

Appendix U

System Alternative 04 Karst Reroute

This page intentionally left blank.

Appendix U Figures and Tables

LIST OF FIGURES

	Page
Figure U-1. CN Alternatives SA-04	U-6
Figure U-2. CN Alternatives Conceptual Route	U-7
Figure U-3. CN Alternatives SA-04 FOH Reroute.....	U-8
Figure U-4. CN Alternatives SA-04 Segment Reroute	U-9

LIST OF TABLES

	Page
Table U-1. SA-04 Proposed Reroutes and Karst Features	U-5
Table U-2. Groundwater	U-10
Table U-3. Surface Water.....	U-14
Table U-4. Wetlands	U-17
Table U-5. Floodplains	U-18
Table U-6. Geology and Soils	U-18
Table U-7. Elevation.....	U-19
Table U-8. Vegetation	U-19
Table U-9. Fish and Wildlife Resources.....	U-27
Table U-10. Unique Natural Resources.....	U-30
Table U-11. Public Lands.....	U-34
Table U-12. Commodity Production	U-34
Table U-13. Recreation and Tourism	U-35

Table U-14.	Population	U-36
Table U-15.	Employment and Income	U-36
Table U-16.	Cultural Resources.....	U-40
Table U-17.	Accidental Release – High Consequence Areas.....	U-41
Table U-18.	Accidental Release – High Consequence Areas and Downstream Region of Influence.....	U-42
Table U-19.	Environmental Justice	U-44

Appendix U

System Alternative 04 Karst Reroute

Background

Sections 5.2.1 and 6.3.2 of the Line 3 Project Final Environmental Impact Statement (EIS) discuss the implications of karst conditions for construction and operation of a pipeline. These two sections consider potential construction and operational impacts related to both (1) surface manifestations of karst (karst topography) and (2) below surface karst conditions, such as fractures, joints, dissolution features, caves, and void spaces in the bedrock aquifer matrix (i.e., karst aquifers and the associated groundwater vulnerability). These two sections identify concerns ranging from surface sinkhole formation to groundwater contamination due to turbidity, sedimentation, or chemical releases.

In addition, the accidental release discussion in Chapter 10, Section 10.2.2.3 of the Final EIS notes that in karst regions, groundwater may flow more rapidly than in other areas, increasing the risk of contamination.

System Alternative 04 (SA-04) is one of the alternatives evaluated in the Final EIS that crosses karst. It crosses karst geology in southeastern Minnesota, Iowa, and Illinois.¹ Several commenters on the Draft EIS stressed concerns about the vulnerability of groundwater in karst areas along SA-04 because of the potential for the rapid spread of contamination should there be an accidental oil release.²

In its December 2017 review of the adequacy of the Final EIS, the Minnesota Public Utilities Commission (Commission) highlighted these concerns and requested analysis of a “reroute” of SA-04 to address the karst issue. The Commission’s December 14, 2017, order states: “the EIS needs to (i) indicate how far and where SA-04 would need to be moved to avoid the karst topography it would otherwise traverse and (ii) provide a revised environmental-impact analysis of SA-04 specifically to reflect the resulting relocation of that alternative.”³

Scope of Karst Analysis

A karst landscape unit, or more simply a “karst unit,” is a “three-dimensional belt or block of soluble bedrock area surrounded by other less soluble rock types.” The three-dimensional nature of a karst landscape can be broadly broken down into three parts: (1) exokarst, (2) epikarst, and (3) endokarst.⁴

Exokarst is composed of surface karst features and topography, including surface subsidence, sinkholes, and fractures. Epikarst is the zone of openings or fractures that extend from the surface (the exokarst) down as much as 35 to 100 feet below the surface. Endokarst refers to the deeper components of the

¹ Line 3 Project Final EIS at page 5-36 (Table 5.2.1.1-4).

² Appendix T-1 Comment 2621-14; Comment 2681, pages 7–10; Comment 1422-1; Comment 1833-2; and Comment 2447-3.

³ Minnesota Public Utilities Commission (December 14, 2017) Order Finding Environmental Impact Statement Inadequate, e-dockets No. 201712-138168-01.

⁴ Pike, R.G., T.E. Redding, R.D. Moore, R.D. Winker and K.D. Bladon (editors). 2010. Compendium of forest hydrology and geomorphology in British Columbia. B.C. Ministry of Forests and Range, Forest Science Program, Victoria, B.C. and FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C. Land Management Handbook 66. Available at www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm.

underground karst landscape, including void spaces, caves, and bedrock aquifers where groundwater occurs in granular pore spaces, partings, joints, fractures, and dissolution features.⁵

The extent and boundaries of karst units are defined through a review of bedrock geology to identify limestone or other soluble bedrock units coupled with field investigation of near surface features.⁶

The Commission's order required the Final EIS to indicate how far and where SA-04 would need to be moved to avoid karst "topography." This appendix addresses karst units more broadly, including both near surface karst topography (exokarst) and karst conditions present at depth (epikarst and endokarst). This is because the ground water vulnerability concerns identified by the Commission could be associated with areas where surface karst features like sinkholes are present, as well as areas where karst conditions are present at depth.

Route Refinement Considerations

As described in more detail below, technical staff⁷ reviewed a number of datasets to identify potential groundwater vulnerability associated with karst units in Minnesota, Iowa, and Illinois. In preparation of this appendix, however, technical staff noted that karst areas are just one of many concerns that need to be balanced in order to appropriately refine any route.

As noted in Section 5.1.4 of the Final EIS, if SA-04 is identified as environmentally preferable in the Certificate of Need determination, alternative routes would be evaluated during a route permit process, and detailed field surveys and engineering would result in refinements to the route, the width of the construction footprint, and construction methods to further avoid and minimize impacts. Final routing analysis, including surveys, engineering, and other refinements would be needed to balance a much larger suite of factors than just karst.

Methodology

The following data sources were used to evaluate the possibility of rerouting SA-04 to avoid karst:

- U.S. Geological Survey (2014),⁸ Carbonate Rocks in the Contiguous United States. This data includes carbonate bedrock information, including exposure data for carbonate rocks buried under greater than 50 feet of glacially derived insoluble sediments in a humid climate and carbonate rocks buried under less than 50 feet of glacially derived insoluble sediments in a humid climate;

⁵ Pike, R.G., T.E. Redding, R.D. Moore, R.D. Winker and K.D. Bladon (editors). 2010. Compendium of forest hydrology and geomorphology in British Columbia. B.C. Ministry of Forests and Range, Forest Science Program, Victoria, B.C. and FORREX Forum for Research and Extension in Natural Resources, Kamloops, B.C. Land Management Handbook 66. Available at www.for.gov.bc.ca/hfd/pubs/Docs/Lmh/Lmh66.htm.

⁶ *Ibid.*

⁷ Technical staff included geologists from Department of Commerce, Energy Environmental Review and Analysis; Ecology and Environment, Inc.; Minnesota DNR; and Minnesota Pollution Control Agency.

⁸ U.S. Geological Survey. 2014. Carbonate Rocks in the Contiguous United States. Available: <https://pubs.usgs.gov/of/2014/1156/pdf/of2014-1156.pdf>.

-
- Minnesota Department of Natural Resources (Minnesota DNR) (2018),⁹ Minnesota Regions Prone to Surface Karst Feature Development, Karst Feature Inventory Points. This data contains information on karst features mapped over the last 25 years. The data file is static, but contains data obtained on the Time Period of Content date, which is shown as 2018; and
 - Iowa Geological Survey, Department of Natural Resources (2005),¹⁰ Potential Karst Geology of Iowa. This data coverage contains information representing areas within 1,000 feet of known sinkholes and other areas that have carbonate bedrock within 50 feet of the ground surface.

Routing through areas with a thicker layer of glacial sediment over soluble carbonate bedrock would not entirely avoid the potential groundwater vulnerabilities associated with karst. Therefore, deeper soluble carbonate bedrock areas (more than 50 feet of overburden) were included in the analysis, as well as areas with near surface soluble carbonate bedrock (less than 50 feet of overburden).

Reroute Assessment

Avoidance Approach

As a first step, the technical staff reviewed potential route options that would completely avoid karst features, including areas with deeper karst bedrock. Figure U-1 shows the extent of karst units in the Minnesota, Iowa, Wisconsin, and Illinois region, illustrating the difficulty of avoiding these units in the routing of a pipeline, particularly through Iowa and to a final destination of Joliet, Illinois.

Technical staff agreed that while avoiding or minimizing karst in Minnesota was possible, there was no reasonable route through Iowa and Illinois that entirely avoided karst. Completely avoiding karst would require a major new route option crossing northern Minnesota, following, for example, the RA-03AM route to a point north of the Twin Cities, then crossing the St. Croix River, and ultimately connecting into the existing Enbridge Energy, Limited Partnership system in Wisconsin. As shown in Figure U-2, such a route would avoid construction of a new pipeline through karst between Wisconsin and Illinois. However, this route would fail to address SA-04's primary objective of avoiding the headwaters area and high quality waters in the surrounding region. As a result, this SA-04 reroute concept through northern Minnesota was not considered further.

Minimization Approach

Since a logical reroute of SA-04 to avoid karst was not feasible, technical staff considered options to minimize crossing shallow karst as a next-best approach. In an effort to identify options to minimize crossing shallow karst (less than 50 feet below the surface), technical staff reviewed possible routes, including a proposal from the Friends of the Headwaters that would reroute SA-04 through south-central Minnesota and central and southern Iowa. The technical staff modified the route slightly to minimize overall length, avoid significant population features (such as bisecting cities), and maximize paralleling of existing linear corridors. Figure U-3 shows the resulting potential route (SA-04 FOH Reroute).

The technical staff concluded that while this alternative crosses areas with less shallow carbonate bedrock than SA-04, it results in a longer overall pipeline length, including an additional 100 miles of

⁹ Minnesota DNR. 2018. Minnesota Regions Prone to Surface Karst Feature Development, Karst Feature Inventory Points. Available at: <https://gisdata.mn.gov/dataset/geos-karst-feature-inventory-pts>.

¹⁰ Iowa Geological Survey, Department of Natural Resources. 2005. Potential Karst Geology of Iowa. Available at: ftp://ftp.igsb.uiowa.edu/gis_library/IA_state/geologic/Karst/karst.html.

pipeline through areas where soluble carbonate bedrock is located more than 50 feet below the surface. Detailed analysis of local surface geology, depth to groundwater, and a number of other variables would be necessary to draw conclusions on which route would ultimately minimize exposure of vulnerable groundwater resources.

Department of Commerce, Energy Environmental Review and Analysis (DOC EERA), Ecology and Environment, Inc., and Minnesota DNR technical staff concluded that while routing through areas with thicker layer glacial sediment over soluble carbonate bedrock may aid in minimizing exposure, such an approach does not entirely avoid the groundwater vulnerabilities associated with karst that the Commission identified as a critical concern.¹¹ Given the failure of this reroute to avoid groundwater vulnerabilities of concern, as well as the potential resource exposure associated with its additional length, the route does not appear to address the request in the Commission's order. DOC EERA saw limited value in an extensive detailed analysis of a re-route that does not address the Commission's request to avoid karst. Nonetheless, to avoid any perception of prejudice, a full environmental assessment was conducted for this route and is provided below.

In addition, more limited reroute options were investigated to assess whether minor revisions to SA-04 could be made to minimize near surface karst without adding many miles of additional pipeline through areas with soluble carbonate bedrock at depth, which itself creates additional oil spill risk. There was discussion and general agreement among technical staff that slight tweaks could be made to existing SA-04, specifically around Austin, Minnesota, to better avoid near surface karst. Figure U-4 shows the resulting slightly modified SA-04 route segment (SA-04 Segment Reroute). This modification avoids shallow soluble carbonate bedrock and surface karst features near Austin, Minnesota, shifting the line north and east, crossing through areas with soluble carbonate bedrock of greater depth with minimal additional overall pipeline length.

Similar to the major reroute identified above, routing this short segment through areas with thicker layer glacial sediment over soluble carbonate bedrock may aid in minimizing exposure, but does not entirely avoid the groundwater vulnerabilities associated with karst that the Commission identified as a critical concern. However, given the minimal additional length and additional new exposure that could be associated with this modified route segment, detailed environmental analysis for this reroute was also conducted to further inform the Commission on the possible benefits and drawbacks of this potential approach for minimizing karst.

¹¹ Minnesota Pollution Control Agency was unable to express formal agreement or disagreement with this assessment during this review process.

