Molt Road/Highway 3 Collector Road Planning Feasibility Study

Prepared For:

Billings City-County Planning Department

In Cooperation with:

City of Billings
and
Yellowstone County

Prepared By:

June 2004

EXECUTIVE SUMMARY

Study Authorization / Purpose / Need

This engineering feasibility study was authorized through a funding agreement between the Montana Department of Transportation and the Billings City-County Planning Department and through authorization from the local Technical Advisory Committee (TAC) and the Policy Coordinating Committee (PCC). Authorization to proceed with the study was granted through a contract dated January 23, 2003 between the Billings City-County Planning Department (the Metropolitan Planning Organization) and HKM Engineering Inc.

The purpose of this study is to satisfy recommendations made by the *West Billings Plan* to perform a feasibility study for the purpose of evaluating the development of a collector corridor between Molt Road (S 302) and MT Highway 3 (N-53) northwest of Billings.

This study is intended to provide a review and assessment of available information, to solicit public comments and opinions, to perform a planning level construction and right-of-way cost analysis, and to complete a cultural and archeological survey of the proposed corridors as a means of determining the planning feasibility of developing a collector road corridor. A detailed economic evaluation including a benefit / cost analysis comparing direct user benefits (travel time savings, accident reduction) to project costs (construction, operation, maintenance) was not performed as a part of this study, as the economic feasibility is expected to be reviewed and discussed by the City of Billings and Yellowstone County, as needed.

Several considerations demonstrate the need and desire to develop an engineering feasibility study towards the continued development of a collector route between Molt Road and MT Highway 3:

- Continued and steady growth in the northwest portion of the Billings urban area at a rate typically greater than Billings proper
- Continued development within and adjacent to the proposed study area
- Development of a transportation corridor that improves north-south linkage, provides an additional rim crossing, develops access and mobility within the immediate area, and affords improved emergency vehicle access
- Development of a transportation corridor suitable for the interconnection of utilities between the upper and lower portions of the Billings urban area currently separated by the rimrocks
- To satisfy recommendations for continued study through approved local planning documents including the 2000 Billings Urban Area Transportation Plan, the 2001 West Billings Plan, and the 2003 City of Billings and Yellowstone County Growth Policy.

Project Location / Background

The general location for the Molt Road/Highway 3 Collector Feasibility Study is situated northwest of the Billings urban area and wholly within Yellowstone County, Montana. The study area is bounded to the south by Molt Road and to the east by MT Highway 3. A Burlington Northern Santa Fe railroad line traverses the western portion of the study area while a Conoco petroleum pipeline bisects the project location along a southwest to northeast alignment. Continuation of the collector road outside of this area is not anticipated or planned.

The development of a road west of Zimmerman Trail and across the Billings rimrocks has been an element of local transportation plans for over 26 years. In 1977, the Billings Transportation Plan Update first identified the area between Montana Highway 3 and the existing railroad alignment as the most desirable location for the development of such a link. Each subsequent Plan update has included some discussion of and recommendations for this particular link, including the most recent 1990 and 2000 Transportation Plans. More recently, the *2003 Yellowstone County and City of Billings Growth Policy*, as well as the *2001 West Billings Plan*, included discussion and recommendations to study the engineering feasibility of developing a corridor between Molt Road and MT Highway 3. Additional studies, documents, and reports include the *Outer Belt Loop Traffic Study* (1987), the *Ironwood Subdivision "Subdivision Improvement Agreement"* (2001), and the *By-Pass Traffic Study and Addendum* (2001).

Study Approach / Management

This feasibility study was developed in close consultation with a project *Steering Committee*, whose goal was to oversee the development of the study, to review the results of individual tasks, and to provide technical direction, as required. The steering committee for this project consisted of the following organizations and individuals:

Yellowstone County	Public Works Department
City of Billings	Vern Heisler, PE City Engineer David D. Mumford, PE Public Works Director
Billings City - County Planning Department	Ramona Mattix, AICP Director, Zoning Coordinator W. Scott Walker, Transportation Planner

Additionally, area landowners within the project limits were afforded an opportunity to contribute to the development of the study. Landowner representatives, as identified through Yellowstone County tax records, were contacted and consulted regarding the development of preliminary corridor alternatives.

Available Information

The Billings urban planning boundary, as identified by the Billings Urban Area 2000 Transportation Plan, encompasses the entire corridor study area, which is further contained within the Shiloh Northwest neighborhood planning area. Average Annual Daily Traffic (AADT) volumes as reported in the approved *Ironwood Subdivision Traffic Accessibility Study* by Engineering Inc. and the *2001 Northwest Bypass Location Transportation Evaluation* by Marvin & Associates report link volumes within the study area for Molt Road at 1000 to 1100 vehicles per day (vpd), respectively, at a point just north of Rimrock Road. The *2001 Northwest Bypass Location Transportation Evaluation* reported AADT volumes for Montana Highway 3 of 2200 vpd adjacent to the study area and 3000 vpd just west of Zimmerman Trail. By comparison, the Montana Department of Transportation reported 3 year AADT's for MT Highway 3 south of Broadview of 1530 vpd in 2000, 1529 vpd in 2001, and 1552 vpd in 2002. The *2001 Northwest Bypass Location Transportation Evaluation* also reported an AADT for 62nd Street West just south of Rimrock Road of 500 vpd.

Traffic accident data was not collected or analyzed for this project.

The engineering firm of Marvin & Associates developed the two most recent reports related to the proposed link: one in 1987 in conjunction with HKM Engineering Inc., and one in December 2001.

The 1987 traffic study was prepared as a part of an "Outer Belt Loop" planning process. Although an outer belt loop plan has since been discontinued, the 1987 traffic evaluation concluded the following points regarding a connection between Molt Road and MT Highway 3; that construction of a "connection road" (between Molt Road and MT Highway 3) would probably not be feasible prior to the year 2000 due to low travel demands (low volumes), that a "road would be a vital part of the (Billings) street system by 2010 even if the Outer Belt Loop were not built". The report recommended "a method of reserving the necessary right-of-way" for a future road between Molt Road and MT Highway 3 be implemented.

Based on a QRS (Quick Response System) traffic model of the Billings area, and assuming a high-speed-access-controlled Outer Belt Loop scenario, a steady Billings area growth rate, and a year 2010 Billings population of 150,000 residents, the studies identified a 1985 potential demand of an "Outer Belt Loop" connection road within the Molt Road/Highway 3 study area of 930 ADT (average daily traffic or vehicles per day), a 1995 potential demand of 1160 ADT, and a 2010 potential demand of 5170 ADT.

Subsequent to the submittal of the 1987 study and prior to the 2001 study, local planners abandoned the concept of a "belt-loop" in favor or a "by-pass" or Arterial concept. The December 3, 2001 study, commissioned by the Billings City-County Planning Department, reviewed two possible arterial corridors between Molt Road and MT Highway 3; Alternate Route "E" and Alternate Route "W". The study reported a year 2021 ADT for Alternate "E" to be approximately 2193 ADT and for Alternate "W" to be approximately 1607 ADT. The study concluded that neither an "East" nor a "West" corridor would function well as a high-speed, limited access arterial based on anticipated traffic volumes and assumed area developments. As a result of conclusions of the 2001 study, the Billings City-County Planning Department requested an Addendum that would revisit the higher demand Alternate "E" corridor and to investigate the application of a collector road functional classification over an arterial road functional classification.

The traffic model used for the 2001 study was modified to include better access opportunities and a 35 mph posted speed. The new model predicted that a collector road would attract a year 2021 demand of roughly 1150 ADT at its intersection with Highway 3. This value represents a nearly 50% decrease in the number of vehicles predicted to use the link than was predicted if the link functioned as a high-speed, limited access arterial. Although reduced, it was noted by the addendum that this demand was still within the functional bounds of a collector road. Discussions with Marvin & Associates noted that this anticipated demand does include traffic from the planned Ironwood Subdivision located on the southern end of the study area, and that roughly 80% of the vehicles anticipated to utilize the collector road corridor would be residents of that subdivision.

The December 2001 study and subsequent addendum demonstrated that a corridor located closer to Billings (Alternate "E") would attract and serve more demand than a corridor located further west and away from Billings (Alternate "W"), and that an Alternate "E" route would function adequately as a collector street. Conclusions of the December 2001 study addendum stated that an Alternate "E" route would "*not function well as a bypass route*", and as a collector street it would "*have the potential to carry a level of traffic appropriate for its function*". The study continued by noting that a link in this area would "*provide the desirable connectivity through the proposed subdivision (Ironwood) and allow an appropriate interface with future subdivisions*".

Preliminary Engineering Feasibility

The focus for this study is to develop and evaluate multiple corridor alternatives by developing a “range” of likely alternatives for the purpose of performing a "screening level" analysis of the corridor. Potential preliminary corridors for the Molt Road/Highway 3 collector road were developed based on field reviews, available data and through meetings with the MPO, the project steering committee, and meetings with adjacent landowners.

Through steering committee and landowner discussions; and based on known physical, topographical, or geographic constraints; a range of viable “design points” were selected for continued study. These points include: four (4) Molt Road intersection points, three (3) rim crossing locations, and one (1) Highway 3 intersection. Also identified are areas that precluded corridor development, either due to geographical or topographical constraints, planned development, or safety concerns. Based on these two sets of points, 5 preliminary corridor alternatives (Corridors 1 through 5) ranging in distance from 3.01 miles to 2.23 miles were developed for public consideration and comment.

Public Involvement

Public comment and opinion regarding the various aspects of this feasibility study were considered towards the final corridor development, including landowner coordination, a public meeting, a project web site, newspaper articles, and various other avenues for public comment. The initial project public informational meeting was conducted on Wednesday, June 3, 2003. Information discussed at the meeting included a history of the project, a discussion of the project scope, and a presentation of the initial study corridors for public consideration.

A second and final public informational meeting was conducted on Thursday, June 3, 2004. This meeting served to present and discuss the findings of the corridor study, City staff recommendations regarding the alternative corridors, and solicited final public input. Public comment received and discussed at the meeting included issues related to lighting, noise, roadway function (arterial verses collector), and speed. Specific discussion items included recommendations for landscaping and berms.

Based on received public comments, Corridors 2 and 5 were identified as the most popular corridors, as they minimized impacts to both the Echo Canyon area located west of the project area and the Ironwood subdivision located within the project study area, and provided for a future rim crossing adjacent to an existing transportation corridor (the BNSF railroad).

Railroad and Utility Coordination

The project study area contains an existing Burlington Northern Santa Fe (BNSF) railroad alignment. Through discussions with BNSF, it was determined that a collector corridor parallel to the existing railroad alignment and right-of-way would be acceptable.

Bisecting both the project study area and the Ironwood subdivision is a high-pressure petroleum pipeline operated by the Conoco Pipeline Company. Construction of a road above the existing line would most likely require relocation of the line due to required road grades compared to the existing pipeline location.

The Billings Public Utilities Department (PUD) is in the process of planning the development of a water storage tank to be located within the project vicinity. PUD would also like to develop a water main through the study area for the purpose of connecting existing systems above the rims with systems below the rims in an effort to "connect a loop", and provide redundancy in the area's water system. It is anticipated that none of the preliminary corridors will impact this planned utility development.

Cultural and Archeological Feasibility

The purpose of the cultural and archeological survey was to identify any cultural, historical, or archeological instances that could preclude further development of a particular corridor alternative. Background information was obtained as either file information or by direct solicitation from the resource agencies.

A pedestrian field survey of the study area was performed to identify instances of historical, cultural, and archeological significance within the rim crossings and upper dry land areas of the preliminary corridors. A survey of the lower valley area (Ironwood subdivision) was not performed, as permission to enter onto this property could not be obtained. As a result of the survey, various instances of historical, cultural, and archeological significance were identified relative to the preliminary corridor locations, including several instances that were determined not to be significant, and therefore not eligible for historical recognition and protection. Each instance identified and recorded by the survey had been previously documented by Montana SHPO. No new instances of historical, cultural, and archeological significance were located by the survey.

Land Use and Zoning

All current zoning in the study area was determined based on Yellowstone County zoning maps provided by the Yellowstone County GIS and Yellowstone County Board of Planning. Land use in the study area is largely agricultural and with some areas of residential development. Residential land use areas will probably be impacted depending on a final corridor selection. Development of a corridor through the area is not anticipated to directly impact any existing residential structures.

The majority of land in the study area is undeveloped dry land with an Agricultural Open zoning classification. The southern portion of the study area (CS 3030 Tract 2) is partially platted as the Ironwood Subdivision Phase 1, and consists of developed and undeveloped Residential zoning classifications (R-9600). Yellowstone County zone maps indicate that portions of T1N R25E Section 19 are zoned Residential R-15000. Typically, T1N R25E Section 19 N1/2 and SW1/4, and T1N R25E Section 20 are agricultural in nature.

Preliminary Feasibility Matrix

Data and information collected in the initial phase of the study is summarized within the following selection matrix, developed to assist in the selection of final corridor alternatives. Through the results of this matrix, preliminary corridors 2 and 5 were selected for continued study.

Corridors	Preliminary Corridor Feasibility			Action
	Public Comment	Cultural & Archeological Feasibility	Preliminary Engineering Feasibility	
Corridor 1	Generally Against Issues - At-grade railroad crossing & Phipps park access.	No Significant Instances	No apparent or significant issues	Discontinue Study of this Corridor
Corridor 2	**Generally Positive Issues - Proximity to Phipps Park and Ironwood access.**	**No Significant Instances**	**No apparent or significant issues**	**Continue with further study**
Corridor 3, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 3, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 4A, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 4A, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 4B, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 4B, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 5	**Generally Positive Issues - Possible impacts to Ironwood.**	**No Significant Instances**	**No apparent or significant issues**	**Continue with further study**

Engineering Feasibility

The focal point of this study was to evaluate project feasibility from a technical or engineering perspective (i.e. cost, safety, design considerations, potential impacts, etc.) as well as the level of public support for such a facility. The evaluation of engineering feasibility was limited to a review and assessment of existing data, preliminary geometric design, and potential project costs.

The range and scope of the Corridor Alternatives considered for this study are explained herein, including a summary of the applicable geometric design standards, right of way standards, typical section (lanes / widths), location alternatives, and possible phasing of alternatives, as well as an opinion of probable construction cost.

Minimum geometric design standards for a collector road as defined by the American Association of State Highway and Transportation Officials (AASHTO) *"A Policy on Geometric Design of Highway and Streets", 2001* and by the City of Billings and Yellowstone County Subdivision Regulations design standards were used for the development of the corridors, and are summarized herein:

- **Roadway Type** Collector Road
- **Design Speed** 35 mph (Max)
- **Rate of Vertical Curve, Sag** K = 49 (Min)
- **Rate of Vertical Curve, Crest** K = 29 (Min), based on SSD
- **Horizontal Curve** R = 500-ft (420-ft Min at *e* = 4.0%)
- **Road Grade** 7.0% (Max)
- **Rate of Superelevation** 4.0% (Max)

The recommended minimum right-of-way width for a collector road as stated within City of Billings and Yellowstone County approved standards is 80-feet, 40-feet each side of centerline. Additional right of way width will be necessary in areas where large cuts or fills result in construction limits beyond minimum desirable widths. For the purpose of this study, right-of-way limits were assumed to be at a typical 80-ft collector section, and to extend beyond this section to the probable limits of cut and fill, as necessary.

The transportation facility studied for this project is a two-lane collector type roadway to be constructed with 14-ft driving lanes, 10-ft parking lane/shoulder areas, and concrete curb, gutter, and sidewalk on both sides. This section is consistent with the City of Billings and Yellowstone County standard designs. The standard typical section was modified through the "rim" crossing to provide for a more economical section.

Preliminary corridor alternatives were developed and selected based on historical data, landowner comments, and general terrain constraints. Evaluation of the preliminary corridors centered on public comment, instances of historical/cultural/archeological significance, and issues related to topography, existing or proposed developments, existing transportation corridors, utilities, and preliminary design and constructability.

Through the results of the preliminary engineering and historical/cultural/archeological analyses, through discussions with the BNSF railroad, Conoco Pipeline Company, and area landowners, and through public comment, only Corridors 2 and 5 were selected for further study. Both

Corridor 2 and Corridor 5 share a common rim crossing located adjacent to the BNSF railroad, and share a common corridor towards Highway 3. Based on these two corridors and the common rim crossing, 3 final study alternatives were developed, and are described herein as *Rail Corridor Alternative 1*, *Rail Corridor Alternative 2*, and *Rail Corridor Alternative 3*.

- **Rail Corridor, Alternative 1** - Rail Corridor Alternative 1 consists of a two-lane collector road beginning at a point along Molt Road located between the BNSF railroad overpass and the entrance to the Ironwood Subdivision. The corridor would continue northerly along a shared property line until reaching the BNSF railroad alignment, at which point the corridor would parallel the railroad alignment as both alignments approach the base of the rims. As the railroad turns and continues towards a tunnel through the rims, the collector corridor would diverge from the railroad and continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3.

- **Rail Corridor, Alternative 2** - Rail Corridor Alternative 2 consists of a two-lane collector road beginning at a point along Molt Road located between the BNSF railroad overpass and the entrance to the Ironwood Subdivision. The corridor would continue northerly then easterly along a shared property line towards the base of the rims. The corridor would continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3.

- **Rail Corridor, Alternative 3** - Rail Corridor Alternative 3 consists of a two-lane collector road beginning at the existing Ironwood Subdivision entrance (Ironwood Drive), and would immediately turn northerly towards the northern subdivision limits. The corridor would then turn easterly along a shared property line towards the base of the rims. The corridor would continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3. Development of this corridor would make use of the current Ironwood Drive intersection, precluding the need for an additional intersection to Molt Road.

It should be noted that detailed roadway alignments are not recommended in this report, as any final alignment development would be part of more detailed alignment study. Corridors alternatives studied as part of this feasibility study adequately represent the expected costs for a planning level evaluation of this type. Possible phasing of the corridor alternatives was considered in terms of discrete and common segments between the corridors that could be considered separately for implementation through construction phasing.

- **Collector Corridor Segment 1** - From Molt Road to the common boundary of T1N R24E Section 24 and T1N R25E Section 19.

- **Collector Corridor Segment 2** - From the common boundary of T1N R24E Section 24 and T1N R25E Section 19 to the top of the rims

- **Collector Corridor Segment 3** - From the top of the rims to Montana Highway 3

The “no-build” alternative is not explicitly analyzed within this feasibility study. Although not specifically analyzed, a no-build alternative can be assumed in that a collector road would not be constructed, resulting in a zero cost.

Economic Feasibility

Assuming a project is feasible in terms of constructability, the economic parameters of a project are the crux of the overall feasibility study, as these parameters tend to lend the greatest influence towards future decisions regarding the continued development of a project. The parameters used in this analysis are listed below.

- Alternative Corridors Evaluated - 3 corridors
- Analysis Period - No analysis period was assumed for this study.
- Construction Costs - based on year 2002-2003 average bid tabs
- Right-of-Way Costs - based on year 2003 land values
- Potential Funding Sources

Probable construction quantities and costs were assumed based on preliminary layouts, standard typical sections, and historical material costs.

A 15 % contingency factor was applied to all planning level cost opinions for each of the corridor alternatives.

Costs related to possible engineering design and construction-engineering services were estimated as a percentage of the total construction costs.

Maintenance and operations costs were not considered towards the evaluation of the corridor alternatives, although these costs should be anticipated.

Opinions of probable project costs, based on right-of-way, construction, miscellaneous items, contingencies, and pre-construction are summarized below. Each corridor alternative has been segmented for comparison.

Rail Corridor, Alternative 1				
	Segment 1 Molt Road to Rims	**Segment 2 Rim Crossing**	**Segment 3 Rims to Highway 3**	**Total Corridor**
Length of Segment (Estimated)	4725 ft (0.895 MI)	3246 ft (0.615 MI)	7456 ft (1.412 MI)	15428 ft (2.922 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$2,276,409	$1,017,174	$2,181,299	$5,474,882
Right of Way [4]	$76,473	$37,704	$51,198	$165,375
Subtotal	**$2,352,882**	**$1,054,878**	**$2,232,497**	**$5,640,257**
Cost per Mile	**$2,629,252**	**$1,715,883**	**$1,580,953**	**$1,930,293**

Rail Corridor, Alternative 2				
	Segment 1 Molt Road to Rims	Segment 2 Rim Crossing	Segment 3 Rims to Highway 3	Total Corridor
Length of Segment (Estimated)	4241 ft (0.803 MI)	3251 ft (0.616 MI)	7456 ft (1.412 MI)	14948 ft (2.831 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$1,968,539	$1,107,517	$2,181,299	$5,257,355
Right of Way [4]	$93,903	$37,704	$51,198	$182,805
Subtotal	**$2,062,442**	**$1,145,221**	**$2,232,497**	**$5,440,160**
Cost per Mile	**$2,567,718**	**$1,859,971**	**$1,580,953**	**$1,921,598**

Rail Corridor, Alternative 3 [5]				
	Segment 1 Molt Road to Rims	Segment 2 Rim Crossing	Segment 3 Rims to Highway 3	Total Corridor
Length of Segment (Estimated)	3671 ft (0.695 MI)	3251 ft (0.616 MI)	7456 ft (1.412 MI)	14378 ft (2.723 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$1,733,651	$1,192,267	$2,181,299	$5,107,217
Right of Way [4]	$328,682	$38,631	$51,198	$418,511
Subtotal	**$2,062,333**	**$1,230,898**	**$2,232,497**	**$5,525,728**
Cost per Mile	**$2,966,253**	**$1,999,120**	**$1,580,953**	**$2,029,200**

[1] All estimates are based on local and MDT 2002/2003 bid-tab material costs and dollars

[2] Excavation/Embankment volume adjusted upward to account for excavation from Segment 2

[3] Excavation/Embankment volume adjusted downward to account for embankment to Segment 1

[4] Estimates derived from local advertised real estate listings

[5] Cost does not include modifications to Ironwood Drive or a new Ironwood subdivision access point

Conclusion and Recommendations

The purpose of the analysis presented in this report was to evaluate the feasibility of developing a transportation link between Molt Road and MT Highway 3 northwest of Billings based on constructability, probable cost, and a first level environmental screening.

The Federal Highway Administration recognizes three definitions of feasibility to be evaluated in studies depending on the specific purpose of the analysis: the degree to which a given alternative mode, management strategy, design, or location is *economically justified*, the degree to which such an alternative is considered *preferable from an environmental or social perspective*, and the degree to which eventual *construction and operation* of such an alternative can be *financed or managed.* For this study, elements of the second and third criteria apply. Using these definitions, the environmental and social justification for the project is demonstrated for the preliminary Corridors 2 and 5 as a result of recommendations in approved local planning documents, received public comment, and the lack of historical and archeological instances within the corridors.

The analysis presented within this study has demonstrated that: 1) the proposed collector corridor alternatives are feasible from a preliminary engineering analysis in that the final study alternatives can successfully traverse the area; 2) the historical and archeological screening process did not identify any instances or "fatal flaws" that would preclude advancement of the final corridor alternative; 3) the proposed collector corridor alternatives are preferable from a social perspective as it minimizes impact to the Echo Canyon area and the Ironwood subdivision as well as using an existing transportation corridor (the BNSF railroad); and that 4) the proposed collector corridor is consistent with community goals and plans.

Based on the results of this study, continued development of a collector corridor through the area is considered feasible from and engineering and environmental standpoint.

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Molt Road/Highway 3 Collector Road Planning Feasibility Study

I. STUDY AUTHORIZATION / PURPOSE / NEED

A. Study Authorization

This feasibility study was authorized through a funding agreement between the Montana Department of Transportation and the Billings City-County Planning Department and through authorization from the local Technical Advisory Committee (TAC) and the Policy Coordinating Committee (PCC). Authorization to proceed with the study was granted through a contract dated January 23, 2003 between the Billings City-County Planning Department (the Metropolitan Planning Organization) and HKM Engineering Inc.

The study was funded and administered by the Billings City-County Planning Department through support from the City of Billings and Yellowstone County work programs. Portions of these work program funds are authorized through the Montana Department of Transportation and the Federal Highway Administration each fiscal year beginning October 1.

B. Study Purpose

The purpose of this study is to satisfy recommendations made by the *West Billings Plan* to perform an engineering feasibility study for the purpose of evaluating the development of a collector corridor between Molt Road (S 302) and MT Highway 3 (N-53) northwest of Billings, generally located in Township 1 North Range 24 East, Section 24 and Township 1 North Range 25 East Sections 19 and 20. The study also serves to provide continued input towards implementation recommendations made within the *Billings Urban Area 2000 Transportation Plan* and the *City of Billings and Yellowstone County 2003 Growth Policy*.

This study is intended to provide a review and assessment of available information, to solicit public comments and opinions, to perform a planning level construction and right-of-way cost analysis, and to complete a cultural and archeological survey of the proposed corridors as a means of determining the planning feasibility of developing a collector road corridor. A detailed economic evaluation including a benefit / cost analysis comparing direct user benefits (travel time savings, accident reduction) to project costs (construction, operation, maintenance) was not performed as a part of this study, as the economic feasibility is expected to be reviewed and discussed by the City of Billings and Yellowstone County, as needed.

C. Project Need

Several considerations demonstrate the need and desire to develop an engineering feasibility study as the first step towards the continued development of a collector route between Molt Road and MT Highway 3, including:

- Continued and steady growth in the northwest portion of the Billings urban area at a rate typically greater than has historically exhibited by Billings proper

- Continued development within and adjacent to the proposed study area

- Development of a transportation corridor that improves north-south linkage, provides an additional rim crossing, develops access and mobility within the immediate area, and affords improved emergency vehicle access

- Development of a transportation corridor suitable for the interconnection of utilities between the upper and lower portions of the Billings urban area currently separated by the rimrocks

- To satisfy recommendations for continued study through approved local planning documents including the 2000 Billings Urban Area Transportation Plan, the 2001 West Billings Plan, and the 2003 City of Billings and Yellowstone County Growth Policy.

II. PROJECT LOCATION / BACKGROUND

A. Project Location

The general location for the Molt Road/Highway 3 Collector Feasibility Study is situated northwest of the Billings urban area and wholly within Yellowstone County, Montana. The project study area is located in Township 1 North Range 24 East Section 24 and Township 1 North Range 25 East Sections 19 and 20. The overall area is generally rural in nature. The northern portion of the study area can be characterized as dry land agricultural located above the sandstone rimrocks. The southern portion of the study are can be characterized as both agricultural and residential interlaced by dry drainage channels subject to 100-year storm events.

The study area, as defined by the project scope, is bounded to the south by Molt Road and to the east by MT Highway 3. A Burlington Northern Santa Fe railroad line traverses the western portion of the study area while a Conoco petroleum pipeline bisects Section 19 along a southwest to northeast alignment. Continuation of the collector road outside of this area is not anticipated or planned. The study area encompasses areas of residential development in various stages and undeveloped dry agricultural land. The location includes a portion of the Billings Rimrocks, a sandstone bluff formation that forms the northern boundary of Billings and the Yellowstone Valley.

A key physical characteristic of Billings is the sandstone “Rimrocks”, which consist of large sandstone bluffs rising up from the valley floor along the northern edge of Billings proper, excluding Billings Heights. This rim formation creates a natural barrier between the lower valley and the upper dry lands located above the rims. Currently, there are three transportation routes that traverse these bluffs: Zimmerman Trail, North 27th Street (MT Highway 3), and Airport Road. The lack of north to south continuity within the City of Billings and the geographic constraints caused by the sandstone rimrocks has necessitated the need for the development of additional rim crossings.

Two arterial streets traverse the immediate area: Molt Road (S-302) and MT Highway 3 (N-53). Major transportation links adjacent to the study area include 62nd Street West and Rimrock Road.

Currently, the area northwest of Billings is experiencing tremendous residential growth, seeing growth rates that are often double that of the City of Billings.[1]

The general location of the study area relative to the City of Billings is shown on Figure 1.

B. Project Background

The development of a new road west of Zimmerman Trail and across the Billings rimrocks has been an element of local transportation plans for over 26 years. In 1977, the Billings Transportation Plan Update first identified the area between Montana Highway 3 and the existing railroad alignment as the most desirable location for the development of such a link. Each subsequent Plan update has included some discussion of and recommendations for this particular link, including the most recent 1990 and 2000 Transportation Plans. More recently, the 2003 Yellowstone County and City of Billings Growth Policy, as well as the 2001 West Billings Plan, included discussion and recommendations to study the engineering feasibility of developing a corridor between Molt Road and MT Highway 3.

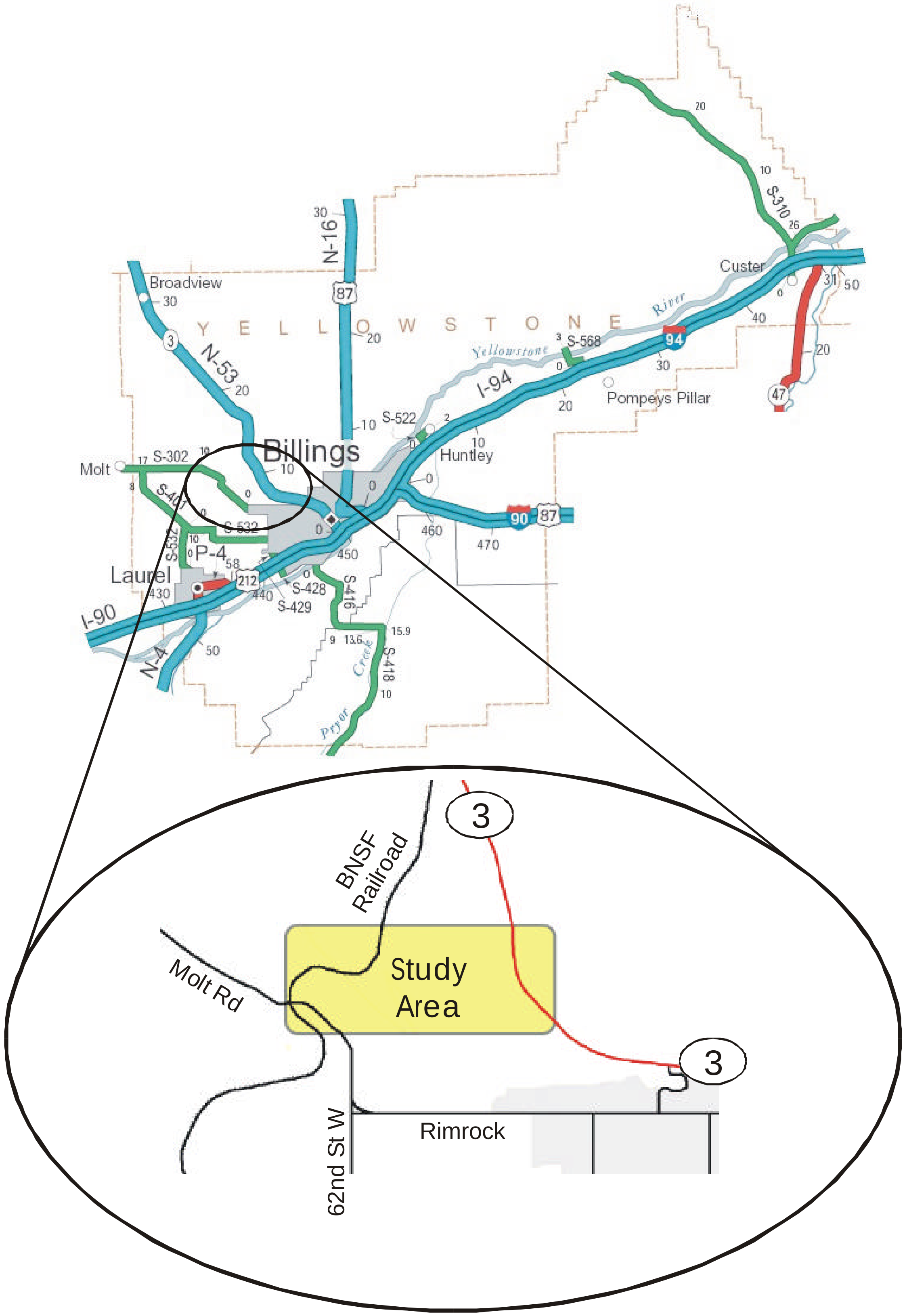
There have been a number of previous studies, documents, and reports that relate to a transportation link either in this area or at this location. The most recent documents to discuss the proposed transportation link are as follows:

- Outer Belt Loop Traffic Study, Marvin & Associates/HKM Engineering Inc., 1987
- Billings Urban Area 2000 Transportation Plan
- West Billings Plan, 2001
- Ironwood Subdivision, Subdivision Improvement Agreement, September 2001
- By-Pass Traffic Study and Addendum, Marvin & Associates, December 2001
- City of Billings and Yellowstone County Growth Policy, 2003

Based on these studies, documents, and reports, and due to continued development within the study area, the Billings City-County Planning Department opted to proceed with a feasibility study to evaluate the engineering and technical feasibility of developing a future transportation corridor within the proposed study area.

