Clarification to 75-20-211 (iii) and (iv)

(iii) need reasonable alternate locations, comparison of alternatives, statement why the proposed location is best suited for the facility.

(iv) baseline data for primary and reasonable alternate locations (see responses in Circular 2)

Clarification to Circular MFSA-2 Section 3.0 (9)

9) Rationale (methods for determining alternative routes and how public input was incorporated).

Clarification to Circular MFSA-2 Section 3.5 (1a), (1c), and (2)

1a) Preferred location criteria

1c) Pipelines: Incorporation of environmental information required by Section 3.2(1)(e) and Section 3.4

2) Explanation of methods.

Keystone Response

Keystone's MFSA application identified a number of alternative routes and provided an analysis which supported its determination that that alternative designated "Route B" is the preferred route. In reviewing Keystone's application, DEQ indicated that the application was incomplete with respect to the identification of alternative routes. In addition, DEQ staff submitted their comments on the suitability of the alternative routes to the Department of State, which resulted in a data request from DOS (Alternatives nos. 1 and 2, dated April 3, 2009). In this data request, DEQ and DOS suggested that additional analysis be conducted using GIS software to help weight and identify three additional alternatives across Montana to include in the EIS.

The data request required Keystone to consider three additional alternatives in locations generally identified by DEQ, with the specific alternative routes to be developed by taking into account numerous avoidance, exclusion, and preference criteria identified by DEQ. These criteria were consistent with the MFSA regulations cited above and Circular MFSA-2. This exercise was intended to ensure that Keystone considered alternative routes that were specifically developed using the MFSA criteria.

The data request directed Keystone to conduct a least cost path GIS analysis to identify specific alternative routes, using the criteria discussed above. Prior to conducting the GIS software analysis, Keystone engaged DEQ and DOS in a series of discussions regarding the appropriate weighting to apply to each criterion (avoidance, exclusion, and preference) to generate alternative routes. In addition to these criteria, DEQ and DOS agreed that additional criteria applicable to large diameter pipeline design and construction could be used after the GIS developed alternatives. These criteria included constructability and routing considerations necessary to develop a route that is realistic—or constructible (i.e., square up river and road crossings at close to 90 degree angles).

After Keystone ran the GIS software, the results developed were within the corridors originally established for the alternatives presented in the MFSA application. The suitability of these GIS generated alternatives, as well as the original alternatives included in the MFSA application, is analyzed in the attached report.

For the reasons discussed in the attached Route Alternatives Analysis Report, none of the alternatives generated by the GIS software are considered preferable to Route B. The primary consideration weighing against the alternatives generated by the GIS analysis is their significantly greater length as compared with Route B. This greater length results in substantially higher construction costs, as well as significantly larger environmental impact areas. Relative capital cost increases for the alternatives over Route B range from $3.25 million to $241 million. Increased cost is particularly relevant with respect to the MFSA routing criterion that favors the use of public lands Montana Code 75-20-301(h). The Code provision specifically provides that public lands should be selected "whenever their use is as economically practicable as the use of private lands." Clearly, in this case, the use of public lands is not as economically practicable as Route B and, for that reason, adherence to a route resulting from the public lands criterion is not appropriate here.

Similarly, the alternatives supplied in the MFSA application were not preferable to Route B for similar reasons, longer length, higher costs and larger environmental impact area. Therefore Route B is the preferred route.

Keystone XL Steele City US Segment

Montana Route Alternatives Analysis Report

Submitted in Response to Montana Department of Environmental Quality
Supplemental Information Request to the
Major Facility Siting Act Application
And in Response to Department of State Data Request 17-1

August 2009

Prepared by:
TransCanada Keystone Pipeline, LP

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Appendices

1.0 Executive Summary

On April 3, 2009, Data Request #1 was received from Entrix regarding the Keystone XL Project Pipeline Presidential Permit Application Environmental Report that was submitted to the US Department of State (DOS). Included in this Data Request was additional discussion on route alternatives required by the Montana Department of Environmental Quality (DEQ).

The full text of this Data Request is included in Appendix A of this report. It provides the complete list of criteria DEQ asked Keystone XL to consider including, 1) start and end points, 2) preferred areas, 3) areas to exclude, and 4) areas to avoid. These are also included in Section 3.2.1. In addition, DEQ had previously requested an assessment of co-locating with the Baker Pipeline beginning in Fallon County, MT. The counties mentioned in Part 1 (a), (b), and (c) of the Data Request constitute the study area for alternatives assessed in this report.

The purpose of this document is to respond to the DOS/DEQ data request and to evaluate various alternatives for the US portion of the Steele City Segment of the Keystone XL Pipeline, particularly focusing on the state of Montana. This report will address the suitability of the GIS alternatives, along with the other alternatives that have been considered in Montana. This evaluation will present Keystone's reasoning for the selection of Alternative B as the preferred route.

A total of seven (7) alternatives are considered in this report. The alternatives were developed manually using desktop geographic and land use data or by using geographic information system (GIS) to produce computer-generated alternatives. The alternatives are illustrated in Figure 1. A large map of the alternatives is attached to this report as Appendix B.