Table U-1. SA-04 Proposed Reroutes and Karst Features

Karst Features	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Alternative	Comparable Segment of SA-04
Overall length of segment (miles)	346	287	86	78
Carbonate rock formations with less than 50 feet of overlying materials (miles crossed) ^a	11	65	7	26
Carbonate rock formations with greater than 50 feet of overlying materials (miles crossed) ^a	286	191	76	48
Minnesota - surface karst features (miles crossed) ^b	0	8	1	7
Iowa – within 1,000 feet of known sinkhole (miles) ^c	0	5	0.4	5
Iowa – between 1,000 feet and 1 mile from known sinkhole (miles) ^c	23	50	4	19

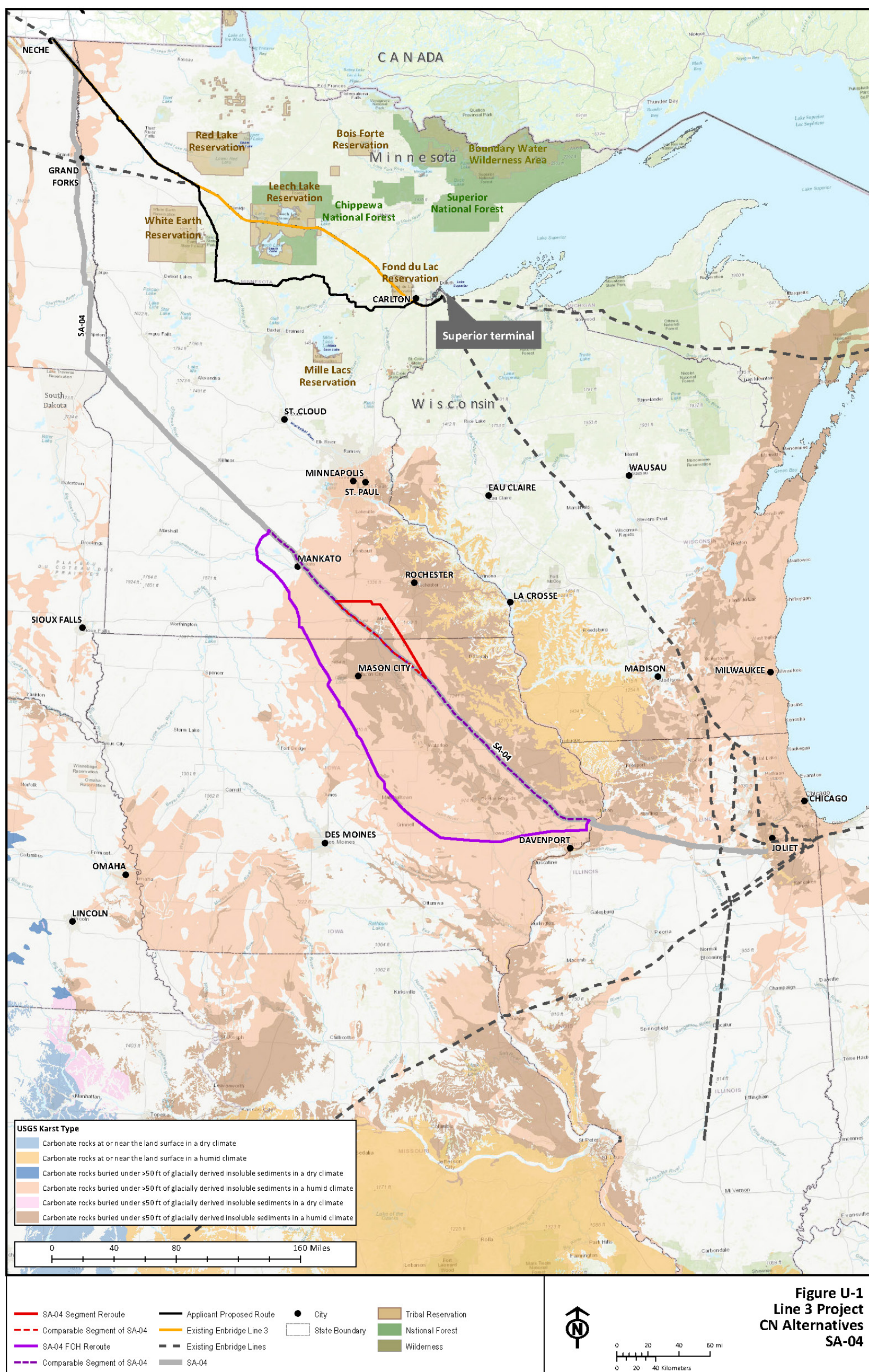
^a U.S. Geological Survey Data - <https://pubs.usgs.gov/of/2014/1156/pdf/of2014-1156.pdf>

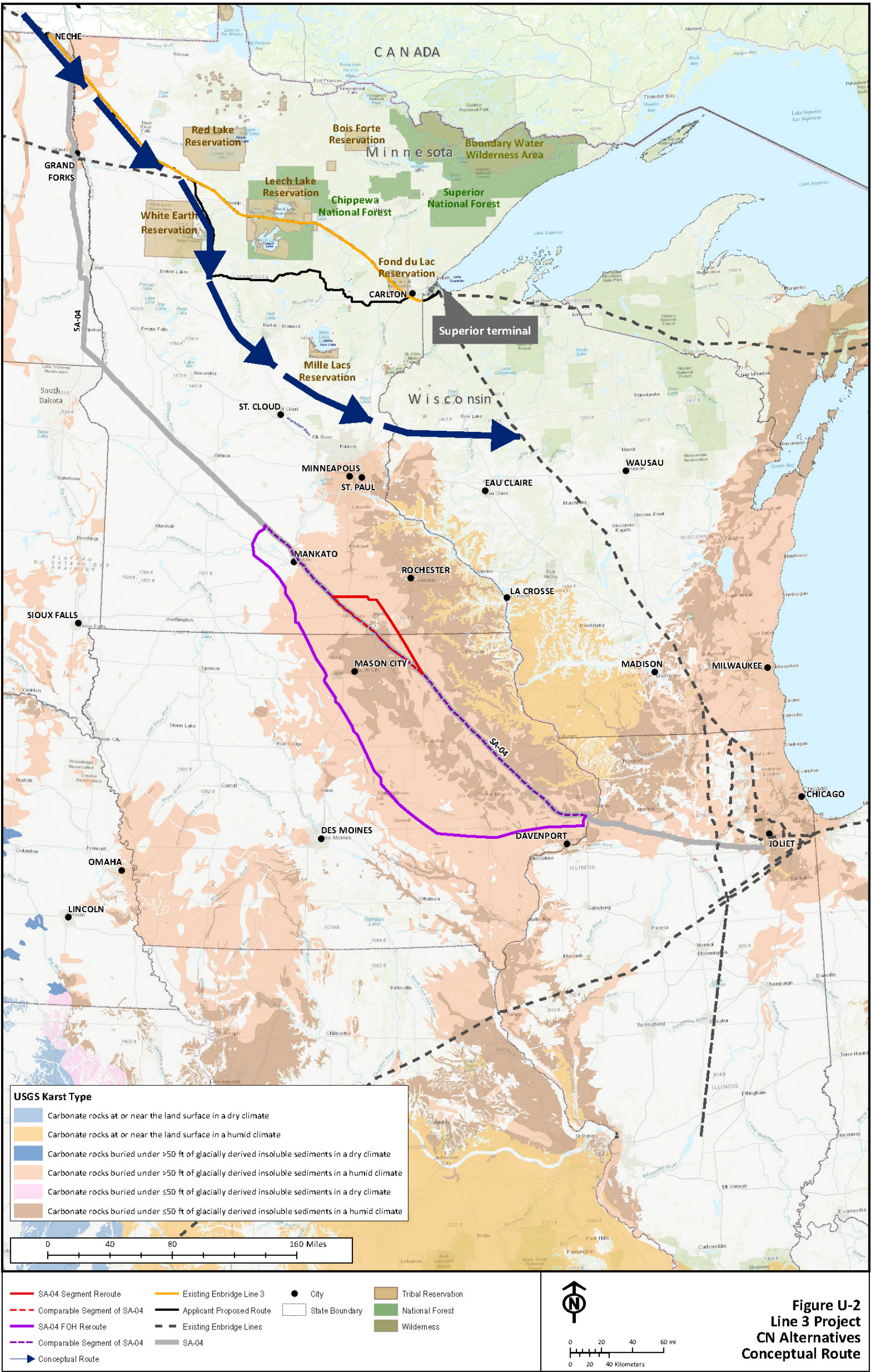
^b MN DNR Data - <https://gisdata.mn.gov/dataset/geos-karst-feature-inventory-pts>

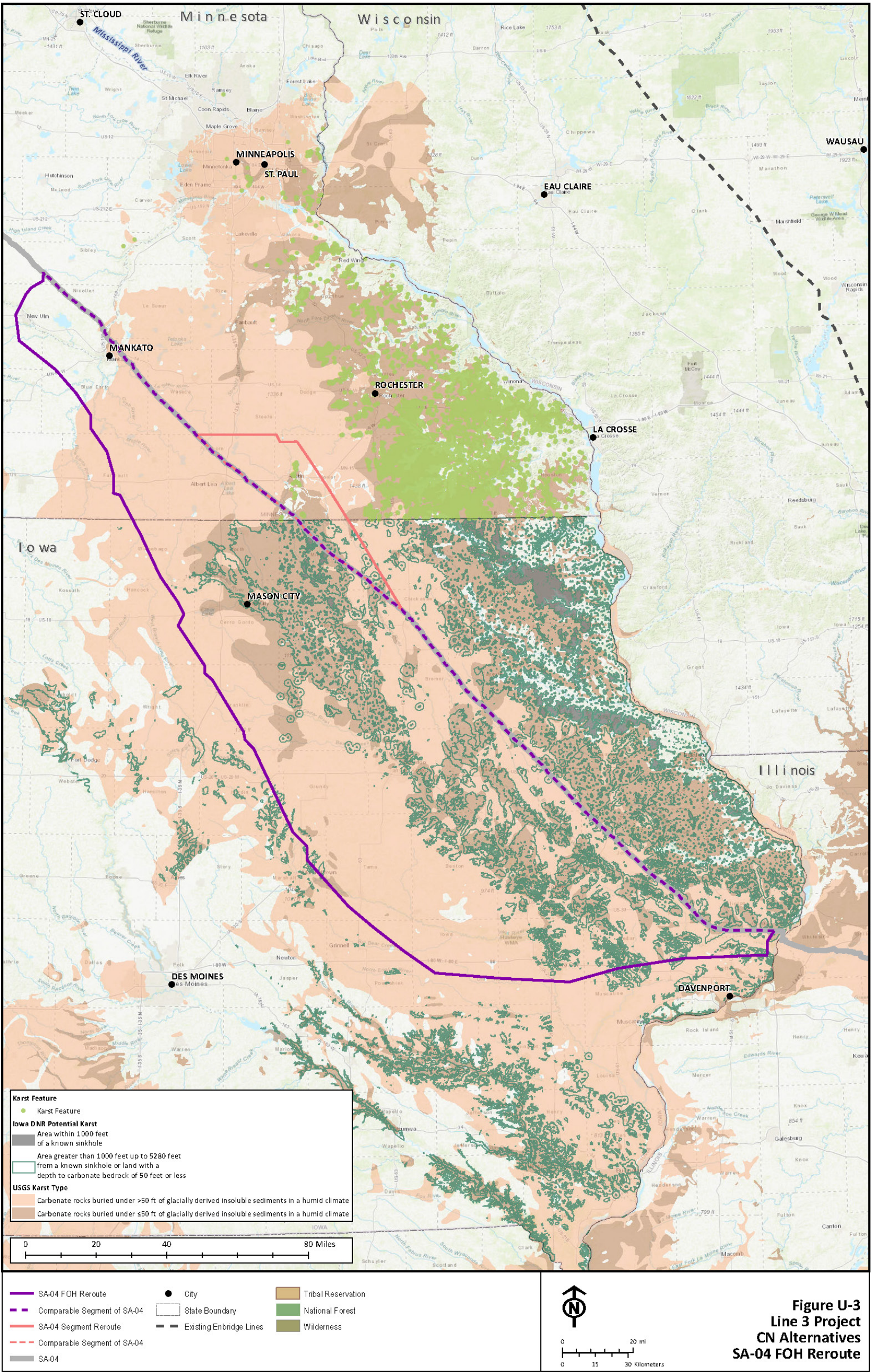
^c Iowa DNR Data - ftp://ftp.igsb.uiowa.edu/gis_library/IA_state/geologic/Karst/karst.html