[1] "West Billings Plan", City of Billings and Yellowstone County, Montana, 2001

Figure 1. Project Location and Study Area



III. STUDY APPROACH / MANAGEMENT

A. Study Approach

The purpose of this planning-level feasibility study is to provide a review and assessment of available information, to solicit public comments and opinions regarding the various study corridors, to perform a planning level construction and right-of-way cost analyses, and to complete a planning level cultural and archeological survey of the proposed corridors. More detailed evaluations of the cost, environmental concerns, and benefit of continuing development of the road will be performed by subsequent projects, as needed. Upon the completion of these tasks, the study will provide conclusions based on the feasibility of developing a corridor between Molt Road and MT Highway 3. The City of Billings Planning staff will make recommendations towards a specific corridor based on the results of this study.

The areas of interest for this engineering feasibility study revolve around the following key project tasks, which are discussed in more detail throughout this report.

- Collection and Review of Existing Information
- Public Comment and Opinion
- Cultural and Archeological Survey
- Engineering Design Feasibility
- Planning Level Opinion of Cost
- Conclusions and Recommendations

B. Study Management

This feasibility study was developed in close consultation with a project *Steering Committee*, whose goal was to oversee the development of the study, to review the results of individual tasks, and to provide technical direction, as required. The steering committee for this project consisted of the following organizations and individuals:

Table 1. Project Steering Committee

Yellowstone County	Public Works Department
City of Billings	Vern Heisler, PE City Engineer David D. Mumford, PE Public Works Director
Billings City - County Planning Department	Ramona Mattix, AICP Director, Zoning Coordinator W. Scott Walker, Transportation Planner

Additionally, area landowners within the project limits were afforded an opportunity to contribute to the development of the study. Landowner representatives, as identified through Yellowstone County tax records, were contacted and consulted regarding the development of preliminary corridor alternatives.

IV. AVAILABLE INFORMATION

A. Background Traffic Volumes

The Billings urban planning boundary, as identified by the Billings Urban Area 2000 Transportation Plan, encompasses the entire corridor study area, which is further contained within the Shiloh Northwest neighborhood planning area. Average Annual Daily Traffic (AADT) volumes as reported in the approved *Ironwood Subdivision Traffic Accessibility Study* by Engineering Inc. and the *2001 Northwest Bypass Location Transportation Evaluation* by Marvin & Associates report link volumes within the study area for Molt Road at 1000 to 1100 vehicles per day (vpd), respectively, at a point just north of Rimrock Road. The *2001 Northwest Bypass Location Transportation Evaluation* reported AADT volumes for Montana Highway 3 of 2200 vpd adjacent to the study area and 3000 vpd just west of Zimmerman Trail. The increase in volume along MT Highway 3 can be accounted for through trips generated by the Indian Cliffs Estates subdivision located east of the study area and west of Zimmerman Trail. By comparison, the Montana Department of Transportation reported 3 year AADT's for MT Highway 3 south of Broadview of 1530 vpd in 2000, 1529 vpd in 2001, and 1552 vpd in 2002.

The *2001 Northwest Bypass Location Transportation Evaluation* also reported an AADT for 62nd Street West just south of Rimrock Road of 500 vpd.

B. Traffic Accidents

Traffic accident data was not collected or analyzed for this project.

C. Planning Documents

The following approved planning documents either recommend the continued study of, or the further development of, a link between Molt Road and MT Highway 3:

1. Billings Urban Area 2000 Transportation Plan
2. West Billings Plan, 2001
3. City of Billings and Yellowstone County 2003 Growth Policy

Based on these studies, further development of a transportation corridor was deemed justified by the City-County Planning Department, the City of Billings, and Yellowstone County.

D. Existing Traffic Studies

The engineering firm of Marvin & Associates developed the two most recent reports related to the proposed link: one in 1987 in conjunction with HKM Engineering Inc., and one in December 2001. Both reports are provided in Appendix C of this study

The 1987 traffic study was prepared as a part of an "Outer Belt Loop" planning process. Although an outer belt loop plan has since been discontinued, the 1987 traffic evaluation concluded the following points regarding a connection between Molt Road and MT Highway 3:

- Construction of a "connection road" (between Molt Road and MT Highway 3) would probably not be feasible prior to the year 2000 due to low travel demands (low volumes).

- That a "road would be a vital part of the (Billings) street system by 2010 even if the Outer Belt Loop were not built".

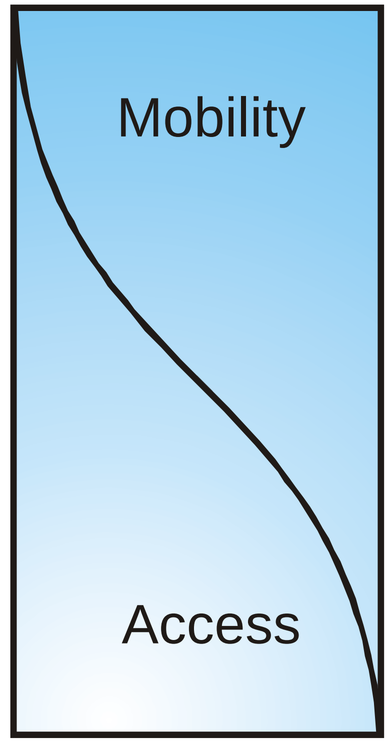
- Recommended "a method of reserving the necessary right-of-way" for a future road between Molt Road and MT Highway 3.

Based on a QRS (Quick Response System) traffic model of the Billings area, and assuming a high-speed-access-controlled Outer Belt Loop scenario, a steady Billings area growth rate, and a year 2010 Billings population of 150,000 residents, the studies identified a 1985 potential demand of an "Outer Belt Loop" connection road within the Molt Road/Highway 3 study area of 930 ADT (average daily traffic or vehicles per day), a 1995 potential demand of 1160 ADT, and a 2010 potential demand of 5170 ADT. In retrospect, it was noted that the demand predicted by this report was high, as historical growth rates for Billings did not meet expected predictions.

Subsequent to the submittal of the 1987 study and prior to the 2001 study, local planners abandoned the concept of a "belt-loop" in favor or a "by-pass" or Arterial concept. The December 3, 2001 study, commissioned by the Billings City-County Planning Department, reviewed two possible arterial corridors between Molt Road and MT Highway 3; Alternate Route "E" and Alternate Route "W". Alternate "E" was situated east of the BNSF railroad and west and north of the Yellowstone County Club, and was assumed to connect to MT Highway 3 approximately 1.5 miles south of Alkali Creek Road. Alternate "W" was located west of the BNSF railroad alignment connecting to Molt Road approximately 1-mile west of Alternate "E" and connected to Highway 3 at Alkali Creek Road, or approximatly1.5 miles north of an Alternate "E" intersection. The routes were evaluated using an updated QRS II traffic model of the Billings area with specific refinements to the study area for the arterial concept. Each alternate was modeled based on a high-speed, access-controlled arterial facility. Based on this model, the study reported a year 2021 ADT for Alternate "E" to be approximately 2193 ADT and for Alternate "W" to be approximately 1607 ADT. The study concluded that neither an "East" nor a "West" corridor would function well as a high-speed, limited access arterial based on anticipated traffic volumes and assumed area developments. The study also illustrated the principle that traffic demand decreases as transportation links are placed further away from existing development or population areas (sometimes referred to as the "Gravity Theory" of traffic demand).

As a result of conclusions of the 2001 study, the Billings City-County Planning Department requested an Addendum that would revisit the higher demand Alternate "E" corridor and to investigate the application of a collector road functional classification over an arterial road functional classification.

The Institute of Transportation Engineers (ITE) defines the basic functional classes of roadways based on the level of mobility or access that particular roadway provides, as illustrated in the figure to the right. Roadway facilities where mobility is of paramount importance are located near the top of the graph, whereas roadway facilities where greater access is of paramount importance and mobility is sacrificed are located near the bottom of the graph. Based on this relationship, ITE defines functional road classes in descending order of mobility as Highways, Arterials, Collectors, and Local roads and/or Cul-de-sacs. As such, the Billings City-County Planning Department requested that a link between Molt Road and MT Highway 3 be modeled as a collector road by assuming low-speeds (35 mph or less), better connectivity, and more local access.



Within ITE's functional classification system, a collector road allows greater local access at the expense of overall mobility

Based on these criteria, the QRS II traffic model was modified to include better access opportunities and a 35 mph posted speed. The new model predicted that a collector road would attract a year 2021 demand of roughly 1150 ADT at its intersection with Highway 3. This value represents a nearly 50% decrease in the number of vehicles predicted to use the link than was predicted if the link functioned as a high-speed, limited access arterial. Although reduced, it was noted by the addendum that this demand was still within the functional bounds of a collector road. Discussions with Marvin & Associates noted that this anticipated demand does include traffic from the planned Ironwood Subdivision located on the southern end of the study area, and that roughly 80% of the vehicles anticipated to utilize the collector road corridor would be residents of that subdivision.

The December 2001 study and subsequent addendum demonstrated that a corridor located closer to Billings (Alternate "E") would attract and serve more demand than a corridor located further west and away from Billings (Alternate "W"), and that an Alternate "E" route would function adequately as a collector street. Conclusions of the December 2001 study addendum stated that an Alternate "E" route would "*not function well as a bypass route*", and as a collector street it would "*have the potential to carry a level of traffic appropriate for its function*". The study continued by noting that a link in this area would "*provide the desirable connectivity through the proposed subdivision (Ironwood) and allow an appropriate interface with future subdivisions*".

Based on these traffic studies, the continued study of a Molt Road to Highway 3 corridor was deemed justified by the jurisdictional agencies.

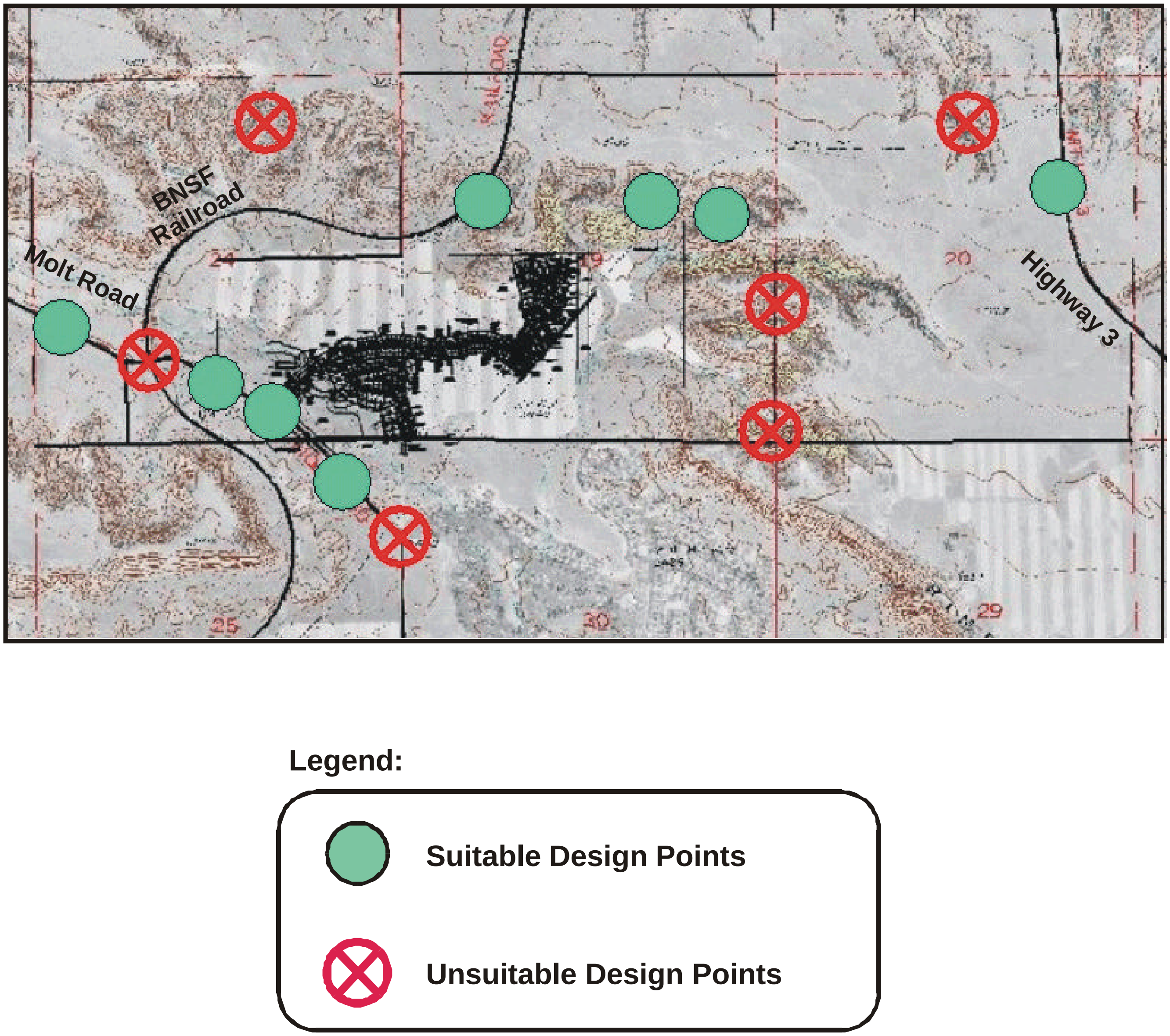
V. PRELIMINARY ENGINEERING FEASIBLITY

The focus for this study is to develop and evaluate multiple corridor alternatives by developing a “range” of likely alternatives for the purpose of performing a "screening level" analysis of the corridor. Potential preliminary corridors for the Molt Road/Highway 3 collector road were developed based on field reviews, available data and through meetings with the MPO, the project steering committee, and meetings with adjacent landowners. Individual landowner meetings were held to facilitate discussion on the project, to collect landowner opinions and comments regarding the study area, and to establish any areas of concern within the project study area from a landowner's perspective. The discussion items and subsequent results of these meetings were used to evaluate initial project impacts and the preliminary feasibility of the project.

Coordination meetings with the project steering committee and landowners within the study area were conducted throughout the initial phase of the study development. Initial steering committee and MPO meetings served to define the project study area, provide input towards chronological events and historical data relative to the project, and to provide guidance towards possible preliminary corridor locations. Based on this information, topographical maps of the study area, complete with ownership boundaries and available subdivision platting, were created for presentation to the study area landowners. Landowners were contacted based on ownership information collected from Yellowstone County.

In an effort to develop viable preliminary corridor alternatives, the project team personally met with or conducted telephone interviews with a representative or representatives of each parcel that could be directly influenced by a possible corridor route within the prescribed study area. At each meeting or interview, the participants were given the opportunity to voice concerns and to provide input into the preliminary corridor selection process. Through these discussions and based on known physical, topographical, or geographic constraints, a range of viable “design points” were selected for continued study. These points, depicted on Figure 2 as circles, represent the culmination of the many MPO, steering committee, and landowner meetings. These points include: four (4) Molt Road intersection points, three (3) rim crossing locations, and one (1) Highway 3 intersection. Also identified are areas that precluded corridor development, either due to geographical or topographical constraints, planned development, or safety concerns (as indicated by the X's). Based on these points, 5 preliminary corridor alternatives ranging in distance from 3.01 miles to 2.23 miles were developed for public consideration and comment. Plan depictions of each of the preliminary corridors are provided in Appendix A of this document.

Figure 2. Preliminary Study Points



VI. PUBLIC INVOLVEMENT

Public comment and opinion regarding the various aspects of this engineering feasibility study were considered towards the final corridor development, including landowner coordination, a public meeting, a project web site, newspaper articles, and various other avenues for public comment. The following list describes the public involvement activities and comment opportunities to date. Newspaper articles related to either the study area or the specific project are included in Appendix E of this report.

A summary of the public involvement for this study is as follows:

- March through August, 2003 — Landowner Coordination and Discussions
- May 27, 2003 — Public Informational Meeting Invitations
- June 3, 2003 — Billings Gazette, article and meeting notice
- June through August, 2003 — Project Informational Web Site
- June 16, 2003 — Cultural Survey Permission Letters
- June 4, 2003 — Public Information Meeting #1
Wednesday, June 4, 7:00 PM
Arrowhead Elementary School
Attendance: ± 140 people
- May 23, 2004 — Billings Gazette, meeting notice
- May 30, 2004 — Billings Gazette, meeting notice
- June 3, 2004 — Public Information Meeting #2
Thursday, June 3, 5:30 PM
Arrowhead Elementary School
Attendance: ± 40 people

The initial public informational meeting was conducted by HKM Engineering Inc. and the Billings City-County Planning Department on Wednesday, June 3, 2003. Information discussed at the meeting included a history of the project, a discussion of the project scope, and a presentation of the initial study corridors for public consideration. Although contentious at times, the comments received through the open forum portion of the meeting provided invaluable input towards the final corridor selections.

A second and final public informational meeting was conducted by the Billings City-County Planning Department with assistance from HKM Engineering Inc. on Thursday, June 3, 2004. This meeting served to present and discuss the findings of the corridor study, City staff recommendations regarding the alternative corridors, and solicited final public input. The meeting was attended by approximately 40 individuals representing the general public, adjacent landowners, and the project representatives. Public comment received and discussed at the meeting included issues related to lighting, noise, roadway function (arterial verses collector), and speed. Specific discussion items included recommendations for landscaping and berms to reduce audio and visual impacts to the surrounding neighborhoods.

Public comments and opinions received throughout the course of the project regarding the preliminary corridor alternatives ranged the spectrum from negative to positive. Based on these comments, Corridors 2 and 5 were identified as the most popular corridors as they minimized impacts to both the Echo Canyon area located west of the project area and the Ironwood subdivision located within the project study area, and provided for a future rim crossing adjacent to an existing transportation corridor (the BNSF railroad). A summary of this evaluation is presented in a corridor feasibility matrix, Table 2.

VII. RAILROAD AND UTILITY COORDINATION

The project study area contains an existing Burlington Northern Santa Fe (BNSF) railroad alignment within Sections 24 and 19. This railroad alignment encompasses a curvilinear route that follows the general terrain towards a tunnel through the rims within Section 19. The BNSF railroad owns right-of-way at 100-ft either side of the railroad centerline throughout the study area except for an area above the tunnel, which is easement. Through discussions with BNSF, it was determined that a collector corridor parallel to the existing railroad alignment and right-of-way would be acceptable. Any encroachment into the railroad right-of-way would be acceptable on the condition that any encroachment would not impact the rail and that an easement would be negotiated. Based on these criteria, Corridor 1 would have the most impact to the railroad, as this corridor would require an at-grade railroad crossing.

Bisecting both the project study area and the Ironwood subdivision is a high-pressure petroleum pipeline operated by the Conoco Pipeline Company. As of the completion of this study, Conoco does not have any information regarding the exact depth of the line, although they believe that the line is between 4 to 5 feet deep on average, based on standard construction practices. Construction of a road above the existing line would most likely require relocation of the line due to required road grades compared to the existing pipeline location. Based on these criteria, Corridor 3, Corridor 4A Option 1, and Corridor 4B Option 2 could be affected by the location of this petroleum line.

The Billings Public Utilities Department (PUD) is in the process of planning the development of a water storage tank to be located within Section 20. Moreover, Billings PUD would like to develop a water main through the study area for the purpose of connecting existing systems above the rims with systems below the rims in an effort to "connect a loop", and provide redundancy in the area's water system. It is anticipated that none of the preliminary corridors will impact this planned utility development, although some coordination between a transportation and utility corridor is advisable.

Railroad or utility instance are noted in the corridor feasibility matrix, Table 2.

VIII. ENVIRONMENTAL FEASIBLITY

A planning level environmental analysis was performed within the study area through the development of a cultural and archeological survey of the corridor alternatives. It should be noted that the need for more specific environmental analysis could be necessary towards the continued development of a corridor through this area. Any additional environmental studies and evaluations would be part of future project development efforts. Although there does not appear to be any obvious environmental "fatal flaws" within the study area beyond those identified by the cultural and archeological survey, environmental issues would need to be examined as part of any detailed location study and environmental analysis.

A. Cultural and Archeological Feasibility

The purpose of the cultural and archeological survey was to identify any cultural, historical, or archeological instances that could preclude further development of a particular corridor alternative. The cultural resource consulting firm of Ethnoscience Inc. was retained to collect all available background information within and near the project site, and to perform a cultural and archeological survey within the study area.

Background information was obtained as either file information or by direct solicitation from the resource agencies. The following resource agencies were contacted for this study.

> <u>Montana Historical Society, State Historic Preservation Office (SHPO</u>) – SHPO conducted a file search for cultural and historic sites within and adjacent to the project limits. Previous studies were identified by SHPO providing information regarding cultural, historical, and archeological site information within and adjacent to the project study area.
>
> <u>Crow Cultural Committee, Cultural Representative</u> – The Crow Cultural Committee was contacted regarding the project to determine if any Crow cultural concerns were located within or adjacent to the project area. The Crow Cultural Committee did not respond to any of the projects inquiries.

Upon completion of an available records search, a pedestrian field survey of the study area was performed to identify instances of historical, cultural, and archeological significance within the rim crossings and upper dry land areas of the preliminary corridors. A survey of the lower valley area (Ironwood subdivision) was not performed, as permission to enter onto this property could not be obtained. Due to surface and subsurface disturbances within the Ironwood subdivision boundaries associated with years of dry land farming and with current housing construction activities, and due to the lack of sites identified through a background search of this area, it was determined by HKM and the MPO that this area could be excluded from the cultural and archeological study. Although excluded, continued development of a Molt Road to Highway 3 corridor may require a future survey of the full corridor.

As a result of the survey, various instances of historical, cultural, and archeological significance were identified relative to the preliminary corridor locations, including several instances that were determined not to be significant, and therefore not eligible for historical recognition and protection. Each instance identified and recorded by the survey had been previously documented by Montana SHPO. No new instances of historical, cultural, and archeological significance were located by the survey.

Each of the preliminary corridor locations was evaluated considering the locations of these instances, and was either removed from further evaluation due to the location of these instances, or was evaluated further due to the lack of cultural sites. Based on this evaluation, Corridor 1, Corridor 2, and Corridor 5 did not contain any instances of concern, and contained only one instance a site not eligible for recognition. Preliminary engineering analyses indicate that a final design alignment could avoid this ineligible site almost entirely.

Conclusions of this evaluation are presented in the corridor feasibility matrix, Table 2.

B. Land Use and Zoning

All current zoning in the study area was determined based on Yellowstone County zoning maps provided by the Yellowstone County GIS and Yellowstone County Board of Planning.

Land use in the study area is largely agricultural and with some areas of residential development. Residential land use areas will probably be impacted depending on a final corridor selection. Development of a corridor through the area is not anticipated to directly impact any existing residential structures.
The majority of land in the study area is undeveloped dry land with an Agricultural Open zoning classification. The southern portion of the study area (CS 3030 Tract 2) is partially platted as the Ironwood Subdivision Phase 1, and consists of developed and undeveloped Residential zoning classifications (R-9600). Yellowstone County zone maps indicate that portions of T1N R25E Section 19 are zoned Residential R-15000. Typically, T1N R25E Section 19 N1/2 and SW1/4, and T1N R25E Section 20 are agricultural in nature.

IX. PRELIMINARY FEASIBILITY MATRIX

Data and information collected in the initial phase of the study is summarized within the following selection matrix, developed to assist in the selection of final corridor alternatives. Through the results of this matrix, preliminary corridors 2 and 5 were selected for continued study. As these two corridors utilize a rim crossing adjacent to the BNSF railroad, the final study corridors are herein described as "Rail Corridors" and are distinguished by alternate connection points and routing alternatives.

Table 2. Preliminary Feasibility Matrix

Corridors	Preliminary Corridor Feasibility			Action
	Public Comment	**Cultural & Archeological Feasibility**	**Preliminary Engineering Feasibility**	
Corridor 1	Generally Against Issues - At-grade railroad crossing and Phipps park access.	No Significant Instances	No apparent or significant issues	Discontinue Study of this Corridor
Corridor 2	**Generally Positive Issues - Proximity to Phipps Park and Ironwood access.**	**No Significant Instances**	**No apparent or significant issues**	**Continue with further study**
Corridor 3, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 3, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 4A, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 4A, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 4B, Option 1	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Utility Issues	Discontinue Study of this Corridor
Corridor 4B, Option 2	Generally Against Issues - Impacts to Ironwood	Instances of Cultural or Archeological Significance within the Corridor	Possible Profile Issues	Discontinue Study of this Corridor
Corridor 5	**Generally Positive Issues - Possible impacts to Ironwood.**	**No Significant Instances**	**No apparent or significant issues**	**Continue with further study**

X. ENGINEERING FEASIBILITY

The focal point of this study was to evaluate project feasibility from a technical or engineering perspective (i.e. cost, safety, design considerations, potential impacts, etc.) as well as the level of public support for such a facility. The evaluation of engineering feasibility was limited to a review and assessment of existing data, preliminary geometric design, and potential project costs. Existing data available for review included project area topographical mapping, aerial photography, approved subdivision plats and subdivision improvement agreements, and approved planning documents and traffic studies related of the corridor. Limited scope field reviews to evaluate existing conditions were also completed including a preliminary review of the site and a preliminary intersection sight distance analysis.

There are a number of features that would require special consideration in the design and construction process. These items include the BNSF Railroad alignment, the BNSF railroad overpass at Molt Road, the Conoco petroleum pipeline, sight distance, 100-yr flood plains, soil conditions, and proposed roadway grades.

A planning level intersection sight distance field analysis was performed along Molt Road near the BNSF railroad overpass located between the Ironwood Drive - Molt Road intersection and Zephyr Lane - Molt Road intersection. The analysis assumed an American Association of State Highway and Transportation Officials (AASHTO) *"A Policy on Geometric Design of Highway and Streets", 2001* Case B1 scenario (left turning vehicle from a stopped condition) and a mainline speed of 65 mph[2]. Results of this preliminary field analysis indicate that a corridor intersection can be safely situated for both Preliminary Corridors 2 and 5. A more detailed sight distance analysis should be performed with the design of any new intersection to Molt Road. No sight distance evaluation was performed along MT Highway 3 as sight distances are considered adequate.

Soil conditions are expected to be acceptable throughout the project although it is likely extensive rock excavation would be necessary through the rimrocks. A detailed soil analysis should be performed as part of any continued corridor development.

While a majority of the corridors are located in undeveloped areas, it is likely that at least some utilities could be present, and would thus require special consideration. Any future design should be developed to minimize utility conflicts to the extent practical.

At the planning level, the focus of an evaluation of corridor alternatives and the engineering feasibility of those corridors is to develop a “range” of feasible alternatives and the various costs associated with those alternatives. The results of that analysis can then be utilized to evaluate the project impacts and the overall feasibility of the project. The range and scope of the Rail Corridor alternatives considered for the Molt/Highway 3 Collector Feasibility Study are explained herein, including a summary of the applicable geometric design standards, right of way standards, typical section (lanes / widths), location alternatives, and possible phasing of alternatives. An opinion of probable construction cost is presented for each alternative considered.

[2] Sight distance is a function of the distance equivalent to a time gap of 7.5 seconds necessary for a passenger car to enter major road traffic and a design speed of 65 mph. For a passenger car, the corresponding necessary sight distance is 720 feet.

A. Geometric Design Standards

Minimum geometric design standards for a collector road as defined by the American Association of State Highway and Transportation Officials (AASHTO) *"A Policy on Geometric Design of Highway and Streets", 2001* and by the City of Billings and Yellowstone County Subdivision Regulations design standards were used for the development of the corridors including design speed, minimum radii for horizontal curves, maximum grade, and vertical curvature. Roadway widths and lane configurations are also addressed and summarized herein.

Table 3. Geometric Design Standards

Roadway Type	Collector Road
Design Speed	35 mph (Max)
Rate of Vertical Curve, Sag	K = 49 (Min)
Rate of Vertical Curve, Crest	K = 29 (Min), based on SSD
Horizontal Curve	R = 500-ft (420-ft Min at *e* = 4.0%)
Road Grade	7.0% (Max)
Rate of Superelevation	4.0% (Max)

B. Right-of-Way Standards

Obtaining adequate right-of-way width is essential to accommodate the construction and maintenance of any transportation facility. The recommended minimum right-of-way width for a collector road as stated within City of Billings and Yellowstone County approved standards is 80-feet, 40-feet each side of centerline. Additional right of way width will be necessary in areas where large cuts or fills result in construction limits beyond minimum desirable widths. For the purpose of this study, right-of-way limits were assumed to be at a typical 80-ft collector section, and to extend beyond this section to the probable limits of cut and fill, as necessary. Right-of-way widths corresponding to an arterial road section were not considered as this corridor is being considered for a collector road only.

C. Typical Sections (Lanes / Widths)

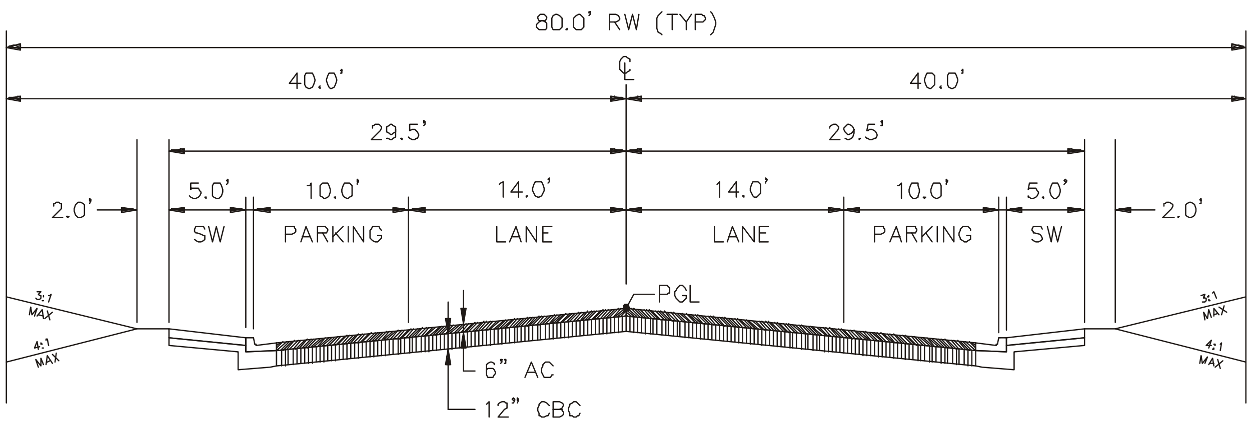
The transportation facility studied for this project is a two-lane collector type roadway to be constructed with 14-ft driving lanes, 10-ft parking lane/shoulder areas, and concrete curb, gutter, and sidewalk on both sides. This section is consistent with the City of Billings and Yellowstone County standard designs.

