

CHAPTER TWO - PROJECT ALTERNATIVES

2.1 Introduction

This chapter describes the physical, spatial and temporal characteristics of alternatives for the new railroad which are considered in detail in the EIS¹ including their location, construction and operation. Information was selected for presentation in this chapter because it has some bearing on the nature and extent of environmental impacts which could result from implementation of the alternatives. Much of the information in this chapter provides detailed descriptions of the various alternative routes. It is important to recognize that some of the information used to predict impacts was preliminary in nature and is subject to change. Also, DM&E has not advanced design of Alternatives B and D to the level of Alternative C. Consequently, some information about Alternatives B and D is lacking. Where pertinent information is not known the text is so noted.

2.2 Alternatives

2.2.1 Alternative A. This alternative is the No Action Alternative. Under this alternative one or more of the Federal agencies with jurisdiction over construction or operation of all or part of the new railroad would choose not to issue permits or other approvals and the new railroad would not be constructed. STB could implement this alternative independently or in conjunction with similar decisions by other agencies. The Forest Service, BLM, BOR, USCG and COE could also independently invoke the No Action Alternative.

2.2.2 Alternative B. DM&E's original proposal, as defined by their February 20, 1998 application to the STB, comprises Alternative B. The alternative has been modified in response to operational constraints (grade) identified between Wall and Wasta².

2.2.2.1 Alternative B Route. This alternative would begin in the NE of Section 31, T. 1 N., R. 16 E. in Pennington County, South Dakota about 0.8 miles northeast of Wall (see Map Volume, Map 1). The alternative would originate on the west side of DM&E's

¹ Information regarding alternatives which were determined not to be reasonable or feasible can be found in the EIS and in the study scope prepared by STB. The study scope can be found at <http://www.stb.gov> by searching under docket #33407.

² DM&E has determined that the grade between Wall and Wasta along the existing main line (known as Wall Hill) is too steep to allow efficient operation of the heavy haul railroad. DM&E modified their February 20, 1998 application to the STB and proposed a reroute around this area. The reroute is shown in the Map Volume, Maps 1 through 5.

existing main line crossing of the Wall Pedro Road. After crossing Wall Pedro Road, DM&E's existing main line turns south and passes through the Town of Wall. Alternative B would leave the existing main line where it turns south and would proceed west to the north of Wall and the Wall Landing Field. Northwest of the Wall Landing Field this alternative would turn to the southwest and cross over Interstate 90 (I-90) in the NE of Section 35, T. 1 N., R. 15 E. about 1.5 miles northwest of DM&E's existing main line crossing of I-90.

Once across I-90 Alternative B would continue southwest and cross Baseline Road approximately 0.4 miles southwest of the I-90 crossing in the SE of Section 35, T. 1 N., R. 15 E. Approximately 0.5 miles southwest of the Baseline Road crossing the alternative would cross DM&E's existing main line in the NE of Section 2, T. 1 S., R. 15 E. directly adjacent to Bull Creek (see Map Volume, Map 1). Approximately 1.4 miles southwest of the Bull Creek crossing Alternative B would turn to the west and then northwest and cross Sections 3 and 4 in T. 1 S., R. 15 E. along the south end of Lake Flat. The turn would occur about 1 mile north of Sage Creek Road. In this area several intermittent tributaries to Bull Creek would be crossed (see Map Volume, Maps 1 and 2). Alternative B would continue northwest parallel to and southwest of Bull Creek and DM&E's existing main line toward Wasta (see Map Volume, Map 2). In this area DM&E's existing railroad is located directly adjacent to and makes a number of crossings of Bull Creek. Alternative B would be routed between 0.5 and 1 mile southwest of the existing main line and Bull Creek. In the SE of Section 13, T. 1 N., R. 14 E. the alternative would be located approximately 0.8 miles southwest of I-90, DM&E's existing main line and Bull Creek (see Map Volume, Map 3). Jensen Road would be crossed in the center of Section 13.

In Section 10, T. 1 N., R. 14 E., about 1.7 miles southeast of Wasta, Alternative B would turn west and then southwest. In Section 10 the alternative would be about 0.5 miles south of I-90 and the Cheyenne River (see Map Volume, Map 4). Several intermittent streams that drain directly to the Cheyenne River would be crossed in the area south and southeast of Wasta. In the SW of Section 16, T. 1 N., R. 14 E. Crooked Creek would be crossed about 0.3 miles from its confluence with the Cheyenne River. In the SE of Section 17, T. 1 N., R. 14 E., about 2 miles south of Wasta, Alternative B would approach to within 750 feet of the Cheyenne River (see Map Volume, Map 4). Alternative B would drop into the Cheyenne River flood plain in the NE of Section 20, T. 1 N., R. 14 E. and would cross the river in the SW of Section 20 about 3 miles south of Wasta (see Map Volume, Map 5). About 0.4 miles southwest of the

Cheyenne River crossing Alternative B would cross Baseline Road approximately 3.2 miles south of Wasta and on the west side of the Cheyenne River flood plain. One the west side of Baseline Road the alternative would intersect DM&E's existing main line in the NE of Section 30, T. 1 N., R. 14 E. At the intersection Alternative B would turn to the south and follow the existing railroad through the south half of Section 30. In this area the alternative would be about 0.25 miles west of Baseline Road (see Map Volume, Map 5). In the SE of Section 30 DM&E's existing main line turns to the southwest and then west and proceeds up Boxelder Creek to Owanka and Rapid City, South Dakota (see Section 2.2.4). Alternative B would leave the existing DM&E main line in the SE of Section 30 and continue south along the west side of the Cheyenne River flood plain crossing Boxelder Creek in the NE of Section 31, T. 1 N., R. 14 E. about 0.5 miles southwest of its confluence with the river.

South of Boxelder Creek Alternative B would continue south along the west side of the Cheyenne River flood plain and east of Brennan Flat. In the NE of Section 31, T. 1 N., R. 14 E. (see Map Volume, Map 5) the alternative would again cross Baseline Road. The Cheyenne River is located about 600 feet east of the proposed Baseline Road crossing location. South of the Baseline Road crossing the Cheyenne River begins to meander toward the west side of the flood plain. In the south of Section 31 the alternative would turn to the southwest and encroach directly on the west bank of the Cheyenne River for approximately 0.5 miles in the SW of Section 6, T. 1 S., R. 14 E. (see Map Volume, Map 5). In this area Alternative B would be constructed on the east side of Brennan Flat and about 0.5 miles southeast of Baseline Road.

Beginning in the NE of Section 7, T. 1 S., R. 14 E. Alternative B would turn more to the southwest and proceed along the west edge of the Cheyenne River flood plain while the river meanders away from the alternative location to the east side of the flood plain (see Map Volume, Maps 5 and 6). For approximately 2.5 miles the Cheyenne River flows on the eastern side of the flood plain and Alternative B and the river would be separated by approximately 0.5 miles (see Map Volume, Map 6). In the NW of Section 23 and NE of Section 22, T. 1 S., R. 13 E. the river meanders back to the northwestern side of the flood plain. In this area, which includes the confluence with Timber Draw, Alternative B would be constructed directly adjacent to the west bank of the river for approximately 0.2 miles (see Map Volume, Maps 6 and 7). In the SE of Section 22 the river again turns south and Alternative B would continue in a southwest direction along the western edge of the flood plain. East of Holcomb Flat, in Section 28, T. 1 S., R. 13 E., the river turns to the northwest and parallels the west edge of the flood plain through Sections 28, 32 and 33 of T. 1 S., R. 13 E. and Section 6 of T. 2 S., R. 13 E. Alternative B

would be constructed directly adjacent to the west or north bank of the river for approximately 1.5 miles in this area (see Map Volume, Maps 7 and 8).

Alternative B would continue in the Cheyenne River flood plain and turn to the west in Section 1, T. 2 S., R. 12 E. south of Holcomb Flat. The alternative would be constructed between 400 feet and 0.4 miles north of Rapid Creek in the north half of Section 2, T. 2 S., R. 12 E. In the NE of Section 3, T. 2 S., R. 12 E. Alternative B would turn to the southwest and cross Rapid Creek about 1.5 miles west of its confluence with the Cheyenne River (see Map Volume, Maps 8 and 9). South of the Rapid Creek crossing, in the SE of Section 3, Alternative B would cross State Highway 44 approximately 1.5 miles east of Creston, South Dakota (see Map Volume, Map 9). Southwest of the State Highway 44 crossing, Alternative B would leave the Rapid Creek drainage and would reenter the Cheyenne River flood plain. Approximately 0.6 miles southwest of the State Highway 44 crossing, after crossing Creston Road, Alternative B would begin paralleling (to the west) the abandoned Chicago, Milwaukee, St. Paul and Pacific Railroad (Old Milwaukee). The alternative would follow the abandoned railroad through the north half of Section 9, T. 2 S., R. 12 E. (see Map Volume, Map 9). In the middle of Section 9 the Old Milwaukee turns abruptly to the southeast and Alternative B would continue to the southwest (see Map Volume, Map 9).

