WEST BELT LOOP LAND USE, CONNECTIVITY AND ACCESS PLAN

Casper, Wyoming

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Prepared for:
Casper Area Metropolitan Planning Organization

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EXECUTIVE SUMMARY

- The WYDOT and Casper Area MPO propose to develop West Belt Loop Road as a limited access control corridor. This practical strategy will reduce congestion and increase capacity due to a reduction of conflicting traffic movements. In addition, controlling access has also been documented to improve safety along arterial routes. The primary goals for this corridor study are two-fold: 1) Establish locations for future public intersections, and 2) Create an access management policy for adoption and use by local agencies.
- The Corridor Study provides land-use projection for intermediate and full regional build-out conditions. In accordance with the Casper Area Regional Transportation Plan Update completed in 2014, the study year is 2040. In order to plan for the full build-out of the corridor and surrounding vacant lands, the Corridor Study includes development and corresponding traffic projections assuming 100-percent development in the area.
- The WYDOT Access Management Guidelines are referenced as the minimum standard for access controls along the corridor. The WYDOT guidelines allow for minimum spacing of one-half miles between intersections on a two-lane roadway. Likewise the policy establishes that the minimum spacing between public intersections on a four-lane divided roadway is one-mile. Minor intersections are allowed at one-half mile intervals provided that access to and from the minor intersections are restricted to right-in/right-out only. In a few cases, right-in/right-out and left in are allowed provided there is a traffic impact analysis performed justifying the third movement.
- Access management recommendations were provided for West Belt Loop and the corridor influence area. Beyond the 13 intersections (described by the previous bullet), guidelines identify properties can also be accessed through frontage roads, reverse frontage roads, backage roads, shared access, and access easements. A traffic impact study will identify the access strategy and typical improvement mitigation measures needed to promote land use development within the corridor influence area of West Belt Loop, as sponsored by the project proponent. Traffic impact studies should reference the West Belt Loop Corridor and Access Study as this: 1) identifies the location of intersections and driveways along the corridor, 2) provides design guidance for interconnecting arterial and driveway location and design, and 3) offers guidance on accessing properties between ½ mile West Belt Loop intersections (so that properties are not land-locked).
- Based on the recommended intersection locations included herein (total of 13-intersections), traffic volumes for 2040 and full area build-out will compromise the safe and efficient capacity of the two-lane roadway. The study concludes that future deteriorated levels-of-service will require construction of two additional lanes creating a divided a four-lane roadway. Justification of the roadway capacity improvements will need to be analyzed to confirm the need for additional lanes, and corresponding intersection capacity improvements (e.g., signal modifications, protected left turn lanes, deceleration lanes, and acceleration lane features).
- Preliminary environmental screening concludes that the inclusion of the 13 recommended intersections will not adversely impact the natural environment or create socio-economic problems in the region adjoining West Belt Loop corridor.
- The corridor study is prepared in compliance with the federal *Moving Ahead for Progress in the 21st Century*," also known as MAP-21.

- At the June 19, 2014 Casper MPO Policy Committee regular meeting, the committee agreed that the local agencies will adopt the Corridor Study by resolution. The communities of Mills, Casper, and Natrona County will adopt the document. WYDOT and FHWA will not formally adopt the document; they will approve the document at the WYDOT regional level, with FHWA concurrence.
- With the exception of the Trevett Lane route analysis (described below); this corridor study is limited to providing general discussion related to future regional transportation networks to area development and connection to established City and County roadways. The future alignment and construction of a regional transportation network will be dictated by the needs of future development surrounding West Belt Loop. Natrona County and City land planners will be tasked to review developer's subdivision and/or development plans to ensure they meet local land development standards. Any future regional connectivity will need to be financed by development; the County, WYDOT, Town of Mills and the City of Casper have stated that future roadway and infrastructure costs would be borne by the developers.
- In accordance with the scope of this corridor study, a preliminary route analysis was performed to determine the feasibility of extending Trevett Lane to connect with West Belt Loop. The analysis concludes that there are at least two possible routes that this collector road may follow to connect with West Belt Loop. In appendix B is a brief summary of the preliminary design including plan and profile sheets.
- A thorough public involvement process was conducted to inform citizens and gain public support for the future access management policy. Three formal open-house meetings were provided to local residents and the general public. In addition, individual property owners were contacted and interviewed.

DEFINITION OF COMMONLY USED TERMS

This section provides a glossary of commonly used terms. The *Highway Capacity Manual* (TRB, 2010), the FHWA website, and the *Transportation Impact Analyses for Site Development* (ITE, 2005) were used to help with the development of the following definitions:

- **Access point** – An intersection, driveway, or opening on a roadway that provides access to a land use or another roadway facility.
- **Access Management** – Techniques state and local governments can use to control access to highways, arterials, or other roadways, typically for the purpose of reducing vehicle conflicts and therefore congestion, and to reduce collision potentials.
- **Access Permit** – The permission provided by a State or local agency for a property to gain access to a roadway.
- **ADT** – Average daily traffic; meaning total traffic volumes for a typical weekday.
- **All-way stop-controlled** – An intersection with stop signs located on all approaches.
- **Arterial** – (General Definition) A signalized street that primarily serves through-traffic and secondarily provides access to abutting properties.
- **Average daily traffic (ADT)** – The average 24 hour traffic volume at a given location on a roadway.
- **Capacity** – The number of vehicles or persons that can be accommodated on a roadway, roadway section, or at an intersection over a specified period of time. Capacity is also a term used to define limits for transit, pedestrian, and bicycle facilities. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- **Collector Street** – (General Definition) A surface street providing land access and traffic circulation within residential, commercial, and industrial areas.
- **Cycle** – A complete sequence of cycle indicators.
- **Cycle length** – The total time for a signal to complete one cycle.
- **Delay** – The additional travel time experienced by a driver, passenger, or pedestrian.
- **Demand** – The number of users desiring service on a highway system or street over a specified time period. Concept typically expressed as vehicles per hour, vehicles per day, or persons per hour or per day.
- **Density (Land Use)**. For this report, refers to the number of persons, homes, employees, or building area provided for within an acre or square-mile.
- **Departing sight distance** – The length of road required for a vehicle to turn from a stopped position at an intersection (or driveway) and accelerate to travel speed.
- **Downstream** – The direction of traffic flow.
- **External Trip** – Is a trip that travels from outside into a defined study area typically using a highway or primary arterial with purpose of traveling through (the study area) or for accessing land uses within the study area.
- **Frontage** – The length of property measures alongside of a road, river, or body of water onto which the property fronts.

- **Frontage Improvement** – Typically refers to roadway improvements constructed along the front of a property, such as widening, curb, gutter, sidewalks, and/or shoulder improvements.
- **Frontage Road** – Is a service road running parallel to a higher speed, limited access roadway typically used to provide access to property, and sometimes for congestion relief or secondary/emergency movements.
- **Functional class** – A transportation facility defined by the traffic service it provides.
- **Growth factor** – A percentage increase applied to current traffic demands or counts to estimate future demands/volumes.
- **Internal Trip**. A trip that occurs between land uses within a defined area, typically traveling off the principal roadway network through parking lots or local streets.
- **Land Use**. The designation of property for human use/habitation, typically categorized in transportation planning into various commercial, residential, service/retail, and institutional classifications distinguished by trip generation or travel characteristics.
- **Level of Service** – The standard used to evaluate traffic operating conditions of the transportation system. This is a qualitative assessment of the quantitative effect of factors such as speed, volume of traffic, geometric features, traffic interruptions, delays and freedom to maneuver. Operating conditions are categorized as LOS A through LOS "F". LOS A generally represents the most favorable driving conditions and LOS F represents the least favorable conditions.
- **Mainline** – The primary through roadway as distinct from ramps, auxiliary lanes, and collector-distributor roads.
- **Major Street** – The street not controlled by stop signs at a two-way stop-controlled intersection.
- **Minor arterial** – (General Definition) A functional category of a street allowing trips of moderate length within a relatively small geographical area.
- **Mitigation** – In transportation planning, referred to as improvements or strategies used to correct traffic, pedestrian/bike, or transit congestion or safety issues.
- **MPO** – Metropolitan planning organization. The Casper Area MPO is the sponsor of the West Belt Loop Corridor and Access Study.
- **Operational analysis** – A use of capacity analysis to determine the level of service on an existing or projected facility with known or projected traffic, roadway, and control conditions.
- **Peak Generator Hour** – The single hour (or hours) in a day during which trip generation for a development or land use is highest.
- **Peak hour** – Single hour (or hours) in a day during which the maximum traffic volume occurs on a given facility (roadway, intersection, etc.). Typically the peak hour is known as the "rush" hour that occurs during the AM or PM work commutes of the typical weekday. The absolute peak hour of the day can also be referred to as the design hour.
- **Peak hour factor** – The hourly volume during the maximum-volume hour of the day divided by the peak 15-minute flow rate within the peak hour; a measure of traffic demand fluctuation within the peak hour.

- **Principal Arterial** - (General Definition) A major surface street with relatively long trips between major points, and with through-trips entering, leaving, and passing through the urban area.
- **Queue** – A line of vehicles, bicycles, or persons waiting to be served by the system in which the flow rate from the front of the queue determines the average speed within the queue. Slower moving vehicles or people joining the rear of the queue are usually considered a part of the queue.
- **Roadside obstruction** – An object or barrier along a roadside or median that affects traffic flow, whether continuous (e.g., a retaining wall) or not continuous (e.g., light supports or a bridge abutment).
- **Road characteristic** – A geometric characteristic of a street or highway, including the type of facility, number and width of lanes, shoulder widths and lateral clearances, design speed, and horizontal and vertical alignment.
- **Roundabout** – An unsignalized intersection with a circulatory roadway around a central island with all entering vehicles yielding to the circulating traffic.
- **Shoulder** – A portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, emergency use, and lateral support of the subbase, base, and surface courses.
- **Spacing** – Typically referred to as the distance between contiguous intersections or driveways along a roadway, as measured from center line to center line, or between edges of curb/shoulder.
- **Station or Stationing.** The measurement system used to designate locations along a roadway, most typically employed in the layout and construction of roadways.
- **Stopping sight distance** – The length of road needed for a moving vehicle to come to a complete stop prior to an obstruction sighted on the road.
- **Synchro**. A analysis software program used to quantify traffic operations and capacity for an intersection, roadway, or roadway network; presenting information in term of vehicle delays, levels-of-service, travel speeds, queueing, and other traffic measures.
- **Traffic conditions** – A characteristic of traffic flow, including distribution of vehicle types in the traffic stream, directional distribution of traffic, lane use distribution of traffic, and type of driver population on a given facility.
- **Transportation Analysis Block (TAB)** – A concept developed for this study that refers to a land use area access by a particular intersection (access point) located along West Belt Loop, as relevant due to the number of trips generated within the TAB and accessing the defined intersection.
- **Travel speed** – The average speed, in miles per hour, of a traffic computed as the length of roadway segment divided by the average travel time of the vehicles traversing the segment.
- **Travel time** – The average time spent by vehicles traversing a highway segment, including control delay, in seconds per vehicle of minutes per vehicle.
- **Trip Distribution and Assignment** – The predicted travel patterns of vehicle trips as they approach and depart a land use. Distribution refers to the travel pattern, usually defined in percentages or fractions, and assignment refers to vehicle trip ends.

- **Traffic forecast** – The predicted traffic volume of the analysis horizon year or time period. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- **Traffic impact study** (TIS) – A *traffic impact study (TIS) or traffic impact analysis (TIA)* is an engineering and planning study that forecasts the potential traffic and transportation impacts of a proposed development on an area, neighborhood, or community.
- **Trip generation** – The number of vehicle trips generated by a development or land use. Most typically predicted for the weekday, AM peak hour, PM peak hour, or AM or PM peak generator hours of the typical weekday.
- **Two-way left-turn lane** – A lane in the median area that extends continuously along a street or highway and is marked to provide a deceleration and storage area, out of the through-traffic stream, for vehicles traveling in either direction to use in marking left turns at intersections and driveways.
- **Two-way stop-controlled** – The type of traffic control at an intersection where drivers on the minor street or driver turning left from the major street wait for a gap in the major-street traffic to complete a maneuver. Typically the minor approaches are stop-controlled.
- **Unsignalized intersection** – An intersection not controlled by traffic signals.
- **Upstream** – The direction from which traffic is flowing.
- **Volume** – The number of persons or vehicles passing a point on a lane, roadway, or other traffic-way during some time interval, often one hour, expressed in vehicles, bicycles, or persons per hour.
- **Volume-to-capacity ratio** – The ratio of flow rate to capacity for a transportation facility.
- **Walkway** – A facility provided for pedestrian movement and segregated from vehicle traffic by a curb, or provide for on a separate right-of-way.
- **WYDOT** – Wyoming Department of Transportation

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1 INTRODUCTION

The population of Natrona County, the City of Casper, and the Town of Mills has increased steadily throughout the last 20 years. Officials with all three agencies indicate continued and steady population growth is projected on the horizon, with over a 20 percent increase expected by year 2040 (within the next 25 years). Traffic growth is anticipated with the population increase, resulting in elevated travel demands that impact operations and capacity for arterials and highways such as Robertson Road, Wyoming Boulevard, State Highway 220, and State Highway 20. These roadways already experience high traffic volumes and, as such, new and improved travel routes are being programmed to address future travel demands.

Officials with the Wyoming Department of Transportation (WYDOT) and Casper Area Metropolitan Planning Organization (hereon referred to as Casper MPO) have already moved to construct one such arterial, known as West Belt Loop. Programmed as a two-lane, 60 mph Highway, the current purpose of West Belt Loop is to provide a bypass between State Highway 220 and State Highway 20/26 west of Casper, generally for use as a freight route and as a means to reduce congestion by circulating traffic around the City proper.

However, even as this roadway is under construction, WYDOT and Casper MPO officials recognize additional improvements will be needed to accommodate long-range travel demands, access future developed properties along the corridor, and improve traffic circulation within and surrounding Casper and Mills. As such, the West Belt Loop Land Use, Connectivity, and Access Plan (herein referenced to as "Corridor Study") was commissioned by WYDOT and Casper Area MPO officials to:

1) Establish access management guidelines,
2) Provide general land use forecasts for properties within an influence area of the corridor,
3) Forecast year 2040 and ultimate regional "build-out" daily and PM peak hour traffic volumes,
4) Determine the general intersection geometrics needed to accommodate forecast year 2040 and regional build-out weekday and PM peak hour traffic volumes,
5) Provide qualitative discussions regarding non-motorized transportation conditions, environmental screening, utility planning, and Map-21 performance measures, and
6) Develop an access management policy and implementation strategy focused on West Belt Loop.

The West Belt Loop Corridor Study was prepared to address these questions in order for WYDOT, Natrona County, Town of Mills, City of Casper, and the Casper Area MPO officials to manage the future development accessibility to West Belt Loop.

1.1 BACKGROUND

West Belt Loop is located west of Casper, extending 7.2 miles (37,862 feet) between State Highway 20/26 (SH 20/26) and State Highway 200 (SH 200) within Natrona County. The northern terminus of the corridor is aligned with SH 20/26 at the Yellowstone Highway intersection, and intersection with SH 200 about 3.35 miles west of the Robinson Road/SH 200 intersection. West Belt Loop will be constructed as a two-lane, 60 mph principal arterial highway. The primary purpose of the highway will be a bypass route used for freight mobility and to reduce congestion on existing Casper streets.

The properties adjacent to the corridor are principally open space and agricultural in nature. There are currently 24 permitted approaches onto West Belt Loop. These accesses are allowed to remain until future land use development motivates the consolidation of access/intersections to the locations specified by this study. Figure 1 illustrates the corridor location and alignment.

1.2 PURPOSE AND NEED

In Chapter 2.0 of the 2001 environmental assessment for the Casper West Belt Loop Corridor, the purpose and need for the West Belt Loop bypass has been established. An excerpt from the original purpose and need description reads "*The primary purpose of the proposed project is to improve the surface transportation system in the Casper area by constructing a new roadway to the west of the city that would facilitate the safe and efficient movement of people and goods*." The environmental document describes the specific project needs as follows:

- Provide system linkage (between Highway 220 and US 20/26),
- Provide a truck bypass route (to relieve congestion on CY Avenue and Wyoming Boulevard),
- Decrease travel time for through traffic (by providing a high-speed, less restrictive arterial roadway),
- Accommodate growth and reduce traffic congestion within the City of Casper (improvement is necessary to redistribute traffic on Robertson Road, CY Avenue, and Wyoming Boulevard),
- Identification, establishment, and preservation of a West Belt Loop Corridor (to achieve corridor preservation by allowing right-of-way acquisition and avoid land use conflicts), and
- Improve Safety (drawing traffic off of existing busy, unrestricted roadways and placing them on a safer limited access bypass road).

It was understood in the original environmental documentation and roadway design documents that only one intersection would be built with the initial project, i.e., at Robertson Road. Permitted private approaches to adjoining properties are included with the initial construction allowing access to adjoining properties. None of these approaches are considered public intersections.

The scope of this corridor study is to establish locations for future intersections. As such, it is prudent to define the intersection specific purpose and need for future intersections as follows:

1) Provide for reasonable public access intersections to facilitate connectivity between adjoining properties to the West Belt Loop road.
2) Provide connections with West Belt Loop Road that will serve to support future regional roadway system network.
3) Space the future intersections to ensure efficient operation and safety is maintained along West Belt Loop.
4) Provide for safe crossings along West Belt Loop Road for non-motorized users.
5) Plan the location and configuration of future intersections taking into account the potential widening of West Belt Loop to a four lane divided roadway.
6) Develop an access management policy that can be used by agencies and developers.

1.3 ORGANIZATION OF STUDY

This report is organized into 11 Sections. Section 1 provides a brief project description and established purpose and need. Section 2 identifies the analytical process that was used to locate intersections along West Belt Loop. Additionally, this section provides an overview of strategies to assure access to properties located along the corridor, as enhanced by full access management guidelines provided within the technical Appendix A.

Section 3 through Section 5 describes the land use, traffic forecasting, and measures-of-effectiveness analyses that was used to develop corridor and intersection traffic control and geometric recommendations. These recommendations were provided for the purpose of right-of-way preservation and project programming needs, as based off traffic forecasts assuming the full development of future land uses along the corridor (which may not occur for dozens of years), and for an intermediate year 2040 analysis condition. Year 2040 is consistent with the planning horizon of the Casper MPO, and this allows for State and local officials to program improvements.

Section 6 through Section 8 describes secondary reviews performed for West Belt Loop; including Non-Motorized Transportation, Utility Planning, and Preliminary Environmental Screening Measures.

Section 9 and Section 10 outlines guidelines and policy recommendations as is related to MAP-21, which is the federal legislation that guides transportation funding within the Nation, and for local policy. Specifically, recommendations are provided regarding local policy as it is related to jurisdictional coordination, land use development, transportation infrastructure, and access management.

Finally, Section 11 provides an overview of the public involvement process performed for this project.

Figure 1. Corridor Location

INSERT TAB SHEET SECTION 2

2 ACCESS MANAGEMENT GUIDELINES

Officials with WYDOT and the Casper Area MPO desire to establish access management guidelines for the West Belt Loop corridor. Officials with the City of Casper, Natrona County, and the Town of Mills have also requested these guidelines consider an access influence area extending up to one-half mile from the West Belt Loop along intersection arterials as residential and commercial properties are poised for development within the influence area of the corridor.

To meet these requests, guidelines were developed in order to help State and local agencies direct access and development along the corridor. These guidelines are summarized within Appendix A. Highlights from these guidelines are summarized within the section as it pertains to the analysis of West Belt Loop for this study; specifically identifying intersection spacing standards and general design parameters along West Belt Loop and intersecting streets. The information provided within the appendix also includes further design discussion, the development process required to analyze traffic impacts, and intersection warrants and mitigation measures recommended to warrant various transportation improvements.

In addition, access guidelines are provided as substantial land use development is anticipated along the corridor, and access to these properties must be defined within the context of intersection recommendations provided by this Plan. In short, it is the intent that West Belt Loop is primarily intersected by roadways that promote regional circulation, or promote access to congregated land uses areas. Access to specific properties would be accomplished through frontage roads, reverse frontage roads, and backage roads connecting with these roadways. It is not the intent that direct access to/from West Belt Loop is allowed for a single property.

2.1 WEST BELT LOOP ACCESS GUIDELINES

WYDOT officials have programmed West Belt Loop as a rural principal arterial. Different types of access are allowed along a rural principal arterial depending upon 1) the general type of land use and 2) the intensity of traffic generated by this current or proposed land use, so long as spacing requirements are also met. The different types of allowed access per general land use type, as defined by the WYDOT Access Manual (March, 2005), range from:

- A right-in and right-out only “field” access provided to an agricultural lot or property if daily use occurs with only a few trips per day for only a few weeks of the year.
- A right-in and right-out only “residential” access provided as an entrance/exit to/from a home for the exclusive benefit of the dwellings resident.
- A “commercial” access provided as an entrance/exit to/from a single business, commercial development, cultural or institutional complex, public establishment, or any development with 3 or more family residences adjacent to the highway; as limited by generating up to 50 trip ends per hour per day.
- A “major” access denotes a street connection, or provides entrance/exist to/from any land use generating more than 50 trip ends per hour per day.

A summary of the spacing standards from the WYDOT Access Manual for these general land uses is summarized in Table 1. The table is read by selecting the type of access for uses shown on the left column, and then comparing the minimum separation distance to access for other land uses identified from the top row. Separation distance is provided in feet from center-of-driveway or street, to center-of-driveway or street.

Table 1. WYDOT Access Spacing Policy for a *Rural Principal Arterial (Undivided Two-Lane Highway)*

Access Type	Field	Residential	Commercial	Major
Field	330 feet	330 feet	660 feet	1,320 feet
Residential	330 feet	660 feet	1,320 feet	1,320 feet
Commercial	660 feet	1,320 feet	2,640 feet	2,640 feet
Major	1,320 feet	1,320 feet	2,640 feet	2,640 feet

Source: WYDOT Access Manual (March 2005)

As shown, spacing between major accesses, between two arterial intersections, an arterial and commercial driveway, or two commercial driveways is 2,640 feet. The prevailing spacing standard for West Belt Loop is 2,640 feet or ½ mile. In other words, a full access break, allowing full movements, can be developed on a ½ basis for intersecting streets or at major commercial driveways. Note that this applies to two or three lane, undivided highways. Access to four lane divided highways requires stricter standards as discussed herein.

Upon coordination with WYDOT officials, it was determined this ½ mile spacing standard should apply principally to interconnecting streets and commercial driveways. This policy would require that the development community coordinate on-site development, per the guidelines provided within Appendix A, so that all properties can benefit from a permitted access location.

2.1.1 Widening and Frontage Designation

West Belt Loop will be an important commute and freight route between SH 20/26 and SH 220, with up to 4,500 peak hourly trips eventually projected along the arterial. As such, the need for widening the principal arterial to four lanes, with a restricted median and left and right turn lanes at major intersections will be required to accommodate forecast traffic. As shown by Figure 2, the cross-section for this current and future roadway consists of the currently proposed 2-lane section and depicts the typical ultimate 4-lane section. The roadway generally requires a 300-feet right-of-way to accommodate the separated roadway and 50-feet median.

2.2 INTERCONNECTING ROADWAYS ACCESS GUIDELINES

The WYDOT Access Manual recommends that no driveway or access be located within 660 feet of a rural highway or arterial. The primary principal of access for interconnecting roads is the need to minimize driveway or street access along interconnecting arterials within 660 feet of the outside curb-line off West Belt Loop.

The remaining arterial connections off West Belt Loop were recommended to promote adequate access to properties, while ensuring the functionality and safety of intersection roadways. Recommendations were based principally off guidance provided in the *Access Management Manual* (TRB, 2003) and *State of the Practice in Highway Access Management* (NCHRP Report 404, 2011), focusing on an influence area located up to ½ mile of West Belt Loop.

Frequently and irregularly spaced traffic signals on arterial roadways result in poor traffic operations with increased safety risk. Past experiences indicate that “near ideal” traffic operations and safety occurs when signals are spaced on the ½ mile basis along an undivided arterial. The introduction of additional signals inside this spacing can result in an impact to traffic operation, as most suitably noted via

Figure 2. West Belt Loop Four Lane Cross Section

increased travel times. Thus, the ideal location of a signal spaced off West Belt Loop along intersecting arterials is ½ mile to maximize traffic operations. A signal spaced ¼ mile off the corridor can be allowed conditionally, if a traffic impact study is provided in support of such an allowance. Any spacing of signals on less than a ¼ mile basis should be prohibited on interconnecting roadways. A summary of these recommendations are provided in Table 2. Note the primary assumption for this summary is interconnecting roadways would have progression speeds ranging between 30 to 50 mph with cycle lengths of between 60 to 120 seconds, typical of roadways intersecting with a rural principal arterial. The applicability of spacing for speeds or signal times falling outside of these ranges can be reviewed with a TIS, with appropriate mitigation provided to offset operational and safety impacts.

Table 2. Signal Spacing for Interconnecting Arterials

	Spacing	Condition/Consideration
Preferred/Ideal	2,640 feet	Maximizes traffic operations, travel time, and safety.
Conditional	1,320 feet	Conditionally allowed with geometric, timing, and coordination mitigation supported by traffic impact study
Prohibited	< 1,320 feet	Less than ¼ mile spacing results in unacceptable impacts to traffic operations, travel times, and safety.

Source: Adapted from Access Management Manual (TRB, 2003) and State of Practice in Highway Access Management (NCHRP Synthesis 404, 2011).

Unsignalized intersections or driveways also impact the mobility of an arterial, as traffic must slow to accommodate vehicles turning into or from the travel-way. The preferred spacing of a driveway is considered based on a number of factors that principally include, safety, sight distance, turning overlaps, influence distance, and egress capacity. A review of these factors was performed with results summarized within Appendix A resulting in separate conclusions for a full access break, right-in and right-out (RIRO) only driveway/intersection, and RIRO with the potential for left-in movements. Table 3 summarizes the results of this review for these access types. These accesses may be allowed conditionally by WYDOT officials between major intersections only with justification provided by a TIS.

Table 3. Unsignalized Driveway/Intersection Spacing for Interconnecting Arterials

	Spacing	Condition/Consideration
Full Access	1,320 feet	Traffic impact study should be required to support operations and geometric recommendations.
Right-In and Right-Out	660 feet	Right-in and right-out driveways can be supported without a full TIS; although the need for a deceleration lane should be assessed in study.
Left-In Potential	660 feet	Allowed with RIRO location with support of traffic impact study.

Source: *Access Management Manual* (TRB, 2003) & *State of Practice in Highway Access Management* (NCHRP 404, 2011).

The spacing conclusions for signalized and unsignalized intersections off West Belt Loop did not have a significant impact upon the traffic analyses for this study. But they have been identified as land uses and development will need access in the future off-corridor, and access guidelines for intersecting roadways can assure adequate operations while maintaining acceptable traffic operations and safety. Methods

regarding how properties can access interconnecting roadways in order to access West Belt Loop are also provided within Appendix A.

2.3 TRAFFIC IMPACT STUDIES AND INFRASTRUCTURE DEVELOPMENT

A traffic impact study is an analysis that quantifies the impacts of a residential, recreational, institutional, and/or commercial development proposal upon traffic and transportation conditions within a finite study area, and recommends improvements or strategies to offset these impacts as necessary. State and local agency officials would rely heavily on the TIS to identified the traffic and transportation impacts of a land use proposal within context to West Belt Loop (and this Study), and determine what mitigation may be needed to minimize impacts to the corridor and its interconnecting arterials. This would include the identification of frontage improvements and/or participation in the advancement of West Belt Loop widening, the construction of interconnecting arterials and frontage roads, and/or the development of future intersections along the corridor.

The scope and study area of the TIS is established at the discretion of State or local land use jurisdiction officials. The TIS submittal should occur prior to and be approved early on in the development permitting process. Developer mitigation will be assessed based upon the conditions outlined in these studies. The construction of developer improvements or the agreements for improvement participation should be conditioned and bound to the development project prior to the issuance of land use, building, occupancy, or access permits.

Mitigation participation, as defined by a TIS, may be required under the following conditions.

1. The developer proposes a land use action along West Belt Loop facilities that have yet to be developed,
2. The project causes the degradation or participates in the further degradation of an intersection or roadway projected to function below operational or capacity standards,
3. When special studies (sight distance, queuing, speed studies, etc.) identify the need for improvements outside of those planned/designed for the corridor, or
4. When a jurisdiction is already in the process of collecting improvement/mitigation fees to help fund project improvements for the corridor.

Typically, the applicant can expect one or more of the following as mitigating measures:

- ◊ **Frontage Improvement:** Frontage improvements provide the opportunity to progress road and pedestrian facilities in a manner consistent with planning and design efforts. Frontage improvements would extend along arterials within property boundaries and can include, but would not be limited to, road improvements, sidewalk construction, bike lanes, parking lanes, and landscape buffers.
- ◊ **Direct Mitigation:** Direct mitigation is intended primarily to offset the significant and specific impacts of a development project as a result of project trips causing a high trip impact beyond what was identified for planned facilities, or to mitigate specific design issues identified by a TIS.
- ◊ **Partial Mitigation.** The State or land use jurisdiction may allow an applicant to participate proportionately with other applicants and/or other public entities to construct improvements that are not exclusively the responsibility of any single applicant or entity. Such participation would be assessed through a fair mitigation fee system, or the project's proportionate share of an improvement can be determined through a TIS. A typical method is dividing project trip assignments along a roadway section or at an intersection by total

projected volumes, projected on a weekday basis (preferred) or via some weighted comparison of peak hourly volumes where daily counts/projections are insufficient. Land values, resulting from actions such as frontage dedication, can be counted as a part of the proportionate contribution. No "pay-back" would occur if a frontage dedication value exceeds a proportionate impact, as an agency lacks the mechanisms for such reimbursement.

The TIS and typical mitigation measures have been identified as transportation improvements will be needed within the influence area of West Belt Loop, with development being a principal reason for these needed improvements. Mitigation strategy recommendations have been provided herein. Also, all traffic impact studies should reference the West Belt Loop Corridor and Access Study as this: 1) identifies the location of intersections and driveways along the corridor, 2) provides design guidance for interconnecting arterial and driveway location and design, and 3) offers guidance on accessing properties between ½ mile West Belt Loop intersections (so that properties are not land-locked).

2.3.1 Levels-of-Service Thresholds

Traffic operations and capacity are currently quantified by the roadway and intersection levels-of-service (LOS) methodologies of the Highway Capacity Manual (TRB, 2010). The premise is generally that operations and capacity are limited or unacceptable, representing congestion, when LOS are under certain thresholds or acceptable when above.

WYDOT policies and local industry practice dictates that LOS C standard be maintained for highways such as West Belt Loop. Intersection operations are normally acceptable at LOS D and above. Mitigation parameters described above would be triggered if a traffic study or TIS find that LOS falls below these respective corridor and intersection operational thresholds.

2.4 WEST BELT LOOP INTERSECTION LOCATIONS

As indicated previously, WYDOT officials are currently in the process of constructing two-lane West Belt Loop between State Highway 220 and State Highway 20 west of Casper. The design stationing for the project begins at the south end of the corridor at STA 100+88 and ends to the north at STA 479+50, extending 37,862 feet or 7.17 miles. Along the corridor there is only the Robinson Road intersection at STA 423+45 that could not be relocated as it is programmed and being constructed now. There are currently 24 permitted private access points along the corridor that would remain until such time that adjacent properties were to develop; at which point, access points would be eliminated in favor of the master corridor access plan. A summary of access breaks currently permitted along the West Belt Loop is shown on Figure 3.

Future intersection locations were established based on guidelines discussed above. Topography and water resource (wetlands) challenges dictate that some intersections were located within reasonable proximity of the set ½-mile intervals. Figure 4 provides the recommended locations for the 13 intersections along the corridor. The map figure identifies alignment alternatives for primary intersecting roadways used to promote regional circulation between West Belt Loop and Natrona County, the City of Casper, and the Town of Mills; specifically including two alignment alternatives for Trevett Lane. Again, it is the intent that specific properties be accessed through frontage roads, reverse frontage roads, and backage roads that extent from the arterials and roads proposed to intersect with West Belt Loop at the 13 intersection locations. Direct access to/from a single property off West Belt Loop is not recommended or anticipated.