The standard typical section was modified through the "rim" crossing to provide for a more economical section. This modified typical more closely represents a standard Montana Department of Transportation rural road with 12-foot lanes and a typical 4-ft shoulder. No curb, gutter, or sidewalk was included in this section. Guardrail was included in areas of fill with a slope of 4:1 or steeper. Inclusion of guardrail will increase the shoulder width from 4-ft to 6-ft to accommodate for both the guardrail's installation and effectiveness.

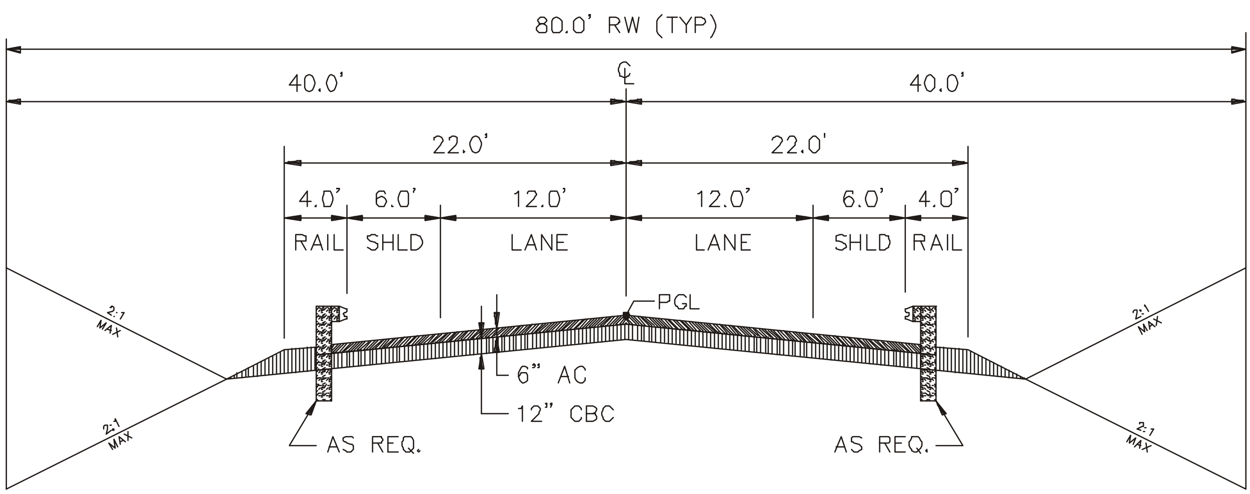
Additional design items including boulevards, landscaping, or sight/noise berms were not considered for this study, but could be included based on desire or need, or as developed through the subdivision development process.

The evaluation considers both two-lane typical sections with standard cut and fill slopes considered for all alternatives. Graphical representations of both typical sections are depicted in Figure 3.

Figure 3. Assumed Typical Sections



COLLECTOR ROAD SECTION 1



COLLECTOR ROAD SECTION 2

D. Recommendations Summary

The following table summarizes the primary design features of the alternatives based on approved City of Billings and Yellowstone County design standards and the 2001 AASHTO "A Policy on Geometric Design of Highways and Streets".

Table 4. Summary of Recommended Geometric Features

Feature	Type	Design
Geometric Design Standards	*Standard Collector (All Sections)*	• 35 mph design speed
		• 7% max grade
		• Sag Vertical Curve, K = 49 (min)
		• Crest Vertical Curve, K = 29 (min)
		• Horizontal Curve, 500-ft (min)
Right of Way	*Standard Collector (All Sections)*	• 80-ft minimum (all sections)
Access Control	*Assumed Regulated Access*	
Typical Section	*Standard Collector*	• 2-14 ft. driving lanes
		• 10-ft parking lane/shoulder
		• Curb/Gutter, Sidewalk
	Rural Two-Lane Road	• 2-12 ft. driving lanes
		• 4-ft shoulder w/o rail
		• 6-ft shoulder w/ rail
Alignment	*Preliminary corridor layout only, no specific alignment recommended*	
Phasing	*By segment only*	

E. Corridor Alternatives

Preliminary corridor alternatives were developed and selected based on historical data, landowner comments, and general terrain constraints. Evaluation of the preliminary corridors centered on public comment, instances of historical/cultural/archeological significance, and issues related to topography, existing or proposed developments, existing transportation corridors, utilities, and preliminary design and constructability. Through this evaluation process, final feasibility study corridors were identified for continued investigation.

Through the results of the preliminary engineering and historical/cultural/archeological analyses, through discussions with the BNSF railroad, Conoco Pipeline Company, and area landowners, and through public comment, only Corridors 2 and 5 were selected for further study. Both Corridor 2 and Corridor 5 share a common rim crossing located adjacent to the BNSF railroad, and share a common corridor towards Highway 3. Based on these two corridors and the common rim crossing, 3 final study alternatives were developed, and are described below as *Rail Corridor Alternative 1*, *Rail Corridor Alternative 2*, and *Rail Corridor Alternative 3*.

It should be noted that detailed roadway alignments are not recommended in this report, as any final alignment development would be part of more detailed alignment study. Corridor alternatives studied as part of this feasibility study adequately represent the expected costs for a planning level evaluation of this type.

F. Final Study Corridor Development and Phasing

This section of the report evaluates the corridor development from preliminary analysis to final analysis, development of probable costs associated with each of the final alternatives, and suggestions for possible construction phasing options. The anticipated corridor costs will be used for the economic evaluation of the corridor alternatives and are presented in greater detail within the Economic Feasibility section of this report.

The anticipated corridor costs are summarized in Tables 5, 6, and 7. Details of the separate cost components for each of the individual corridors are included in Appendix D.

Rail Corridor, Alternative 1

Rail Corridor Alternative 1 consists of a two-lane collector road beginning at a point along Molt Road located between the BNSF railroad overpass and the entrance to the Ironwood Subdivision. The corridor would continue northerly along a shared property line until reaching the BNSF railroad alignment, at which point the corridor would parallel the railroad alignment as both alignments approach the base of the rims. As the railroad turns and continues towards a tunnel through the rims, the collector corridor would diverge from the railroad and continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3.

This corridor would require an additional intersection to Molt Road located between the BNSF railroad overpass and Ironwood Drive, a section of Molt Road already considered unsafe by area residents. A planning level sight distance analysis, however, showed that over 1000 feet of intersection sight distance in both directions would be available at this location.

The anticipated length of Alternative 1 is 2.92 miles. A graphical depiction of Alternative 1 is located in Appendix B.

Rail Corridor, Alternative 2

Rail Corridor Alternative 2 consists of a two-lane collector road beginning at a point along Molt Road located between the BNSF railroad overpass and the entrance to the Ironwood Subdivision. The corridor would continue northerly then easterly along a shared property line towards the base of the rims. The corridor would continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3.

This corridor would require the same additional intersection to Molt Road as Rail Corridor Alternative 1. As previously noted, area residents already consider this section of Molt Road unsafe, although a planning level sight distance analysis showed that over 1000 feet of intersection sight distance in both directions would be available at this location.

The anticipated length of the Alternative 2 is 2.83 miles. A graphical depiction of Alternative 2 is located in Appendix B.

Rail Corridor, Alternative 3

Rail Corridor Alternative 3 consists of a two-lane collector road beginning at the existing Ironwood Subdivision entrance (Ironwood Drive), and would immediately turn northerly towards the northern subdivision limits. The corridor would then turn easterly along a shared property line towards the base of the rims. The corridor would continue upward along the terrain towards the top of the rims. Once on top, the corridor would progress easterly towards an at-grade intersection with Highway 3.

Development of this corridor would make use of the current Ironwood Drive intersection, precluding the need for an additional intersection to Molt Road. Modification to or removal of the existing Ironwood entry treatment is not anticipated to be necessary, as the corridor can be assumed to become a collector street within the Ironwood subdivision that would serve Phase III, IV, V, and an as yet unnumbered phase located in the northwest corner of the subdivision. Realignment of a portion of the existing Ironwood Drive near Molt Road may be necessary to improve operations at the intersection, requiring the completion of the northwest leg of the existing roundabout as depicted on Ironwood's proposed development mapping and the removal of the southwest leg of the roundabout.

The anticipated length of Alternative 3 is 2.71 miles. A graphical depiction of Alternative 3 is located in Appendix B.

Corridor Phasing

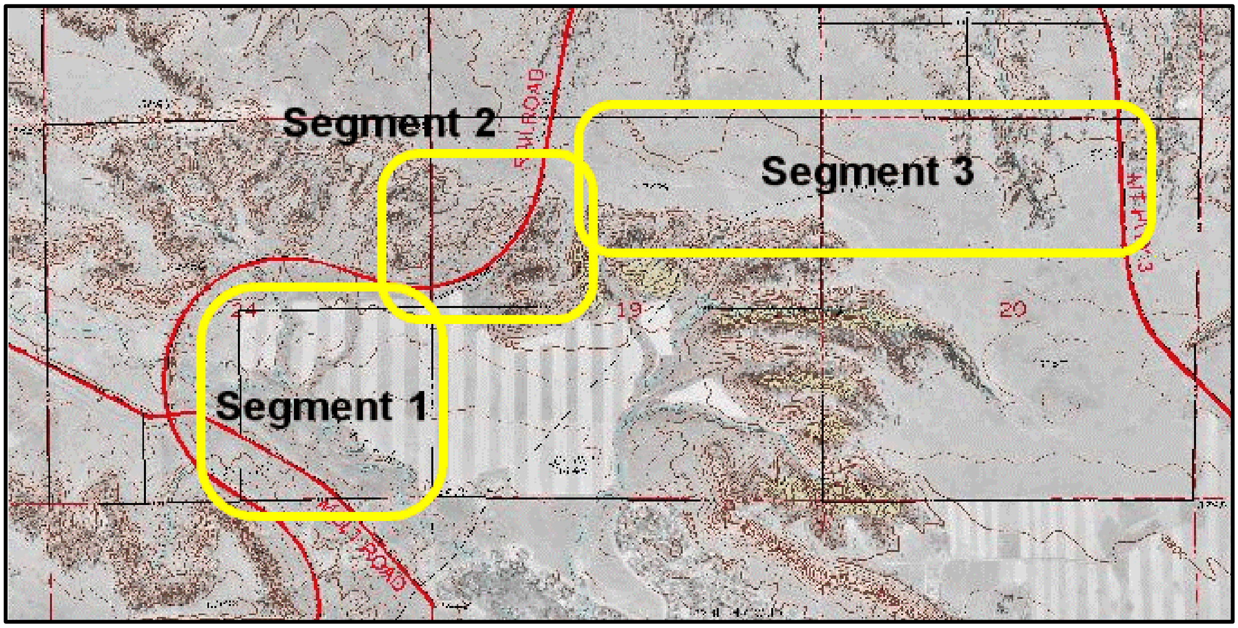
Possible phasing of the corridor alternatives was considered in terms of discrete and common segments between the corridors that could be considered separately for implementation through construction phasing. The general descriptions for each segment are described herein, and are depicted in Figure 4:

- **Collector Corridor Segment 1** - From Molt Road to the common boundary of T1N R24E Section 24 and T1N R25E Section 19.

- **Collector Corridor Segment 2** - From the common boundary of T1N R24E Section 24 and T1N R25E Section 19 to the top of the rims

- **Collector Corridor Segment 3** - From the top of the rims to Montana Highway 3

Figure 4. Potential Corridor Phasing Segments



G. No Build Alternative

Typically, a "no-build" condition forms the basis for an evaluation of alternatives by establishing the conditions against which the build alternatives can be compared. Since this project was scoped to evaluate a specific mode and linkage based on previous studies including the *Billings Urban Area 2000 Transportation Plan*, the *West Billings Plan*, and the *2003 Growth Policy*, as well as the *2001 Marvin & Associates Northwest By-Pass Transportation Evaluation* and subsequent addendum, the “no-build” alternative is not explicitly analyzed within this feasibility study. Although not specifically analyzed, a no-build alternative can be assumed in that a collector road would not be constructed, resulting in a zero cost.

XI. ECONOMIC FEASIBILITY

Economic feasibility typically focuses on the economic benefits and economic costs associated with the development and long term operations of an engineering project. The economic feasibility of a project is generally determined based on the results of a benefit-cost (B-C) analysis and a resulting B-C ratio, which compares the value of economic benefits to the value of economic costs. A specific benefit to cost ratio was not developed for this study, as this level of economic analysis was considered not necessary at this time. As the project is considered necessary and worthwhile for the Billings community, the MPO determined that project cost would be the only economic factor considered for this particular study.

A. Economic Study Parameters

Assuming a project is feasible in terms of constructability, the economic parameters of a project are the crux of the overall feasibility study, as these parameters tend to lend the greatest influence towards future decisions regarding the continued development of a project. The parameters used in this analysis are listed below.

- Alternative Corridors Evaluated - Three (3) study corridor alternatives were evaluated beginning at Molt Road and generally proceeding in a northeasterly to easterly direction and connecting with Montana Highway 3. An urban collector road was used for the level of roadway development as detailed within approved City of Billings and Yellowstone County subdivision regulations. Routing was influenced by length, probable rim crossings, and impacts. Phasing of the route was considered assuming some portions of the road could be realized through developer construction or contributions.

- Analysis Period - No analysis period was assumed for this study. All costs are assumed in present dollars.

- Construction Costs - Average 2002 and 2003 MDT and City of Billings bid prices for similar project elements were used to estimate possible construction costs for the various alternative corridors. Due to the planning level nature of this study, various aspects of the possible construction costs were assumed based on similar construction projects. Costs include materials, mobilization, preliminary and construction engineering, and contingencies.

- Right-of-Way Costs - Current market values (2003) for land within, adjacent to, or near the project study area were used to estimate right-of-way costs. The extent of right-of-way that may be required was estimated based on preliminary horizontal and vertical layouts, typical roadway sections, and assumed excavation/embankment limits corresponding to a level of development consistent with a planning level document of this type. Although current market values were used, land values in this area fluctuate wildly, and care should be taken when estimating future right-of-way costs during the decision process.

- Potential Funding Sources - The identification of potential funding and funding sources are vital towards the continued development of any engineering project. Although not a inclusive list, possible funding sources as identified by the 2000 Billings Urban Area Transportation plan that could be utilized towards the continued development of this route include Surface Transportation Program Hazard Elimination Funds (STPHS) and State Fuel Tax Funds (City and County). Additional funding could be realized through the Surface Transportation Program Urban Funds (STPU) and developer contributions and construction. Project funding and funding sources are not specifically considered in this study.

B. Cost Evaluation

Planning level project development costs have been estimated for each of the alternative corridors. The following sections define the basic costs used to estimate the planning level opinions of cost, including project planning, pre-construction, right of way, and construction. As this study is a review of engineering feasibility, and not overall feasibility, maintenance and operational costs were not included in the development of the corridor cost analyses, although costs related to these activates can be expected. The cost evaluations are based on recent MDT and City of Billings bid tabulations, local projects, and other data, and include the following items:

Right of Way

Right-of-way limits were based on preliminary construction limits and typical right-of-way widths to establish total right-of-way areas. Costs for the acquisition of right-of-way are based on a cross sectional sampling of current market values for Agricultural and Residential land uses adjacent to the corridor study area.

Construction

Probable construction quantities and costs were assumed based on preliminary layouts, standard typical sections, and historical material costs.

Earthwork estimates (excavation and embankment) were based on USGS quad maps (20-foot contours) and preliminary alignments within each of the corridor alternatives. Volumes of excavation and embankment were extracted from 25-foot cross sections, assumed cut and fill slopes, and using the "average end area" method of volume estimation. Each alternative was evaluated further by segmenting the corridor assuming construction phasing and applying shrink/swell factors based on assumed soil conditions. Segments 1 and 3 used a shrink factor of 27%, while Segment 2 used a swell factor of 10%. Moreover, excessive excavation from Segment 2 was applied to embankment needs of Segment 1. Segment 3 exhibited a balance between excavation and embankment. It should be noted that the continued engineering development of a final corridor would result in a more accurate depiction of earthwork volumes assuming better mapping, a final alignment, and a final typical section or sections.

No bridge structures are necessary for any of the alternative corridors, although some drainage structures are anticipated in Segment 1 of each of the 3 corridor alternatives. Quantities were developed based on estimated crossing lengths and a per linear foot cost. General drainage costs were estimated based on a per mile drainage cost for local projects in similar terrain conditions, although Segment 2 of each corridor could expect a greater cost verses Segments 1 and 3 due to the general topography. A more detailed hydrological analysis would be necessary during any continued engineering development.

Surfacing Costs for each of the alternative corridors was based on assumed and continuous subsurface conditions throughout the corridor. A riding surface was estimated using a section of 0.5 ft. of Plant Mix Bituminous Surfacing and 1.0 ft. Crushed Base Course. Estimates of seal, prime, and tack were also included.

Miscellaneous Costs (traffic control, roadside development, erosion control, fencing, etc.) were considered as miscellaneous construction costs and estimated as a percentage of the major items. Probable intersection costs were not included in the development of the construction cost estimate, although some cost would be incurred to connect to Molt Road and/or to Highway 3. It is assumed that these costs are included in the miscellaneous cost item.

Contingencies

A 15 % contingency factor was applied to all planning level cost opinions for each of the corridor alternatives.

Pre-construction Costs (Engineering Design) and Construction Engineering

Costs related to possible engineering design and construction engineering services were estimated as a percentage of the total construction costs.

Maintenance Costs

Maintenance and operations costs were not considered towards the evaluation of the corridor alternatives, although these costs should be anticipated.

C. Opinion of Probable Project Costs

Opinions of probable project costs, based on right-of-way, construction, miscellaneous items, contingencies, and pre-construction are summarized below. Each corridor alternative has been segmented for comparison.

Table 5. Rail Corridor, Alternative 1 Economic Evaluation

Rail Corridor, Alternative 1				
	Segment 1 Molt Road to Rims	**Segment 2 Rim Crossing**	**Segment 3 Rims to Highway 3**	**Total Corridor**
Length of Segment (Estimated)	4725 ft (0.895 MI)	3246 ft (0.615 MI)	7456 ft (1.412 MI)	15428 ft (2.922 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$2,276,409	$1,017,174	$2,181,299	$5,474,882
Right of Way [4]	$76,473	$37,704	$51,198	$165,375
Subtotal	**$2,352,882**	**$1,054,878**	**$2,232,497**	**$5,640,257**
Cost per Mile	**$2,629,252**	**$1,715,883**	**$1,580,953**	**$1,930,293**

Table 6. Rail Corridor, Alternative 2 Economic Evaluation

Rail Corridor, Alternative 2				
	Segment 1 Molt Road to Rims	**Segment 2 Rim Crossing**	**Segment 3 Rims to Highway 3**	**Total Corridor**
Length of Segment (Estimated)	4241 ft (0.803 MI)	3251 ft (0.616 MI)	7456 ft (1.412 MI)	14948 ft (2.831 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$1,968,539	$1,107,517	$2,181,299	$5,257,355
Right of Way [4]	$93,903	$37,704	$51,198	$182,805
Subtotal	**$2,062,442**	**$1,145,221**	**$2,232,497**	**$5,440,160**
Cost per Mile	**$2,567,718**	**$1,859,971**	**$1,580,953**	**$1,921,598**

Table 7. Rail Corridor, Alternative 3 Economic Evaluation [5]

Rail Corridor, Alternative 3				
	Segment 1 Molt Road to Rims	**Segment 2 Rim Crossing**	**Segment 3 Rims to Highway 3**	**Total Corridor**
Length of Segment (Estimated)	3671 ft (0.695 MI)	3251 ft (0.616 MI)	7456 ft (1.412 MI)	14378 ft (2.723 MI)
Cost Elements [1]				
Construction/Engineering [2, 3]	$1,733,651	$1,192,267	$2,181,299	$5,107,217
Right of Way [4]	$328,682	$38,631	$51,198	$418,511
Subtotal	**$2,062,333**	**$1,230,898**	**$2,232,497**	**$5,525,728**
Cost per Mile	**$2,966,253**	**$1,999,120**	**$1,580,953**	**$2,029,200**

[1] All estimates are based on local and MDT 2002/2003 bid-tab material costs and dollars

[2] Excavation/Embankment volume adjusted upward to account for excavation from Segment 2

[3] Excavation/Embankment volume adjusted downward to account for embankment to Segment 1

[4] Estimates derived from local advertised real estate listings

[5] Cost does not include modifications to Ironwood Drive or a new Ironwood subdivision access point

XII. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The purpose of the analysis presented in this report was to evaluate the feasibility of developing a transportation link between Molt Road and MT Highway 3 northwest of Billings based on constructability, probable cost, and a first level environmental screening.

The Federal Highway Administration recognizes three definitions of feasibility to be evaluated in studies depending on the specific purpose of the analysis. Those three definitions are as follows:

- The degree to which a given alternative mode, management strategy, design, or location is *economically justified*.
- The degree to which such an alternative is considered *preferable from an environmental or social perspective*.
- The degree to which eventual *construction and operation* of such an alternative can be *financed or managed.*

For this engineering feasibility analysis, elements of the second and third criteria apply. Using these definitions, the environmental and social justification for the project is demonstrated for the preliminary Corridors 2 and 5 as a result of recommendations in approved local planning documents, received public comment, and the lack of historical and archeological instances within the corridors.

The study satisfies social justification by addressing recommendations made by the *West Billings Plan*, the *Billings Urban Area 2000 Transportation Plan*, and the *City of Billings and Yellowstone County 2003 Growth Policy* to evaluate and develop a corridor between Molt Road and MT Highway 3.

Although a screening level historical and archeological analysis did identify some instances within the study area, no instances or "fatal flaws" were identified within the final study alternatives that would preclude further development.

It should be noted that a more detailed traffic study of the corridors would presumably illustrate further benefits such as travel time savings and public safety through traffic reduction along portions of Molt Road and Rimrock Road.

Based on a planning level analysis of the available data, assumed geometric design standards and typical sections, and assumptions to possible construction phasing, probable project costs range from $5.4 million to $5.6 million. These costs do not include costs related to the relocation of unknown utilities within the corridor or potential modifications to existing roads or access points.

The ability to finance the construction and operation of the collector is a function of the availability of funding, whether local or Federal. Local funding would facilitate the development of the route as a true "local" route, as commercial trucking could be restricted from using the route. Restricting commercial traffic from any future route would complement current City and County growth policies regarding how future development of the west end of the valley between Laurel and the Billings city limits is planned to proceed. Regardless, the MPO and the Billings City Council will determine the degree to which eventual construction of such an alternative can be undertaken by the City of Billings.

In conclusion, the analysis presented within this study has demonstrated that:

- The proposed collector corridor alternatives are feasible from a preliminary engineering analysis in that the final study alternatives can successfully traverse the area.

- Although the historical and archeological screening process did identified specific instances within the overall study area, the process did not identify any instances or "fatal flaws" that would preclude advancement of the final corridor alternatives.

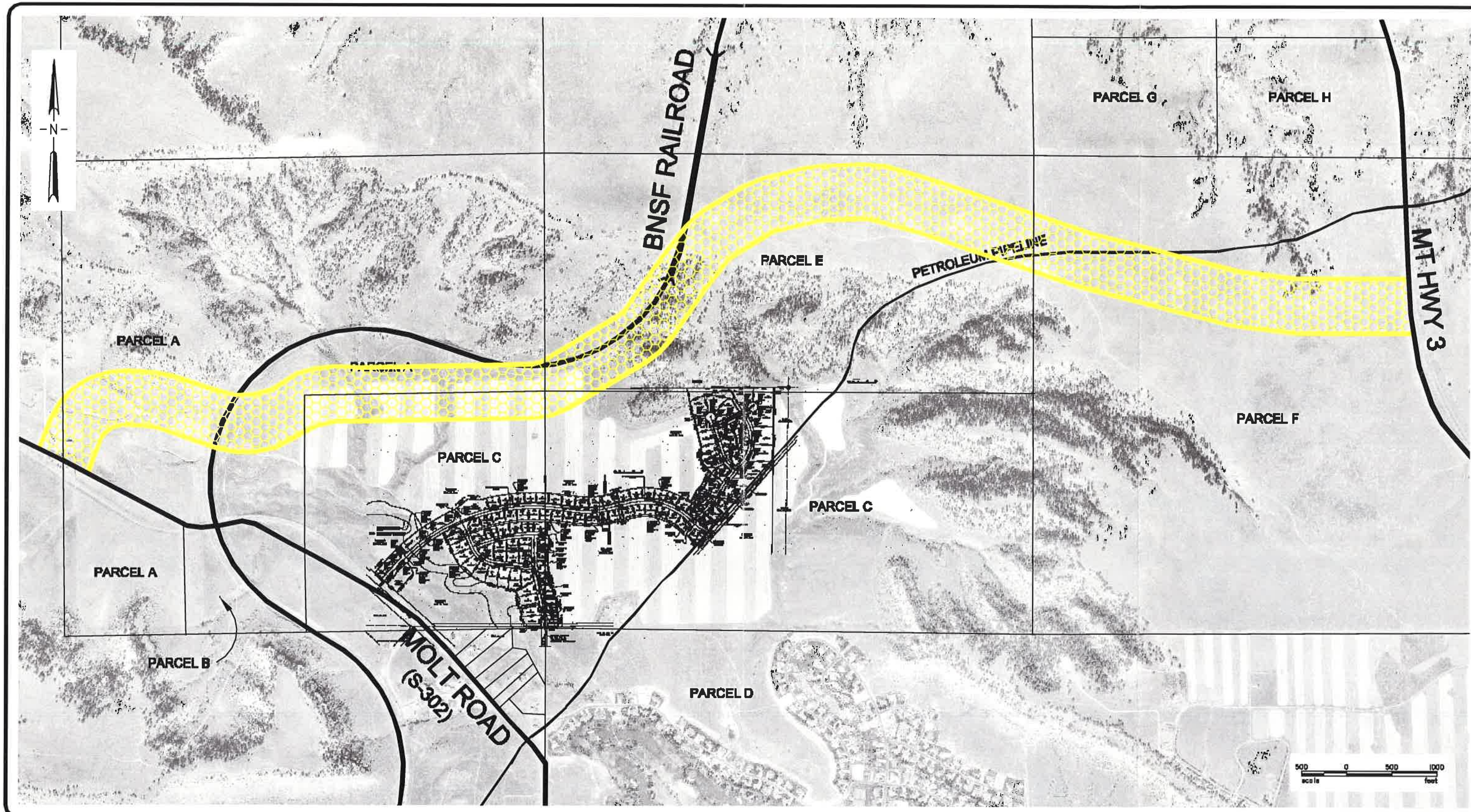
- The proposed collector corridor alternatives are preferable from a social perspective as they minimize impact to the Echo Canyon area and the Ironwood subdivision, as well as utilizing an existing transportation corridor (the BNSF railroad).

- The proposed collector corridor alternatives are consistent with community goals and plans.

B. Recommendations

Based on the results of this study, continued development of a collector corridor through the area is considered feasible from and engineering and environmental standpoint.