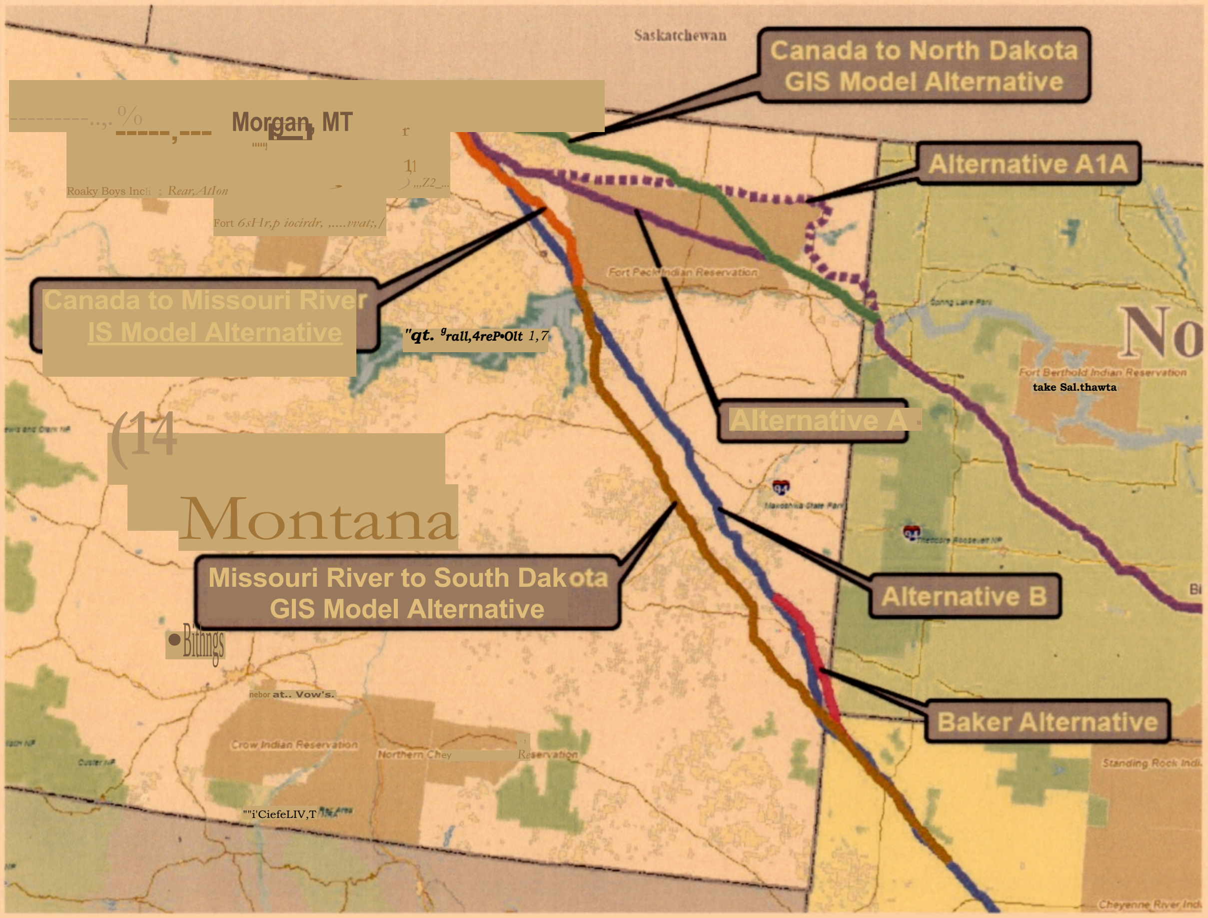


Figure I — Keystone XL Project Montana Alternatives

For the purposes of this document, the comparisons will be grouped as follows:

Eastern Alternatives

- Alternative A (purple)
- Alternative A I A (dashed purple)
- Canada to North Dakota GIS (green)

Western Alternatives

- Alternative B (blue)
- Canada to Missouri River GIS (red)
- Missouri River to South Dakota GIS (brown)
- Baker Alternative (pink)

A study team was established to re-analyze the above proposed route alternatives and include the GIS model alternatives in the analysis. The team used GIS data, existing agency supplied data files, USGS topographic quadrangle maps, aerial imagery, personal knowledge of the areas, and professional pipeline construction specialists to perform this study. The team also considered public scoping, agency scoping, and sensitivity analysis. This detailed assessment addresses the Department of State (DOS) and Montana Department of Environmental Quality (DEQ) Data Requests to conduct a route alternative assessment.

Each alternative was assessed equally by evaluating environmental, engineering, and constructability criteria and potential effects. The results of this analysis identified Alternative B as the preferred route under MFSA criteria, including that it has the shortest route length (see note below on Baker Alternative), required the least capital expenditure, and had the smallest overall environmental footprint. Table 1.1 below summarizes the length, cost, and relative cost for each alternative.

Table 1.1 — Keystone XL Steele City US Cost Comparison for Alternatives

Alternative	Length (miles)	Relative Cost	Total Cost
Alternative B (Preferred)	850.7	-	$2,250,000,000
Baker Alternative (with B)	848.6	+$3,250,000	$2,253,250,000
*GIS Model Alternatives (Canada to Missouri River and Missouri River to South Dakota)	861.2	+$22,000,000	$2,272,000,000
Alternative A	919.8	+$170,100,000	$2,420,100,000
GIS Model Alternative (Canada to North Dakota)	924.8	+$182,900,000	$2,432,900,000
Alternative AlA	951.2	+$241,000,000	$2,491,000,000

These two alternatives were combined to be a more accurate comparison with Alternative B

Although the Baker Alternative is 2.1 miles shorter than Alternative B, it would include a number of additional road and foreign pipeline crossings, resulting in a higher capital cost. Another concern is that of safety. Operating heavy construction equipment around the gathering lines in the Baker area increases the risk of pipeline damage. The remaining alternatives are longer and cross more waterbodies than Alternative B when considering the entire route from Morgan City, Montana to Steele City, Nebraska Greater environmental impact and capital cost would be incurred by constructing any alternative other than Alternative B.

The GIS models were weighted towards the use of public lands. This preference is based on Montana Code Annotated Section75-20-301(1)(h) which provides that one of the findings necessary for MFSA certification is *"that the use of public lands for location of the facility was evaluated and public lands were selected whenever their use is as economically practicable as the use of private lands."* This report will support the conclusion that Alternative B incorporates the use of public lands to the extent economically practicable while maximizing consideration to length, constructability, and environmental impact.

2.0 Introduction

2.1 Project Overview

Keystone is proposing to construct and operate a crude oil pipeline and related facilities from Hardisty, Alberta, Canada, to the Port Arthur and east Houston areas of Texas in the United States (US). The project, known as the Keystone XL Project (Project), will have a nominal capacity to deliver up to 900,000 barrels per day (bpd) of crude oil from an oil supply hub near Hardisty to existing terminals in Nederland near Port Arthur, and the Houston Ship Channel in Houston, Texas.