FOH = Friends of the Headwaters

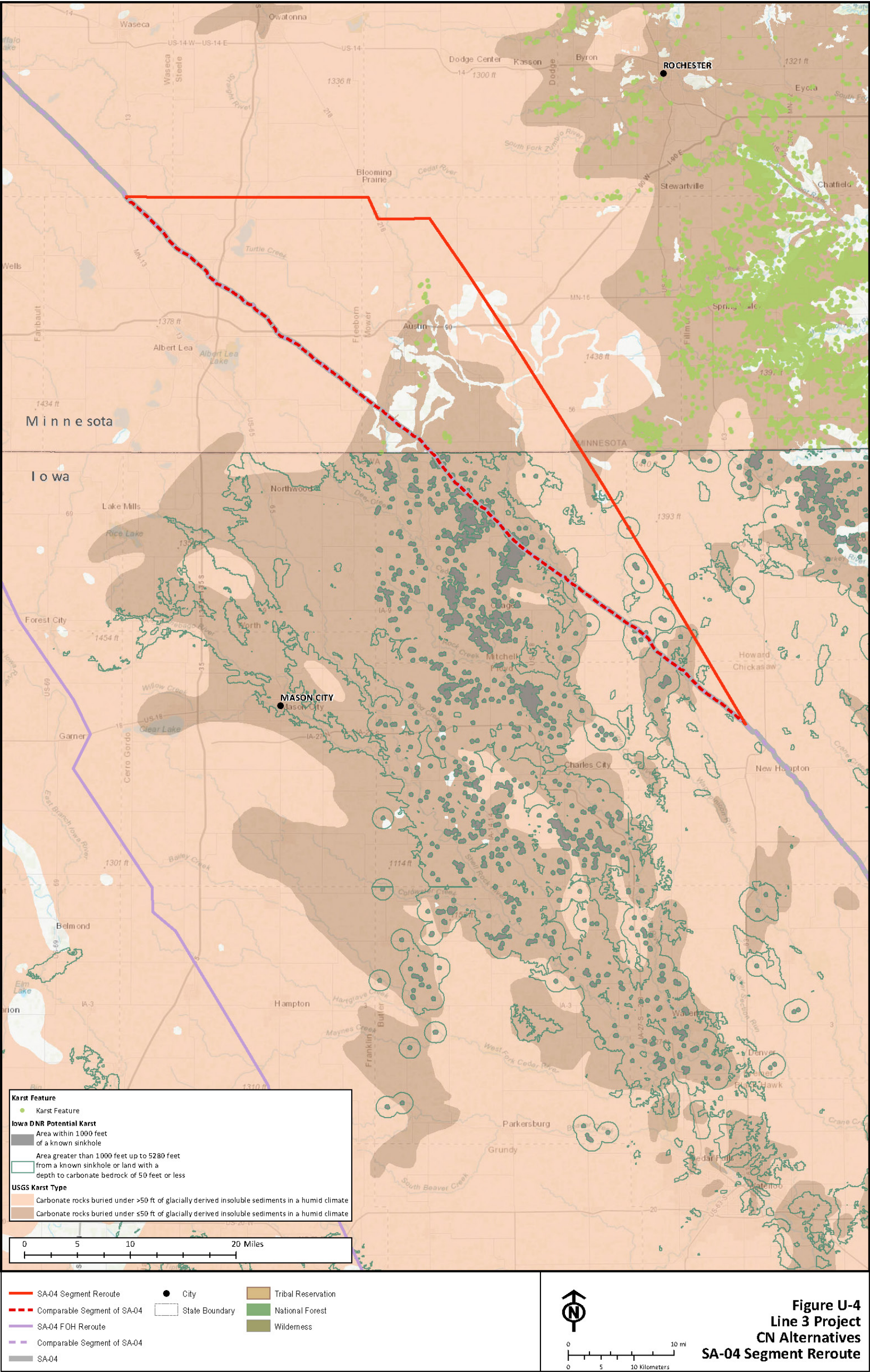
SA = System Alternative







Document Path: M:\Chicago\Enbridge_Line_3\Maps\MXD\Report\EIS\Final_2012_rev01\Summary\Appendix_U\3_FOHW_al_lines_UAppendix.mxd 2/7/2018



Document Path: M:\Chicago\enbridge_line_3\Maps\MXD\Report\EIS\Final_2017_rev01\Summary\Appendix_U\4_SA04_Mod_all_lines_UAppendix.mxd 2/7/2018

Resource Tables

The tables in this section provide an analysis of the resources present along the two options identified above to minimize crossing shallow karst (less than 50 feet below the surface)—SA-04 FOH Reroute and SA-04 Segment Reroute. The parameters presented in these tables are the same as those parameters evaluated in Chapters 5, 10, and 11 of the EIS for the various Certificate of Need alternatives. Each table in this section compares the reroutes to the segment of SA-04 that it would replace. Measurements are provided as being within a particular distance from the centerline, unless otherwise noted. For example, a reference to “within 25 feet of the centerline” means that the analysis provides for an evaluation of a resource from 0 to 25 feet on one side of the centerline **and** 0 to 25 feet on the opposite side of the centerline.

Table U-2. Groundwater

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Cretaceous Bedrock within 25 feet of the centerline (acres)	16.7	0	20.8	0
Devonian Bedrock within 25 feet of the centerline (acres)	735.8	346.5	161.4	241.5
Mississippian Bedrock within 25 feet of the centerline (acres)	455.2	0	0	0
Ordovician Bedrock within 25 feet of the centerline (acres)	65.4	99.0	0	0
Pennsylvanian Bedrock within 25 feet of the centerline (acres)	61.9	6.5	0	0
Silurian Bedrock within 25 feet of the centerline (acres)	246.5	666.0	0	0
Cretaceous Bedrock within 1,000 feet of the centerline (acres)	678.0	0	829.7	0
Devonian Bedrock within 1,000 feet of the centerline (acres)	29,745.0	13,929.6	6,494.5	9,687.0
Mississippian Bedrock within 1,000 feet of the centerline (acres)	17,817.3	0	0	0
Ordovician Bedrock within 1,000 feet of the centerline (acres)	2,613.9	3,953.5	0	0
Pennsylvanian Bedrock within 1,000 feet of the centerline (acres)	2,499.7	258.7	0	0
Silurian Bedrock within 1,000 feet of the centerline (acres)	9,932.3	26,573.3	0	0
Wellhead Protection Areas ^a within 25 feet of the centerline (acres)	4.3	3.4	26.4	3
Wellhead Protection Areas ^a within 1,000 feet of the centerline (acres)	157	175	1,010	138
Wells within 25 feet of the centerline (count)	1	17	2	9
Wells within 1,000 feet of the centerline (count)	93	767	66	103
IA Groundwater Vulnerability - Sinkholes (400-meter radius around each) within 25 feet of the centerline (acres)	0.00	36.08	0.00	36.08
IA Groundwater Vulnerability - Good bedrock aquifers; thin drift confinement within 25 feet of the centerline (acres)	225.58	421.96	36.09	72.45

Table U-2. Groundwater

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA Groundwater Vulnerability - Good bedrock aquifers; moderate drift confinement within 25 feet of the centerline (acres)	221.36	409.29	100.05	33.61
IA Groundwater Vulnerability - Variable bedrock aquifers; thin drift confinement within 25 feet of the centerline (acres)	275.21	0.00	0.00	0.00
IA Groundwater Vulnerability - Variable bedrock aquifers; moderate drift confinement within 25 feet of the centerline (acres)	472.56	0.00	0.00	0.00
IA Groundwater Vulnerability - Drift groundwater source within 25 feet of the centerline (acres)	119.92	0.00	0.00	0.00
IA Groundwater Vulnerability - Alluvial aquifers (southeast Iowa) within 25 feet of the centerline (acres)	155.46	61.67	0.00	0.00
IA Groundwater Vulnerability - Alluvial aquifers (northeast Iowa) within 25 feet of the centerline (acres)	53.90	188.77	45.98	99.14
IA Groundwater Vulnerability - Alluvial aquifers (northwest Iowa) within 25 feet of the centerline (acres)	57.40	0.00	0.00	0.00
IA Groundwater Vulnerability - All Areas within 25 feet of the centerline (total acres)	1,581	1,118	182	241
IA Groundwater Vulnerability - Sinkholes (400-meter radius around each) within 1,000 feet of the centerline (acres)	0.00	1,475.54	0.00	1,475.54
IA Groundwater Vulnerability - Good bedrock aquifers; thin drift confinement within 1,000 feet of the centerline (acres)	8,960.13	16,643.91	1,449.56	2,826.96
IA Groundwater Vulnerability - Good bedrock aquifers; moderate drift confinement within 1,000 feet of the centerline (acres)	8,703.83	16,219.42	3,929.47	1,451.71
IA Groundwater Vulnerability - Variable bedrock aquifers; thin drift confinement within 1,000 feet of the centerline (acres)	10,903.29	0.00	0.00	0.00
IA Groundwater Vulnerability - Variable bedrock aquifers; moderate drift confinement within 1,000 feet of the centerline (acres)	19,092.14	0.00	0.00	0.00
IA Groundwater Vulnerability - Variable bedrock aquifers; shale confinement within 1,000 feet of the centerline (acres)	21.43	0.00	0.00	0.00
IA Groundwater Vulnerability - Drift groundwater source within 1,000 feet of the centerline (acres)	4,735.44	0.00	0.00	0.00
IA Groundwater Vulnerability - Alluvial aquifers (southeast Iowa) within 1,000 feet of the centerline (acres)	6,280.85	2,547.32	0.00	0.00
IA Groundwater Vulnerability - Alluvial aquifers (northeast Iowa) within 1,000 feet of the centerline (acres)	2,234.18	7,820.76	1,940.72	3,924.61

Table U-2. Groundwater

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA Groundwater Vulnerability - Alluvial aquifers (northwest Iowa) within 1,000 feet of the centerline (acres)	2,351.34	0.00	0.00	0.00
IA Groundwater Vulnerability - All Areas within 1,000 feet of the centerline (total acres)	63,283	44,707	7,320	9,679
MN Low Aquifer Vulnerability Areas within 25 feet of the centerline (acres)	4.03	50.28	193.55	48.79
MN Medium Aquifer Vulnerability Areas within 25 feet of the centerline (acres)	464.68	505.12	96.73	149.80
MN High Aquifer Vulnerability Areas within 25 feet of the centerline (acres)	49.48	68.29	50.21	32.93
MN Unrated Aquifer Vulnerability Areas within 25 feet of the centerline (acres)	0.00	0.00	0.00	0.00
MN Aquifer Vulnerability Areas – All within 25 feet of the centerline (total acres)	518.19	623.69	340.49	231.53
MN Low Aquifer Vulnerability Areas within 1,000 feet of the centerline (acres)	183.32	1,930.24	7,640.31	1,864.30
MN Medium Aquifer Vulnerability Areas within 1,000 feet of the centerline (acres)	18,592.50	20,067.87	3,907.74	6,011.76
MN High Aquifer Vulnerability Areas within 1,000 feet of the centerline (acres)	1,981.05	2,965.29	2,102.67	1,413.75
MN Unrated Aquifer Vulnerability Areas within 1,000 feet of the centerline (acres)	0.00	0.00	0.00	0.00
MN Aquifer Vulnerability Areas – All within 1,000 feet of the centerline (total acres)	20,756.87	24,963.40	13,650.72	9,289.81
Sole Source Aquifers (EPA) within 25 feet of the centerline (acres)	0	0	0	0
Sole Source Aquifers (EPA) within 1,000 feet of the centerline (acres)	0	0	0	0
MN PCA's What's in my Neighborhood Points within 25 feet of the centerline (count)	2	0	7	0
MN PCA's What's in my Neighborhood Points within 1,000 feet of the centerline (count)	29	43	36	8
EPA Facility Registry Service ^b - Sites within 25 feet of the centerline (count)	1	0	0	0
EPA Facility Registry Service ^b - Sites within 1,000 feet of the centerline (count)	95	72	13	22
Drinking Water SMAs within 25 feet of the centerline (acres)	0	5.6	10	4.9
Drinking Water SMAs within 1,000 feet of the centerline (acres)	22	216	397	182
MN Pollution Sensitivity of Near-Surface Material - Karst within 25 feet of centerline (acres)	0.00	49.52	6.24	41.65
MN Pollution Sensitivity of Near-Surface Material - High within 25 feet of centerline (acres)	22.31	29.78	11.72	17.67
MN Pollution Sensitivity of Near-Surface Material - Moderate within 25 feet of centerline (acres)	15.56	11.83	7.79	0.40