APPENDIX A
PRELIMINARY CORRIDOR ALTERNATIVES



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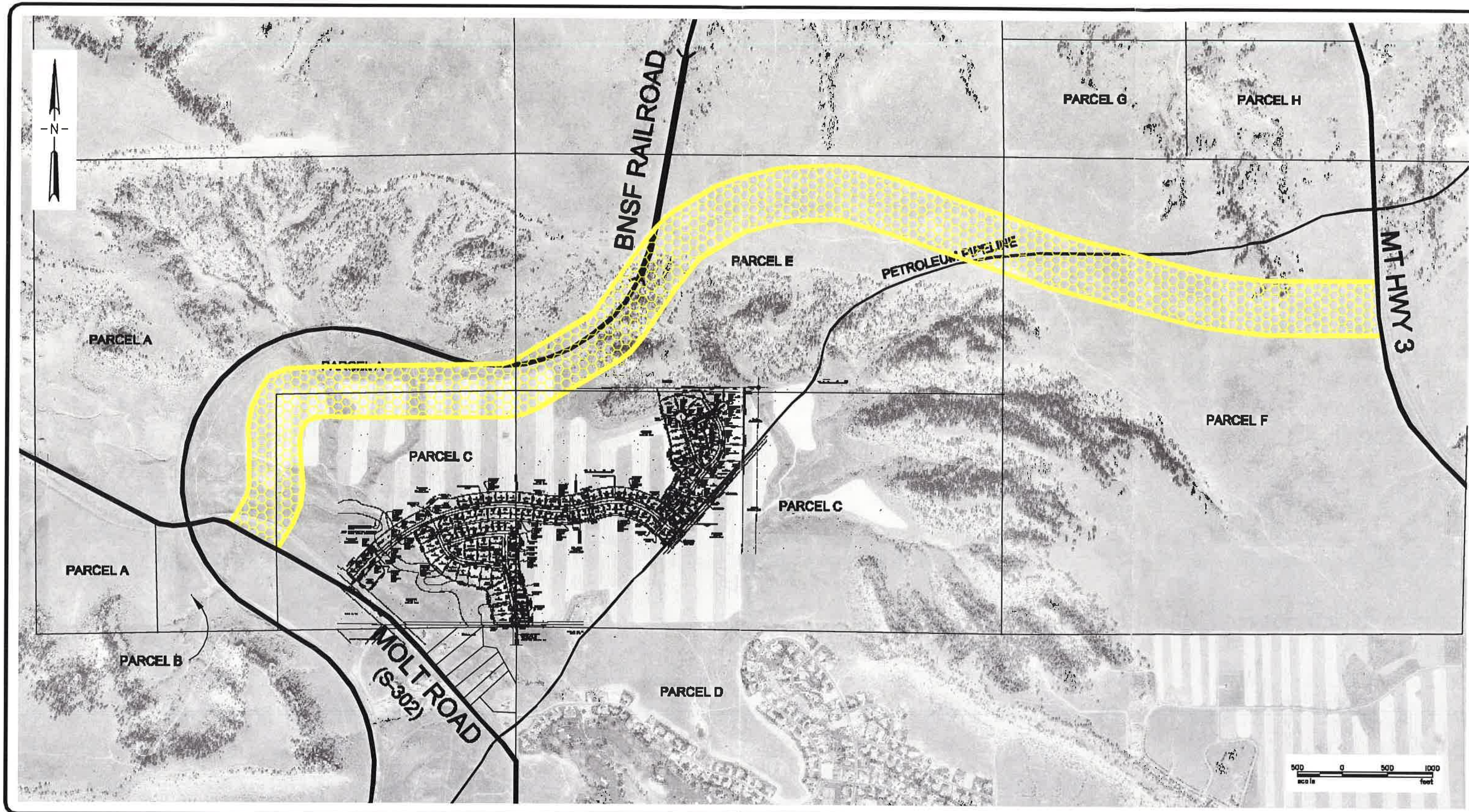
MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

PRELIMINARY STUDY CORRIDOR #1



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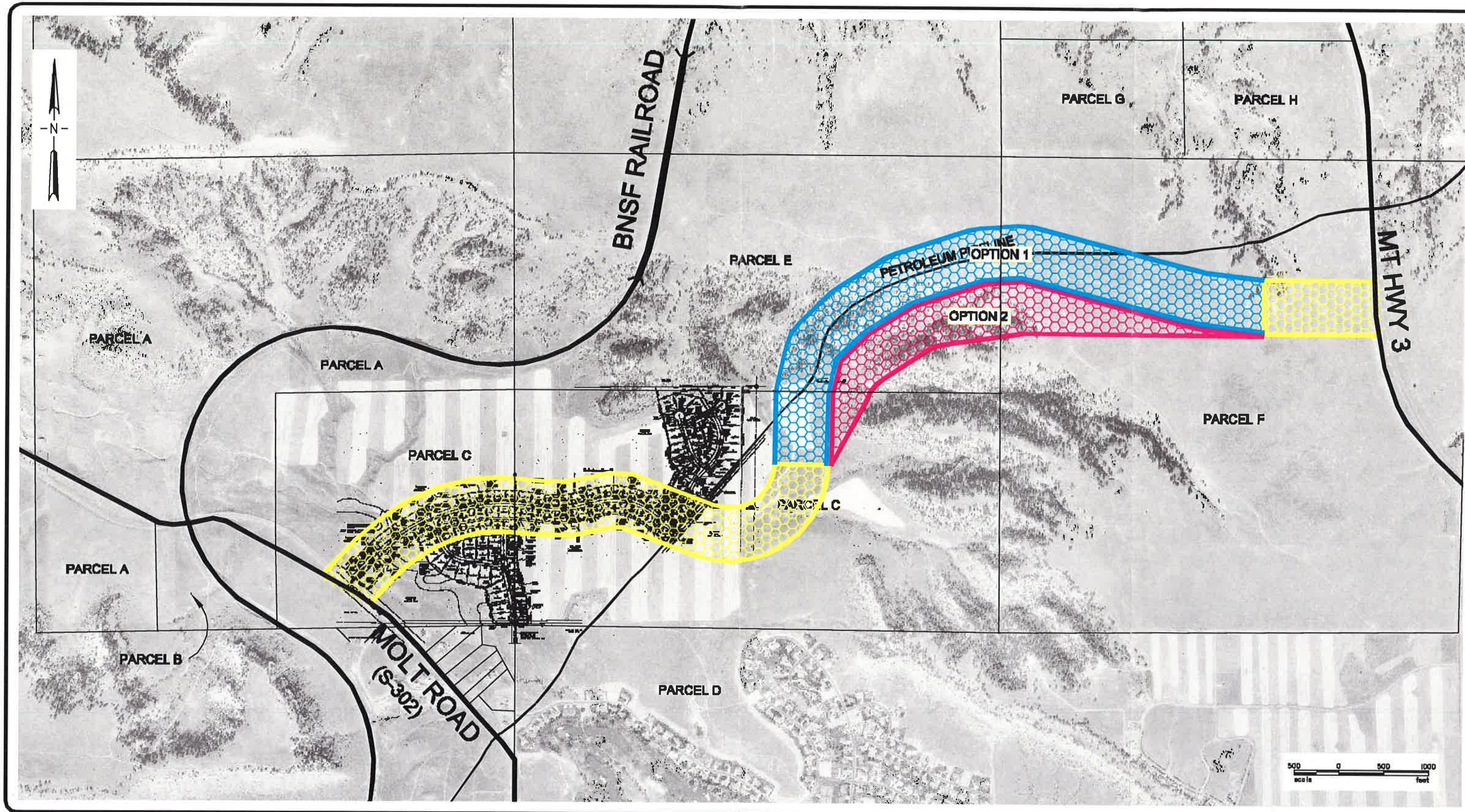
MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

PRELIMINARY STUDY CORRIDOR #2



MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

PRELIMINARY STUDY CORRIDOR #3

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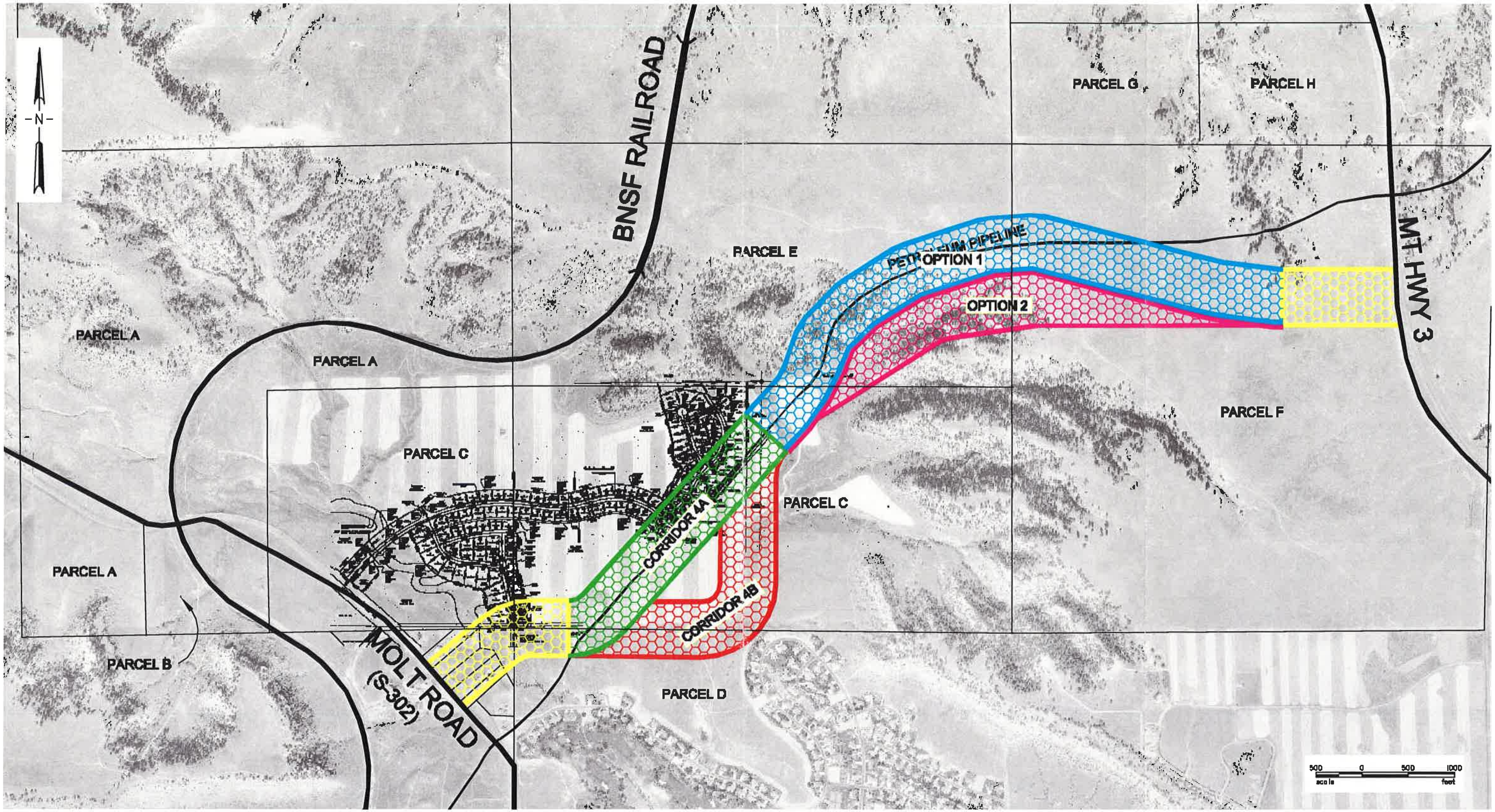

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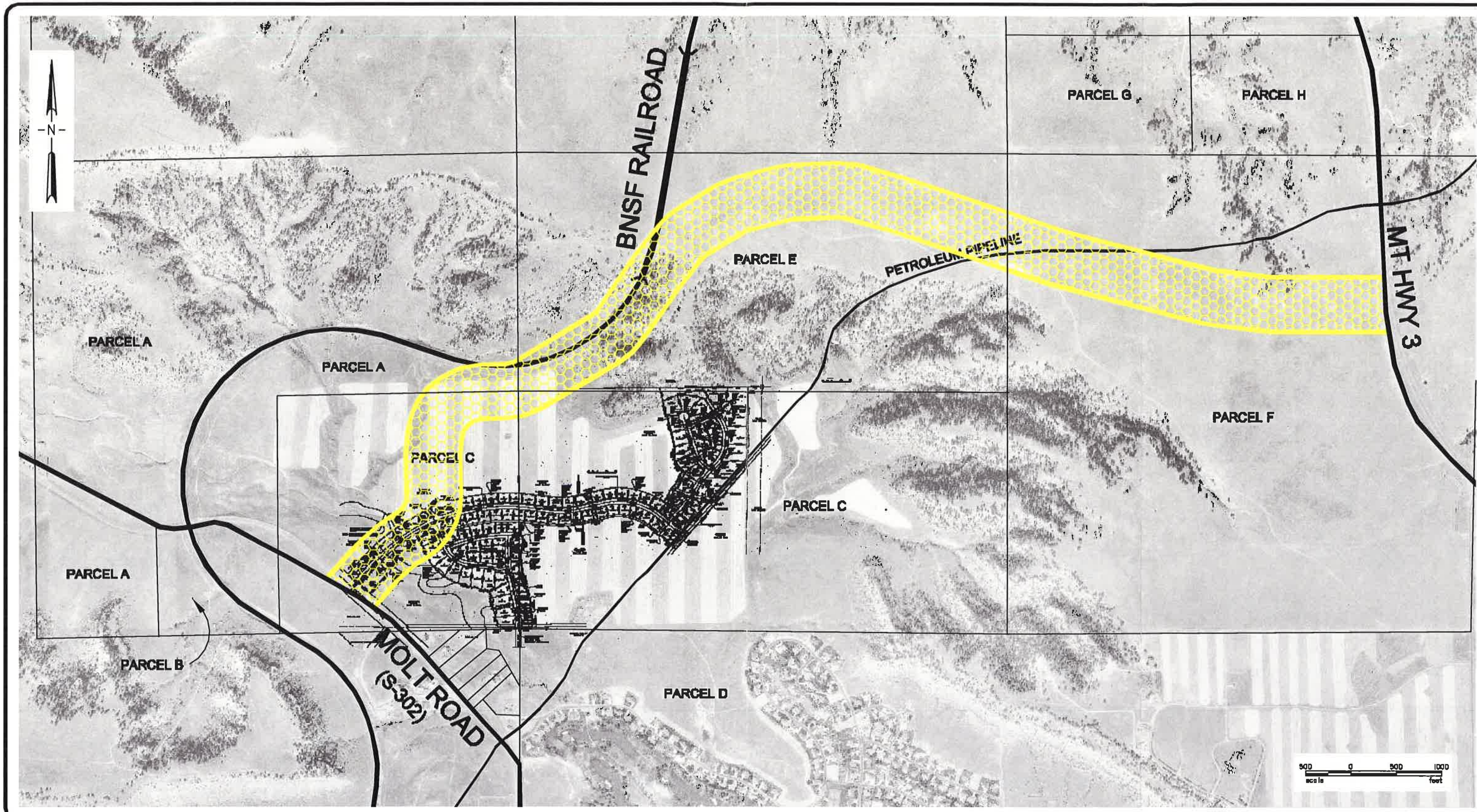
MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

PRELIMINARY STUDY CORRIDOR #4



MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

PRELIMINARY STUDY CORRIDOR #5

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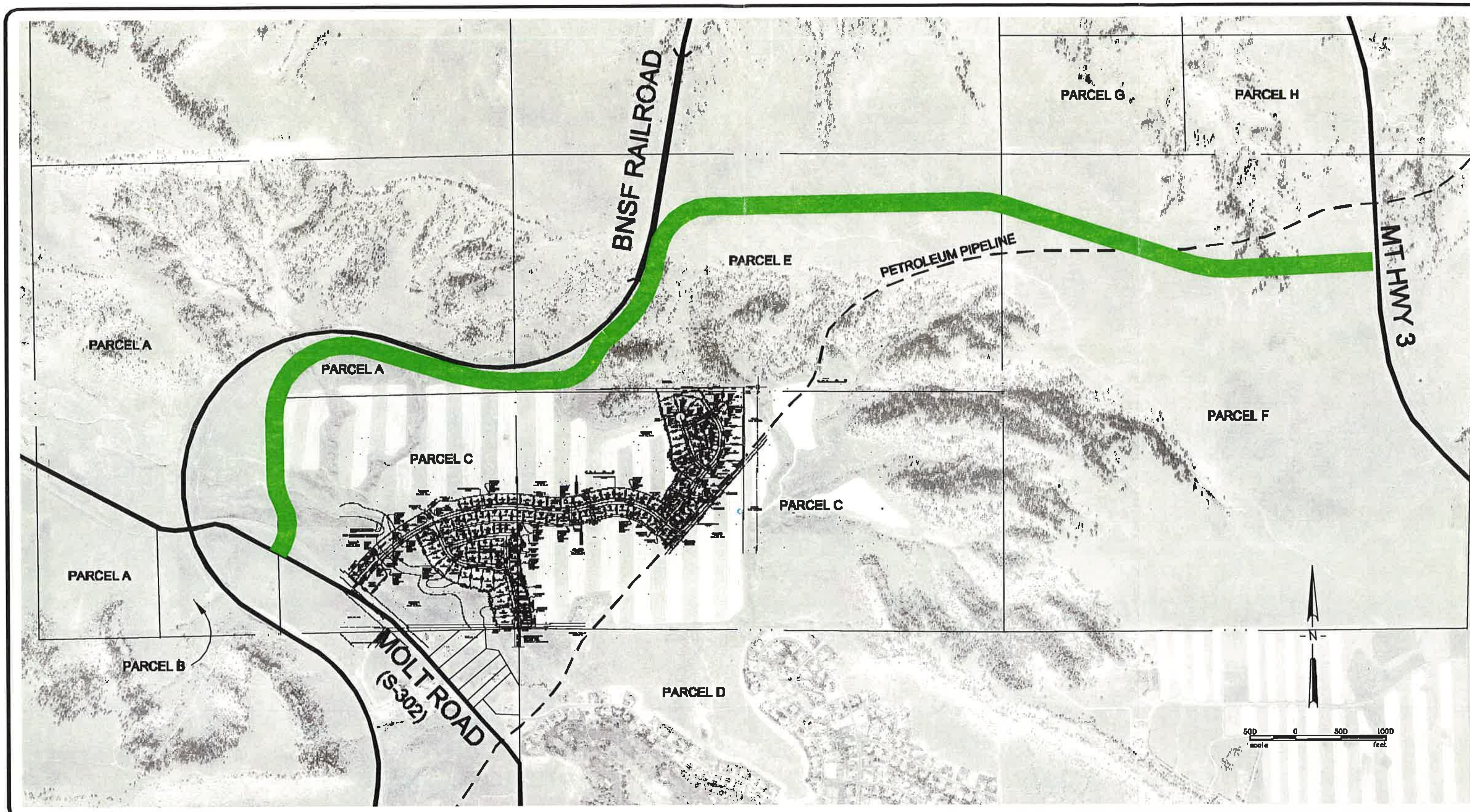
APPENDIX B
FINAL CORRIDOR ALTERNATIVES



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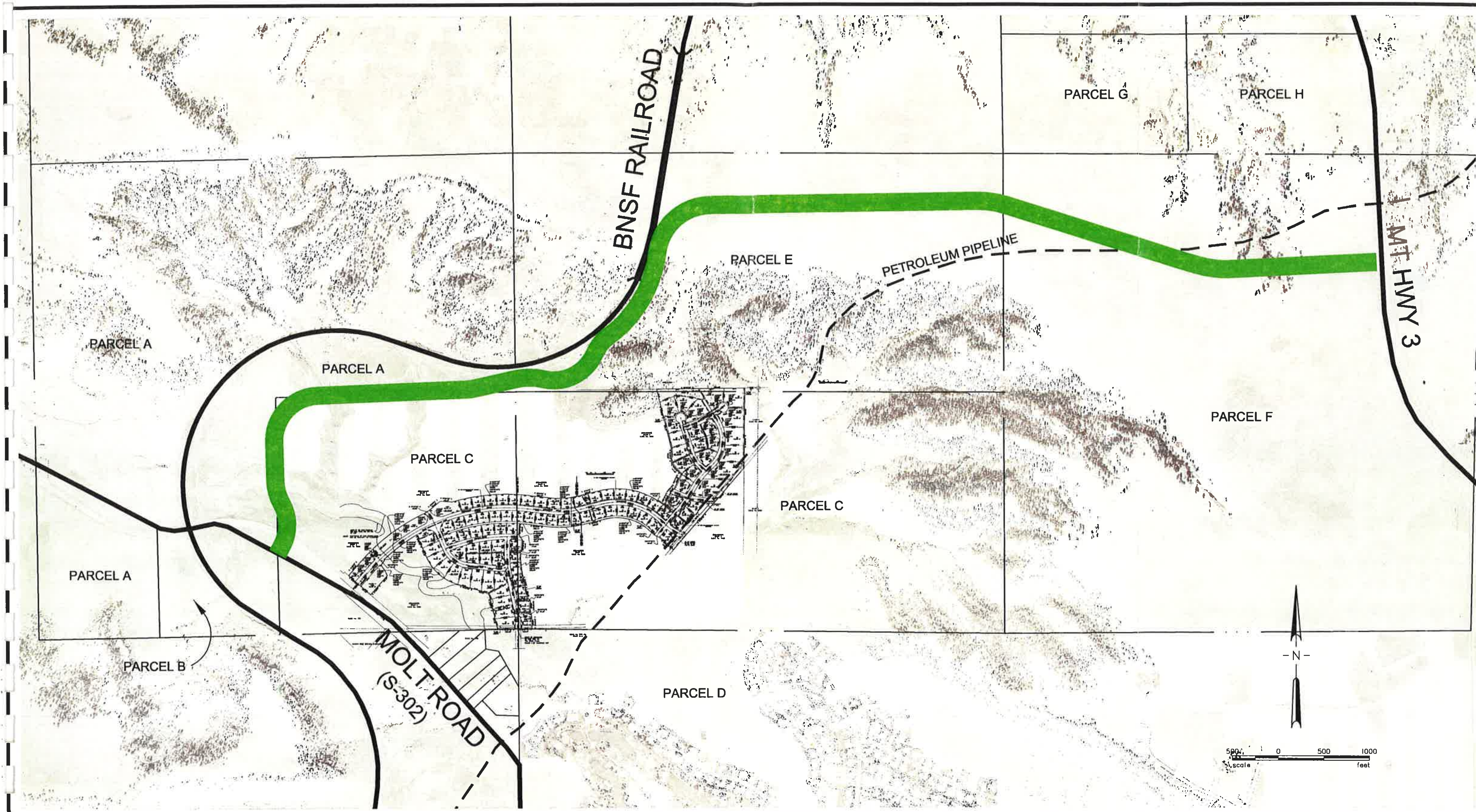
MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

RAIL CORRIDOR ALTERNATE 1



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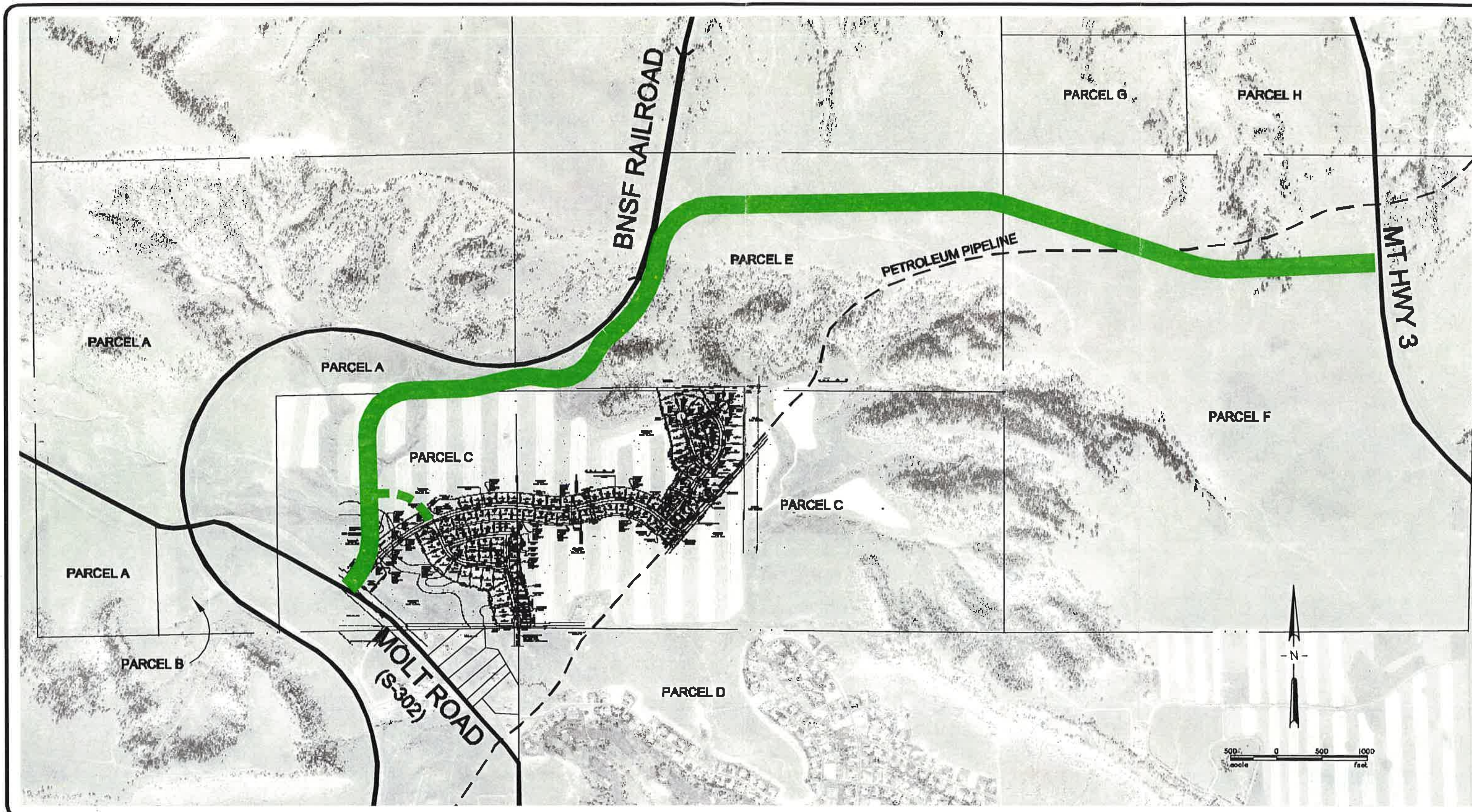
MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

RAIL CORRIDOR ALTERNATE 2



MOLT ROAD / HIGHWAY 3 COLLECTOR STUDY

RAIL CORRIDOR ALTERNATE 3

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APPENDIX C
APPROVED TRAFFIC STUDIES & REPORTS

OUTER BELT LOOP ROAD

STATE HIGHWAY #3 TO FAS 302 (MOLT ROAD)

TRAFFIC VOLUME ELEMENT

PREPARED FOR

YELLOWSTONE COUNTY COMMISSIONERS

PREPARED BY

HKM ASSOCIATES

AND

MARVIN & ASSOCIATES

APRIL 1987

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The project road is part of a future arterial street which was previously identified in the Billings Urban Area Transportation Plan. The arterial street is known as the Outer Belt Loop. It would extend from a point on U.S. Route 87 (Roundup Road) near Alexander Road to Federal Aid Secondary Route 302 (Molt Road). The project road would be located between State Highway Route 3 and FAS 302 on the western end of the Outer Belt Loop, as shown in Figure 1.

This section of roadway has long been discussed as a potential alternative truck route to relieve problems on Zimmerman Trail. At present, Zimmerman Trail (which is east of the project road) accommodates truck traffic from the north via Highway 3. The alignment and grade of Zimmerman Trail has presented numerous problems for truck traffic in the past, especially in conditions of inclement weather.

The concern for traffic safety on Zimmerman Trail along with the knowledge of future traffic growth has prompted the Yellowstone County Commissioners to study the feasibility of constructing the project roadway within the time frame of the transportation planning period. If feasible, a preliminary design could be completed within the project corridor and the necessary right-of-way could be reserved for future construction.

This report is a summary of traffic volumes and travel demand and is the initial element of a feasibility study and preliminary

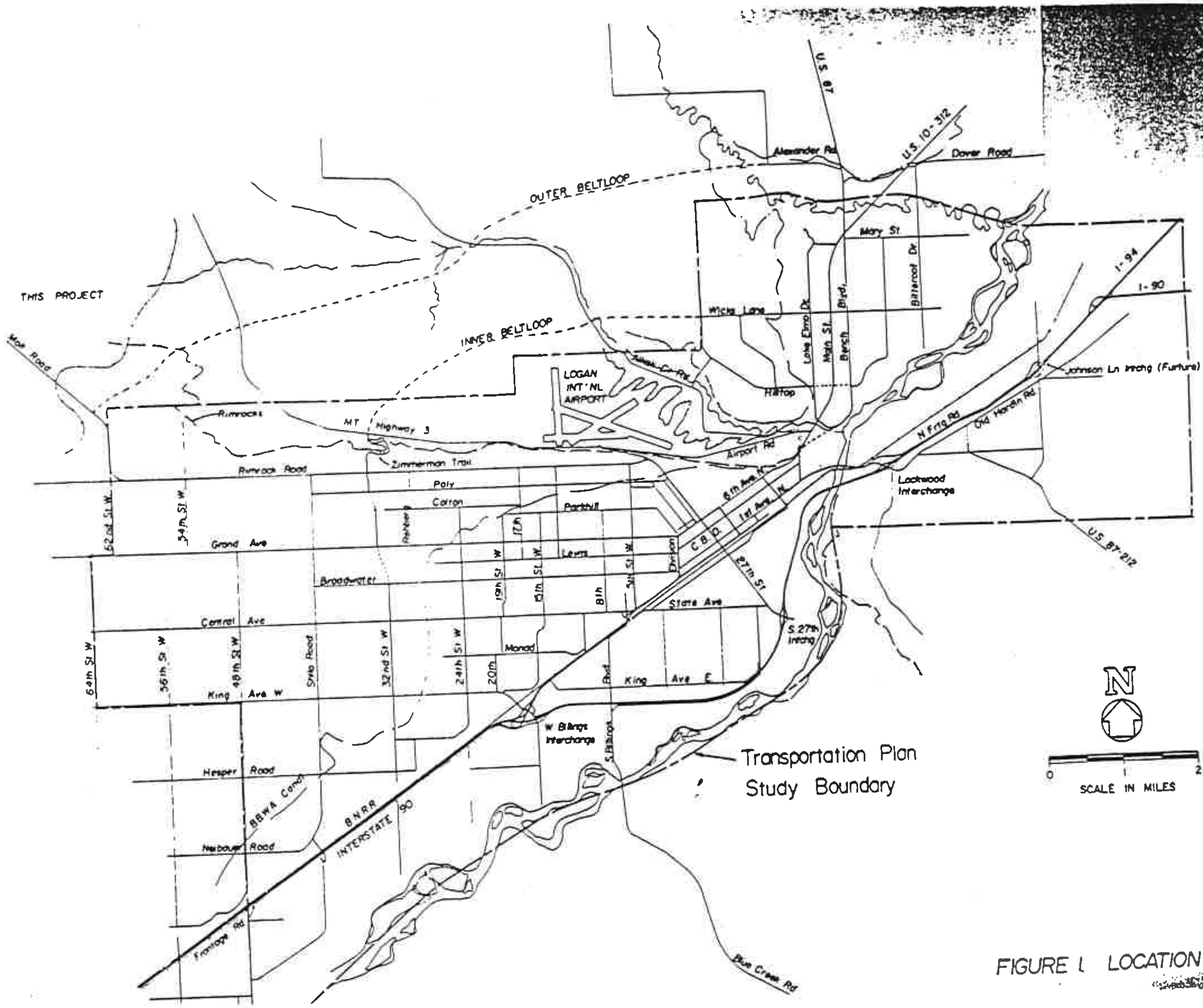


FIGURE 1 LOCATION MAP

design. Existing traffic volume data on area roadways is presented and projected traffic volumes for various combinations of roadway system configurations throughout the planning period have been prepared and are detailed within this report. Traffic volumes at specific locations on the project roadway are included and will be used in preparation of preliminary design plans.

A discussion of the study results within this report is limited to conclusions that may be drawn only from the traffic volume analysis. Other factors such as traffic accidents, geometric designs, construction costs and other economic data must be considered to adequately justify the feasibility of construction. Specific recommendations with regard to future road system improvements are based on objective evaluations of traffic volumes and existing conditions.

HISTORICAL TRAFFIC DATA

The Montana Department of Highways provided traffic data on area streets. This information is published on an annual basis in a report entitled "Traffic By Section". The latest volumes available were for the year 1985. In order to supplement and update traffic volumes, manual turning movement counts were taken at the intersections of Highway 3 and Zimmerman Trail, Rimrock Road and Zimmerman Trail and the intersection of Rimrock Road and Molt Road. These counts, which are summarized in Appendix "A", were factored to provide an estimate of 1987 Average Daily Traffic (ADT) volumes.

The following table presents traffic volumes provided by the MDOH and factored ADT's for 1987:

Roadway Section	1983 ADT	1985 ADT	ANNUAL % CHANGE	1987 STUDY ADT
Highway 3 East of Zimmerman	3,550	4,330	+11%	4,000
Commercial Vehicles	447	575	+14%	200 (T)
Highway 3 West of Zimmerman	1,585	1,210	-11%	1,250
Commercial Vehicles	356	160	-22%	60 (T)
Zimmerman Trail at Hwy. 3	3,900	3,390	- 6%	3,900
Zimmerman Trail at Rim. R.	3,900	3,740	- 2%	3,950
Rimrock Road East of Zimm.	5,361	7,402	+19%	7,050
Rimrock Road West of Zimm.	5,820	7,940	+18%	8,100
Molt Road at 62nd St. W.	?	?	?	900

Traffic volumes over the past four years exhibited very sporadic trends on Highway 3 and Zimmerman Trail. A definite reduction in volumes was noted between 1983 and 1985. Yet, 1987 levels would almost indicate no growth between 1983 and 1987. It is apparent that traffic volumes to the north on Highway 3 have been reduced for one or many reasons which cannot be throughly explained. It can only be assumed that traffic volumes will increase in the future as has been the long term trend.

Traffic volume increases on Rimrock Road show a strong pattern of growth with some slowing in the past two years. The recent annexation of land to the west of this area and the accompanying construction of sewer facilities will undoubtedly spur additional growth in the future.

The largest percent change in traffic was noted for commercial vehicles. The 1987 data indicate counts for semi tractor trailers but do not reflect total commercial vehicles.