The Project will consist of three new pipeline segments plus two new pump stations on the Cushing Extension of the Keystone Pipeline Project. The Cushing Extension, from Steele City, Nebraska to Cushing, Oklahoma, links the Steele City and Gulf Coast Segments of Keystone XL. The Steele City Segment of the Project extends from Hardisty, Alberta, southeast through Montana and South Dakota to Steele City, Nebraska. The Gulf Coast Segment extends from Cushing, Oklahoma, south to Nederland, Texas. The Houston Lateral extends from the Gulf Coast Segment in Liberty County, Texas, southwest to Moore Junction, Harris County, Texas, near the Houston Ship Channel.

The Steele City US Segment has an in-service date of December 2012. To accomplish this, construction would begin in May 2011 and would continue until winter weather hinders progress. A second construction season would begin in May 2012. Montana will be affected by both construction seasons.

2.2 Scope

A total of 7 alternatives are considered in this report. Each alternative was evaluated taking into consideration recommended MFSA criteria.

1) Alternative A
2) Alternative Al A
3) Canada to North Dakota Alternative (GIS model)
4) Alternative B
5) Canada to Missouri River Alternative (GIS model)
6) Missouri River to South Dakota Alternative (GIS model)
7) Baker Alternative

2.3 Desktop Review

The team consisting of representatives from engineering, environmental, construction, land, and project management met on June 16-17, 2009, and conducted a detailed desktop review of the route alternatives. As indicated in Keystone's MFSA application, the project team had met on several occasions to define alternatives supplied in that application. The June 2009 meeting was to address the GIS model alternatives specified in the DOS/DEQ Data Request. Using Geographic Information System (GIS) data, imagery, and personal knowledge of the project area, each potential route was refined with important factors identified such as length, number of crossings (i.e., roads, railways. large waterbodies, foreign utility lines, etc.), environmental constraints, land use compatibility issues, and co-location possibilities. Two primary corridors were identified for more detailed evaluation. An Eastern Corridor which includes:

1) Alternative A
2) Alternative AlA
3) Canada to North Dakota Alternative (GIS model);

and a Western Corridor which includes:

1) Alternative B
2) Canada to Missouri River Alternative (GIS model)
3) Missouri River to South Dakota Alternative (GIS model)
4) Baker Alternative

A larger scale map of the route alternatives is attached to this report as Appendix B.

3.0 Route Selection Criteria

In assessing a route for the construction of a major pipeline, a number of criteria arc examined to ensure a cost-effective installation and the proper protection of environmental resources. Among these are:

- Length
  - Control points
  - Minimize route length
- Environmental Impact
  - Identification of environmentally sensitive areas
  - Location of large waterbodies
  - Densely populated areas
  - Land ownership
  - Land use
- Total cost
  - Major road and railroad crossings
  - Crossings of other pipelines or utilities
  - Terrain and geology
  - Co-location opportunities

The DEQ specified additional criteria in the Data Request which are listed in Appendix A and Section 3.2.1. These additional criteria were considered in preparing the GIS model alternatives and evaluated in determining the preferred route.

3.1 Length

3.1.1 Control Points

Control points affect the overall length of the pipeline because the route must interconnect or pass through these locations. The control points that influenced the alternatives analysis for the Project are:

- Starting point — US/Canadian border near Morgan, Montana
- Ending point — Steele City, Nebraska Terminal
- The Missouri River crossing near Ft. Peck Lake (for the Western Alternatives)

3.1.2 Minimizing Length

One of the criteria examined when selecting a pipeline route is total length and associated costs. In the case of the Project, the most direct path from Morgan, MT to Steele City, NE would offer the minimum length. Minimizing the length of a pipeline route is a major goal during the planning process but may not always be the most cost effective alternative. Routing a pipeline to avoid environmentally sensitive and densely populated areas, as well as the avoidance of large waterbody crossings, is an important factor in determining a pipeline route. Many times, environmental issues, geotechnical concerns, land acquisition issues, and constructability issues may outweigh the cost of the additional length of pipe to avoid such areas.

3.2 Environmental Impact

The methodology employed to conduct the environmental constraints study utilizes a "fatal flaw" approach, seeking to determine what, if any, environmental, land-use/planning, or physiographic issues represent impediments to pipeline construction within the study area. The data used for this analysis were based on publicly available information, especially existing GIS databases, and previous experience/knowledge of the area in question. (See listing of data resources utilized in Section 4.0.) All of the criteria examined came from those listed in the DOS/DEQ data request as well as the requirements of MFSA and its regulations and Circular 2.

3.2.1 Identification of Environmentally Sensitive and Other Sensitive Areas

Consideration is given to avoiding sensitive areas, if practical. If avoidance is impractical, the steps to mitigate or minimize impact to the area are evaluated and incorporated into the routing process. The criteria below were provided in the Data Request, detailing how the Least-Cost Path GIS Model should be weighted with regard to environmentally or other sensitive areas.

- Areas that are *preferred* in the GIS Model:
  - On public lands
  - Where it utilizes or parallels existing utility and/or transportation corridors
  - In logged areas rather than undisturbed forest, in timbered areas
  - In geologically stable areas
  - Non-erosive soils in flat or gently rolling terrain
  - In roaded areas where existing roads can be used for access to the facility during construction and maintenance
  - Where the facility will create the least visual impact
  - A safe distance from residences and other areas of human concentration
  - Lands which can be returned to their original condition through re-contouring, conservation of topsoil and reclamation

- Areas that are *excluded* in the GIS Model:
  - National wilderness areas
  - National primitive areas
  - National wildlife refuges and ranges
  - State Wildlife Management Areas
  - Wildlife habitat protection areas
  - National parks and monuments
  - State parks
  - National recreation areas
  - Corridors of rivers in the national wild and scenic rivers system and rivers eligible for inclusion in the system
  - Roadless areas of 5,000 acres or greater in size, managed by federal or state agencies to retain their roadless character
  - Rugged topography defined as areas with slopes greater than 30 percent

    - Specially managed buffer areas surrounding national wilderness areas and national primitive areas
    - Active faults
    - Large waterbodies
    - Residences
    - Domestic wells
    - Oil and gas wells

- Areas that are *avoided* in the GIS Model:
    - Wetlands and streams
    - Listed threatened or endangered species habitat or candidates for Endangered Species Act (ESA) listing habitats (lek areas, etc.)
    - Irrigated farmland

- Additional sensitive areas typically avoided during route refinement:
    - Paleontological sites
    - Wellhead protection areas and aquifers
    - Known locations of cultural resources
    - Other High Consequence Areas (HCA) as designated by the Pipeline and Hazardous Materials Safety Administration (PHMSA).