Table U-2. Groundwater

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Pollution Sensitivity of Near-Surface Material - Low within 25 feet of centerline (acres)	325.15	407.31	312.48	158.51
MN Pollution Sensitivity of Near-Surface Material - Very Low within 25 feet of centerline (acres)	154.05	119.34	1.97	7.39
MN Pollution Sensitivity of Near-Surface Material - Water (Not Rated) within 25 feet of centerline (acres)	1.27	5.98	0.24	5.98
MN Pollution Sensitivity of Near-Surface Material - Bedrock at or near surface within 25 feet of centerline (acres)	0.00	0.00	0.00	0.00
MN Pollution Sensitivity of Near-Surface Material - Karst within 1,000 feet of centerline (acres)	0.00	2,052.70	234.37	1,615.00
MN Pollution Sensitivity of Near-Surface Material - High within 1,000 feet of centerline (acres)	849.49	1,215.33	483.07	722.18
MN Pollution Sensitivity of Near-Surface Material - Moderate within 1,000 feet of centerline (acres)	593.28	472.97	299.91	43.95
MN Pollution Sensitivity of Near-Surface Material - Low within 1,000 feet of centerline (acres)	12,778.53	15,907.60	12,518.77	6,333.34
MN Pollution Sensitivity of Near-Surface Material - Very Low within 1,000 feet of centerline (acres)	6,377.06	5,075.08	92.47	355.38
MN Pollution Sensitivity of Near-Surface Material - Water (Not Rated) within 1,000 feet of centerline (acres)	164.45	239.41	20.62	224.14
MN Pollution Sensitivity of Near-Surface Material - Bedrock at or near surface within 1,000 feet of centerline (acres)	0.00	4.49	0.00	0.00

^a The total acreage for wellhead protection areas (WPAs) accounts for some overlap due to the presence of multiple WPAs.

^b The Facility Registry Service is an EPA database that identifies facilities, sites, or places subject to environmental regulations or of environmental interest.

EPA = U.S. Environmental Protection Agency

FOH = Friends of the Headwaters

IA = Iowa

MN = Minnesota

PCA = Pollution Control Agency

SA = System Alternative

SMA = Supply Management Area

Table U-3. Surface Water

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
NHD Waterbodies within 25 feet of the centerline (count)	21	11	6	0
NHD Waterbodies within 60 feet of the centerline (count)	24	11	9	0
NHD Waterbodies within ½ mile of the centerline (count)	242	193	68	66
USACE Navigable Waters within 25 feet of the centerline (count)	0	0	0	0
USACE Navigable Waters within 60 feet of the centerline (count)	0	0	0	0
National Rivers Inventory - Rivers within 25 feet of the centerline (count)	3	1	0	0
National Rivers Inventory - Rivers within 60 feet of the centerline (count)	3	1	0	0
Public Waters - Basins within 25 feet of the centerline (count)	3	0	0	0
Public Waters - Basins within 60 feet of the centerline (count)	5	0	0	0
Public Waters - Courses within 25 feet of the centerline (count)	20	15	13	6
Public Waters - Courses within 60 feet of the centerline (count)	20	15	13	6
Trout Streams within 25 feet of the centerline (count)	0	0	0	0
Trout Streams– within 60 feet of the centerline (count)	0	0	0	0
Impaired Lakes– within 25 feet of the centerline (count)	0	0	0	0
Impaired Lakes– within 60 feet of the centerline (count)	0	0	0	0
Impaired Streams – within 25 feet of the centerline (count)	21	11	6	4
Impaired Streams – within 60 feet of the centerline (count)	21	11	6	4
303d Listed Impaired Waters (MN) – within 25 feet of the centerline (count)	9	5	3	3
303d Listed Impaired Waters (MN) – within 60 feet of the centerline (count)	9	5	3	3
Wild Rice Lakes (MN) – within 25 feet of the centerline (count)	0	0	0	0
Wild Rice Lakes (MN) – within 60 feet of the centerline (count)	0	0	0	0
Minnesota River - Mankato (HUC ^a 8b: 07020007) - Water Quality Score	47	47	N/A	N/A
Minnesota River - Mankato (HUC 8: 07020007) - within 25 feet of centerline (acres)	179.32	124.44	N/A	N/A
Minnesota River - Mankato (HUC 8: 07020007) - within 60 feet of centerline (acres)	251.18	174.20	N/A	N/A
Cottonwood River (HUC 8: 07020008) - Water Quality Score	62	N/A	N/A	N/A

Table U-3. Surface Water

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Cottonwood River (HUC 8: 07020008) - within 25 feet of centerline (acres)	29.18	N/A	N/A	N/A
Cottonwood River (HUC 8: 07020008) - within 60 feet of centerline (acres)	40.86	N/A	N/A	N/A
Blue Earth River (HUC 8: 07020009) - Water Quality Score	43	N/A	N/A	N/A
Blue Earth River (HUC 8: 07020009) - within 25 feet of centerline (acres)	112.81	N/A	N/A	N/A
Blue Earth River (HUC 8: 07020009) - within 60 feet of centerline (acres)	157.91	N/A	N/A	N/A
Watonwan River (HUC 8: 07020010) - Water Quality Score	48	N/A	N/A	N/A
Watonwan River (HUC 8: 07020010) - within 25 feet of centerline (acres)	41.68	N/A	N/A	N/A
Watonwan River (HUC 8: 07020010) - within 60 feet of centerline (acres)	58.35	N/A	N/A	N/A
Le Sueur River (HUC 8: 07020011) - Water Quality Score	52	52	52	52
Le Sueur River (HUC 8: 07020011) - within 25 feet of centerline (acres)	116.46	231.38	40.04	40.29
Le Sueur River (HUC 8: 07020011) - within 60 feet of centerline (acres)	163.05	323.94	96.24	56.48
Minnesota River-Shakopee (HUC 8: 07020012) - Water Quality Score	51	51	N/A	N/A
Minnesota River-Shakopee (HUC 8: 07020012) - within 25 feet of centerline (acres)	38.89	76.63	N/A	N/A
Minnesota River-Shakopee (HUC 8: 07020012) - within 60 feet of centerline (acres)	54.40	107.36	N/A	N/A
Cedar River (HUC 8: 07080201) - Water Quality Score	N/A	39	39	39
Cedar River (HUC 8: 07080201) - within 25 feet of centerline (acres)	N/A	116.81	199.67	116.81
Cedar River (HUC 8: 07080201) - within 60 feet of centerline (acres)	N/A	163.53	479.18	163.53
Shell Rock River (HUC 8: 07080202) - Water Quality Score	N/A	39	N/A	39
Shell Rock River (HUC 8: 07080202) - within 25 feet of centerline (acres)	N/A	74.54	N/A	74.54
Shell Rock River (HUC 8: 07080202) - within 60 feet of centerline (acres)	N/A	104.35	N/A	104.34
Cannon River (HUC 8: 07040002) - Water Quality Score	N/A	N/A	50	N/A
Cannon River (HUC 8: 07040002) - within 25 feet of centerline (acres)	N/A	N/A	79.89	N/A
Cannon River (HUC 8: 07040002) - within 60 feet of centerline (acres)	N/A	N/A	191.68	N/A
Wapsipinicon River (HUC 8: 07080102) - Water Quality Score	N/A	N/A	39	N/A
Wapsipinicon River (HUC 8: 07080102) - within 25 feet of centerline (acres)	N/A	N/A	20.89	N/A

Table U-3. Surface Water

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Wapsipinicon River (HUC 8: 07080102) - within 60 feet of centerline (acres)	N/A	N/A	199.67	N/A

^a HUC 8 maps the sub-basin level, analogous to medium-sized river basins. The “8” refers to the number of digits in the code.

FOH = Friends of the Headwaters

HUC = Hydrologic Unit Code

MN = Minnesota

N/A = Not applicable

NHD = National Hydrography Dataset

SA = System Alternative

USACE = U.S. Army Corps of Engineers

Table U-4. Wetlands

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
NWI wetlands within 25 feet of the centerline (total acres) ^a	65	51.5	14	8.1
NWI wetlands within 60 feet of the centerline (total acres) ^a	91	71.6	37	11.8
NWI Wetlands - Freshwater Emergent Wetlands within 25 feet of the centerline (acres)	20.5	34.3	7.4	5.4
NWI Wetlands - Freshwater Forested/Shrub Wetland within 25 feet of the centerline (acres)	25.0	7.8	2.0	0.4
NWI Wetlands - Freshwater Pond within 25 feet of the centerline (acres)	3.0	1.1	1.6	0
NWI Wetlands - Riverine Wetlands within 25 feet of the centerline (acres)	15.2	8.3	3.0	2.3
NWI Wetlands - Lakes within 25 feet of the centerline (acres)	1.4	0	0	0
NWI Wetlands - Freshwater Emergent Wetlands within 60 feet of the centerline (acres)	28.5	46.7	19.8	7.6
NWI Wetlands - Freshwater Forested/Shrub Wetland within 60 feet of the centerline (acres)	34.2	10.3	4.6	0.5
NWI Wetlands - Freshwater Pond within 60 feet of the centerline (acres)	4.6	1.5	3.9	0
NWI Wetlands - Riverine within 60 feet of the centerline (acres)	22.1	13.1	8.5	3.7
NWI Wetlands - Lakes within 60 feet of the centerline (acres)	1.9	0	0	0
MN Public Wetlands – within 25 feet of the centerline (acres)	0.4	0	0	0
MN Public Wetlands – within 60 feet of the centerline (acres)	0.6	0	0	0
Calcareous Fens – within 25 feet of the centerline (count)	0	0	0	0
Calcareous Fens – within 60 feet of the centerline (count)	0	0	0	0

^a Due to rounding, the addition of the individual wetland types may not sum to the total shown.

FOH = Friends of the Headwaters

MN = Minnesota

NWI = National Wetlands Inventory

SA = System Alternative

Table U-5. Floodplains

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
FEMA Designated Special Flood Hazard Areas – within 25 feet of the centerline (acres)	1,526	1,340	494	473
FEMA Designated Special Flood Hazard Areas – within 60 feet of the centerline (acres)	2,137	1,890	1,198	662

FEMA = Federal Emergency Management Agency

FOH = Friends of the Headwaters

SA = System Alternative

Table U-6. Geology and Soils

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SSA-04 Segment Reroute	Comparable Segment of SA-04
Total Distance (miles [rounded])	346	287	86	78
Prime Farmland (miles/percentage) ^a	299.8/87%	252.9 / 88%	81.7 / 95%	67.2 / 86%
Highly Erodible Soils (wind) (miles/percentage) ^b	6.8 / 2%	8.7 / 3%	1.1 / 1%	1.0 / 1%
Highly Erodible Soils (Water) (miles/percentage) ^c	178.6 / 52%	81.4 / 28%	22.9 / 27%	19.4 / 25%
Hydric Soils (miles/percentage)	112.4 / 33%	110.5 / 38%	35.1 / 41%	33.5 / 43%
Compaction Prone Soils (miles/percentage) ^d	73.6 / 21%	74.9 / 26%	11.2 / 13%	18.1 / 0.1%
Course Textured Soils (miles/percentage) ^e	19.5 / 6%	29.5 / 10%	15.9 / 18%	8.16 / 11%
Stony/Rocky Soils (miles/percentage) ^f	0.3 / <0.01%	1.3 / <0.1%	2.3 / 3%	1.0 / < 0.1%

^a This categorization includes soils that are considered prime farmlands when drained or irrigated.^b Highly erodible soils (wind) are classified by Wind Erodibility Groups 1 and 2.^c Highly erodible soils (water) are classified as those with slopes > 5% + slopes 0–5% with k-factor > 0.4. K-factor is the soil erodibility factor, which represents both the susceptibility of soil to erosion and the rate of runoff.^d Compaction prone soils includes soils with clay loam or finer textures in somewhat poor, poor, and very poor drainage classes.^e Course textured soils include sandy loams and coarser soils, including gravels.^f Stony/rocky soils include soils with a cobbly, stony, bouldery, gravelly, or shaly modifier to the textural class.