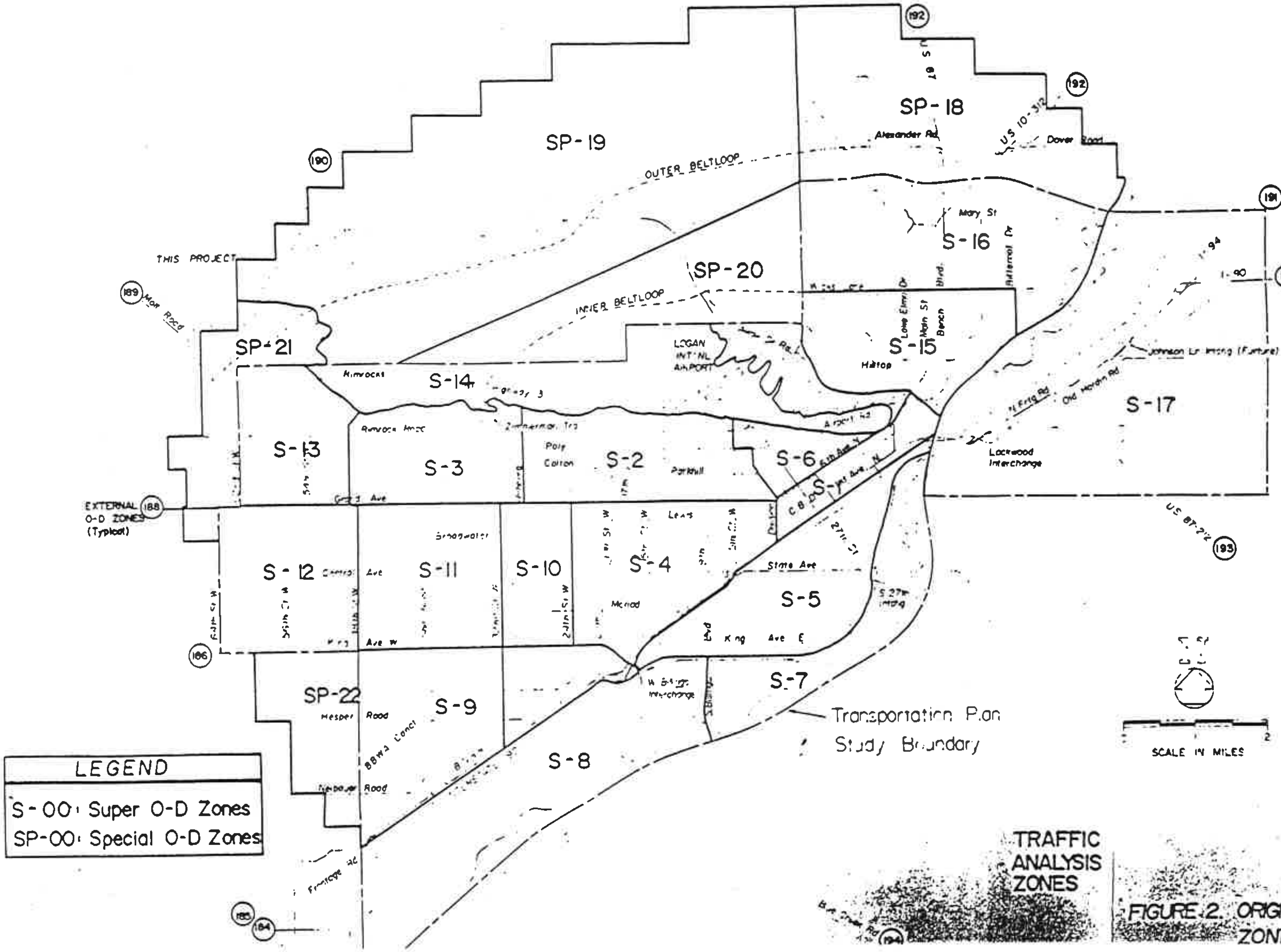
QUICK RESPONSE SYSTEM MODELING

A model of the Billings Urban Area Transportation System was created according to procedures outlined in the NCHRP Report #187, "Quick-Response Urban Travel Estimation Techniques And Transferable Parameters" also known as the QRS Model. The model was used to estimate future traffic volumes on the project road and surrounding roadways for various time periods and system conditions. Model calculations were made on a micro computer using the Federal Highway Administration's QRS software.

At the outset of this study, it was decided that this model would be used rather than rely on the Transportation Plan Update. The update has been proven to contain some rather gross inconsistencies especially on roadway links in the urban area fringe. Also, it would be impossible to compute a number of alternatives using the Transportation Plan Data without requesting special computer runs by the Department of Highways.

Figure 2. is the Origin-Destination zones that were delineated for the purposes of this study. Each area is designated as a Super Zone since they contain several O-D zones. In addition to the zones included in the Transportation Planning Boundary, four additional zones beyond the boundary were created. These new zones would have a direct impact on the Belt Loop system.

A report by Mountain West Research, "Employment, Population and Housing Forecasts for the Billings Urban Area 1980-2010" was used to obtain socio-economic data which was input into the QRS model. The data was presented within approximately 190 Origin-Destination zones.



TRAFFIC ANALYSIS ZONES

FIGURE 2. ORIGIN-DESTINATION ZONES

This data was transcribed into the 23 super zones and 11 exterior zones and used in the model analysis. Those areas not included in the Mountain West Report were estimated after conversations with John Darling, City-County Director of Planning.

Once the socio-economic data was input, zone to zone travel times were calculated and input to the computer. The model produced zone by zone trip productions and attractions. This information was used in the iterative process of trip distribution. The QRS model distributed trips by use of a Gravity formulation, which is one of the most common transportation modeling tools. The result of this process was trip tables for three time periods and five system conditions. Appendix "B" is an example of the computer output.

Traffic loading on the various system configurations was based on an all or nothing assignment procedure. Figure 3. shows the traffic loadings on area roads using 1985 model input data. Also shown is 1987 traffic counts on the roads. The correlation between the model and actual counts is fairly consistent and represents the best calibration that could be obtained with the given data. Several combinations and disagregations of O-D zones were used to calibrate the model since it appeared all other factors were consistant with actual conditions.

The trip generation and distribution data was loaded into computer files for several time periods and system configurations. Traffic loadings were then compiled for the alternative future conditions and the results of those loadings are presented in the following report section.

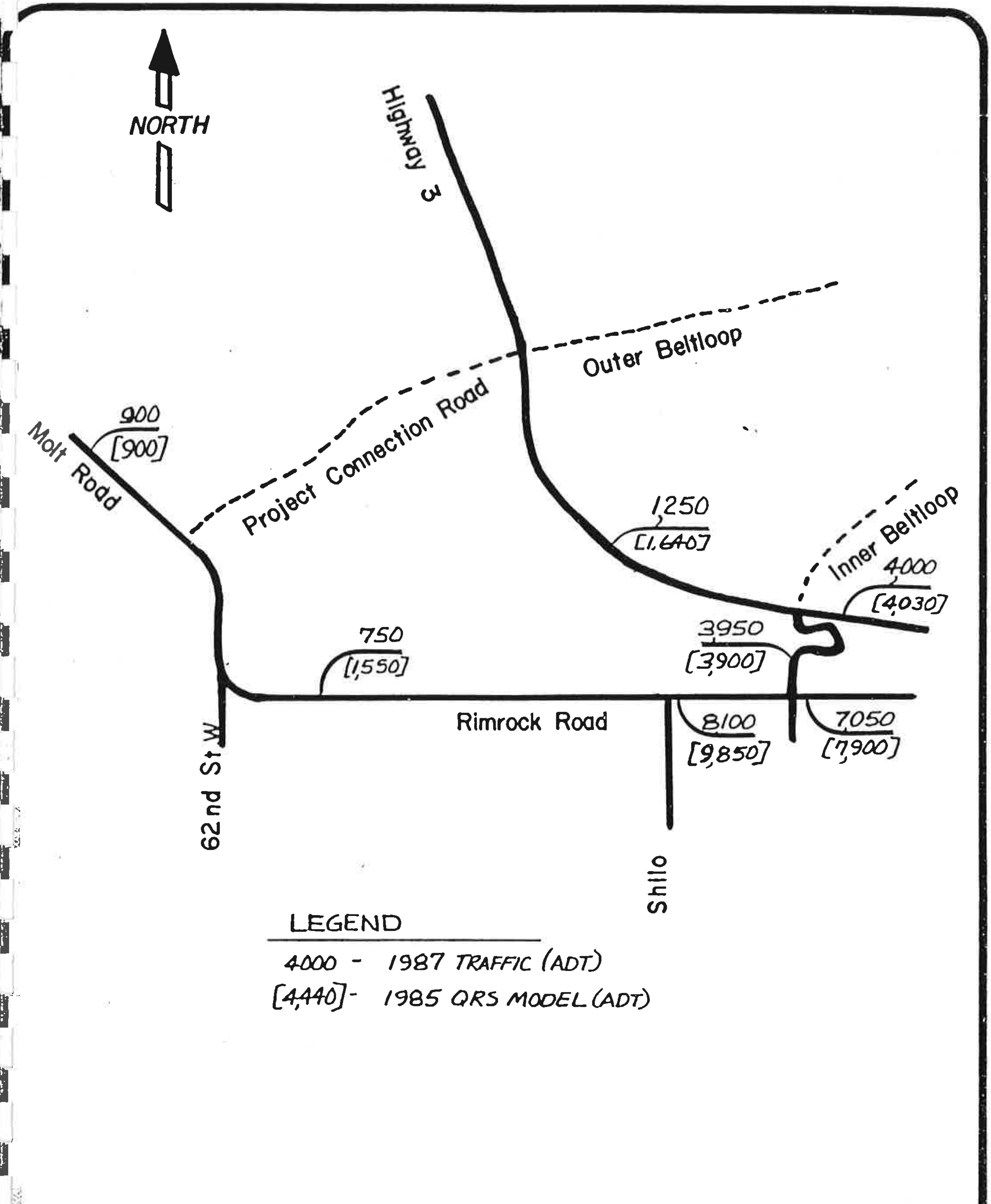


Figure 3. EXISTING TRAFFIC COUNTS AND QRS MODEL CALIBRATION

TRAFFIC VOLUME PROJECTIONS

The QRS model was used to make traffic volume projections for the project connection road and surrounding roads under the following conditions:

1. Year 1985 O-D Data, Traffic Assigned to Existing Street System Plus the Project Connection Road
2. Year 1995 O-D Data, Traffic Assigned to Existing Street System Plus the Inner Beltloop and the Project Connection Road
3. Year 2010 O-D Data, Traffic Assigned to Existing Street System Plus the Inner & Outer Beltloops and the Project Connection Road
4. Year 2010 O-D Data, Traffic Assigned to Existing Street System

Figure 4. represents traffic loadings on the existing street system assuming that the project connection road was in place. The 1985 transportation data base was used to load these links. The all-or-nothing traffic assignment indicates that the Highway 3 - Molt Road connection would carry 930 ADT, if it were in existence today. Unfortunately, the confidence level on the north leg of Highway 3 is not as great as other links in the system (see model calibration figures). If a 30% error were assumed, the loading on the connection road would probably be about 500 ADT. This is equivalent to volumes on typical local or residential streets.

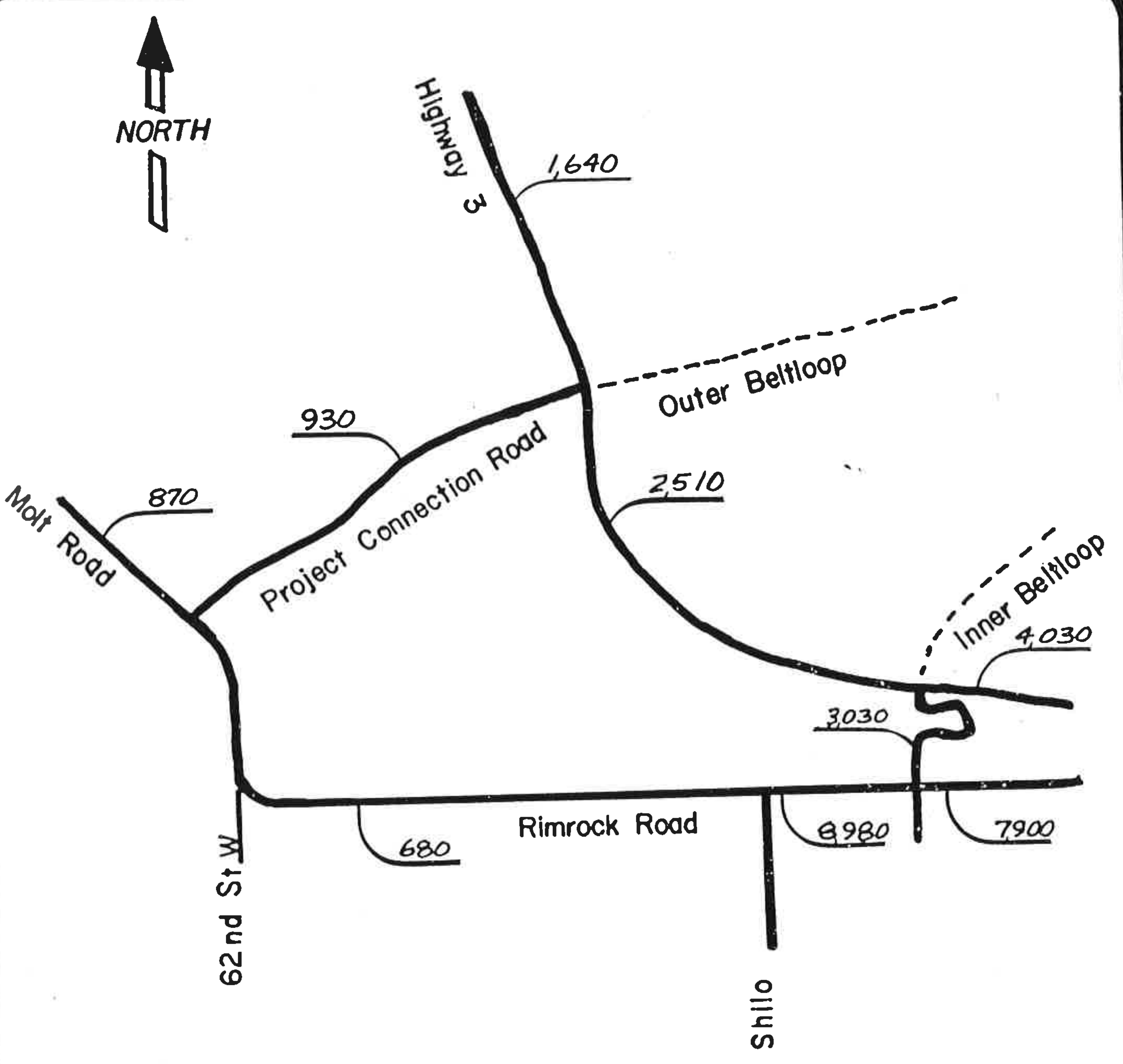


FIGURE 4. 1985 TRAFFIC LOADINGS WITH PROJECT CONNECTION ROAD

At this point in time, the connection road would not serve a great number of people or alleviate traffic congestion on any of the other streets in the area. Even without the benefit of an economic analysis, it could be safely assumed that immediate construction of the project road would not be feasible.

Figure 5. shows traffic loadings on a street system which includes the project connection road and the Inner Belt Loop. The data base for this loading is 1995 planning data. It was assumed that the new High School and related subdivisions would be established to a degree which would require alternative access by 1995 and therefore the Inner Belt Loop would be needed.

As can be seen, the Inner Belt Loop would carry in excess of 8,000 ADT in 1995, if it were in place. This traffic would load Zimmerman Trail to levels in excess of 10,000 ADT. A large traffic volume increase on Rimrock Road would also be experienced. At this point in time, major improvements would be required at the intersections with Zimmerman Trail and on Zimmerman Trail itself.

Even with some congestion on the Zimmerman Trail link, the project connection road would only load slightly higher than 1985 levels. If the project road were not built by 1995, the additional traffic on Zimmerman Trail would not be significant.

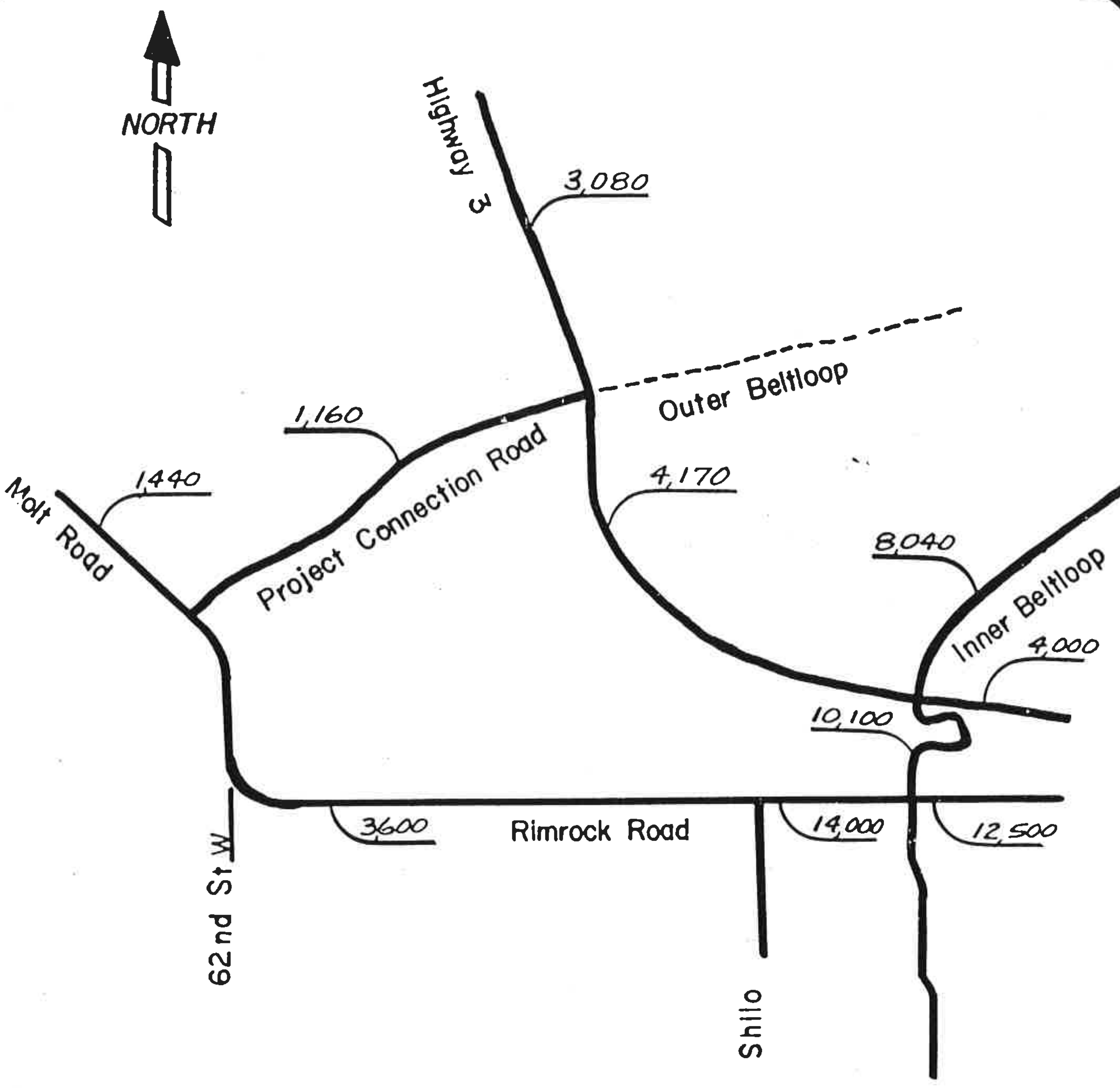


FIGURE 5 . 1995 TRAFFIC LOADINGS WITH INNER BELTLOOP AND PROJECT CONNECTION

Figure 6. is a representation of traffic loadings on the urban street system if the Transportation Plan streets were in place in the year 2010. The project connection road would carry approximately 5,200 ADT or typical collector level traffic volumes. Only a small portion of that volume would be contributed by the Outer Belt Loop. At this point in time the Outer Belt Loop would probably not be a viable route, at least between Alkali Creek and Highway 3.

A cross connection between the Inner and the Outer Belt Loop would carry over 13,000 ADT. To handle this volume of traffic, a minimum of two collector streets would be required.

The Inner Belt Loop would load at approximately 12,000 ADT and Zimmerman Trail would be required to carry in excess of 14,000 ADT. The project connection road would have a significant effect on improving the level of service and costs of Belt Loop facilities under these future conditions.

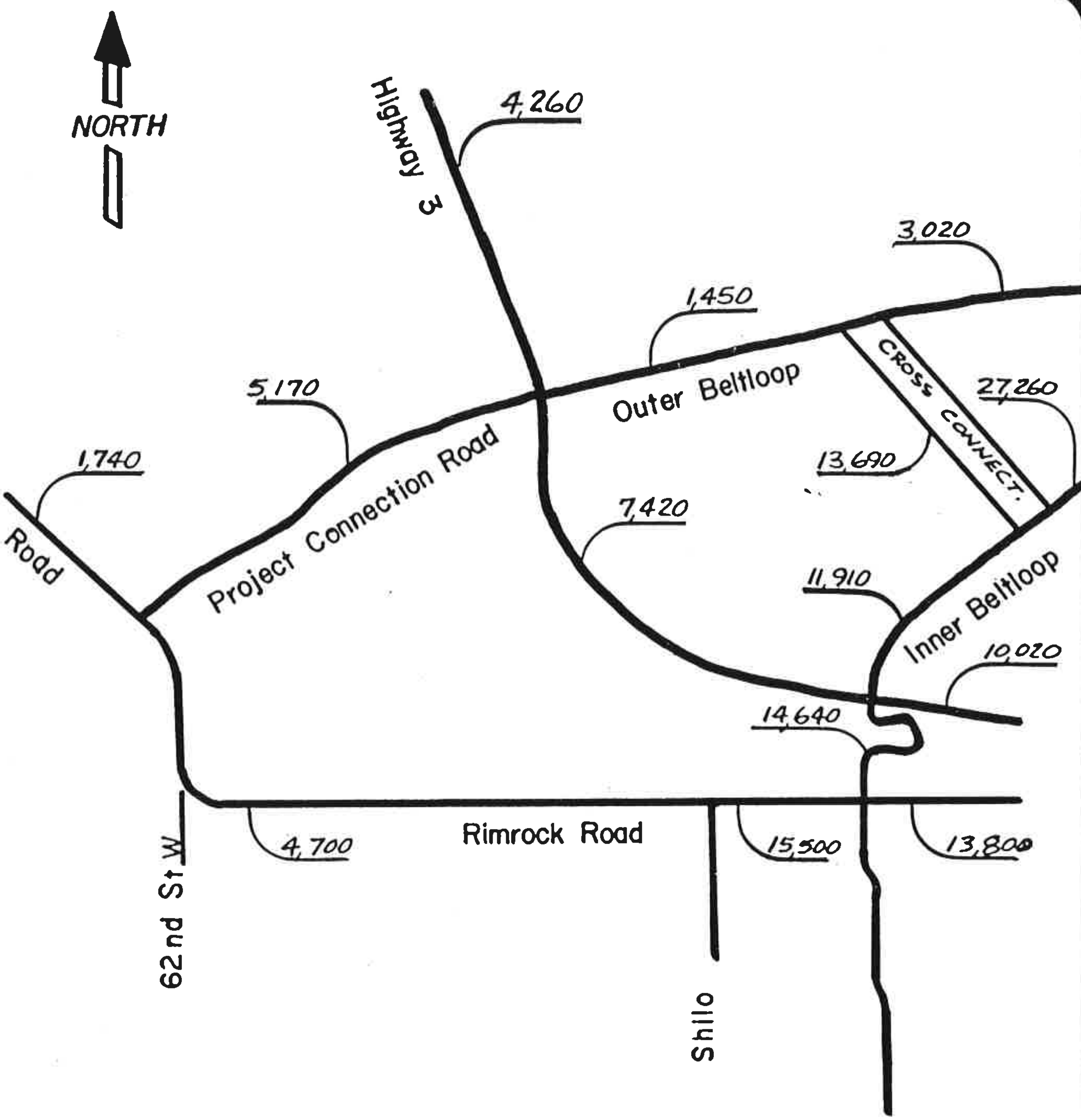


FIGURE 6. YEAR 2010 TRAFFIC LOADINGS WITH INNER AND OUTER BELTLOOPS

Figure 7. shows the year 2010 traffic loadings if no system improvements were made. At first sight, it may appear that the do-nothing alternative has reduced the magnitude of traffic volumes in this area and thus has reduced construction requirements. However, it should be remembered that travel demand would not have been served and other streets beyond this area would be extremely congested. The existence of these streets will undoubtedly determine growth patterns into the future of the Billings Urban Area. Since the planned street system defines the community's growth goals and objectives, it must be assumed that this system will necessarily be required and design volumes for the project road will be based on the existence of the Inner Belt Loop at a minimum.

DESIGN VOLUMES

Figure 8. is the design hour turning movement volumes for the intersection of Highway 3 and the project connection road. It should be remembered that the Outer Belt Loop would not have significant volumes by the year 2010, but it may carry major volumes within a 30 to 40 year planning range.

Figure 9. shows design hour turning movement volumes at the project road's intersection with Molt Road. The major traffic flow would be on the connection road and not on Molt Road, therefore realignment of Molt Road should be considered in the preliminary design.

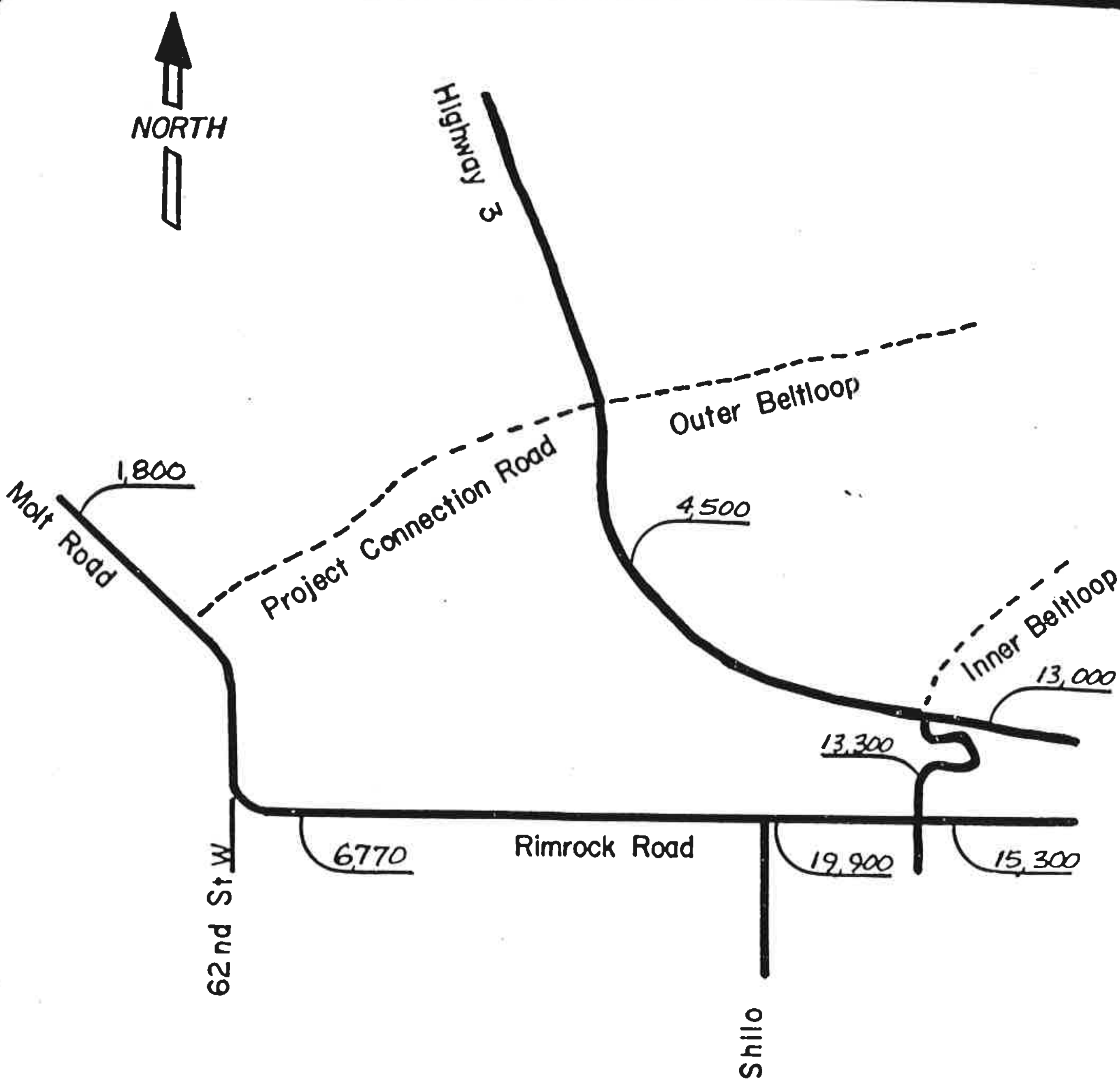


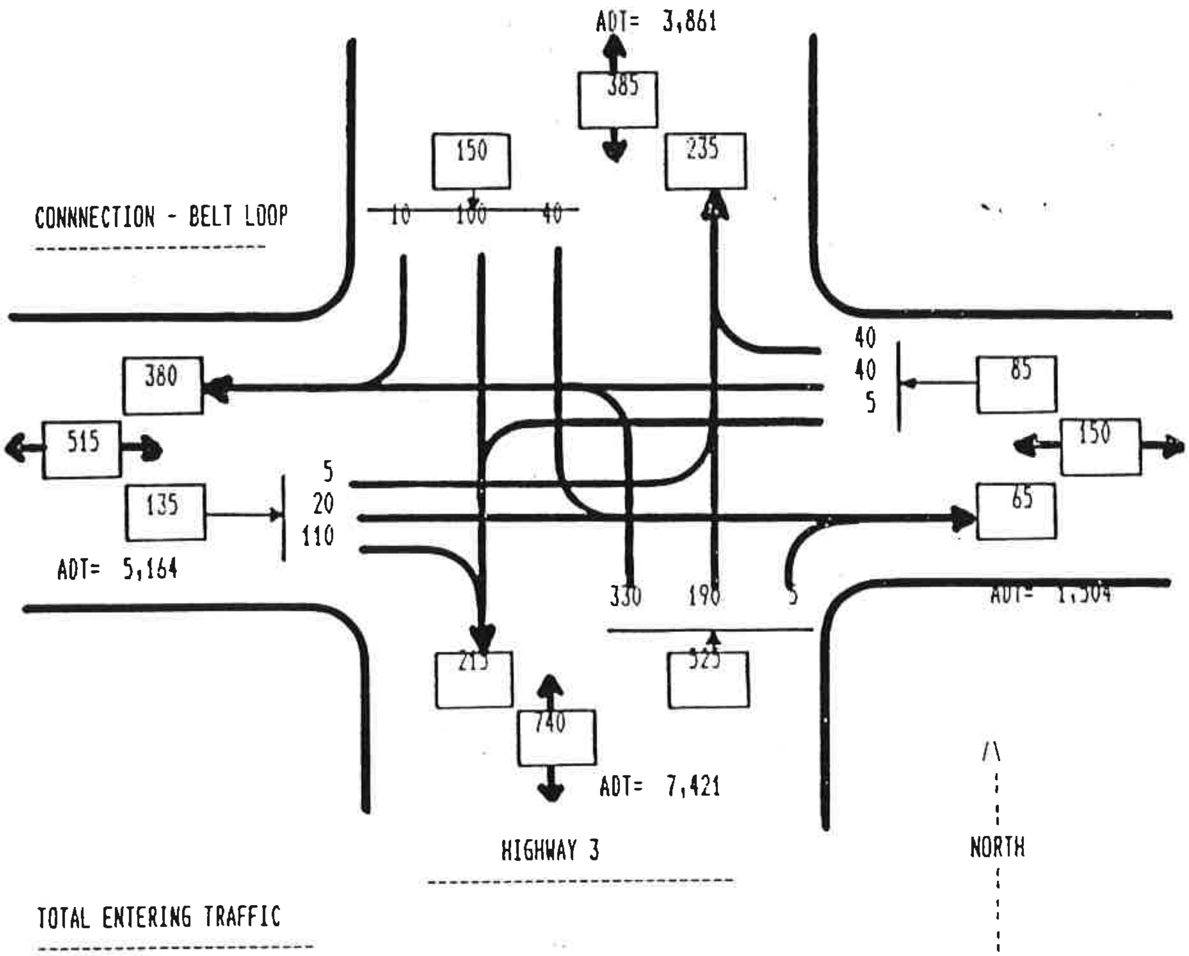
FIGURE 7. YEAR 2010 TRAFFIC LOADINGS ON EXISTING SYSTEM

FIGURE 8. SUMMARY OF TURNING MOVEMENT VOLUMES

INTERSECTION OF : HIGHWAY 3 and PROJECT CONNECTION ROAD

DATE : YEAR 2010 DAY OF WEEK : DESIGN HOUR TIME PERIOD : 4:3-5:3

ADT
FACTORS MO.= 0.95 DAY= 0.95 HOUR= 0.09 COMPOSITE= 10.027



TOTAL ENTERING TRAFFIC

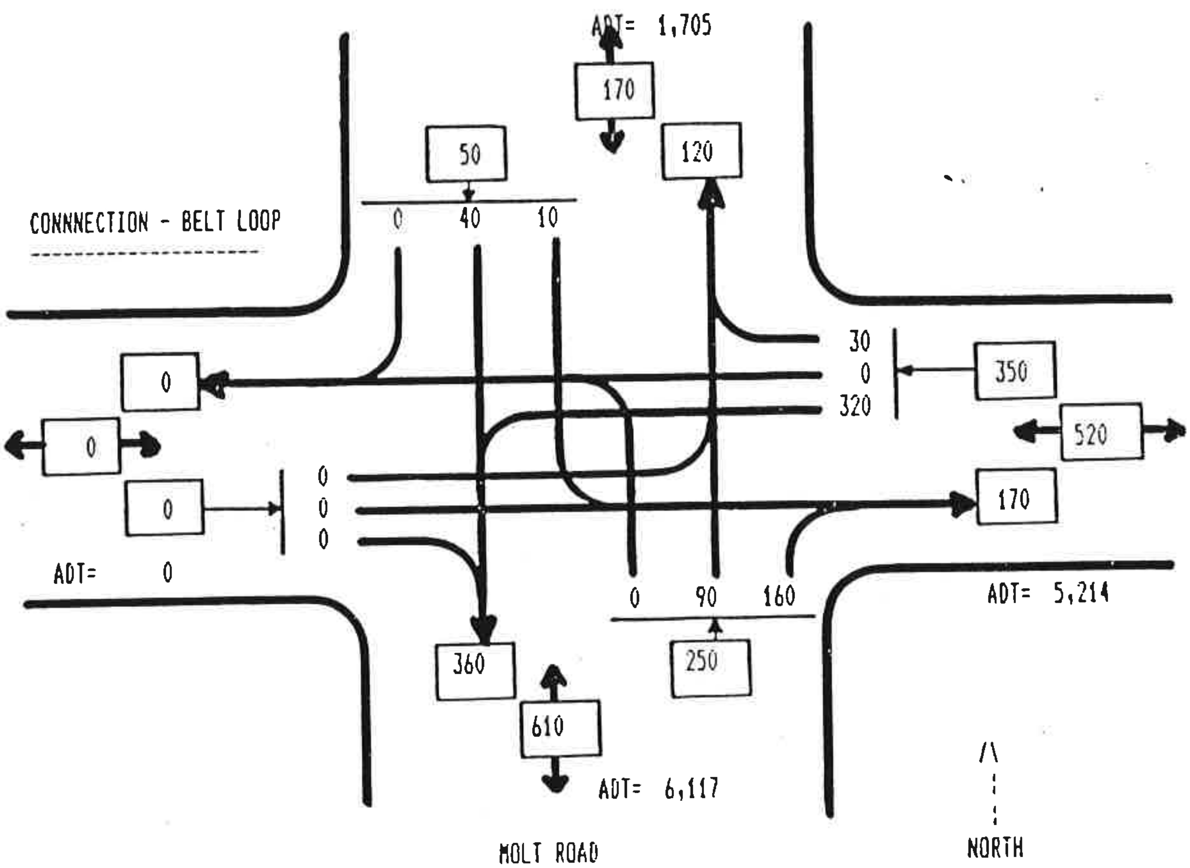
	HOUR	ADT
NORTH/SOUTH =	625	6,267
EAST/WEST =	220	2,206
TOTAL =	845	8,473