In the NE of Section 17, T. 2 S., R. 12 E. Alternative B would cross Cole Draw approximately 0.9 miles upstream of its confluence with the Cheyenne River. South of Cole Draw the alternative would leave the Cheyenne River flood plain and proceed up the Spring Creek drainage, crossing from Pennington into Custer County in the south half of Section 20, T. 2 S., R. 12 E. (see Map Volume, Map 10). Spring Creek would be crossed in the south half of Section 20 and the alternative would continue along the east edge of the creek's flood plain through Section 29 and the north half of Section 32, T. 2 S., R. 12 E. Alternative B in this area would be constructed 0.25 miles or less from Spring Creek and west of Spring Creek Road. In some areas the alternative would be constructed directly adjacent to the creek (see Map Volume, Map 10). Spring Creek would again be crossed at several locations in Section 32, T. 2 S., R. 12 E. as Alternative B switches back to the west side of the Spring Creek flood plain. In this area Alternative B would be about 1 mile west of the north end of Phiney Flat. The alternative would be constructed directly adjacent to Spring Creek in a number of locations in Section 6, T. 3 S., R. 12 E. and Sections 1, 12, 14 and 15 of T. 3 S., R. 11 E. (see Map Volume, Map 11). Spring Creek would again be crossed in the SE of Section 15, T. 3 S., R. 11 E. About 0.3 miles southwest of Spring Creek Alternative B would cross Spring Creek Road. About 1.5 miles south of the road crossing the alternative would turn to the

south, traverse the southern portion of Phiney Flat (see Map Volume, Maps 12 and 65), and reenter the Cheyenne River flood plain in the NE of Section 9, T. 4 S., R. 11 E. about 2 miles north of the intersection of Pennington, Custer and Shannon counties (see Map Volume, Map 66). In the SE of Section 9 and the SW of Section 16, T. 4 S., R. 11 E, the alternative would be constructed directly adjacent to the Cheyenne River.

Battle Creek would be crossed in the NW of Section 21, T. 4 S., R. 11 E., approximately 1,000 feet upstream of its confluence with the Cheyenne River (see Map Volume, Map 66). From Battle Creek Alternative B would continue south between about 1,000 feet and 0.5 miles west of the Cheyenne River and Pine Ridge Indian Reservation. In the SW of Section 29, T. 4 S., R. 11 E. the alternative would turn west and run north of the river toward Red Shirt, South Dakota. Approximately 1.5 miles east of Red Shirt the alternative would cross State Highway 40 in Section 25, T. 4 S., R. 10 E. (see Map Volume, Map 67). Near the State Highway 40 crossing the alternative would be constructed within 800 feet of the Cheyenne River. West of State Highway 40 the alternative would continue for approximately 2 miles in a westerly direction to the middle of Section 27, T. 4 S., R. 10 E. At this point Alternative B would turn south and cross Red Shirt Creek. The alternative would continue south across French Creek paralleling the Cheyenne River to the west (between 500 feet and 0.5 miles). About 1.5 miles south of French Creek, in the SW of Section 9, T. 5 S., R. 10 E., Alternative B would turn to the west following the meanders of the Cheyenne River (see Map Volume, Map 68). In Section 8, T. 5 S., R. 10 E. the alternative would be constructed adjacent to the Cheyenne River and Pine Ridge Indian Reservation.

Alternative B would continue west approximately 6.5 miles on the north side of the Cheyenne River to Section 21, T. 5 S., R. 9 E. In Sections 13, 14 and 23, T. 5 S., R. 9 E. the alternative would be constructed on the northern edge of the flood plain. In this area the river and the alternative alignment would be separated by 600 feet to 0.5 miles. However, in Section 22, T. 5 S., R. 9 E. the river meanders to the north end of the flood plain and Alternative B would be constructed directly adjacent to the north bank of the river (see Map Volume, Map 69). In the middle of Section 22 the river swings back to the south and in Section 21 Alternative B would again be aligned over 0.5 miles from the river.

In Section 21 Alternative B would turn to the south and continue along the western edge of the river flood plain for about 2 miles to the SW of Section 33, T. 5 S., R. 9 E. In the SW of Section 33 the alternative would turn to the southwest and leave the Cheyenne River flood plain (see Map Volume, Map 18). At this point Alternative B would be routed up the Cottonwood Creek drainage to the west of Harrison Flat.

The alternative would be constructed along the north and western edges of Cottonwood Creek's flood plain. Alternative B would be constructed directly adjacent to the creek in the SW of Section 33, T. 5 S., R. 9 E. and 2 crossings would be made in the SE of Section 32. Two additional crossings of Cottonwood Creek would be made in the NE of Section 7, T. 6 S., R. 9 E. and Alternative B would encroach on the creek the SW of Section 7 (see Map Volume, Maps 18 and 19). After additional crossings in Section 18, T. 6 S., R. 9 E. and Section 13, T. 6 S., R. 8 E. Alternative B would leave the Cottonwood Creek drainage and traverse the southern portion of Harrison Flat and cross Lame Johnny Creek in the SW of Section 35, T. 6 S., R. 8 E. About 0.4 miles southwest of Lame Johnny Creek the alternative would cross from Custer into Fall River County (see Map Volume, Map 70).

In Section 8, T. 7 S., R. 8 E. Alternative B would descend back into the Cheyenne River flood plain and turn to the west (see Map Volume, Map 71). The location is approximately 7 miles southeast of Buffalo Gap, South Dakota. Alternative B would encroach on the north bank of the river in the SE of Section 7, T. 7 S., R. 8 E. (see Map Volume, Map 71). The alternative would continue in a southwest direction along the north edge of the river's flood plain to Section 22, T. 7 S., R. 7 E. In the NE of Section 22, about 1.8 miles north of Oral, South Dakota, Alternative B would cross Beaver Creek approximately 0.2 miles upstream of its confluence with the Cheyenne River. Approximately 0.4 miles south of the Beaver Creek crossing and 0.5 miles north of the Cheyenne River Alternative B would join DM&E's existing Black Hills Subdivision Branch Line (see Map Volume, Map 72) and would follow the existing railroad right-of-way for approximately 12.9 miles to the south.³

Approximately 1 mile south of the Beaver Creek crossing Alternative B would cross the Cheyenne River in the NE of Section 27, T. 7 S., R. 7 E. (see Map Volume, Map 72). Once across the Cheyenne River the alternative would proceed up the Sand Creek drainage using the Black Hills Subdivision Branch Line right-of-way toward Smithwick. In the SE of Section 27 the alternative would pass through the Town of Oral and cross County Road 2. Sand Creek would be crossed once in the SW of Section 34, T. 7 S., R. 7 E. and twice in the NE of Section 3, T. 8 S., R. 7 E. In Section 11, T. 8 S., R. 7 E. Alternative B would cross Sand Creek and switch to the east side of the flood plain (see Map Volume, Maps 72 and 73). In Sections 24 and 25, T. 8 S., R. 7 E., 5 crossings of Sand

³ The existing Black Hills Subdivision Branch Line eventually connects with Chadron, Nebraska. Currently, DM&E hauls flour on this line. Traffic consists of approximately 2 trains weekly. Each train consists of about 50 cars. Longer trains are not feasible and the flour cars are not filled to capacity because of problems with the tracks including excessive grades and curves.

Creek would be required (see Map Volume, Map 73). Northwest of Smithwick (in the SW of Section 31, T. 8 S., R. 8 E.) Alternative B would turn to the southwest and follow the Black Hills Subdivision Branch Line for another 3 miles to the NE of Section 23, T. 9 S., R. 7 E. At this point the Black Hills Subdivision Branch Line turns to the south and continues to Oelrichs, South Dakota. Alternative B would leave the existing railroad at this point and turn to the west toward Heppner, South Dakota (see Map Volume, Map 24).

Approximately 2.2 miles west of its departure from the Black Hills Subdivision Branch Line Alternative B would cross Horsehead Creek. The crossing would occur in the SW of Section 21, T. 9 S., R. 7 E. (see Map Volume, Map 24) approximately 3.8 miles upstream of the creek's discharge to Angostura Reservoir. Approximately 0.3 miles west of the Horsehead Creek crossing Alternative B would cross U.S. Highway 18. The crossing would occur about 6 miles north of Oelrichs. After crossing U.S. Highway 18 the alternative would proceed west crossing south of Angostura Reservoir. About 2.1 miles west of U.S. Highway 18 Alternative B would cross County Road 79 in the SW of Section 19, T. 9 S., R. 7 E. Approximately 6.3 miles west of the U.S. Highway 18 crossing the alternative would cross Dry Creek (in the SE of Section 29, T. 9 S., R. 6 E.) 2.3 miles upstream of its discharge to Angostura Reservoir (see Map Volume, Map 25). At its closest Alternative B would be constructed approximately 1.8 miles south of Angostura Reservoir.

Once across Teepee Creek in the SE of Section 22, T. 9 S., R. 5 E. the alternative would proceed north of Heppner (see Map Volume, Map 26). Northwest of Heppner Alternative B would turn to the southwest and cross Bitter Creek in the SW of Section 29, T. 9 S., R. 5 E. One mile south of Bitter Creek the alternative would turn to the west and proceed across Ash and Hat creeks (in Section 36, T. 9 S., R. 4 E.). Approximately 4.2 miles southeast of Heppner the alternative would cross State Highway 71 in Section 34/35, T. 9 S., R. 4 E. (see Map Volume, Map 27). Once across the highway Alternative B would turn to the northwest and cross Plum Creek about 4.5 miles west of the highway crossing in the SW of Section 25, T. 9 S., R. 3 E. (see Map Volume, Map 28).

Once across Plum Creek Alternative B would continue to the northwest approximately 5.2 miles toward Edgemont. The alternative would proceed around the east and north end of Edgemont crossing Cottonwood Creek in the NW of Section 6, T. 9 S., R. 3 E. approximately 0.3 miles upstream from its confluence with the Cheyenne River (see Map Volume, Map 31). Northeast of the Cottonwood Creek crossing Alternative B would cross A Street and the Cheyenne River in the SE of Section 36, T. 8 S., R. 2 E. Approximately 0.3 miles north of A Street the alternative would cross U.S. Highway 18 between Edgemont and Dudley, South Dakota.