Included in the scope of this Corridor Study is the evaluation of the extension of Trevett Lane to West Belt Loop. Agency officials are interested to know if it is feasible to extend the roadway through challenging terrain on the north side of the North Platte River. Appendix B includes a write up on the preliminary route study.

This intersection plan and preliminary roadway system map was developed as follows:

1. In accordance with the WYDOT Access Manual and as described above, half-mile spacing was determined for nearly 7.2 miles of West Belt Loop, denoting potential access locations along the two lane arterial. In addition, 1-mile spacing was selected for major arterial connections recognizing the future need for a four-lane divided highway. The half mile and mile spacing identified by the WYDOT Access Manual were the principal and guiding factor for the corridor, as the environmental document designates the roadway as a limited access primary arterial.
2. The primary purpose for construction of West Belt Loop, as defined in the 2004 Environmental Assessment's purpose and need statement is to relieve congestion on existing arterials by providing a bypass route west of Casper. Facilitating higher speeds along the future corridor is a significant benefit in the efficient movement of pass-through traffic. In addition, the corridor must provide connectivity to existing and future area land uses. The balance of these two features must consider motorized and non-motorized safety.
3. The most likely locations for east-west and north-south connectivity from West Belt Loop to existing local arterials are identified on Figure 4. At this planning stage, it is assumed that the transportation grid system will consist of minor arterial and collector roadways. Considerations for the transportation mobility system included topography, existing land use, and environmental features. Projecting the future regional mobility needs assisted us in defining critical intersection locations.
4. A review of land use and individual property owner access needs resulted in the provision of intersections on principally the half mile spacing. It was the intent that each significant developable zone was provided one access, if not two access points if an area designation extended over one-half mile along West Belt Loop. Likewise, access to individual property holdings, including existing residences, was considered in the intersection evaluation. A detailed discussion of the Transportation Assignment Blocks is included in Section 3.1.

Following Table 4 is a summary of each intersection and its primary purpose and connectivity. Shown is the intersection identifier, the proposed stationing of the intersection, definition of access type and likely controls, and a description of anticipated purpose.

2.5 Direct Property Access

Wyoming Statutes (W.S.) 24-6-101 through W.S. 24-6-111, entitled "Chapter 6 – Access Facilities", defines laws pertaining to property access and also grants access authority to the Wyoming Department of Transportation (WYDOT) officials and local jurisdictions for highways, arterials, and roadways. These laws are further explained and elaborated upon in "Chapter 13, Access Facilities" of WYDOT Rules and Regulations. These laws and regulations fundamentally govern access conditions along West Belt Loop.
Essentially, regulations confirm that private properties abutting West Belt Loop have rights to access so long as no other reasonable access is available (i.e. properties are "land-locked") by way of connections such as arterials, collectors, private roads,

frontage roads, backage roads, or service roads. WYDOT officials have the authority to restrict access spacing to 660 feet, regardless of property location, where right-in and right-out movements only can be allowed. A stipulation is WYDOT officials have the authority to eliminate any access, regardless of property location and spacing, in order to preserve safety for the majority or roadway users.

In order to preserve the access rights of existing and land-locked property owners, WYDOT officials previously granted 24 “temporary” access permits along West Belt Loop. WYDOT and other local jurisdiction officials will work to promote an arterial and street network that provides access to these land-locked properties in the future so existing temporary access can be restricted and/or eliminated over time. Furthermore, as properties subdivide and develop in the future, it is anticipated that local land use officials will require that secondary access be developed to properties. This will assure no direct connections, be it temporary or otherwise, will be promoted to West Belt Loop outside of the 13 intersections specified by this report. Thus, it is the goal that direct property access is discouraged along West Belt Loop and that only community access be secured through the 13 intersections pre-approved by WYDOT officials.

Figure 3. Currently Permitted (Temporary) Access for West Belt Loop

Figure 4. Proposed Intersection Locations for West Belt Loop

Table 4. West Belt Loop Intersection Location Summary & Justification

Intersection Number	Location/Intersection Selection Criteria and Primary Purpose	Transportation System Connectivity
1	(Station110+00) Right-in/right-out accessing future adjoining commercial businesses on both sides of West Belt Loop Road. Provides an access to existing subdivided residential properties.	Local minor access intersection to collector road system. Right in/right out only required for safety purposes
		1900 feet (0.4 mile) spacing between Intersections
2	(Station 129+00) Major Intersection - Located at a currently permitted intersection. Provides full movement access to local businesses and residential properties. Would also facilitate U-turn movement for access to businesses between Highway 220 and this intersection	Major access intersection via local collector road system
		3112 feet (0.6 miles) spacing between intersections
3	(Station 160+12) East/West access to local properties at an existing permitted intersection.	Local minor access intersection to collector road system
		2640 feet (0.5 miles) spacing between intersection
4	(Station 186+52) East/west access to developable residential properties on the south bank of the river.	Major access intersection via local collector road system
		2348 feet (0.44 mile) spacing between intersections
5	(Station 210+00) Perpetuate the existing west side right-in/right-out access approach. Provides access to Rimrock Road.	Local minor access intersection. Right in/right out only required for safety purposes.
		3300 feet (0.62 miles) spacing between intersections
6	(Station 243+00) Major Intersection - Ideally located to connect with Trevett Lane. Also provides regional mobility to future residential property to the west. Located north of the Oregon Trail Turnout – requires frontage road connection between turnout and future Trevett Lane, i.e., eliminates access to West Belt Loop and improves safety.	Major access intersection to minor arterial road system
		3690 feet (0.75 miles) spacing between intersections
7	(Station 282+60) East/west residential property access to future developable properties.	Local minor access intersection to collector road system
		2805 feet (0.53 miles) spacing between intersections
8	(Station 310+65) Major Intersection – Located north of the existing wetlands. This location provides connectivity to the east and would connect in with Robertson Road; The alignment could tie into Poison Spider Road at Robertson Road. The intersection provides connection to land uses east and also to Seven Mile Road	Major access intersection to minor arterial road system
		3334 feet (0.63 miles) spacing between intersections
9	(Station 344+00) East/west residential property access to future developable properties.	Local minor access intersection to collector road system
		2645 feet (0.50 miles) spacing between intersections
10	(Station 370+45) Major Intersection – Located immediately northeast of the Oregon Trail Irrigation Drain ditch. The intersection provides access off of the south side of West Belt Loop. The intersection provides regional connectivity to the south.	Major access intersection to minor arterial road system

Table 4 (Continued). West Belt Loop Intersection Location Summary & Justification

Intersection Number	Location/Intersection Selection Criteria and Primary Purpose	Transportation System Connectivity
2640 feet (0.50 miles) spacing between intersections		
11	(Station 396+85) Local access to future developable properties south and east of West Belt Loop. A northerly connection to realigned Poison Spider Road is not advised from this location. The intersection could tie into the dead end section of Poison Spider Road east of West Belt Loop.	Local minor access intersection to collector road system
2640 feet (0.50 miles) spacing between intersections		
12	(Station 423+25) Robertson Road Intersection	Major access intersection to minor arterial road system
2660 feet (0.50 miles) spacing between intersections		
13	(Station 449+85) Local access to future light industrial developments	Local minor access intersection to collector road system

INSERT TAB SHEET SECTION 3

3 LAND USE AND TRAFFIC FORECASTING

A traffic analysis was prepared to determine the intersection and lane capacity needed to support forecast traffic volumes. This section describes the land use assumptions developed for this Study in order to prepare traffic forecasts and the capacity analysis.

3.1 LAND USE SUMMARY

Land use information was established along the influence area of the corridor. This influence area generally extends ½-mile to the west and ¾ mile to the east, encompassing the properties most likely to derive access (via frontage, reverse frontage, and backage roads) and generate traffic along the length of West Belt Loop. Overall, 5,040.9 acres of property was designated within the influence area of the corridor.

Five general land uses were developed for this study. The land use assumptions were purposely kept general so they could be easily integrated into local land use policy, yet are also specific enough as to provide for corridor trip generation estimates as described in the next section. Likewise, the land uses are conservative for the purpose of estimating the highest range of land density and corresponding traffic generation potential. The intent of this land use projection is not to artificially bump up traffic generation projections; it is standard traffic engineering approach to estimate the highest "reasonable" land use densities based on demographic, geopolitical, and topographic indicators. The land use projections presented here are meant to represent a plausible and rational evolution of growth westward from the communities and around the road corridor itself.

Figure 5 highlights these land use development areas. A description of each land use, density information used for the purpose of traffic estimation, is summarized as follows:

Open Space. The project corridor includes un-developable property along the north side of the North Platte River and historically significant lands related to the Red Buttes Battlefield and cemetery. These areas exclude any trip generation estimates in the transportation model.

Approximately 396.3 acres was designated as open space within the influence area of the West Belt Loop.

Typical Residential. This land use designation is anticipated to be the predominant development along the corridor at full build out of the area. This land use assumes an average density of 2.5 units per acre, which is typical of developed residential projects throughout the region. As shown, these residential areas are located in relatively level terrain (less than 10% grade) that could be served by public utilities. The land is highly buildable and can be developed using conventional subdivision street layouts.

Along the south and north side of the North Platte River, the river front properties would usually be developed at lower densities (i.e., one-half to full-acre lots) with corresponding lower traffic generation. For the purposes of this study, we have taken a more conservative approach by designating these properties at typical residential densities.

There were 3,056.4 acres designated to this land use for this study, which results in a total of 7,641 total single family homes.

Light Residential and Agricultural. The area south of the river located on slightly steeper terrain (10% - 25%% slopes) as well as a large portion of the existing platted Grand View Acres Subdivision are assumed to develop at a range of 1 unit per one to

Figure 5. Proposed Land Use Summary for West Belt Loop

five acres, depending upon location. The likelihood of higher density development is limited by topography and the current land uses being developed in the subdivision.

There were 393.5 acres designated to light residential for this Study, which represents 277 single family homes dispersed through these areas.

Light Industrial/Industrial Park. Shown in green, industrial land uses are primarily projected along the northern terminus area of West Belt Loop, adjacent to properties of similar character. The projected nature of these areas reflects those of an industrial park which contain a mix of manufacturing, warehouse, service, and light office facilities. A 15 percent average building coverage rate, meaning the area the building occupies per acre, is anticipated within these areas. This building coverage rate is somewhat reduced from typical and similar industrial park projects given varied topography and other inhibiting factors.

Approximately 621.8 acres were designated for industrial uses within the influence area of the West Belt Loop Corridor, which represents 4,062.8 thousand square-feet (ksf) of total potential building area.

Commercial/Business Park. The orange areas represent projected commercial land uses along the West Belt Loop corridor. These areas are projected to include a mixture of office, service retail, general retail, and commercial businesses. Aggregated primarily around major study intersections, it is anticipated that buildings would occupy an average of 15 percent total ground coverage in designated areas. This building coverage rate is somewhat reduced from typical and similar business park projects given varied topography and other inhibiting factors.

There were 572.9 acres designated to commercial land uses along the corridor, which calculates to about 3,743.8 thousand square-feet (ksf) of total potential building area.

These five general categories forecast the location and general characteristics of land use development along West Belt Loop corridor. In addition, they were developed to help establish higher priority access/approach connectivity needs, and as a basis for developing trip/traffic projections in conformance with national designations and methodologies. As these land uses were developed independently, they do not necessarily conform to the land use or zoning codes of Natrona County, the City of Casper, or the Town of Mills and would need to be refined or reclassified prior to adoption in local planning documentation. They do however provide a realistic approach to density development estimation and trip generation estimates for this type of study/plan.

3.2 ASSUMPTIONS AND LAND USE DEVELOPMENT

Initial Assumptions: As has been stated previously, in order to successfully forecast future traffic generation estimates, identify precise locations for future intersections, and to generate corridor-specific access control standards, it was necessary to analyze what the likely future land uses along the West Belt Loop corridor would be. While strict land use regulations from Natrona County and the adjacent communities could force specific land uses and access controls, that scenario was not the intent of the land use projections.

An initial focus of the study was to review access control options by looking at land use projections ½ to ¾ mile on either side of the Belt Loop corridor. It quickly became obvious that that was too narrow of a focus, particularly on the east side. As a consequence, likely land uses connecting back to the existing corporate boundaries were considered, along with the ancillary road corridors needed to facilitate them.

The section of Wyoming State land located in the center of the analysis area was also included in the future land use assessment. It was assumed that a significant portion of the property (not including the areas related to the Red Buttes Battlefield) would be a candidate for development, at some point in the future.

The land use projections were based on likely outcomes using the analysis factors noted below, and were not based on an inventory (needs and surpluses) of land use categories in the broader community.

Land Use Projection Methodology: In general terms, the physical, political and cultural "landscapes" were taken into account in the process of developing the land use projections. Initial land use forecasts and intersection locations were produced based on review of available information, which included: the WYDOT West Belt Loop road plans, terrain and topographic characteristics, aerial photographs, existing land uses, wetland locations, utility maps, ownership records, existing land use planning and zoning documents, ½ mile intersection spacing, and opportunities for logical extensions of existing roads. These initial projections were then "ground truthed" by a site visit, which also produced a library of site photographs. This library of photographs became invaluable later on when fine tuning the intersection locations.

After adjustments to the initial land use projections based on the first site visit, the modified plans were presented for comment during a series of meetings with public officials and landowners. Section 7 describes the property owner coordination and public involvement process. The consultant attempted to meet with all property owners adjacent to the corridor. Land owners and the public were invited to three public meeting held throughout the project development.

After the first round of public comments, the preliminary land use projections and intersection locations were modified. In addition to comments from the public, more site specific information became available, which was also incorporated into the final recommendations. The additional information included: more precise information about the location and heights of power lines and utility easements, likelihood of access to public water and sewer service, better definition of wetland areas and sites with challenging soil conditions, view-shed considerations, review of proposed highway elevations versus existing ground levels (looking for practical intersection opportunities), analysis of alternate routes for extensions of existing roadways, and review of lands that are seemingly well suited for open space uses (such as overly steep terrain and land that is culturally sensitive, specifically the Red Butte Battlefield and cemetery).

In reviewing opportunities for road connections back to the existing street networks in Casper and Mills, several things become apparent. First, north of the North Platt River, a standard east-west, north-south street grid will be difficult to implement over the entire area because of terrain. However, the area is suited to curvilinear road systems and there are multiple opportunities to make acceptable connections as was discovered when analyzing options for connecting Trevett Lane to West Belt Loop. Next, if these connections are to be made in the future, it will be important that the County and communities of Casper and Mills plan ahead in order to reserve the corridors. South of the North Platt River, there are few opportunities to tie back to existing roads because of the paucity of existing roads and terrain limitations.

While these land use projections were tasked with reviewing intersection opportunities at ½ mile intervals, good highway planning dictates that a one mile interval produces a more optimal spacing to accommodate land access while preserving the ability to move through traffic efficiently. As a consequence, the intersection locations were reviewed with the idea in mind that

some would be full access and likely signalized in the future. Depending on regional growth and traffic generation, other intersections at the ½-mile spacing (i.e., between major intersections) will likely need to be limited access controlled, i.e., right-in, right-out only. The suggested full access locations have been referred to as "major intersections", the limited ones as "minor intersections". Obvious relationships of intersection spacing to land use projections are the resultant need for frontage roads and the creation of commercial opportunities at major intersections.

Density and Compatibility Assumptions: Residential densities for the bulk of the area north of the North Platt River were assumed to be low density, single family residential and assigned a density of 2.5 dwelling units per gross acre. The reasoning for this density assignment is that there will be a high level of inefficiency because of terrain characteristics, parkland needs, rights-of-way, drainage ways, wetlands and existing utility corridors. For similar reasons an even lower density factor was assigned to the residential areas south of the North Platt River (below the Rimrock hillside). Irrespective of how accurate these density assumptions prove to be, the objective was to generate realistic traffic projections for how the Belt Loop road will be impacted by future traffic.

Compatibility of adjacent land use was a factor in projecting future land uses along the corridor. The projections looked to extend the existing industrial/commercial trend on the north in locations that have (or will have) good road access. However, because of terrain and the separation created by the Belt Loop itself, there is an opportunity to create more residential land southeast of the road, as an extension of existing residential uses in the town of Mills.

As the amount of residential properties in the area expands, there will be a parallel need for retail and service commercial areas. A reasonable land planning approach is to designate new commercial land at the major intersections and/or adjacent to existing commercial. By suggesting future commercial at the major intersections, several planning objectives are advanced: the surrounding residential areas have convenient access to commercial opportunities in a reasonable distance, residential neighborhoods can be buffered from high traffic intersections, and the commercial uses have better exposure to through traffic customers.

Assuming a high volume of traffic that will use the intersection of the Belt Loop and Highway 220, it is concluded that the corner parcels surrounding the future major intersections will develop as commercial properties. The marketability of these high visibility travel nodes will naturally attract customers to the commercial land uses. At the South and north ends of the West Belt Loop corridor, commercial uses would gravitate to pass-thru clientele such as truck and other motor vehicle services. In areas that would develop as medium and high density residential, commercial properties tend to focus on regional or neighborhood needs (e.g., markets, services, convenience stores, etc.).

INSERT TAB SHEET SECTION 4

4 TRIP GENERATION AND TRAFFIC FORECASTS

This section describes the trip generation, assignments, and traffic forecasts developed for this study in order to prepare the West Belt Loop capacity analysis.

4.1 TRIP GENERATION

Trip generation was projected using the methods outlined in the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (9th Edition, 2012). The *Trip Generation Manual* is a nationally recognized method for forecasting trip generation for a range of commercial, retail, institutional and residential land uses. The forecasting methods provided in the Manual are developed based on the survey of other land use developments located in the United States.

Trip generation was determined using rates that equate traffic to the number of residential dwelling units. A summary of the ITE Codes associated with study land uses for this project are described as follows:

> **Residential (Single Family) – Land Use Code 210.** These include *"all single family detached homes on individual lots."* As indicated, single family homes were assumed at 1 unit per one to five acres in the case of the Agricultural/Light Residential land use of this study and 2.5 units per acre in the case of the Typical Residential study land use.
>
> **Industrial Park – Land Use Code 130.** These include *"a number of industrial or related facilities. Characterized by a mix of manufacturing, service and warehouse facilities."* As indicated previously, industrial buildings are assumed to occupy 15 percent of each acre of property identified for this study land use.
>
> **Business Park – Land Use Code 770.** These *"consist of a group of flex-type or incubator one- or two-story buildings served by a common roadway system. The tenant space is flexible and lends itself to a variety of uses…..offices, retail and wholesale stores, restaurants, recreational areas and warehousing, manufacturing, light industrial, or scientific research functions"* As indicated previously, commercial buildings are assumed to occupy 15 percent of each acre of property identified for this study land use.

There is a total of 5,040.9 developable acres highlighted by the study land use plan. About 68-percent of this total area was designated light and typical residential, 12-percent industrial park, 11-percent Business Park, and 8 percent open space.

The attributes formerly discussed, regarding the assignments of homes per acre or building area per acre was assigned to these land use areas. Trip generation was then determined by comparing the ITE rates with land use distinctions, resulting in trip totals for the typical weekday and PM peak hours of the typical weekday. A summary of total trip generation is provided on Table 5 below for the entire influence area of the corridor, assuming full land use development. It is important to note that full build out of the area around West Belt Loop is not likely to occur until well after the 2040 study horizon. However, it is vital that this study consider the ultimate "potential" build out of the area. The local agencies need to plan and provide an intersection location plan that will efficiently serve the community well into the future.

Table 5. Total Trip Generation, Full Build Land Uses for West Belt Loop

Land Use	Acres (Units)[1]	Weekday Trips	PM Peak Hour Trips		
			In	Out	Total
Light Residential	393.5 (277 sfu)	2,650	175	102	277
Typical Residential	3056.4 (7,671 sfu)	73,050	4,833	2,838	7,671
Light Industrial/Industrial Park	621.8 (4,063 ksf)	27,750	726	2,728	3,454
Commercial/Business Park	572.9 (3,744 ksf)	46,550	1,228	3,491	4,719
Open Space	396.3	0	0	0	0
Total Trips	**5,040.9**	**150,000**	**6,962**	**9,159**	**16,121**

Source: ITE Trip Generation Manual (9th Edition)
1. Units are identified as sfu = single family units or ksf as thousands square-feet.

As shown on Table 5, a total of 150,000 weekday trips would be generated within the region. About 16,121 trips would be generated during the PM peak hour. Overall, about 1.8 percent of daily trips are generated by light residential land area, 48.7 percent with the typical residential homes, 18.5 percent by industrial uses, and 31.0 percent by commercial/business uses.

These traffic projections represent the total traffic generated by fully built and occupied land uses within the influence area of West Belt Loop. Not all of this traffic will necessarily use the corridor to access the region; as many trips are internal trips or will use other routes to access the area (e.g., Robertson Road, Poison Spider Road, Trevett Lane, etc.).

4.1.1 Year 2040 Trip Generation

Year 2040 trip generation was developed in order to match the current planning horizon of the Casper MPO; therefore allowing intermediate improvements to be programmed with regional and local transportation plans and policy. Officials with Natrona County are in the process of updating comprehensive land use plans for the region in coordination with planners from KLJ Consultants; with results used to help State and local agencies plan development growth and policy. As such, KLJ served as a resource to determine the composition of land uses likely to develop over 26 years along the influence area of West Belt Loop. Summary land use assumptions for year 2040, as determined in coordination KLJ Consultants, includes:

Open Space. *Up to 15 acres of open space could be promoted by year 2040 within developable areas of the West Belt Loop influence area.*

Light Residential and Agricultural. *About 220 acres and 220 single family homes were assumed for the year 2040 analysis.*

Typical Residential. *A total of 200 acres was assumed for development by year 2040; resulting in a total of 500 single family homes.*

Light Industrial/Industrial Park. *Approximately 400 acres was assumed for development by year 2040 calculates to 2,613.6 thousand square-feet (ksf) of total potential building area.*

Commercial/Business Park. *There were 415 acres assumed for development by year 2040, which represents about 2,744.5 thousand square-feet (ksf) of building area.*

Year 2040 trip generation was then determined based on the land uses and methodologies described previously. A summary of resulting total trip generation is summaries in Table 6 for the assumed developable area of West Belt Loop.

Table 6. Total Trip Generation, Intermediate Year 2040 Land Use Development

Land Use	Acres (Units)[1]	Weekday Trips	PM Peak Hour Trips		
			In	Out	Total
Light Residential	220.0 (220 sfu)	2,100	139	81	220
Typical Residential	200.0 (500 sfu)	4,750	315	185	500
Light Industrial/Industrial Park	400.0 (2,613.6 ksf)	17,850	466	1,756	2,222
Commercial/Business Park	415.0 (2,744.5 ksf)	34,130	901	2,560	3,461
Open Space	15.0	0	0	0	0
Total Trips	**1,250.0**	**58,830**	**1,821**	**4,582**	**6,403**

Source: ITE Trip Generation Manual (9th Edition)
1. Units are identified as sfu = single family units or ksf as thousands square-feet.

As shown, a total of 58,830 weekday trips would be generated along the West Belt Loop by year 2040. Peak hour traffic generation is estimated to be 6,403 trips during the PM peak hour.

4.2 Internal Trip Capture, External Trips, and Block Assignments

For this project, the land uses and trips projected along West Belt Loop were aggregated into 24 transportation assignment blocks (TABs). These blocks represent the land use area and corresponding trips most likely to be served by an intersection(s) or approach(s) located along West Belt Loop. For instance, TAZ block 1 is projected to contain both commercial/business park and light residential land uses. This area is most easily and likely accessed by the approaches located near stations 110+00 and 125+00. The trips associated with these land uses are expected to use these approaches to access West Belt Loop. The "Transportation Assignment Block" map is shown on Figure 6. Again note direct access to West Belt Loop is not proposed for each TAB, rather traffic would converge at these intersections following access to interconnecting roadways via frontage roads, reverse frontage roads, and backage roads.

Through these TABs, the varying impacts of land use traffic can be predicted at various locations along the 7.2 mile corridor. Trip generation was estimated for each of the 24 blocks based on the methodologies described earlier, resulting in total trip potentials as defined in Table 5 and Table 6 for the "full build" condition and year 2040. However, not all of these trips defined in these tables would be assigned to West Belt Loop. Internal trip reductions must be addressed, and then the trips that would be assigned externally to roadways outside of West Belt Loop would be projected, before trips can be assigned to the corridor. This section describes these traffic diversions prior to forecasts being provided for West Belt Loop.

Figure 6. Transportation Analysis Blocks for West Belt Loop

4.2.1 Internal Trip Capture

An internal trip is one that occurs between land uses, typically traveling off the principal roadway network through parking lots or on local streets system to access other developments. Internal trip capture is usually applied as a reduction to total trip generation. However, the requirement is there has to be some synergy between land uses to in order to apply this reduction. For instance, there are minimal opportunities to apply internal trip capture between two residential land use developments as they are similar in service/function. However, there are opportunities to address internal trip capture between residential properties with work, commercial, and/or service-based land uses as interaction between these uses is common during a typical travel/week day.

One such example may be a homebound work commuter who uses an arterial to access a shopping center where a gym, grocery store, and restaurant is visited through a shopping center parking lot, and then the commuter uses local streets to travel home. This activity may represent four separate trips to each specific land use (i.e. gym, grocery, restaurant and home), but it represents the impact of one trip to arterial streets and this is why internal capture should be determined for shopping centers, urban villages, or new neighborhoods where multiple land uses served by a common arterial system would be located.

As such, internal capture was determined between the general residential, light industry/industrial park, and commercial/business park land uses reviewed for West Belt Loop within each TAB. The ITE Trip Generation Handbook (2nd Edition, 2012) outlines the current methodology used to estimate internal trip capture reductions between land uses. Inbound and outbound capture rates are provided for each land use pair. The maximum potential capture is estimated from total trips on an individual land use basis, the individual trip potentials are compared, and then the lower trip total is taken as the trip capture between land uses. If there are more than two land uses being reviewed, then this comparison is repeated and trip capture potentials are combined between land use pairs. The following Figure 7 graphic shows the inbound and outbound internal trip reduction rates for the PM peak hour, as based on the land use pairs reviewed for this study.

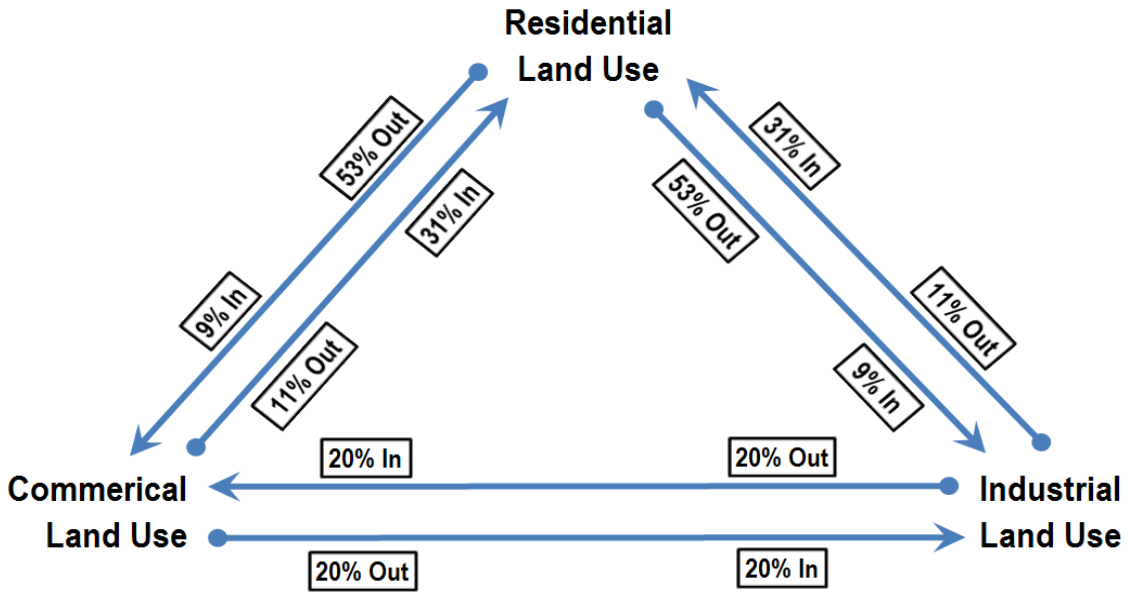


Figure 7. Internal Trip Capture Distributions

For example, TAB 3 (shown on Figure 6) has the potential to generate 718 trips during the PM peak hour under the full build condition. Residential units have the potential to generate 20 inbound and 20 outbound internal capture trips, while the commercial has the potential to generate 14 inbound and 50 outbound trips. The lower trip total drives the comparison between inbound and outbound pairs such that internal capture is limited to 20 trips traveling from commercial to residential with 14 trips traveling from residential to commercial, for a total internal capture reduction of 34 trips from total trip generation. If Industrial was located within this TAB, the review would be expanded to include residential-to-industrial and commercial-to-industrial comparisons, and the resulting totals would be combined.

The internal trip calculation process was performed for 15 of the West Belt Loop TABs, as they are predicted to contain two or more primary land use types. The internal trips were totaled for the full build out condition, and for the intermediate year 2040 analysis conditions, and then reduced from corridor trip totals. Table 7 provides a summary of trip generation following reduction of internal trips for the full build condition during the weekday and PM peak hour.

Table 7. Trip Totals Less Internal Capture, Full Build Land Uses

Trip Type	Weekday Trips	PM Peak Hour Trips		
		In	Out	Total
Trip Generation Potential	150,000	6,962	9,159	16,121
Internal Trip Capture	14,100	755	755	1,510
Total Trips less Internal	**135,900**	**6,207**	**8,404**	**14,611**

As shown, 14,100 weekday and 1,510 PM peak hour internal trips are expected with development along West Belt Loop. This means 135,900 weekday trips and 14,611 PM peak hour trips would travel externally from TABs; although as discussed in a following section, not all of these trips would travel on West Belt Loop to access the region. There is nearly a 9.4 percent reduction in total trips, as a result of internal capture, with full corridor and land use development. Table 8 provides a summary of trip totals for year 2040.

Table 8. Trip Totals Less Internal Capture, Intermediate Year 2040 Development

Trip Type	Weekday Trips	PM Peak Hour Trips		
		In	Out	Total
Trip Generation Potential	58,830	1,821	4,582	6,403
Internal Trip Capture	4,100	220	220	440
Total Trips less Internal	**54,730**	**1,601**	**4,362**	**5,963**

There are 4,100 weekday and 440 PM internal trips expected along West Belt Loop by year 2040. This leaves 54,730 weekday and 5,963 PM peak hour trips to access West Belt Loop and the external roadway network. There is nearly a 6.9 percent reduction in total trips as a result of internal capture by year 2040.

4.2.2 External Trips

Through the access management guidelines, it was identified that a roadway network be developed to accommodate short trip ends between properties off West Belt Loop (between TABs) and to promote circulation throughout the region. Frontage and backage roads, common access, access easements, shared parking lots, etc. are all methods promoted to reduce travel demands between properties within the land use influence areas of the corridor. Off corridor arterial roadway connections to Robinson Road and Poison Spider Road and extensions of roadways such as Trevett Lane are ways to access the City of Casper, Town of Mills, and Natrona County without direct use of West Belt Loop. These ultimate improvements would reduce the potential for highway congestion like the situation on Wyoming Boulevard. Unfortunately Wyoming Boulevard does not include access management and has deteriorated to LOS F in many areas. The highway has been developed with numerous private accesses and closely spaced intersections. To be consistent with the vision for the area and the aforementioned access guidelines, it was assumed that off- West Belt Loop arterials would be promoted to develop circulation between properties and to/from the region.

There was no finite methodology available to estimate the number of trips that would divert to other corridors away from West Belt Loop. Per discussions with Casper MPO officials and the Regional Transportation Plan Consultant, the current regional travel demand model does not predict these external, off-corridor trips. As such, these trips were estimated for this study.