FOH = Friends of the Headwaters

SA = System Alternative

Table U-7. Elevation

Measurement/Data Evaluated ^a	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Elevation High	1,296 feet above MSL	1,328 feet above MSL	1,359 feet above MSL	1,329 feet above MSL
Elevation Low	580 feet above MSL	605 feet above MSL	1,173 feet above MSL	1,121 feet above MSL
Net Elevation change beginning to end	-342 feet	+342 feet	-61 feet	+61 feet
Total Distance	346 miles	287 miles	86 miles	78 miles

^a Elevation data was calculated using United States Geological Survey and Environmental Systems Research Institute data.

FOH = Friends of the Headwaters

MSL = mean sea level

SA = System Alternative

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA and MN noxious weed species	MN: <ul style="list-style-type: none"> ▪ common buckthorn ▪ glossy buckthorn ▪ reed canary grass ▪ smooth brome ▪ honeysuckle ▪ wild parsnip ▪ common reed ▪ white sweetclover ▪ yellow sweetclover ▪ Canada thistle ▪ sow thistle ▪ birdsfoot trefoil ▪ cow vetch IA: none listed	MN: <ul style="list-style-type: none"> ▪ common buckthorn ▪ glossy buckthorn ▪ reed canary grass ▪ smooth brome ▪ honeysuckle ▪ Russian-olive ▪ wild parsnip ▪ common reed ▪ white sweetclover ▪ yellow sweetclover ▪ Canada thistle ▪ birdsfoot trefoil ▪ cow vetch ▪ crown vetch IA: none listed	MN: none listed IA: none listed	MN: none listed IA: none listed
Ecoregions – Level III Western Corn Belt Plains (miles crossed)	0	0	0	0
Ecoregions – Level IV Eastern Iowa and Minnesota Drift Plains (miles crossed)	1.7	177.2	86.2	78
Ecoregions – Level IV Des Moines Lobe (miles crossed)	172.0	55.2	0	0

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Ecoregions – Rolling Loess Prairies (miles crossed)	169.3	51.1	0	0
Ecoregions – Level III North Central Hardwood Forests (miles crossed)	0	0	0	0
Ecoregions – Level IV Big Woods (miles crossed)	0	3.9	0	0
Ecoregions – Level III Interior River Valley and Hills (miles crossed)	0	0	0	0
Ecoregions – Level IV Upper Mississippi Alluvial Plain (miles crossed)	3.5	0	0	0
NLCD Cover Class within 25 feet of the centerline (total acres)	2,099.9	1,741.7	522.7	473.1
NLCD Cover Class ^a : Evergreen Forest within 25 feet of the centerline (acres/percentage)	0/0%	0/0%	0/0%	0/0%
NLCD Cover Class ^a : Deciduous Forest within 25 feet of the centerline (acres/percentage)	66.8/3.2%	6.6/<1%	9.5/1.8%	2.2/<1%
NLCD Cover Class ^a : Grassland/Herbaceous within 25 feet of the centerline (acres/percentage)	79.8/3.8%	54.6/3.1%	33.4/6.4%	17.2/3.6%
NLCD Cover Class ^a : Pasture/Hay within 25 feet of the centerline (acres/percentage)	111.0/5.3%	20.2/1.2%	20.1/3.8%	3.7/<1%
NLCD Cover Class ^a : Cultivated Crops within 25 feet of the centerline (acres/percentage)	1,662.2/79.2%	1,540.3/88.4%	357.5/68.4%	421.5/89.1%
NLCD Cover Class ^a : Woody Wetlands within 25 feet of the centerline (acres/percentage)	24.9/1.2%	5.9/<1%	0.4/<1%	0.9/<1%
NLCD Cover Class ^a : Barren Land within 25 feet of the centerline (acres/percentage)	0.9/<1%	8.3/<1%	0.8/<1%	0.5/<1%
NLCD Cover Class ^a : Emergent Herbaceous Wetlands within 25 feet of the centerline (acres/percentage)	9.1/<1%	20.6/1.2%	0.9/<1%	1.5/<1%
NLCD Cover Class ^a : Open Water within 25 feet of the centerline (acres/percentage)	8.4/<1%	2.6/<1%	1.0/<1%	0.9/<1%
NLCD Cover Class ^a : Developed within 25 feet of the centerline (acres/percentage)	136.7/6.5%	82.6/4.7%	98.9/18.9%	24.8/5.2%
NLCD Cover Class within 60 feet of the centerline (total acres)	2,939.8	2,438.2	731.6	662.1
NLCD Cover Class ^a : Evergreen Forest within 60 feet of the centerline (acres/percentage)	0/0%	0/0%	0/0%	0/0%
NLCD Cover Class ^a : Deciduous Forest within 60 feet of the centerline (acres/percentage)	93.7/3.2%	9.9/<1%	13.0/1.8%	3.3/<1%
NLCD Cover Class ^a : Grassland/Herbaceous within 60 feet of the centerline (acres/percentage)	112.9/3.8%	76.3/3.1%	46.3/6.3%	24.26/3.7%
NLCD Cover Class ^a : Pasture/Hay within 60 feet of the centerline (acres/percentage)	155.8/5.3%	28.5/1.2%	27.9/3.8%	5.11/<1%
NLCD Cover Class ^a : Cultivated Crops within 60 feet of the centerline (acres/percentage)	2,325.9/79.1%	2,154.9/ 88.4%	472.8/64.6%	588.64/ 88.9%
NLCD Cover Class ^a : Woody Wetlands within 60 feet of the centerline (acres/percentage)	34.2/ 1.1%	7.8/ <1%	0.4/ <1%	1.2/ <1%
NLCD Cover Class ^a : Barren Land within 60 feet of the centerline (acres/percentage)	1.2/<1%	11.4/<1%	0.8/<1%	0.7/<1%

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
NLCD Cover Class ^a : Emergent Herbaceous Wetlands within 60 feet of the centerline (acres/percentage)	13.3/<1%	29.4/1.2%	1.4/<1%	2.37/<1%
NLCD Cover Class ^a : Open Water within 60 feet of the centerline (acres/percentage)	12.2/<1%	3.8/<1%	1.2/<1%	1.37/<1%
NLCD Cover Class ^a : Developed Land within 60 feet of the centerline (acres/percentage)	190.5/6.5%	116.2/4.8%	167.8/22.9%	35.16/5.3%
NLCD Cover Class ^a : Shrub/Scrub within 60 feet of the centerline (acres/percentage)	0.2/<1%	0/0%	0/0%	0/0%
NLCD Cover Class within ½ mile of the centerline (total acres)	222,138.6	184,001.2	55,669.4	50,358.5
NLCD Cover Class ^a : Evergreen Forest within ½ mile of the centerline (acres/percentage)	11.3/<1%	43.9/<1%	8.7/<1%	9.8/<1%
NLCD Cover Class ^a : Deciduous Forest within ½ mile of the centerline (acres/percentage)	6,948.4/3.1%	2,407.0/1.3%	1,009.4/1.8%	776.1/1.5%
NLCD Cover Class ^a : Grassland/Herbaceous within ½ mile of the centerline (acres/percentage)	9,513.1/4.0%	6,138.3/3.3%	3,035.8/ 5.5%	1,956.5/3.9%
NLCD Cover Class ^a : Pasture/Hay within ½ mile of the centerline (acres/percentage)	12,653.8/5.7%	3,558.5/1.9%	1,893.2/3.4%	763.8/1.5%
NLCD Cover Class ^a : Cultivated Crops within ½ mile of the centerline (acres/percentage)	173,453.9/78.0%	155,636.3/ 84.6%	45,569.0/81.9%	42,948.6/85.3%
NLCD Cover Class ^a : Woody Wetlands within ½ mile of the centerline (acres/percentage)	2,309.8/ 1%	1,740.2/<1%	225.1/<1%	413.3/ <1%
NLCD Cover Class ^a : Barren Land within ½ mile of the centerline (acres/percentage)	114.3/ <1%	529.6/ <1%	17.2/ <1%	28.2/ <1%
NLCD Cover Class ^a : Emergent Herbaceous Wetlands within ½ mile of the centerline (acres/percentage)	1,648.6/<1%	1,791.0/ <1%	125.9/ <1%	115.0/ <1%
NLCD Cover Class ^a : Open Water within ½ mile of the centerline (acres/percentage)	1,643.0/ <1%	599.9/<1%	85.6/ <1%	73.0/ <1%
NLCD Cover Class ^a : Developed within ½ mile of the centerline (acres/percentage)	13,837.1/ 6.2%	11,551.2/6.3%	3,699.6/ 6.6%	3,274.2/ 6.5%
NLCD Cover Class ^a : Shrub/Scrub within ½ mile of the centerline (acres/percentage)	5.3/<1%	5.4/ <1%	0/0%	0/0%
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Southern Mesic Oak-Basswood Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	0.25	0	0.25
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Mesic Prairie (Southern), Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.11	0.26	1.15	0.26
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Mesic Prairie (Southern), High MBS Rank, S2 Conservation Rank ^b (acres)	0	0	0.17	0

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Southern Terrace Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	0.40	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Silver Maple - (Virginia Creeper) Floodplain Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	0	0.01	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	2.55	0.10	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Sugar Maple - Basswood - (Bitternut Hickory) Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.48	0.05	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Southern Dry Prairie, High MBS Rank, No Conservation Rank ^b (acres)	0	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline – Elm-Ash-Basswood Terrace Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.53	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 25 feet of the centerline (total acres)	3.67	1.07	1.32	0.51
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Southern Mesic Oak-Basswood Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	0.35	0	0.35
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Mesic Prairie (Southern), Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.16	0.36	8.73	0.36
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Mesic Prairie (Southern), High MBS Rank, S2 Conservation Rank ^b (acres)	0	0	0.24	0

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline –Southern Terrace Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	0.56	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Silver Maple - (Virginia Creeper) Floodplain Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	0	0.2	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	3.75	0.16	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Sugar Maple - Basswood - (Bitternut Hickory) Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.68	0.17	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Southern Dry Prairie, High MBS Rank, No Conservation Rank ^b (acres)	0	0.01	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline – Elm-Ash-Basswood Terrace Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0.77	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within 60 feet of the centerline (total acres)	5.36	1.81	8.97	0.71
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Floodplain Forest, Outstanding MBS Rank, No Conservation Rank ^b (acres)	0	16.05	0	16.05
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Floodplain Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	32.90	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Mesic Oak-Basswood Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	62.23	0	56.03

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Sugar Maple-Basswood-(Bitternut Hickory) Forest, Outstanding MBS Rank, S2 Conservation Rank ^b (acres)	0	34.63	0	34.63
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Sugar Maple-Basswood-(Bitternut Hickory) Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	39.28	42.69	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Sugar Maple-Basswood-(Bitternut Hickory) Forest, High MBS Rank, S2 Conservation Rank ^b (acres)	0	67.73	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Wet-Mesic Hardwood Forest, High MBS Rank, S2 Conservation Rank ^b (acres)	0	0	0	8.73
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Wet-Mesic Hardwood Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0	0	0	34.02
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Wet-Mesic Hardwood Forest, Outstanding MBS Rank, No Conservation Rank ^b (acres)	0	22.8	0	22.8
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Mesic Prairie (Southern), High MBS Rank, S2 Conservation Rank ^b (acres)	0	8.73	17.85	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Mesic Prairie (Southern), Moderate MBS Rank, S2 Conservation Rank ^b (acres)	7.61	34.02	40.67	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Mesic Prairie (Southern), Outstanding MBS Rank, S2 Conservation Rank ^b (acres)	0	2.48	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Wet Prairie (Southern), Moderate MBS Rank, S2 Conservation Rank ^b (acres)	0	0	0.38	0

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Silver Maple-Green Ash-Cottonwood Terrace Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	0	0	19.03	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Terrace Forest, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	73.73	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline –Silver Maple - (Virginia Creeper) Floodplain Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	0	153.74	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline –Silver Maple - (Virginia Creeper) Floodplain Forest, Outstanding MBS Rank, S3 Conservation Rank ^b (acres)	0	0.12	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest, High MBS Rank, S3 Conservation Rank ^b (acres)	0	34.36	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Red Oak - Sugar Maple - Basswood - (Bitternut Hickory) Forest, Moderate MBS Rank, S3 Conservation Rank (acres)	125.16	106.08	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Calcareous Fen (Southeastern), Outstanding MBS Rank, S1 Conservation Rank ^b (acres)	0	0.85	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Dry Prairie, Outstanding MBS Rank, No Conservation Rank ^b (acres)	0	0.91	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Dry Prairie, Moderate MBS Rank, No Conservation Rank ^b (acres)	0	1.97	0	0

Table U-8. Vegetation

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Southern Dry Prairie, High MBS Rank, No Conservation Rank ^b (acres)	0	60.11	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Seepage Meadow/Carr, Outstanding MBS Rank, S3 Conservation Rank ^b (acres)	0	6.74	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Elm-Ash-Basswood Terrace Forest, High MBS Rank, S2 Conservation Rank ^b (acres)	1.14	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Elm-Ash-Basswood Terrace Forest, Moderate MBS Rank, S2 Conservation Rank ^b (acres)	55.46	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline – Elm-Basswood-Black Ash-(Hackberry) Forest, Moderate MBS Rank, S3 Conservation Rank ^b (acres)	33.02	0	0	0
MN Native Plant Community Systems and Rare Native Plant Communities within ½ mile of the centerline (total acres)	261.67	762.87	77.93	172.26

^a The NLCD cover percentage was calculated by dividing the acreage of the individual NLCD cover class by the total number of acres of all NLCD cover classes. The values in the table may not sum to the total due to rounding.