3.2.2 Large Waterbodies

In a project such as Keystone XL, some large waterbodies and streams cannot be avoided. In this case, rivers such as the Milk, Missouri, and Yellowstone, must be crossed using either open-cut methods or horizontal directional drill (HDD) technology. Either method must be carefully engineered and take into consideration the length of the crossing, depth of the water, height of the banks, and subsurface conditions. Although a desirable route may exist on either side of a crossing, these conditions will dictate the most desirable crossing site. This can affect the route on either side.

3.2.3 Population Density

Every effort is made to avoid densely populated areas such as towns and suburban developments. To the extent practical, adequate clearance will be maintained at these locations:

- Residences and farmsteads
- Rural schools and recreational areas
- Municipal sewage ponds
- Industrial facilities (e.g., rail yards, warehouses), except when in industrial corridors
- Rural cemeteries

3.2.4 Land ownership

Landowner relations are critical to the successful construction of a pipeline. Landowners have numerous concerns when a pipeline is crossing their property. To the extent practical, consideration is given to:

- Following existing property lines;

- Following existing utility corridors where possible;
- Minimizing cuts of windbreaks;
- Conserving topsoil; and
- Maintaining drainage in cultivated fields.

3.2.5 Land Use

A determination is made as to what, if any, environmental, land-use/planning, or physiographic findings represent impediments to pipeline construction. Consideration is given to avoiding the area, if practical. If avoidance is impractical, the steps to mitigate or minimize impact to the area are evaluated and incorporated into the routing process. Such areas would likely include:

- Listed Contaminated Sites;
- Cultural Resources/Native American Lands;
- National Parks, National Monuments, State Parks with developed recreation facilities
- Other lands including US Fish and Wildlife Service (USFWS), National Park Service (NPS), US Army Corps of Engineers (USACE), US Department of Defense (USDOD), Natural Resources Conservation Service (MRCS), etc.

The GIS-generated alternatives place a higher preference for the crossing of public lands, such as Bureau of Land Management (BLM) and State Lands, without consideration of economic practicability.

3.3 Total Cost

The total construction cost of a pipeline project is affected by the following features. In addition, increased long-term operational costs are likely to be incurred if the pipeline is constructed in or near some of these features.

3.3.1 Major Road and Railroad Crossings

Major road and railroad crossings typically fall under the jurisdiction of an agency or the applicable railroad. The responsible agency/railroad will generally grant a permit to cross the feature. The generally accepted practice for crossing features such as this is to align the pipeline as near perpendicular as practical. Many times this alignment is favorable to the jurisdictional agency/railroad and is specified in the permit. This perpendicular alignment is the least intrusive to the agency/railroad and is the most desired construction scenario.

Major roads and railroads are usually crossed by a horizontal boring method. Boring under a road or railroad is an additional capital expenditure above the contractor's base installation price. The agency/railroad usually requires greater pipe wall thickness and may require a casing. Both of these requirements add cost to pipeline construction.

3.3.2 Crossings of Other Pipelines or Utilities; Co-location Opportunities

In areas where pipelines or utilities exist, the industry practice is to co-locate to the extent practical with existing utility corridors. Existing pipeline rights-of-way and electrical transmission line rights-of-way are generally evaluated first. The rationale behind this is to maximize the use of land that has previously been disturbed. This practice is not always feasible due to development and growth that may have occurred adjacent to the existing rights-of-way.

If the proposed pipeline crosses a foreign utility, then a contractual agreement must be reached between the parties. In many cases, the owner or operator of the existing utility will specify the configuration of the crossing. Each crossing of a foreign utility results in additional construction costs.

3.3.3 Terrain and Geology

Terrain and geological considerations also affect pipeline routing. Steep terrain and areas prone to washout are typically avoided in pipeline construction. The pipeline operating company looks beyond the installation and considers long-term maintenance of the right-of-way. Favorable terrain lends itself to more reasonable pipeline route maintenance. Subsurface conditions that affect routing include rock, unstable soils, and the like, which are generally avoided.

4.0 Data Resources

The following sources of data were utilized in this assessment:

- Recent 2006 aerial photography obtained from the US Department of Agriculture;
- United States Geological Survey (USGS) Topographic Quadrangle Maps;
- Delorme State Atlas Gazetteers;
- National Land Cover Database (N LCD 2001);
- Montana Cadastral Mapping Program
- Montana Refined Products and Crude Oil Pipelines (DEQ)
- Pennwell Maps
- Railroads, 1:100,000 (Bureau of Transportation Statistics)
- Topologically Integrated Geographic Encoding and Referencing (TIGER) system 2000 (US Census)
- National Hydrography Dataset (NHD)
- Visual Resource Management Areas (BLM)
- 1:100,000 scale geologic maps from Montana Bureau of Mines and Geology (MBMG)
- 30-meter National Elevation Dataset (NED)
- Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database
- Highly Populated Areas (HPA) and Other Populated Areas (OPA) from the HCA Data Sets (PHMSA)
- Fault lines, USGS, MBMG
- National Wilderness Areas (nationalatlas.gov)
- National Primitive Areas and National Primitive Area Buffers (BLM, USFS)
- National Wildlife Management Areas (USFWS)
- Areas of Critical Environmental Concern (Montana State Library)
- State Wildlife Management Areas (Montana Fish, Wildlife and Parks)
- National Parks and Monuments (National Park Service)
- Montana State Parks (Montana Fish, Wildlife and Parks)
- National Recreation Areas (National Park Service)
- Rivers with wild and scenic designation as well as those eligible for designation (nationalatlas.gov)
- Areas with a roadless designation (USFS)
- National Wilderness Area Buffers (nationalatlas.gov)
- Montana Critical Infrastructure and Structures Data Model (obtained from Michael Fashoway, Montana GIS Portal, Critical Infrastructure Framework Lead)
- Water wells in Montana, Ground Water Information Center (MBMG)
- Oil and Gas wells within Montana (Montana Board of Oil and Gas)
- Threatened and Endangered species critical habitat and occurrence (USFWS)
- Irrigated farmlands (Montana Agricultural Reappraisal Landcover dataset, (DEQ)

These resources were utilized to identify the following information required for route selection:

- Co-location opportunities with other existing pipelines, electric transmission lines, railways, roadways, and other utilities.
- Identification of other opportunities such as beneficial topography, land use, etc.
- Identification of major constraints such as those listed in Section 3.2.