The steps for estimating these trips were simple. Initially, all trips generated by land uses were assigned to the corridor. Internal trips were reduced, leaving 91 percent corridor assignments with the full build condition and 93 percent by year 2040. Next, the generalized capacity thresholds within the Quality/Level of Service Handbook (Florida DOT, 2012) were identified for highways and freeways in “Transitioning” (rural to suburban/urban) and “Rural Undeveloped” areas. This resource indicates a two lane highway/freeway has a practical capacity limit of around 1,600 peak hourly vehicles and a four lane highway/freeway 4,000 peak hourly vehicles to maintain a level-of-service (LOS) C standard. (LOS C is promoted in Wyoming for arterial traffic movements/flow.) Corridor traffic was reduced until the majority of peak hourly volumes fell below the 1,600 peak hour vehicles threshold for a two lane freeway/highway, as assumed for year 2040 and 4,000 peak hour vehicles for a four lane freeway/highway. This assumes alternative travel means/roadways must be in place for corridor land uses prior to a total degradation of traffic operations along West Belt Loop following the 2040 horizon year.

For the full build condition, it was assumed that just over 30 percent of trip generation totals, or nearly 34 percent of trips following internal capture reductions, would use future minor arterials and collector roadways to circulate between properties and/or access the community. The resulting trips assigned to West Belt Loop are shown on Table 9.

Table 9. External Trip Diversions, Full Build Land Uses

Trip Type	Weekday Trips	PM Peak Hour Trips		
		In	Out	Total
Total Trips less Internal	**135,900**	**6,207**	**8,404**	**14,611**
External Trip Diversion	45,950	2,097	2,841	4,938
Total Trips less Internal	**89,950**	**4,110**	**5,563**	**9,673**

A total of 89,950 weekday trips and 9,673 trips are expected to commute along West Belt Loop with full development of corridor land uses. This utilization represents 60 percent of the trips generated by land uses within the corridor influence area.

It was assumed that just over 18 percent of trip generation totals, or nearly 20 percent of trips following internal capture reductions, would use off West Belt Loop roadways to circulate between properties and/or access the community in year 2040. Table 10 provides a summary of trip totals assigned to West Belt Loop for year 2040.

Table 10. External Trip Diversions, Intermediate Year 2040 Development

Trip Type		PM Peak Hour Trips		
		In	Out	Total
Trip Generation Potential	54,730	1,601	4,362	5,963
External Trip Diversion	4,100	315	860	1,175
Total Trips less Internal	**54,730**	**1,286**	**3,502**	**4,788**

A total of 54,730 weekday trips and 4,788 trips are expected to commute along West Belt Loop by year 2040. This utilization represents 75 percent of the trips generated by land uses within the corridor influence area.

4.2.3 Block Assignments

The land use trips projected for assignment were aggregated into 24 TAB's that represent the land use area most likely to be served by an intersection(s) or approach(s) proposed along West Belt Loop. These trips were assigned to the corridor following the internal and external trip reductions described in the previous sections. Again, these are not direct assignments to/from Corridor land uses; rather they are the congregate assignments of trips after they reach study intersections via connecting roadways. Access to/from corridor land uses would be provided via frontage roads, reverse backage roads, backage roads, access easements, etc.

Table 11 summarizes the land uses, total trip generation, internal and external trip reductions, and the resulting PM Peak hour trips for assignment to West Belt Loop under the full land use development scenario.

Table 11. TAB Land Use Assignments and Trip Summaries, Full Build Land Uses

TAB	TAB Land Use Assumptions			TAB PM Peak Hour Trip Assignments			
	Residential (SF Units)	Commercial (ksf)	Industrial (ksf)	Total Trip Generation	Internal Trip Capture	External Trip Reduction	**TAB Trip Assignment**
1	28	490.1	0.0	646	-22	-211	**413**
2	23	490.1	0.0	641	-18	-210	**413**
3	100	490.1	0.0	718	-68	-220	**430**
4	100	490.4	0.0	718	-68	-220	**430**
5	76	0.0	0.0	76	-0	-25	**51**
6	76	0.0	0.0	76	-0	-25	**51**
7	0	0.0	0.0	0	-0	-0	**0**
8	483	0.0	0.0	483	-0	-164	**319**
9	489	288.1	0.0	852	-76	-262	**514**
10	1,102	230.0	0.0	1,392	-62	-449	**881**
11	482	0.0	0.0	482	-0	-163	**319**
12	663	0.0	0.0	663	-0	-224	**439**
13	602	213.0	344.5	1,154	-164	-334	**656**
14	261	169.9	0.0	475	-44	-146	**285**
15	535	0.0	258.7	755	-46	-240	**469**
16	356	0.0	0.0	356	-0	-121	**235**
17	239	0.0	520.8	682	-94	-199	**389**
18	485	0.0	0.0	485	-0	-164	**321**
19	211	0.0	601.8	723	-68	-221	**434**
20	400	0.0	326.7	678	-58	-210	**410**
21	242	392.0	386.8	1,065	-254	-274	**537**
22	765	490.1	653.4	1,938	-356	-534	**1,048**
23	0	0.0	326.7	278	-0	-94	**184**
24	230	0.0	653.4	785	-112	-228	**445**
Total	**7,948**	**3,743.8**	**4,062.8**	**16,121**	**1,510**	**4,938**	**9,673**

Table 12 provides a summary of land uses, trip totals, and the resulting PM Peak hour assignments for TAB's along West Belt Loop under the year 2040 condition.

Table 12. TAB Land Use Assignments and Trip Summaries, Intermediate Year 2040 Land Use

TAB	TAB Land Use Assumptions			TAB PM Peak Hour Trip Assignments			
	Residential (SF Units)	Commercial (ksf)	Industrial (ksf)	Total Trip Generation	Internal Trip Capture	External Trip Reduction	**TAB Trip Assignment**
1	0	490.1	0.0	618	-0	-122	**496**
2	0	490.1	0.0	618	-0	-122	**496**
3	100	490.1	0.0	718	-68	-129	**521**
4	100	490.1	0.0	718	-68	-129	**521**
5	30	0.0	0.0	30	-0	-6	**24**
6	30	0.0	0.0	30	-0	-6	**24**
7	0	0.0	0.0	0	-0	-0	**0**
8	0	0.0	0.0	0	-0	-0	**0**
9	0	130.7	0.0	165	-0	-32	**133**
10	0	130.7	0.0	165	-0	-32	**133**
11	0	0.0	0.0	0	-0	-0	**0**
12	0	0.0	0.0	0	-0	-0	**0**
13	0	0.0	0.0	0	-0	-0	**0**
14	0	0.0	0.0	0	-0	-0	**0**
15	120	0.0	0.0	120	-0	-24	**96**
16	0	0.0	0.0	0	-0	-0	**0**
17	40	0.0	0.0	40	-0	-8	**32**
18	0	0.0	0.0	0	-0	-0	**0**
19	0	0.0	326.7	278	-0	-54	**224**
20	0	0.0	326.7	278	-0	-54	**224**
21	0	392.0	326.7	772	-76	-137	**559**
22	300	130.7	653.4	1,020	-228	-156	**636**
23	0	0.0	326.7	278	-0	-54	**224**
24	0	0.0	653.4	555	-0	-110	**445**
Total	**720**	**2,744.8**	**2,631.6**	**6,403**	**440**	**4,938**	**4,788**

There are two things of note when comparing the full build and year 2040 TAB tables. First, note that land use development and trip assignments are projected to initiate along the northern and southern ends of the corridor. This assumption was discussed with local agency officials and confirmed with County's Land use consultant. Also, note there are a few TABs where the resulting assignments are higher in year 2040 versus the full build condition. This occurs because the

internal trip and street network reductions are not as significant with these blocks, due to a lack of synergetic land uses and/or due to a lack of potential street/network connectivity.

The trips from these tables were then assigned to West Belt Loop, via proposed intersections, to estimate travel demands for the PM peak hour of the typical weekday. Travel distance was used as the primary method for distributing trips between the 13 proposed study intersections and connections/intersections with Highway 220 and State Highway 20/26, respectively, where further regional access is achieved. For instance, the intersection at STA 282+60 provides access to TAB's 11 and 12. Located roughly an equal distance between Highway 220 and State Highway 20/26, approximately 50 percent of trips were assigned to/from the north and 50-percent to/from the south via West Belt Loop under the full build/development condition. This process was repeated for all TAB's and via all study intersections. A summary of distributions from study intersections with northbound and southbound assignments is shown in Table 13 for the PM peak hour for each proposed intersection, and the TAB(s) served. These assignments are shown for both the full build and year 2040 forecast conditions.

Table 13. Trip Assignment Tables, Full Build and Intermediate Year 2040 Land Uses

Station	TABs Accessed	Percent Distribution To/from North	Percent Distribution To/from South	Full Build Assignments		Year 2040 Assignments	
				To/from North	To/from South	To/from North	To/from South
110+00	1 & 2	≈ 10%	≈ 90%	21	205	24	249
129+00	1 & 2	≈ 10%	≈ 90%	62	538	74	645
160+12	3 & 4	≈ 20%	≈ 80%	172	688	208	834
186+52	5 & 6	≈ 30%	≈ 70%	32	70	14	34
210+00	7 & 8	≈ 30%	≈ 70%	12	141	0	0
243+00	7 & 8 9 & 10	≈ 30% ≈ 40%	≈ 70% ≈ 60%	83 558	84 837	0 106	0 160
282+60	11 & 12	≈ 50%	≈ 50%	379	379	0	0
310+65	13 & 14	≈ 60%	≈ 40%	565	376	0	0
344+00	15 & 16 17	≈ 70% ≈ 70%	≈ 30% ≈ 30%	494 272	210 117	67 22	29 10
370+45	18	≈ 80%	≈ 20%	257	64	0	0
396+85	20	≈ 80%	≈ 20%	328	82	179	45
423+25	19 21 & 22	≈ 80% ≈ 90%	≈ 20% ≈ 10%	347 1,387	87 196	179 1,056	45 139
449+85	23 & 24	≈ 90%	≈ 10%	567	63	603	66
			Total Trips (Validation)	**9,673 PM Peak Hour Trips**		**4,788 PM Peak Hour Trips**	

The trip assignments to/from the intersections are equal to the trip totals shown for TAB's 9 on Table 11 for the Full Build Condition and on Table 10 and Table 12 for year 2040. Note where turn restrictions were proposed, trips were assigned by way of the closest intersection with full

turn movements, assuming such access would be achieved via frontage roads, backage roads, access easements, shared parking lots, etc.

4.3 TRAFFIC FORECASTS

Up to this point, the trips generated by full build and year 2040 land uses would comprise the majority of forecasted traffic volumes for West Belt Loop. However, there are a number of "through" trips anticipated along the corridor that would serve as baseline traffic prior to any development of property. Per the direction of WYDOT and Casper MPO officials, these baseline trips were identified from the *Casper West Belt Loop Environmental Impact Assessment* (WYDOT, 2001). The referenced document contains the most recent forecasts developed for the corridor.

According to section 4.5.1.2 of the environmental document, "*Model runs were made to forecast traffic volumes 20 years in the future. Output from the model estimated that approximately 4,000 vehicles per day would use a new West Belt Loop at the south and approximately 6,000 vehicles per day would use it at the north end if it were constructed*". As such, a baseline volume of 4,000 ADT was assumed south and 6,000 ADT north of the Robinson Road intersection upon completion of the corridor, as Robinson Road is the only proposed intersection where substantial traffic would divert away from West Belt Loop.

A review of historical count data from WYDOT available for SH 220 and SH 20/26 indicates PM peak hour (design hour) traffic comprises about 9.2 percent of total weekday traffic. Given this calculation, a baseline volume of 370 PM peak hour trips was assumed on the south end and 550 PM peak hour trips assumed on the north end of West Belt Loop, with a 50-50 northbound and southbound distribution. The differential between south and north volumes was reconciled with entering and existing turn movements at the West Belt Loop/Robertson Road intersection. Again, this represents only the PM peak hour "cut-through" traffic between SH 220 and SH 20 that would occur with the construction of West Belt Loop, with traffic diverting from Robertson Road, CY Avenue, and Wyoming Boulevard within Casper.

The baseline volumes, full build, and year 2040 traffic assignments, as shown in Table 12 and Table 13, were combined to generate forecast travel demand volumes for West Belt Loop. Both full land use development and year 2040 traffic forecasts are summarized on Figure 8 for the weekday and PM peak hour. Recall the full traffic forecasts reflect horizon year; rather are meant to simply identify travel demands assuming full development of land uses within the corridor influence area. Traffic volumes are shown between major intersections proposed along West Belt Loop. However, actual turning movement forecasts were developed and are available for further review and discussion.

Figure 8. Year 2040 and Full Land Use Development Traffic Forecasts for West Belt Loop

INSERT TAB SHEET SECTION 5

5 OPERATIONS/CAPACITY ANALYSIS

This section provides a summary of the methodologies, analyses, and recommendations of the traffic operations/capacity analysis prepared for West Belt Loop, as based on full land use development and year 2040 traffic forecasts. Given this study reviews long range traffic conditions (25 years and beyond to some long-range future condition), the recommendations that follow are very conceptual in nature and should be subject to revisions, as based on the collection of current and prevailing traffic information in the future.

It is intended these conclusions be used as a basis for: permitting access location and function; developing and/or advancing concept designs; preparing construction cost estimates for project programming purposes; and for right-of-way acquisition/preservation. As stated throughout this document, the locations defined by this study are well thought out and accurate; they should be considered final locations for future construction. Deviation of these locations will need to be approved by WYDOT and the governing local agency.

5.1 ANALYSIS SCOPE AND METHODOLOGY

Intersection levels-of-service, arterial levels-of-service, arterial travel speeds, and general capacity thresholds were used in the review of operational and capacity conditions for West Belt Loop. This section provides an overview of analysis methodologies, with section 5.2 providing a summary of analyses. Section 5.3 outlines capacity/operational recommendation.

5.1.1 Methodology – Arterial Capacity

Arterial capacity offers a preliminary or “first glance” method for estimating the number of through-travel lanes that would be needed to accommodate forecast traffic volumes along an arterial or highway. As discussed earlier, arterial capacity was a method used to help support the distribution/assignment of external versus West Belt Loop trips. Arterial capacity was also a method used to recommend the general cross section of West Belt Loop, meaning the number of through travel lanes along the Highway.

Arterial capacity was reviewed according to guidelines provided within the *Quality/Level of Service Handbook* (Florida DOT, 2012). The Handbook defines arterial cross-sections (i.e. number of through lanes) based upon generalized peak hourly or average daily traffic volumes. The backing methodology behind these tables is based on information and equations provided within the Highway Capacity Manual (TRB, 2010), which is the prevailing resource used in measuring and quantifying traffic operations and capacity for transportation infrastructure.

WYDOT officials maintain a LOS C standard for the operation condition/mobility of Highways. Table 5 of Appendix A from the *Quality/Level of Service Handbook* outlines peak hourly volume thresholds to maintain a LOS C standard for various Highway cross-sections aligned within areas “transitioning” from rural to urban or suburban in nature. Table 6 of Appendix A provides peak hourly volume thresholds to maintain a LOS C standard for various cross sections aligned in developed, rural areas. The purpose of this review using these guidelines is to plan a general arterial cross section based on a comparison of forecast traffic volumes with the thresholds provided for two, four, or even six lane highways. Both sets of criteria were reviewed because this is a developing rural area that will eventually transform into one of a quasi-urban to suburban setting. The thresholds discussed are summarized in Table 14 for two, four, and six-lane roadway sections. Intersection analyses are then used to further evaluate and determine the arterial and intersection design needs.

Table 14. Generalized Average Daily Highway Volumes to Maintain LOS C Standard – Transitioning to Urban and Developed Rural Areas			
Peak Hourly Volumes Versus Lanes for:	Two Lanes	Four Lanes	Six Lanes
Highways – "Transitioning" Rural-to-Urban	1,550	4,460	6,700
Highways - Rural "Develop" Areas	1,550	3,860	5,790
Source: *Quality/Levels-of-Service Handbook* (Florida DOT, 2009)			

5.1.2 Methodology – Intersection Operations (Levels-of-Service)

Levels-of-service (LOS) methodologies are derived from the *Highway Capacity Manual* (TRB, 2010). The *Highway Capacity Manual* (HCM) is a nationally recognized and locally accepted method of measuring traffic flow and congestion for roadways, intersections, pedestrian facilities, and transit accommodation. Typical criteria for these facilities range from LOS A, indicating free-flow conditions with minimal delays, to LOS F, indicating extreme congestion with significant delays.

The focus for this analysis is on forecast signalized and two-way stop-controlled intersection conditions. LOS for a signalized intersection is defined in terms of the average control delay experienced by all vehicles at the intersection, typically over a specified time period such as a peak hour. LOS for a one- or two-way stop controlled intersection is the function of the average control vehicle delay experienced by a particular approach or approach movement over a specified interval such as a peak hour. Typically, the stopped approach or movement experiencing the worst LOS is reported for the intersection.

LOS was determined for this study using Synchro 8.0, Build 805, (Trafficware, 2013). This software tool utilizes the methodologies of HCM 2010 and is a standard industry analytical tool. LOS D is the planning threshold used when planning the long-range capacity/operation of intersections. This is not to be confused with arterial LOS threshold discussed previously. The level of complexity in movement with associated delays at intersections is expected by motorists; the tolerance of a LOS D condition is acceptable. Conversely, drivers do not expect such delays while traveling a typical roadway section and the tolerance for delay is therefore less; resulting in the LOS C standard used for planning roadways. And it is acceptable and typical that a roadway, arterial, or highway section can function at LOS C with intersections that operate at LOS D.

5.1.3 Methodology – Arterial LOS and Travel Speeds

Synchro 8.0 also has the capability to report arterial LOS and travel speed directly in compliance with Highway Capacity Manual. The general number of lanes needed to accommodate full build and intermediate year 2040 traffic forecasts was planned initially with the *Quality/Level of Service Handbook*. Arterial and intersection concepts were advanced using Synchro and intersection LOS analyses. Finally, Synchro was used to determine effectiveness measures for the overall corridor within the context of both the arterial and intersection concepts developed for the corridor. Again, LOS C is the overall threshold required by WYDOT for arterials and Highways.

5.2 Traffic Operations/Capacity Analysis

Two analysis conditions were reviewed for this study. The first includes a review of forecast travel demands assuming the full development of land uses projected within a ½ to ¾ mile influence

area of West Belt Loop, resulting in the assignment of 9,700 PM peak hour trips (along the corridor). This level of traffic would be reached well into the future, even beyond the intermediate year 2040 analysis horizon additionally studied by this report.

Year 2040 forecasts were reviewed to be in compliance with the analysis horizon of the Casper MPO so WYDOT, the MPO, and local agencies can reasonably plan and program transportation improvements along and within the influence area of West Belt Loop. As indicated previously, nearly 4,800 trips would be assigned by land uses to the corridor under this analysis condition.

Once trips were assigned, it was the goal of this study to determine and recommend the capacity necessary to accommodate forecast traffic volumes meeting the following conditions:

- In excess of two travel lanes were programmed to accommodate between 1,600 and 4,500 peak hourly vehicles, with six lanes considered above 4,500 ADT.
- A LOS C condition was maintained for the West Belt Loop arterial, on average, with the two or four lane configuration identified, overall.
- The channelization (turn lane additions, etc.) and control conditions (signal, stop-sign, etc.) required to promote a LOS D condition was achieved for all study intersections.

Full Build-Out Condition. A four lane highway is recommended for West Belt Loop following the full development of corridor land uses (into the future well beyond year 2040). The potential for additional travel lanes may be needed for 1.4 miles on the north end of West Belt Loop (SH 20/26 to Robinson Road) as traffic volumes are in excess of 4,500 peak hourly vehicles. There would be ten signalized and three unsignalized intersections; resulting in an arterial LOS C condition with an approximately 42 mph average and overall travel speed in both directions of the corridor. All intersections are forecast to operate at LOS D or better with turn lanes provided, as appropriate. Figure 9 shows the LOS results for the corridor under the full land use development analysis condition.

Year 2040 Condition. A two lane corridor can be maintained for the majority of West Belt Loop through year 2040. However, a four-lane sections is recommended, respectively, for 1.4 miles on the north end (SH 20/26 to Robinson Road) and 1.1 miles on the south end (SH 220 to STA 160+00) of West Belt Loop to accommodate higher traffic volumes generated by adjacent land use properties. There would be five signalized and five unsignalized intersections forecast for development by year 2040; resulting in an arterial LOS C condition with an approximately 42 mph average and overall travel speed in both directions. All intersections are forecast to operate at LOS D or better with turn lanes provided, as appropriate. Figure 10 shows the LOS results for the corridor under the year 2040 analysis condition.

5.3 INTERSECTION RECOMMENDATIONS

This section outlines the full land use development and intermediate year 2040 recommendations on an intersection-by-intersection basis. Provided are general descriptions of lane configurations and controls, with a screen capture from Synchro Model used to provide a visual of recommendations for West Belt Loop and each intersection. These represent the 13 intersections proposed between West Belt Loop and interconnecting roadways. Access to land uses/properties would be provided by way of frontage roads, reverse frontage roads, backage roads, shared access, access easements, etc.

Figure 9. Full Land Use Development LOS Results for West Belt Loop

Figure 10. Intermediate, Year 2040 LOS Results for West Belt Loop

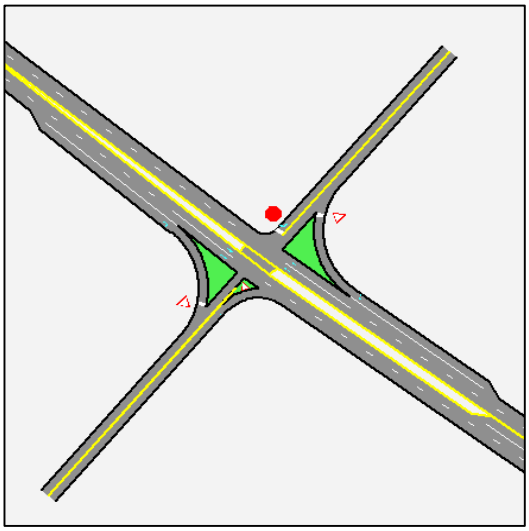
1. West Belt Loop STA 110+00

The corridor is recommended to have a divided, four lane cross section north and south of this intersection under both the full development and intermediate year 2040 conditions. Even in year 2040, adjacent corridor land uses are anticipated for development which is why the additional lane capacity is needed in the more immediate future.

The intersection would have similar designs between the full development and year 2040 conditions. Right-in and right-out only turn movements are recommended on the east and west stop-controlled approaches, given this intersection's close proximity to SH 220. But these approaches are indeed needed given the nature of likely commercial land use that is forecasted to develop near the West Belt Loop/SH 220 intersection. North and south right-turn deceleration lanes are recommended to effectively remove turning from through traffic as developed in compliance with WYDOT standards for a 60 mph facility. Flared approaches are a tool WYDOT uses to enhance sight distance and safety at intersections, and are therefore recommended for right turn departures.

This minor intersection would provide access to a minor collector roadway system used to access commercial, industrial, residential, or open space properties.

Full Land Use & Intermediate Conditions



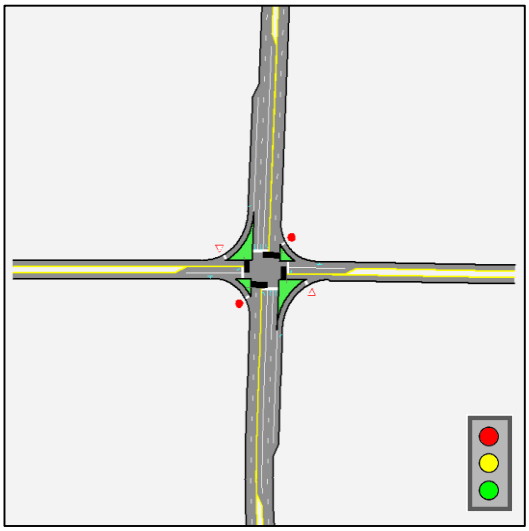
2. West Belt Loop STA 129+00

The corridor is recommended to have a divided, four lane cross section north and south of this intersection under both the full development and intermediate year 2040 conditions.

The intersection would have similar designs between the full development and year 2040 conditions. A traffic signal would be used to control traffic movements at this intersection. The signal should be coordinated with others along West Belt Loop in order to preserve north-south progression. To maintain a LOS D or better standard, left-turn lanes were provided on all approaches with protected phases used in the north-south approaches and protected-permitted on the east-west approaches. North and south right and left-turn deceleration lanes should be developed in compliance with WYDOT standards and/or as based on a queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turns.

This would be the first major intersection located north of SH 220 with anticipation of a minor arterial or primary collectors extending to give access to substantial property. In addition, this intersection would provide a U-turn movement for traffic to redirect and access SH 220.

Full Land Use & Intermediate Conditions



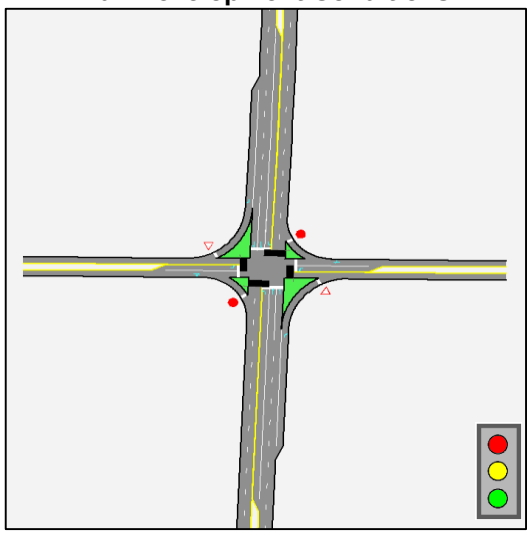
3. West Belt Loop STA 160+12

The corridor is recommended to have a divided, four lane cross section north and south of this intersection under the full development condition. Only two lanes are needed north of the intersection by year 2040, with outer add and drop lanes used to promote four lanes south.

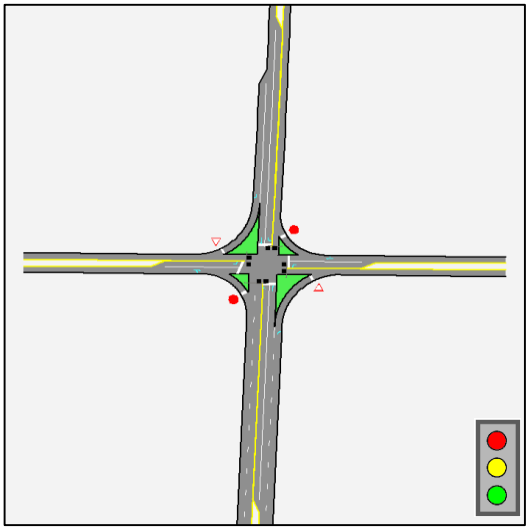
A traffic signal would be used to control traffic movements at this intersection in both the intermediate and long term conditions. The signal should be coordinated with others along West Belt Loop in order to preserve north-south progression between intersections. Left-turn lanes should be provided on all approaches, with protected phases used in the north-south and protected-permitted on the east-west approaches. Southbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study, as with the northbound left-turn lane. The outer approaching northbound lane would end in a right-turn at the intersection, whereas a free eastbound right-turn would transition into a full southbound lane departing the intersection. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turns.

Although a signal is recommended, this minor intersection would provide access to minor collector roadways used to access commercial, industrial, residential, or open space properties.

Full Development Conditions



Intermediate Year 2040 Condition



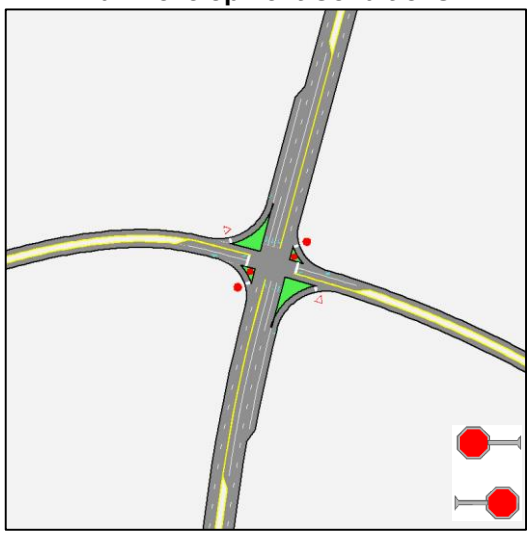
4. <u>West Belt Loop STA 186+52</u>

The corridor is recommended to have a divided, four lane cross section north and south of this intersection under the full development condition. Only two lanes are needed north and south of the intersection by year 2040.

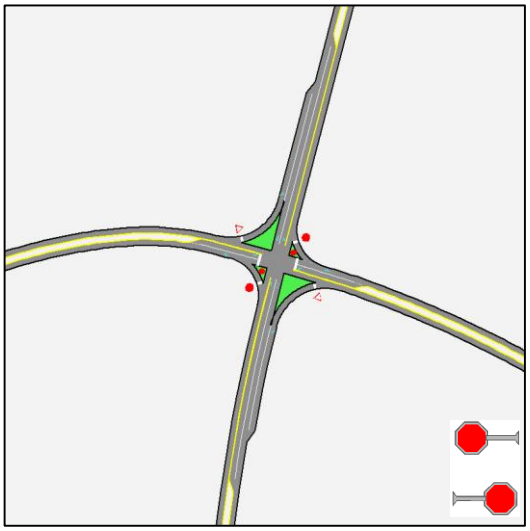
The east and west approaches should be stop-controlled with left-turn lanes developed to accommodate queues. North and southbound right and left-turn deceleration lanes should be developed for traffic departing a 60 mph facility. Flared approaches are recommended for right turn departures, as controlled by stop signs.

This has been recommended as a major intersection from a functionality perspective, which means minor arterials or primary collector streets would extend to the intersection. However, the LOS analysis confirms no signal is needed. The need for a signal should be reviewed if more intense land uses are developed along West Belt Loop.

Full Development Conditions



Intermediate Year 2040 Condition

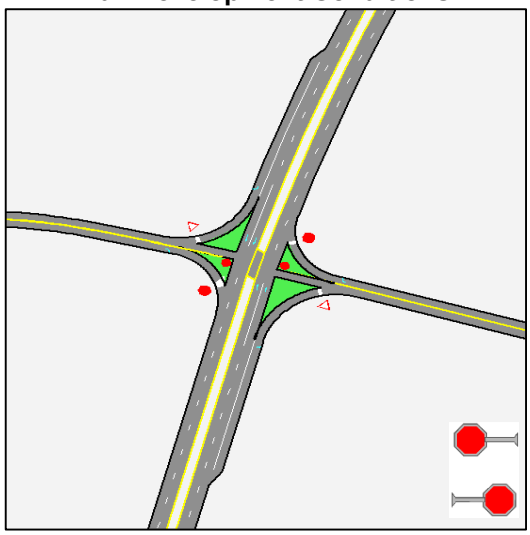


5. West Belt Loop STA 210+00

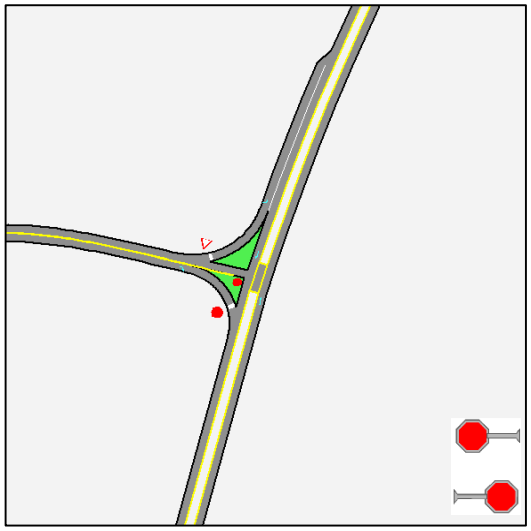
The corridor is recommended to have a divided, four lane cross section north and south of this intersection under the full development condition. Only two lanes are needed north and south of the intersection by year 2040. East and west approaches should be stop-controlled with right-in and right-out turn allowances only with full land use development; however, only the west leg of the intersection is anticipated for development by year 2040. Northbound and southbound right and left-turn deceleration lanes should be developed for traffic departing a 60 mph facility. Flared approaches are recommended for right turn departures, as controlled by stop signs.

This minor intersection would provide access to Rimrock Road initially, and adjacent residential properties in the long-term.

