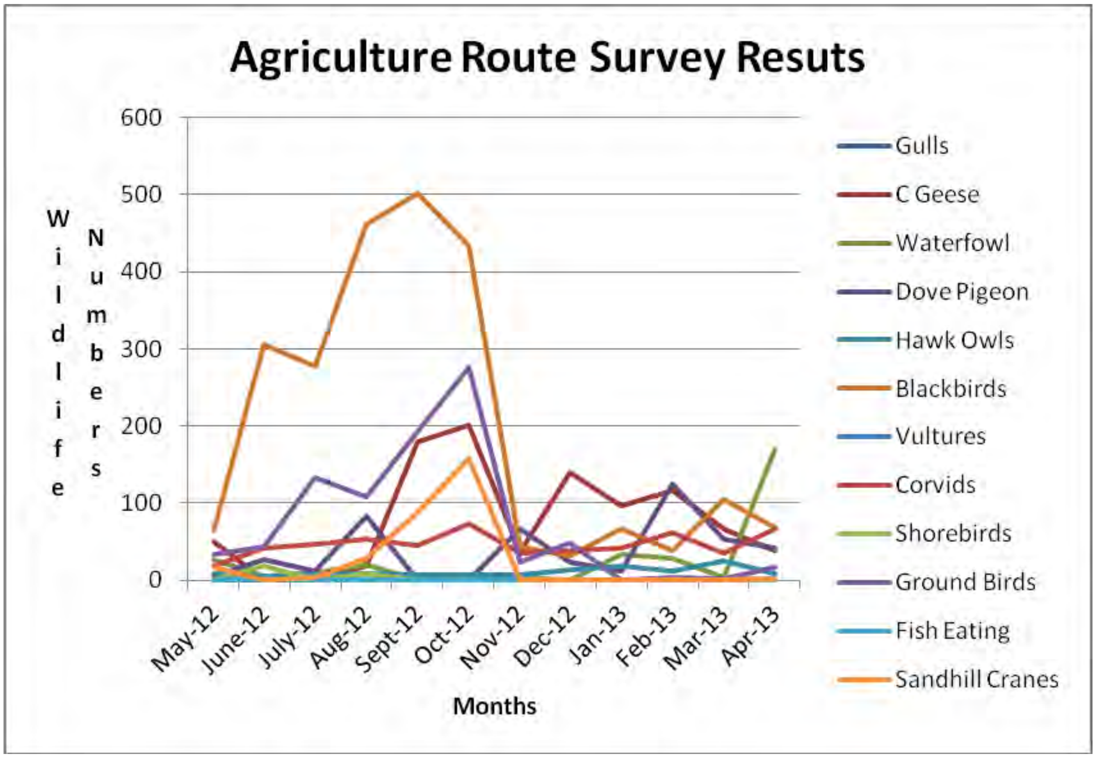


Figure 5: Results of wildlife surveys along the Agriculture Route.

Chapter 3b.2e: Urban Ornamental Landscaping

This route consisted of five points in the Belgrade urban area north of BZN. This route consisted of a city park, cemetery, and two grain elevators. A total of 2,685 birds were observed along this route (Table 8 and Figure 6). Doves and pigeons accounted for 1534 or 57% of all the birds recorded along this route. Doves and pigeons were attracted to the excellent food source provided by the grain elevators.

Table 8. Urban Landscaping Route Survey Results

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Geese	3	0	0	0	0	0	0	24	0	0	4	0	31
Waterfowl	5	0	0	1	0	0	0	0	0	0	0	8	14
Dove Pigeon	197	86	130	60	0	0	205	309	242	136	92	77	1534
Hawk Owls	1	0	0	0	0	0	1	0	1	2	1	0	6
Blackbirds	1	27	34	9	224	103	16	0	0	32	29	5	480
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	12	16	15	5	13	8	4	3	2	8	15	7	108
Shorebirds	0	1	0	0	0	0	0	0	0	0	0	0	1
Ground Birds	5	18	23	41	235	164	1	13	0	4	2	5	511
Fish Eating	0	0	0	0	0	0	0	0	0	0	0	0	0
Sandhill Cranes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	224	148	202	116	472	275	227	349	245	182	143	102	2685

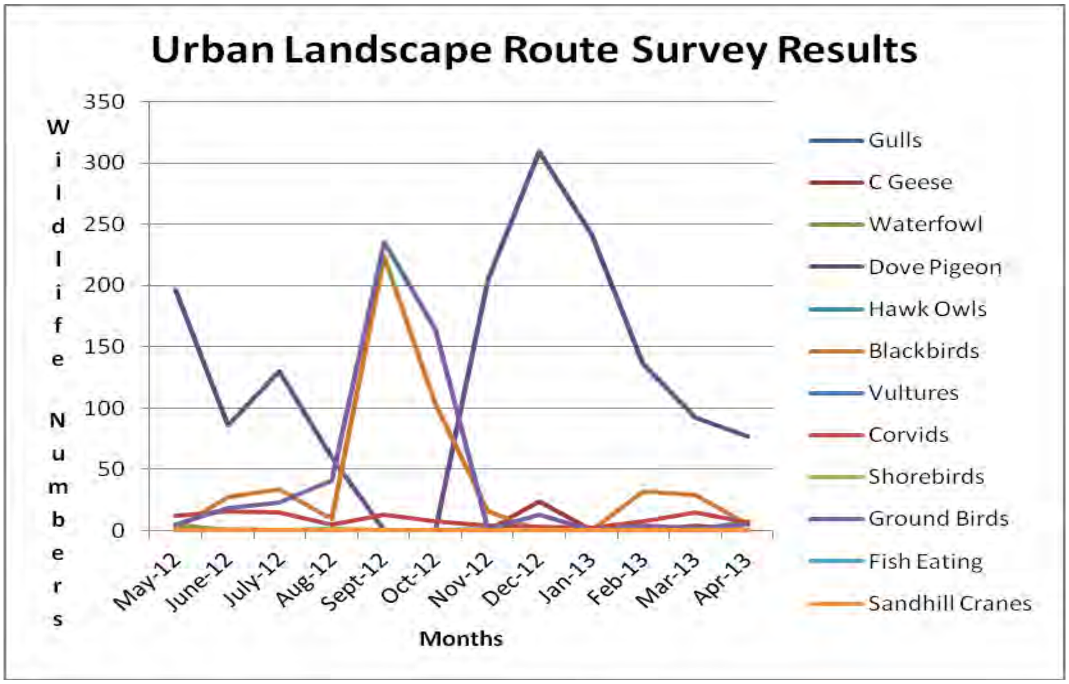


Figure 6. Results of wildlife surveys in the Urban Area.