5.0 Alternative Assessments

Using the criteria outlined in Section 4, and following the requirements of the DOS/DEQ data request as well as NEPA requirements, Keystone completed an analysis of each of the 7 alternatives as outlined below.

5.1 Length

5.1.1 Control Points

As has been previously stated, the two primary control points for the Project are the border crossing near Morgan, MT and the terminal near Steele City, NE. Additionally, the Missouri River crossing was a primary control point for the Western Alternatives.

5.1.2 Minimize Route Length

The comparative lengths of the Project alternatives are shown in Table 5.1. These lengths are for the entire Steele City US Segment of the Project (i.e., the border crossing near Morgan, Montana to Steele City, Nebraska) . The Eastern Alternatives have a shorter route length in Montana than the Western Alternatives. However, comparing the mileage in Montana only would be misleading because the Eastern Alternatives result in a greater overall project length.

Table 5.1 — Total Steele City US **Mileage Comparison**

Alternative	Length (miles)
Alternative A	919.8
Alternative AlA	951.2
Canada to North Dakota (GIS Model)	924.8
Alternative B	850.7
Canada to South Dakota Alternatives (combined GIS Models)	861.2
Baker Alternative with Alternative B	848.6

Minimizing the overall length is a primary goal in pipeline routing. The overall length directly affects environmental impact and total cost.

This table clearly shows that the Eastern Alternatives, Alternative A, Alternative AlA, and the Canada to North Dakota GIS Model Alternative range from 70 miles to 101 miles longer overall than any of the Western Alternatives.

The Western Alternatives represent a more direct path from Morgan, Montana to Steele City, Nebraska. The Baker Alternative (with Alternative B) is the absolute shortest alternative, however as was stated in Section 3.1.2, the shortest alternative is not always the most feasible, as discussed below for the Baker Alternative. The environmental and cost impacts of length will be discussed later in this section.

5.2 Environmental Impact

The following environmental criteria are set forth in the DOS/DEQ Data Request. They are listed in Section 3.2.1:

- Areas to exclude in developing alternatives

- Areas to avoid in developing alternatives; and
- Areas to preferentially route the alternative through.

The overall length of the pipeline is also considered in the environmental impact. As a general rule, the longer the route, the greater the environmental impact. These criteria were evaluated for the alternatives within the study area specified in the Data Request. Highlights of criteria/data from the analysis are presented in Table 5.2 through Table 5.5.

Table 5.2 —Waterbody Crossings in the Data Request Study Area

Alternative	Total Crossings
Alternative A	99
Alternative A 1 A	90
Canada to North Dakota (GIS Model)	98
Alternative B	163
Canada to South Dakota Alternatives (combined GIS Models)	205
Baker Alternative with Alternative B	171

The first three alternatives in this table show a lower number of waterbody crossings in the study area. Like the mileage comparison discussed above, this is misleading because these alternatives represent a much shorter length in Montana, but a greater overall project length.

Waterbody crossings shown in Table 5.2, include the following:

Eastern Alternatives

- Alternative A: Frenchman Creek, Poplar River, and Big Muddy Creek.
- Alternative AlA (with Alternative A): Frenchman Creek, West Fork Poplar River, Poplar River, Lake Creek, and Big Muddy Creek.
- Canada to North Dakota GIS Model Alternative: Frenchman Creek, West Fork Poplar River, Poplar River, Big Muddy Creek, and Shotgun Creek.

Western Alternatives

- Alternative B: Frenchman Creek, Willow Creek, Milk River, Missouri River, Yellowstone River, Cabin Creek, Sandstone Creek, Little Beaver Creek, and Boxelder Creek.
- Baker Alternative (with Alternative B): Frenchman Creek, Willow Creek, Milk River, Missouri River, Yellowstone River, Cabin Creek, and Little Beaver Creek.

- Canada to Missouri River and Missouri River to South Dakota GIS Model Alternatives (Combined): Frenchman Creek, Willow Creek, Milk River, Missouri River, McGuire Creek, Bear Creek, South Fork Rock Creek, Yellowstone River, O'Fallon Creek, Pennel Creek, Sandstone Creek, and Little Beaver Creek.

For clarification, the Eastern Alternatives (A, A IA, and Canada to North Dakota) share the same starting point at Morgan, Montana and end at the same point in Williams County, North Dakota as specified in the Data Request. The specified constraints for the Western Alternatives were Morgan, Montana, the Missouri River crossing near Ft. Peck Dam, and the exit point of Harding County, South Dakota.

Table 5.3 below summarizes the Land Use for the alternatives. The land use types are based on the classifications in the NLCD. The figures in the table are for the study area based on the above constraints.

Table 5.3 – Land Use Estimates for Study Area

	Alternative A	Alternative A1A	Canada to North Dakota (GIS Model)	Alternative B	Canada to South Dakota Alternatives (combined GIS Models)	Baker Alternative with Alternative B
Alternative Length (miles)[#]	186.2	217.6	191.1	353.9	364.4	351.8
Land Use (miles)[##]						
Agriculture	94.3	125.5	111.5	96.6	53.0	96.4*
Rangeland/Grassland	81.9	82.6	70.5	238.9	288.6	238.3*
Shrubland	7.6	7.9	6.8	13.2	17.3	12.9*
Wetlands	0.91	0.46	1.46	0.7	0.6	0.69*
Forest/Woodlands	1.1	0.9	0.9	4.4	4.6	4.3*
Developed	0.02	0.04	0.04	0.12	0.14	0.11*
Barren	0.33	0.33	0.04	0.12	0.16	0.11*

[#]Total miles for Montana and affected counties in North and South Dakota ONLY

[##] Statistics for Montana and affected counties in North and South Dakota ONLY

*Estimated mileage based on comparison to Alternative B

All Alternatives cross sparsely populated areas. The population density for the Alternatives is specified below in Table 5.4. The majority of the land use as shown above has been identified as agriculture and/or open range.