^b MBS Ranks are noted as the following:

- Outstanding = sites containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes
- High = sites containing very good quality occurrences of the rarest species, high quality examples of rare native plant communities, and/or important functional landscapes
- Moderate = sites containing occurrences of rare species and/or moderately disturbed native plant communities, and/or landscapes that have a strong potential for recovery.

Conservation ranks are shown as null – no rank, S1 - critically imperiled, S2 – imperiled, and S3 – vulnerable to extirpation.

FOH = Friends of the Headwaters

IA = Iowa

MBS = Minnesota Biological Survey

MN = Minnesota

NLCD = National Land Cover Database

SA = System Alternative

Table U-9. Fish and Wildlife Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
AMAs within 25 feet of the centerline (count)	0	1	0	0
AMAs within 60 feet of the centerline (count)	0	1	0	0
AMAs within ½ mile of the centerline (count)	0	2	0	0
MN DNR designated trout lakes and streams within 25 feet of the centerline (count)	0	0	0	0
MN DNR designated trout lakes and streams within 60 feet of the centerline (count)	0	0	0	0
MN DNR designated trout lakes and streams within ½ mile of the centerline (count) ^a	0	2	0	0
Muskie Lakes within 25 feet of the centerline (count)	0	0	0	0
Muskie Lakes within 60 feet of the centerline (count)	0	0	0	0
Muskie Lakes within ½ mile of the centerline (count)	0	0	0	0
MN Lakes rated for Fish IBI within 25 feet of centerline (count)	0	0	0	0
MN Lakes rated for Fish IBI within 60 feet of the centerline (count)	0	0	0	0
MN Lakes rated for Fish IBI within ½ mile of the centerline (count)	0	0	0	0
MN Lakes of Biological Significance within 25 feet of the centerline (count)	1	0	0	0
MN Lakes of Biological Significance within 25 feet of the centerline (acres)	0.9	0	0	0
MN Lakes of Biological Significance within 60 feet of the centerline (count)	1	0	0	0
MN Lakes of Biological Significance within 60 feet of the centerline (acres)	1.2	0	0	0
MN Lakes of Biological Significance within ½ mile of the centerline (count)	2	2	0	0
MN Lakes of Biological Significance within ½ mile of the centerline (acres)	208.8	104.01	0	0
Invasive species waters (infested waters) within 25 feet of the centerline(count)	0	0	0	0
Invasive species waters (infested waters) within 60 feet of the centerline (count)	0	0	0	0
Invasive species waters (infested waters) within ½ mile of the centerline (count)	0	0	0	0
Invasive species waters (infested streams) within 25 feet of the centerline (count)	0	0	0	0
Invasive species waters (infested streams) within 60 feet of the centerline (count)	0	0	0	0
Invasive species waters (infested streams) within ½ mile of the centerline (count)	0	0	0	0
Non-indigenous aquatic species within 25 feet of the centerline (count)	0	0	0	0
Non-indigenous aquatic species within 60 feet of the centerline (count)	0	0	0	0
Non-indigenous aquatic species within ½ mile of the centerline (count)	4	0	0	0

Table U-9. Fish and Wildlife Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Sentinel Lakes within 25 feet of the centerline (count)	0	0	0	0
MN Sentinel Lakes within 60 feet of the centerline (count)	0	0	0	0
MN Sentinel Lakes within ½ mile of the centerline (count)	0	0	0	0
MN freshwater mussel sites within ½ mile of the centerline (count)	0	1	0	0
Perennial Streams Crossed by Centerline (count)	98	65	28	12
Intermittent Streams Crossed by Centerline (count)	187	193	49	39
Ephemeral Streams Crossed by Centerline (count)	4	0	0	0
Canal/Ditch Crossed by Centerline (count)	36	25	20	12
Artificial Path Crossed by Centerline (count)	30	6	0	3
Connectors Crossed by Centerline (count)	3	1	0	0
Streams Crossed by Centerline in MN (total count)	61	68	53	23
Streams Crossed by Centerline in IA (total count)	297	222	44	43
Wildlife Conservation Lands				
Conservation Easements within 25 feet of the centerline (count)	12	3	2	0
Conservation Easements within 25 feet of the centerline (acres)	8.58	5.9	1.54	0
State Conservation Areas within 25 feet of the centerline (count)	4	1	1	1
State Conservation Areas within 25 feet of the centerline (acres)	24.19	0.12	0.13	0.12
Conservation Easements within 60 feet of the centerline (count)	12	3	3	0
Conservation Easements within 60 feet of the centerline (acres)	12.18	8.28	3.00	0
State Conservation Areas within 60 feet of the centerline (count)	4	1	1	1
State Conservation Areas within 60 feet of the centerline (acres)	33.73	0.17	0.18	0.17
Conservation Easements within ½ mile of the centerline (number)	31	27	9	2
Conservation Easements within ½ mile of the centerline (acres)	883.5	807.64	277.79	59.54
MN Resource Management Areas within ½ mile of the centerline (count)	2	0	0	0
MN Resource Management Areas within ½ mile of the centerline (acres)	7.46	0	0	0
State Conservation Areas within ½ mile of the centerline (count)	13	6	1	3
State Conservation Areas within ½ mile of the centerline (acres)	1,886.5	213.85	14.18	129.42

Table U-9. Fish and Wildlife Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA Local Parks within 25 feet of the centerline (count)	1	0	0	0
IA Local Parks within 25 feet of the centerline (acres)	2.82	0	0	0
IA State Parks within 25 feet of the centerline (count)	1	0	0	0
IA State Parks within 25 feet of the centerline (acres)	1.36	0	0	0
IA Local Parks within 60 feet of the centerline (count)	1	0	0	0
IA Local Parks within 60 feet of the centerline (acres)	3.95	0	0	0
IA State Parks within 60 feet of the centerline (count)	1	0	0	0
IA State Parks within 60 feet of the centerline (acres)	1.95	0	0	0
IA Local Parks within ½ mile of the centerline (count)	2	0	0	0
IA Local Parks within ½ mile of the centerline (acres)	135.38	0	0	0
IA State Parks within ½ mile of the centerline (count)	1	0	0	0
IA State Parks within ½ mile of the centerline (acres)	107.38	0	0	0
IA State Recreation Areas within ½ mile of the centerline (count)	0	1	0	1
IA State Recreation Areas within ½ mile of the centerline (acres)	0	8.32	0	8.32
IBAs within 25 feet of the centerline (count)	3	2	0	0
IBAs within permanent 25 feet of the centerline (acres)	23.0	24.5	0	0
IBAs within 60 feet of the centerline (count)	3	2	0	0
IBAs within 60 feet of the centerline (acres)	32.2	34.2	0	0
IBAs within ½ mile of the centerline (count)	3	2	0	0
IBAs within ½ mile of the centerline (acres)	2,276.2	2,737.0	0	0
Raptor Stick Nests within ½ mile of the centerline ^b	N/A	N/A	N/A	N/A

^a The 2 streams of the FOH comparable segment of SA-04 do not cross the centerline.

^b Field survey data was not collected for these alternatives.

AMA = Aquatic Management Area

FOH = Friends of the Headwaters

IA = Iowa

IBA = Audubon Important Bird Area

IBI = Index of Biotic Integrity

MN DNR = Minnesota Department of Natural Resources

MN = Minnesota

N/A = Not available

SA = System Alternative

Table U-10. Unique Natural Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Threatened and Endangered Species				
Federally Listed Species (count)	12	13	5	5
Critical Habitat – within 1 mile (count)	0	0	0	0
Critical Habitat within 1 mile (acres)	0	0	0	0
Known Occurrences of State-protected Animal Species within 25 feet of the centerline (No. of Species) ^a	0	0	0	0
Known Occurrences of State-protected Animal Species within 60 feet of the centerline (No. of Species) ^a	0	0	0	0
Known Occurrences of State-protected Animal Species within ½ mile of centerline (No. of Species) ^a	4	9	0	5
Known Occurrences of State-protected Plant Species within 25 feet of the centerline (No. of Species) ^a	0	0	0	0
Known Occurrences of State-protected Plant Species within 60 feet of the centerline (No. of Species) ^a	0	0	1	0
Known Occurrences of State-protected Plant Species within ½ mile of centerline (No. of Species) ^a	1	5	4	3
Species of Greatest Conservation Need				
Mammals				
Mammals (Low) within 25 feet of the centerline (acres)	1,795.67	1,542.91	398.44	437.2
Mammals (Medium) within 25 feet of the centerline (acres)	104.87	32.65	32.71	9.8
Mammals (High) within 25 feet of the centerline (acres)	0.05	0	<0.01	0
Mammals Total within 25 feet of the centerline (acres) (acres)	1,900.59	1,575.56	431.15	447
Birds				
Birds (Low) within 25 feet of the centerline (acres)	2,080.69	1,734.12	522.61	472.58
Birds (Medium) within 25 feet of the centerline (acres)	18.69	1.54	0.12	0
Birds (High) within 25 feet of the centerline (acres)	0	0	0	0
Birds Total within 25 feet of the centerline (acres)	2,099.38	1,735.66	522.73	472.58
Reptiles and Amphibians (Herptiles)				
Reptiles and Amphibians (Herptiles) (Low) within 25 feet of the centerline (acres)	963.92	731.71	73.02	60.49
Reptiles and Amphibians (Herptiles) (Medium) within 25 feet of the centerline (acres)	1.58	0.73	0	0
Reptiles and Amphibians (Herptiles) (High) within 25 feet of the centerline (acres)	0	0	0	0

Table U-10. Unique Natural Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Reptiles and Amphibians (Herptiles) Total within 25 feet of the centerline (acres)	965.49	732.44	73.02	60.49
<i>Mammals</i>				
Mammals (Low) within 60 feet of the centerline (acres)	2,510.31	2,160.49	950.42	612
Mammals (Medium) within 60 feet of the centerline (acres)	149.65	45.51	75.15	13.78
Mammals (High) within 60 feet of the centerline (acres)	0.1	0.01	0.01	0
Mammals Total within 60 feet of the centerline (acres)	2,660.06	2,206.00	1,025.59	625.78
<i>Birds</i>				
Birds (Low) within 60 feet of the centerline (acres)	2,912.39	2,427.65	1,254.40	661.69
Birds (Medium) within 60 feet of the centerline (acres)	26.81	2.27	0.29	0.04
Birds (High) within 60 feet of the centerline (acres)	0	0	0	0
Birds Total within 60 feet of the centerline (acres)	2,939.19	2,429.92	1,254.69	661.74
<i>Reptiles and Amphibians (Herptiles)</i>				
Reptiles and Amphibians (Herptiles) (Low) within 60 feet of the centerline (acres)	1,350.10	1,025.42	174.67	84.29
Reptiles and Amphibians (Herptiles) (Medium) within 60 feet of the centerline (acres)	2.17	1.05	0	0
Reptiles and Amphibians (Herptiles) (High) within 60 feet of the centerline (acres)	0	0	0	0
Reptiles and Amphibians (Herptiles) Total within 60 feet of the centerline (acres)	1,352.27	1,026.47	174.67	84.29
<i>Mammals</i>				
Mammals (Low) within ½ mile of the centerline (acres)	190,117.15	159,150.39	50,164.88	45,392.76
Mammals (Medium) within ½ mile of the centerline (acres)	11,199.50	6,420.28	1,947.70	1,621.83
Mammals (High) within ½ mile of the centerline (acres)	14.29	6.74	0.79	0.22
Mammals Total within ½ mile of the centerline (acres)	201,330.94	165,577.41	52,113.38	47,014.81
<i>Birds</i>				
Birds (Low) within ½ mile of the centerline (acres)	220,297.35	183,182.46	55,613.77	50,293.80
Birds (Medium) within ½ mile of the centerline (acres)	1,763.92	414.55	39.32	43.96
Birds (High) within ½ mile of the centerline (acres)	0	0.00	0	0
Birds Total within ½ mile of the centerline (acres)	222,061.27	183,597.01	55,653.09	50,337.76