Chapter 3b.2f: Wetland Route Results

This route consisted of six points on natural wetlands near the town of Manhattan and public access fishing sites along the Gallatin River. A total of 10,731 birds observed along this route (Table 9 and Figure 7). Waterfowl accounted for 8,676 or 81% of the total birds observed along this route. Canada geese accounted for 1,251 or 12% of the total. Birds along this route exhibited a seasonal distribution peaking in the fall and corresponding to winter migration. The natural wetlands near Manhattan were especially attractive to migrating ducks. There were also a number of swans and bald eagles observed at the wetlands near Manhattan.

Table 9. Wetland Route Survey Results

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	0	0	0	0	0	29	0	0	0	0	0	29
C. Geese	23	13	40	15	114	295	248	111	23	143	179	47	1251
Waterfowl	14	9	79	66	411	190	1893	4028	212	985	635	154	8676
Dove Pigeon	0	0	0	0		0	0	0	0	0	0	0	0
Hawk Owls	1	1	11	4	1	1	2	2	5	5	5	1	39
Blackbirds	24	36	38	50	0	18	6	0	0	0	3	7	182
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	0	2	5	6	2	3	2	5	12	13	8	10	68
Shorebirds	13	73	2	76	0	2	5	0	0	0	0	0	171
Ground Birds	14	42	133	31	6	13	1	0	29	0	5	13	287
Fish Eating	2	7	3	0	7	0	0	1	0	0	0	8	28
Sandhill Cranes	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	91	183	311	248	541	522	2186	4147	281	1146	835	240	10731

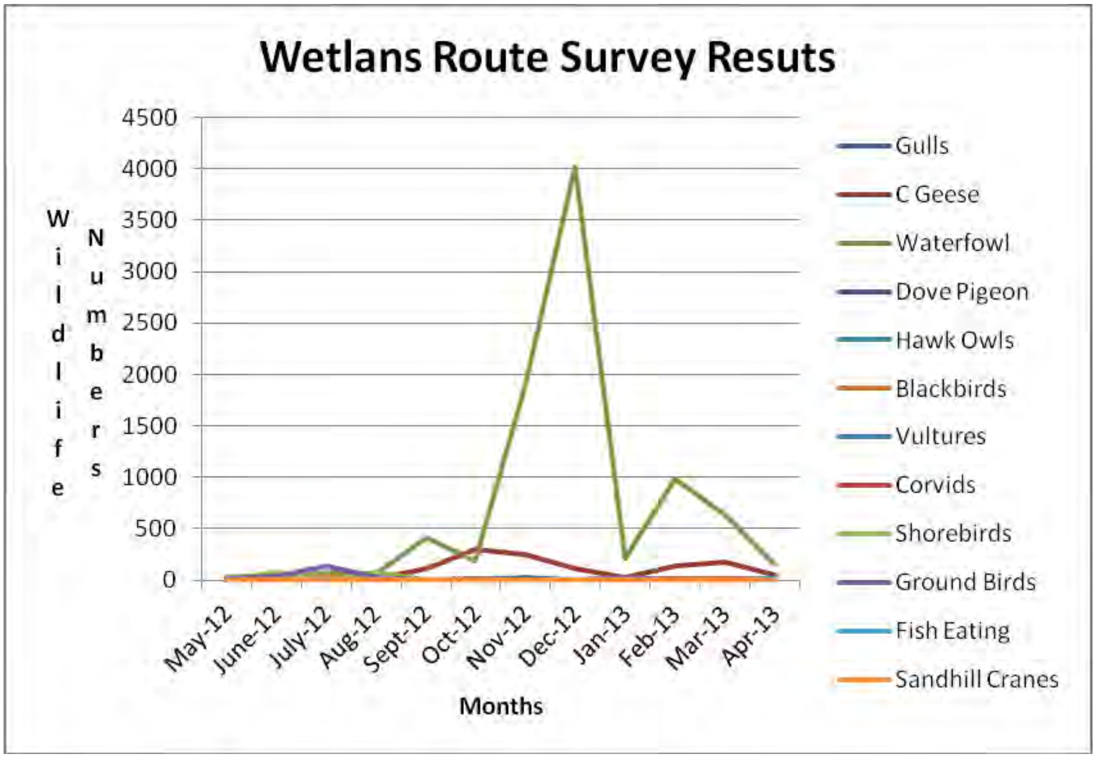


Figure 7. Results of the Wetland Route Survey

Chapter 3b.2g: Aircraft Operations Area (AOA) Route Results

This route consisted of eight survey points established along a county road outside the perimeter fence. A total of 1,336 birds were observed along this route (Table 10 and Figure 8). Blackbirds accounted for 387 or 29% of the total birds observed along this route, while crows accounted for 23% and Canada geese accounted for 11% of the total. The crows were observed foraging for trash in the parking lots and around the main terminal building. The Canada geese were observed feeding in the irrigated hay fields on the NW corner of the AOA. The crows and Canada geese appeared to be resident birds habituated to the urban area. Numbers for all three species of birds peaked in late summer corresponding to post molt period for urban birds.

One anomalous Canada goose observation in September 2012 accounted for 89% of all the geese recorded in the AOA. This observation was likely related to in influx of migrant birds. Counts in the remaining 11 months were near zero due to the active and aggressive wildlife management program implemented by airport staff.

Table 10. AOA Survey Results

Bird Group	May 12	June 12	July 12	Aug 12	Sept 12	Oct 12	Nov 12	Dec 12	Jan	Feb	Mar	Apr	Total
Gulls	0	0	0	0	0	0	0	0	0	0	0	0	0
C. Geese	4	0	0	0	124	0	2	9	0	0	0	0	139
Waterfowl	3	0	44	0	0	0	0	0	0	0	0	0	47
Dove Pigeon	0	4	0	1	0	0	23	2	10	14	22	13	89
Hawk Owls	1	3	4	6	6	7	1	0	6	3	6	6	49
Blackbirds	24	46	46	106	52	74	13	0	2	0	10	14	387
Vultures	0	0	0	0	0	0	0	0	0	0	0	0	0
Crows/Ravens	30	21	12	38	19	17	8	19	36	36	37	26	299
Shorebirds	0	1	7	17	0	0	0	0	0	0	0	0	25
Ground Birds	14	29	74	38	63	25	16	0	0	21	0	11	291
Fish Eating	1	3	0	0	0	0	0	0	0	0	0	0	4
Sandhill Cranes	0	0	4	0	2	0	0	0	0	0	0	0	6
Total	77	107	191	206	266	123	63	30	54	74	75	70	1336