Full Development Conditions



Intermediate Year 2040 Condition



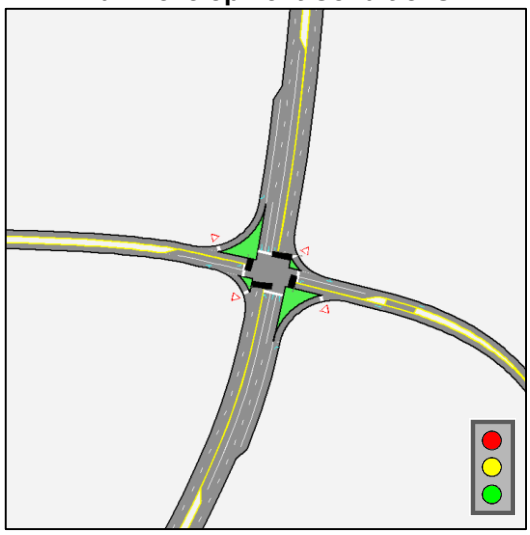
6. West Belt Loop STA 243+00

The corridor is recommended to have a divided, four lane cross section north and south of this intersection under the full development condition. Only two lanes are needed north of the intersection by year 2040.

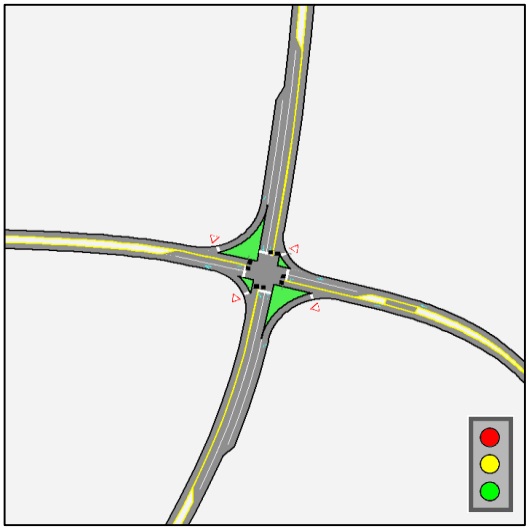
A traffic signal would be used to control traffic movements at this intersection extending from year 2040 and beyond to full development. The signal should be coordinated with others along West Belt Loop in order to preserve north-south progression between intersections. Left-turn lanes should be provided on all approaches, with protected phases used in the north-south approaches and protected-permitted on the east-west approaches. Northbound and southbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turn traffic.

This has been recommended as a major intersection from a functionality perspective, which means minor arterials or primary collector streets would extend to the intersection. This would be an ideal connection for the extension of Trevett Lane and the access of commercial, industrial, and residential properties.

Full Development Conditions



Intermediate Year 2040 Condition

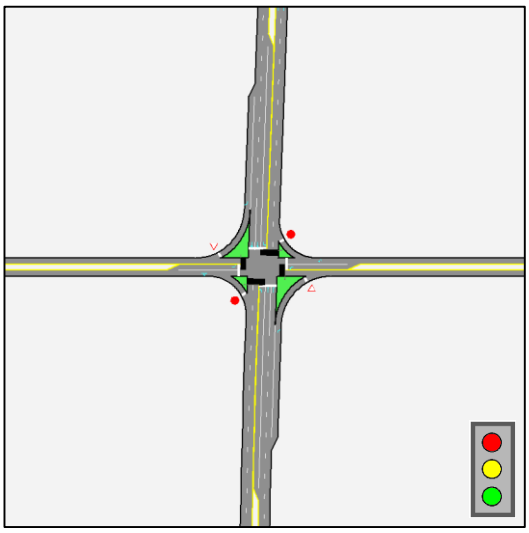


7. West Belt Loop STA 282+60

The corridor is recommended to have a divided, four lane cross section at the intersection with full land use development. The intersection may not be needed by year 2040. A signal would be used to control traffic movements, as coordinated with others signals along West Belt Loop to preserve north-south progression. Left-turn lanes were provided on all approaches, with protected phases used in the north-south approaches and protected-permitted on the east-west approaches. Northbound and southbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turn traffic.

Although a signal is recommended, this minor intersection would provide access to minor collector roadways used to access commercial, industrial, residential, or open space properties.

Full Development Conditions

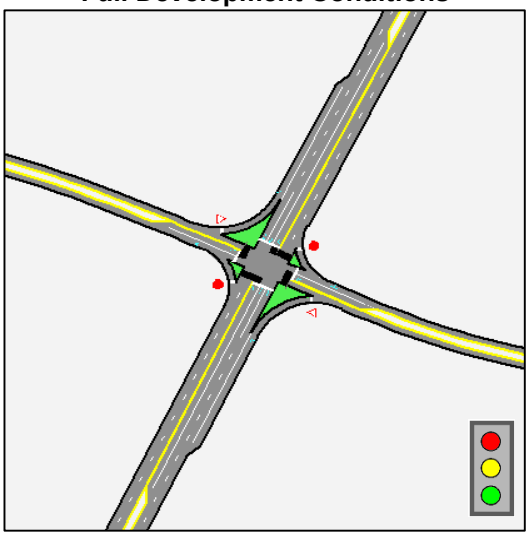


8. West Belt Loop STA 310+65

The corridor is recommended to have a divided, four lane cross section at the intersection with full land use development. The intersection may not be needed by year 2040. A signal would be used to control traffic movements, as coordinated with others signals along West Belt Loop to preserve north-south progression. Left-turn lanes were provided on all approaches, with protected phases used in the north-south approaches and protected-permitted on the east-west approaches. Northbound and southbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turn traffic.

This has been recommended as a major intersection from a functionality perspective, which means minor arterials or primary collector streets would extend to the intersection. The primary function of this intersection is to promote east/west connectivity across the corridor. However, a north/south connection from 7 Mile is a possibility, although no agency has any plans to construct such a connection.

Full Development Conditions



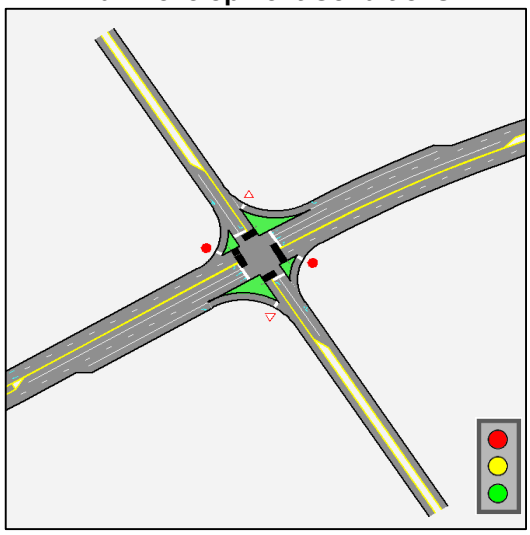
9. West Belt Loop STA 344+00

This should have a divided, four lane cross section north and south of this intersection with full land use development. A two lane cross section is recommended with year 2040 land uses.

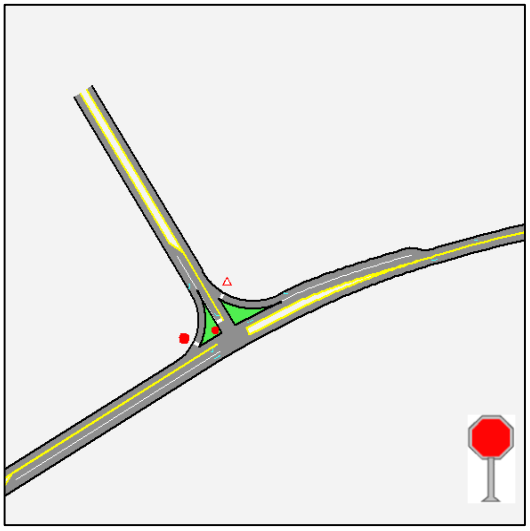
A signal would be used to control traffic movements under the full development condition, although stop controls are recommended on only one minor approach by year 2040 (land use development is only projected to the north). For the long range condition, the signal should be coordinated with others in order to preserve progression along West Belt Loop. Left-turn lanes were provided on all approaches, with protected phases used in the West Belt Loop and protected-permitted on minor approaches. Corridor right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on a queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turn traffic.

Although a signal is recommended, this minor intersection would provide access to minor collector roadways used to access commercial, industrial, residential, or open space properties.

Full Development Conditions



Intermediate Year 2040 Condition

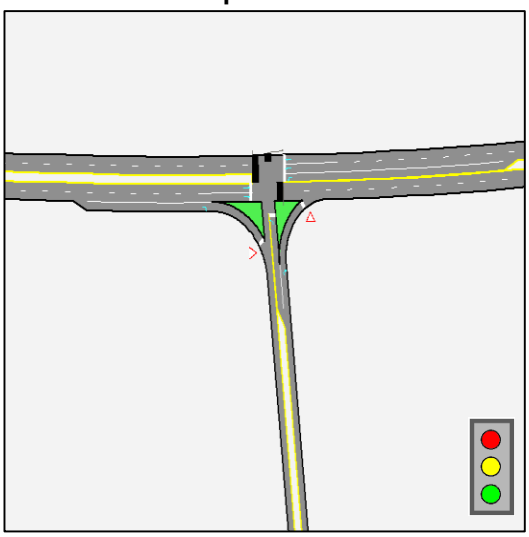


10. <u>West Belt Loop STA 370+45</u>

The corridor is recommended to have a divided, four lane cross section at the intersection with full land use development. The intersection may not be needed by year 2040. A northbound approach should be signalized will full land use development along West Belt Loop. An eastbound right-turn and westbound left-turn deceleration lanes should be developed for traffic departing a 60 mph facility, as based on WYDOT requirements and queue analyses. Flared approaches are recommended for right turn approaches, as controlled with yield signs, and departures, as controlled by stop signs.

This has been recommended as a major intersection from a functionality perspective, which means minor arterials or primary collector streets would extend to the intersection. No northbound approach can be provided due to the alignment of Poison Spider Road.

Full Development Conditions

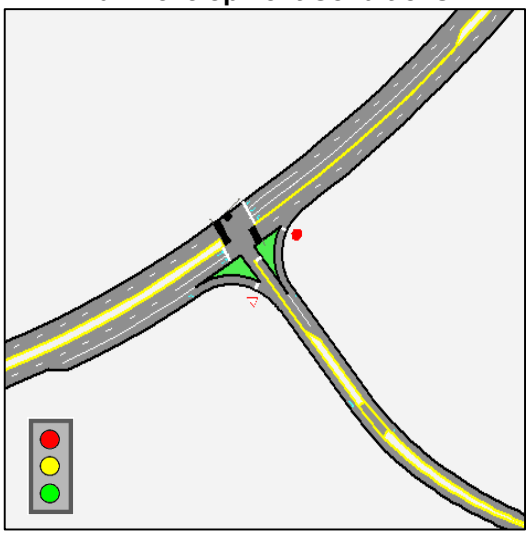


11. <u>West Belt Loop STA 396+85</u>

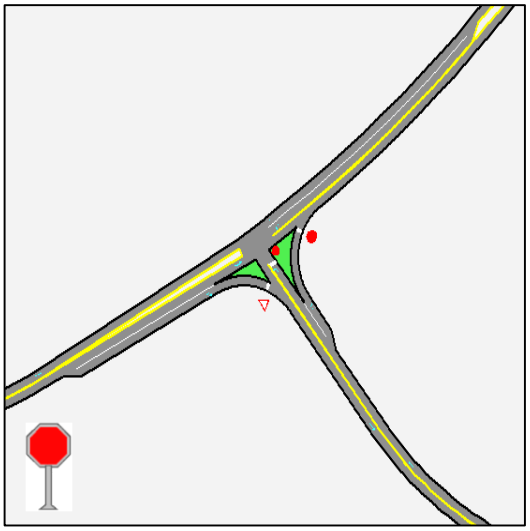
The corridor is recommended to have a divided, four lane cross section east and west of this intersection under the full development condition. Only two lanes are needed by year 2040. The intersection should be signalized with full land use development along West Belt Loop; however stop-controls can be used up until year 2040. An eastbound right-turn and westbound left-turn deceleration lanes should be developed for traffic departing a 60 mph facility, as based on WYDOT requirements and queue analyses. Flared approaches are recommended for right turn approaches, as controlled with yield signs, and departures, as controlled by stop signs.

Although a signal is recommended, this minor intersection would provide access to minor collector roadways used to access commercial, industrial, residential, or open space properties. No northbound approach can be provided due to the alignment of Poison Spider Road.

Full Development Conditions



Intermediate Year 2040 Condition



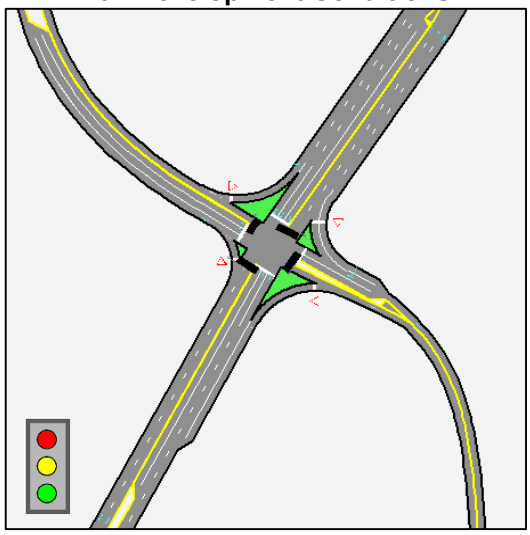
12. <u>West Belt Loop STA 423+25 (Robertson Road Intersection)</u>

The corridor is recommended to have a divided, four to six lane cross section north and four lane cross section south of the intersection under the full development condition, with outer add and drop lanes used to promote four lanes south. Four lanes are needed north and two lanes south of the intersection by year 2040.

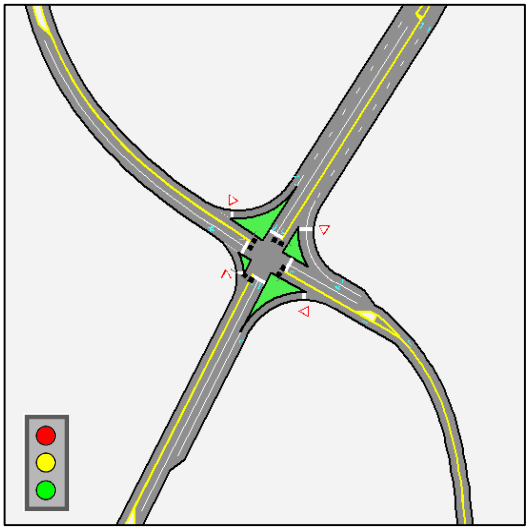
A traffic signal would be used to control traffic movements at this intersection in both the intermediate and long term conditions. The signal should be coordinated with others along West Belt Loop in order to preserve north-south progression between intersections. Left-turn lanes should be provided on all approaches, with protected phases used in the north-south and protected-permitted on the east-west approaches. Southbound and northbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turns.

This has been recommended as a major intersection connecting with existing Robinson Road, and accessing commercial, industrial, and residential properties.

Full Development Conditions



Intermediate Year 2040 Condition



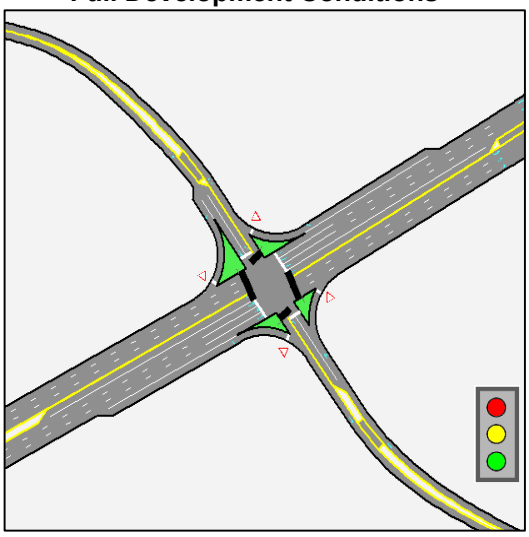
13. <u>West Belt Loop STA 449+85</u>

The corridor is recommended to have a divided, four to six lane cross section north and south of the intersection under the full development condition. Four lanes are needed north and two lanes south of the intersection by year 2040.

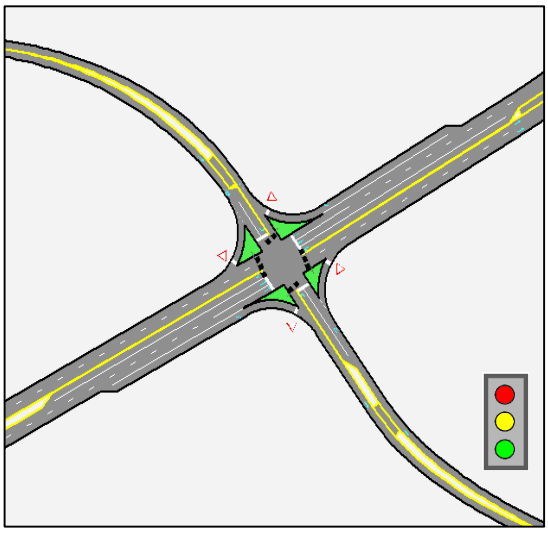
A traffic signal would be used to control traffic movements at this intersection in both the intermediate and long term conditions. The signal should be coordinated with others along West Belt Loop to preserve north-south progression. Left-turn lanes should be provided on all approaches, with protected phases used in the north-south and protected-permitted on the east-west approaches. Southbound and northbound right and left-turn deceleration lanes should be developed in compliance with WYDOT standards, and/or as based on queue study. Flared approaches are recommended for right turn departures at the intersection, as controlled by stop signs for movements entering West Belt Loop and yield signs for departing right turns.

Although a signal is recommended, this minor intersection would provide access to minor collector roadways used to access commercial, industrial, residential, or open space properties.

Full Development Conditions



Intermediate Year 2040 Condition



INSERT TAB SHEET SECTION 6

6 NON MOTORIZED TRANSPORTATION

In accordance with the 2004 Environmental Assessment, the main purpose of the West Belt Loop is to serve as a bypass route connecting traffic, in particular truck traffic, between Highway 20/26 and Highway 220. With the exception of some recreational cyclists, the sparsely populated area does not generate cyclist or pedestrian needs at this time or in the foreseeable future.

The goal of this section is to lay out a preliminary strategy for future development of non-motorized facilities. It is not intended to establish any detailed policies or standards. The State, County and City of Casper will need to address pedestrian and cyclist development standards in the future as developments begin to in-fill along the corridor.

By its design, the WYDOT secondary highway serves as a major arterial; maintaining vehicular mobility and safety is its primary function. Unlike lower speed collector and residential systems, the higher speed arterial highways are not ideal conduits for non-motorized travel. Functional, safe and efficient non-motorized facilities are generally off-street paved and unpaved trail systems and sidewalk systems running parallel with the bypass corridor. Physically separating the trails and pedestrian systems from the highway should be a goal of future regional development.

It is important to note that the West Belt Loop bypass introduces a barrier to east-west mobility. Future area development, especially residential development west of the bypass, must address safe pedestrian and cyclist crossings. Future developments west of West Belt Loop will undoubtedly need to cross the highway to access Casper and Mills and intersection designs will need to consider the pedestrian safety aspects. Mid-block crossing should be discouraged for obvious safety reasons.

Based on the recommended intersection layout addressed in this corridor study, intersections will be spaced generally every one-half mile. Major intersections likely to be signalized are staggered at approximate one-mile minimum spacing. The recommended intersections, whether signalized or unsignalized, would serve as central crossing locations for pedestrians and cyclists.

There have been several studies conducted in Casper that address non-motorized travel in the City and outlying communities. Two of the more focused studies are the *Casper Area Trails, Path and Bikeway Plan* and the *Casper MPO Long-Range Transportation Plan Update*. Both documents were prepared for the Casper MPO. The first study addresses design elements, recommended standards, and policy implementation strategies. The Long-Range Transportation Plan focuses on specific infrastructure performance, projected travel demands, and long-range regional growth. The trails plan does include some recommended trail improvements but does not extend west of the Casper area of influence. The Transportation Plan update addresses mostly the vehicular planning issues, but also provides some information pertaining to potential non-motorized corridor development.

In conclusion, it will be up to the county to establish non-motorized mobility standards and policies for the West Belt Loop corridor developments. Where developments interface with West Belt loop, the county would need to coordinate closely with WYDOT to establish these standards and policies. Whatever trail systems or crossings are planned with future development, they must not impede the function of the arterial roadway.

INSERT TAB SHEET SECTION 7

7 UTILITY PLANNING

Section 3 of this Corridor Study addresses projected land development capabilities of the corridor. Land use projections were determined based on several factors including topography, adjacent development and growth trends, aesthetic value (e.g., river front property), and proximity of the development from potential commercial centers. This section provides a brief overview of the ability to serve this area with utility infrastructure.

The Consultant planning staff contacted the City Water and Sewer Department representatives to determine accessibility of services as well as future capacity of the regional water delivery and sewage treatment facilities. Contacts were also made to local water company providers who serve areas immediately northwest of the West Belt Loop corridor. The following is a summary of the findings of this investigation.

7.1 WATER SERVICES

The City of Casper does not currently have any plans to extend water service further west of Robertson road than is already provided for the incorporated City properties. Much of the region is at higher elevation and would likely require supplemental pumping to increase pressure zone to minimum delivery pressures if city water were ever to be extended west of the City limits. Currently the area near West Belt Loop between Robertson Road and Highway 20/26 is serviced by the Town of Mills.

West Belt Loop Corridor lies within or adjacent to the Pioneer Water and Sewer District. Discussions with district staff indicate that adequate supply would be available to serve the area. There are currently no water mains or distribution lines in the area; regional development will require the long-range planning, design construction and funding of trunk main construction.

7.2 SEWER SERVICES

The West Belt Loop corridor is tributary to the City of Casper sewage treatment plant located on the North Platte River. The sewage treatment plant administrators indicated that the plant has considerable unused capacity at the plant to handle the future West Belt Loop developments. A trunk sewer system should be planned to collect waste from the area. Development will need to lead the way for extension of services to the area.

In addition to water and sewer services, future development would need to extend power, gas, communications and cable to serve future commercial, industrial and residential development. Some areas of the corridor already include some of these services, especially in the region around Robertson Road and north to Highway 20/26. The attached Figure 11 illustrates the approximate locations of existing utilities along the entire corridor. It is assumed that with the availability of these private utilities in the vicinity that development and utility companies would extend services to the corridor.

In summary, there appears to be future capacity, or opportunity for public and private utility purveyors to serve the West Belt Loop corridor development.

Figure 11. Utility Plan

INSERT TAB SHEET SECTION 8

8 PRELIMINARY ENVIRONMENTAL SCREENING

A preliminary environmental screening process was undertaken to determine the level of impacts the future intersections might have on the local environment. In the West Belt Loop Environmental Assessment, the bypass project went through an exhaustive National Environmental Policy Act (NEPA) process. Included in the NEPA process was a comprehensive environmental review. The original Environmental Assessment (EA) addressed potential impacts to land use, farm and ranchland, socioeconomics, wildlife and fisheries, wetlands, traffic, air & noise impacts, cultural resources, and floodplain impacts. The West Belt Loop project included all necessary mitigation measures as part of the process before the roadway design was approved and released for construction. Construction of the highway began in 2012 and should be completed in Fall 2014.

This Corridor Plan establishes precise locations for future major and minor intersections along the 7.2 mile corridor. Although the planning of these intersections does not require a reevaluation of the EA, it is expected that FHWA and WYDOT will require a pre-NEPA screening be conducted in accordance with the guidelines outlined in the FHWA *Guidance on Using Corridor and Subarea Planning to Inform NEPA (April 5, 2011).*

During the field review and topographic research, three primary environmental items related to the placement of intersections were identified. These include: Impacts to wetlands, property accessibility (socioeconomics), and cultural /historic impacts. The attached Figure 12 identifies property boundaries, historically significant sites/features, and delineated wetlands.

Regarding property accessibility, the intersections can be reached by future private development. Future connectivity may require frontage road and collector road development from developable areas to the defined intersections.

The figure illustrates that the proposed intersections do not adversely impact or conflict with known cultural sites and biologically diverse wetlands.

The environmental screening for this Corridor Plan included a field investigation, topographic research, thorough review of the EA, and resource agency contacts. Resource agency letters were distributed to the following agencies to solicit comments on any known or anticipated environmental issues:

Agency	Response Received
Natrona County Floodplain Administrator	☑
WYDOT (Planning)	
Wyoming Game and Fish Department	
Wyoming DEQ	
Wyoming State Historic Preservation Office	
FHWA Wyoming Division	☑
US Army Corps of Engineers	☑
US FWS Wyoming	
EPA Region 8	
NRCS, Wyoming East Area	

Agency response letters are included in Appendix C. Note only those agencies with a check provided a response to the screening inquires. Based on input received, the resource agencies do not consider any major environmental obstacles to future intersections along West Belt Loop.

Figure 12. Environmental Screening Map

INSERT TAB SHEET SECTION 9

9 MAP-21 PERFORMANCE MEASURES

FHWA is currently working with the State and metropolitan planning organizations to transition toward and implement a performance-based approach to carrying out the Federal Highway Program known as Transportation Performance Management. Transportation Performance Management represents the opportunity to prioritize needs, and align resources for optimizing system performance in a collaborative manner. This transition supports the recent legislation "Moving Ahead for Progress in the 21st Century," also known as MAP-21. This legislation integrates performance into many federal transportation programs and contains several performance elements.

Both the Cheyenne MPO and Casper Area MPO are working towards development of performance-based standards and the metric to measure performance. In our discussions with FHWA and various state DOTs, the process to establish specific guidelines to meet the federal performance targets is still a work in progress. The FHWA has indicated to WYDOT Planning that in the absence of set compliance measures, they are willing to work with local agencies to establish performance standards on a project by project basis. It is incumbent though for those agencies to thoughtfully determine realistic and measurable rating criteria applicable to the following seven national goals

1. Safety
2. Infrastructure Condition
3. Congestion Reduction
4. System Reliability
5. Freight Movement and Economic Viability
6. Environmental Sustainability
7. Reduced Project Delivery Delays

As with any new federal program, there will be a learning curve to establish compliance with the requirements of the program. Discussions with WYDOT Planning and FHWA officials indicate that FHWA will work with the consultant and MPO to develop project specific criteria and their respective measurements. It is incumbent on the MPO to exercise due-diligence in this process; FHWA is willing to be flexible.

In the absence of specific target goals and measures, and considering some subjectivity to measuring the effectiveness of a few of the criteria, the following Table 15 has been developed to illustrate the preliminary approach to meeting MAP-21 and performance based standards.

Table 15. Map -21 Performance Descriptions and Measures

Performance Measure	Description	Preliminary Measures and Metric
Safety	Significant reduction of traffic fatalities and injuries on Public Roads.	*Goal Challenges*: • Must define the threshold for "significant" reductions • Some measurable criteria, but can be subjective *Metric:* • Crash study as baseline • Establish/document safety features • Predictive Methods for reviewing the safety and operational effects of geometric recommendations for the corridor (Using IHSDM Software)
Infrastructure Condition	Maintain the highway infrastructure in good repair.	*Goal Challenges*: • Application to new construction will be difficult; challenging to rate new pavement sections vs. existing roadway • Requires subjective approach *Metric:* • Document maintenance standards and pavement preservation method • Document pavement design life-cycle investigation. • Outline pavement inspection and rating process (Pavement Management System) • Apply numeric value to alternative pavement section designs in relation to their life expectancies
Congestion Reduction	Achieve significant reduction in congestion on the National Highway System.	*Goal Challenges*: • Must define the threshold for "significant" reductions. *Metric:* • Use Transportation Forecasting methods to determine transportation reallocation • Assign values to corridor and intersection LOS improvement
System Reliability	Improve the efficiency of the surface transportation system.	*Goal Challenges*: • Challenge will be applying weighted scores to levels of improvement *Metric:* • Consider using reduced travel times, i.e., trip reduction and corresponding reduced user costs (FHWA formula) • Develop numeric system for level of trip reductions – possibly by percent reduction
Freight Movement & Economic Vitality	Improve the national freight network by strengthen the ability of rural communities to access trade markets, and Support regional economic development.	*Goal Challenges*: • Goal has two distinct parts – requires separate metrics • Freight vitality is more easily measurable • Local economic growth is subjective *Metric:* • Predict potential for freight growth via transportation planning tools; Apply corresponding numeric values • Regional development potential could be measured based on percent growth potential
Environmental Sustainability	Protect and enhance the natural environment. Cultural Resources Biological Resources Wetlands Impacts Socio-economic (Covered in Economic Vitality above)	*Goal Challenges*: • Compliance threshold is subjective • Requires documentation of regional environmental jewels, highlights, treasures, benefits • Need to establish "what is allowable" *Metric:* • Sustainability means "*no adverse environmental impact*" - baseline • Documentation of mitigation measures • Document/measure construction requirements for environmental compliance • Apply corresponding numeric value

9.1 MAP-21 APPLICATION, WEST BELT LOOP

The application of MAP-21 performance measures with the West Belt Loop project is summarized as follows:

Safety. West Belt Loop was designed to accommodate higher speed traffic operations between Highway 20/26 and Highway 220. Stopping sight distance combined with reasonable roadway geometrics are addressed in the design. Likewise, the bypass route will serve traffic currently using Robertson Road, CY Avenue, and other city streets. Providing these pass-through motorists with a more direct route will improve safety on the existing transportation system. Moving forwards, safety must be monitored for West Belt Loop in order to assure MAP-21 goals, and to preserve the interest of public safety.

Safety has historically been monitored and measured through collision statistics. When crash rates for a particular corridor or intersection exceeds historical trends or averages for a jurisdiction, as established through the governing body, the facility may be designated a high accident corridor or high accident location (HAL) by this body.

For instance, WYDOT maintains historical collision data for State Highways and Arterials. According to *FY 2012 Problem Identification* (WYDOT, 2012), a 1.5605 crash rate per million vehicle miles of travel (VMT) and 0.0163 fatalities per million vehicle miles of travel was calculated for State Highways in year 2010. As such, moving forward, the recommended threshold for safety is a crash rate of 1.56 million VMT and fatality rate of 0.02 million VMT for West Belt Loop, as rates exceed averages and therefore would qualify as an HAC. This would be subject to revision with future WYDOT collision analyses.

In terms of intersections, it is standard industry practice to further review safety issues when a crash rate of greater than 1 collision per million entering vehicles is calculated; or whenever a fatality has occurred and has been classified intersection-related. In the future, an HAL should be considered if a crash rate of 1 collision per million entering vehicles or an intersection-related facility is noted for West Belt Loop intersections.

Additional traffic/safety analyses and potential safety improvements may be warranted when rates exceed these thresholds.

- **Infrastructure Condition.** The design life for a new roadway is typically 20-years. With regular preventative maintenance, the pavement and base life expectancy could extend beyond 20-years provided traffic wheel loads do not drastically increase The design includes provisions to remove storm drainage – one of the primary contributors to pavement deterioration.
- **Infrastructure Condition** West belt Loop is designated as a State Route and will be operated and maintained by WYDOT. The pavement was designed to accommodate freight and passenger vehicles. The State currently operates a pavement infrastructure inspection and maintenance program. Maintenance includes pavement preservation, pavement resurfacing, safety feature inspection and maintenance (i.e., safety rail), signing and striping maintenance. The State's maintenance program is included in the Casper District's annual schedule and budgeting process.
- **Congestion Reduction.** West Belt Loop is being constructed as operational, capacity, and safety mitigation for traffic congestion for Robertson Road, CY Avenue, and Wyoming Boulevard within Casper. Corridor and intersection levels-of-service (LOS) were used as primary measures to assure operations and capacity of West Belt Loop. LOS is a standard industry measure accepted for the review of traffic conditions.

A LOS C condition is recommended for West Belt Loop and LOS D condition for study intersections moving forward, as measured using Highway Capacity Manual methodologies. Capacity or signal improvements may be required if these capacity goals are not met. In addition, the reduction of congestion on Robertson Road, CY Avenue, and Wyoming Boulevard, in terms of LOS and delay benefits, should be considered in this metric; as such improvements prove the benefit of West Belt Loop.