Table U-10. Unique Natural Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Reptiles and Amphibians (Herptiles)				
Reptiles and Amphibians (Low) within ½ mile of the centerline (acres)	102,101.04	78,485.58	7,311.98	6,314.88
Reptiles and Amphibians (Medium) within ½ mile of the centerline (acres)	258.29	131.05	0.12	0
Reptiles and Amphibians (High) within ½ mile of the centerline (acres)	0.00	0.00	0	0
Reptiles and Amphibians (Herptiles) Total within ½ mile of the centerline (acres)	102,359.33	78,616.63	7,312.11	6,314.88
Wildlife Action Network Habitats (MN Only)				
Low within 25 feet of the centerline (acres)	0	0	0.17	0
Low-Medium within 25 feet of the centerline (acres)	8.5	2.26	0	0
Medium within 25 feet of the centerline (acres)	6.38	1.49	0.05	0
Medium-High within 25 feet of the centerline (acres)	1.5	18.63	0.06	0.18
High within 25 feet of the centerline (acres)	0	8.27	0	0
Total within 25 feet of the centerline (acres)	16.39	30.65	0.28	0.18
Low within 60 feet of the centerline (acres)	0	0	0.4	0
Low-Medium within 60 feet of the centerline (acres)	11.9	3.17	0	0
Medium within 60 feet of the centerline (acres)	8.94	2.08	0.13	0
Medium-High within 60 feet of the centerline (acres)	2.1	26.22	0.14	0.26
High within 60 feet of the centerline (acres)	0	11.44	0	0
Total within 60 feet of the centerline (acres)	22.95	42.91	0.67	0.26
Low within ½ mile of centerline (acres)	0.81	1.31	17.85	0
Low-Medium within ½ mile of centerline (acres)	1,135.92	366.33	0.01	0
Medium within ½ mile of centerline (acres)	681.69	405.17	10.74	0
Medium-High within ½ mile of centerline (acres)	299.72	1973.15	7.1	29.14
High within ½ mile of centerline (acres)	0	737.24	0	0
Total within ½ mile of centerline (acres)	2,118.14	3,483.21	35.7	0
Minnesota Biological Survey Sites of Biodiversity Significance^b				
Outstanding within 25 feet of centerline (acres)	0	0.54	0	0
High within 25 feet of centerline (acres)	0	2.07	0.17	0
Moderate within 25 feet of centerline (acres)	4.55	5.93	1.28	0.6
Below within 25 feet of centerline (acres)	1.93	0	0.53	0
Total within 25 feet of centerline (acres)	6.48	8.54	1.98	0.6
Outstanding within 60 feet of centerline (acres)	0	0.76	0	0

Table U-10. Unique Natural Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
High within 60 feet of centerline (acres)	0	2.9	0.4	0
Moderate within 60 feet of centerline (acres)	6.34	8.39	10.68	0.84
Below within 60 feet of centerline (acres)	2.71	0	1.27	0
Total within 60 feet of centerline (acres)	9.05	12.05	12.35	0.84
Outstanding within ½ mile of centerline (acres)	0	149.92	0	73.48
High within ½ mile of centerline (acres)	1.14	352.5	17.85	10.28
Moderate within ½ mile of centerline (acres)	376.23	698.32	72.63	105.09
Below within ½ mile of centerline (acres)	214.51	192.57	150.95	35.14
Total within ½ mile of centerline (acres)	591.88	1,393.31	241.43	223.99
Minnesota Scientific and Natural Areas^c				
Within 25 feet of the centerline (count)	0	0	1	0
Within 25 feet of the centerline (acres)	0	0	0.13	0
Within 60 feet of the centerline (count)	0	0	1	0
Within 60 feet of the centerline (acres)	0	0	0.31	0
Within ½ mile of the centerline (count)	0	0	1	0
Within ½ mile of the centerline (acres)	0	0	14.18	0

^a Data presented applies only to Minnesota.

^b MBS Ranks are noted as the following:

- Outstanding = sites containing the best occurrences of the rarest species, the most outstanding examples of the rarest native plant communities, and/or the largest, most intact functional landscapes
- High= sites containing very good quality occurrences of the rarest species, high quality examples of rare native plant communities, and/or important functional landscapes
- Moderate = sites containing occurrences of rare species and/or moderately disturbed native plant communities, and/or landscapes that have a strong potential for recovery.
- Below = sites below minimum biodiversity threshold for statewide significance. These sites lack occurrences of rare species or natural features or do not meet Minnesota Biological Survey standards for outstanding, high, or moderate rank.

^c No Research Natural Areas or Research or Educational Areas occur in Iowa within any of the ROIs. In the EIS, these areas were considered analogous to SNAs for states other than MN.

EIS = environmental impact statement

FOH = Friends of the Headwaters

IA = Iowa

MN = Minnesota

ROI = region of interest

SA = System Alternative

SNA = Scientific and Natural Area

Table U-11. Public Lands

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Federal Lands within 25 feet of the centerline (acres)	0.0	0.0	0.0	0.0
Federal Lands within 60 feet of the centerline (acres)	0.0	0.0	0.0	0.0
MN State Wildlife Management Areas within 25 feet of the centerline (acres)	1.7	0.4	0.1	0.1
MN State Wildlife Management Areas within 60 feet of the centerline (acres)	2.4	0.5	0.3	0.2
IA Conservation and Recreation Lands within ½ mile of the centerline (acres)	3,510.9	311.2	360.8	232.2
NRCS Conservation Easements within 25 feet of the centerline (acres)	1.0	0.0	1.5	0.0
NRCS Conservation Easements within 60 feet of the centerline (acres)	1.4	0.0	4.5	0.0

FOH = Friends of the Headwaters

IA = Iowa

MN = Minnesota

NRCS = Natural Resources Conservation Service

SA = System Alternative

Table U-12. Commodity Production

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Agricultural Land				
Cultivated crops within 25 feet of the centerline (acres)	1,662.1	1,540.3	357.7	421.6
Cultivated crops within 60 feet of the centerline (acres)	2,326.0	2,155.2	830.8	589.2
Grass/Pastureland within 25 feet of the centerline (acres)	111.1	20.3	20.1	3.7
Grass/Pastureland within 60 feet of the centerline (acres)	155.7	28.5	48.1	5.1
Prime Farmland within 25 feet of the centerline (acres)	679.1	778.2	244.0	220.3
Prime Farmland within 60 feet of the centerline (acres)	948.5	1,089.3	584.1	308.7
Farmland of Statewide Importance within 25 feet of the centerline (acres)	603.3	186.8	27.7	39.4
Farmland of Statewide Importance within 60 feet of the centerline (acres)	846.3	262.2	66.1	55.2
Market Value of Agricultural Land	Market Value of Agricultural Land unable to be determined due to lack of available data			
Forested Land				
Deciduous Forest within 25 feet of the centerline (acres)	66.8	6.6	9.5	2.2

Table U-12. Commodity Production

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Deciduous Forest within 60 feet of the centerline (acres)	93.7	9.9	13.0	3.3
Evergreen Forest within 25 feet of the centerline (acres)	0.0	0.0	0.0	0.0
Evergreen Forest within 60 feet of the centerline (acres)	0.0	0.0	0.0	0.0
Mixed Forest within 25 feet of the centerline (acres)	0.0	0.0	0.0	0.0
Mixed Forest within 60 feet of the centerline (acres)	0.0	0.0	0.0	0.0
Market Value of Forested Land	Market Value of Forested Land unable to be determined due to lack of available data			
Mineral Land				
Mining Sites within 25 feet of the centerline (count)	2	1	1	0
Mining Sites within 60 feet of the centerline (count)	2	1	2	0
Mineral Resources within 25 feet of the centerline (count)	0	1	0	0
Mineral Resources within 60 feet of the centerline (count)	1	0	0	0
Market Value of Mineral Land	Market Value of Mineral Land unable to be determined due to lack of available data			

FOH = Friends of the Headwaters

SA = System Alternative

Table U-13. Recreation and Tourism

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Parks, Forests, and Special Management Areas Crossed by the Centerline (miles)	6.2	1.0	0.2	<0.0
Parks, Forests, and Special Management Areas within 25 feet of the centerline (acres)	37.3	6.0	1.6	0.1
Parks, Forests, and Special Management Areas within 60 feet of the centerline (acres)	52.3	8.5	4.8	0.2
State-Designated Land Based Trails within 25 feet of the centerline (number of crossings)	8	6	2	0
State-Designated Land Based Trails within 60 feet of the centerline (number of crossings)	8	6	2	0
Local and State Parks within ½ mile of the centerline (acres)	423.2	8.0	416.9	8.0
Snowmobile Trails within 25 feet of the centerline (number of crossings)	8	14	9	7
Snowmobile Trails within 60 feet of the centerline (number of crossings)	8	14	9	7
State-Designated Trout Streams within 25 feet of the centerline (number of crossings)	0	0	0	0

Table U-13. Recreation and Tourism

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
State-Designated Trout Streams within 60 feet of the centerline (number of crossings)	0	0	0	0
Scenic Byways within 25 feet of the centerline (number of crossings)	0	1	0	0
Scenic Byways within 60 feet of the centerline (number of crossings)	0	1	0	0

FOH = Friends of the Headwaters

SA = System Alternative

Table U-14. Population

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN				
Populated Areas ^a Crossed by the Centerline (number of populated areas)	10	4	2	1
Population of Populated Areas Crossed by the Centerline (total population)	81,220	45,913	687	64
Populated Areas Crossed by the Centerline (miles)	5.59	1.19	1.38	0.39
Populated Areas Located within 1,310 feet ^b of the centerline (acres)	1,618.39	566.39	430.56	178.37

^a Populated areas include cities and census designated places.^b The measure of 1,310 feet is intended to include those areas located within 1,250 feet beyond a typical construction right-of-way of 60 feet.

FOH = Friends of the Headwaters

MN = Minnesota

SA = System Alternative

Table U-15. Employment and Income

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
MN Counties – Per Capita Personal Income ^a				
Blue Earth	\$27,324	\$27,324		
Brown	\$28,444			
Dodge			\$30,495	
Faribault	\$28,168			
Freeborn		\$27,332	\$27,332	\$27,332
La Sueur		\$29,714		
Mower		\$27,459	\$27,459	\$27,459
Nicollet	\$28,089	\$28,089		
Sibley	\$28,811	\$28,811		
Steele			\$28,736	

Table U-15. Employment and Income

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Waseca		\$27,179	\$27,179	\$27,179
Average	\$28,167	\$27,987	\$28,240	\$27,323
MN Counties – Median Household Income ^a				
Blue Earth	\$52,119	\$52,119		
Brown	\$53,319			
Dodge			\$68,718	
Faribault	\$60,029			
Freeborn		\$60,824	\$60,824	\$60,824
La Sueur		\$75,887		
Mower		\$68,106	\$68,106	\$68,106
Nicollet	\$61,501	\$61,501		
Sibley	\$59,596	\$59,596		
Steele			\$58,141	
Waseca		\$53,199	\$53,199	\$53,199
Average	\$57,313	\$61,605	\$61,798	\$60,710
MN Counties – Labor Force ^a				
Blue Earth	38,519	38,519		
Brown	13,912			
Dodge			11,510	
Faribault	7,291			
Freeborn		16,013	16,013	16,013
La Sueur		15,384		
Mower		20,241	20,241	20,241
Nicollet	19,175	19,175		
Sibley	8,343	8,343		
Steele			19,531	
Waseca		9,997	9,997	9,997
Average	17,448	18,239	15,458	15,417
MN Counties – Unemployment Rate ^a				
Blue Earth	4.9%	4.9%		
Brown	2.7%			
Dodge			3.3%	
Faribault	3.1%			
Freeborn		4.6%	4.6%	4.6%
La Sueur		4.3%		
Mower		5.8%	5.8%	5.8%
Nicollet	3.5%	3.5%		
Sibley	4.2%	4.2%		
Steele			4.3%	
Waseca		4.7%	4.7%	4.7%
Average	3.7%	4.6%	4.5%	5.0%