Northwest of the U.S. Highway 18 crossing Alternative B would begin to parallel an existing BNSF railroad corridor. Alternative B would be constructed east of the BNSF corridor around the east side of Edgemont (see Map Volume, Map 31).

Once across U.S. Highway 18 Alternative B would proceed northwest for approximately 11 miles adjacent to the east side of the BNSF corridor which traverses along the eastern edge of the Cheyenne River flood plain. About 1 mile northwest of the U.S. Highway 18 crossing (in the SE of Section 26, T. 8 S., R. 2 E.) the Cheyenne River is located directly adjacent to west side of the BNSF corridor. However, in this area Alternative B would be constructed on the east side of the BNSF corridor and away from the river (see Map Volume, Map 31). Alternative B would continue to the northwest paralleling the BNSF corridor to the NW of Section 23, T. 7 S., R. 1 E. where the alternative would cross over the BNSF corridor (see Map Volume, Map 34). The crossing is about 1.8 miles southeast of Burdock, South Dakota. At this point Alternative B would turn to the west following the Cheyenne River flood plain into Wyoming and leave the BNSF corridor which continues to the northwest to Newcastle, Wyoming.

Approximately 1.8 miles west of the BNSF crossing the alternative would cross Beaver Creek (in the SW of Section 16, T. 7 S., R. 1 E.) about 1 mile upstream of its confluence with the Cheyenne River. Once across Beaver Creek Alternative B would proceed west running between 700 and 2,000 feet north of the Cheyenne River across Sections 17 and 18, T. 7 S., R. 1 E. (see Map Volume, Map 35). About 4.2 miles west of the BNSF crossing Alternative B would leave South Dakota and enter Niobrara County, Wyoming south of Twentyone Divide. Alternative B would continue west toward Riverview, Wyoming running parallel to and north of the Cheyenne River. In Section 20, T. 40 N., R. 60 W., just west of the Twentyone Draw confluence with the Cheyenne River, Alternative B would be constructed just north of the river for several hundred feet (see Map Volume, Map 35).

In the NW of Section 24, T. 40 N., R. 61 W. Alternative B would cross Old State Highway 85. Directly west of the highway crossing Alternative B would turn to the northwest and leave the Cheyenne River flood plain. Robbers Roost Creek would be crossed in the SW of Section 14, T. 40 N., R. 61 W. about 1.2 miles west of the Old State Highway 85 crossing (see Map Volume 36). The crossing would occur about 1 mile northwest of the creek's confluence with the Cheyenne River. About 2.5 miles west of Robbers Roost Creek the alternative would cross U.S. Highway 85 about 0.4 miles northwest of the intersection with Pipe Road (see Map Volume, Map 36). The crossing would occur approximately 2.5 miles north of Riverview.

Once across U.S. Highway 85 Alternative B would proceed northwest up the Bobcat Creek drainage. A number of crossings of the creek would be required in Sections 6, 7 and 8, T. 40 N., R. 61 W. and in Section 1, T. 40 N., R. 62 W. About 3.8 miles west of U.S. Highway 85 Alternative B would leave the Bobcat Creek drainage and proceed up the Alkali Creek drainage toward Morrisey, Wyoming. Alternative B would continue in a northwest direction up Alkali Creek to Section 30, T. 41 N., R. 62 W. where it would cross from Niobrara into Weston County (see Map Volume, Map 38). Approximately 0.5 miles northwest of the county line Alternative B would cross Morrisey Road. About 1.5 miles northwest of the county line the alternative would turn to the west and cross Roxson Road in the NE of Section 23, T. 41 N., R. 63 W. about 300 feet south of Morrisey Road and its intersection with the Cheyenne River Road (see Map Volume, Map 39).

West of Morrisey Alternative B would continue up the Alkali Creek drainage between the creek and the Cheyenne River Road. About 5 miles west of the Roxson Road crossing Alternative B would leave the Alkali Creek drainage and enter the headwaters of the Coyote Creek drainage. Coyote Creek would be crossed in the NE of Section 13, T. 41 N., R. 64 W. (see Map Volume, Map 40). About 1 mile west of the Coyote Creek crossing the alternative would turn to the northwest toward the Cheyenne River Road. In the NW of Section 5, T. 41 N., R. 64 W. the alternative would cross Lodgepole Creek (see Map Volume, Map 41). Directly west of the creek crossing the alternative would cross Grieves Road. Once across Grieves Road Alternative B would continue to the northwest running for approximately 7 miles between 0.5 and 1 mile north of Grieves Road up the Wildcat Creek drainage, crossing Wildcat Creek in the SW of Section 31, T. 42 N., R. 64 W. In Section 20, T. 42 N., R. 65 W. Alternative B would turn to the west and leave the Wildcat Creek drainage (see Map Volume, Map 43).

In the NW of Section 19, T. 42 N., R. 65 W. Alternative B would cross Dull Center Road and enter the Black Thunder Creek drainage (see Map Volume, Map 43). The crossing would occur about 1.7 miles north of Black Thunder Creek and the Grieves Road intersection. For approximately 5.5 miles west of Dull Center Road the alternative would be located north of Black Thunder Creek. Three crossings of Black Thunder Creek would occur in Section 7, T. 42 N., R. 66 W. upstream of the Horse Creek confluence (see Map Volume, Map 44).

At the confluence of Lion Creek with Black Thunder Creek, in the NW of Section 12, T. 42 N., R. 67 W., Alternative B would split into 2 legs (see Map Volume, Map 44). The split is known as the "Y". The southern leg would proceed southwest up Lion Creek to the southern SPRB coal mines. The northern leg would proceed north

up Black Thunder Creek to the northern mines. The two legs are described below:

Southern Leg. From the Y the southern leg of Alternative B would proceed west, then southwest up the Lion Creek drainage. In the NE of Section 11, T. 42 N., R. 67 W. the southern leg would cross Lion Creek and would run southwest paralleling the east/south side of the creek for approximately 3 miles to Lynch Road which would be crossed in the SE of Section 21, T. 42 N., R. 67 W. (see Map Volume, Map 74). West of Lynch Road the southern leg would turn to the west and cross Lion Creek in the NE of Section 29, T. 42 N., R. 67 W. The southern leg would continue west and southwest roughly following Keyton Road between 1 and 1.5 miles to the north. In Section 30, T. 42 N., R. 67 W. the southern leg would cross Rochelle Road. In Section 26, T. 42 N., R. 68 W. the southern leg would leave the Lion Creek drainage and cross through the headwaters of the Frog Creek drainage.

In the NE of Section 34, T. 42 N., R. 68 W. the southern leg would cross Frog Creek and turn southwest. In Section 17, T. 41 N., R. 68 W. the southern leg would cross Keyton Creek and Rochelle Hills Road. About 1.6 miles southwest of the Rochelle Hills Road crossing the southern leg of Alternative B would cross from Weston into Campbell County (see Map Volume, Map 77). The southern leg would continue southwest for approximately 1.7 miles and pass from Campbell into Converse County. Once in Converse County the southern leg would turn to the west and cross a number of streams that are tributary to Antelope Creek. In Section 26, T. 41 N., R. 69 W. Wildcat Creek would be crossed approximately 3.5 miles north of its confluence with Antelope Creek. Approximately 1.8 miles to the west the southern leg would cross Beckwith Creek in the SE of Section 28, T. 41 N., R. 69 W. (see Map Volume, Map 52). In Section 31, T. 41 N., R. 69 W. the southern leg would enter the Antelope Creek drainage.

West of Porcupine Creek the southern leg of Alternative B would continue down the Antelope Creek drainage. Antelope Creek would be crossed in the SW of Section 32, T. 41 N., R. 70 W. After the crossing of Antelope Creek in the SE of Section 31, T. 41 N., R. 70 W., the route turns SW and proceeds to the Antelope Mine. The southern leg would terminate in the SE of Section 2, T. 40 N., R. 71 W. (see Map Volume, Map 54).

Northern Leg. From the Y in the NE of Section 12, T. 42 N., R. 67 W. (see Map Volume, Map 44) the northern leg of Alternative B would proceed northwest up the Black Thunder Creek drainage. About 2 miles northwest of the Y the northern leg would cross Little Thunder Creek in the NE of Section 3, T. 42 N., R. 67 W. about 0.4 miles southwest of its confluence with Black Thunder Creek. The crossing would be 2.2 miles east of

Darlington School. In the NE of Section 33, T. 43 N., R. 67 W. the northern leg would cross State Highway 450 and continue northwest up the Black Thunder Creek drainage (see Map Volume, Map 45). In Section 14, T. 43 N., R. 68 W. the northern leg would turn to the north and cross Buzzard Creek (see Map Volume, Map 78). In Section 4, T. 43 N., R. 68 W. the northern leg would turn to the west and cross Little Mike Creek. The northern leg would continue in a westerly direction south of Black Thunder Creek across the Weston-Campbell County line in Section 1, T. 43 N., R. 69 W. (see Map Volume, Map 80).

In the east half of Section 1, T. 43 N., R. 69 W., about 0.3 miles east of Keeline Road, a mine spur would originate from the northern leg to provide service to the Jacobs Ranch, North Rochelle and Black Thunder mines (see Map Volume, Map 80). The mine spur would proceed west up HA Creek around the north side of HA Divide (see Map Volume, Map 82) to Section 1, T. 43 N., R. 70 W. where it would enter the Jacobs Ranch Mine. On Jacobs Ranch the spur would turn south toward the North Prong Little Thunder Creek (see Map Volume, Map 55).