FIGURE 9. SUMMARY OF TURNING MOVEMENT VOLUMES

INTERSECTION OF : MOLT ROAD and PROJECT CONNECTION ROAD

DATE : YEAR 2010 DAY OF WEEK : DESIGN HOUR TIME PERIOD : 4:3-5:3

ADT FACTORS MO.= 0.95 DAY= 0.95 HOUR= 0.09 COMPOSITE= 10.027



TOTAL ENTERING TRAFFIC

	HOUR	ADT
NORTH/SOUTH =	290	2,908
EAST/WEST =	350	3,510
TOTAL =	640	6,418

SUMMARY AND CONCLUSIONS

The Quick Response System was used to load traffic volumes on the project connection road and area streets. The traffic loadings represented various combinations of time periods and street system configurations. Based on the results of the traffic volume projections, the following conclusions can be reached:

1. Construction of the project connection road would probably not be feasible prior to the year 2000 because of low travel demand.

2. The project connection road would be a vital part of the street system by the year 2010 even if the Outer Belt Loop were not built.

3. Since the need for the project connection road is exhibited by future travel demand (within the accepted planning period), a method of reserving the necessary right-of-way during the intervening years should be instituted. Even though construction would be 15 to 20 years in the future, it is recommended that Yellowstone County proceed with a location study and preliminary design to specifically define the required right-of-way. This will provide a tool to restrict building in the corridor; acquire right-of-way during subdivision platting procedures; and inform developers of future land use planning requirements in this area. While existing landowners in the area may be hesitant to donate right-of-way for a construction project so far in the future, this will at least insure that the corridor is not blocked by development in the intervening years.

4. While not necessarily a part of this study, the high travel demands evident on the Inner Belt Loop and thus, Zimmerman Trail, should be of major concern to planners and the local governments. It would appear, at this point in time, that construction alternatives are severely limited. One alternative, not yet addressed, would be a tunnel beginning north of Highway 3 and ending at the base of the rimrocks on the existing Zimmerman Trail grade. Consideration should be given to this alternative in future planning or location studies.

Marvin & Associates
Traffic, Transportation, & Civil Engineers

Rick Leuthold, P.E.
Engineering Inc.
P.O. Box 81345
Billings, MT 59108

December 14, 2001

Re: Northwest Bypass
Transportation Analysis

Dear Rick:

This letter serves as an addendum to our December 3, 2001 report relative to the Northwest Bypass Transportation Analysis. The purpose of this addendum is to answer additional questions raised by the City of Billings during our review meeting on December 12, 2001.

It was noted in the meeting that our original report implied that Alternate "W" would be located within undeveloped land and Alternate "E" would be surrounded by developed land. This does not correctly describe current conditions, since both alternates would be located on land that is not currently developed. References within the report were addressing conditions being proposed. The correct wording should indicate that Alternate "E" would be located on undeveloped land, which has a major subdivision being proposed . Alternate "W" would be located on undeveloped land that has no known proposals for development.

During our meeting, I was requested to perform additional analysis to determine what impacts would be associated with using Alternate "E" as a location for a future collector street, since the original study concluded that it would not be ideal for a bypass route. Subsequent to our meeting, I was able to reformulate the traffic model so that Alternate "E" would have the characteristics of an urban collector street with travel speeds of 35 mph. The model results indicate that year 2021 traffic loadings would be approximately 1150 ADT on the northeastern portion of the route. This represents a reduction of approximately 1050 ADT from our previous model results. This traffic volume level is on the low end of typical collector street volumes, but slightly higher than desirable traffic volumes on local streets. Thus, the Alternate "E" location could function as a collector street within the planned subdivision.

Impacts on the Billings street system associated with construction of a collector street at the Alternate "E" location were calculated based on previously detailed model results. Changes in existing arterial street system volumes would be localized. Year 2021 traffic volumes would have the following percentage ADT changes on the area street system:

Highway 3 West of Zimmerman	1.5% Increase
Zimmerman Trail	3.1% Decrease
Rimrock Road West of Shiloh	10.6 % Decrease
Shiloh Road South of Rimrock	0.9 % Decrease
62nd South of Rimrock	2.4% Increase

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54th South of Rimrock	3.3% Decrease
Inner Beltloop (Future)	1.5% Decrease
North Billings Bypass (Future)	17% Increase

To put this into perspective, traffic counts normally have a standard error of approximately 10%, which means that ADT volumes can only be stated within 10% accuracy. Thus, most of the above noted street system volume changes are not statistically significant. The future North Billings Bypass would have the highest level of probable impact, but the base volume for that link is only 2300 ADT and the future facility would have the capacity to carry traffic well in excess of that volume level.

It should also be noted that the Alternate "E" street location would also serve a reduced level of bypass type traffic even though it would function as a collector street. From model traffic distribution elements, it appears that approximately 50 vehicles per day would use this street as a Billings bypass. Unless expressly prohibited by ordinance, approximately 8 of these vehicles would be commercial type trucks.

In summary, the Alternate "E" location analyzed within our study would not function well as a bypass route. As a collector street it would have the potential to carry a level of traffic appropriate for its function. It would also provide desirable connectivity through the proposed subdivision and allow an appropriate interface with future subdivisions that may share boundaries in the future.

Hopefully the above information is adequate for the City to evaluate the options available to them with regard to the proposals being considered. If additional information is necessary, please advise.

Respectfully Submitted,

Robert R. Marvin, P.E., P.T.O.E.

Marvin & Associates
Traffic, Transportation, & Civil Engineers

Rick Leuthold, P.E.
Engineering Inc.
P.O. Box 81345
Billings, MT 59108

December 3, 2001

Re: Northwest Bypass Location Transportation Evaluation

Dear Rick:

This letter summarizes my findings with respect to a transportation analysis of the Northwest Bypass location. I have attached a table and figures to illustrate results of our traffic modeling efforts on this study.

Background and Purpose

The Northwest Bypass is that portion of an Outer Belt Loop concept that was presented in the Billings Urban Area Transportation Plan approximately 20 years ago. The original Billings Transportation Plan, prepared by DeLeuw Cather, Inc. in 1969, included an Inner Belt Loop. The Inner Belt Loop in that plan, connected Wicks Lane to Highway 3 near Zimmerman Trail and required a mile long decent from the top of the rims to Rimrock Road through an area, which is now replete with high-end housing developments. Traffic projections on this connection were approximately 1200 ADT for the year 1990. At this level of traffic demand, the Inner Belt Loop was not part of the 20 year Transportation Improvements Program (TIP) list, but was included as a future transportation link well beyond the fiscal planning horizon.

In April 1987, I performed a transportation analysis for the Northwest Bypass as a subconsultant to HKM Engineering. The report, "Outer Belt Loop Road State Highway 3 to FAS 302 Molt Road Traffic Volume Element" used an early version of the QRS II traffic model based on Transportation Plan demographics. At that time, the average daily traffic (ADT) on Highway 3 west of Zimmerman Trail was 1250 with 160 Commercial vehicles. Current ADT on Highway 3 at the same location is approximately 2010 with 300 commercial vehicles. The model analysis in this study resulted in 1987 traffic loadings between 500 and 900 ADT on the Northwest Bypass. Future traffic volume projections were 1000 ADT in 1995 and 5100 ADT in the year 2010, which included both the Inner and Outer Belt Loops, as were located in the 1977 Transportation Plan. This level of demand was based on optimistic growth projections presented in a 1985 demographic projection study, which targeted a year 2010 population of 150,000 people in Billings. The conclusion of this study stated that construction of the connection road was premature, but would be required at some date beyond the conventional planning horizon. It was also recommended that Yellowstone County initiate right-of-way reservations on an alignment that would be determined by the second phase of the study. The

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second study phase was to be completed by HKM, but it was never authorized and no other actions were taken by the County Commissioners.

In the 1990 Transportation Plan Update, Engineering Inc. and Marvin & Associates perpetuated the Outer Belt Loop concept and made more specific recommendations for the Inner Belt Loop connection at Rimrock Road via a Zimmerman Trail tunnel. At that time the Inner Belt Loop link was projected to have a much higher level of traffic demand, but costs involved with construction prevented it from becoming a high priority within the 20 year fiscal plan. The Outer Belt Loop location was parroted from the earlier plan and presented as a future system link, which extended beyond the plan's horizon year.

In the year 2000, Marvin & Associates was responsible for transportation analysis of the North Billings Bypass Feasibility Study as subconsultants to HKM Engineering. The Northwest Bypass segment was not included in that study since it was considered a separate issue from the study's primary concern, which was a truck bypass for the Camino-Real International Trade Corridor. This study established the feasibility of a northern bypass route and paved the way for funding of future route location and environmental documents. Even though this study did not establish a specific location for the North Bypass, public input along with topographic and environmental considerations clearly established that the ultimate bypass routing would be substantially north of the Outer Belt Loop location shown in the Transportation Plan.

It is notable that the North Bypass is not exactly synonymous with the Outer Belt Loop. I believe the change in terminology also involves a slight, but distinct change in function. The Belt Loop concept implies that a high degree of connectivity with the urban street system would be involved. However, the primary function of the North Bypass would be elimination of external traffic from the urban street system, especially commercial truck traffic. Connectivity to the urban street system would be highly controlled. The Northwest Bypass, as it is called within this study, should ideally function as a western extension of the North Bypass route. The connection between Highway 3 and Molt Road, as previously studied, could no longer provide a link as indicated in the Transportation Plan because the outer Belt Loop has been replaced by the North Bypass. Location of the Northwest Bypass is a prime factor in whether it functions as part of the North Bypass route or whether it merely functions as another urban system link.

Proposed development of land surrounding the Molt Road - Highway 3 connection alignment, as indicted in the Transportation Plan's "Functional Classification Map", and requests for right-of-way dedication has created a controversy on whether the Transportation Plan Map's location is valid. Therefore, City-County Planning commissioned this analysis as a supplement to the Northwest Urban Planning study currently in progress. The purpose of this study is to determine the magnitude of traffic demands and benefits that are associated with the Northwest Bypass link at various locations and the type of demand that could beneficially be serviced at those locations. This study does not address any of the topographic and environmental consequences associated with alternative corridor locations, but it does address the larger issues concerning the functionality of alternate corridor locations in terms of transportation issues.

Traffic Model

The Montana Department of Transportation (MDT) developed a QRS II traffic model for the year 2000 Billings Transportation Plan update. It was modified by MDT for use in the North Bypass Feasibility Study and for the Northwest Urban Planning Study. An attempt was made to use this model for demand calculations in this study, but we were not able to run the program and obtain consistent results due the models extensive use of external subroutines. We have only been able to obtain the GNE model network, but not all of the QRS II operating parameters and subroutines used by MDT. In order to perform necessary model runs within the project time frame and budget, we decided to use a QRS II model previously developed by Marvin & Associates for use on the initial North Billings Feasibility Study, which has been modified to be corridor specific. This model was calibrated closely with existing traffic volumes. Numerous system-wide checks were made to increase confidence in the traffic distribution sensitivity of the model. It was determined that this model would be able to accurately estimate travel demand trends on corridor links. As with any model, traffic volume output is not absolute, but provides an indication of the magnitude of system link changes resulting from the introduction or elimination of new links.

Alternates Modeled

The range of alternate locations is very confined due to existing development, topography, and functional practicality. The location indicated in the current transportation plan map, which we refer to as Alternate "E", is as far east as the alignment can be moved due to development in the Yellowstone Country Club area. This alignment would run roughly parallel and east of the old railroad grade to the top of the Rimrocks and would intersect Highway 3 approximately 1.2 miles south of the Alkali Creek Road intersection with Highway 3.

From multiple runs using the traffic model, it was determined that traffic loadings on the Northwest Bypass would be substantial lower wherever the western connection to Molt Road was made. It was determined that bypass traffic demand is reduced the farther west that the connection is moved. From this standpoint, the Alternate "E" location would produce the highest traffic demand of all feasible alternate locations.

In order to compare the functionality of a more western location, an alignment beginning approximately 1 mile west of the Alternate "E" location was selected. This westerner connection is referred to as Alternate "W" within this report. The Highway 3 end of Alternate "W" was placed at the Alkali Creek Road intersection, which is in the same general location where the North Bypass would most likely begin. The length of the Alternate "E" bypass road would be about 3.0 miles and Alternate "W" would be about 4.2 miles. While the Alternate "W" alignment may not be totally representative of all other western locations, it provides a realistic comparison between the defacto location (Alternate "E") and its closest competition in terms of traffic demand.

Model Traffic Demand

Table 1 presents model results for the year 2001 calibrated base, year 2021 base condition without the Northwest Bypass link, and both "E" and "W" alternate volumes for years 2001 and 2021. Existing ADT volumes are given for each of the select system links as a basis of comparison. Year 2021 conditions assume that all of the Transportation Plan improvements would be in-place, including the Inner Belt Loop and the North Billings Bypass links.

Year 2001 model volumes indicate that if the Northwest Bypass currently existed it would have traffic demands in a range between 500 ADT (Alternate "E") and 200 ADT (Alternate "W"). The largest traffic volume changes on existing streets would be on Rimrock Road west of 54th Street West, with a 37% decrease in ADT and on 62nd Street West with a 22% increase. Proportionately similar changes would occur for both alternates except on Alkali Creek Road, where Alternate "W" traffic model loadings are higher than Alternate "E" traffic.

Year 2021 model volumes indicate a higher traffic demand for the Northwest Bypass connection as would be expected. Traffic demand for Alternate "E" would be approximately 2200 ADT while Alternate "W" demand would be 1600. The calculated "E"/"W" traffic demand ratio between the two alternates for year 2001 and year 2021 volumes are 2.50 and 1.36, respectively. This indicates that urbanization of the Billings Northwest area tends to reduce the differences related to route location. Under existing development conditions, the Northwest Bypass would be a fringe roadway with very little traffic demand. As the area develops and the roadway becomes surrounded by urban development, perhaps in 30 years, it is conceivable that demand for travel on the Northwest Bypass would be similar wherever it is located within a 2 to 3 mile wide corridor. At that point, it would simply function as a minor arterial street within the urban street system.

Year 2021 model street system volume changes follow a similar pattern as those projected for the year 2001. Traffic volumes on the North Billings Bypass would be the same for both alternates. The Inner Belt Loop Road traffic demand would also be similar for both alternate locations. The highest volume changes would be on Molt Road north of Rimrock Road and on 62nd Street West south of Rimrock Road for both alternates. This indicates that traffic impacts to the planned Billings street system from the Northwest Bypass, at either of these locations, would be very localized.

Traffic Distribution

Attached Figures 1 thru 4 provide graphic illustrations of traffic distribution for the two alternate locations in 2001 and 2021. Figure 1, which represents year 2001 Northwest Bypass traffic distribution for Alternate "E", indicates that the majority of traffic (63%) would be related to travel demand between Billings proper and areas along Molt Road, which are west of the bypass. Less traffic demand (24%) would be associated with bypass related movements from Highway 3 to I-90 and extreme west end locations in the metropolitan area. Only 13% of the traffic would have an origin or destination within the immediate area of the bypass (Yellowstone Country Club and surrounding area).

Figure 2 presents similar traffic distribution information for Alternate "W" in the year 2001. Total bypass traffic volumes are less than at the Alternate "E" location, but traffic distribution is substantially different. The volume of Highway 3 bypass traffic demand is about the same as Alternate "E", which in this case represent approximately 50% of all traffic assigned to the Northwest Bypass. Alternate "W" would accommodate substantially fewer trips from areas west along Molt Road and from areas within the immediate vicinity of the Northwest Bypass road.

Figures 3 and 4 illustrate the same type of data that as Figures 1 and 2, except they represent year 2021 conditions. An added dimension is associated with year 2021 traffic distribution due to the presence of the North Billings Bypass facility. The North Bypass route would attract approximately 600 ADT from the Northwest Bypass for both alternates. There are also two bypass functions that the study route would accommodate under year 2021 conditions: bypass traffic from Highway 3 and bypass traffic from US 87, north of Billings Heights. Twenty eight percent of Alternate "E" traffic would serve bypass demand while thirty percent of Alternate "W" traffic would be associated with this demand. The difference each between alternate's traffic distribution is not as great in the year 2021 model as it is in the 2001 model. This provides further evidence that urbanization around the Northwest Bypass would tend to change its functionality from a true bypass route to that of a minor urban arterial.

Bypass Functionality

An origin-destination (O-D) study was conducted as part of the North Billings Bypass Feasibility Study. The following table presents key O-D information, which is pertinent to the bypass function of this route:

From:	To: I-90 West	West end
Highway 3:		
All Trips	3.7%	35.2%
Commercial Trips	6.3%	15.2%
US 87:		
All Trips	3.6%	41.3%
Commercial Trips	15.8%	24.3%

At year 2001 traffic volume levels the bypass demand for external Billings area trips on Highway 3 would be 74 ADT, 19 of which would be commercial vehicles (trucks). Traffic on Highway 3 with a west end origin or destination would be 705 ADT, 45 of which would be commercial vehicles. Since the west end area can essentially be defined as any part of Billings west of 19th Street West, the Northwest Bypass would not be in a position to serve all of the traffic demand between Highway 3 and the west end. Since model volumes for Alternate "E" are approximately 470 ADT and only 24% of that traffic is a part of the bypass distribution, it could be assumed that at least 94% of the west end travel demands would not be met by this alternate location. At least 84% of the traffic loading on Alternate "W" would be demand for external urban area travel (bypass function) and only 2% of the Highway 3 - west end travel demand would be served by this alternate.

A similar situation would be associated with year 2021 travel demand. I-90 West - Highway 3 external trips would be approximately 170 ADT and Highway 3 - west end travel demand would be approximately 1620 ADT. Alternate "E" would accommodate 27% of the west end travel demand while Alternate "W" would serve only 19% of this demand. This calculation does not include any bypass traffic associated with US 87. It is assumed that most US 87 bypass traffic would be served by the North Billings Bypass, which would have a closer connection to I-90 and less travel time to the west end. In this case, the bypass distribution from the North Billings Bypass has origins and destinations on the westerly edge of the Billings Heights.

In general, Alternate "W" would primarily serve bypass traffic with a small volume of urban street traffic included. Alternate "E", while also accommodating the bypass function, has a greater roll in serving localized urban travel desires.

Traffic Operations

There are two critical elements of traffic operations: safety and efficiency. Predictions of accident experience are based on exposure rates (traffic volumes), facility type, geometry, and intersection conflicts. Typically, intersections have more exposure and conflicts than do unimpeded sections of roadway and therefore, accident rates are usually much higher at intersection than on sections of roadway in-between intersections. When comparing Alternate "E" and "W" alignments, it can be seen that Alternate "W" would be 40% longer than Alternate "E", but carry less traffic. Alternate "E" would have three major intersections with high left turn movement volumes, while Alternate "W" would only have two major intersections with substantially higher thru movements than turn movements. Assuming that both routes could be built with similar geometric standards, Alternate "W" would have a higher potential for safe operations due to less traffic and fewer conflict movements.

Since Alternate "E" would have higher traffic loadings on a shorter route, it could be assummed that this route would have a travel time advantage. However, from the perspective of roadway functionality, Alternate "E" may not be as efficient as it appears. Bypass traffic on Alternate "E" would be exposed to a higher level of mixed trip purposes with more inter-urban traffic volumes in the traffic stream on Alternate "E" than would be on Alternate "W".

Access associated with the bypass route is also a very important traffic operations consideration. Alternate "E" alignment would pass through the middle of a proposed residential subdivision. Access to the local subdivision streets would undoubtedly be required. The addition of several local street intersections along the bypass would create an undesirable mixture of slower access traffic and the higher speed bypass traffic, which is associated with a much longer trip length than typical urban travel. This situation would not only increase accident potential, but it would slow overall travel speeds. Slower speeds would not only reduce the ability of the route to save travel time for inter-urban trip purposes, but it would severely reduce the route's efficiency a bypass for external and commercial traffic.

Alternate "W" has the advantage of being surrounded by largely undeveloped land. Substantially more access control features could be built into design criteria to insure that the route serves its primary function as a bypass route.

Benefits and Costs

While it is beyond the scope of this analysis to perform a detailed benefit/cost analysis, the traffic model output is available to enable basic calculations of travel time benefits that may be associated with each alternate. Table 2 presents a summary of vehicle miles of travel (VMT) and vehicle hours of travel (VHT) calculations for base conditions and Alternates "E" and "W" in the year 2021. Link benefits are estimated by travel time savings. In this case, both alternates have a higher travel time than the base condition, which means that the Northwest Bypass would provide a dis-benefit. The reason for higher travel times appears to be a traffic shift from the Inner Belt Loop to the North Billings Bypass route, which would be more accessible from the Northwest Bypass location. Additional system wide modeling would be necessary to determine whether a true negative benefit is associated with the Northwest Bypass link.

Rudimentary cost estimates for the two alternates are based on average per mile costs for similar facilities. Alternate "E" would require construction of several minor intersections with local roads and additional turn lanes on the southern portion of its route. In addition, Alternate "E" would require construction of three major intersections, one on Molt Road and two on Highway 3. The cost estimate for construction of Alternate "E" is $7.0 million.

Alternate "W" would have a more rural type design with two lanes in each direction and 8' shoulders. Two major intersections would be required, one on Molt Road and one on Highway 3. Costs of construction for Alternate "W" are estimated to be $8.2 million.

Conclusions and Recommendations

Our analysis has focused on the transportation related viability of a future Northwest Bypass route location. The analysis provides a comparison between Alternate "E", which is depicted on the Transportation Plan Functional Classification Map, and Alternate "W", which is located further west. Traffic modeling of the two alternate locations has accomplished two objectives: 1) It confirmed intuitive reasoning that a route closer to the urban area would have a greater traffic demand. 2) It gave a clear indication of Northwest Bypass traffic distribution, which provided information about the functionality and operational limitations of both alternates.

The traffic operations evaluation indicates that Alternate "W" has the potential for safer operations due to lower traffic volumes and fewer intersection conflicts. Alternate "E" could however, be more efficient since it has the potential to provide less travel time for a greater number of vehicles with appropriate access control. Access control along each route will be a critical factor with regard to safety and efficiency. In that respect, Alternate "W" would have a higher potential for limiting adjacent land access.

The most important aspect of route location for the Northwest Bypass is functionality. In order to truly be a bypass route, it has to function as a bypass. It must provide relatively unimpeded travel for external and commercial traffic on the fringe of the urban area with direct connections to external highway facilities. Its primary function is mobility with land use access being subservient to this function. Alternate "E" cannot provide the defined functionality of a bypass since it will be surrounded by an urban environment that will require a high level of adjacent land access. If constructed at this location without access to surrounding land, it would act as a barrier to inter-neighborhood travel and two additional intersections with Molt Road would be required to serve each half of the subdivision. In addition, Alternate "E" would not provide a direct connection to the North Billings Bypass route. Construction of a roadway link at the Alternate "E" location could serve as an urban arterial link, but it could not operate well as a bypass route.

The Alternate "W" location used within this analysis was connected to 72nd Street as an additional model run (see attached figure). Even though travel speed on 72nd between Molt Road and I-90 was increased by 15 mph over other north-south streets, this connection only added 500 ADT to bypass traffic demand in the year 2021. This again indicates that the Northwest Bypass may not be feasible within the current planning horizon.

A rudimentary analysis of benefits indicates that both alternates fail to prove definitive benefits in terms of travel time reductions within the corridor. Thus, calculation of benefit/cost ratios are impractical for use in comparison. Construction costs for Alternate "E" are estimated to be $7.0 million. With an average traffic loading of approximately 1330 ADT over the next twenty years, the average construction cost per vehicle mile would be $0.72. In comparison, construction of a one mile segment of the 32nd Street West connection between Grand and Broadwater is estimated to be approximately $2.2 million. The anticipated average ADT over a 20 year period is 12,000, which calculates to an average construction cost per vehicle mile of $ 0.025. This indicates that the Northwest Bypass link would be extremely costly in comparison with competing facility needs within the Billings urban area.

Realistically, the Northwest Bypass location will only be valuable to Billings when the Billings metropolitan area reaches a population of approximately 200,000. At that time, the most practical alignment for the bypass would most likely be along the Shorey Road alignment. It is recommended that a location study for the Northwest bypass facility be completed and the alignment tied to existing property lines. Right-of-way reservations should be made by whatever mechanism Yellowstone County has available in order to secure the appropriately identified alignment prior to significant development in the area.

In conclusion, we have found no compelling evidence from a transportation perspective to support construction of a Northwest Bypass at the location indicated on the year 2000 Transportation Plan Functional Classification Map. In fact, we have found that construction of a bypass at this location would not adequately serve the functions of a true bypass. Even if this route was constructed as a minor arterial link, it would not be cost effective given the location and timing of other planned improvement projects (North Billings Bypass, Inner Belt Loop and Airport Road reconstruction) which would better serve connectivity within the Billings urban environment.

Relocation of this Transportation Plan link does not necessarily affect the integrity of the Transportation Plan. The purpose of the Functional Classification Map is to outline existing arterial and collector streets along with arbitrary link lines to indicate future street system "functions". There are no legal implications associated with any of these links until a formal location study has been completed or land reservations have been secured for future street construction. A similar situation would exist with the North Billings Bypass, which will soon enter the location planning phase of project development. It is very probable that the final location of this bypass will be substantially different than the arbitrary line shown on the Transportation Plan Functional Classification Map. The transportation planning process is supposed to be comprehensive, coordinated and "continuing". Special studies and plan updates continually modify the plan to adjust for dynamic changes in traffic, land use, the society and the environment.

Respectfully Submitted,

Robert R. Marvin, P.E., P.T.O.E.