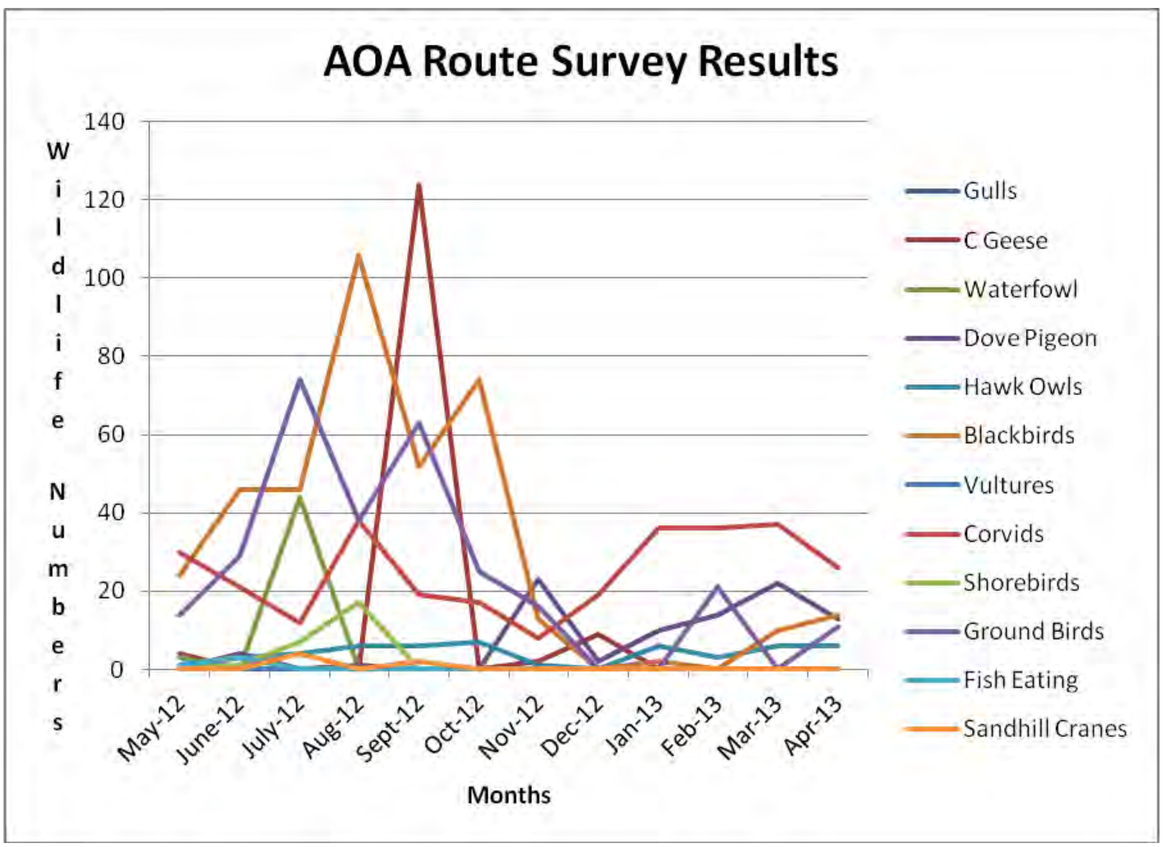


Figure 8. Results of wildlife surveys in the Aircraft Operations Area

Chapter 3b.2h: Owl Survey Results

A nocturnal owl survey was conducted in August 2012 and January, 2013 by playing owl vocalization tapes around the perimeter road in the AOA. No owls responded.

Chapter 3b.2i: Mammal Survey Results

Spotlight surveys were also conducted in August, 2012 and January 2013 by driving the perimeter road inside the AOA and searching for mammals. No mammals were observed during the spotlight surveys.

Small mammal trapping occurred in the AOA for 48 trap nights in August and September 2012; two Meadow voles and two deer mice were captured in August and two deer mice were captured in September.

Large mammal surveys were conducted monthly in conjunction with regularly scheduled bird surveys. Table 11 and Figure 9 presents the results of large mammal surveys. Most of the large mammals observed throughout this study were deer associated with the agricultural fields surrounding BZN.

Table 11: Results of large mammal surveys

Species	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April	Total
Elk	0	0	0	0	0	0	0	0	0	0	0	0	0
Deer	5	1	14	7	10	25	110	90	5	3	42	6	318
Antelope	0	0	0	0	0	8	0	0	0	0	0	2	10
Coyotes	0	0	0	0	1	0	0	0	0	0	2	0	3
Marmots	0	0	1	0	0	0	0	0	0	0	0	0	1
Total	5	1	15	7	11	33	110	90	5	3	44	8	332

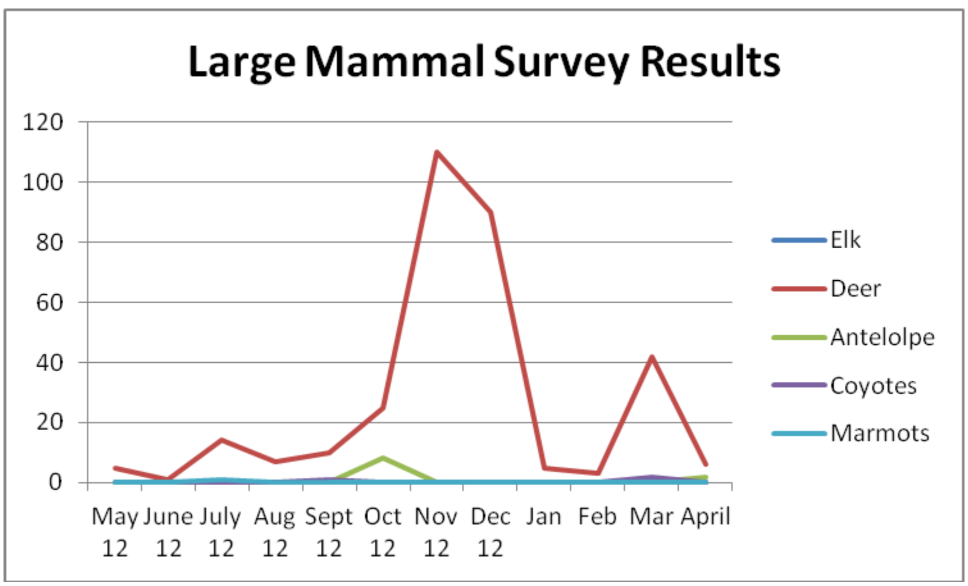


Figure 9. Results for large mammal surveys.

Chapter 3c: Wildlife Daily and Seasonal Movements

Daily movements were observed by all species of birds in all guilds. A fundamental principal of wildlife ecology is that animals will move around their home ranges throughout the day searching for food. These daily and diurnal movements were observed on repetitive counts, where numbers of birds differed each time an individual point was surveyed. Birds observed one day were not present in the same numbers in the exact same location the next day because of daily movement patterns associated with food gathering.