To service the North Rochelle Mine, this alternative would parallel the north side of State Highway 450 beginning in the NE of Section 23, T. 43 N., R. 70 W. The alternative would proceed east approximately 2.5 miles. In the NW of Section 29, T. 43 N., R. 69 W. the alignment would cross over State Highway 450 and curve south. From this point the alternative would proceed 1.5 miles to the NW of Section 6, T. 42 N., R. 69 W. The North Rochelle Mine Spur would depart from the alternative in the NW of Section 6, T. 42 N., R. 69 W. and proceed in a westerly direction for about 3.2 miles where it would join existing mine load out facilities in Section 9, T. 42 N., R. 70 W. School Creek Road would be crossed by this mine spur both in the NW and SW of Section 6, T. 42 N., R. 69 W. Reno Road would be crossed in the NE of Section 11, T. 42 N., R. 70 W.

The northern leg would continue up Black Thunder Creek on the south side for approximately 5 miles where it would cross to the north side of the creek in the SW of Section 20, T. 44 N., R. 69 W. (see Map Volume, Map 81). Once across Black Thunder Creek the northern fork would turn north up the Cottonwood Creek drainage and pass just east of Hay Lakes in Sections 14 and 23, T. 45 N., R. 70 W. (see Map Volume, Map 58). Approximately 6 miles north of Hay Lakes a mine spur would originate in Section 15, T. 46 N., R. 70 W. This spur would provide service to the Coal Creek Mine (see Map Volume, Map 60). The spur would extend approximately 3 miles to the west. A second mine spur would originate from the northern leg approximately 3 miles north of the Coal Creek Mine Spur (see Map Volume, Map 61). This spur would originate about 1.3 miles south of the Belle Fourche

River and would provide service to the Cordero Mine. The spur would pass between the Belle Fourche River and Saddle Horse Butte in Section 31, T. 47 N., R. 70 W. The 2.2 mile long spur would terminate in the NE of Section 36, T. 47 N., R. 71 W. about 800 feet southeast of the Belle Fourche River.

The northern leg would cross the Belle Fourche River 3 times in the NW of Section 29, T. 47 N., R. 70 W. (see Map Volume, Map 62). On the north side of the river the northern leg would cross Kicken Draw in the NE of Section 19, T. 47 N., R. 70 W. and proceed north toward Caballo Creek. South of Caballo Creek, in Section 7, T. 47 N., R. 70 W., a mine spur would extend approximately 1.5 miles to the northwest (see Map Volume, Map 62) to provide service to the Rojo Mine (terminating in Section 1, T. 47 N., R. 71 W.).

The northern leg would continue north crossing Caballo Creek in the NE of Section 35, T. 48 N., R. 71 W. North of Caballo Creek the northern leg would provide service to the Belle Ayr and Caballo mines (see Map Volume, Map 63).

2.2.2.2 Alternative B Land Ownership. Figure 2-1 shows land ownership in the vicinity of the alternatives in South Dakota and Wyoming. A summary of land ownership for this alternative is provided in Table 2-1. The majority of the lands (nearly 80 percent) which would be crossed by Alternative B are private. Most of the Federal lands which would be crossed by this alternative are NFS lands which are associated with BGNG in South Dakota and TBNG in Wyoming.

Bureau of Land Management. Alternative B would cross the 5.7 miles of public lands in both South Dakota and Wyoming. The South Dakota public lands are managed by the BLM's South Dakota Field Office in Belle Fourche. Because of the complex history of homestead grants in western South Dakota, public lands are fragmented. The primary use is rangeland and management is primarily the responsibility of the lessee.

Wyoming public lands which would be affected by the alternative are managed by the Newcastle and Buffalo Field offices. The Newcastle Field Office manages public lands in Niobrara and Weston counties. Public lands within this field office are intermingled land surface ownership and overlapping mineral ownership. About 291,000 acres of public land surface and 1.4 million acres of subsurface Federal minerals are managed by the Newcastle Field Office. Principal land uses include grazing, oil and gas, and wildlife habitat. Public lands in Campbell County are managed by the Buffalo Field Office. The Buffalo Field Office manages nearly 800,000 acres of public surface and 4.7 million acres of Federal mineral estate. Very little public lands would be affected by the alternatives in the Buffalo Field Office. Affected

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**Table 2-1
Summary of Land Ownership (in Miles) for Alternative B**

Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.3	2.3	2.4	1.6	5.7	2.0
DOE	0.3	0.2	0	0	0.3	0.1
Forest Service	16.3	11.2	35.6	23.5	51.9	17.5
State	2.7	1.9	7.4	4.9	10.1	3.4
Private	122.3	84.4	105.8	70.0	228.1	77.1
Total	144.9	100	151.2	100	296.1	100

public lands are located between Gillette and Wright, Wyoming.

In South Dakota Alternative B would cross 3.3 miles of public lands. These lands are scattered along the route and consist of small, isolated parcels. The first public land parcel which would be crossed consists of approximately 80 acres and is located in Section 19, T. 1 N., R. 15 E. in Pennington County between Wall and Wasta south of I-90 and Bull Creek (see Map Volume, Map 2). Another parcel of public lands would be crossed about 1.4 miles southeast of Wasta in Section 10, T. 1 N., R. 14 E. This 160-acre parcel is located about 0.4 miles south of I-90 (see Map Volume, Map 4).

A 200-acre public land parcel would be crossed just south of the proposed Boxelder Creek crossing in Section 31, T. 1 N., R. 14 E. on the north end of Brennan Flat (see Map Volume, Map 5). This crossing would occur about 4.7 miles south of Wasta in Pennington County. This parcel includes a portion of the Cheyenne River which is located approximately 800 feet east of the alternative through this public land parcel. South of Holcomb Flat a 70-acre public land parcel would be crossed in Section 1, T. 2 S., R. 12 E. (see Map Volume, Map 8). This parcel would be crossed about 2.5 miles east of the alternative's proposed crossing of State Highway 44 and about 0.5 miles east of the confluence of Rapid Creek with the Cheyenne River. A portion of this parcel is located in the Cheyenne River flood plain.

A 40-acre public land parcel is located at the crossing of State Highway 44 in Section 3, T. 2 S., R. 12 E. in Pennington County (see Map Volume, Map 9). This parcel is located southeast of the intersection of Creston Road and State Highway 44 and lies between Rapid Creek and the Cheyenne River.

A 160-acre public land parcel would be crossed west of Harrison Flat and about 2.2 miles west of the proposed Alternative B crossing from Custer into Fall River County (see Map Volume, Map 71). The parcel is located in Section 5, T. 7 S., R. 8 E. about 1.3 miles north of the Cheyenne River. About 5 miles southeast of Edgemont,

public lands would be crossed in Sections 15 and 22, T. 9 S., R. 3 E. (see Map Volume, Map 29).

A 160-acre public land parcel would be crossed about 4 miles southeast of Edgemont in Section 22, T. 9 S., R. 3 E. A 40-acre public land parcel would also be crossed about 3.1 miles northwest of Edgemont within the BNSF corridor in Section 22, T. 8 S., R. 2 E. (see Map Volume, Map 32). These crossings would occur in Fall River County.

Alternative B would cross 2.4 miles of public lands in Wyoming. A public land parcel would be crossed by this alternative in Niobrara County at the point where the alternative would enter the Alkali Creek drainage in Section 4, T. 40 N., R. 62 W. and Section 32, T. 41 N., R. 62 W. (see Map Volume, Map 38) about 4.5 miles southeast of Morrisey. This parcel is managed by the BLM's Newcastle Field Office. All other public lands which would be crossed by Alternative B in Wyoming are located on the north end of the northern leg. These parcels are located west of Dry Creek in Section 33, T. 47 N., R. 70 W. and Sections 4, 5 and 23, T. 46 N., R. 70 W. (see Map Volume, Maps 59, 60 and 61). These lands are managed by the BLM's Buffalo Field Office and are located south of the proposed crossing of the Belle Fourche River in Campbell County.

Department of Energy. A 360-acre parcel of Department of Energy (DOE) managed lands would be crossed by this alternative in Fall River County in Section 8, T. 9 S., R. 3 E. (see Map Volume, Map 30). The parcel is about 2.5 miles southeast of Edgemont and about 1.3 miles west of the Cheyenne River. This parcel was used for uranium tailings disposal but has been cleaned up. No surface disturbing activities are allowed by DOE on this parcel. If this alternative is selected it may be necessary to reroute to avoid this parcel.

Forest Service. In South Dakota Alternative B would cross 16.3 miles of NFS lands on BGNG. These NFS lands are managed by the Fall River Ranger District which is headquartered in Hot Springs, South Dakota. Alternative B would cross 35.6 miles of NFS lands in

Wyoming. These lands are managed by the Douglas Ranger District which is headquartered in Douglas, Wyoming.

Buffalo Gap National Grassland. BGNG is located in southwestern South Dakota and includes more than 595,000 acres of land that borders and is intermingled with private, state, Indian reservation, and national park lands. Alternative B would affect the western unit of BGNG which extends from the Cheyenne River on the east to the Wyoming and Nebraska borders on the west and south, respectively. Principal land uses on the BGNG are grazing and recreation.