Table 1. MODEL RESULTS - SELECT LINKS / NORTHWEST BYPASS

Street	Location	Current ADT	Year 2001 Models Base	Year 2001 Models Alt "E"	Year 2001 Models Alt "W"	Year 2021 Models Base	Year 2021 Models Alt "E"	Year 2021 Models Alt "W"	Difference From Base Volumes: Year 2001 Models Alt "E"	Difference From Base Volumes: Year 2001 Models Alt "W"	Difference From Base Volumes: Year 2021 Models Alt "E"	Difference From Base Volumes: Year 2021 Models Alt "W"
Highway 3	Rural North	2200	2073	2073	2073	4605	4605	4605	0.00%	0.00%	0.00%	0.00%
Highway 3	West of Zimmerman	3000	2479	2581	2458	5540	5245	5012	4.11%	-0.85%	-5.32%	-9.53%
Highway 3	West of N 27th Street	5800	6318	6482	6308	6835	7243	6915	2.60%	-0.16%	5.97%	1.17%
Zimmerman Trail	South of Highway 3	5000	6635	6373	6474	20304	18981	19221	-3.95%	-2.43%	-6.52%	-5.33%
Zimmerman Trail	North of Highway 3					13988	13742	13760			-1.76%	-1.63%
Molt Road	Rural West	750	716	716	716	1433	1433	1433	0.00%	0.00%	0.00%	0.00%
Molt Road	North of Rimrock	1000	992	868	987	1433	2784	2200	-12.50%	-0.50%	94.28%	53.52%
Rimrock Road	West of 54th	1300	705	444	625	1459	717	1062	-37.02%	-11.35%	-50.86%	-27.21%
Rimrock Road	East of 54th	2700	2522	2238	2422	4181	3241	3598	-11.26%	-3.97%	-22.48%	-13.94%
Rimrock Road	West of Shiloh	5500	4592	4282	4473	7792	6520	6884	-6.75%	-2.59%	-16.32%	-11.65%
Shiloh Road	South of Rimrock	8000	8985	8865	8935	11116	10708	10771	-1.34%	-0.56%	-3.67%	-3.10%
62nd Street West	South of Rimrock	500	498	607	551	2222	2847	2701	21.89%	10.64%	28.13%	21.56%
54th Street West	South of Rimrock	1800	1365	1355	1358	3118	2972	2982	-0.73%	-0.51%	-4.68%	-4.36%
Alkali Creek Road	East of Highway 3	200	99	115	117				16.16%	18.18%		
North Billings Bypass	East of Highway 3					2336	2954	2950			26.46%	26.28%
Northwest Bypass	HWY 3 to Molt Road			469	187		2193	1607				

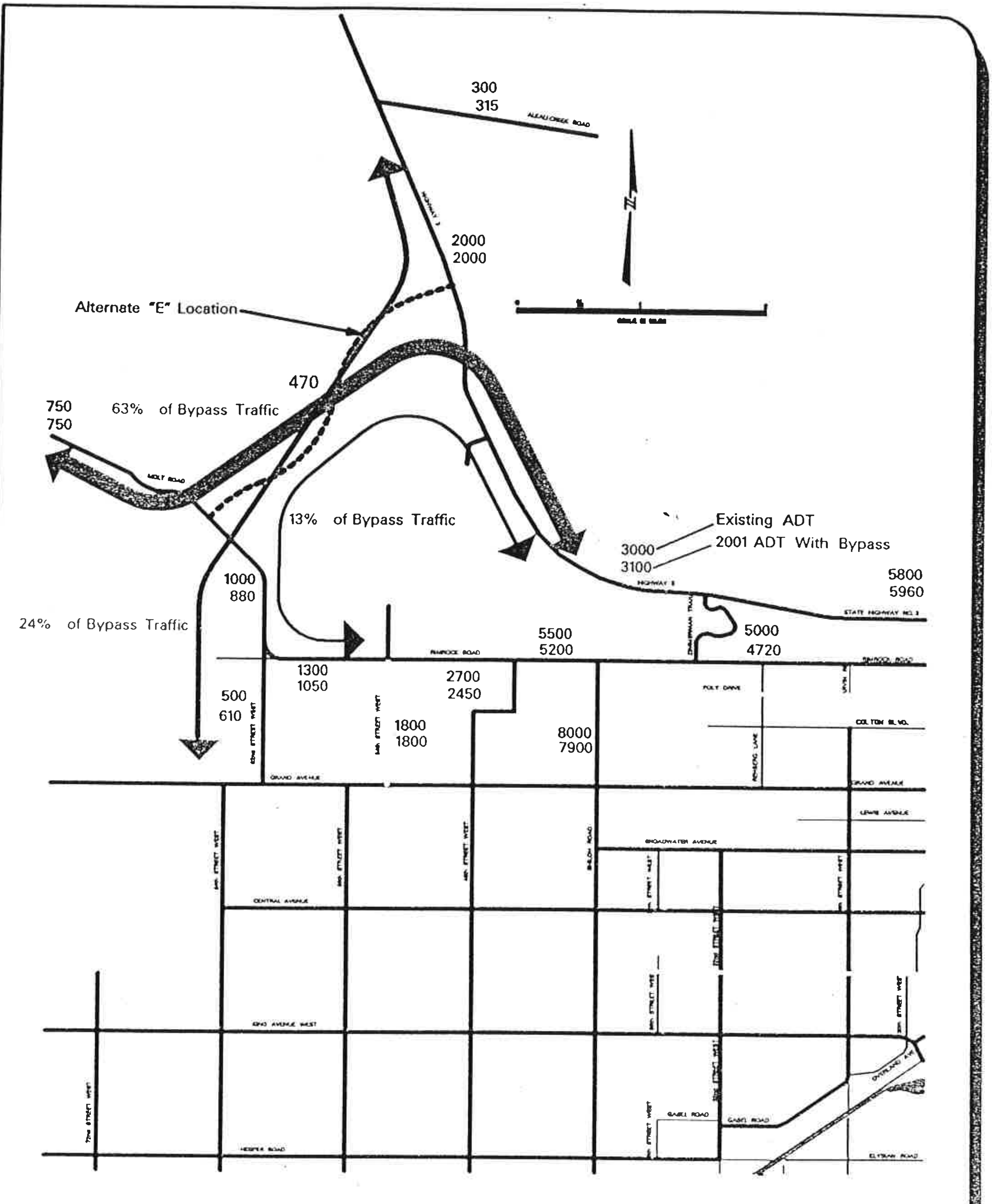


Figure 1. Alternate "E" Alignment Year 2001 Model Traffic Distribution

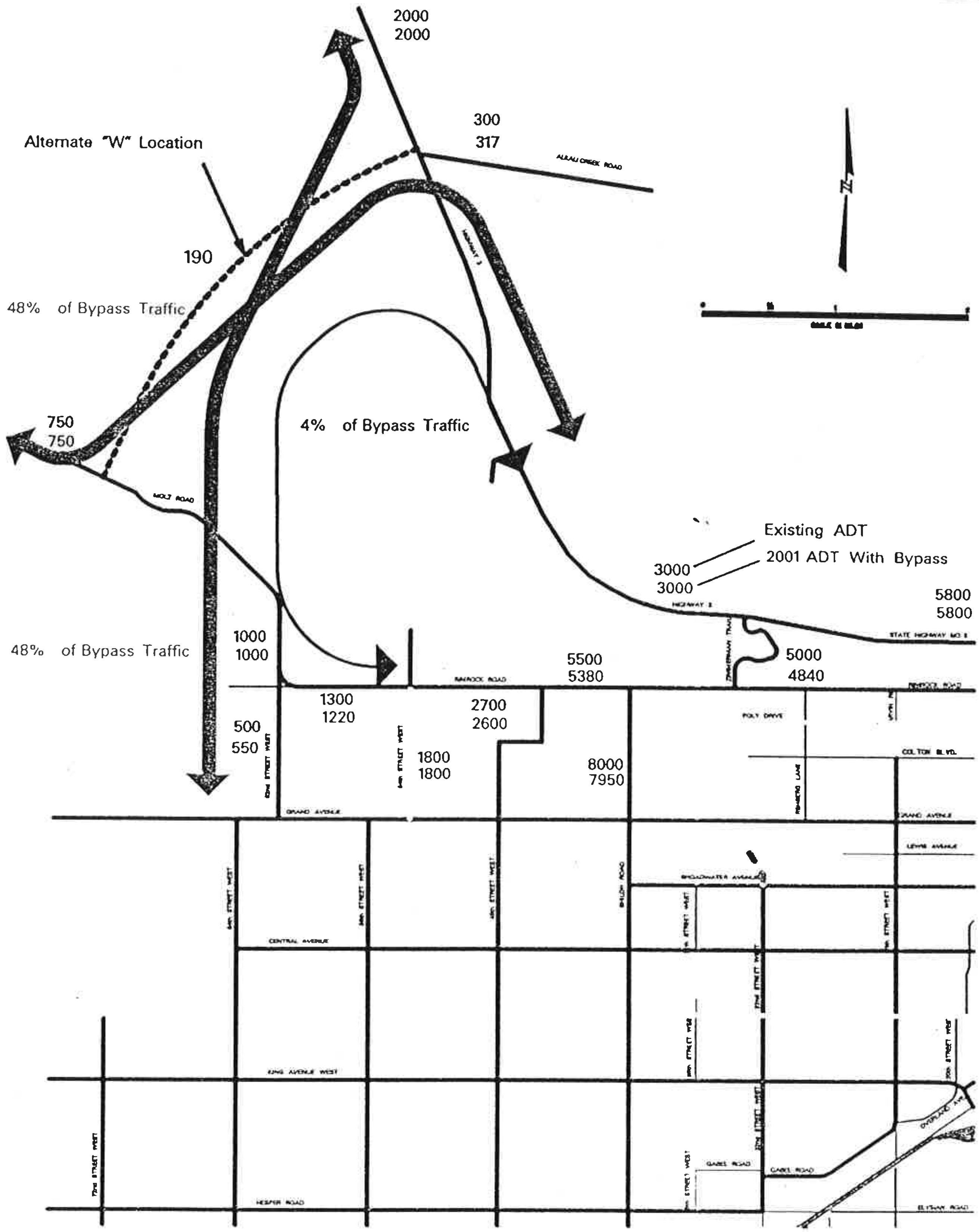


Figure 2. Alternate "W" Year 2001 Model Traffic Distribution

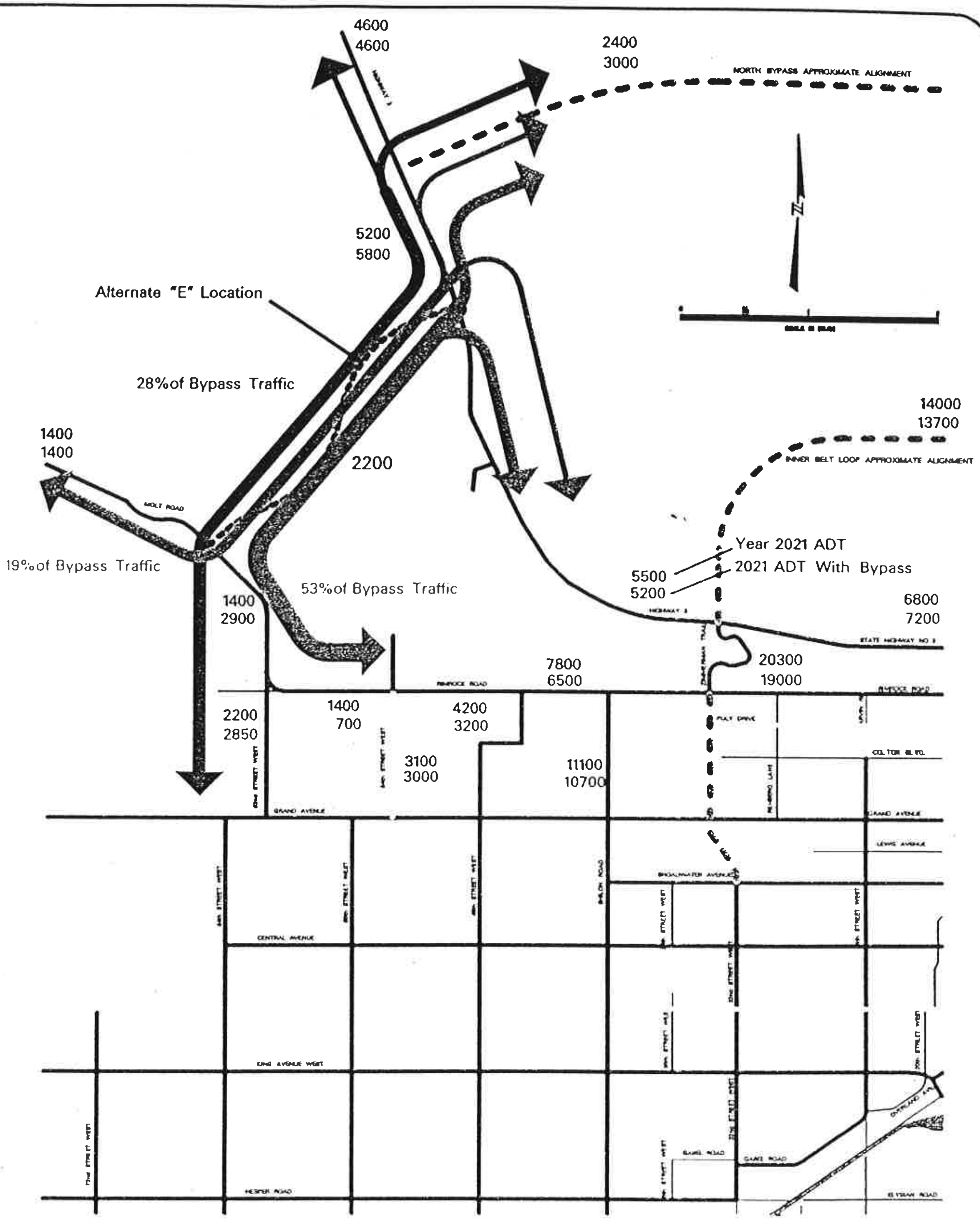


Figure 3. Alternate "E" Alignment Year 2021 Model Traffic Distribution

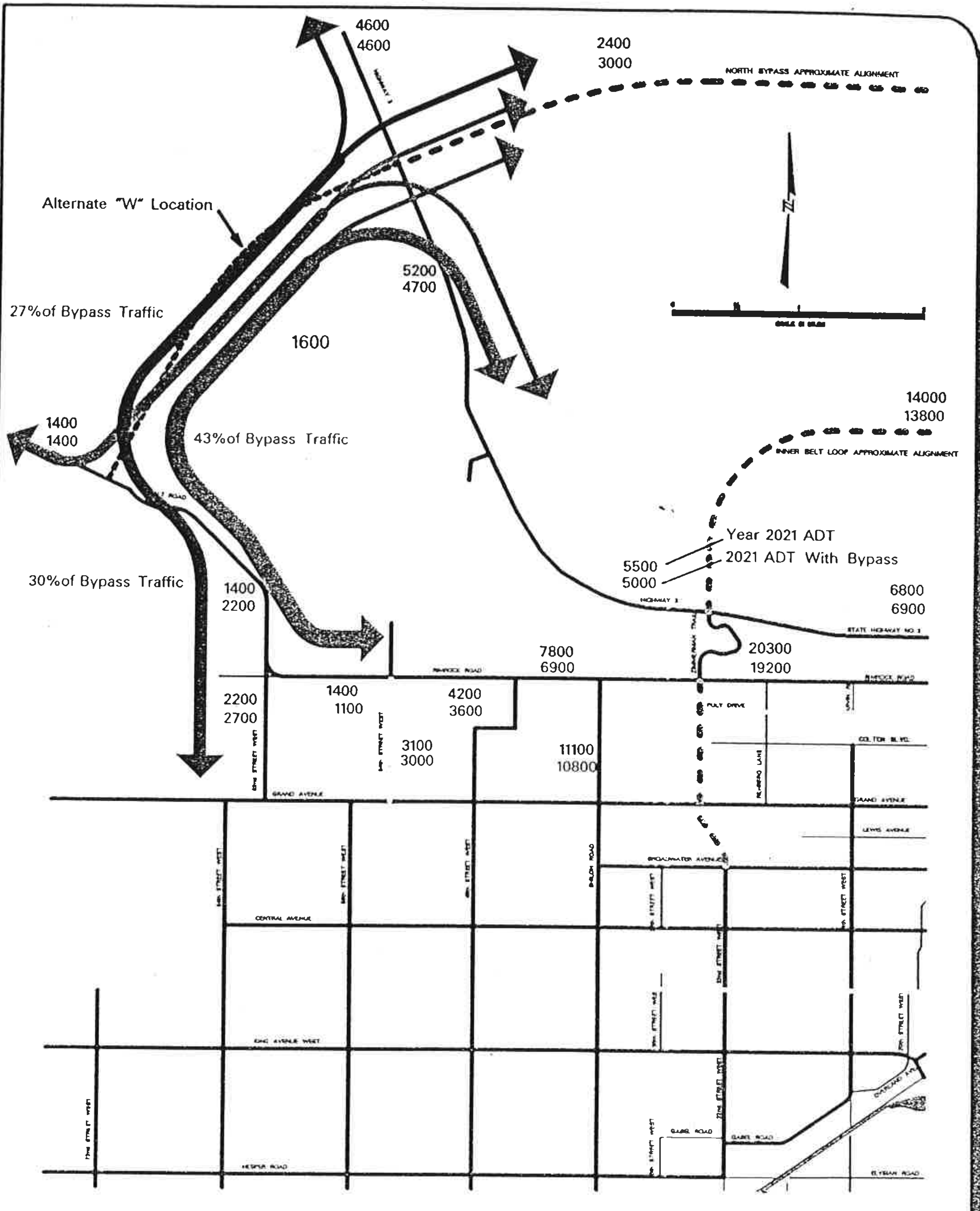


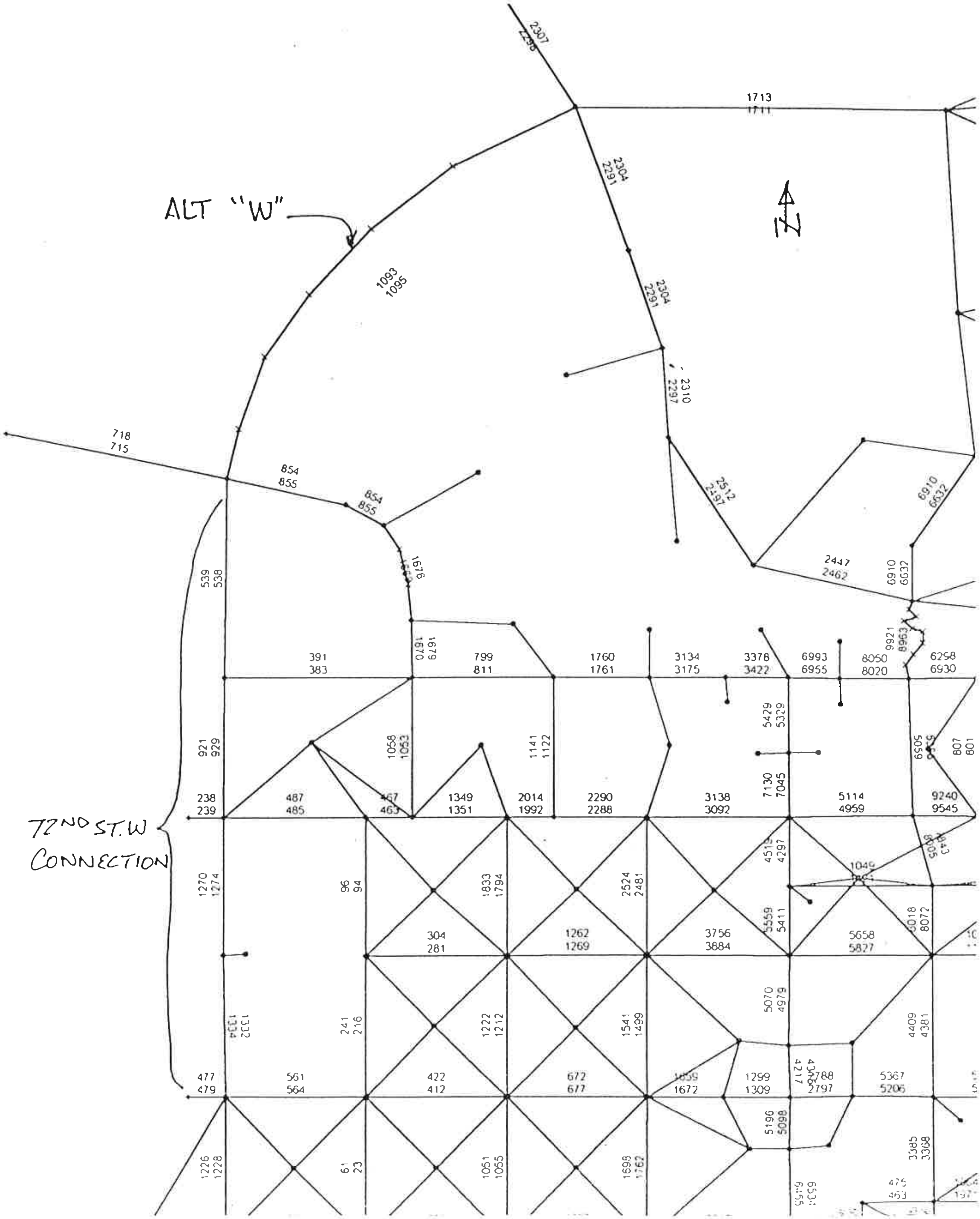
Figure 4. Alternate "W" Alignment Year 2021 Model Traffic Distribution

Table 2. Vehicle Miles & Vehicle Hours of Travel Comparison - Year 2021

	SEGMENT	Length Alt "E"	Length Alt "W"	Speed Alt "E"	Speed Alt "W"	ADT Base	ADT Alt "E"	ADT Alt "W"	VMT Base	VMT Alt "E"	VMT Alt "W"	VHT Base	VHT Alt "E"	VHT Alt "W"
Highway 3	West of Zimmerman	3.6	4.8	60	65	5540	5245	5012	26592	18882	24058	409	315	370
Highway 3	West of N. 27th Street	3.2	3.2	60	60	6835	7243	6915	21872	23178	22128	365	386	369
Zimmerman Trail	South of Highway 3	1	1	30	30	20304	18981	19221	20304	18981	19221	677	633	641
Zimmerman Trail	North of Highway 3	4.7	4.7	50	50	13988	13742	13760	65744	64587	64672	1315	1292	1293
Molt Road	North of Rimrock	1.4	2.4	55	60	1433	2784	2200	3439	3898	5280	57	71	88
Rimrock Road	West of 54th	1	1	50	50	1459	717	1062	1459	717	1062	29	14	21
Rimrock Road	East of 54th	1	1	45	45	4181	3241	3598	4181	3241	3598	93	72	80
Rimrock Road	54th to Zimmerman	2.4	2.4	45	45	7792	6520	6884	18701	15648	16522	416	348	367
Shiloh Road	South of Rimrock	1	1	45	45	11116	10708	10771	11116	10708	10771	247	238	239
62nd Street West	South of Rimrock	1	1	45	45	2222	2847	2701	2222	2847	2701	49	63	60
54th Street West	South of Rimrock	1	1	45	45	3118	2972	2982	3118	2972	2982	69	66	66
North Billings Bypass	East of Highway 3	13.2	12	65	65	2336	2954	2950	28032	38993	35400	431	600	545
Northwest Bypass	HWY 3 to Molt Road	3	4.2	50*	60	0	2193	1607	0	6579	6749	0	132	112
	TOTALS	38	40			80324	80147	79663	206780	211230	215144	4157	4229	4252

* Speed is based on anticipated intersection delay, QRS II Model used 60 mph for both alternate bypass links

YEAR 2021 72ND STREET CONNECTION



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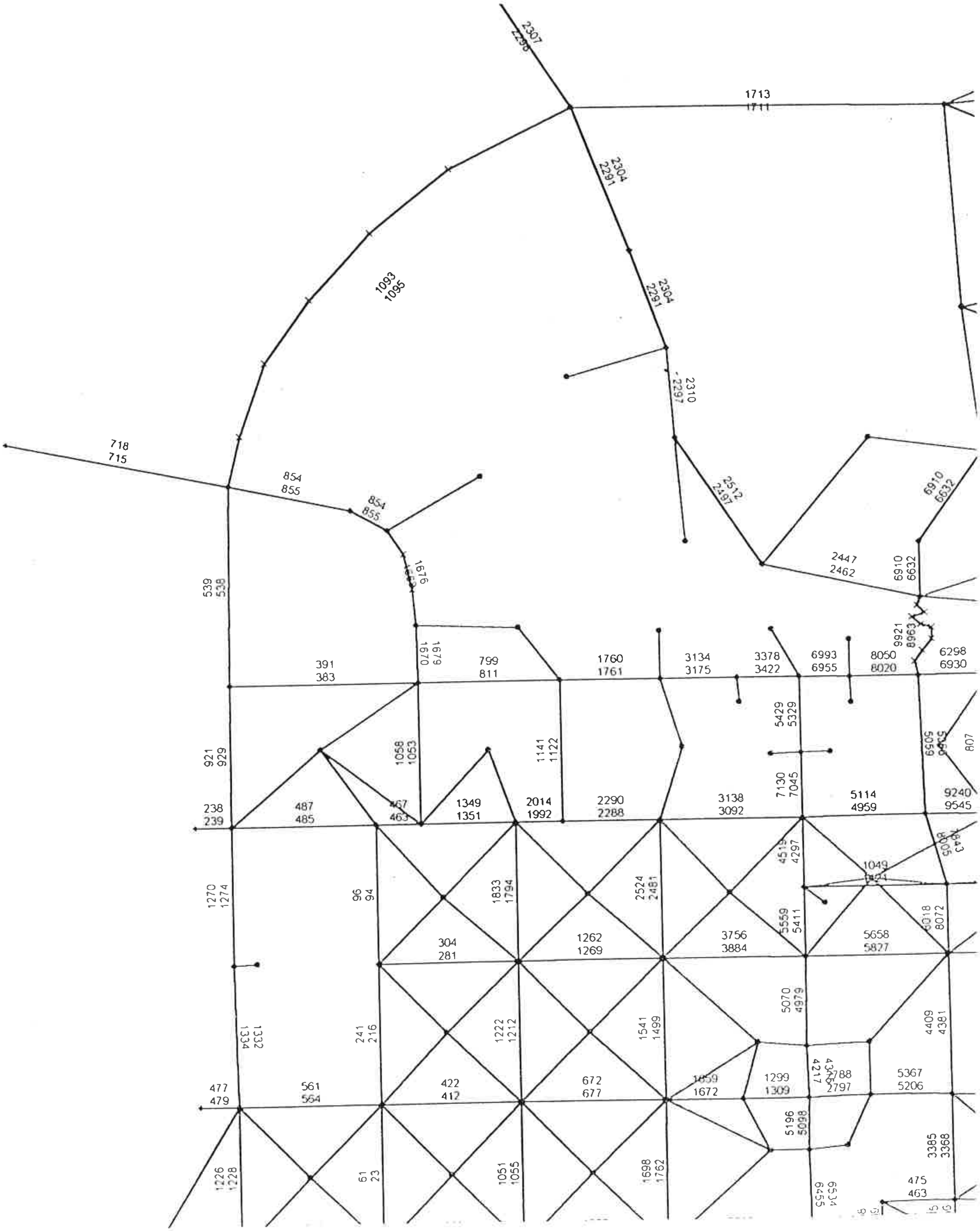

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5206
5196
5098
3385
3368
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Marvin & Associates
Traffic, Transportation, & Civil Engineers

Rick Leuthold, P.E.
Engineering Inc.
P.O. Box 81345
Billings, MT 59108

December 14, 2001

Re: Northwest Bypass
Transportation Analysis

Dear Rick:

This letter serves as an addendum to our December 3, 2001 report relative to the Northwest Bypass Transportation Analysis. The purpose of this addendum is to answer additional questions raised by the City of Billings during our review meeting on December 12, 2001.

It was noted in the meeting that our original report implied that Alternate "W" would be located within undeveloped land and Alternate "E" would be surrounded by developed land. This does not correctly describe current conditions, since both alternates would be located on land that is not currently developed. References within the report were addressing conditions being proposed. The correct wording should indicate that Alternate "E" would be located on undeveloped land, which has a major subdivision being proposed . Alternate "W" would be located on undeveloped land that has no known proposals for development.

During our meeting, I was requested to perform additional analysis to determine what impacts would be associated with using Alternate "E" as a location for a future collector street, since the original study concluded that it would not be ideal for a bypass route. Subsequent to our meeting, I was able to reformulate the traffic model so that Alternate "E" would have the characteristics of an urban collector street with travel speeds of 35 mph. The model results indicate that year 2021 traffic loadings would be approximately 1150 ADT on the northeastern portion of the route. This represents a reduction of approximately 1050 ADT from our previous model results. This traffic volume level is on the low end of typical collector street volumes, but slightly higher than desirable traffic volumes on local streets. Thus, the Alternate "E" location could function as a collector street within the planned subdivision.

Impacts on the Billings street system associated with construction of a collector street at the Alternate "E" location were calculated based on previously detailed model results. Changes in existing arterial street system volumes would be localized. Year 2021 traffic volumes would have the following percentage ADT changes on the area street system:

Highway 3 West of Zimmerman	1.5% Increase
Zimmerman Trail	3.1% Decrease
Rimrock Road West of Shiloh	10.6 % Decrease
Shiloh Road South of Rimrock	0.9 % Decrease
62nd South of Rimrock	2.4% Increase

Suite ... Creekside 1001 South 24th Street West P.O. Box 80785 Billings, Montana ...

54th South of Rimrock	3.3% Decrease
Inner Beltloop (Future)	1.5% Decrease
North Billings Bypass (Future)	17% Increase

To put this into perspective, traffic counts normally have a standard error of approximately 10%, which means that ADT volumes can only be stated within 10% accuracy. Thus, most of the above noted street system volume changes are not statistically significant. The future North Billings Bypass would have the highest level of probable impact, but the base volume for that link is only 2300 ADT and the future facility would have the capacity to carry traffic well in excess of that volume level.

It should also be noted that the Alternate "E" street location would also serve a reduced level of bypass type traffic even though it would function as a collector street. From model traffic distribution elements, it appears that approximately 50 vehicles per day would use this street as a Billings bypass. Unless expressly prohibited by ordinance, approximately 8 of these vehicles would be commercial type trucks.

In summary, the Alternate "E" location analyzed within our study would not function well as a bypass route. As a collector street it would have the potential to carry a level of traffic appropriate for its function. It would also provide desirable connectivity through the proposed subdivision and allow an appropriate interface with future subdivisions that may share boundaries in the future.

Hopefully the above information is adequate for the City to evaluate the options available to them with regard to the proposals being considered. If additional information is necessary, please advise.

Respectfully Submitted,

Robert R. Marvin

Robert R. Marvin, P.E., P.T.O.E.