◊ **System Reliability and Efficiency.** As indicated above, LOS is the measure of traffic flow and congestion for an arterial to assure capacity. In terms of reliability and efficiency confirmation, it makes some sense to relate these standards to travel speeds so that WYDOT and local agency officials have a way to validate capacity/operations through the use of speed surveys.

The Highway Capacity Manual defines highway and freeway LOS in terms of time-spent following and density factors. There are many variables that go into highway capacity analyses for highways and freeway segments. However, the threshold for these facilities generally calculates to 65 to 70 percent of travel speeds, which ranges between 39 and 42 mph, or an average of around 40.5 mph for a 60 mph facility such as West Belt Loop. The threshold for further evaluation employing highway capacity analyses should occur if a speed study indicates that a segment of West Belt Loop were to operate at less than 40.5 mph. Note this is a very preliminary investigation and should not be directly related to HCM analyses; rather used only as a cutoff point for further analyses/investigation.

◊ **Freight Movement and Economic Vitality.** The Casper West Belt Loop Environmental Assessment (EA) indicates "Truck traffic on CY Avenue (Highway 220) west of Robertson Road exceeds 20% of the total traffic. On CY Avenue between Robertson Road and Wyoming Boulevard, truck traffic is about 10% and on Wyoming Boulevard between CY Avenue and Business 20/26 about 20%." The EA further discusses West Belt Loop would offer the opportunity to divert between "300 and 450" trucks from these arterials. In accordance with the EA, the net reduction of truck traffic on the existing roadways is: 15% on CY Avenue west of Robertson Road; 6.5% on CY Avenue between Robertson Road and Wyoming Boulevard; and 17.5% on Wyoming Boulevard between CY Avenue and SH 20/26.

The improved mobility of freight contributes to local economic vitality. For the purpose of MAP-21, Freight Movement and Economic Vitality goals can be achieved if truck counts indicate an average of between 300 and 450 trucks use West Belt Loop each day, as averaged through the year, and if truck traffic is reduced by 3.5 to 5% on CY Avenue and 3.5% on Wyoming Boulevard, again as averaged throughout the year. If these goals are not met, then local agencies and WYDOT should consider implementing a study to determine how signage and other similar measures can be used to promote truck activity on West Belt Loop.

◊ **Environmental Sustainability.** Within the 7.2 mile West Belt Loop corridor are several environmental items of significance. These items include wetlands, historically significant sites (i.e., Red Buttes Battlefield and Oregon Trail), bio-diverse riparian habitat (along North Platte River), and ranchlands. The measure of impact to these environmental issues of concern were addressed in the 2001 West Belt Loop Environmental Assessment. In some cases, wetlands mitigation was instituted where necessary. Likewise, the route is significantly detached from the battlefield area. The Oregon Trail is not as easily defined and roadway construction does not impact any visible wagon tracks or other historically significant sites.

All of the future intersections identified in this study are located to not impact any known or suspected environmental or cultural feature. In the case of future developments in areas known to include historic features, the development will need to consider potential impacts and provide mitigation measures accordingly.

It is assumed that future intersections and associated transportation infrastructure will impact regional transportation mobility. In some local rural residential areas, traffic patterns will be modified. In other words, local landowners will have direct access to and from West Belt Loop. It is expected the traffic from future development along the corridor, as well as pass-through traffic may travel through the existing residential neighborhoods, However, pursuant to a brief destination evaluation, it is not expected that motorists will "short cut" through the slower speed, stop controlled residential roads.

A summary of the resulting MAP-21 thresholds for West Belt Loop are provided in Table 16.

Table 16. Map-21 Performance Thresholds

Performance Measure	Performance Thresholds
Safety	Safety standards are met if less than 1.56 collisions or 0.02 fatalities are calculated per million miles of vehicle travel for West Belt Loop, less this be considered a high accident corridor. A high accident location would be noted with a crash rate of 1 collision per million entering vehicles at an intersection, or if one intersection-related fatality were to occur. Additional traffic/safety analyses and potential safety improvements may be warranted when rates exceed these thresholds.
Infrastructure Condition	Given the West Belt Loop Road and future intersections will be operated and maintained by WYDOT, the condition of the infrastructure improvements, including all future signals, will be well maintained. WYDOT pavement maintenance practices will be implemented thus ensuring the longest sustainable life expectancy before costly repairs are required.
Congestion Reduction	A LOS C threshold is recommended for West Belt Loop and LOS D for study intersections. Capacity or signal improvements may be warranted where these thresholds are not met. Also reduced congestion on Robertson Road, CY Avenue, and Wyoming Boulevard support the benefit of West Belt Loop improvements.
System Reliability	A speed of 40.5 mph (not to be confused with posted regulatory speed limit) should be maintained for West Belt Loop. Further capacity analyses should be performed if a speed study were to find that speeds did not meet or exceed this threshold.
Freight Movement & Economic Vitality	This goal can be achieved if truck counts indicate an average of between 300 and 450 trucks use West Belt Loop each day and if truck traffic is reduced by 3.5 to 5% on CY Avenue and 3.5% on Wyoming Boulevard, as averaged throughout the year. A study should be performed to determine how truck traffic on West Belt Loop can be increased (via signage, etc.) if these truck goals were not met for the corridor.
Environmental Sustainability	The West Belt Loop and future intersection construction meets NEPA compliance requirements related to environmental impacts. There will be no net effect on the natural environment.

INSERT TAB SHEET SECTION 10

10 POLICY RECOMMENDATIONS

This section provides Policy recommendations for West Belt Loop and the land use influence area of the corridor. The recommendations are provided to guide WYDOT, Natrona County, Town of Mills, Casper MPO, and local agencies with jurisdictional responsibility over future land use and developments.

For the purpose of these policy guidelines, the West Belt Loop corridor "influence" area generally extends ½-mile to the west and ¾ mile to the east, encompassing the properties most likely to directly access and generate traffic along the length of West Belt Loop along. In addition, this would include connecting roadways, frontage roads, reverse frontage roads, and backage roads located within this influence area.

10.1 JURISDICTIONAL COORDINATION

The completion of West Belt Loop will more closely link communities within Natrona County and the adjoining municipalities. West Belt Loop will provide these communities more direct access for land use development with associated economic growth. As such, coordination on issues such as land use and infrastructure development will be important to the future. A summary of policy and guidelines for jurisdictions includes:

- ◊ WYDOT and the FHWA have approved the access management strategies, including intersection locations, as outlined herein. Record of this approval is on file with the WYDOT Casper office and at the Casper Area MPO office.
- ◊ Natrona County, City of Casper, and the Town of Mills will need to adopt this study, including these access management policy conditions. Discussions with the Casper Area MPO Policy Committee on June 19, 2014 concluded that the three agencies will adopt the Study by resolution. Further, agency planning and engineering staff will be instructed on the use of the study related to development along the West Belt Loop.
- ◊ Encourage regional adoption of specific land use policy that fits within the general assumptions of West Belt Loop for the corridor influence area, with enforcement via Comprehensive Plan and zoning regulations for Natrona County, City of Casper, and the Town of Mills; including maps, goals, polices, and development standards.
- ◊ Encourage arterial connectivity to the six major intersections proposed along the corridor in order to promote regional mobility, as promoted through the transportation plans, arterial roadmaps, goals, polices, and development standards of the Casper MPO, Natrona County, City of Casper, and Town of Mills.
- ◊ Develop common roadway design standards so there is consistency in traffic operations/capacity, cross-sectional, and structural elements between jurisdictions.

10.2 LAND USE POLICY RECOMMENDATIONS

Adequate transportation access and economic vitality are typically related. Sufficient access should be provided to/from West Belt Loop and interconnecting roadways to maximize the success of land use development. This section provides summary land use policy recommendations for the West Belt Loop influence area, as summarized as follows:

- ◊ New development should be promoted in a manner that preserves the rural character of the corridor until such time that that this is no longer a concern.

- Attempt to locate commercial land uses with direct access to West Belt Loop intersections, and not so commercial traffic must traverse residential neighborhood to access these 13 West Belt Loop intersections.
- Promote "Cluster" or "Mixed Use" developments where services and tasks can be achieved internally within neighborhoods without use of West Belt Loop or major arterials to travel between origin and designation centers.
- Promote use of frontage roads with future development to connect properties to major and minor intersections. Meet all required emergency services requirements related to property access, i.e., avoid single point of entry developments and promote multiple accesses for emergency responders.
- Promote Walkable Communities where access between land uses and services can be achieved by non-motorized means without the use of roads (i.e. walking, biking, etc.).
- Provide a buffer between commercial and industrial with residential land uses along the corridor, also away from West Belt Loop as possible.
- Require traffic impact studies for land use and building actions, as to promote consistent analysis of infrastructure needs and to determine transportation impact mitigations.
- Explore methods for soliciting development/developer support of West Belt Loop corridor infrastructure through measures such as frontage improvements, traffic impact study mitigation, proportionate mitigation project support, and potentially impact fees, as enforced through subdivision and building policies.

10.3 TRANSPORTATION POLICY RECOMMENDATIONS

Transportation policy will guide the future widening of West Belt Loop; development of study intersections, interconnecting roadways, frontage roads, reverse frontage roads, and backage roads; and preservation of access. A summary of transportation policy recommendations for West Belt Loop includes:

- Designate right-of-way for future corridor expansion and for interconnecting arterials, as defined by local transportation plans.
- Assertively install traffic controls (stop signs, signals, etc.) at intersections in advance of access and land use development.
- Develop deceleration lanes and turn lanes at intersections to improve capacity and preserve safety at signalized and unsignalized intersections.
- Coordinate traffic signals along West Belt Loop in order to preserve corridor mobility.
- Construct pedestrian facilities along interconnecting roadways and secondary roads, as prescribed in local transportation plan. No pedestrian facilities are currently being promoted along West Belt Loop.
- Promote transit as an additional means to reduce traffic congestion along West Belt Loop in the future. Develop additional north-south and east-west arterials to promote local circulation to the City of Casper and Town of Mills, improving circulation within Natrona County, and reducing travel demands along West Belt Loop.
- Develop MPO, local, and State transportation improvement programs that promote the development of West Belt Loop infrastructure through governmental participation and development/developer support.
- Project-specific traffic studies should be developed in accordance with State and local practices, or as recommended by attached Access Standards, in order to assure adequate

traffic mobility/circulation and access to West Belt Loop and as a means to promote consistent analysis of infrastructure needs.

- Explore methods for soliciting development/developer support of West Belt Loop corridor development through measures such as frontage improvements, traffic impact study mitigation, proportionate mitigation project support, and potentially impact fees, as enforced through subdivision and building policies.
- In compliance with MAP-21 recommendations, a high accident corridor (HAC) should be considered if West Belt Loop were calculated to have a crash rate in excess of 1.56 million vehicle miles of travel (VMT) or fatality rate in excess of 0.02 million VMT. A high accident location should be considered with a crash rate of 1 collision per million entering vehicles, or if one intersection-related facility is noted for an intersection. Additional traffic/safety analyses and potential safety improvements may be warranted when rates exceed these thresholds.
- In compliance with MAP-21 recommendations, a LOS C condition is recommended for West Belt Loop and LOS D condition for intersections, as measured using Highway Capacity Manual methodologies.
- Additional Highway Capacity Analyses should be performed if a speed study indicates that a segment of West Belt Loop were to operate at less than 40.5 mph.

10.4 ACCESS MANAGEMENT

Section 2 of this study outlines access management recommendations, with broadened definitions provided in the Technical Appendix A. A summary of policy recommendations as it pertains to access management includes:

- Phase out “temporary” or seasonal access as land uses develop within the influence area of West Belt Loop.
- Restrict access to only the 13 intersections defined/recommended by the West Belt Loop corridor Plan through a resolution passed by each Council. If some deviation occurs, no major intersection should be relocated within ½ mile spacing of another major intersection.
- Revise intersection improvement recommendations with further traffic study and the provision of TIS as corridor infrastructure and land uses develop along West Belt Loop in the future. However, these recommended intersection improvements should stand and be developed as development progresses over time, with right-of-way preservation and construction, unless WYDOT approves minor deviations.
- Promote access to corridor land uses by virtue of frontage roads, reverse frontage roads, backage roads, shared access, and access easements, as provided for by West Belt Loop Access Guidelines. (Appendix A)
- Explore methods for soliciting development/developer support of West Belt Loop intersection development through traffic impact study mitigation, proportionate mitigation project support, and potentially impact fees, as enforced through subdivision and building policies.
- In compliance with MAP-21, a LOS D condition is recommended for intersections along West Belt Loop, as measured using Highway Capacity Manual methodologies.
- A high accident location should be considered with a crash rate of 1 collision per million entering vehicles, or if one intersection-related facility is noted for an intersection. Additional traffic/safety analyses and potential safety improvements may be warranted when rates exceed these thresholds.

INSERT TAB SHEET SETION 11

11 PUBLIC INVOLVEMENT PROCESS

A public and stakeholder involvement process was used to inform citizens and help generate support for the future development West Belt Loop. A summary of this process is provided in this section, with further details provided in the Technical Appendix D.

11.1 KEY STAKEHOLDERS

The Consultant, Casper MPO and WYDOT prepared a public involvement strategy to guide the landowner coordination and public relations process. The public relations program addresses the general public but places special emphasis on agencies and property owners who are directly and indirectly impacted by the proposed corridor (See Table 17):

Table 17. West Belt Loop, Key Stakeholders

Primary Stakeholders	Secondary (Specialized) Stakeholders
▪ WYDOT (District and Cheyenne) ▪ FHWA ▪ Casper Area MPO ▪ Natrona County ▪ Town of Mills ▪ Directly Impacted Property Owners	▪ Regional Property Owners ▪ Emergency Services ▪ School District ▪ Resource Agencies ▪ Utility Companies

Primary stakeholders consist of the sponsoring agencies with jurisdiction or direct interest with the improvements as well as property owners, both private and public whose properties will be impacted with new intersections. Secondary stakeholders with somewhat lower impacts resulting from the corridor include emergency service providers, utilities, local school district, and various resource agencies. The public relations approach taken with this study included four key coordination steps.

11.2 LANDOWNER MEETINGS

Between 8/20/13 and 8/21/13, the consultant met with several landowners one-on-one and in a group setting. Appendix C includes meeting notes from the one-on-one meetings, including the date of the meetings. On 1/27/14 the consultant, Casper MPO and Town of Mills representatives conducted a follow up property owner meeting at the Town of Mills meeting room. This meeting was intended to meet property owners not initially contacted in the 1st round of individual meetings. The goal of all individual landowner meetings was to inform them of the project, how the project may impact them, and solicit feedback on their respective land use and future development plans (if any).

11.3 PUBLIC MEETING PRESENTATIONS

Public open house meetings were conducted on 10/17/13, 3/3/14 and 7/7/14. The 1st meeting was conducted at the CY Middle School with the 2nd and 3rd meetings were held at the Christ Church on Zero Road. The 1st meeting was conducted prior to completion of the draft study. The second meeting provided a summary of the findings and conclusions and outlined the preliminary locations of the future intersections. At the final meeting, the consultant presented the final findings and corridor recommendations. Included in Appendix D are various public involvement

documents including presentations, attendance list, meeting minutes, and comment forms received. In attendance at these meetings were representatives for all impacted local agencies, including WYDOT and FHWA.

11.4 PUBLIC PRESENTATION

The final step in the public relations process was an open house meeting held on July 7, 2014. A formal presentation was provided outlining the final access plan and intersection locations. Appendix D includes the relevant backup for this meeting.

INSERT TAB SHEET APPENDIX A

APPENDIX A - WEST BELT LOOP ACCESS MANAGEMENT POLICY

Officials with the Casper Metropolitan Planning Organization (herein referred to as Casper MPO), Natrona County, Town of Mills, and the Wyoming Department of Transportation (WYDOT) desire to establish access management guidelines for the West Belt Loop corridor. As residential and commercial properties are poised for development along West Belt Loop, these local agencies have directed these guidelines consider an access influence area extending up to one-half mile from the corridor along interconnecting arterials. The purpose of the access management plan is to establish guidelines that promote adequate access corridor properties, via interconnecting arterials and secondary access strategies, while ensuring the functionality of West Belt Loop via high access control measures.

1. WEST BELT LOOP

WYDOT officials have programmed West Belt Loop as a rural principal arterial. According to the WYDOT Access Manual (March, 2005), these arterials "serve movements with trips involving substantial statewide or interstate travel and also serve the larger cities and towns. These highways have high access control and high mobility; their main purpose is the efficient movement of people and goods and they are meant to provide little or no land access."

From the 2014 West Belt Loop Land Use, Connectivity, and Access Plan, it is known that the interconnecting roadways will be needed to promote east-west connectivity to the City of Casper, Town of Mills, and Natrona County. Figure 4 in Section 2 of this July 2014 Corridor Study defines the precise locations for future intersections along the 7.2 mile corridor. Most of these intersections will be signalized with full regional build out, with right and left-turn lanes developed to promote capacity.

The discussion provided in Section 1 is intended to guide access development for properties located along the arterial between primary east-west arterials. Also described in that section is the permitting and traffic impact study processes recommended to gain access to West Belt Loop and anticipated right-of-way designation requirements for fronting properties. Section 2 will provide access management discussions for interconnecting arterials, and Section 3 discusses traffic impact study standards and infrastructure development guidelines for developments accessing interconnecting roadways.

1.1 Access Spacing

The summary of allowed access spacing for a rural principal arterial is summarized in Table A.1 below. The headers denote the type of access to/from various land uses ranging from:

- ◊ A right-in and right-out only "field" access provided to an agricultural lot or property if daily use occurs with less than 6 trips per day for only a few weeks of the year. These accesses do not directly connect to residences or other buildings and are expressly used for ranch and agricultural use.
- ◊ A right-in and right-out only "residential" access provided as an entrance/exit to/from a home for the exclusive benefit of the dwellings resident.
- ◊ A "commercial" access provided as an entrance/exit to/from a single business, commercial development, cultural or institutional complex, public establishment, or any development with 3 or more family residences adjacent to the highway; as limited by generating up to 50 trip ends per hour per day.
- ◊ A "major" access denotes a street connection, or provides entrance/exit to/from any land use generating more than 50 trip ends per hour per day.

The table is read by selecting the type of access for uses shown on the left column, and then comparing the minimum separation distance to access for other land uses identified from the top row. Separation distance is provided in feet from center-of-driveway or street, to center-of-driveway or street.

Table A.1. Access Spacing Policy for a *Rural Principal Arterial*

Access Type	Field	Residential	Commercial	Major
Field	330 feet	330 feet	660 feet	1,320 feet
Residential	330 feet	660 feet	1,320 feet	1,320 feet
Commercial	660 feet	1,320 feet	2,640 feet	2,640 feet
Major	1,320 feet	1,320 feet	2,640 feet	2,640 feet

Source: WYDOT Access Manual (March 2005)

As shown, spacing between major accesses, be it between two arterial intersections, or an arterial and any commercial driveway, or between any two commercial driveways is 2,640 feet. The prevailing spacing standard for West Belt Loop is 2,640 feet or ½ mile, given the nature of commercial land use development that is predicted to occur along the arterial throughout the next several years. This means a full access break, allowing all right and left-turn and through movements, can be developed on the ½ -mile basis for intersecting streets or at major commercial driveways.

WYDOT Access Manual guidelines specify field and residential access be limited to right-in and right-out turn movements only. This may promote U-turns at major intersections or the use of off-West Belt Loops frontage, backage, or side streets to perform turn-around maneuvers to access driveways.

Several other additional spacing and design principals were defined by the WYDOT Access Manual. A summary of principals applicable to access development along a *rural principal arterial* include:

- Access on West Belt Loop should be aligned directly across from each other, and not offset, when on opposite sides of the road. Right-in and right-out driveways can be offset, if necessary.
- Joint access should be promoted when possible and straddle property lines, as conforming to spacing standards, when possible.
- Access should be developed to avoid backing or queuing from a driveway onto a roadway.
- All accesses shall have a minimum clearance of 12.5 feet from the abutting property line, unless a joint access is used.
- The distance from right-of-way line to the near edge of service pumps, vendor stands, tanks or private water hydrants should be a minimum of 20 feet.
- No access shall be allowed within a deceleration or acceleration lane.
- No single commercial or residential development will have two or more access points on West Belt Loop without the justification of a traffic study.
- A two-way driveway should have a minimum width of 24 feet and maximum width of 40 feet.
- Driveways and intersections should align with West Belt Loop at a minimum 70-degree angle with right-in and right-out driveways allowing up to a 60 degree angle.
- The commercial driveway radii should not be less than 25 feet nor greater than 50 feet.
- Access should be designed in accordance with criteria provided within the WYDOT Access Management Manual and Road Design Manual (April 2013).

Stopping sight distances should be maintained in accordance with the WYDOT Access Manual. Entering sight distances should be maintained in accordance with guidelines outlined within A Policy on Geometric Design of Highways and Streets (AASHTO 6th Edition, 2011).

1.2 Access Permit and Traffic Impact Study

Application must be submitted to the District Engineer for any property access desired along West Belt Loop. Permits must be submitted for any new access, or for the alternation of any current access. An access must be used for what it was intended and permitted. A new permit must also be filed for any access poised for change as a result of significant occupancy, business, or land use change.

Per the WYDOT Access Manual, application for access permit will be accepted only from an individual, partnerships, corporation, qualified agent, or other body recognized by law as owning all or the major interest in the property abutting West Belt Loop. The permit form or its attachments must identify: the project location and address; name of property owners and/or easement users; the type of access requested (field, residential, commercial, or major); and a design sketch or drawing showing the proposed access designs. The sketch must identify property lines, arterial right-of-ways, drainage details, location of structures and obstructions, general driveway designs (including width, radii, channelization, etc.), and location of adjacent/neighboring upstream and downstream access.

In many instances, a traffic impact study (TIS), documenting the traffic and transportation impacts of a new development, may be required to support an access permit application. A TIS is typically required by District Engineers when:

- A proposed development land use has the potential to generate 50 or more peak hourly trips;
- Two or more access are proposed from a single property or contiguous development;
- Project access requires geometric design report, as the result of high turn volumes, queue potentials, or other design impacts;
- When the intersection of a connecting arterial is being developed;
- When a project is expected to have unusually high truck volumes;
- When a spacing or design deviation from access guidelines is requested; or
- To address other traffic and transportation issues identified by District Engineers.

Traffic studies should be developed in accordance with guidelines provided with the *WYDOT Access Manual* and the *WYDOT Traffic Studies Manual* (March 2011). A deviation from access guidelines may be requested from WYDOT Officials, in terms of spacing or design. The requested deviation will be considered by the Access Review Committee appointed by the District Engineer. The Committee will recommend the deviation be approved or denied; potentially with planning or design modifications provided as conditions in the case of approval.

1.3 Widening and Frontage Designation

West Belt Loop will be an important commute and freight route between State Highway 20/26 and State Route 220, with up to 4,500 peak hourly trips eventually projected along the arterial. As such, the need for widening the principal arterial to four lanes, with a restricted median and left and right turn lanes at major intersections will be required to accommodate forecast traffic. As shown by Figure 2 of the main report, the cross-section for this current and future roadway consists of the currently proposed 2-lane section and depicts the typical ultimate 4-lane section. The roadway generally requires a 300-feet right-of-way to accommodate the separated roadway and 50-feet median.

2. INTERCONNECTING ROADWAYS

The WYDOT Access Manual recommends that no driveway or access be located within 660 feet of a rural highway or arterial. The first principal of access for interconnecting roads is the need to minimize driveway or street access along interconnecting arterials within 660 feet of the outside curb-line off West Belt Loop.

The remaining arterial connections off West Belt Loop were recommended to promote adequate access to properties, while ensuring the functionality and safety of intersection roadways. Recommendations were based principally off guidance provided in the *Access Management Manual* (TRB, 2003) and *State of the Practice in Highway Access Management* (NCHRP Report 404, 2011), focusing on an influence area located up to ½ mile of West Belt Loop.

2.1 Traffic Signal Spacing

Frequently or irregularly spaced traffic signals on arterial result in poor traffic operations with increased safety risk. Technical resources indicate near ideal traffic operations and safety occurs when signals are spaced on the ½ mile basis. The introduction of more signals impacts traffic operations, as most suitably noted via increased travel times. For instance, three signals per mile result in a 9 percent increase of travel times while four signals per mile increase travel times by 16 percent; ranging up to a 39 percent increase of travel times when eight signals are spaced within a mile (on a 660 foot basis).

The ideal location of a signal is preferred ½ mile off West Belt Loop. A signal spaced ¼ mile off the corridor can be allowed conditionally, if a traffic impact study is provided in support of such an allowance. The TIS must recommended geometric, signal cycle, signal timing, and signal coordination mitigation to minimizes impact to traffic operations and travel time. Any spacing of signals on less than a ¼ mile basis should be prohibited on interconnecting roadways.

A summary of these recommendations are provided in Table A.2. Note the primary assumption for this summary is interconnecting roadways would have progression speeds ranging between 30 to 50 mph with cycle lengths of between 60 to 120 seconds, as roadways intersecting with a rural principal arterial. The applicability of spacing for speeds or signal times falling outside of these ranges can be reviewed again with the use of a TIS, with appropriate mitigation provided to offset operational and safety impacts.

Table A.2. Signal Spacing for Interconnecting Arterials

	Spacing	Condition/Consideration
Preferred/Ideal	2,640 feet	Maximizes traffic operations, travel time, and safety.
Conditional	1,320 feet	Conditionally allowed with geometric, timing, and coordination mitigation supported by traffic impact study
Prohibited	< 1,320 feet	Less than ¼ mile spacing results in unacceptable impacts to traffic operations, travel times, and safety.

Source: Adapted from Access Management Manual (TRB, 2003) and State of Practice in Highway Access Management (NCHRP Synthesis 404, 2011).

2.2 Unsignalized Intersection and Driveway Spacing

Unsignalized intersections or driveways also impact the mobility of an arterial, as traffic must slow to accommodate vehicles turning into or from the travel-way. The Access Management Manual indicates the delay caused by these vehicles can cause a “shock wave” that can ripple through vehicle platoons,

increasing delays and even causing rear-end and lane-change crashes located a considerable distance from the turn location.

The preferred or ideal spacing of a driveway is considered based on a number of factors that principally include, if not necessarily limited to, safety, sight distance, turning overlaps, influence distance, and egress capacity. The following has been determined via technical resources as it regards these considerations in the recommendation of unsignalized access for this study:

1. The crash rate increases with greater than five full access breaks, permitting left-turn movements, allowed along one side of an arterial with relatively uniform spacing of 1,050 feet (this can translate to 10 access with two driveways aligned across from each along the roadway). This principal would be considered in the review of limiting full access breaks allowing left-turn movements, as driveway spacing below 1,000 feet could impact safety.
2. According to *A Policy on Geometric Design of Highways and Streets* (AASHTO, 6th Edition, 2011), stopping sight distance ranges from between 200 to 425 feet along a roadway with operating speeds ranging between 30 to 50 mph. This principal would be considered in the review of full access breaks (allowing left-turn movements) and driveways/intersections allowing right-in/ right-out turn movements only. The resulting principal applied to this study is less than 425 feet of unobstructed stopping sight distance, including the sight obstructing activities associated with an upstream driveway/intersection, could impact safety.
3. *A Policy on Geometric Design of Highways and Streets* indicates a clear sight-line of between 350 to 555 feet is needed for drivers to perform a left-turn movement from a stopped position onto a road with operating speeds of between 30 to 50 mph. Assuming a downstream driveway as an obstruction, the resulting principal applied is less than 555 feet of unobstructed entering sight distance for left-turn movements, including the sight obstructing activities associated with an upstream driveway/intersection, could impact safety.
4. According to *A Policy on Geometric Design of Highways and Streets*, a sight-line of between 290 to 480 feet is needed for drivers to perform a right-turn movement from a stopped position onto a roadway with operations speeds of 30 to 50 mph. The principal applied is an unobstructed entering sight distance of 480 feet is needed, clear of the obstructing activities of a downstream driveway/intersection, to maximize safety.
5. Technical resources indicate a minimum distance of 185 to approximately 400 feet (later value interpolated) is needed to minimize collision potentials along an arterial with operating speeds of 30 to 50 mph due to overlapping right-turn maneuvers between unsignalized driveways/intersections. A minimum spacing of 400 feet assures safety between right-turn driveways/intersections.
6. Assuming an allowable spillback potential of up to 5 percent, driveway influence distances of between 335 to 520 feet are ideal for minimizing the breaking potential of vehicles behind right turn movements. On principal, a minimum spacing of 520 feet assures the safety of travelers on interconnecting West Belt Loop arterials.
7. The capacity of passenger cars to enter a roadway is not as finite an element as with the other factors previously listed. This is because, in addition to speed, trip generation and the use of a driveway can heavily impact entering capacity. This factor is even downplayed within the more current guideline, *State of the Practice in Highway Access Management*, as opposed to the *Access Management Manual*. As such, less weight was attributed to this factor, as compared with the elements listed above. Based on technical resources, the ideal distance to maximize the capacity of passenger cars to enter a roadway from unsignalized drives ranges between 330 to 950 feet (later value interpolated) on roadways with progression speeds of between 30 and 50 mph. The statistical average of 640 feet is derived from these values, and was therefore considered the limiting factor in analyses.

Reviewing these various discussions leads to separate conclusions, which result then in various access types of a full access break, right-in and right-out (RIRO) only driveway/intersection, with the potential for a left-in movement at RIRO locations.

Full Access Break. First, a full access break with left turns is limited by the first criteria, as collision potentials increase when spacing is allowed below 1,050 feet. Based on these guidelines, the potential for one full unsignalized access break can be allowed between West Belt Loop and the offset signal highlighted in the previous section. The ideal scenario would be to locate this driveway or intersection mid-distance between West Belt Loop and this potential signal mentioned previously, at a spacing of 1,320 feet (¼ mile) off West Belt Loop.

However, the conclusion to allow a full access at the ¼ mile should be supported with a TIS. The TIS would consider: 1) whether adequate traffic operations can be maintained, 2) whether the two-stage capacity of a center-turn lane would be required to promote adequate operations; 3) to support the need for auxiliary/turn lanes and potential pocket/queue lengths for the median break, and 4) to assess the impact to overall travel times/operation for the corridor. If acceptable traffic operations cannot be maintained, the reduction of turning movements should be enforced starting with an outbound left-turn from and then inbound left-turn to an unsignalized driveway or intersection. A RIRO only driveway could be supported on the ¼ mile without development of a full TIS; only with a summary determination for the need of a deceleration lane being required.

RIRI Break. The criteria for controlling right-turns ranges between a 400 feet minimum, to reduce collision potentials due to overlapping right turns, to a maximum of 640 feet, regarding the minimum capacity for cars to enter the roadway. Criteria for sight distances and spillback fall within these potentials. As such, 640 feet is the controlling factor for right turning vehicles to/from arterials, which would place these driveways nearly an equal distance between the full access break driveway and potential signals. An equal distance would fall around 660 feet (1/8th mile), which is the logical spacing criteria then for right-in and right-out only driveways and intersections. Note this complies with the offset spacing requirement that the Wyoming DOT would require off West Belt Loop.

A TIS should not be needed to support the development of a RIRO on 660 foot spacing, even at the ¼ mile mark identified above. However, the determination for the need of deceleration and acceleration lane can be provided according to criteria listed later in this document.

Left-In at RIRO. The potential to allow left-turn egress or U-turns at a RIRO location is not restricted via any of the criteria listed above. A TIS can be submitted to support this movement off of an arterial. The TIS should review the factors outlined above for a full median break. In addition, the TIS must consider the impact of such an allowance at upstream or downstream intersections. Specifically a review of the vehicle storage needs for back-to-back left-turn queues, including tapers, should be considered with the lane not permitted if these queues cannot be reasonably accommodated. In addition, no left-turn into the queue spillback from a signalized intersection should be permitted.

A summary of access spacing guideless for roadways intersecting West Belt Loop is provided in Table A.3. Again, the primary assumption for this summary is interconnecting roadways would have progression speeds ranging between 30 to 50 mph, with reasonable trip levels generated at driveways/intersections promoting adequate traffic operations.