Alternative B would cross 16.3 miles of NFS lands on BGNG. These lands are primarily located in Custer and Pennington counties between U.S. Highway 44 and Oral. The first parcels which would be crossed are located in Pennington County on the south side of U.S. Highway 44 east of Creston (see Map Volume, Map 9). In the north half of Section 9, T. 2 S., R. 12 E. Alternative B would follow the abandoned Old Milwaukee Railroad across NFS lands.⁴ In the middle of Section 9 the Old Milwaukee turns to the southeast and Alternative B proceeds to the southwest. In the SW of Section 9 and the NE of Section 17, T. 2 S., R. 12 E. NFS lands would be crossed.

A second parcel would be crossed just north of the Pennington-Custer County line as the alternative leaves the Cheyenne River flood plain and turns up the Spring Creek drainage west of the Creston Road. This includes portions of Sections 17 and 20 in T. 2 S., R. 12 E. Additional NFS lands would be crossed in the Spring Creek drainage in Sections 31 and 32, T. 2 S., R. 12 E.; Section 6, T. 3 S., R. 12 E.; and Section 1, T. 3 S., R. 11 E. (see Map Volume, Map 10).

Alternative B would again enter NFS lands about 0.3 miles north of the intersection of Pennington, Custer and Shannon counties in Section 21, T. 4 S., R. 11 E. (see Map Volume, Map 66). From the intersection of the counties the alternative would follow the north side of the Cheyenne River to the south to Red Shirt. In this area a contiguous stretch of approximately 7.6 miles of NFS lands would be crossed in the following sections: Sections 20, 21, 28, 29, 30, 31 and 32, T. 4 S., R. 11 E. and Sections 25, 26, 27, and 28, T. 4 S., R. 10 E. (see Map Volume, Maps 66 and 67). Once south of Red Shirt Alternative B would continue across private lands in the Cheyenne River flood plain to Section 9, T. 5 S., R. 10 E. where a small parcel (133 acres) of NFS lands would be

crossed directly west of the Cheyenne River (see Map Volume, Map 68).

Alternative B would again enter BGNG northeast of Harrison Flat in Section 14, T. 5 S., R. 9 E. in Custer County (see Map Volume, Map 68). NFS lands, intermixed with private lands, would be crossed in the vicinity of Harrison Flat. NFS lands include portions of Sections 14, 22, 23, 32 and 33, T. 5 S., R. 9 E. and Sections 5 and 6, T. 6 S., R. 9 E. (see Map Volume, Maps 18 and 19). Some of these NFS lands are located in the Cottonwood Creek drainage.

Thunder Basin National Grassland. TBNG is located in northeastern Wyoming and occupies about 572,000 acres of land among a mosaic of state, Federal and private lands. NFS lands generally lie between Douglas on the south, to Newcastle on the east, to Gillette on the north, and to Wright on the west. A great deal of coal is mined on the grassland, including the largest coal strip-mine operation in the nation. Other important land uses include oil and gas, grazing and recreation.

Alternative B would cross 35.6 miles of NFS lands on TBNG. No NFS lands would be crossed by this alternative in Niobrara County. Alternative B would first enter NFS lands about 3.1 miles west of Morrisey in Weston County (see Map Volume, Map 40). These lands are located in the headwaters of Coyote Creek south of the Cheyenne River Road and include Sections 17 and 18, T. 41 N., R. 63 W. and Section 10, T. 41 N., R. 64 W. North of Grieves Road, in the Wildcat Creek drainage, Alternative B would cross NFS lands in Sections 22, 26 and 27, T. 42 N., R. 65 W. Lands west of Dull Center Road are NFS lands including portions of Sections 13, 14 and 24, T. 42 N., R. 66 W. (see Map Volume, Map 43).

Much of the southern leg of this alternative would cross NFS lands. From the headwaters of Lion Creek, around the south side of the Rochelle Hills, Alternative B would cross over 9 miles of contiguous NFS lands (see Map Volume, Map 74 to 77). This includes the headwaters of Frog, Keyton and Horse creeks. NFS lands which would be crossed in this area include: Section 29, T. 42 N., R. 67 W.; Sections 25, 26, 27, and 34, T. 42 N., R. 68 W.; Sections 3, 4, 8, 9, 17, 18, and 19, T. 41 N., R. 68 W.; and Sections 24 and 25, T. 41 N., R. 69 W. NFS lands would also be crossed by the southern leg of Alternative B immediately west of where Alternative B would cross into Converse County from Campbell County. This 560-acre parcel would be crossed in Section 27, T. 41 N., R. 69 W. (see Map Volume, Map 52).

NFS lands would also be crossed by the southern leg where it is aligned north of Antelope Creek from about Gibson Draw to Porcupine Creek. NFS lands in this area include Sections 29, 31 and 32, T. 41 N., R. 69 W. and Section 35, T. 41 N., R. 70 W. (see Map Volume, Maps

⁴ The analysis assumes that disturbance adjacent to the Old Milwaukee Railroad would occur on NFS lands. However, the actual Old Milwaukee Railroad right-of-way is owned by the State of South Dakota. If this alternative is constructed entirely within the Old Milwaukee right-of-way NFS lands may not be affected.

52 and 53). The southern leg terminus on Antelope Mine would occur on NFS lands in Section 6, T. 40 N., R. 70 W. and Sections 1 and 12, T. 40 N., R. 71 W. (see Map Volume, Maps 53 and 54)

Much of the northern leg up the Black Thunder Creek drainage would cross NFS lands including the crossing of State Highway 450 and parts of Sections 19, 29, 30 and 33, T. 43 N., R. 67 W. and Sections 3 and 10, T. 43 N., R. 68 W. The NFS lands north of State Highway 450 are smaller in size and more checkerboard in nature than those which would be crossed by the southern leg. One mile west of the crossing from Weston into Campbell County NFS lands would be crossed in Sections 20, 27, 28 and 35, T. 44 N., R. 69 W. (see Map Volume, Maps 80 and 81). These lands are directly west and north of the confluence of HA Creek with Black Thunder Creek. Additional NFS lands would be crossed in Sections 1 and 12, T. 44 N., R. 70 W. and Section 7, T. 44 N., R. 69 W. as Alternative B leaves the Black Thunder Creek drainage and enters the Cottonwood Creek drainage (see Map Volume, Maps 57 and 81).

NFS lands would be crossed by the spur to Jacobs Ranch Mine (see Map Volume, Map 55). These lands include portions of Sections 11, 12, 14 and 23, T. 43 N., R. 70 W. along the western edge of HA Divide. The North Rochelle Mine Spur would cross NFS lands in Section 24, T. 43 N., R. 70 W.; Sections 29, 30, 31 and 32, T. 43 N., R. 69 W.; Sections 1, 9 and 12, T. 42 N., R. 70 W.; as well as in Section 6, T. 42 N., R. 69 W.

State of South Dakota. About 2.7 miles of lands owned by the State of South Dakota would be crossed by Alternative B. The first parcel is located just south of Boxelder Creek on the east end of Brennan Flat adjacent to the Cheyenne River in Section 6, T. 1 S., R. 14 E. (see Map Volume, Map 5). The second parcel would be crossed just north of the intersection of Pennington, Custer and Shannon counties in Section 16, T. 4 S., R. 11 E. about 5 miles east of Red Shirt (see Map Volume, Map 66). A 320-acre state-owned parcel would be crossed in Fall River County in the Plum Creek drainage in the east half of Section 36, T. 9 S., R. 3 E. This parcel is about 7.3 miles southeast of Edgemont (see Map Volume, Map 28). The final state-owned parcel which would be crossed by Alternative B in South Dakota is located in western Fall River County approximately 1.5 miles southwest of Burdock. The parcel is located in the SW of Section 16, T. 7 S., R. 1 E. at the Beaver Creek crossing (see Map Volume, Map 35). State-owned parcels which would be crossed are used for grazing.

State of Wyoming. A total of 7.4 miles of lands owned by the State of Wyoming would be crossed by this alternative, all of which are used for grazing. The first parcel is just 0.5 miles west of the South Dakota-Wyoming State line in Section 16, T. 40 N., R. 60 W. (see

Map Volume, Map 35). This parcel is in Niobrara County on the north side of the Cheyenne River but south of Twentyone Divide and east of the confluence of Twentyone Draw and the Cheyenne River. The area between Robbers Roost Creek and State Highway 18 in Niobrara County is state-owned lands (see Map Volume, Map 36). The state-owned parcels between the highway and the creek include the SW of Section 9 and Section 16, T. 41 N., R. 61 W. Two miles west of Morrisey Alternative B would cross state-owned Section 16, T. 41 N., R. 63 W. (see Map Volume, Map 40). This section is located in Weston County.

State-owned lands would be crossed north of Grieves Road in the Wildcat Creek drainage. This parcel (Section 36, T. 42 N., R. 65 W.) is located approximately 0.6 miles northeast of "the Nose" in Weston County (see Map Volume, Map 42). A state section would be crossed approximately 2.6 miles east of the Y in Section 16, T. 42 N., R. 66 W. (see Map Volume, Map 44). This section is located in the Black Thunder Creek drainage near the School Draw confluence in Weston County.

No state-owned lands would be crossed on the southern leg. Additional state-owned lands in Section 36, T. 44 N., R. 69 W. would be crossed by the northern leg just north of the spur to Black Thunder Mine. That section is located at the confluence of HA Creek and Black Thunder Creek in Campbell County. The section is bisected by Keeline Road. In the Cottonwood Creek drainage, in Section 36, T. 45 N., R. 70 W., a state-owned section would be crossed (see Map Volume, Map 57). This section is approximately 1.8 miles south of Hay Lakes. The spur to the Cordero Mine would terminate on state-owned lands in Section 36, T. 47 N., R. 71 W. This section is just south of the Belle Fourche River and west of Saddle Horse Butte in Campbell County (see Map Volume, Map 61). Finally, the north end of the northern leg, including the spur to the Belle Ayr Mine, would cross through a small portion of a state-owned section in Section 36, T. 48 N., R. 71 W. (see Map Volume, Map 63). This section is crossed by Caballo Creek.