APPENDIX D
PRELIMINARY COST INFORMATION

Rail Corridor - Alternative 1, Segment 1

Corridor/Segment Properties:

Length of Corridor	15427.7	feet
Length of Section	4725.3	feet
PMBS (Aggregate)	6.0	in
Base Course	12.0	in

Typical Road Section 1:

Length	4725.3	ft
Pavement Width	45.0	ft
Lane Width	14.0	ft
Shoulder Width	8.5	ft
Crown (C)	2%	ft/ft
PMBS (Aggregate) X-Section Area	22.5	ft^2
Base Course X-Section Area	45.0	ft^2
PCC Curb & Gutter	9450.7	ft
PCC Sidewalk	47253.3	sf

Typical Road Section 2:

Length	0.0	ft
Pavement Width	38.0	ft
Lane Width	12.0	ft
Shoulder Width	6.0	ft
Crown (C)	2%	ft/ft
PMBS (Aggregate) X-Section Area	19.0	ft^2
Base Course X-Section Area	51.6	ft^2
Guardrail	0.0	ft

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Cont, 25-ft X-sect)	42227.1
Fill (20-ft Cont, 25-ft X-sect)	171284.9

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	7589.3	Ton
Base Course	15178.5	yds^3
Aggregate Cover	304.8	Ton
Asphalt Cement	455.4	Ton
Prime	28.4	Ton
Seal	35.1	Ton
Tack	7307.7	gal

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 1, Segment 1

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	83,636	$	83,636
PMBS (Aggregate)	TON	7,589	$	22.00	$	166,965
Crushed Base Course (CBC)	CY	15,179	$	12.50	$	189,731
Cover	TON	305	$	29.00	$	8,839
Asphalt Cement	TON	455	$	232.00	$	105,643
Prime	TON	28	$	235.00	$	6,682
Seal	TON	35	$	212.00	$	7,442
Tack	GAL	7,308	$	0.70	$	5,115
Excavation/Emb	CY	171,300	$	2.25	$	385,425
Curb and Gutter	LF	9,451	$	10.00	$	94,507
Sidewalk	SF	47,253	$	3.25	$	153,573
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	47	$	1,500	$	70,880
Subtotal					**$**	**1,278,438**

Major Drainage Structures	Units	Length (ft)		Price	
Major Channel Crossing	LF	380	$	375.00	$142,500
Minor Channel Crossing 1	LF	100	$	375.00	$37,500
Minor Channel Crossing 2	LF	150	$	375.00	$56,250

Miscellaneous Items	@ 15%	$	191,766
Contingency (% of total)	@ 15%	$	255,968
Subtotal		**$**	**1,962,421**

Construction Engineering (Percentage of Subtotal)	8%	$	156,994
Preliminary Engineering (Percentage of Subtotal)	8%	$	156,994
Construction Costs Subtotal		**$**	**2,276,409**

Right-of-Way	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	11.475	$	3,000	$	34,425
Res - Unoccuped, Unimproved (Acres)	4.672	$	9,000	$	42,048
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**16.147**			**$**	**76,473**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,352,882**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 1, Segment 2

Corridor/Segment Properties:

Length of Corridor	15427.7	*feet*
Length of Section	3245.7	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	348.7	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	ft^2
Base Course X-Section Area	45.0	ft^2
PCC Curb & Gutter	697.3	*ft*
PCC Sidewalk	3486.7	*sf*

Typical Road Section 2:

Length	2897.0	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	ft^2
Base Course X-Section Area	51.6	ft^2
Guardrail	1650.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	227897.4
Fill (20-ft Contours, 50-ft X-sections)	55442.8

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*4489.1*	Ton
Base Course	*11790.5*	*yds*^{3}
Aggregate Cover	*180.3*	Ton
Asphalt Cement	*269.3*	Ton
Prime	*16.8*	Ton
Seal	*20.8*	Ton
Tack	*4322.5*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 1, Segment 2

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	43,377	$	43,377
PMBS (Aggregate)	TON	4,489	$	22.00	$	98,760
Crushed Base Course (CBC)	CY	11,791	$	12.50	$	147,381
Cover	TON	180	$	29.00	$	5,229
Asphalt Cement	TON	269	$	232.00	$	62,488
Prime	TON	17	$	235.00	$	3,952
Seal	TON	21	$	212.00	$	4,402
Tack	GAL	4,323	$	0.70	$	3,026
Excavation/Emb	CY	89,900	$	2.25	$	202,275
Curb and Gutter	LF	697	$	10.00	$	6,973
Sidewalk	SF	3,487	$	3.25	$	11,332
Guardrail	LF	1,650	$	15.25	$	25,163
Drainage	STA	32	$	1,500	$	48,685
Subtotal					**$**	**663,043**

Major Drainage Structures	Units	Length (ft)		Price	Cost
NA	LF	0	$	375.00	$0

Miscellaneous Items	@ 15%	$	99,456
Contingency (% of total)	@ 15%	$	114,375
Subtotal		**$**	**876,874**
Construction Engineering (Percentage of Subtotal)	8%	$	70,150
Preliminary Engineering (Percentage of Subtotal)	8%	$	70,150
Construction Costs Subtotal		**$**	**1,017,174**

Right-of-Way

	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	12.568	$	3,000	$	37,704
Res - Unoccuped, Unimproved (Acres)	0.000	$	9,000	$	-
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**12.568**			**$**	**37,704**

Utility Relocation		UNKNOWN
Grand Total	**$**	**1,054,878**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 1, Segment 3

Corridor/Segment Properties:

Length of Corridor	15427.7	feet
Length of Section	7456.6	feet
PMBS (Aggregate)	6.0	in
Base Course	12.0	in

Typical Road Section 1:

Length	7456.6	ft
Pavement Width	45.0	ft
Lane Width	14.0	ft
Shoulder Width	8.5	ft
Crown (C)	2%	ft/ft
PMBS (Aggregate) X-Section Area	22.5	ft^2
Base Course X-Section Area	45.0	ft^2
PCC Curb & Gutter	14913.2	ft
PCC Sidewalk	74566.0	sf

Typical Road Section 2:

Length	0.0	ft
Pavement Width	38.0	ft
Lane Width	12.0	ft
Shoulder Width	6.0	ft
Crown (C)	2%	ft/ft
PMBS (Aggregate) X-Section Area	19.0	ft^2
Base Course X-Section Area	51.6	ft^2
Guardrail	0.0	ft

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	24069.3
Fill (20-ft Contours, 50-ft X-sections)	32763.5

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*11975.9*	Ton
Base Course	*23951.8*	yds^3
Aggregate Cover	*481.0*	Ton
Asphalt Cement	*718.6*	Ton
Prime	*44.9*	Ton
Seal	*55.4*	Ton
Tack	*11531.6*	gal

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 1, Segment 3

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	93,020	$	93,020
PMBS (Aggregate)	TON	11,976	$	22.00	$	263,470
Crushed Base Course (CBC)	CY	23,952	$	12.50	$	299,398
Cover	TON	481	$	29.00	$	13,949
Asphalt Cement	TON	719	$	232.00	$	166,705
Prime	TON	45	$	235.00	$	10,544
Seal	TON	55	$	212.00	$	11,743
Tack	GAL	11,532	$	0.70	$	8,072
Excavation/Emb	CY	32,900	$	2.25	$	74,025
Curb and Gutter	LF	14,913	$	10.00	$	149,132
Sidewalk	SF	74,566	$	3.25	$	242,340
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	75	$	1,200	$	89,480
Subtotal					**$**	**1,421,876**

Major Drainage Structures	Units	Length (ft)		Price	Cost
NA	LF	0	$	375.00	$0

Miscellaneous Items	@ 15%	$	213,281
Contingency (% of total)	@ 15%	$	245,274
Subtotal		**$**	**1,880,430**
Construction Engineering (Percentage of Subtotal)	8%	$	150,434
Preliminary Engineering (Percentage of Subtotal)	8%	$	150,434
Construction Costs Subtotal		**$**	**2,181,299**

Right-of-Way

	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	17.066	$	3,000	$	51,198
Res - Unoccuped, Unimproved (Acres)	0.000	$	9,000	$	-
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**17.066**			**$**	**51,198**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,232,497**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 2, Segment 1

Corridor/Segment Properties:

Length of Corridor	14948.4	*feet*
Length of Section	4725.0	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	4241.1	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	*ft^2*
Base Course X-Section Area	45.0	*ft^2*
PCC Curb & Gutter	8482.1	*ft*
PCC Sidewalk	42410.7	*sf*

Typical Road Section 2:

Length	0.0	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	*ft^2*
Base Course X-Section Area	51.6	*ft^2*
Guardrail	0.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	26936.0
Fill (20-ft Contours, 50-ft X-sections)	126397.1

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*6811.5*	*Ton*
Base Course	*13623.0*	*yds^3*
Aggregate Cover	*273.5*	*Ton*
Asphalt Cement	*408.7*	*Ton*
Prime	*25.5*	*Ton*
Seal	*31.5*	*Ton*
Tack	*6558.8*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 2, Segment 1

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	71,361	$	71,361
PMBS (Aggregate)	TON	6,812	$	22.00	$	149,853
Crushed Base Course (CBC)	CY	13,623	$	12.50	$	170,288
Cover	TON	274	$	29.00	$	7,932
Asphalt Cement	TON	409	$	232.00	$	94,816
Prime	TON	26	$	235.00	$	5,997
Seal	TON	32	$	212.00	$	6,679
Tack	GAL	6,559	$	0.70	$	4,591
Excavation/Emb	CY	127,000	$	2.25	$	285,750
Curb and Gutter	LF	8,482	$	10.00	$	84,821
Sidewalk	SF	42,411	$	3.25	$	137,835
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	47	$	1,500	$	70,875
Subtotal					**$**	**1,090,797**

Major Drainage Structures	Units	Length (ft)		Price	
Major Channel Crossing	LF	380	$	375.00	$142,500
Minor Channel Crossing 1	LF	100	$	375.00	$37,500
Minor Channel Crossing 2	LF	110	$	375.00	$41,250

Miscellaneous Items	@ 15%	$	163,620
Contingency (% of total)	@ 15%	$	221,350
Subtotal		**$**	**1,697,016**
Construction Engineering (Percentage of Subtotal)	8%	$	135,761
Preliminary Engineering (Percentage of Subtotal)	8%	$	135,761
Construction Costs Subtotal		**$**	**1,968,539**

Right-of-Way

	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	4.955	$	3,000	$	14,865
Res - Unoccuped, Unimproved (Acres)	8.782	$	9,000	$	79,038
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**13.737**			**$**	**93,903**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,062,442**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 2, Segment 2

Corridor/Segment Properties:

Length of Corridor	14948.4	*feet*
Length of Section	3251.0	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	352.9	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	*ft^2*
Base Course X-Section Area	45.0	*ft^2*
PCC Curb & Gutter	705.9	*ft*
PCC Sidewalk	3529.3	*sf*

Typical Road Section 2:

Length	2897.7	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	*ft^2*
Base Course X-Section Area	51.6	*ft^2*
Guardrail	1650.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	228705.4
Fill (20-ft Contours, 50-ft X-sections)	51971.5

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*4496.8*	*Ton*
Base Course	*11806.8*	*yds^3*
Aggregate Cover	*180.6*	*Ton*
Asphalt Cement	*269.8*	*Ton*
Prime	*16.8*	*Ton*
Seal	*20.8*	*Ton*
Tack	*4330.0*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 2, Segment 2

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	47,229	$	47,229
PMBS (Aggregate)	TON	4,497	$	22.00	$	98,930
Crushed Base Course (CBC)	CY	11,807	$	12.50	$	147,585
Cover	TON	181	$	29.00	$	5,237
Asphalt Cement	TON	270	$	232.00	$	62,595
Prime	TON	17	$	235.00	$	3,959
Seal	TON	21	$	212.00	$	4,409
Tack	GAL	4,330	$	0.70	$	3,031
Excavation/Emb	CY	114,000	$	2.25	$	256,500
Curb and Gutter	LF	706	$	10.00	$	7,059
Sidewalk	SF	3,529	$	3.25	$	11,470
Guardrail	LF	1,650	$	15.25	$	25,163
Drainage	STA	33	$	1,500	$	48,765
Subtotal					**$**	**721,932**

Major Drainage Structures	Units	Length (ft)		Price	
NA	LF	0	$	375.00	$0

Miscellaneous Items	@ 15%	$	108,290
Contingency (% of total)	@ 15%	$	124,533
Subtotal		**$**	**954,756**
Construction Engineering (Percentage of Subtotal)	8%	$	76,380
Preliminary Engineering (Percentage of Subtotal)	8%	$	76,380
Construction Costs Subtotal		**$**	**1,107,517**

Right-of-Way	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	12.568	$	3,000	$	37,704
Res - Unoccuped, Unimproved (Acres)	0.000	$	9,000	$	-
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**12.568**			**$**	**37,704**

Utility Relocation		UNKNOWN
Grand Total	**$**	**1,145,221**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 2, Segment 3

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	93,020	$	93,020
PMBS (Aggregate)	TON	11,976	$	22.00	$	263,470
Crushed Base Course (CBC)	CY	23,952	$	12.50	$	299,398
Cover	TON	481	$	29.00	$	13,949
Asphalt Cement	TON	719	$	232.00	$	166,705
Prime	TON	45	$	235.00	$	10,544
Seal	TON	55	$	212.00	$	11,743
Tack	GAL	11,532	$	0.70	$	8,072
Excavation/Emb	CY	32,900	$	2.25	$	74,025
Curb and Gutter	LF	14,913	$	10.00	$	149,132
Sidewalk	SF	74,566	$	3.25	$	242,340
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	75	$	1,200	$	89,480
Subtotal					**$**	**1,421,876**

Major Drainage Structures	Units	Length (ft)		Price	Cost
NA	LF	0	$	375.00	$0

Miscellaneous Items	@ 15%	$	213,281
Contingency (% of total)	@ 15%	$	245,274
Subtotal		**$**	**1,880,430**
Construction Engineering (Percentage of Subtotal)	8%	$	150,434
Preliminary Engineering (Percentage of Subtotal)	8%	$	150,434
Construction Costs Subtotal		**$**	**2,181,299**

Right-of-Way

	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	17.066	$	3,000	$	51,198
Res - Unoccuped, Unimproved (Acres)	0.000	$	9,000	$	-
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**17.066**			**$**	**51,198**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,232,497**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 3, Segment 1

Corridor/Segment Properties:

Length of Corridor	14378.5	*feet*
Length of Section	3671.2	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	3671.2	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	*ft^2*
Base Course X-Section Area	45.0	*ft^2*
PCC Curb & Gutter	7342.4	*ft*
PCC Sidewalk	36712.0	*sf*

Typical Road Section 2:

Length	0.0	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	*ft^2*
Base Course X-Section Area	51.6	*ft^2*
Guardrail	0.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	27278.7
Fill (20-ft Contours, 50-ft X-sections)	107375.1

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*5896.3*	*Ton*
Base Course	*11792.5*	*yds^3*
Aggregate Cover	*236.8*	*Ton*
Asphalt Cement	*353.8*	*Ton*
Prime	*22.1*	*Ton*
Seal	*27.3*	*Ton*
Tack	*5677.5*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 3, Segment 1

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	60,917	$	60,917
PMBS (Aggregate)	TON	5,896	$	22.00	$	129,719
Crushed Base Course (CBC)	CY	11,793	$	12.50	$	147,406
Cover	TON	237	$	29.00	$	6,867
Asphalt Cement	TON	354	$	232.00	$	82,076
Prime	TON	22	$	235.00	$	5,191
Seal	TON	27	$	212.00	$	5,782
Tack	GAL	5,678	$	0.70	$	3,974
Excavation/Emb	CY	107,300	$	2.25	$	241,425
Curb and Gutter	LF	7,342	$	10.00	$	73,424
Sidewalk	SF	36,712	$	3.25	$	119,314
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	37	$	1,500	$	55,068
Subtotal					**$**	**931,164**

Major Drainage Structures	Units	Length (ft)		Price	Cost
Major Channel Crossing	LF	400	$	375.00	$150,000
Minor Channel Crossing 1	LF	100	$	375.00	$37,500
Minor Channel Crossing 2	LF	110	$	375.00	$41,250

Miscellaneous Items	@ 15%	$	139,675
Contingency (% of total)	@ 15%	$	194,938
Subtotal		**$**	**1,494,526**
Construction Engineering (Percentage of Subtotal)	8%	$	119,562
Preliminary Engineering (Percentage of Subtotal)	8%	$	119,562
Construction Costs Subtotal		**$**	**1,733,651**

Right-of-Way

Right-of-Way	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	1.738	$	3,000	$	5,214
Res - Unoccuped, Unimproved (Acres)	8.282	$	9,000	$	74,538
Res - Unoccuped, Improved (Acres)	1.383	$	160,000	$	221,280
Public	2.765	$	10,000	$	27,650
Right-of-Way Costs Subtotal	**14.168**			**$**	**328,682**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,062,333**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 3, Segment 2

Corridor/Segment Properties:

Length of Corridor	14378.5	*feet*
Length of Section	3251.0	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	352.8	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	*ft^2*
Base Course X-Section Area	45.0	*ft^2*
PCC Curb & Gutter	705.6	*ft*
PCC Sidewalk	3527.9	*sf*

Typical Road Section 2:

Length	2897.9	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	*ft^2*
Base Course X-Section Area	51.6	*ft^2*
Guardrail	1650.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	236866.4
Fill (20-ft Contours, 50-ft X-sections)	48616.1

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*4496.8*	*Ton*
Base Course	*11806.8*	*yds^3*
Aggregate Cover	*180.6*	*Ton*
Asphalt Cement	*269.8*	*Ton*
Prime	*16.8*	*Ton*
Seal	*20.8*	*Ton*
Tack	*4330.0*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 3, Segment 2

Construction Costs

Item	Units	Quantity	Price	Cost
Mobilization (7%)	LUMP SUM	1	$ 50,843	$ 50,843
PMBS (Aggregate)	TON	4,497	$ 22.00	$ 98,930
Crushed Base Course (CBC)	CY	11,807	$ 12.50	$ 147,585
Cover	TON	181	$ 29.00	$ 5,237
Asphalt Cement	TON	270	$ 232.00	$ 62,595
Prime	TON	17	$ 235.00	$ 3,959
Seal	TON	21	$ 212.00	$ 4,409
Tack	GAL	4,330	$ 0.70	$ 3,031
Excavation/Emb	CY	136,950	$ 2.25	$ 308,138
Curb and Gutter	LF	706	$ 10.00	$ 7,056
Sidewalk	SF	3,528	$ 3.25	$ 11,466
Guardrail	LF	1,650	$ 15.25	$ 25,163
Drainage	STA	33	$ 1,500	$ 48,765
Subtotal				**$ 777,177**

Major Drainage Structures	Units	Length (ft)	Price	
NA	LF	0	$ 375.00	$0

Miscellaneous Items	@ 15%	$ 116,576
Contingency (% of total)	@ 15%	$ 134,063
Subtotal		**$ 1,027,816**
Construction Engineering (Percentage of Subtotal)	8%	$ 82,225
Preliminary Engineering (Percentage of Subtotal)	8%	$ 82,225
Construction Costs Subtotal		**$ 1,192,267**

Right-of-Way

	Acres or Each	Est. Price	
Agricultural - Suburban (Acres)	0.000	$ 5,000	$ -
Agricultural - Open (Acres)	12.877	$ 3,000	$ 38,631
Res - Unoccuped, Unimproved (Acres)	0.000	$ 9,000	$ -
Res - Unoccuped, Improved (Acres)	0.000	$ 160,000	$ -
Public	0.000	$ 10,000	$ -
Right-of-Way Costs Subtotal	**12.877**		**$ 38,631**

Utility Relocation	UNKNOWN
Grand Total	**$ 1,230,898**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

Rail Corridor - Alternative 3, Segment 3

Corridor/Segment Properties:

Length of Corridor	14378.5	*feet*
Length of Section	7456.6	*feet*
PMBS (Aggregate)	6.0	*in*
Base Course	12.0	*in*

Typical Road Section 1:

Length	7456.6	*ft*
Pavement Width	45.0	*ft*
Lane Width	14.0	*ft*
Shoulder Width	8.5	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	22.5	*ft^2*
Base Course X-Section Area	45.0	*ft^2*
PCC Curb & Gutter	14913.2	*ft*
PCC Sidewalk	74566.0	*sf*

Typical Road Section 2:

Length	0.0	*ft*
Pavement Width	38.0	*ft*
Lane Width	12.0	*ft*
Shoulder Width	6.0	*ft*
Crown (C)	2%	*ft/ft*
PMBS (Aggregate) X-Section Area	19.0	*ft^2*
Base Course X-Section Area	51.6	*ft^2*
Guardrail	0.0	*ft*

Cut/Fill Quantities:

(assumes crossover between segments)

Cut (20-ft Contours, 50-ft X-sections)	24069.3
Fill (20-ft Contours, 50-ft X-sections)	32763.5

Road Quantities:

(based on x-sectional area or top surface)

PMBS (Aggregate)	*11975.9*	*Ton*
Base Course	*23951.8*	*yds^3*
Aggregate Cover	*481.0*	*Ton*
Asphalt Cement	*718.6*	*Ton*
Prime	*44.9*	*Ton*
Seal	*55.4*	*Ton*
Tack	*11531.6*	*gal*

Cut/Fill quantities adjusted for each Segment to account for assumed swell/shrink factors, construction phasing, and adjacent borrow sources

Rail Corridor - Alternative 3, Segment 3

Construction Costs

Item	Units	Quantity		Price		Cost
Mobilization (7%)	LUMP SUM	1	$	93,020	$	93,020
PMBS (Aggregate)	TON	11,976	$	22.00	$	263,470
Crushed Base Course (CBC)	CY	23,952	$	12.50	$	299,398
Cover	TON	481	$	29.00	$	13,949
Asphalt Cement	TON	719	$	232.00	$	166,705
Prime	TON	45	$	235.00	$	10,544
Seal	TON	55	$	212.00	$	11,743
Tack	GAL	11,532	$	0.70	$	8,072
Excavation/Emb	CY	32,900	$	2.25	$	74,025
Curb and Gutter	LF	14,913	$	10.00	$	149,132
Sidewalk	SF	74,566	$	3.25	$	242,340
Guardrail	LF	0	$	15.25	$	-
Drainage	STA	75	$	1,200	$	89,480
Subtotal					**$**	**1,421,876**

Major Drainage Structures	Units	Length (ft)		Price	
NA	LF	0	$	375.00	$0

Miscellaneous Items	@ 15%	$	213,281
Contingency (% of total)	@ 15%	$	245,274
Subtotal		**$**	**1,880,430**
Construction Engineering (Percentage of Subtotal)	8%	$	150,434
Preliminary Engineering (Percentage of Subtotal)	8%	$	150,434
Construction Costs Subtotal		**$**	**2,181,299**

Right-of-Way	Acres or Each		Est. Price		
Agricultural - Suburban (Acres)	0.000	$	5,000	$	-
Agricultural - Open (Acres)	17.066	$	3,000	$	51,198
Res - Unoccuped, Unimproved (Acres)	0.000	$	9,000	$	-
Res - Unoccuped, Improved (Acres)	0.000	$	160,000	$	-
Public	0.000	$	10,000	$	-
Right-of-Way Costs Subtotal	**17.066**			**$**	**51,198**

Utility Relocation		UNKNOWN
Grand Total	**$**	**2,232,497**

Unit costs are based on 2002/2003 MDT Average Prices

Right-of-Way costs based on 2002 real estate prices

APPENDIX E
PUBLIC EXPOSURE

billingsgazette.com
Billings Gazette

http://www.billingsgazette.com/index.php?display=rednews/2001/12/18/build/local/40annex.inc

Subdivider seeks land annexation to Billings

By ED KEMMICK
Of The Gazette Staff

The owner of 287 acres just north of Yellowstone Country Club hopes to have his land annexed by the city early next year.

Landowner Shane Gundlach is working with builder Dan Wells to develop the property as the Ironwood Estates Subdivision, which will have about 400 home sites and will include about 50 acres of public park land and more than five miles of walking and biking trails.

The layout of the subdivision also will incorporate a road that might be used in the future as a link between Molt Road and Highway 3 above the Rims.

Gundlach and Wells have submitted the paperwork to petition for annexation, but the city won't act on the request until an urban expansion study has been completed. The purpose of the study, being done by Engineering Inc., is to determine how city services could be extended to thousands of acres of land between Shiloh Road and 56th Street West, from King Avenue to the Rims.

Completion of that study will make it possible for other developers around the Yellowstone Country Club to move forward with annexation. Besides Gundlach's land, several hundred acres in that corner of the valley are likely to be brought into the city within the next year.

Gundlach and Wells said they were involved from the beginning in the preparation of the West Billings Neighborhood Plan, meant to guide development and land-use decisions in an area encompassing more than 33 square miles west of the city.

They said Ironwood Estates conforms with that plan by developing dryland farm ground rather than irrigated land and by connecting to city water and sewer service as a means of achieving the kind of residential density needed for orderly growth.

It also complies with the planning document by providing corridors for pedestrian and bike trails and by setting aside nearly 50 acres of park land, more than double the amount required by law.

"This fits hand in hand with the West End plan," Wells said.

The potential connecting road through the subdivision was first suggested in another planning document, the 1977 Transportation Plan for the Billings area. The proposed route was included in the 1990 and 2000 updates of the plan, but some confusion arose over the purpose of the road.

The Transportation Plan appeared to suggest that the Molt Road-Highway 3 connector would be part of the proposed North Bypass, which would move traffic around Billings to the north by creating a link between the I-90/I-94 interchange and Highway 3.

During the West End planning process, Gundlach and other West End property owners received assurances from city and county officials that the bypass would be moved farther west.

But when Engineering Inc. turned in preliminary drawings of Ironwood Estates, showing no connecting road of any kind, former Planning Board member Jeff Essmann feared the worst. He fired off a letter to planning staff members and elected officials, saying the subdivision proposal was prepared in violation of the Transportation Plan and "deliberately ignored the needs of this community."

Essmann said the Highway 3-Molt Road link was always shown as going through what is now the Gundlach property because it appears to be the easiest place to build a road between Zimmerman Trail and the railroad tracks that are just west of the planned subdivision. He and others involved in planning warned that if land weren't set aside now, the city could lose forever access to a potentially vital north-south link.

Essmann's letter went out in November. The City-County Planning Department subsequently contracted with Marvin and Associates to do a traffic evaluation of the proposed connector road through Gundlach's property.

Marvin's study concluded that a full bypass connection at that location would be unnecessary, but that in the future a collector street moving mainly local traffic from the Rims to Molt Road might well be needed. Existing streets designated as collectors include Lewis Avenue, Colton Boulevard and Lake Elmo Road.

Public Works Director Dave Mumford said Monday that Engineering Inc. has been asked to reconfigure the subdivision's street layout to accommodate the proposed link. The street would serve the needs of the subdivision for now and would dead-end at the northeast corner of the property, ready to be connected when needed.

Wells said he and Gundlach are hoping to have the land annexed by the third week in January and to begin building a road and other improvements on the property in the spring, with the first few houses completed by next fall.

A foundation has already been dug for a house Gundlach intends to build for himself in the northeast corner of the subdivision. He said he's building it to jump-start the subdivision, but eventually wants to build a house on land he owns just east of Ironwood Estates.

Gundlach, a Montana native whose business, GTI System Integrators, specializes in automating major law firms, said he bought the Ironwood Estates acreage only to guarantee access to his own eventual home site, and decided to create a subdivision as a way of getting his investment back.

"I'm not a developer," he said. "I never thought I would be."

Gundlach and Wells said the subdivision will be built with three types of homeowners in mind. The northwestern corner will be developed on smaller lots, built for empty-nesters who want a maintenance-free lifestyle.

Other lots would be developed for families who want full city services but larger-than-average lots. The final market they are aiming at is people who want upscale houses on private roads. That means through-traffic would be allowed on some streets, but gates would be installed at several intersections to limit access to portions of the subdivision.

"We were trying to do a subdivision different than any that had been done before," Gundlach said. "We wanted to make a subdivision the city would be proud of."

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City annexes large area of far west end

By ED KEMMICK
Of The Gazette Staff

The city of Billings got bigger Monday night, but not much more populous. That will come later.

The expansion came when the City Council voted in favor of four separate annexations, all of them in the area of the Yellowstone Country Club. All told, the annexations added 558.4 acres of mostly vacant land to the city.

The council also made a few adjustments - adding $6,000 to the Tumbleweed Runaway Program and $5,000 to the Community Housing Resource Board - before approving $1.6 million in Community Development Block Grant and Home Program allocations.

The largest of the four annexations was a 288-acre parcel northwest of the Yellowstone Country Club between the Rimrocks and Molt Road. The owners of the property are planning to develop it as the Ironwood Estates Subdivision.

As part of the annexation agreement, the owners have agreed that if a road connection is someday built between Highway 3 and Molt Road, they will not object to having a residential collector street run through the subdivision. They also agreed to prepare a plan showing the level and type of public park improvements that will be created during each phase of the subdivision development.

The second-largest parcel is 248 acres west of Molt Road and north of Rimrock Road. The owner intends to use the land for residential and commercial purposes. A third landowner has 20 acres of property between the country club and Molt Road about a quarter mile north of Rimrock Road. The owner is planning a single-family development.

The last annexation involves 2.4 acres northwest of the country club on Molt Road and 62nd Street West. The owners of all four properties requested annexation in order to have access to city services, primarily water and sewer service.

City Administrator Dennis Taylor said that with the new annexations, the city nearly surrounds the Yellowstone Country Club and the housing area around it, all of which is outside city limits. He said he has been meeting with representatives of homeowners in the area and expects to have annexation petitions from more than half of them submitted by fall.

If everything proceeds on schedule, Taylor said, the country club area could be annexed by the end of the year.

Funding additions

The council tinkered only slightly with the annual CDBG and Home Program allocations recommended by the Community Development Board.

The amendments increased funding for the Community Housing Resource Board from $10,000 to $15,000, and for the Tumbleweed program from $10,000 to $16,000. The extra money for the housing board will come out of a CDBG contingency fund.

The Tumbleweed program, however, was funded as part of public service activities, which meant the additional $6,000 had to be subtracted from the other recipients of those funds. To spread out the impact, the council voted to reduce each of the other 18 allocations by slightly more than $300.

The council also voted to create a $2 million special improvement district along King Avenue East in the area of the Amend Park soccer complex. The project will bring storm drains, sewer and water services, sidewalks, street lights and street-widening improvements to King Avenue East from South Billings Boulevard to Parkway Lane and lesser improvements to Simpson Street from South Billings Boulevard to Foote Street.

A variety of public sources will be used to fund all but $1.2 million of the project, which will come from assessments on property owners.

In addition, the council approved a $642,733 contract with JTL Group, the low bidder, to build a concrete bicycle-pedestrian trail from Coulson Park to downtown Billings.

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Meeting set to discuss 2-mile connector road

By JACI WEBB
Of The Gazette Staff
New plans for a road to link the Molt Road and Highway 3 rest on building a road less traveled.

Five possible corridors for a 2-mile stretch of road that will connect the far West End to the Rims will be presented at a public meeting at 7 p.m. Wednesday at Arrowhead Elementary. It would provide the city's fourth link from the valley to the Rims.

The road has been in local planning documents since 1977, but recently plans for it have taken a new direction. Originally designed as an arterial that would be part of the inner belt loop across the Rims, the proposed road has been downgraded to a 2-lane neighborhood collector. It will link the neighborhood near Ironwood subdivision north of Yellowstone Country Club to Highway 3.

Todd Cormier, transportation project manager with HKM Engineering Inc., expects the neighborhood to be considerably relieved with plans for a smaller road. Cormier said he envisions a day when the West End will use the collector to get downtown faster.

Construction of such a road is still several years away, Cormier said.

"We're not developing alignments – we're not developing a road," Cormier said. "We're just coming in studying the area, developing the corridors and looking at costs."

Public comment from the meeting will be presented to the City County Planning Department, which will then decide how to proceed. All major land owners who might be affected by the road have been contacted and have provided input on the design. Cormier said he hopes to receive more comment about the corridors, all of which stretch through Ironwood subdivision. The identified corridors for the road are mostly west of the Yellowstone Country Club and east of the railroad tracks. One of the routes would follow the petroleum pipeline through a coulee and another would cross the railroad tracks.

"It's been a concern of a lot of people that this will be a truck route," Cormier said. "That's not the case. It's not going to be an arterial road like 27th Street. What this will do is provide a nice, neighborhood connection point for people in the Molt Road area or in the Ironwood subdivision to go downtown."

Cormier said through a planning study, he hopes to determine which corridor works best, considering such things as public input cost. He said both the city of Billings and Yellowstone County are paying for the study because the road would be in both jurisdictions.

The question of who will pay for the construction of the road is still up in the air. Cormier said that if federal money is used for construction, semi-trucks must be allowed to use the road. However, he said it would be inconvenient for semis to use the road because it won't provide easy access to the interstate.

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Council to consider connector road study

Gazette Staff

A new study evaluates five potential alignments for a new route connecting Molt Road and Highway 3 northwest of Billings.

The study, conducted by HKM Engineering Inc., will be presented for consideration at tonight's City Council meeting. The meeting begins at 6:30 p.m. at City Hall.

Traffic studies since the 1970s have identified the need for additional routes across the Rimrocks, according to HKM. The Billings West End Plan, approved in 2001, mentioned the need to evaluate and develop a major route connecting Molt Road and Highway 3.

All five alignments studied in HKM's feasibility study would intersect with the Molt Road west of Zimmerman Trail and with Highway 3 north of Billings. The alignments are between 2.23 and 3.01 miles long.

A public information meeting attended by 140 people was held June 4, and a Web site was established to allow people to make comments online. The consultants also met with affected property owners.

The only other item on the council's regular agenda is a public hearing and resolution for annexing a 1-acre tract on the northeast corner of Bitterroot Drive and Erin Street in the Heights. Planning staff is recommending that the council approve a resolution annexing the property.

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