Table A.3. Unsignalized Driveway/Intersection Spacing for Interconnecting Arterials		
	Spacing	**Condition/Consideration**
Full Median	1,320 feet	Traffic impact study should be required to support operations and geometric recommendations.
Right-In and Right-Out	660 feet	Right-in and right-out driveways can be supported without a full TIS; although the need for a deceleration lane should be accessed in study.
Left-In Potential	660 feet	Allowed with RIRO location with support of traffic impact study.
Source: *Access Management Manual* (TRB, 2003) & *State of Practice in Highway Access Management* (NCHRP 404, 2011).		

2.3 Secondary Access

The Access Management Manual recognizes several improvements that can be used to provide access to properties fronting West Belt Loop, and for those properties located within the West Belt Loop influence area. This describes the range of "secondary access" measures that can be promoted for West Belt Loop developments:

- **Frontage Roads.** These roadways would align directly outside of West Belt Loop right-of-way, fronting and providing access to commercial and institutional properties located along the arterial between interconnecting streets. They would provide clear and understandable access to properties fronting West Belt Loop, and could serve as an immediate alternate or service route for the arterial. However, a significant drawback is the turning restrictions identified by Table 3 could complicate access to frontage roadways to/from interconnecting arterials. In addition, frontage roads have been known to impact the character and quality of a commute by reducing visual interest of the corridor to the typical driver. While the use of these frontage roadways are not prohibited, they are less encouraged given noted challenges.

- **Reverse Frontage Road.** These roadways are similar to frontage roads in that they provide more immediate access to properties located along West Belt Loop. However, the key difference is a band of development properties would buffer West Belt Loop from the frontage road, so that the rear of these properties fronts the corridor. The advantage tends to be an improvement in the character of a corridor commute, with clear and understandable access still provided to property. A continued significant drawback is that turning restrictions noted in Table 3 would continue to complicate access to the reverse frontage road, but this secondary access measure would have more support and appeal over the typical frontage road.

- **Shared Access.** This refers to a single driveway or intersection providing access to two or more properties either located along West Belt Loop or along interconnecting arterials. Shared access is a principal and critical element of management plans, as driveway spacing restrictions limit the opportunity for access to individual parcels. As such, this secondary measure should be promoted at every opportunity within the West Belt Loop influence area.

- **Access Easements.** As another principal and critical element of secondary access measures within the West Belt Loop influence area, these easements allow for circulation between properties/parcels along West Belt Loop and interconnecting roadways. These easements should be promoted at every opportunity as the corridor and area properties develop.

- **Mixed-Use Developments.** A mixed use development is comprised of several land uses with synergetic qualities where several tasks can be achieved with one trip end. Drivers can travel a property, or cluster of properties, to achieve consumer, service, occupational, residential, or recreational purposes without the use of streets to access these various land uses. Although this is a land use strategy, the promotion of mixed use developments can help reduce traffic impacts

on roadways and the need for multiple access points. Developers may wish to consider this land use approach to promoting successful projects.

- **Walkable Communities or Developments.** A property or cluster of properties can be developed to promote walking or biking between land uses to achieve consumer, service, occupational, residential, or recreational purposes without the use of streets or access. This "new urbanism" approach to development has been trending throughout the United States, promoting developments where citizens can address needs without having to use automobiles, and is a land use action developers may wish to consider for the West Belt Loop influence area.

2.4 Signal Analysis

The need for a traffic signal should be established based upon the warrants provided within the *Manual of Uniform Traffic Control Devices for Highways and Streets* (FHWA, 2009 Edition). This information can be recommended in a TIS or design study. As these are new interconnecting roadways, it is anticipated that Eight, Four, and One-Hour Volume warrants; the Coordinated Signal System Warrant, and the Roadway Network Warrant would be used to establish the need for a traffic signal based on forecast traffic volumes. Chapter 4C of the Manual defines the criteria of noted warrants, with the range of all warrants listed as follows:

- 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

Of the volume warrants, both the four- and eight-hour warrants can be used to exclusively demonstrate the need for a traffic signal. The peak hour volume warrant should be supported with the justification of an additional warrant to demonstrate a signal need, unless local agency officials dictate otherwise.

The geometrical configuration and control/phasing of a signalized intersection should be developed in coordination with an analysis of traffic function/operation using the intersection levels-of-service (LOS) methodologies of the most current *Highway Capacity Manual* (HCM). The *Highway Capacity Manual* (HCM) is a nationally recognized and locally accepted method of measuring traffic flow and congestion for intersections. Criteria range from LOS A, indicating free-flow conditions with minimal vehicle delays, to LOS F, indicating congestion with significant vehicle delays (and operational failures).

LOS for a signalized intersection is defined in terms of the average control delay experienced by all vehicles at the intersection, typically over a specified time period such as a peak hour or design hour. Table A.4 outlines the LOS criteria for signalized intersections from the current *Highway Capacity Manual (TRB, 2010)*.

Table A.4. Signalized Level of Service	
Level of Service	Signalized: Control Delay (sec/veh)
A	≤10
B	>10 – 20
C	>20 – 35
D	>35 – 55
E	>55 – 80
F	> 80
Source: *Highway Capacity Manual* (TRB, 2010)	

The analysis should be performed based upon a review of 20-year traffic forecast during the two peak/commute hours of typical weekdays (weekends can be reviewed also, per the discretion of the local officials). The geometrical configurations needed to maintain a LOS D standard should be designed for the intersection, as based on 20 year forecasts. A LOS D standard is desired for approaches and turn lanes as possible. Various software packages can be used in the analyses so long as reported results are based on HCM methodologies.

2.5 Roundabout Considerations

A roundabout may be considered in place of full median breaks and traffic signals, at the ¼ and ½ mile spacing. Typically the development of roundabouts for traffic controls at these locations would preclude the development of RIRO driveways between major intersections, unless a TIS can demonstrate acceptable intersection and corridor operations can be maintained otherwise.

Unfortunately, there are no fixed warrants for determining the need for a roundabout, similar to the warrants available for traffic signal determinations or even auxiliary lane reviews. The desire or need for a roundabout is therefore explored in coordination with local agencies. A traffic impact study and/or feasibility study can be provided for review and justification of a roundabout on interconnecting roadways. Adapted from *Roundabouts, An Informational Guide* (NCHRP Report 672, 2nd Edition, 2010), a feasibility study should include:

- Identify why a roundabout is being considered as an intersection improvement, as compared with other intersection alternatives.
- Identify a conceptual roundabout configuration, which includes the number of lanes per each approach, circulatory lanes, and the designation of lanes.
- Develop a traffic operations and safety analysis, comparing the benefit of a roundabout compared with other intersection alternatives.
- Review the impact of a roundabout in context to the operation of the corridor, as compared with intersection alternatives.
- Determine whether an appropriately sized and configured roundabout can be feasibly implemented compared with other improvements (review cost, right-of-way, etc.).
- Identify all potential complicating factors, asses their relevance to location, and identify any mitigation efforts that might be required.
- Demonstrate institutional and community support; potentially indicating the support of key institutions and community leaders.

2.6 Left and Right Turn Lanes

Left and right turn lanes can be developed at both signalized and unsignalized intersections and driveways along intersecting West Belt Loop roads. As indicated, the determination of turn lane needs for signalized intersections is established with a TIS or design study that recommends a geometric configuration based on a review of traffic forecasts, operations/capacity needs, and likely signal operating plan (cycle length, phasing, phase splits, etc.).

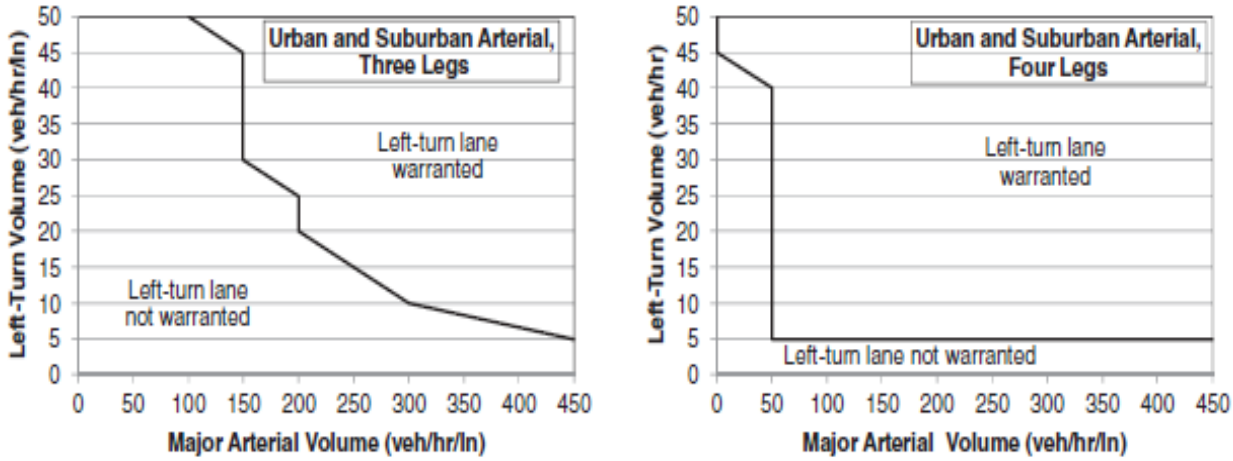
The development of left and right turn lanes at unsignalized intersections are used to improve the operation of an arterial by promoting departure routes that minimize the slowing and/or delay of through vehicles following turning vehicles. The decision for turn lanes is typically more subjective than with signals. The decision for turn lanes should be coordinated between the agency and the proponent of the turn lane.

However, turn lane warrants were identified for use in the decision and determination process, with recommendation conveyed through a TIS or design study. These warrants are provided with discussion on left and right turn lanes, which is as follows.

The scope of TIS or design studies would be developed in coordination with local agencies and developer per the processes described later in this document. However, as any improvement to West Belt Loop and interconnecting roadways would be new construction, it is recommended that any improvement evaluation for geometrics at a signalized intersection review a minimum of forecast 20 year traffic conditions for the peak hours of the AM and PM work commutes, or other timeframes specified by WYDOT or local agencies.

Left-Turn Lane. Left turn-lanes are needed to improve capacity and traffic operations, provide designated access for development, help address safety issues, address sight distance limitations, and other reasons, which are all principal issues to identify in a TIS. In addition, left turn lane warrants were obtained for this guideline from *Left-Turn Accommodations at Unsignalized Intersections* (NCHRP Report 745, 2013). Charts are shown on the next page for three and four leg intersections, for what is considered a suburban area along West Belt Loop.

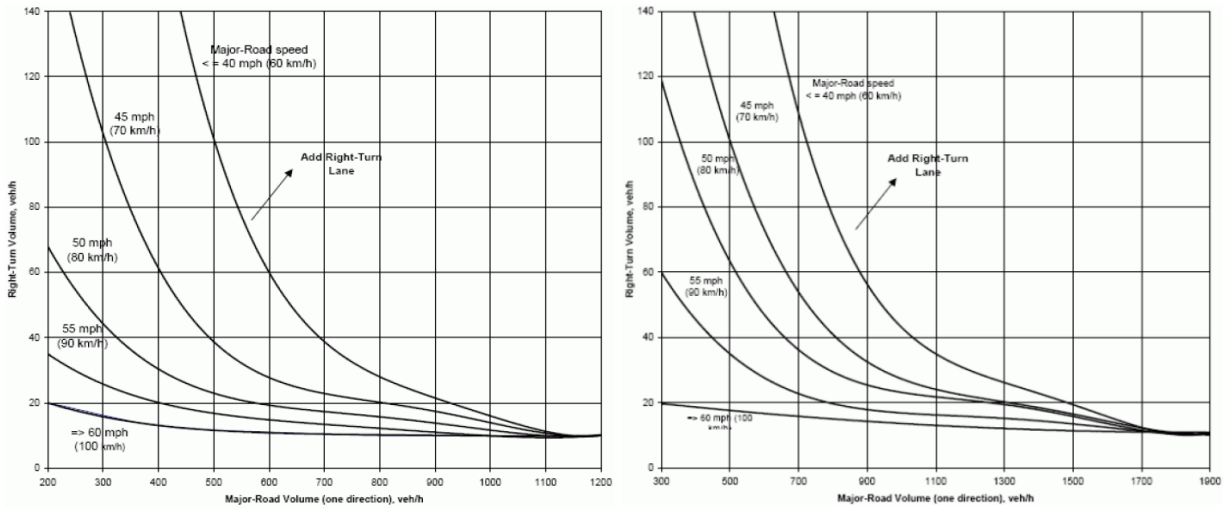
The warrant is reviewed by comparing total directional volumes with left-turn volumes for the peak or design hour(s). The turn lane should be considered when forecast volumes plot above the trend line shown, and may not be necessary if plotted below. Again this information should be used in support of any information developed in coordination with WYDOT or local agencies.



Left Turn Lane Warrants for Three and Four Leg Intersections –
Source: Left-Turn Accommodation at Unsignalized Intersections (NCHRP Report 745, 2013)

Right Turn Lane. Right turn-lanes are needed to improve capacity and traffic operations, provide designated access for development, help address safety issues, and other reasons, which are all principal issues to identify in a TIS. In addition, right turn lane warrants were obtained for this guideline from *WYDOT Traffic Studies Manual*. Charts are shown below for two and four lane roadways.

The warrant is reviewed by comparing the right turn-turn volumes for the commute peaks hour with the total direction volume being reviewed, as based on different speed limit thresholds shown as trend lines. The turn lane should be considered forecast volumes plot above the trend lines shown, and may not be necessary if plotted below. Again this information should be used in <u>support</u> of any information developed in coordination with WYDOT or local agencies.



Right Turn Warrants for Two Lane (Left) and Four Lane (Right) Roadways –
Source: Traffic Studies Manual (WYDOT, 2011)

Pocket lengths and tapers for turn lanes would be developed in coordination with local agency guidelines, WYDOT design standards, or information provided within A Policy on Geometric Design of Highways and Streets. For signals, these determinations are augmented with average, 85th percentile, and/or 95th percentile queue analyses which are reflected in turn bay lengths. For unsignalized locations, turn bay lengths are a function of needed queue storage and deceleration distance.

2.7 Unsignalized Intersection Analysis

As highlighted above, turn lanes can be developed at intersection or driveways using a justification report that includes turn lane warrants. In addition, geometric determinations of a stopped approach to an intersection or driveway and the need for stop-signs should also be supported upon a functional/operational review of forecast, 20-year traffic conditions during the commute/peak hour, as based upon the method of the most current HCM. A LOS D standard should be maintained for the entire intersection with four-way stop controls, or on the stopped approaches to a single or two-way stop-controlled intersection.

Table A.5 outlines the LOS criteria for unsignalized intersections from the *Highway Capacity Manual*. As shown, LOS thresholds, as a function of control delay, vary between signalized and unsignalized intersections. This is because driver tolerances for delay have been documented to be much higher at signalized intersections versus at unsignalized intersections.

Table A.5. Unsignalized Intersection Level of Service

Level of Service	Unsignalized: Control Delay (sec/veh)
A	≤10
B	>10 - 15
C	>15 - 25
D	>25 - 35
E	>35 - 50
F	>50

Source: *Highway Capacity Manual* (TRB, 2010)

Similar to signals, the turn pocket determinations for a turn lane to a stopped approach are augmented with average, 85th percentile, and/or 95th percentile queue analyses which are reflected in turn bay lengths. Ultimately these distances should be developed in coordination with State and local officials.

2.8 Design Deviation

Design deviations should require enough information and description so the local jurisdictions can provide an approval or denial. Per a TIS or design report, the deviation/variance request must identify the standard design element, and then explain why the design cannot be used for the roadway or intersection design element. The deviation must then provide an alternate design and justification for the appropriateness and safety of the design. Such justification should include: a cost-benefit analysis, operational analyses, safety analyses, engineering judgment, and reference to any alternate standard. A registered professional engineer should certify the design deviation/variance. The deviation applies to only the project for which it is approved.

2.9 Direct Property Access

Wyoming Statutes (W.S.) 24-6-101 through W.S. 24-6-111, entitled "Chapter 6 – Access Facilities", defines laws pertaining to property access and also grants access authority to the Wyoming Department of Transportation (WYDOT) officials and local jurisdictions for highways, arterials, and roadways. These laws are further explained and elaborated upon in "Chapter 13, Access Facilities" of WYDOT Rules and Regulations. These laws and regulations fundamentally govern access conditions along West Belt Loop.
Essentially, regulations confirm that private properties abutting West Belt Loop have rights to access so long as no other reasonable access is available (i.e. properties are "land-locked") by way of connections such as arterials, collectors, private roads, frontage roads, backage roads, or service roads. WYDOT officials have the authority to restrict access spacing to 660 feet, regardless of property location, where right-in and right-out movements only can be allowed. A stipulation is WYDOT officials have the authority to eliminate any access, regardless of property location and spacing, in order to preserve safety for the majority or roadway users.

In order to preserve the access rights of existing and land-locked property owners, WYDOT officials previously granted 24 "temporary" access permits along West Belt Loop. WYDOT and other local jurisdiction officials will work to promote an arterial and street network that provides access to these land-locked properties in the future so existing temporary access can be restricted and/or eliminated over time. Furthermore, as properties subdivide and develop in the future, it is anticipated that local land use officials will require that secondary access be developed to properties. This will assure no direct connections, be it temporary or otherwise, will be promoted to West Belt Loop outside of the 13 intersections specified by this report. Thus, it is the goal that direct property access is discouraged along West Belt Loop and that only community access be secured through the 13 intersections pre-approved by WYDOT officials.

3. TRAFFIC IMPACT STUDIES AND INFRASTRUCTURE DEVELOPMENT

A traffic impact study (TIS) is an analysis that quantifies the impacts of a residential, recreational, institutional, and/or commercial development proposal upon traffic and transportation conditions within a finite study area, and recommends improvements or strategies to offset these impacts as necessary. As it pertains to development impacts, the TIS should also define what level of participation should be required of a project proponent to mitigate traffic related impacts.

Please note that TIS and Design Study have been used somewhat interchangeably throughout this document and some of the supporting/referenced technical studies. Typically, a TIS is developed in support of a new or modified land use action, as usually sponsored by the land use action proponent. A Design Study is used primarily to define improvements and is typically led by an agency. However, both studies typically have traffic forecasting and improvement analyses elements; the TIS can be used to support a range of actions and processes so long as the purpose is well defined within the report.

The recommended practice for traffic impact studies was principally developed based on information provided by *the WYDOT Access Management Manual* and *WYDOT Traffic Studies Manual*; however, the guidelines for the City of Casper and Natrona County should also be addressed during the development of these studies. The only exception from WYDOT policy includes what has been noted in the next paragraph, as a trip generation letter can be a useful tool in establishing the need for a traffic study.

3.1 TIS Strategies

Trip Generation and Distribution Letter. An applicant wishing to pursue a land use action or secure a local access permit within the influence area of West Belt Loop should first submit a trip generation and distribution (TG&D) letter to WYDOT and local agencies for consideration. Generally, this letter defines likely approach and departure routes of trips generated by new development, which is sufficient in some cases to assign mitigation fees or proportionate shares of improvement projects. Officials with the lead land use jurisdiction can use this letter to help determine whether a TIS should be required, or whether the letter itself is sufficient to support the permitting process.

The TG&D letter should be submitted during or shortly following pre-application discussions/interviews, to provide the applicant sufficient time to develop a traffic impact analysis, if required by the lead land use jurisdiction, prior to project approval. Most typically, the information provided within a TG&D letter may include:

- **Project Location.** A written description of the project location in relation to roadways and public facilities located near the project site. The site should also be displayed graphically on an attached figure.
- **Project Action.** A written description of the land use action(s) should be provided. The description should include: use and size of the project (both site area and, as available, building area); existing and proposed zoning; project access locations; and development/phasing and completion/occupancy schedules. If the project involves West Belt Loop, any access permit being sought should be described with an access application attached. A site plan is desired as an attached figure, when possible.
- **Trip Generation.** The TG&D letter should identify the number of trips anticipated with project development. Trip generation should be determined based upon the methodologies of the most current, Institute of Transportation Engineers (ITE) Trip Generation Manual, unless trip generation data more applicable to the proposed land use can be presented by the applicant. State or local officials will determine whether supplemental trip generation data can be used for the TG&D letter.

  When relevant, total project trips will be separated into trip types (i.e., new, pass-by, diverted, and shared) to better describe the traffic characteristics of retail and commercial developments. Trip types should also be identified using ITE resources or some other means acceptable to local officials. Project trip generation should be provided for the typical weekday, weekday AM peak hour and weekday PM peak hour only, unless agency officials requests some other time period be addressed as the result of unique land use impacts (i.e., Saturday peak hours for shopping centers, etc.).
- **Trip Distribution and Assignment.** A description of project trip distribution and assignments will be provided in the TG&D letter. The methodologies used to distribute and assign project trips will be provided. As a guide, trip assignments should be provided for site access and key intersections located within the direct vicinity of the site, and for those key intersections projected to support more than 25 peak hour trips beyond the immediate site vicinity during the typical weekday or other time period specified by agencies. Trip distribution and assignment estimates should be provided for any roadway and intersection proposed within the final construction and occupancy timeline of the proposed project.

Traffic Impact Study. As indicated, a traffic impact study (TIS) is intended to forecast traffic conditions and identify potential transportation improvements and strategies to mitigate capacity, operational, and safety deficiencies; and identify a proponent's participation in such improvements

or strategies. The TIS is typically used to support land use actions, zone changes, comprehensive land use amendments, and access permits for projects with larger trip generation potentials; however, the TIS can be assigned by local officials for other reasons. The following are anticipated typical reasons a TIS may be required for a project:

- The project is projected to generate more than 50 trips during the commute AM and/or PM peak hours, or during the peak generators of the project whenever they occur (i.e. if a peak hour occurs on Saturday for a retail development)
- When it is expected project driveway trips will significantly impact traffic operations on adjacent arterials, requiring operational analyses or the review of turn lane warrants.
- The project proposes two or more driveways along arterials, with trip levels that suggest one driveway may suffice.
- The project is proposed along a route(s) that historically experiences or is projected to experience traffic operations or accident safety issues.
- When the project is being developed along a newly constructed or proposed roadway or at a new intersection.
- The project is proposed within the vicinity of a school, community park, or some area with high levels of pedestrian and neighborhood activity.
- When heavy truck volumes are projected for a development.
- To support a transportation design deviation request for a development.
- Or other reasons identified by State or local officials.

The scope and study area of the TIS is established at the discretion of State or local land use jurisdiction officials. The TIS would address traffic conditions/operations during one or two peak periods of traffic activity during the typical weekday on adjacent streets (i.e., AM peak, Noon, or PM "rush"/commute peak hours). Additional timeframes can be requested for analysis if peak periods/timeframes of activity are expected to occur during a weekend (i.e., commercial developments, recreational activities, church services, etc.).

The study will address traffic conditions/functions during the forecast completion year of the project, as this represents the horizon in which project impacts are greatest in comparison to background (non-projected related) traffic. However, in the case of the West Belt Loop study area, long-range analyses may be performed to help establish or confirm the ultimate configuration of intersecting roadways or intersections.

In addition to the project location, project action, trip generation, and trip distribution/assignment information required of the TG&A letter, a TIS report may also include the following information:

- **Introduction.** The introduction must define the purpose of the TIA, provide a project description, discuss the scope and extent of the study, and discuss methodology and assumptions. The introduction should also provide the site location and description information, as highlighted by the TG&D section, for the TIS. Site location and site plan figures are required.
- **Roadway Inventory.** A TIS must provide a description of the transportation network located within the project study area, as established by the State and land use jurisdiction. These descriptions include roadway classifications, roadway channelization, speed limits, intersection controls (signal, stop-controlled, etc.), intersection channelization (includes

turn lane storage), etc. A figure or table highlighting roadway characteristics (class, lanes and speeds) and intersection channelization and controls are recommended.

- **Traffic Counts.** Recent weekday and peak hour traffic counts must be secured for study arterials and intersections. Average daily traffic/24-hour (weekday) counts must be secured for at least one location on primary study arterials, if available. Intersection turn movement counts must be obtained for study intersections identified for review by agencies for peak hours. Counts conducted 18-months prior to study initiation cannot be used in the TIS and must be updated. As it pertains to the West Belt Loop influence area, traffic volumes for new intersections can be obtained from the Casper MPO. A figure that summarizes existing turn movement counts, or baseline future counts, is required. Weekday counts can either be summarized graphically or in a table within the TIS. Raw count data or baseline volumes from the MPO should be included in an appendix, as available.

- **Accident Histories (Discretionary).** State and local agencies may require collision histories be reviewed for existing study roadways and intersections. Typically, the most current, three-year period of collision activity is reviewed, as obtained from State and/or local officials. The data is examined to summarize the number and severity of accidents, highlight the reoccurrence of particular accident types and sometimes to examine accident frequency/rates as compared with State or local averages.

  An accident review is intended to identify any deficiencies that may result as a function of poor geometrical or traffic control roadway or intersection designs. A straight collision rate can be calculated to help determine whether a safety issue is statistically valid for an intersection or specific location, per the following equation.

  $$\text{Intersection Collision Rate (ICR)} = \frac{\text{Average Accidents per Year} * 1{,}000{,}000}{365 * \text{Total Entering Intersection Volumes}}$$

  (collisions per million entering vehicles)

  An ICR less than 1.00 collisions per million entering vehicles typically does not necessarily denote a safety issue at an intersection. The ICR that equals or exceeds 1.00 collisions per million entering vehicles represents should be reviewed further to determine whether a high accident location (HAL) is present. The TIS should then attempt to analyze the cause of the accidents and recommend potential improvement options for locations with rates higher than 1.0.

- **Pedestrians/Transit.** A summary of adjacent or nearby pedestrian and transit accommodations within the study area should be summarized in TIS reports, as well as any future accommodations.

- **Programmed Improvements.** The TIS must describe any improvements that are programmed by agencies or other developments, as they may influence travel patterns or capacity within the study area. Programmed improvements must be factored, as necessary, within traffic forecasts and the future operations analysis. The Casper MPO transportation demand model can be used to assist with the process of programming improvements. A figure highlighting programmed improvements is recommended. The source for each improvement must be identified within the TIS.

- **Baseline (Without-Project) Forecasts.** Baseline traffic volume should be developed for the forecast build-out year of the proposed project. In the case of new roadways, the exiting volumes previously described may be replaced by baseline forecasts. Forecast traffic volumes will be developed by using a specific annual growth rate, as identified through historical traffic counts and/or via information provided by agencies; or these baseline volumes may be data provided by the Casper MPO. As necessary, the trips

generated by recently approved, concurrently developing projects should be included into baseline forecast projections. State and local officials will identify the "pipeline" projects to be included in a TIS, and should typically be able to provide trip assignments from other traffic studies. A figure that summarizes pipeline project location and pipeline project trip assignments is required, as well as a figure that highlights future baseline traffic volumes.

- **Future Project Volumes:** Project trip generation, distribution, and assignment must also be summarized in the TIA, as specified by the TG&D section (and approved subsequently by the agencies). Future with-project traffic volumes will be developed by combining project trip figures that highlight project trip assignments and the baseline or future with-project traffic volumes previously discussed. A figure denoting forecast traffic volumes should be provided.

- **Traffic Operations.** Traffic operations should be gauged according to the intersection LOS methodologies of the most current Highway Capacity Manual (HCM), as previously discussed. As indicated, a range of software options is acceptable for LOS calculations so long as methodologies are consistent with the HCM. LOS worksheets containing summary assumptions (channelization, controls, peak hour factors, heavy vehicle assumption, etc.) must be provided in the appendix to the TIS.

  As indicated, intersection geometrics, controls, and timing plans (for signals) should be developed to promote LOS D or better operations through the ultimate forecast horizon/design year of the West Belt Loop influence area, a minimum of 20 years out from existing conditions. Also the goal of maintaining LOS D or better operations for approaches and movements is also desired through the long range horizon.

- **Additional Analysis (Discretionary).** State or local officials may require additional analyses to support a TIS. This is especially true of the West Belt Loop study area, as it may be difficult to focus on intersection operations for interconnecting roadways when alignments have yet to be established. The TIS may include, but not necessarily limited to, an analysis of arterial traffic capacity, volume-to-capacity, vehicle delays, travel times, travel speeds, emissions, sight distance assessment, speed studies, and/or heavy vehicle analyses (turning templates, ESAL loading calculations, etc.). The deficiency thresholds for these other analyses will be based on coordination with State and local agencies, or best industry practices defined by organizations such as ITE, AASHTO, the TRB, etc.

- **Capacity Improvements.** As needed, improvements should be recommended to mitigate capacity or safety issues within the study area, as determined through operational analyses, accident analysis, and/or the additional analyses summarized within a TIS. Typically, the improvement needed to specifically mitigate a project's specific impact is identified and recommended by a TIS. In situations, this recommendation could come via the support of some regional improvement and identification of fair participation. In the case of the West Belt Loop influence area, many roadway and intersection improvements will be new to the area. As such, upon coordination with State and local agencies, the TIS should attempt to reflect these improvements and recommend reasonable participation measures; unless the local agency has already established some form of mitigation fee system that can be applied in-lieu of participation recommendations.

  Improvement recommendations should also be supported with additional industry guides/measures, as applicable. For instance, signal recommendations should be supported with MUTCD warrants previously mentioned; auxiliary lane recommendations with previously mentioned turn lane warrants and queuing analyses; safety analyses with the Highway Safety Manual (TRB, 2012) or Traffic Engineering Handbook (ITE, 9th Edition,

2012); and other applicable industry standards available from organizations such as ITE, AASHTO, the TRB, etc.

◊ **Summary and Conclusion.** The TIS must contain a summary section that clearly highlights the conclusions and recommendations of the study. The summary section, if separated from the document for cursory review by members of the public or a public agency, should provide sufficient detail to describe the project, provide a summary of trip generation and study results and provide a clear understanding of proposed improvements and project mitigation. The report would be submitted and stamped by an engineer licensed in Wyoming.

An outline of the typical TIS is as follows:

1. Executive Summary
   a. Project Description
   b. Trip Generation & Distribution & Forecasts
   c. Deficiencies Identification Recommendation
   d. Improvements and Mitigation
2. Introduction and Background
   a. Project Definition
   b. Scope and Study Area
   c. Study Methods and Definitions
3. Existing Conditions
   a. Road/Intersection Description
   b. Traffic Volume Summaries
   c. Traffic Operations & Capacity Analysis
   d. Safety Reviews
   e. Pedestrian/Transit Facilities
   f. Additional/Discretionary Analysis
4. Future Without Project Conditions
   a. Programmed Improvements
   b. Pipeline Projects and Base Forecasts
   c. Traffic Operations & Capacity Analysis
   d. Additional/Discretionary Analysis
5. Future With Project Conditions
   a. Trip Generation
   b. Trip Distribution
   c. Traffic Forecasts
   d. Traffic Operations
   e. Additional/Discretionary Analysis
6. Improvements and Mitigation
   a. Improvement Alternatives
   b. Project Participation/Mitigation
   c. Improvement Timelines
   d. Improved Traffic Operations
   e. Improved Additional/Discretionary Analysis
7. TIS Summary
   a. Project Description
   b. Trip Generation & Distribution & Forecasts
   c. Deficiencies Identification
   d. Improvements and Mitigation Recommendation

3.2 Mitigation Support

Many of the interconnecting roadways to West Belt Loop will be "shovel ready"; with the planning and design needed for construction in place prior to private development actions occurring within the influence area of the corridor. This shovel ready status allows for a range of funding and participation options to occur. This section describes recommended developer participation measures for the development of West Belt Loop interconnecting roadways.

The TG&D letter and potential TIS submittal should occur prior to and be approved early on in the development permitting process. Developer mitigation will be assessed based upon the conditions outlined in these studies. The construction of developer improvements or the agreements for improvement participation should be conditioned and bound to the development project prior to the issuance of land use, building, occupancy, or access permits.

Mitigation participation will typically be required under one or more of the following conditions.

1. The developer proposes a land use action along West Belt Loop facilities that have yet to be developed.
2. The project causes the degradation or participates in the further degradation of an intersection or roadway projected to function below operational or capacity standards.
3. When special studies (sight distance, queuing, speed studies, etc.) identify the need for improvements outside of those planned/designed for the corridor.
4. When a jurisdiction is already in the process collecting improvement/mitigation fees to help fund project improvements for the corridor.