Angostura Unit. All the alternatives would cross through the Angostura Unit. The Angostura Unit is located in Custer and Fall River counties in southwestern South Dakota. Angostura Dam and Reservoir, located on the Cheyenne River about 9 miles southeast of Hot Springs, provide multipurpose benefits, including irrigation, flood control, fish and wildlife conservation, recreation and sediment control.

The primary function of the Angostura Unit is to impound and deliver a full supply of irrigation water for production of forage and grain crops. The unit land, consisting of 12,218 acres extending along the Cheyenne River approximately 24 miles downstream from the dam, are served by the Angostura Canal.

In 1950 commissioners of Fall River and Custer counties approved the creation of the Angostura Irrigation District. The irrigation district and the United States agreed to a service and repayment contract in May 1951. Under the agreement the United States reimburses the district for 27.6 percent of the cost of operating and maintaining the supply works. That percentage reflects the portion applicable to benefits other than Angostura Unit irrigation. The irrigation district has operated and maintained the dam, reservoir and associated project irrigation facilities since January 1, 1968. Repayment toward construction of the distribution system totals \$718,000, while annual water service charges amount to \$3,650 over a 30-year period beginning in 1968. The annual payments are the result of a formula reflecting the farm parity ratio and the total irrigated crop value for the project each year.

In 1995 BOR began negotiations with the irrigation district for a new water supply contract. Traditional questions of silt, recreation, and irrigation were joined by Native American water rights, interstate water development, conservation, water rights, and water supply contracting.

Approximately 11.7 miles of Alternative B would cross through the Angostura Unit. This includes 5 miles of private land, 5.9 miles of NFS lands, and 0.8 miles of state lands.

2.2.3 Alternative C. This alternative was developed in response to comments received during scoping from Federal, state and local agencies as well as private land owners and the general public. The alternative was designed to minimize or eliminate several significant environmental impacts associated with Alternative B, particularly on NFS lands on BGNG and TBNG. DM&E has advanced the design for this alternative much further than the design for the other alternatives. Consequently, information regarding the location and extent of this alternative is more complete than for the other alternatives.

2.2.3.1 Alternative C Route. The following discussion is limited only to those portions of the Alternative C route which are materially different than those described above for Alternative B. In many places the alternative routes are identical or nearly the same. These areas are typically not described further.

This alternative would begin in the same location as Alternative B and follows the same route (see Section 2.2.2.1) for approximately 13 miles to the intersection with DM&E's existing main line west of Baseline Road in Section 30, T. 1 N., R. 14 E., Pennington County (see Map Volume, Maps 1 through 5). In the SE of Section 30, T. 1 N., R. 14 E. Alternative C would deviate slightly from

Alternative B and run directly adjacent to DM&E's existing main line for about 0.5 miles (see Map Volume, Map 5).

Alternative C would continue south in the Cheyenne River flood plain and would parallel (mostly to the east) the route described for Alternative B for approximately 18 miles, crossing the same roads and streams as described in Section 2.2.2.1 (see Map Volume, Maps 5 to 11). In the SE of Section 17, T. 2 S., R. 12 E., just south of the Creston Road crossing, Alternative C would cross over Alternative B and proceed up the Spring Creek drainage (see Map Volume, Map 9). Like Alternative B, Alternative C would make a number of crossings of Spring Creek and in many areas it has been routed closer to the creek than Alternative B. In the north half of Section 14, T. 3 S., R. 11 E. Alternative C would cross to the east side of Spring Creek. In the SE of Section 21, T. 3 S., R. 11 E. Alternative C would again cross Alternative B and continue to the west, while Alternative B would turn in a southern direction (see Map Volume, Map 12).

Beginning in the SE of Section 21 Alternative C would run west for about 2.5 miles to Section 24, T. 3 S., R. 10 E. where it would turn to the southwest for 2 miles (see Map Volume, Map 12). In the SW of Section 27, T. 3 S., R. 10 E. Alternative C would cross Willow Creek. In the NE of Section 31, T. 3 S., R. 10 E. Alternative C would cross State Highway 40 about 0.3 miles east of the Battle Creek crossing (see Map Volume, Map 13). Battle Creek would be crossed in the NW of Section 31, T. 3 S., R. 10 E. and the alternative would be constructed directly adjacent to the south bank of Battle Creek in the NW of Section 31 and the NW of Section 36, T. 3 S., R. 9 E. (see Map Volume, Map 14).

About 1.5 miles west of the Battle Creek crossing Alternative C would turn toward the southwest, gradually heading in a southern direction. In the south half of Section 18, T. 4 S., R. 9 E. Dry Creek would be crossed. Approximately 3.2 miles south of the Dry Creek crossing Alternative C would cross East French Creek Road in the NW of Section 6, T. 5 S., R. 9 E. About 0.5 miles south of the East French Creek Road crossing the alternative would cross French Creek in the SW of Section 6, T. 5 S., R. 9 E. (see Map Volume, Map 16). Approximately 1.2 miles south of the French Creek crossing Alternative C would cross the South Fork of French Creek in the SW of Section 7, T. 5 S., R. 9 E.

Alternative C would continue south for about 6.5 miles across broken terrain west of the Cheyenne River and Squaw-Humper Table. In Section 18, T. 6 S., R. 9 E. Alternative C would rejoin the route for Alternative B. Alternative C would follow the Alternative B route for approximately 1.2 miles roughly between Cottonwood Cutoff Road and 268th Street. Alternative C would cross Cottonwood Creek in the NE of Section 13, T. 6 S., R. 8

E. (see Map Volume, Map 19) and 268th Street in the SE of Section 13. About 0.2 miles south of 268th Street Alternative C would leave the Alternative B route and turn south and proceed across Harrison Flat for about 1.6 miles.

Alternative C would continue south across the south end of Harrison Flat and pass from Custer County into Fall River County about 0.7 miles west of the Cheyenne River (see Map Volume, Map 20). One mile south of the county line Alternative C would cross the Cheyenne River in the SW of Section 1, T. 7 S., R. 8 E. Once across the river Alternative C would proceed south within the Hay Canyon flood plain, crossing Hay Canyon Creek many times while weaving across the flood plain for approximately 6 miles (see Map Volume, Map 20). In Section 1, T. 8 S., R. 8 E. Alternative C would turn to the southwest for about 1.2 miles, crossing County Road 2C in the NE of Section 11, T. 8 S., R. 8 E. West of County Road 2C Alternative C would continue along the Hay Canyon drainage and cross Hay Canyon Creek 2 more times in Section 10, T. 8 S., R. 8 E. (see Map Volume, Maps 21 and 22).

Alternative C would leave the Hay Canyon drainage in the SW of Section 20, T. 8 S., R. 8 E. and for the next 3.2 miles run in a southwest direction crossing several tributaries to Plumb Creek in Sections 20 and 29, T. 8 S., R. 8 E. (see Map Volume, Map 22). Approximately 0.6 miles north of Smithwick in the SW of Section 31, T. 8 S., R. 8 E. Alternative C would again join Alternative B. Both alternatives would be routed from this point to the south within DM&E's existing Black Hills Subdivision Branch Line right-of-way. The route for Alternative C from approximately Smithwick to the crossing of U.S. Highway 18 in Section 21, T. 9 S., R. 7 E. would be similar to the route for Alternative B described in Section 2.2.2.1 (see Map Volumes, Maps 23 and 24).

Beginning in the SW of Section 19, T. 9 S., R. 7 E. Alternative C would be routed parallel to Alternative B between 400 and 1,600 feet to the south. Alternative C would follow Alternative B in this manner for the next 4 miles. In Sections 28 and 29, T. 9 S., R. 6 E. Alternative C would cross Alternative B twice (see Map Volume, Map 25). For the next 3.5 miles Alternative C would be located between 300 and 5,000 feet south of Alternative B. In Section 23, T. 9 S., R. 5 E. Alternative C would cross to the north of Alternative B and proceed west to Heppner in the SE of Section 20, T. 9 S., R. 5 E. (see Map Volume, Map 26).

Alternative C would cross Hat Creek in the SE of Section 25, T. 9 S., R. 4 E. (see Map Volume, Map 27) about 1.2 miles north of the Alternative B crossing. In the SW of Section 26, T. 9 S., R. 4 E. Alternative C would cross State Highway 71. Beginning about 1.9 miles west

of the State Highway 71 crossing Alternative C would follow the same route as Alternative B for approximately 1.7 miles. In the SE of Section 25, T. 9 S., R. 3 E. Alternative C would cross Plum Creek and then head northwest for the next 3 miles within about 0.25 miles of Alternative B. In the SW of Section 9, T. 9 S., R. 3 E. Alternative C would turn to the north for approximately 1.2 miles and then would turn northwest for about 3.5 miles around the east side of Edgemont. The north and northwestern directions followed by the Alternative C route would distance Alternative C from Edgemont by at least 1 mile (see Map Volume, Maps 30 and 31). Alternative C would cross the Cheyenne River about 1.5 miles east of Edgemont in NE of Section 31, T. 8 S., R. 3 E.

Northwest of Edgemont Alternative C would join the BNSF railroad corridor in the same manner as was described for Alternative B in Section 2.2.2.1. Similar to Alternative B, Alternative C would leave the BNSF railroad corridor in Section 15, T. 7 S., R. 1 E. and proceed west toward Wyoming (see Map Volume, Map 34).