Seasonal movements were observed in populations of ducks, Canada geese, swans, and bald eagles. Flightlines of ducks and Canada geese were observed to intersect aircraft flightlines in both the approach and departure corridors to BZN.

Chapter 3d: Overview of Current Wildlife Management Program at BZN

The primary wildlife management technique implemented by BZN staff is habitat modifications to reduce the amount of food, water, and shelter available to wildlife, thus preventing wildlife from inhabiting the AOA. This preventative control is nonlethal, long term, and publicly acceptable. Approximately 1000 acres of grass occurs in the AOA, which is mowed to a height of 2-6 inches throughout the year, when soil moisture conditions allow access with heavy equipment. Taller grass height is not recommended due to the resulting increase in small mammal populations that attract hazardous species of hawks that are known to inhabit the area surrounding BZN.

A drainage ditch and two retention basins exist in the AOA. The drainage ditch transects the southern portion of the AOA and carries stormwater throughout most of the year. The vegetation on both banks of the ditch is 12-24 inches tall and provides nesting and roosting habitat for ducks and blackbirds. The basins are located in the NW corner of the AOA and retain water from spring snow melt and from summer rain events. Vegetation in the basins is 12-24 inches tall and is not mowed during the year.

These preventative controls are supplemented with a full cadre of nonlethal and lethal control techniques. Nonlethal techniques include wildlife hazing with sirens, horns, dogs, pyrotechnics, and vehicle herding. BZN possesses a Migratory Bird Depredation Permit and three Canada geese were taken during calendar year 2012. BZN also utilizes provisions of the Canada goose depredation order to control nesting of resident geese. Approximately 47 eggs in 9 nests were treated at the Belgrade Sewer Treatment Plant in 2012 and an additional 8 adult Canada geese were removed with lethal controls.

The OPS Specialists conduct daily wildlife patrols in the AOA. These patrol personnel identify wildlife hazards on the airport and recommend appropriate control actions. OPS Specialists also notify the Air Traffic Control Tower so that appropriate warnings can be added to the Air Traffic Information Satellite System or a Notice to Airmen issued.

Chapter 3e: Legal Status of Species

BZN contains no suitable habitat for any federally or state listed threatened or endangered species. No federal or state listed threatened or endangered species were observed during this study and none are expected to occur on BZN. Bald and Golden eagles are known to occur in the vicinity of BZN and both species are protected by the Bald and Golden Eagle Protection Act. Numerous species of migratory birds were observed on and near BZN and all are protected by the Migratory Bird Treaty Act. BZN currently holds a depredation permit issued by the US Fish and Wildlife Service to take migratory birds, but does not possess a permit to take eagles or T&E species.

The following table (Table 12) is a list of Threatened and Endangered Species potentially occurring in Gallatin County. This table is a new FAA requirement, but the presence of this table in this report in no way implies that these species could potentially occur on or near BZN and in no way implies that BZN must conduct a Section 7 Consultation with the US Fish and Wildlife Service on its wildlife management program.

Table 12: Threatened and Endangered Species potentially occurring in Gallatin County.

Scientific Name	Common Name	Suitable Habitat Present on or near BZN
Spiranthes diluvialis	Ute Ladies' Tresses	NO
Lynx canadensis	Canada Lynx	NO
Ursus arctos horribilis	Grizzly Bear	NO
Centrocercus urophasianus	Greater Sage-Grouse	NO
Anthus spragueii	Sprague's Pipit	NO
Gulo gulo luscus	Wolverine	NO
Pinus albicaulis	Whitebark Pine	NO

Source:http://www.fws.gov/montanafieldoffice/Endangered_Species/Listed_Species/countylist.pdf

Chapter 4. Hazard Analysis and Recommendations

AWC's hazard analysis is separated into primary and secondary hazards. The separation is based primarily on land ownership, the primary hazards occur on property owned by the airport where the airport has the authority and capabilities to easily and efficiently implement the recommended mitigations. The Primary Hazards are located on airport property and provide personnel with immediate and unrestricted access for wildlife control and monitoring. In addition, primary hazards are also based on limitations in fiscal resources and environmental regulations. Mitigation of primary hazards can be accomplished with existing financial resources and within existing regulatory frameworks. Secondary hazards require long term financial commitments, exorbitant mitigation fees, and involve compliance with extensive environmental regulations. This separation of hazards facilitates a common sense approach that airport managers can use to prioritize limited funds and man power for accomplishment of the recommendations and mitigations.

Also included in this chapter are mitigations and recommendations. AWC lists mitigations for specific hazards that can be accomplished within existing monetary and staffing frameworks. These hazard specific mitigations also focus on the ability and legal authority to manage migratory birds and resident game animals as compared to endangered species where management abilities are extremely limited. Recommendations are programmatic documents that can be prepared and implemented to address all potential wildlife issues throughout the airport and the surrounding urban area.

FAA AC 150/5200-33B provides a hazard ranking for various species of migratory birds as does a recent USDA publication (DeVault et. at. 2011) (Table 13.). Both publications assign a hazard ranking on a scale of 1-100 where 100 is the highest hazard ranking score.

The species of migratory birds listed below have the potential to produce engine ingestions and cause structural damage to aircraft. The following table presents the hazard ranking for species of birds observed in the AOA.

Table 13. Hazard rankings for migratory birds observed at BZN.

Species	AC 150/5200-33B	DeVault et.al. 2011
Hawks	25	25
Owls	23	44
Doves	14	10
Vultures	64	44
Canada Geese	55	46
Bald Eagles	41	36
Crows	16	12

The ACRP report published in May of 2011 listed all available nonlethal control methods for migratory birds and their probability of success. Table 14 is a summary of that report relevant to the hazardous species observed at BZN.

Table 14. List of Nonlethal mitigations available for migratory bird management and their probability of success.

Method	Blackbirds	Corvids	Dove/Pigeons	Vultures	Hawks	Gulls	Geese	Cranes
Deterrents								
Avitrol	G	Na	F	NA	NA	F	F	NA
Methyl-anthranilate	G	G	G	G	G	G	G	G
Antrhaquinone	G	G	G	G	G	G	G	G
Tactiles	F/G	F/G	F/G	F/G	F/G	F/G	F/G	F/G
Effigies	G	G	G	G	G	G	G	G
Mylar Tape & Flags	P	P	P	P	P	F	P	P

Lights & Mirrors	F	F	F	F	F	F	F	F
Predator Models	F	F	F	F	F	F	F	F
Harassment								
Gas Exploders	F/G	F/G	F/G	F/G	F/G	F/G	F/G	F/G
Pyrotechnics	G	G	G	G	G	G	G	G
Biosonics	NA	NA	NA	NA	NA	F	G	NA
Ultrasonics	NR	NR	NR	NR	MR	NR	NR	NR
Lasers	P	P	P	P	P	P	P	P
Falconry	F	F	F	F	F	F	F	F
Dogs	G	G	G	G	G	G	G	G
Exclusion								
Overhead Wires	G	NA	G	NA	NA	F	G	F
Anti Perch Devices	G	G	G	G	G	G	G	G

Legend: G=good, F=fair, P=poor, NA=not available, NR=not recommended.
Source: ACRP 2011.