Table 5.4 – Route Alternatives Population Density for Study Area

ST	Alternatives *See Key Below	County	Area (sq mi)	Population	Density (persons/sq mi)
MT	1,2,3,4,5	Phillips	5,212	4,416	0.8
MT	1,2,3,4,5	Valley	5,062	7,184	1.4
MT	1,2,3	Roosevelt	2,369	10,372	4.4
MT	2,3	Daniels	1,427	1,872	1.3
MT	2	Sheridan	1,706	3,557	2.1
MT	4,6	McCone	2,683	1,842	0.7
MT	4	Dawson	2,383	8,612	3.6
MT	4,6	Prairie	1,743	1,105	0.6
MT	6	Custer	3,793	11,333	3.0
MT	4,6,7	Fallon	1,623	2,746	1.7
ND	1,2,3	Williams	2,148	19,294	9.0
ND	1,2	McKenzie	2,861	5,711	2.0
ND	7	Bowman	1,167	3,169	2.7
SD	4,6,7	Harding	2,678	1,242	0.5

*Alternatives Key:

1. Alternative A
2. Alternative A1A
3. Canada to North Dakota Alternative (GIS model)
4. Alternative B
5. Canada to Missouri River Alternative (GIS model)
6. Missouri River to South Dakota Alternative (GIS model)
7. Baker Alternative

Table 5.5 below, summarizes the ownership of public lands in the study area.

Table 5.5 – Mileage Summary of Publicly Owned Lands for Study Area

	Alternative A	Alternative A1A	Canada to North Dakota Alternative (GIS)	Alternative B	Canada to Missouri River Alternative (GIS)	Missouri River to South Dakota Alternative (GIS)	Baker Alternative with Alternative B
US Fish and Wildlife Service	-	0.1	-	-	-	-	-
US Bureau of Land Management	17.5	17.2	39.6	40.6	45.0	88.6	52.1
US Department of Defense	-	-	-	1.7	-	1.6	1.7
MT State Trust Lands	14.3	35.2	37.8	19.3	24.0	36.4	20.0
Navigable Waterways (State Dept of Natural Resources)	-	-	-	0.3	0.1	0.2	0.3
Total Mileage on Publicly Owned Lands	**31.8**	**52.5**	**77.4**	**61.9**	**69.1**	**126.8**	**74.1**

5.3 Total Cost

Factors other than length can impact the total cost of a pipeline project.

- Major road and railroad crossings
- Crossings of other pipelines or utilities
- Terrain and geology

5.3.1 Crossings

Table 5.6 summarizes the road. railroad, and foreign utility crossings for the study area specified in the Data Request.

Table 5.6 — Road, Railroad, Pipeline and Power Line Crossings for Study Area

Crossing Type"	Alternative A	Alternative AIA	Canada to North Dakota (GIS Model)	Alternative B	Canada to South Dakota Alternatives *(combined* GIS Models)	Baker Alternative with Alternative B
Road	190	203	159	309	297	395
Rail	1	5	1	7	8	7
Pipeline	0	0	0	1	1	25@
Power Line	3	2	9	9	12	9
Total	194	210	169	326	413	438

Statistics for Montana and affected counties in North and South Dakota ONLY
24 of these crossings are gathering lines in the Baker production area

The total crossings for the Eastern Alternatives are lower because of their shorter length in the specified Data Request study area.

The cost for each Alternative is summarized in Table 5.7 below. As shown, Alternative B is the lowest cost alternative. The costs below do not include the additional cost that would be incurred from steeper terrain on public lands on the GIS alternatives (Section 5.3.2).

Table 5.7 — Keystone XL Cost Comparison for Alternatives

Alternative	Relative Cost	Total Cost
Alternative **B**	-	$2,250,000,000
Baker Alternative (with B)	+$3,250,000	$2,253,250,000

Alternative	Relative Cost	Total Cost
*GIS Model Alternatives (Canada to Missouri River and Missouri River to South Dakota)	+$22,000,000	$2,272,000,000
Alternative A	+$170,100,000	$2,420,100,000
GIS Model Alternative (Canada to North Dakota)	+$182,900,000	$2,432,900,000
Alternative A 1 A	+$241,000,000	$2,491,000,000

**These two alternatives were combined to be a more accurate comparison with Alternative B*

The following were considered when evaluating the project cost.

- Alternative B is shorter than:
  - Alternative A lA by 101 miles.
  - Alternative A by 70 miles.
  - GIS Model Route - Canada to North Dakota by 75 miles.
  - Combined GIS Model Routes - Canada to Missouri River and Missouri River to South Dakota by 11 miles.
- The Baker Alternative, if applied to Alternative B. is 2 miles shorter, but creates the following concerns:
  - There are approximately 80 oil wells in the Baker Alternative vicinity. Twenty-four (24) gathering lines were identified from aerial imagery. There are likely considerably more. Gathering lines are treated as foreign pipelines for estimating costs. Each crossing of a foreign pipeline adds $25,000 - $35,000 to the cost of the Project. The additional crossings would negate any savings from the shorter length.
  - There are 6 additional public road crossings at a total estimated cost of $326,000.
  - There are 80 well pad road crossings at a total estimated cost of $2,200,000.
  - The Baker Alternative crosses into North Dakota for less than 9 miles. Initiating the full regulatory process in North Dakota for this short distance is impractical. This would have a negative impact on schedule for the Project.
  - Operating heavy construction equipment around the gathering lines in the Baker area increases the risk of pipeline damage. In addition, placement of the Keystone XL pipeline in this area would expose it to greater risk of damage due to maintenance of the existing gathering lines or installation of new gathering lines.