Once in Wyoming Alternative C would parallel Alternative B, occasionally crossing. The alternatives would run roughly parallel to the west and northwest for approximately 35 miles. The alternatives would generally cross all the same roads and streams (see Section 2.2.2.1). However, in the NW of Section 4, T. 41 N., R. 64 W. in Weston County Alternative C would cross to the north side of Alternative B and cross Cheyenne River Road, which would not be crossed by Alternative B in this area (see Map Volume, Map 41).

Beginning in Section 24, T. 42 N., R. 66 W., just west of the Dull Center Road crossing, Alternative C would be constructed approximately 0.5 miles south and parallel to Alternative B for about 2 miles to the west. Alternative C would then turn to the northwest for approximately 4.5 miles, still parallel to Alternative B with the distance between the alternatives ranging from 330 feet to 0.5 miles. In this area Alternative C would cross Black Thunder Creek and Horse Creek.

In Section 12, T. 42 N., R. 67 W., east of the Lion Creek crossing, Alternative C would cross the southern leg of Alternative B. Alternative C would continue in a westerly direction and run between the northern and southern legs of Alternative B (see Map Volume, Map 44). From the Alternative B Y, Alternative C would run west approximately 8.6 miles to Section 4, T. 42 N., R. 68 W. Along this stretch Alternative C would cross 3 tributaries to Little Thunder Creek in Sections 5 and 6, T. 42 N., R. 67 W. Also, in the SE of Section 5, T. 42 N., R. 67 W., Alternative C would cross Lynch Road approximately 0.2 miles south of Darlington School. Approximately 3.2 miles west of the Lynch Road crossing Alternative C

would cross Piney Creek in the south half of Section 2, T. 42 N., R. 68 W. (see Map Volume, Map 46).

East of the Weston-Campbell County line (see Map Volume, Map 47) Alternative C would cross several tributaries to Little Thunder Creek in Sections 5 and 6, T. 42 N., R. 68 W. and Section 31, T. 43 N., R. 68 W. On the west side of the Weston-Campbell County line Alternative C would also cross several tributaries to Little Thunder Creek in Sections 36, 35, 34, 33, and 28, T. 43 N., R. 69 W. (see Map Volume, Maps 47 and 48).

In the SE of Section 29, T. 43 N., R. 69 W. Alternative C would form a "T" (see Map Volume, Map 48). The southern leg would proceed towards the southern coal mines and the northern leg would proceed to the northern mines. The routes for these legs are described below:

Southern Leg. From the T the southern leg of Alternative C would proceed to the southwest crossing School Creek in the NW of Section 32, T. 43 N., R. 69 W. (see Map Volume, Map 48). About 0.4 miles southwest of the School Creek crossing Alternative C would approach School Creek Road and run parallel to the road on the east side for approximately 0.8 miles. In the NE of Section 6, T. 42 N., R. 69 W. Alternative C would cross to the west side of the road and then immediately back to the east side (see Map Volume, Map 49). It is anticipated that School Creek Road would be relocated to the east in this area to avoid the multiple crossings. In the NW of Section 6 the southern leg would leave School Creek Road and proceed to the southwest. Approximately 0.2 miles southwest of the School Creek Road crossing Alternative C would cross School Creek and then continue southwest about 0.4 miles where it would cross Reno Road. The North Rochelle Mine spur would depart from the south leg of Alternative C in the NW of Section 6, T. 42 N., R. 69 W. From this point the spur would proceed in a westerly direction for about 3.2 miles where it would join existing mine load out facilities in Section 9, T. 42 N., R. 70 W. School Creek Road would be crossed by this spur both in the NW and SW of Section 6, T. 42 N., R. 69 W. and the Reno Road would be crossed in the NE of Section 11, T. 42 N., R. 70 W.

In Section 12, T. 42 N., R. 70 W. Alternative C would curve toward the southeast where, for the next 3.5 miles, it would cross 8 tributaries to School Creek (see Map Volume, Maps 49 and 50). In Section 29, T. 42 N., R. 69 W. Alternative C would turn south. In the north half of Section 32, T. 42 N., R. 69 W. Alternative C would cross Piney Canyon Road. Approximately 1.5 miles south of the Piney Canyon Road crossing, in Section 5, T. 41 N., R. 69 W., Alternative C would cross West Fork and then continue south on the west side of the West Fork drainage (see Map Volume, Map 51), crossing several

tributaries to West Fork. In the SE of Section 17, T. 41 N., R. 69 W. Alternative C would cross Phillips Road.

Alternative C would continue south leaving the West Fork drainage and would cross several tributaries to Beckwith Creek in Section 20, T. 41 N., R. 69 W. (see Map Volume, Map 52). In Section 29, T. 41 N., R. 69 W. Alternative C would turn towards the west, leaving Campbell County and entering Converse County. In the north half of Section 36, T. 41 N., R. 70 W. Alternative C would join the Alternative B route and parallel it approximately 300 feet to the north. The southern leg would roughly parallel Alternative B, crossing back and forth to the north and south sides. The distance between Alternative C and Alternative B would range between 50 and 2,000 feet. Alternative C would follow the 5.6 mile route of Alternative B through the Antelope Creek drainage, ending in the Antelope Creek Mine area in the SE of Section 2, T. 40 N., R. 71 W. (see Map Volume, Map 54).

Northern Leg. From the T in SW of Section 28, T. 43 N., R. 69 W. (see Map Volume, Map 48) the northern leg of Alternative C would be constructed towards the northwest. State Highway 450 would be crossed in the NW of Section 29, T. 43 N., R. 69 W. Approximately 2.3 miles northwest of the State Highway 450 crossing, in Section 23, T. 43 N., R. 70 W., Alternative C would again fork (see Map Volume, Map 55). One branch would head north to the northern SPRB mines, while the other would proceed west to the Jacobs Ranch Mine. The west fork would meet with Alternative B in the NE of Section 23, T. 43 N., R. 70 W. and would follow the same route described in Section 2.2.2.1 to the Jacobs Ranch Mine in Section 14, T. 43 N., R. 70 W.

The northern leg would continue north, crossing Little Thunder Road in the SE of Section 35, T. 44 N., R. 70 W. Approximately 3.6 miles north of the Little Thunder Road crossing Alternative C would cross Black Thunder Creek in the NW of Section 14, T. 44 N., R. 70 W. (see Map Volume, Map 56). About 350 feet to the north of the Black Thunder Creek crossing Alternative C would cross Keeline Road in the SW of Section 11, T. 44 N., R. 70 W. Alternative C would continue north crossing 2 tributaries to Black Thunder Creek in Sections 11 and 2, T. 44 N., R. 70 W. In Section 35, T. 45 N., R. 70 W. Alternative C would cross 2 tributaries to Cottonwood Creek and then continue north to Section 23, T. 45 N., R. 70 W. where it would cross a tributary to Hay Lake (see Map Volume, Map 58). In the NE of Section 23, T. 45 N., R. 70 W. Alternative C would cross Alternative B running parallel on the east side for about 2 miles. In the south half of Section 2, T. 45 N., R. 70 W. Alternative C would cross Alternative B and parallel it on the west side for about 1.5 miles before turning to the northwest in Section 35, T. 46 N., R. 70 W.

In Section 8, T. 46 N., R. 70 W. a spur would be constructed to Coal Creek Mine (see Map Volume, Map 60) in the same location as Alternative B. In the NW of Section 31, T. 47 N., R. 70 W. a spur would originate and follow the same route around Saddle Horse Butte to the Cordero Mine as described for Alternative B (see Map Volume, Map 61).

Alternative C would continue north approximately 0.3 miles to the Belle Fourche River crossing in the NW of Section 31, T. 47 N., R. 70 W. (see Map Volume, Map 61). About 2.2 miles north of the Belle Fourche crossing Alternative C would cross Kicken Draw and one of its tributaries in the SE of Section 13, T. 47 N., R. 71 W. Approximately 1.8 miles north of the Kicken Draw crossing a spur would be constructed to the Rojo Mine (see Map Volume, Map 62). Alternative C would cross the east side of Alternative B about 0.5 miles north of the Rojo Mine Spur. About 1 mile north of the Rojo Mine Spur Alternative C would meet again with Alternative B and the 2 alternatives would parallel each other to the Belle Ayr and Caballo Mines (see Map Volume, Map 63).

2.2.3.2 Alternative C Land Ownership. Like Alternative B the majority of the lands (about 80 percent) which would be crossed by Alternative C are private. A summary of land ownership for this alternative is provided in Table 2-2. Most of the Federal lands which would be crossed by this alternative are NFS lands which are associated with BGNG in South Dakota and TBNG in Wyoming. A general land ownership map is provided on Figure 2-1. More detailed land ownership mapping is provided in the Map Volume.

Bureau of Land Management. In South Dakota Alternative C would cross 3.4 miles of public lands. These lands are scattered along the route and are small, isolated parcels. The first parcel which would be crossed consists of approximately 80 acres and is located in Section 19, T. 1 N., R. 15 E. in Pennington County between Wall and Wasta south of I-90, DM&E's existing main line and Bull Creek (see Map Volume, Map 3) and east of Jensen Road. Another parcel of public lands would be crossed about 1.4 miles southeast of Wasta in Section 10, T. 1 N., R. 14 E. This 160-acre parcel is located about 0.4 miles south of I-90 (see Map Volume, Map 4).