Chapter 4a. Hazard Analysis

Primary Hazards

Resident Canada geese at the Belgrade Sewer Treatment Plant

- Canada geese have been responsible for more human fatalities resulting from collisions with aircraft than any other species.
- A resident flock of Canada geese exists at the Belgrade Sewer Treatment Plant adjacent to BZN.
- The ponds at the Belgrade Sewer Treatment Plant are the primary Canada goose attractant but hay fields, located inside the AOA, that are sprayed with treated effluent provide a food source and serve as a lesser attractant.
- The Canada goose Depredation Order gives cities a great deal of flexibility to limit the expansion of resident flocks.
- Based on the potential for these large dense bodied birds to cause damage, and the ability to manage this local population, the resident flock of Canada geese at the Belgrade Sewer Treatment Plant, pose a Primary Hazard at BZN.

Mitigation:

- BZN staff should increase existing coordination and communication activities with the City of Belgrade related to development of this resident flock of Canada geese.
- BZN staff should encourage the City of Belgrade to stop aerating the ponds during the winter months thereby allowing the ponds to completely freeze over eliminating any Canada goose roosting habitat.
- BZN staff, in conjunction with the City of Belgrade, should also develop a contingency plan for goose roundups and nest control during the molting season to control expansion of this resident flock.
- Purchase and implement nonlethal control devices such as pyrotechnics.
- Continue annual nest control actions according to provisions of the Canada goose Depredation Order
- Continue annual renewals of the Migratory Bird Take Permit issued to BZN by the US Fish and Wildlife Service for lethal control of Canada geese.
- BZN should encourage sport hunting actions on adjacent private property to reduce the local Canada goose population.

Bald Eagles in and near the AOA

- Bald eagles are winter migrants to the area and nest at various sites on the Gallatin River
- Bald Eagles were observed soaring in the approach and departure corridors and had the potential to intersect flightlines used by aircraft at BZN.
- Bald eagles are attracted to the AOA due to illegal dumping of deer and elk carcasses during big game hunting seasons.
- Non-lethal Wildlife Management Actions are allowed by special permit only.
- Based on the potential for these birds to cause damage and the incidents of sightings in the AOA, eagles in the AOA pose a primary wildlife hazard.

Crows and Ravens in the AOA

- Crows were observed in the AOA throughout this study.
- Crows were observed feeding and roosting in the AOA around the main terminal building and parking lots.
- Flightlines used by crows traveling between feeding and roosting sites were observed to intersect flightlines used by aircraft at BZN.
- Wildlife Management Actions, both lethal and nonlethal, have been directed toward removal of crows from the AOA.
- Based on the potential for these birds to cause damage and the incidents of sightings in the AOA, crows in the AOA pose a primary wildlife hazard.

Mitigation: Continue to implement all available nonlethal and lethal control actions to reduce the crow population using the AOA.

Illegal Dumping adjacent to the AOA

- Big game hunters dump the carcasses of deer and elk in road ditches adjacent to the east side of the AOA.
- Dumping of big game carcass in road right of ways is prohibited by State Law codified in the Montana Administrative Code Chapter 75-10-212
- Big Game carcasses attract Bald eagles and other scavengers
- Flight lines of Bald Eagles traveling to and from the AOA to feed on big game carcasses intersect with aircraft approach and departure corridors
- Based on the food attractant provided by big game carcasses illegally dumped adjacent to the AOA, this practices poses a primary hazard

Mitigation:
Initiate discussions with the County Planning Department to strength and enforce illegal dumping regulations. Initiate a public relations campaign prior to hunting season to advise hunters of the hazard caused by illegal dumping activities. Airport staff may be required to collect and remove carcasses that are attracting hazardous species of wildlife.

Secondary Hazards

Farmland Surrounding BZN

- Row crops, such as wheat, barley, corn, and alfalfa provide a viable food source for many avian species known to be hazardous to aviation.
- Agricultural lands adjacent to BZN are all privately owned.
- Cattle feedlots adjacent to BZN provide an excellent food source for resident and migratory bird species.
- Based on the resources needed to manage this wildlife attractant farmlands pose a Secondary Wildlife Hazard.

Mitigation: Encourage hunting of resident and migratory bird species on farmlands adjacent to BZN. In conjunction with the Wildlife Hazard Working Group, develop a contingency plan to educate adjacent landowners on the attractiveness of crops to species known to be hazardous to aviation. Row crops currently being planted near BZN include corn, wheat, barley, and alfalfa. Conversion of this land to dry land hay or inclusion of the area in the Conservation Reserve Program would reduce food available for migratory birds.

Wetlands North of the Airport

- Wetlands located approximately 3 miles north of BZN provide excellent feeding and roosting habitat for hazardous species of migratory birds including: ducks, geese, swans, and eagles.
- These wetlands have the potential to develop a migratory bird flightline that would cross BZN and intersect with aircraft approach and departure corridors.

- Currently the warmer open water associated with these wetlands serves to attract hazardous species away from the AOA.
- Based on the potential for migratory birds attracted to these wetlands to create a bird flightline that intersects aircraft flightlines, wetlands in the surrounding area pose a Secondary Hazard at BZN.

Mitigation: BZN should continue monitoring surveys to detect seasonal changes in the populations of hazards species of migratory birds and issue NOTAMS to advise pilots of the location of the hazard.

Chapter 4c. Recommendations:

1) Development of a Wildlife Hazard Management Plan (WHMP).

Based on the presence of FAA defined wildlife attractants, and presence of wildlife species known to be hazardous to aviation AWC recommends BZN develop a WHMP. The WHMP will include (a) identification of key personnel to implement the plan; (2) identification of hazardous wildlife attractants on or near the airport; (3) identification of wildlife management techniques to minimize the hazard; (4) prioritization of appropriate management measures; (5) recommendation for necessary permits, equipment, and supplies; and (6) identification of training requirements for airport personnel.

2) Continuation of Annual Monitoring

Airports are required to update the Wildlife Hazard Management Plan every 12 consecutive months. The update will include a review of plan effectiveness when a triggering event occurs. The goal of a monitoring plan should be to determine if wildlife attractants or hazardous wildlife species have changed compared to the baseline established in the original WHA and to determine if a WHMP should be implemented or to evaluate an on-going WHMP. BZN should also continue the wildlife management program being conducted by airport staff using a combination of lethal and nonlethal control techniques.