5.3.2 Terrain and Geology

The GIS model was weighted to give routing preference to public lands. A desktop review of the GIS model indicates that the public lands crossed encompass steeper terrain than the alternatives not weighted towards public lands. This is based on a review of USGS topographic maps. Steeper terrain creates construction and restoration challenges and adds significant cost as a result. These additional costs cannot be readily quantified and are not included in Table 5.7. There were no significant geological differences between any of the alternatives.

6.0 Findings

Eastern Alternatives

Based on the team's assessment of the route alternatives, the Eastern Alternatives are less desirable than the Western Alternatives because of an increase in the overall pipeline length by an average of 70 to 100 miles. Alternative Al A is the longest of the Eastern routes and considered the least desirable. It is 31 miles longer than Route A, with few accompanying benefits. The Canada to North Dakota GIS Alternative is 6 miles longer than Alternative A. The additional length of 70 to 100 miles will result in a $170,100,000 - $241,000,000 cost increase.

The added length of the Eastern Alternatives also means a greater environmental impact because of the increased project footprint. The use of any of the Eastern Alternatives would also necessitate the construction of at least 1 additional pump station and accompanying power transmission line (compared to the Western Alternatives) that would further increase the environmental footprint and cost associated with the Project.

Eastern Alternatives also drove the route north, which would affect the available construction season and could result in a third construction season to complete.

The GIS-generated Alternative from the Canadian Border to Williams County, North Dakota does not provide any benefits that would make an Eastern Alternative more practical than a Western Alternative.

Western Alternatives

Based on the requirement in the Data Request to favor routing across public lands in the GIS model, the route generated was expected. '1 he emphasis on public lands is the primary reason for the deviation between Alternate B and GIS models. The combination of the GIS models (Canada to Missouri River and Missouri River to South Dakota), is 10.5 miles longer than Alternative B. There are 42 more waterbody crossings on the GIS model alternative compared to Alternative B. Although there are 12 fewer road crossings on the GIS model alternative when compared to Alternative B, the overall impact is greater because of the additional length and number of stream crossings. This is contradictory to the routing objective to minimize length while minimizing environmental impact.

The additional cost to construct the GIS Model Alternative as compared to Alternative B is estimated to be $22,000,000. The added length and increased number of waterbody crossings contribute to this number.

The Baker Alternative was considered as a partial alternative to Alternative B. The Baker Alternative is all in Fallon County, Montana. The primary concern in this area is safety. There are approximately 80 oil wells in the Baker Alternative vicinity. Twenty-four (24) gathering lines were identified from aerial imagery. Operating heavy construction equipment around the gathering lines in the Baker area increases the risk of pipeline damage. In addition, utilization of the Baker Alternative would require the initiation of the North Dakota regulatory process. Initiating the full regulatory process in North Dakota for fewer than 9 miles is impractical.

Review of the USGS maps indicates that by routing on public lands, more rugged terrain would be encountered. This will result in greater construction costs. These additional costs cannot be readily quantified and are not included in Table 5.7. In addition, severe terrain will likely require a wider construction right-of-way, again creating a larger environmental footprint. Restoration and long-term maintenance of the affected area will be increased.

7.0 Conclusions

The evaluation identifies Alternative B as the preferred route under MI'SA, including the following reasons:

- Because of the comparative length, the Western Alternatives are superior to the Eastern Alternatives in capital costs and environmental impact. The Eastern Alternatives are 70 to 101 miles longer and would cost an additional $170,100,000 - $241,000,000. Additional cost would be incurred in addressing the additional reclamation required for the larger project footprint. Overall Alternative B is considerably lower than the other alternatives and considerably much more economical.
- The GIS model for the Western Alternatives would result in an increase in overall Project capital cost expenditures of at least $22,000,000 over Alternative B.
- The Western GIS model results identify a considerably larger environmental footprint than that which would be experienced with Alternative B.
- By striving to co-locate with the Baker Pipeline, the increased capital costs would be about $3,250,000. The primary concern for the Baker Alternative is that of safety. Operating heavy construction equipment around the gathering lines in the Baker area increases the risk of pipeline damage.
- The rugged terrain identified by the USGS topographic maps for the Western GIS Model would result in a wider construction right-of-way, site restoration challenges, and long-term maintenance concerns.

Tn response to the Data Request received from Entrix on April 3, 2009, the project team thoroughly studied additional GIS alternatives for the Keystone XL Pipeline. The assessment was based on criteria that were provided in the Data Request. The team established that the Eastern Alternatives are more costly, therefore not as economically practicable as the Western Alternatives. The Eastern Alternatives also result in greater environmental footprint thus increased impacts to the ecology and present agricultural land use. Of the Western Alternatives analyzed, Alternative B maximizes the use of public lands to the extent economically practicable while also maximizing consideration to length, constructability, and environmental impact.

Appendix A

Alternatives

1. Provide location and detailed information on route alternatives, route variations, and/or pump stations for the Steele City Segment, Gulf Coast Segment, and Houston Lateral not included in the ER.

Montana Alternatives DEQ Data Requests

1. Provide GIS data for counties within Montana, North Dakota, and South Dakota. Page 18 graphically depicts counties where data are needed. Page 19 describes GIS data for preferences, exclusions, and avoidances MDEQ indicated to include in the analysis.

    a. Counties for Montana: Carter, Custer, Daniels, Dawson, Fallon, Garfield, McCone, Phillips, Prairie, Richland, Roosevelt, Sheridan, Valley, and Wibaux.