Typically, the applicant can expect one or more of the following as mitigating measures:

- ◊ **Frontage Improvement:** Frontage improvements provide the State or land use jurisdiction the opportunity to progress road and pedestrian facilities in a manner consistent with planning and design efforts. Frontage improvements would extend along arterials within property boundaries and can include, but would not be limited to, road improvements, sidewalk/pathway construction, bike lanes, parking lanes, and landscape buffers.
- ◊ **Direct Mitigation:** Direct mitigation is intended primarily to offset the significant and specific impacts of a development project as a result of project trips causing a high trip impact beyond what was identified for planned facilities, or to mitigation specific design issues identified by a proponent TIS.
- ◊ **Partial Mitigation.** The State or land use jurisdiction may allow an applicant to participate proportionately with other applicants and/or other public entities to construct improvements that are not exclusively the responsibility of any single applicant or entity. Such participation would be assessed through a fair mitigation fee system, or the project's proportionate share of an improvement can be determined through a TIS. A typical method is dividing project trip assignments along a roadway section or at an intersection by total projected volumes, projected on a weekday basis (preferred) or via some weighted comparison of peak hourly volumes where daily counts/projections are insufficient. Land values, resulting from actions such as frontage dedication, can be counted as a part of the proportionate contribution. No "pay-back" would occur if a frontage dedication value exceeds a proportionate impact, as an agency lacks the mechanisms for such reimbursement.

3.3 Levels-of-Service Thresholds

Traffic operations and capacity are currently quantified by the roadway and intersection levels-of-service methodologies of the Highway Capacity Manual (TRB, 2010). The premise is generally that operations and capacity are limited or unacceptable, representing congestion, when LOS are under certain thresholds or acceptable when above.

WYDOT and local industry practice is to maintain a LOS C standard for highways such as West Belt Loop; traffic operations are acceptable at LOS A through LOS C. Intersection operations are acceptable at LOS D or above (LOS A through LOS D is acceptable). Improvements and mitigation would be triggered if deemed necessary by the TIS, and as approved by the local agency.

INSERT TAB SHEET APPENDIX B

APPENDIX B – TREVETT LANE PRELIMINARY ROUTE ANALYSIS

The scope of this study includes a requirement to determine the feasibility of extending Trevett Lane from its current westerly terminus to West Belt Loop. It is intended that Trevett Lane function as a collector road and serve as the east-west corridor immediately north of the North Platte River.

The attached Figure B.1 provides an aerial view illustration of the area between the west end of Trevett Lane and West Belt Loop. Trevett Lane is situated on the top of the rim rocks above the river. There is an existing primitive road extending down the slope to an oxbow bench area on the north side of the river. Two alternative alignments were considered in the route analysis:

1. A southerly extension that would drop the roadway down to the oxbow bench. The alignment would then ascend up through the rim rocks to a connection with West Belt Loop. The point of connection with West Belt Loop is close to the future Oregon Trail interpretive turnout on West Belt Loop (as referenced in the WYDOT construction plans). One benefit of the southerly route is that it provides direct access to developable river properties.
2. The northerly alignment extends northwest through two buttes above the rim. The point of connection with West Belt Loop is the same as described for the southerly alignment. Although this route does not provide easy access to developable river properties, it is a shorter route and more fiscally conservative.

Utilizing the Natrona County GIS data base, a topographic analysis was conducted to determine the projected grades and potential cut and fill required for each of the alternatives. Figure B.2 illustrates a preliminary roadway profile for the two alternatives. In both cases, grades generally are kept below 10 percent (with a few exceptions close to 13 percent grade). Both routes are deemed feasible from a purely constructability standpoint.

In conclusion, the extension of Trevett Lane is considered feasible. Given there are no plans to extend the roadway, it is assumed that the final route design will be established by local land development needs. As stated elsewhere in this study, none of the local agencies have plans to initiate the design and construction of the Trevett Lane extension.

Insert Figure B.1

Insert Figure B.2

INSERT TAB SHEET APPENDIX C

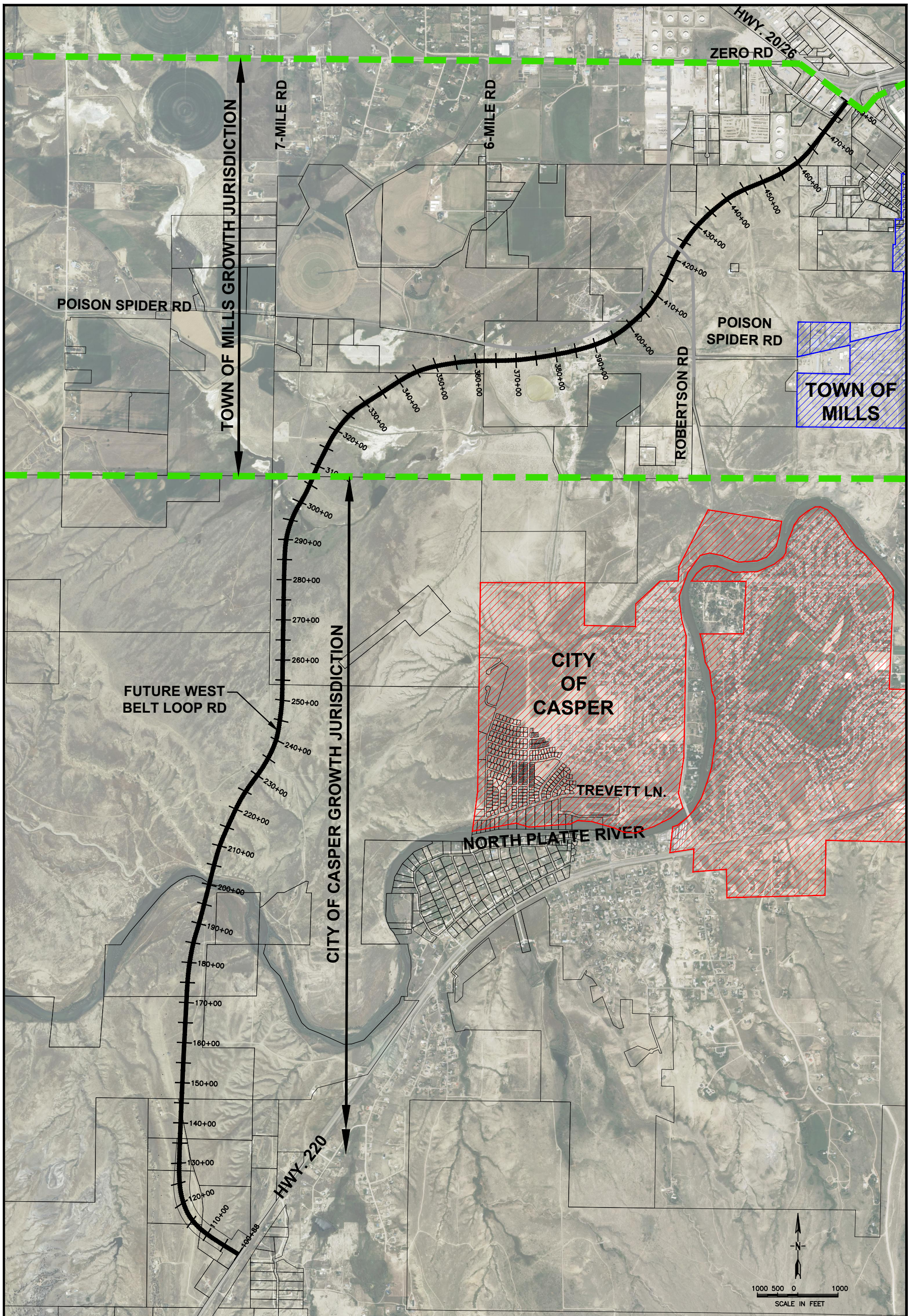
APPENDIX C – RESOURCE AGENCY CONTACT LETTERS

Included herewith are response letters received from various resource agencies.

Insert Resource agency letters here Three total – Natrona County USACE and one FHWA

INSERT TAB SHEET APPENDIX D

APPENDIX D – PUBLIC INVOLVEMENT DOCUMENTATION



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DATE: 12/2013

WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN

CASPER WYOMING

PROJECT NO.
5140001/010/0114

CORRIDOR LOCATION / GROWTH BOUNDARY
* GROWTH BOUNDARIES ESTABLISHED WITH CASPER COMMUNITY DEVELOPMENT, JULY 2013 CASPER-MILLS GROWTH BOUNDARIES

FIGURE NUMBER
FIG. 1

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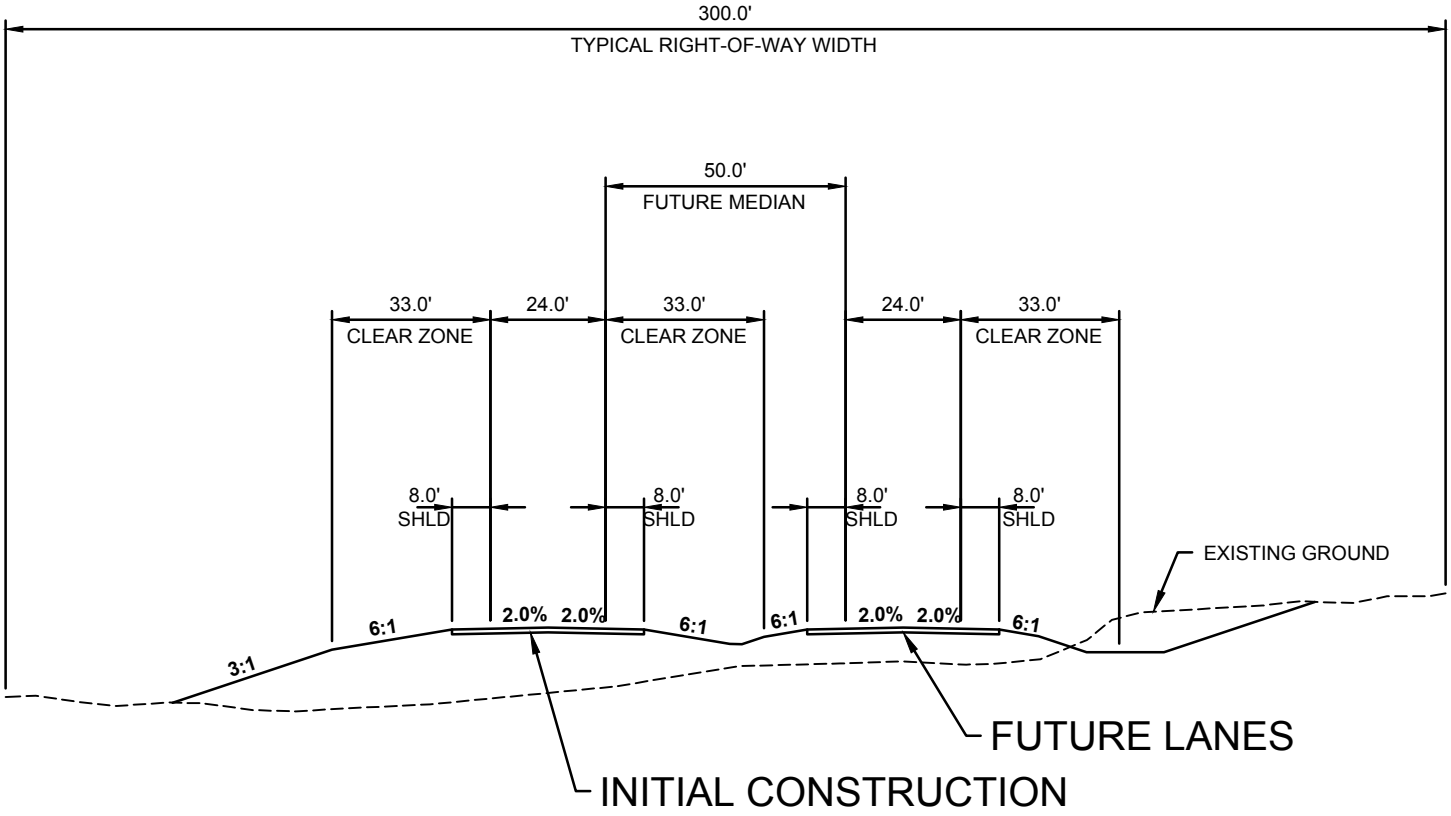

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WEST BELT LOOP LAND USE
CONNECTIVITY AND ACCESS PLAN
CASPER WYOMING

PROJECT NO.
5140001/010/0114

WEST BELT LOOP
TYPICAL CROSS SECTION

FIGURE NUMBER
FIG. 2

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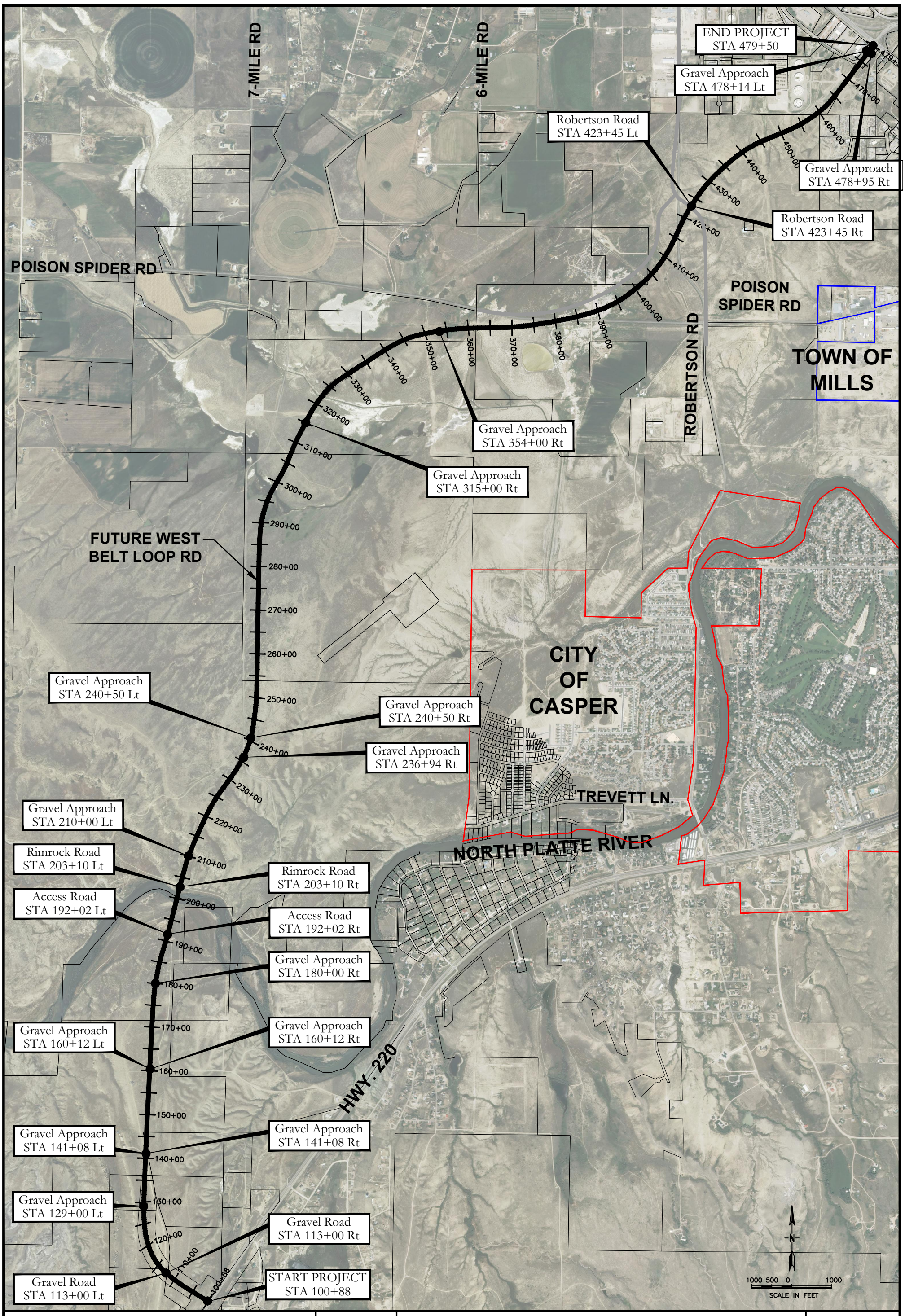

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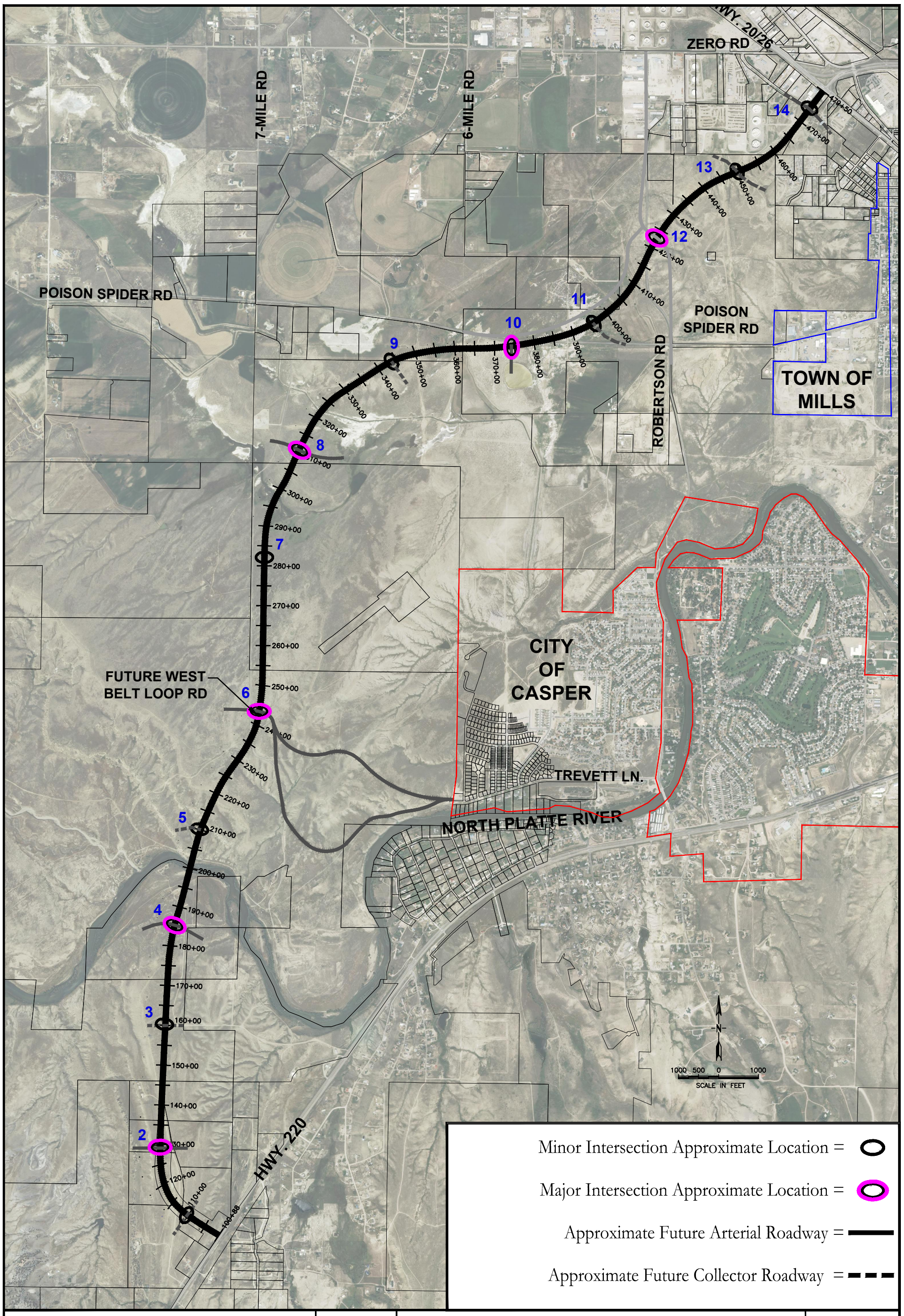
WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN

CASPER WYOMING

CURRENT PERMITTED ACCESS LOCATIONS

PROJECT NO.
5140001/010/0114

FIGURE NUMBER
FIG. 3



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CASPER — WEST BELT LOOP LAND USE, CONNECTIVITY, AND ACCESS PLAN — WYOMING

RECOMMENDED INTERSECTIONS

PROJECT NO. 5140001/010/0114

FIGURE NUMBER FIG. 4

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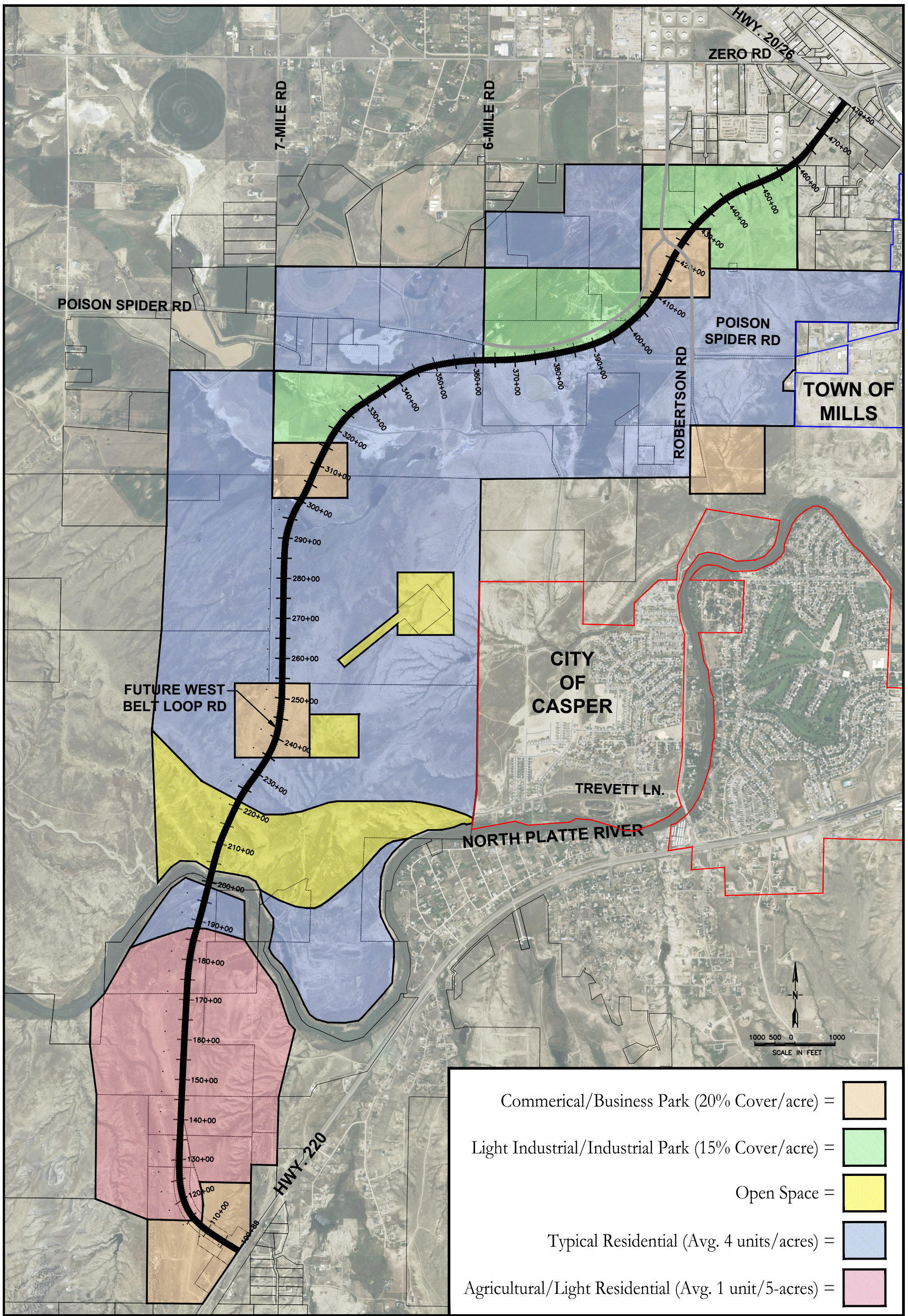

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WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN

CASPER WYOMING

PROJECTED LAND USE

PROJECT NO.
5140001/010/0114

FIGURE NUMBER
FIG. 5

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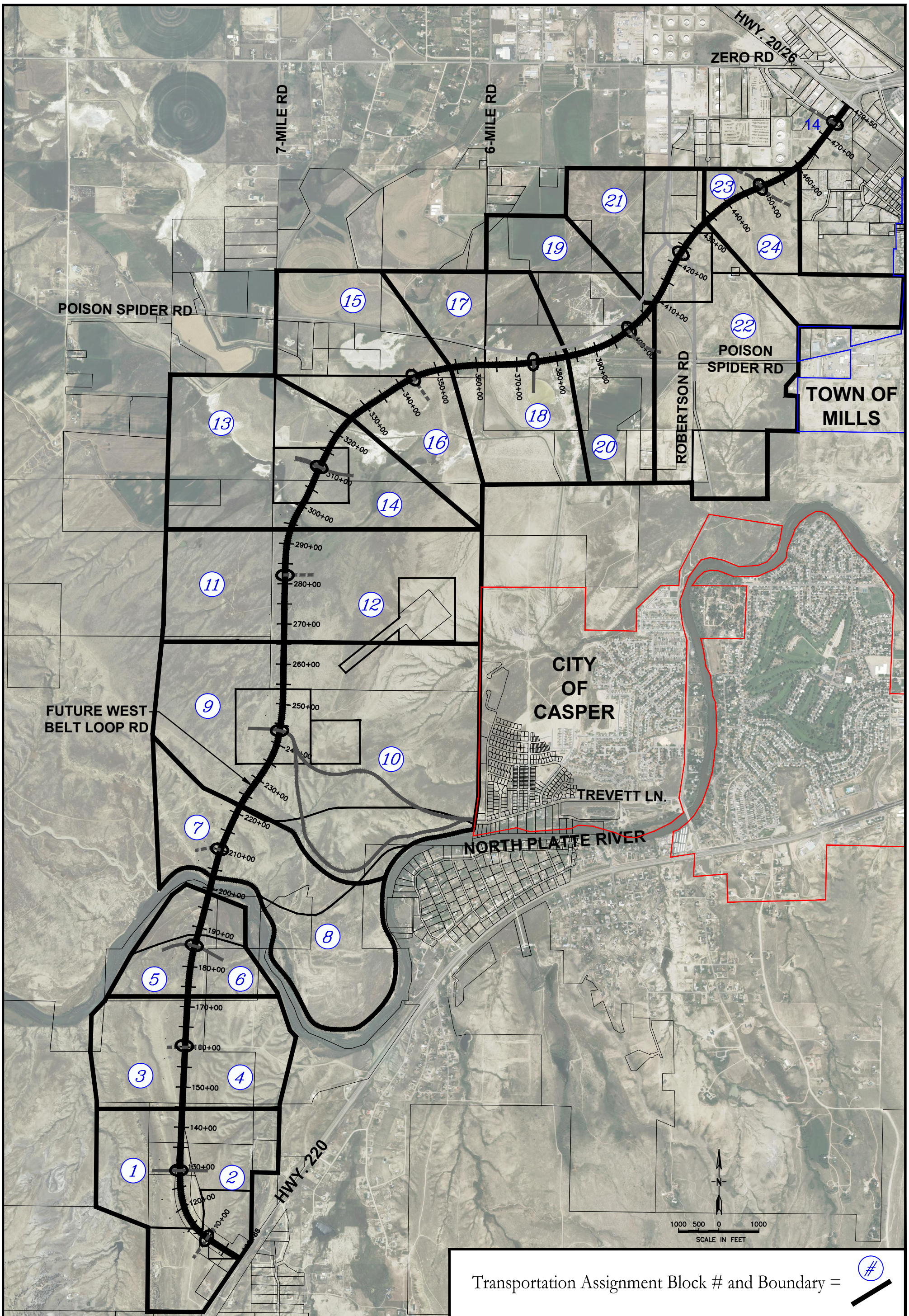

Transportation Assignment Block # and Boundary =

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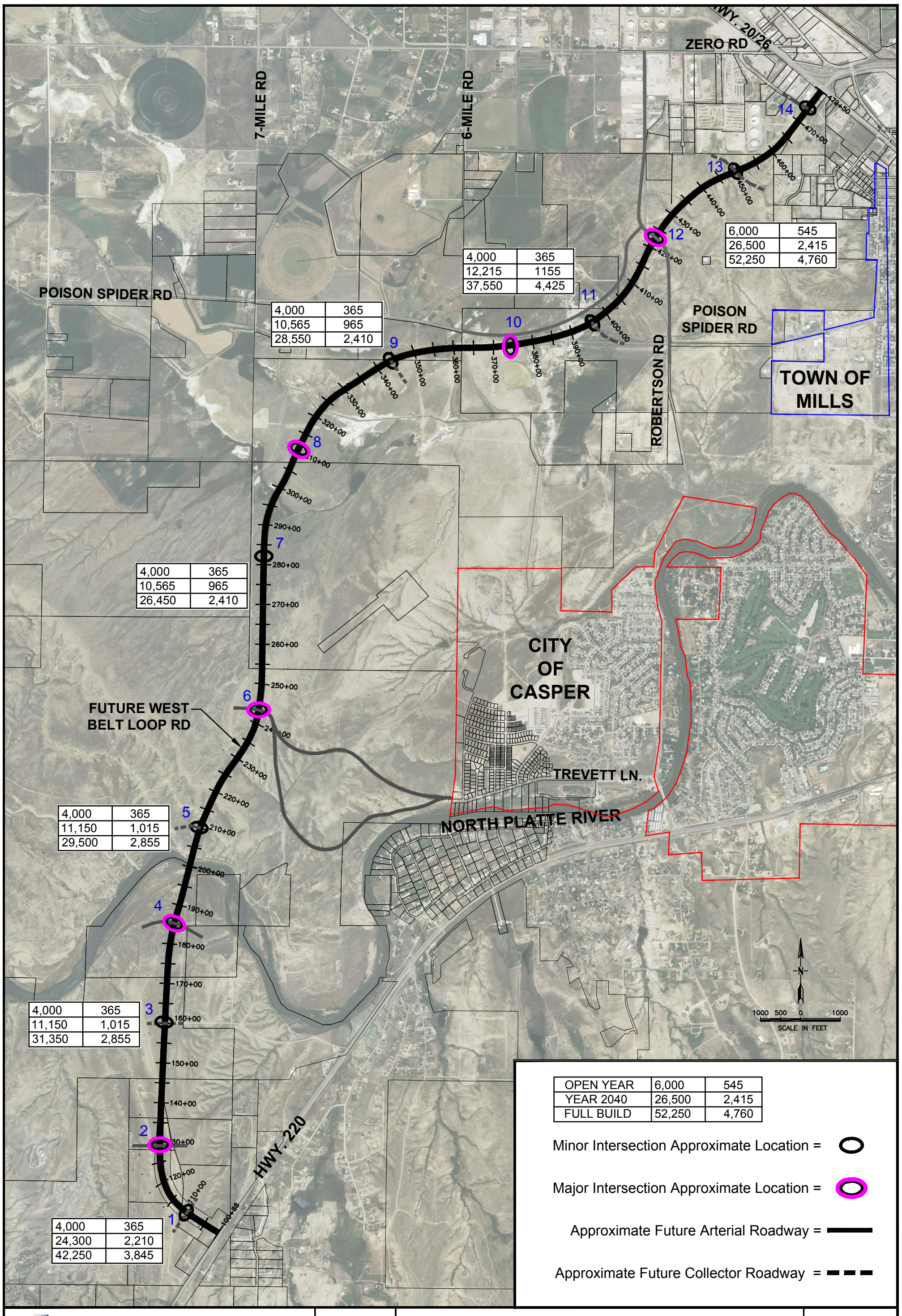
WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN

WYOMING

TRANSPORTATION ASSIGNMENT BLOCKS

PROJECT NO.
5140001/010/0114

FIGURE NUMBER
FIG. 6



OPEN YEAR	6,000	545
YEAR 2040	26,500	2,415
FULL BUILD	52,250	4,760

Minor Intersection Approximate Location =

Major Intersection Approximate Location =

Approximate Future Arterial Roadway =

Approximate Future Collector Roadway =

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CASPER — WEST BELT LOOP LAND USE, CONNECTIVITY, AND ACCESS PLAN — WYOMING

PROJECT NO. 5140001/010/0114

FORCAST YEAR 2040 & FULL BUILD TRAFFIC VOLUMES
AVERAGE DAILY TRAFFIC (ADT) & PRE PEAK HOUR

FIGURE NUMBER
FIG. 8

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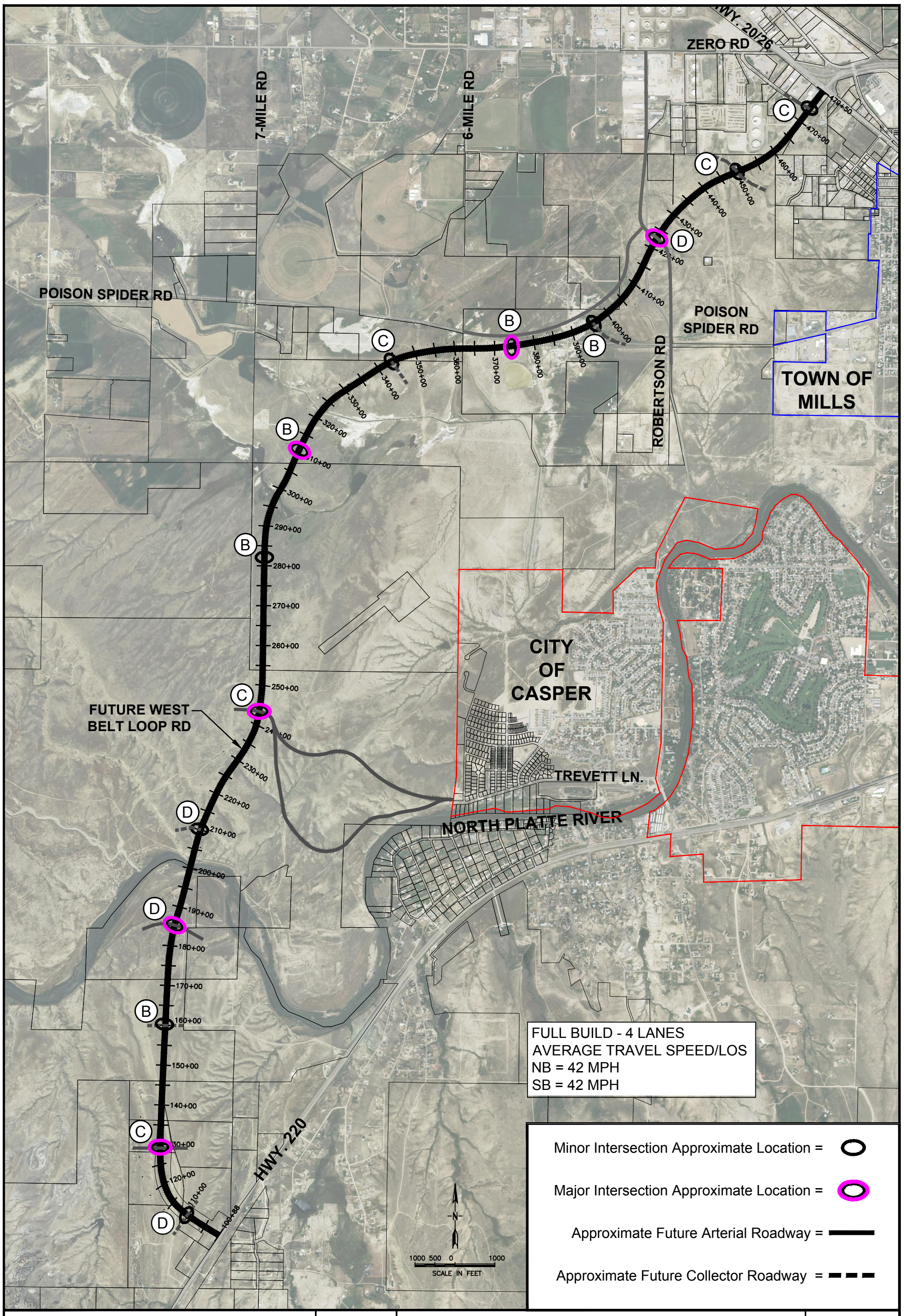

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WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN
CASPER WYOMING

FULL BUILD CONDITION
LEVELS-OF-SERVICE RESULTS

PROJECT NO.
5140001/010/0114

FIGURE NUMBER
FIG. 9

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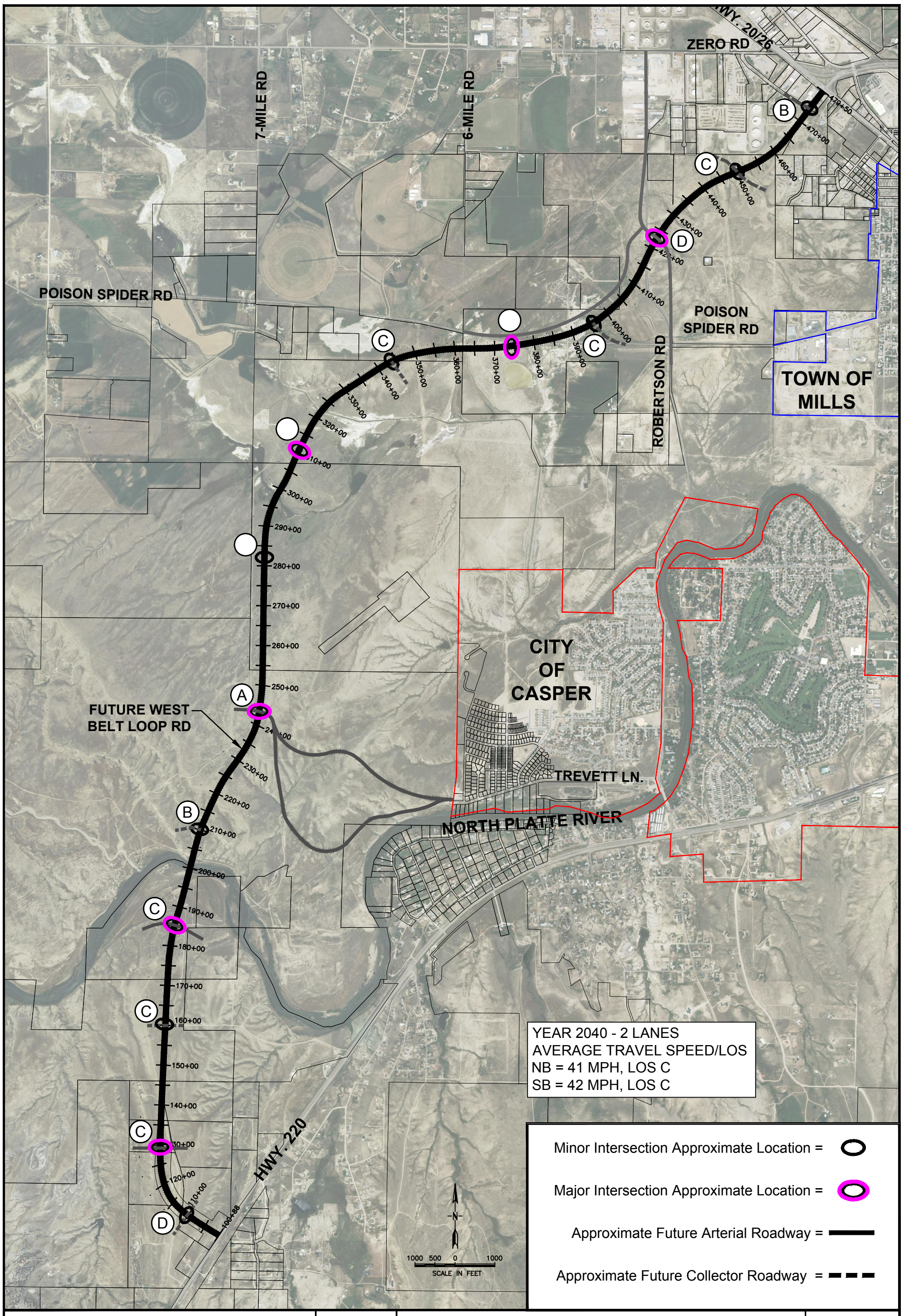

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WEST BELT LOOP LAND USE,
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CASPER WYOMING

YEAR 2040
LEVELS-OF-SERVICE RESULTS

PROJECT NO.
5140001/010/0114

FIGURE NUMBER
FIG. 10

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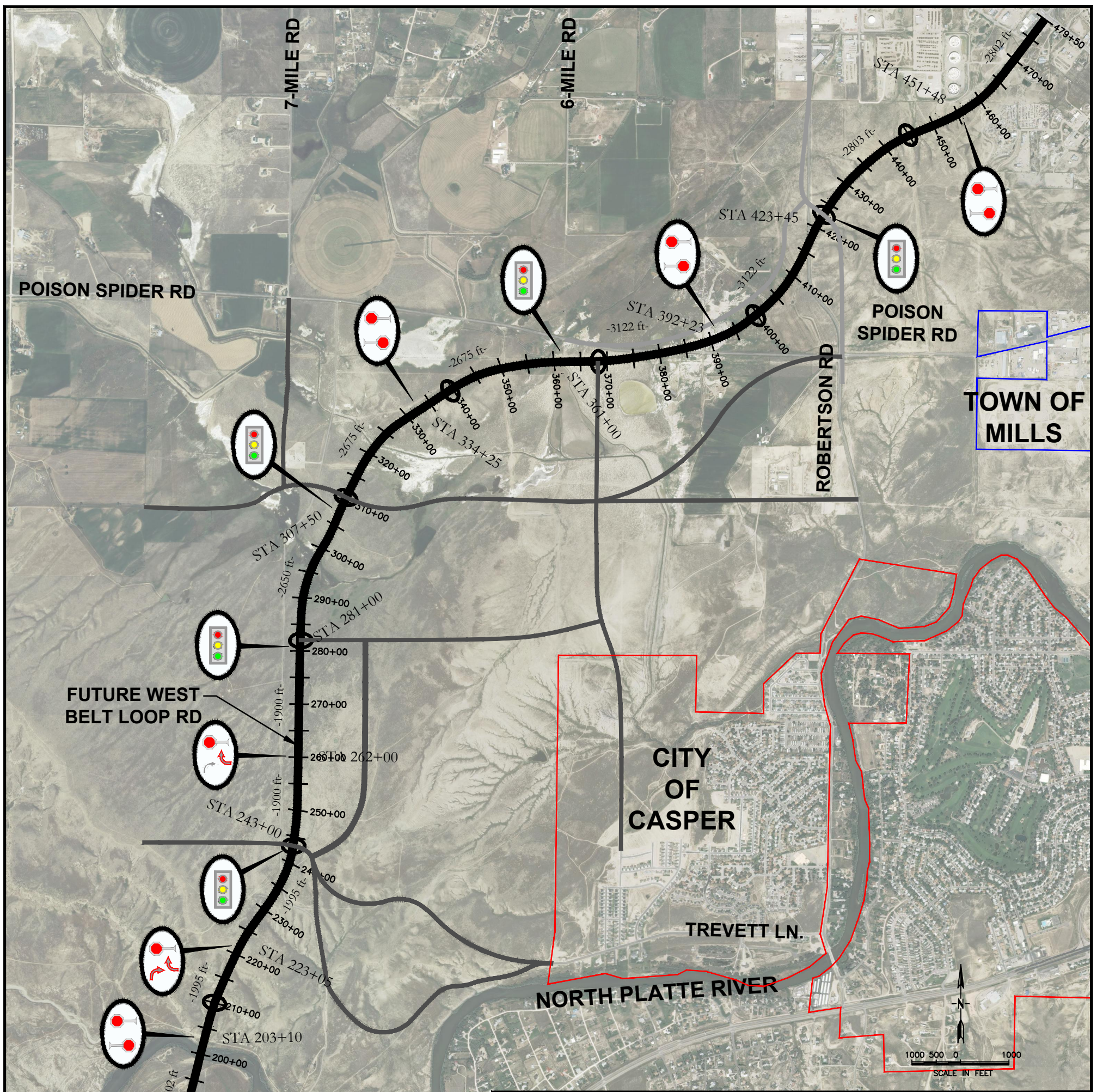

Potential & Approximate Intersection/Approach Spacing = -1600 ft-

Potential & Approximate New Intersection-Approach = STA 150+10

Potential & Approximate New Roadway Alignment =

Full Intersection & Control, Eventual Traffic Signal =

Full Intersection & Limited Control, Stopped Approach =

Limited Intersection & Control, Right-Turn Approach =

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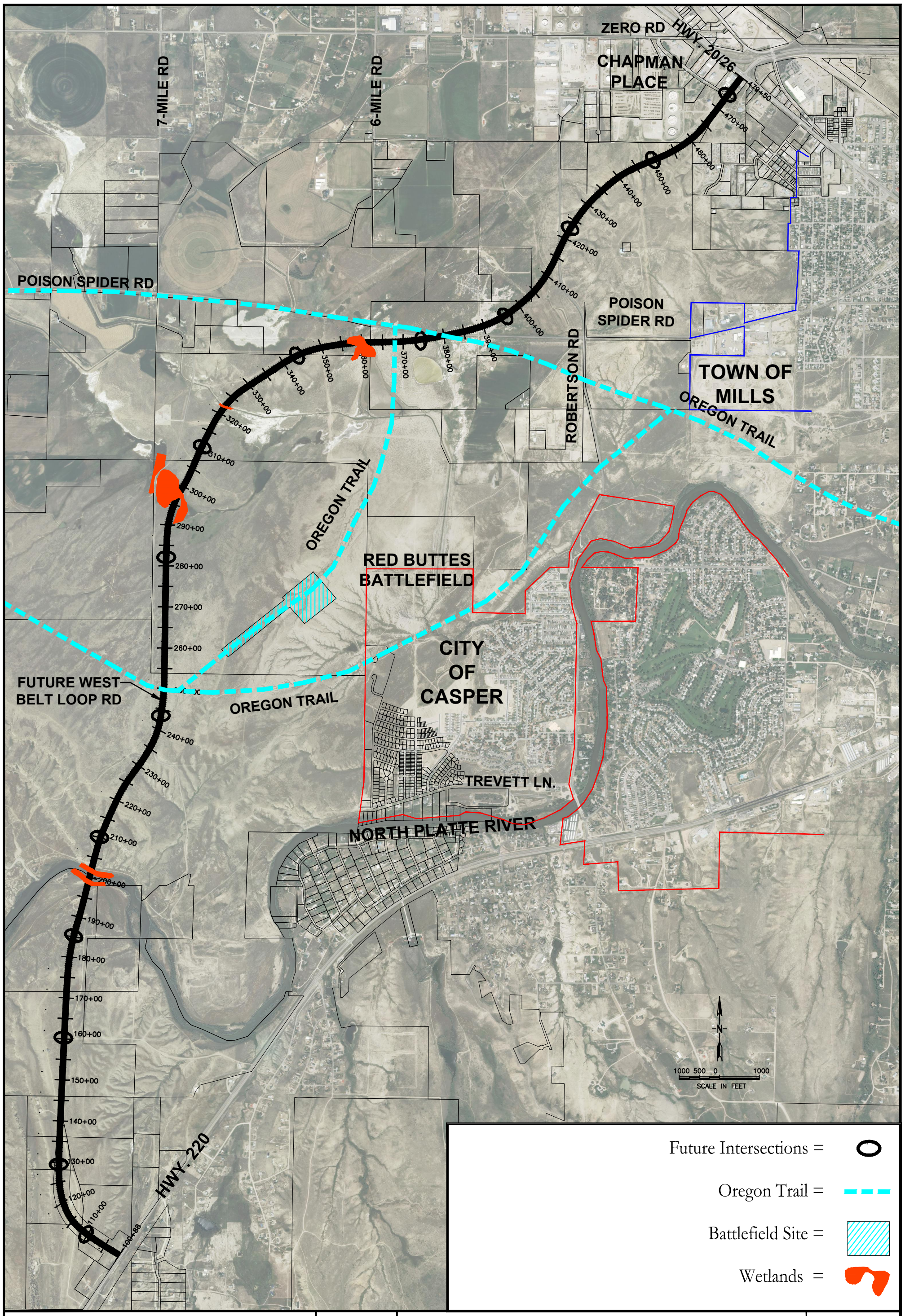
CASPER — WEST BELT LOOP LAND USE, CONNECTIVITY, AND ACCESS PLAN — WYOMING

FULL LAND USE DEVELOPMENT INTERSECTION CONTROL

PROJECT NO. 5140001/010/0114

FIGURE NUMBER FIG. 11



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CASPER — WEST BELT LOOP LAND USE, CONNECTIVITY, AND ACCESS PLAN — WYOMING

WETLANDS DELINEATION AND CULTURAL FEATURES

PROJECT NO. 5140001/010/0114

FIGURE NUMBER FIG. 13

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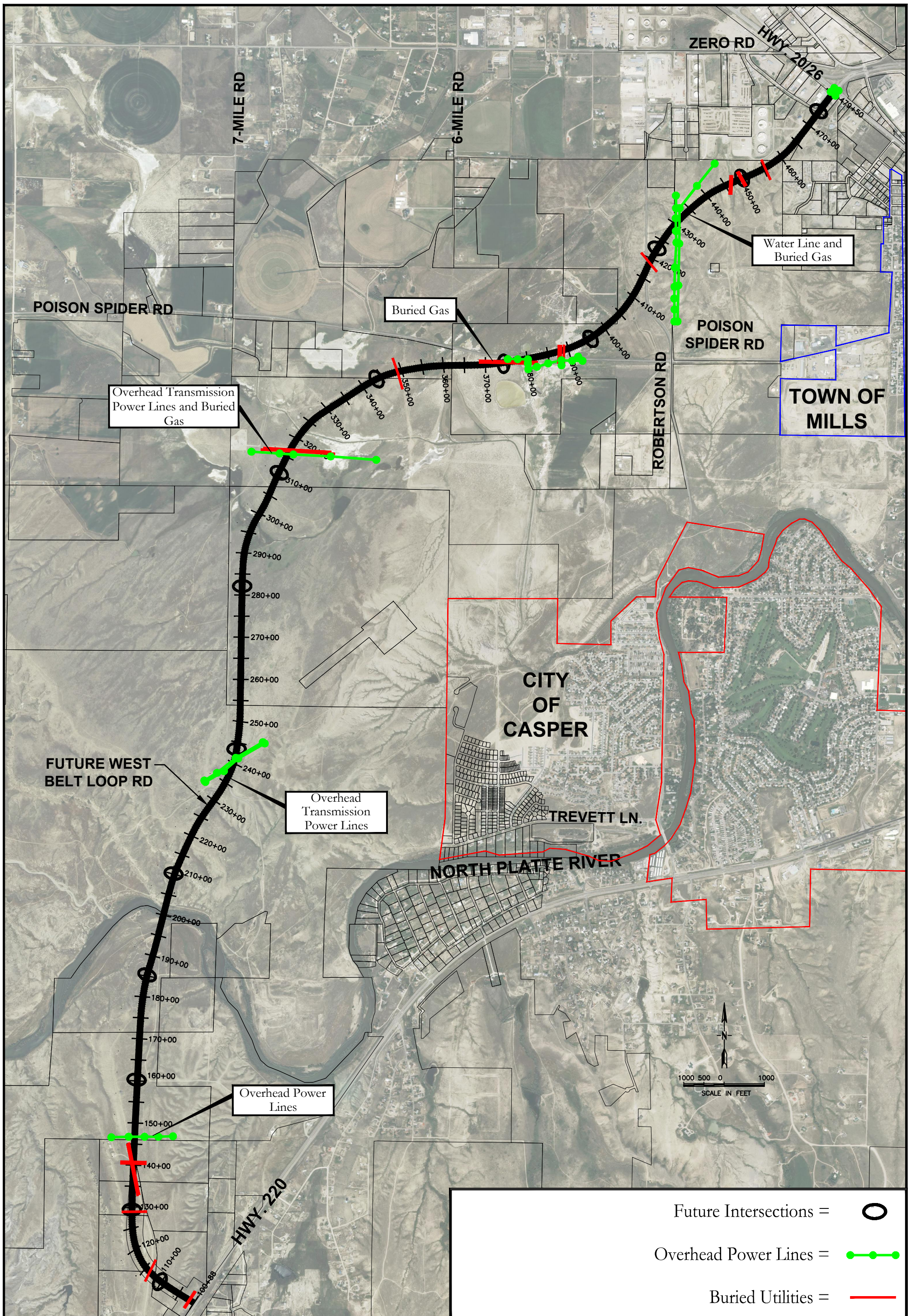

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WEST BELT LOOP LAND USE, CONNECTIVITY, AND ACCESS PLAN
CASPER WYOMING

UTILITY PLAN

PROJECT NO. 5140001/010/0114

FIGURE NUMBER
FIG. 13

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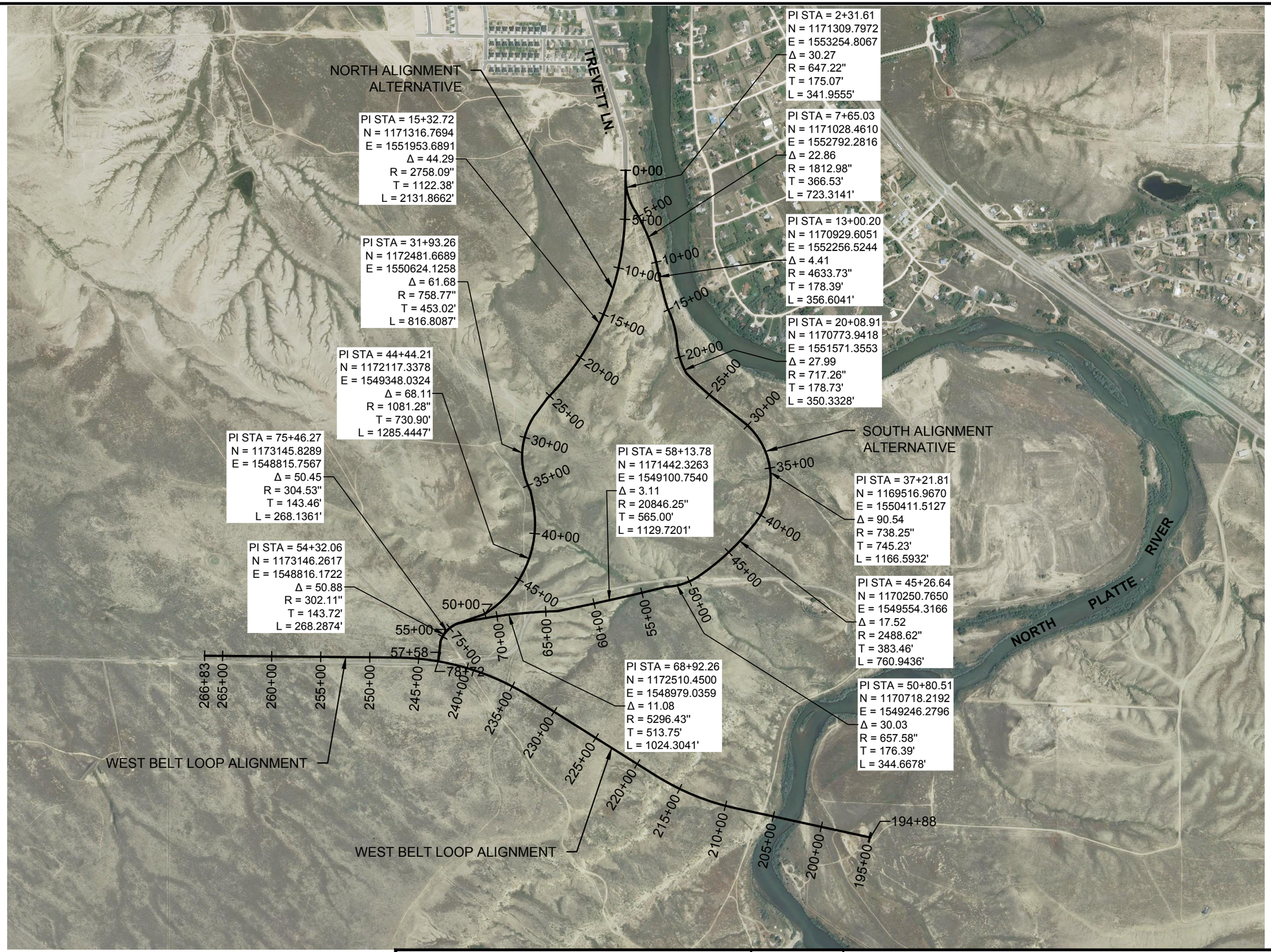

1000 500 0 1000

SCALE IN FEET

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R:\5140\001\ACAD\TREVETTE-LANE_NOIMAGE - Standard\TREVETTE-LANE_NOIMAGE 4A.dwg Plotted by jon svaleson on Jul/3/2014

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CHK'D. BY: JP
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DATE: 05/2014

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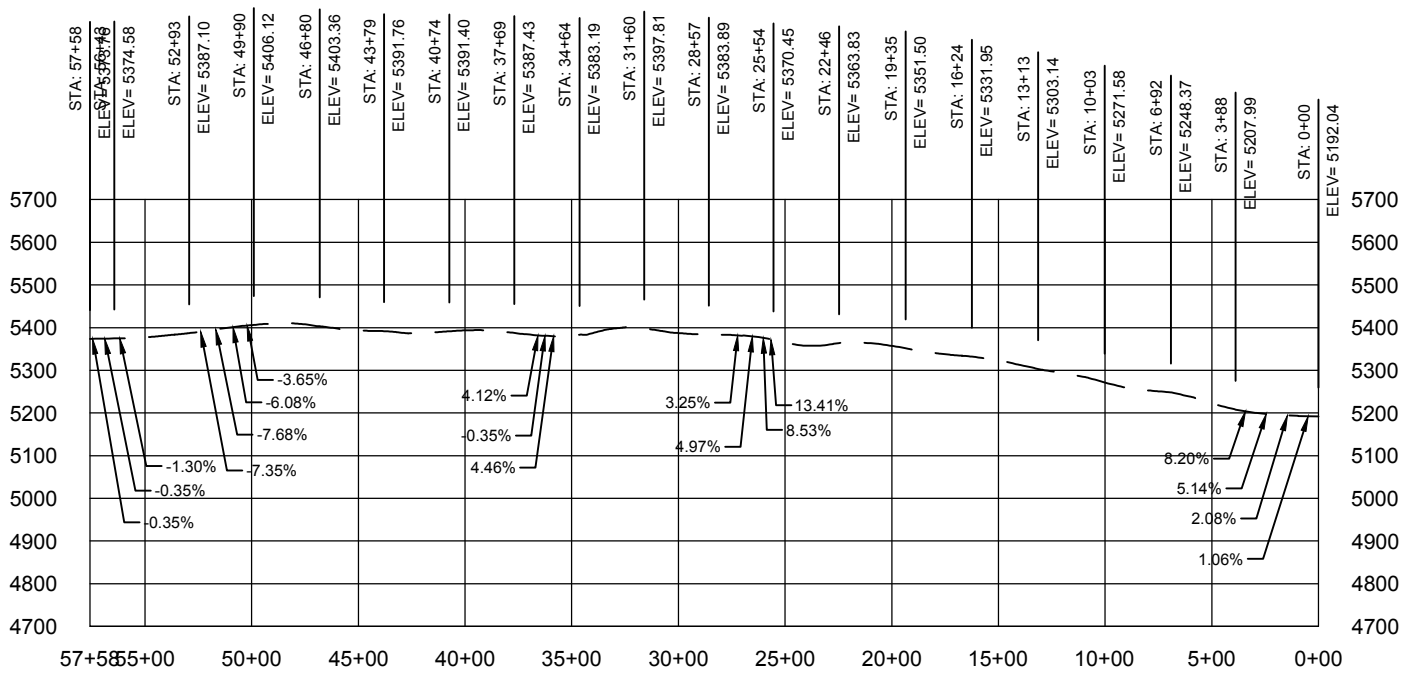
WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN

WYOMING

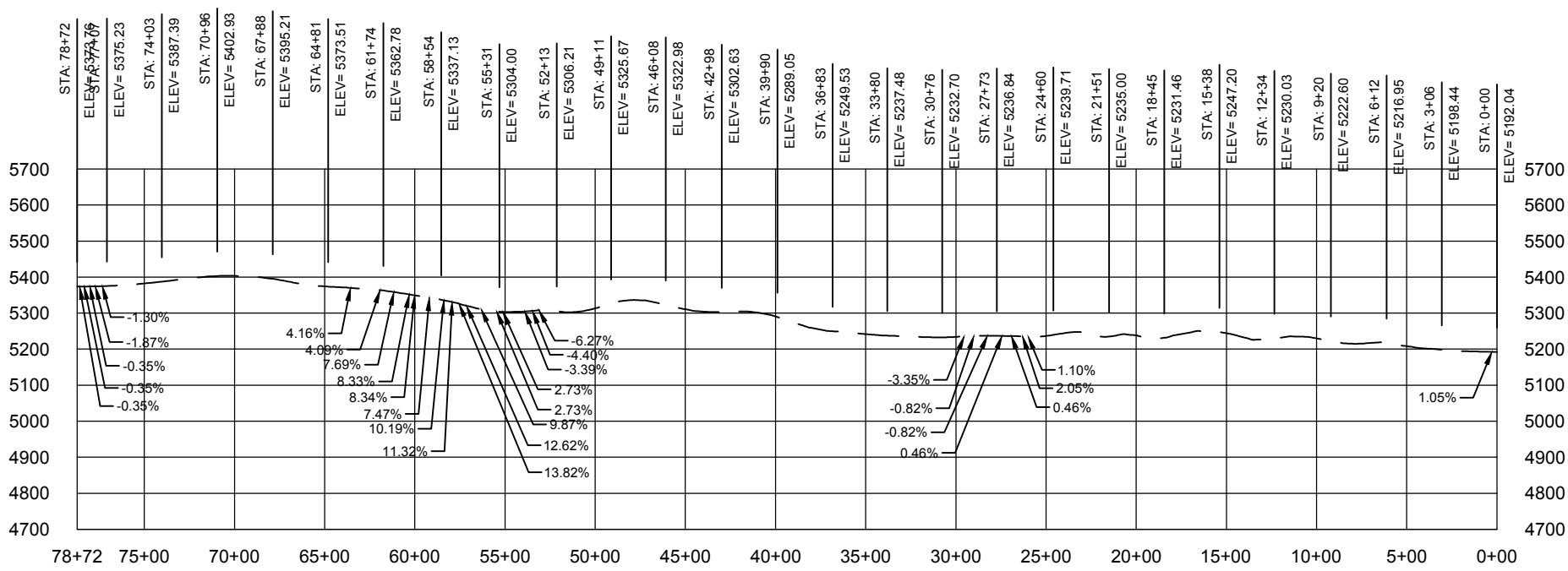
TREVETT LANE ROUTE DESIGN

PROJECT NO.
5140.001

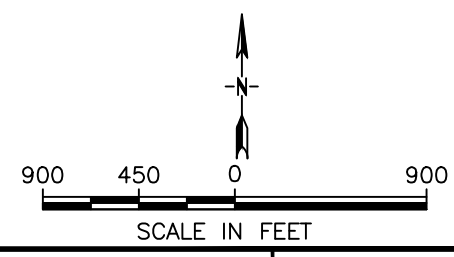
FIGURE NUMBER
FIG. B1



NORTH ROUTE ALTERNATE



SOUTH ROUTE ALTERNATE



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WEST BELT LOOP LAND USE,
CONNECTIVITY, AND ACCESS PLAN
CASPER WYOMIMG

TREVETT LANE ROUTE DESIGN AND PROFILES

PROJECT NO.
51400001/010/0114

FIGURE NUMBER
FIG. B2

R:\5140\001\ACAD\TREVETTE-LANE_NOIMAGE - Standard\TREVETTE-LANE_NOIMAGE 4A.dwg Plotted by jon svaleson on Jul/3/2014