3) Development of a Wildlife Hazard Training Program

14 CFR § 139.337(f) and AC 150/5200-36A allow Airports to use the “train-the-trainer” approach when providing the requisite training, provided the trainers receive and successfully complete their initial and recurrent training from a qualified airport wildlife biologist. Trainers who are not qualified airport wildlife biologists are limited to providing training to their airport employees.

The purpose of the training will be to familiarize personnel involved with wildlife hazard management with basic wildlife identification and dispersal techniques. The training may include hands-on training using pyrotechnics, and other deterrent equipment, with an emphasis on safety and effectiveness. These training courses will be available to all personnel who have responsibility in dispersing wildlife at BZN. Wildlife Hazard Training is required for all airport personnel involved in wildlife management every 12 consecutive months. The training will be customized to fit the needs of individual recipients and situations, and will incorporate management issues relating directly to BZN wildlife strikes, populations, and physical environment. Instruction will be tailored to competence levels and areas of participating personnel.

At a minimum the initial and recurrent training must include:

- Summary of bird strike data from the National Wildlife Strike Database
- Review of wildlife strikes, control actions, and observations over the past 12 months
- Review of the airports Wildlife Hazard Assessment
- Review of the airports Wildlife Hazard Management Plan to include:
    - Wildlife attractants
    - Wildlife permits
    - Airport specific management actions and responsibilities

- Wildlife identification
- Process for accurate voluntary reporting of wildlife strikes into the National Wildlife Strike Database
- Pyrotechnic training as appropriate
- Oral exam

All BZN staff engaged in wildlife management actions completed the initial Wildlife Hazard Training in April, 2013.

Literature Cited

ACRP Synthesis #23. 2011. Bird Harassment, Repellant, and Deterrent Techniques for Use on and Near Airports. Transportation Research Board.

DeVault, T.L. et.al. 2011. Interspecific Variation in Wildlife Hazards to Aircraft: Implications for Airport Wildlife Management. Wildlife Society Bulletin 35(4):394-402.

Dolbeer, R. A. 2009. Birds and aircraft – fighting for airspace in ever more crowded skies. Human – Wildlife Conflicts 3(2):165-166

Dolbeer, R. A., and P. Eschenfelder. 2003. Amplified bird-strike risks related to population increases of large birds in North America. Pages 49-67 *in* Proceedings of the International Bird Strike Committee meeting, Warsaw, Poland.

Droege, S. 1990. The North American Breeding Bird Survey. Pg. 1-4 *in* J. R. Suaer, and S. Droege, eds. Survey designs and statistical methods for estimation of population trends. U. S. Fish and Wildlife Service Biological Report 90(1)

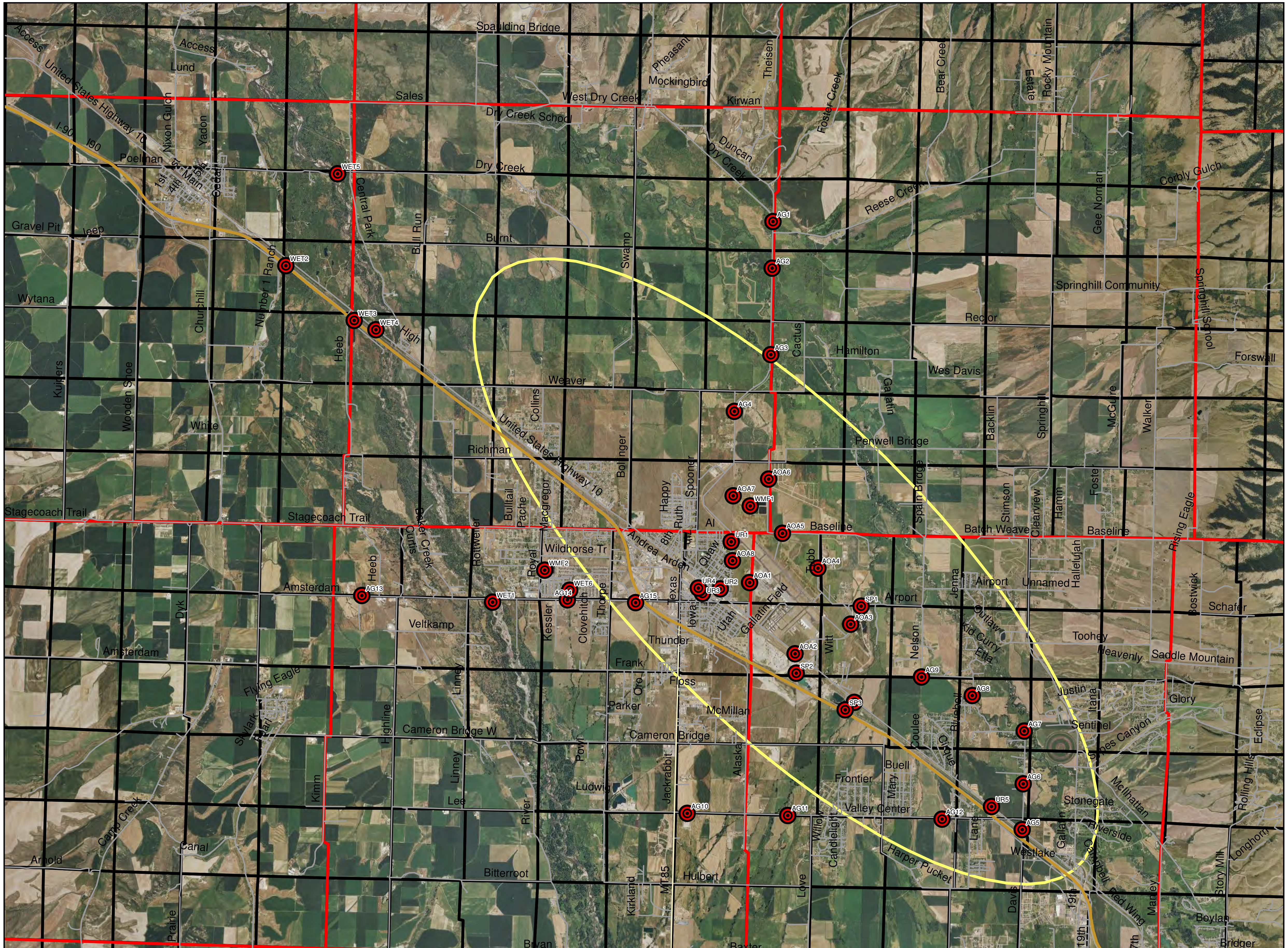
NTSB. 2009. Fourth update on investigation into ditching of US Airways jetliner into Hudson River. NTSB Advisory, 12 February 2009. National Transportation Safety Board, Washington, D.C., USA, <http://www.ntsb.gov/ Pressrel/2009/090212b.html>.