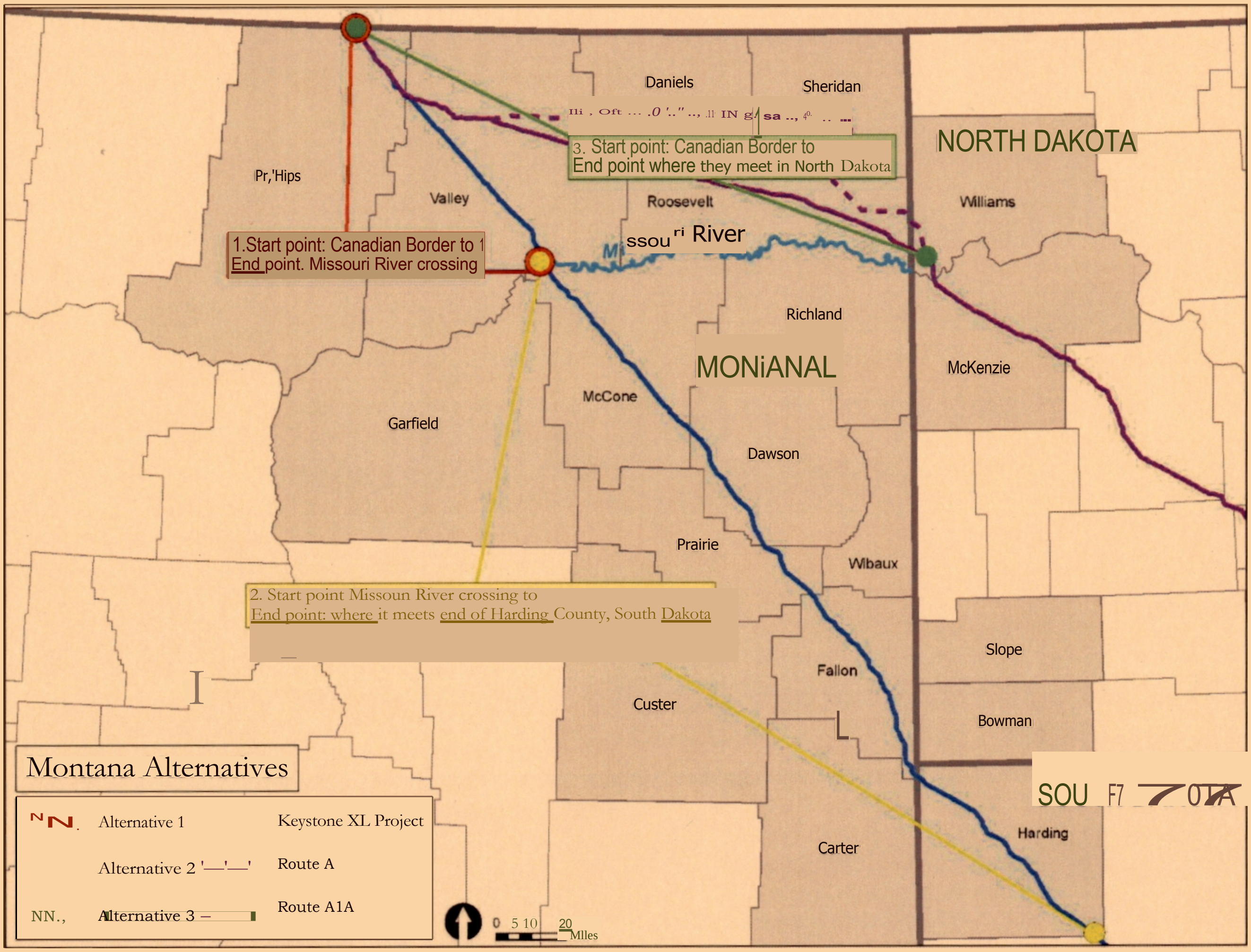
        i. ENTRIX has received a Montana GIS data disc. MDEQ indicated the disc contains most of GIS data on page 19 other than: active faults, residences, domestic wells, oil and gas wells, and wetlands. MDEQ has contacts at some of the agencies responsible for this missing data in Montana if we are not able to obtain.

    b. Counties for North Dakota: Bowman, McKenzie, Slope, and Williams.

    c. Counties for South Dakota: Harding.

2. Provide an ArcGIS Spatial Analyst Least Cost Path/Least Cost Corridor analysis exercise for the three Montana alternatives. Start and stop points of three alternatives are graphically depicted on page 18. ArcGIS ModelBuilder is the suggested method to organize and run the analysis exercise. The model should be set up so that it can be reweighted and rerun to find optimal results for the alternatives.

    a. MDEQ would like to be involved in developing the model and weighting the variables.


Daniels
Sheridan
NORTH DAKOTA
3. Start point: Canadian Border to
End point where they meet in North Dakota
Valley
Roosevelt
Williams
1.Start point: Canadian Border to
End point. Missouri River crossing
River
Richland
McKenzie
MONiANAL
McCone
Garfield
Dawson
Prairie
Wibaux
2. Start point Missoun River crossing to
End point: where it meets end of Harding County, South Dakota
Slope
Fallon
Custer
Bowman
Montana Alternatives
Alternative 1
Alternative 2
Alternative 3
Keystone XL Project
Route A
Route A1A
Harding
Carter
0 5 10 20
Miles

Start and End points:

1. Start point: Canadian Border to End point: Missouri River crossing
2. Start point: Missouri River crossing to End point: where it meets end of Harding County, South Dakota
3. Start point: Canadian Border to End point: where they meet in North Dakota

Prefer to Locate a Facility on the following:

I. On public lands
2. where they utilize or parallel existing utility and/or transportation corridors
3. In logged areas rather than undisturbed forest, **in** timbered areas
4. In geologically stable areas
5. Non-erosive soils in flat or gently rolling terrain
6. In roaded areas where existing roads can be used for access to the facility during construction and maintenance
7. Where the facility will create the least visual impact
8. A safe distance from residences and other areas of human concentration
9. Cross lands which can be returned to their original condition through re-contouring, conservation of topsoil and reclamation

Areas that should be *Excluded* in the model:

I. National wilderness areas
2. National primitive areas
3. National wildlife refuges and ranges
4. State wildlife management areas
5. Wildlife habitat protection areas
6. National parks and monuments
7. State parks
8. National recreation areas
9. Corridors of rivers in the national wild and scenic rivers system and rivers eligible for inclusion in the system
10. Roadless areas of 5,000 acres or greater in size, managed by federal or state agencies to retain their roadless character
II. Rugged topography defined as areas with slopes greater than 30 percent
12. Specially managed buffer areas surrounding national wilderness areas and national primitive areas
13. Active faults
14. Large water bodies
15. Residences
16. Domestic wells
17. Oil and gas wells

Areas that should be *Avoided* in the model:

1. Wetlands and streams
2. Listed Threatened or Endangered species habitat or candidates for ESA listing habitats
    a. Lek areas, etc.
3. Irrigated farmland

Appendix B