Table U-15. Employment and Income

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA Counties – Per Capita Personal Income ^a				
Bremer		\$31,001		
Buchanan		\$30,216		
Cedar	\$29,271			
Cerro Gordo	\$28,763			
Chickasaw		\$26,915	\$26,915	\$26,915
Clinton	\$27,116	\$27,116		
Delaware		\$29,978		
Fayette		\$26,002		
Franklin	\$24,909			
Grundy	\$32,953			
Hancock	\$27,732			
Hardin	\$27,657			
Howard		\$25,567	\$25,567	\$25,567
Iowa	\$28,640			
Johnson	\$31,981			
Jones		\$27,891		
Marshall	\$25,197			
Mitchell		\$25,990	\$25,990	\$25,990
Poweshiek	\$26,583			
Scott	\$30,037			
Tama	\$26,144			
Winnebago	\$25,917			
Average	\$28,064	\$27,853	\$26,157	\$26,157
IA Counties – Median Household Income ^a				
Bremer		\$64,264		
Buchanan		\$55,881		
Cedar	\$60,435			
Cerro Gordo	\$64,815			
Chickasaw		\$48,013	\$48,013	\$48,013
Clinton	\$50,067	\$50,067		
Delaware		\$59,452		
Fayette		\$47,711		
Franklin	\$47,524			
Grundy	\$61,606			
Hancock	\$54,813			
Hardin	\$51,821			
Howard		\$49,199	\$49,199	\$49,199
Iowa	\$55,099			
Johnson	\$56,808			
Jones		\$55,507		
Marshall	\$54,193			
Mitchell		\$52,564	\$52,564	\$52,564
Poweshiek	\$50,725			
Scott	\$56,454			
Tama	\$53,833			
Winnebago	\$49,278			
Average	\$54,819	\$53,629	\$49,925	\$49,925

Table U-15. Employment and Income

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
IA Counties – Labor Force^a				
Bremer		13,394		
Buchanan		10,702		
Cedar	10,277			
Cerro Gordo	23,248			
Chickasaw		6,332	6,332	6,332
Clinton	24,025	24,025		
Delaware		9,695		
Fayette		10,397		
Franklin	5,185			
Grundy	6,453			
Hancock	5,674			
Hardin	8,743			
Howard		4,787	4,787	4,787
Iowa	8,828			
Johnson	83,133			
Jones		9,973		
Marshall	20,635			
Mitchell		5,420	5,420	5,420
Poweshiek	10,045			
Scott	88,127			
Tama	8,768			
Winnebago	5,557			
Average	22,050	10,525	5,513	5,513
IA Counties – Unemployment Rate^a				
Bremer		3.2%		
Buchanan		3.8%		
Cedar	3.3%			
Cerro Gordo	4.1%			
Chickasaw		3.2%	3.2%	3.2%
Clinton	4.6%	4.6%		
Delaware		3.4%		
Fayette		4.3%		
Franklin	5.4%			
Grundy	3.8%			
Hancock	1.8%			
Hardin	3.4%			
Howard		3.7%	3.7%	3.7%
Iowa	1.8%			
Johnson	3.2%			
Jones		4.5%		
Marshall	5.9%			
Mitchell		3.6%	3.6%	3.6%
Poweshiek	4.3%			
Scott	4.9%			
Tama	5.7%			
Winnebago	6.6%			
Average	4.2%	3.8%	3.5%	3.5%

Table U-15. Employment and Income

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
----------------------------	-------------------	-----------------------------	-----------------------	-----------------------------

^a Counties greyed out are those not located in the segment analyzed. All source information is from the American Community Survey 2016 data.

FOH = Friends of the Headwaters

IA = Iowa

MN = Minnesota

SA = System Alternative

Table U-16. Cultural Resources

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Archaeological sites within 25 feet of the centerline ^a (count)	9	24	0	4
Archaeological sites within 60 feet of the centerline (exclusive of 0–25 feet from centerline) ^a (count)	3	9	0	1
Archaeological sites within ½ mile ^a (count)	194	110	0	19
Archaeological sites within 1 mile ^a (count)	392	134	3	30
Historic structures within 25 feet of the centerline ^b (count)	0	0	0	0
Historic structures within 60 feet of centerline (exclusive of 0–25 feet from centerline) ^b (count)	0	1	0	0
Historic structures within ½ mile ^b (count)	0	33	5	2
Historic structures within 1 mile ^b (count)	0	48	8	4
Cemeteries within ½ mile ^c (count)	25	17	7	1
Cemeteries within 1 mile ^c (count)	46	38	11	5
NRHP-listed properties within 25 feet of the centerline ^d (count)	1	1	0	0
NRHP-listed properties within 60 feet of the centerline ^d (count)	1	1	0	0
NRHP-listed properties within ½ mile ^d (count)	6	2	0	0
NRHP-listed properties within 1 mile ^d (count)	9	5	2	0

^a Data was obtained from the IA and MN SHPOs. It represents the most current data as of January 2018. It includes only those resources reported to the respective SHPO.

^b Data was obtained from the MN SHPO. It represents the most current data as of January 2018. It includes only those resources reported to the respective SHPO. Data for IA was not included in this analysis as it was not obtained from the SHPO.

^c Cemetery data was obtained from ESRI.

^d NRHP information acquired from the National Park Service datasets. For the FOH SA-04 Segment Alternative, one resource is noted in two locations; however, it is counted as one resource within the ½ and 1 mile counts.

ESRI = Environmental Systems Research Institute

FOH = Friends of the Headwaters

IA = Iowa

MN = Minnesota

NRHP = National Register of Historic Places

SA = System Alternative

SHPO = State Historic Preservation Officer

Table U-17. Accidental Release – High Consequence Areas

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
HCA populated area within 2,500 feet of centerline (acres)	3265	1975	781	509
HCA unusually sensitive ecological area within 2,500 feet of centerline (acres)	4425	2124	0	214
Region of interest HCA drinking water sources within 2,500 feet of centerline (acres)	107	1671	682	192
WPAs ^a within 2,500 feet of centerline (acres)	440	755	2,416	435
Wells within 2,500 feet of centerline (count)	1536	1860	429	381
Reservation lands within 2,500 feet of centerline (acres)	0	0	0	0
Biological Areas of Interest – Aquatic management areas within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Scientific and natural area within 2,500 feet of the centerline (acres)	0	0	13.49	0
Biological Areas of Interest – Easement ^b within 2,500 feet of the centerline (acres)	523	745	193	101
Biological Areas of Interest – Lakes of biological significance within 2,500 feet of the centerline (acres)	205.5	89.7	0	0
Biological Areas of Interest – Marginal cropland within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – MBS sites within 2,500 feet of the centerline (acres)	575.0	1282.8	219.2	202.0
Biological Areas of Interest – Muskie lakes within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Native plant communities within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Native prairies within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Sensitive lakeshore areas within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Trout lakes within 2,500 feet of the centerline (acres)	0	0	0	0
Biological Areas of Interest – Wild rice lakes within 2,500 feet of the centerline (acres)	0	0	0	0
Commodity Production Areas – National forests within 2,500 feet of the centerline (acres)	0	0	0	0
Commodity Production Areas – Other forest land within 2,500 feet of the centerline (acres)	0	62	0	0
Commodity Production Areas – State forest within 2,500 feet of the centerline (acres)	0	0	0	0

Table U-17. Accidental Release – High Consequence Areas

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Commodity Production Areas – Harvested wild rice lakes within 2,500 feet of the centerline (acres)	0	0	0	0
Recreation and Tourism Areas of Interest – State plan/recreational areas ^c within 2,500 feet of the centerline (acres)	286	269	0	76
Recreation and Tourism Areas of Interest – State parks within 2,500 feet of the centerline (acres)	54	347	0	347
Recreation and Tourism Areas of Interest – Wildlife Management Areas within 2,500 feet of the centerline (acres)	743	111	0	111
Recreation and Tourism Areas of Interest – Waterfowl production areas within 2,500 feet of the centerline (acres)	0	0	0	0

^a The total acreage for wellhead protection areas (WPAs) accounts for some overlap due to the presence of multiple WPAs.

^b Includes Minnesota Board of Water and Soil Resources conservation easements, wetland bank easements, and Emergency Watershed Protection Program Easements.

^c Includes recreational areas such as parks and Emergency Watershed Protection Program Easements.

FOH = Friends of the Headwaters

HCA = high consequence area

MBS = Minnesota Biological Survey

SA = System Alternative

WPA = wellhead protection area

Table U-18. Accidental Release – High Consequence Areas and Downstream Region of Influence

Measurement/Data Evaluated ^a	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
HCA populated area within 10 miles and 500 feet (acres)	719	333	39	148
HCA unusually sensitive ecological area within 10 miles and 500 feet (acres)	411	408	0	0
Region of interest HCA drinking water sources within 10 miles and 500 feet (acres)	765	12	0	0
WPAs ^b within 10 miles and 500 feet (acres)	866	12	13	0
Number of wells within 10-mile-long downstream feet (count)	56	6	7	9
Reservation lands within 10 miles and 500 feet (acres)	314	0	0	0
Biological Areas of Interest – Aquatic management area within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Scientific and natural area within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Easement ^c within 10 miles and 500 feet (acres)	667	230	77	2

Table U-18. Accidental Release – High Consequence Areas and Downstream Region of Influence

Measurement/Data Evaluated ^a	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Biological Areas of Interest – Lakes of biological significance within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Marginal cropland within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – MBS sites within 10 miles and 500 feet (acres)	74.3	131.1	0	0
Biological Areas of Interest – Muskie lakes within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Native plant communities within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Native prairies within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Sensitive lakeshore areas within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Trout lakes within 10 miles and 500 feet (acres)	0	0	0	0
Biological Areas of Interest – Wild rice lakes within 10 miles and 500 feet (acres)	0	0	0	0
Commodity Production Areas – National forests within 10 miles and 500 feet (acres)	0	0	0	0
Commodity Production Areas – Other forest land within 10 miles and 500 feet (acres)	0	0	0	0
Commodity Production Areas – State forest within 10 miles and 500 feet (acres)	0	0	0	0
Commodity Production Areas – Harvested wild rice lakes within 10 miles and 500 feet (acres)	0	0	0	0
Recreation and Tourism Areas – State plan/recreational areas ^d within 10 miles and 500 feet (acres)	642	0	0	130
Recreation and Tourism Areas – State parks within 10 miles and 500 feet (acres)	386	0	0	120
Recreation and Tourism Areas – Wildlife Management Areas within 10 miles and 500 feet (acres)	421	0	0	40
Recreation and Tourism Areas – Waterfowl production areas within 10 miles and 500 feet (acres)	0	0	0	0

^a Within 10 miles downstream of water crossing and 500 feet on either side of the centerline

^b The total acreage for wellhead protection areas (WPAs) accounts for some overlap due to the presence of multiple WPAs.

^c Includes Minnesota Board of Water and Soil Resources conservation easements, wetland bank easements, and Emergency Watershed Protection Program Easements.

^d Includes recreational areas, such as parks and Emergency Watershed Protection Program Easement.

FOH = Friends of the Headwaters

HCA = high consequence area

SA = System Alternative

WPA = wellhead protection area

Table U-19. Environmental Justice

Measurement/Data Evaluated	SA-04 FOH Reroute	Comparable Segment of SA-04	SA-04 Segment Reroute	Comparable Segment of SA-04
Census tracts that qualify as environmental justice community based on minority population (meaningfully greater percent minority) ^{a,b} (count)	0	1 census tract has meaningfully greater percent minority than county ^c	0	0
Census tracts that qualify as environmental justice community based on income crossed by the centerline ^{a,b,d} (count)	0	1 ^e	0	0

^a Results apply to a 25- and 50-foot buffer from the centerline.

^b Minority community is based on a) having over 50% minority population or b) percent minority in census tract is ten percentage points greater than county

^c In Iowa: Census Tract 18.01 has 34.1% minority, compared to 15.2% in County. Difference of 18.9 > 10.

^d Low-income community is defined as a census tract with over 40% individuals below 185% of poverty.

^e In Iowa, Census Tract 4802 in Hardin County meets criteria at 40.2%.

FOH = Friends of the Headwaters

SA = System Alternative