Robbins, C. S., and W. T. Van Velzen. 1967. The breeding bird survey, 1966. US Department of Interior, Bureau of Sport Fisheries and Wildlife, Division of Wildlife Research, Migratory Bird Populations Station, Washington, DC. Special Scientific Report—Wildlife No. 102. 43pp.

Root, R. B. 1967. The niche exploration pattern of the blue-grey gnatcatcher. Ecological Monographs 37:317-350

Serveringhaus, W. 1981. Guild theory development as a mechanism for assessing environmental impact. Environmental Management 5:187-18=90

Appendix A
GIS Map of Wildlife Survey Points



Legend

TYPE

- Interstate
- Montana Roads
- Secondary
- U.S. Route
- Gallatin County Roads
- Wildlife Area
- Township
- Section
- Wildlife Survey Points

AOA - Air Operations Area
UR - Urban
AG - Agricultural
WMF - Waste Management Facility
SP - Spoil Pile
WET - Water/Wetland

0 1 2 4 6 8 Miles

N

MORRISON MAIERLE, INC.
An Employee-Owned Company

Engineers
Surveyors
Scientists
Planners

2880 Technology Blvd. W.
Bozeman, MT 59718

Phone: (406) 587-0721
Fax: (406) 922-6702

Path: N:\0761\114\GIS\Figure1.mxd

DRAWN BY: KH
CHK'D BY: MM
APPR. BY: XX
DATE: 04/2012

BELGRADE

BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT

MT

WILDLIFE HAZARD ASSESSMENT 2012

PROJECT NO.
N:\0761.114

FIGURE NUMBER
FIG. 1

Legend

<all other values>

TYPE

- Interstate
- Montana Roads
- Secondary
- U.S. Route
- Gallatin County Roads
- Wildlife Survey Points

AOA - Air Operations Area
UR - Urban
AG - Agricultural
WMF - Waste Management Facility
SP - Spoil Pile
WET - Water/Wetland

N

0 0.3 0.6 1.2 1.8 2.4 Miles

MORRISON MAIERLE, INC.
An Employee-Owned Company
Engineers
Surveyors
Scientists
Planners
2880 Technology Blvd. W.
Bozeman, MT 59718
Phone: (406) 587-0721
Fax: (406) 922-6702

DRAWN BY: KH
CHK'D BY: MM
APPR. BY: XX
DATE: 04/2012

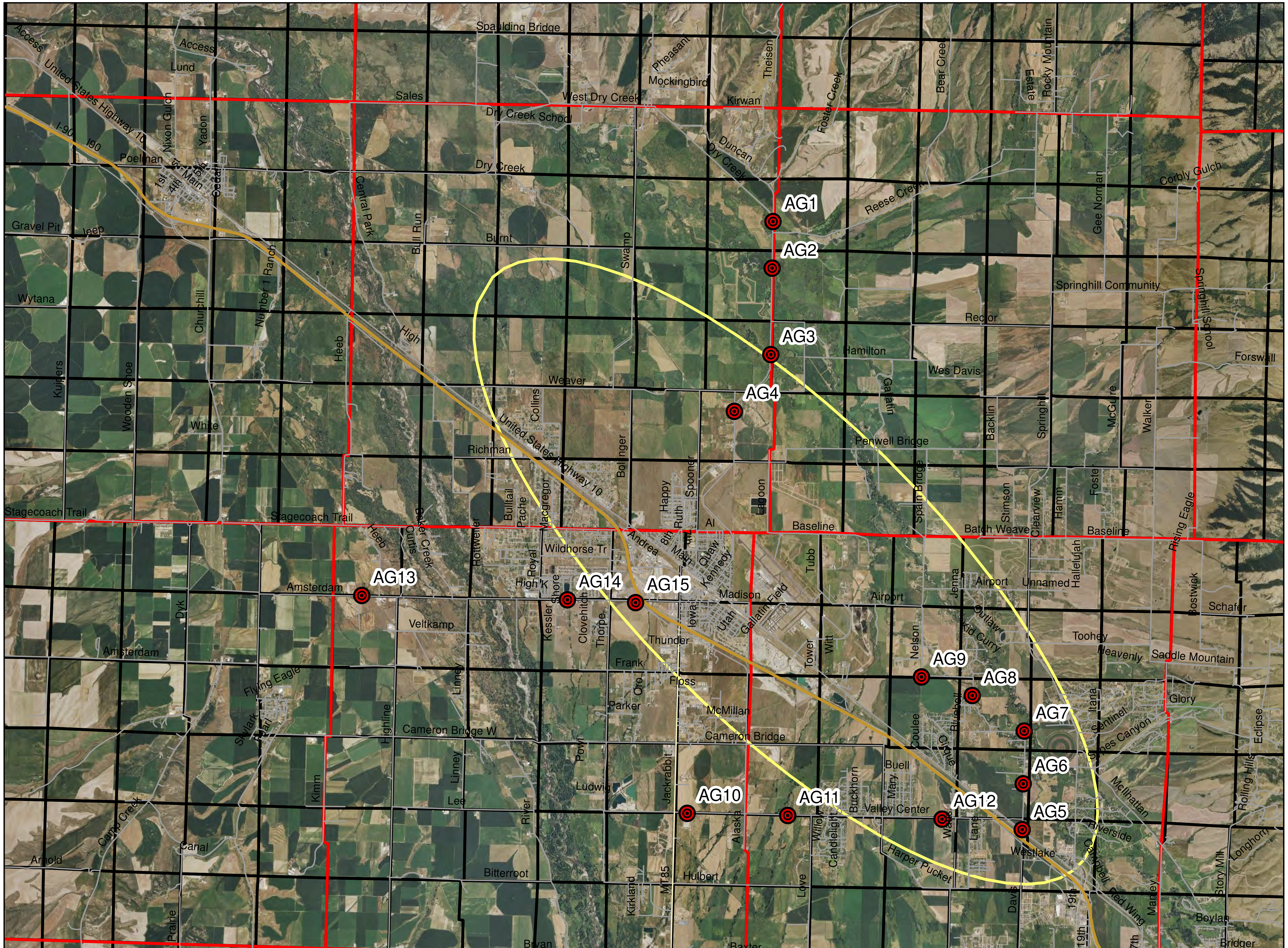
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT
BELGRADE MT

WILDLIFE HAZARD ASSESSMENT 2012
AIR OPERATIONS AREA WILDLIFE SURVEY POINTS

PROJECT NO. N:\0761.114

FIGURE NUMBER
FIG. 2

Path: N:\0761\114\GIS\Figure2.mxd



Legend

TYPE

- Interstate
- Montana Roads
- Secondary
- U.S. Route
- Gallatin County Roads
- Wildlife Area
- Township
- Section
- Wildlife Survey Points

AOA - Air Operations Area
UR - Urban
AG - Agricultural
WMF - Waste Management Facility
SP - Spoil Pile
WET - Water/Wetland

N

0 1 2 4 6 8 Miles

MORRISON MAIERLE, INC.
An Employee-Owned Company
Engineers
Surveyors
Scientists
Planners
2880 Technology Blvd. W.
Bozeman, MT 59718
Phone: (406) 587-0721
Fax: (406) 922-6702

DRAWN BY: KH
CHK'D BY: MM
APPR. BY: XX
DATE: 04/2012

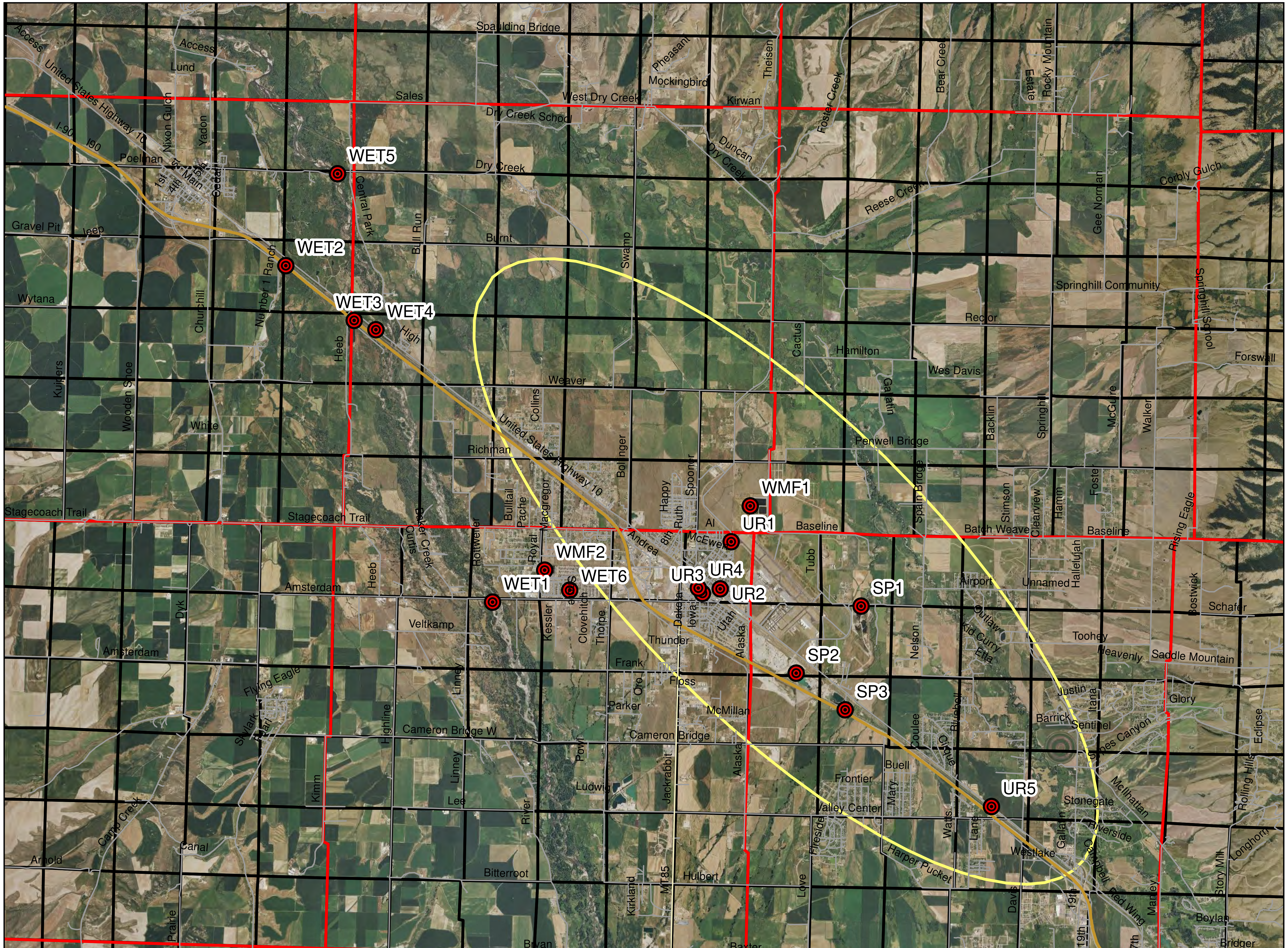
BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT
BELGRADE MT

PROJECT NO.
N:\0761.114

WILDLIFE HAZARD ASSESSMENT 2012
AGRICULTURAL AREA WILDLIFE SURVEY POINTS

FIGURE NUMBER
FIG. 3

Path: N:\0761\114\GIS\Figure3.mxd



Legend

<all other values>

TYPE

- Interstate
- Montana Roads
- Secondary
- U.S. Route
- Gallatin County Roads
- Wildlife Area
- Township
- Section
- Wildlife Survey Points

AOA - Air Operations Area
UR - Urban
AG - Agricultural
WMF - Waste Management Facility
SP - Spoil Pile
WET - Water/Wetland

N

0 1 2 4 6 8 Miles

MORRISON MAIERLE, INC. An Employee-Owned Company	Engineers Surveyors Scientists Planners	2880 Technology Blvd. W. Bozeman, MT 59718 Phone: (406) 587-0721 Fax: (406) 922-6702	DRAWN BY: KH CHK'D BY: MM APPR. BY: XX DATE: 04/2012	**BOZEMAN YELLOWSTONE INTERNATIONAL AIRPORT** BELGRADE MT	PROJECT NO. N:\0761.114
Path: N:\0761\114\GIS\Figure4.mxd		COPYRIGHT © MORRISON-MAIERLE, INC., 2012		WILDLIFE HAZARD ASSESSMENT 2012 WILDLIFE SURVEY POINTS	FIGURE NUMBER **FIG. 4**

Appendix B: Site Photos

Belgrade Waste Water Treatment Facility adjacent to BZN

Gravel Pit or Spoil Pile south of BZN


Agricultural field near BZN


Pigeons feeding at a grain elevator along the Urban route

Waterfowl wintering on the natural wetlands near Manhattan

Canada geese feeding in the AOA

Big game carcass illegally dumped adjacent to BZN