A 200-acre public land parcel would be crossed just south of the proposed Boxelder Creek crossing in Section 31, T. 1 N., R. 14 E. on the north end of Brennan Flat (see Map Volume, Map 5). This crossing would occur about 4.7 miles south of Wasta in Pennington County. This parcel includes a portion of the Cheyenne River which is located approximately 1,000 feet east of the Alternative C route through this parcel. South of Holcomb Flat a public

land parcel would be crossed in Section 1, T. 2 S., R. 12 E. (see Map Volume, Map 8). This parcel would be crossed about 2.5 miles east of the alternative's proposed crossing of State Highway 44 and about 0.5 miles east of the confluence of Rapid Creek with the Cheyenne River. A portion of this parcel is located in the Cheyenne River flood plain.

A 40-acre public land parcel would be crossed about 0.1 miles south of the crossing of State Highway 44 in Section 3, T. 2 S., R. 12 E. in Pennington County (see Map Volume, Map 9). This parcel is located southeast of the intersection of Creston Road and State Highway 44 and northeast of Alternative C's intersection with the Old Milwaukee right-of-way.

About 5 miles southeast of Edgemont public lands would be crossed in Sections 15 and 22, T. 9 S., R. 3 E. (see Map Volume, Map 29). A 40-acre public land parcel would also be crossed about 3.1 miles northwest of Edgemont within the BNSF corridor in the SE of Section 22, T. 8 S., R. 2 E. Alternative C would cross a 120-acre parcel of public lands in the south half of Section 17, T. 7 S., R. 1 E. about 450 feet west of the Beaver Creek crossing (see Map Volume, Map 35). These crossings would occur in Fall River County.

In Wyoming Alternative C would cross 1.5 miles of public lands. The first crossing would be in Niobrara County where Alternative C would cross a 120-acre parcel of public lands south of Bobcat Creek in the NW of Section 7, T. 40 N., R. 61 W. (see Map Volume, Map 37). The second public land parcel which would be crossed by Alternative C in Wyoming is in Section 4, T. 40 N., R. 62 W. and Section 32, T. 41 N., R. 62 W. just north of Alkali Creek in northern Niobrara County. This parcel is located about 4.5 miles southeast of Morrisey (see Map Volume, Map 38).

The final public land parcel which would be crossed by Alternative C is a 40-acre parcel located in the SW of Section 26, T. 46 N., R. 70 W. (see Map Volume, Map 59). This public land parcel is the only one which would be crossed by Alternative C which is managed by the Buffalo Field Office. The parcel is located south of the Belle Fourche River crossing in Campbell County.

Forest Service. Alternative C was partially developed to minimize/eliminate potential impacts to RARE II and inventoried roadless areas on BGNG (see Chapter 3). This avoidance was achieved by routing the alternative to the north and west up Battle Creek and away from the Cheyenne River near Red Shirt. Consequently, this alternative would reduce the amount of NFS lands crossed by over 10 miles.

**Table 2-2
Summary of Land Ownership (in Miles) for Alternative C**

Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.4	2.4	1.5	1.2	4.9	1.8
Forest Service	6.1	4.3	32.8	25.0	38.9	14.2
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	131.0	91.8	87.3	66.5	218.3	79.7
Total	142.6	100	131.2	100	273.8	100

Buffalo Gap National Grassland. Alternative C would cross 6.1 miles of NFS lands on BGNG. These lands are primarily located in Custer and Pennington counties between U.S. Highway 44 and Oral. The first parcels which would be crossed are located in Pennington County south of Rapid Creek and U.S. Highway 44, east of Creston and directly north of the Pennington-Custer County line (see Map Volume, Map 9). These parcels are located in Sections 9, 17, and 20, T. 2 S., R. 12 E. Alternative C would follow the abandoned Old Milwaukee across NFS lands in Section 9.⁵

A second parcel of NFS lands would be crossed just south of the Pennington-Custer County line in the Spring Creek drainage in Section 1, T. 3 S., R. 11 E. and Section 6, T. 3 S., R. 12 E. (see Map Volume, Map 10). A 2,700-acre parcel would be crossed in Section 19, T. 3 S., R. 11 E. and Sections 24 and 26, T. 3 S., R. 10 E. (see Map Volume, Map 12) in Custer County. This parcel is about 3 miles west of the Spring Creek Road crossing. About 3 miles northeast of the Dry Creek crossing Alternative C would cross the northwest corner of a 38,000-acre tract of NFS lands in Section 4, T. 4 S., R. 9 E. (see Map Volume, Map 14). Alternative C would also cross through a 720-acre parcel of NFS land in Section 19, T. 5 S., R. 9 E. about 1.5 miles southeast of South Fork French Creek (see Map Volume, Map 17). The next crossing of NFS lands by Alternative C would be in Section 31, T. 5 S., R. 9 E. about 2 miles west of the Cheyenne River (see Map Volume, Map 18) and 2 to 3 miles north of the crossing of the Cottonwood Cutoff Road.

Alternative C avoids NFS lands through the remainder of its route through South Dakota. However, the alternative does approach within 0.25 miles of NFS lands in the upper reaches of Hay Canyon north of Smithwick (see Map Volume, Map 22).

⁵ The analysis assumes that disturbance adjacent to the Old Milwaukee Railroad would occur on NFS lands. However, the actual Old Milwaukee Railroad right-of-way is owned by the State of South Dakota. If this alternative is constructed entirely within the Old Milwaukee right-of-way NFS lands would not be affected.

Thunder Basin National Grassland. Alternative C would cross 32.8 miles on NFS lands on TBNG. No NFS lands would be crossed in Niobrara County. Alternative C would first enter NFS lands on TBNG about 3.1 miles west of Morrisey and south of the Cheyenne River Road in Weston County (see Map Volume, Map 40). These lands are located in the headwaters of Coyote Creek and include Sections 9, 8, 17, and 18, T. 41 N., R. 63 W. and the east half of Section 10, T. 41 N., R. 64 W. North of Grieves Road, in the Wildcat Creek drainage, Alternative C would cross NFS lands in Sections 35, 26, 27, and 22, T. 42 N., R. 65 W. NFS lands, immediately west of Dull Center Road, would be crossed by Alternative C in Sections 23 and 24, T. 42 N., R. 66 W. (see Map Volume, Map 43).

North of Piney Canyon Road in Weston County Alternative C would cross NFS lands in Sections 1, 2, 3, and 4, T. 42 N., R. 68 W. (see Map Volume, Map 46). The crossing would occur about 0.7 miles south of Little Thunder Creek. Immediately east of the Weston-Campbell County line Alternative C would cross through NFS lands in Section 31, T. 43 N., R. 68 W. (see Map Volume, Map 47). East of the T Alternative C would cross through NFS land in Sections 33 and 34, T. 43 N., R. 96 W. (see Map Volume, Map 48) in the Little Thunder Creek drainage.

The majority of the southern leg of Alternative C is routed across NFS lands. The following sections contain Alternative C crossings of NFS lands in Campbell County: Sections 29, 30, 31, and 32, T. 43 N., R. 69 W.; Sections 6, 18, 19, 30, 29, and 32, T. 42 N., R. 69 W.; Sections 5, 8, 17, 21, 20, and 29, T. 41 N., R. 69 W.; and Sections 11 and 12, T. 42 N., R. 70 W. The southern leg of Alternative C would cross NFS lands in Converse County in the following sections: Sections 30 and 31, T. 41 N., R. 69 W.; Section 35, T. 41 N., R. 70 W.; Section 6, T. 40 N., R. 70 W.; and Sections 1 and 12, T. 40 N., R. 71 W. (see Map Volume, Maps 48 through 54).

About 2.2 miles northwest of the T the northern leg of Alternative C would cross a 40-acre parcel of NFS land in the SW of Section 24, T. 43 N., R. 70 W. Approximately 2.7 miles northwest of the T the northern leg would cross

a 1,800-acre parcel of NFS land in Sections 11, 12, 14 and 23, T. 43 N., R. 70 W. (see Map Volume, Map 55). Also in Campbell County Alternative C would cross the northwest corner of a 500-acre parcel of NFS land in Section 2, T. 44 N., R. 70 W. (see Map Volume, Map 57). This crossing would be approximately 1.5 miles northeast of the Keeline Road crossing.

State of South Dakota. A total of 2.1 miles of land owned by the state of South Dakota would be crossed by Alternative C. The first crossing of state land would occur in the southern half of Section 6, T. 1 S., R. 14 E. in Pennington County on the eastern edge of Brennan Flat (see Map Volume, Map 6). The parcel is located about 1 mile south of the Boxelder Creek crossing. A second parcel would be crossed directly north of the East French Creek Road crossing in Section 36, T. 4 S., R. 8 E. This parcel is located in Custer County about 0.6 miles north of the French Creek crossing (see Map Volume, Map 16).

In Fall River County state lands would be crossed adjacent to Plum Creek crossing. The northeast corner of a 320-acre parcel of state land would be crossed in Section 36, T. 9 S., R. 3 E. (see Map Volume, Map 28). The next crossing in Fall River County would be a small 80-acre parcel of state land in Section 8, T. 9 S., R. 3 E. about 1.2 miles west of the Cheyenne River (see Map Volume, Map 30) and about 2 miles southeast of Edgemont. The most western crossing of state lands in South Dakota would be in Section 16, T. 7 S., R. 1 E. about 0.15 miles west of the Beaver Creek crossing and north of the Cheyenne River (see Map Volume, Map 35).

State of Wyoming. A total of 9.6 miles of lands owned by the State of Wyoming would be crossed by Alternative C. The first crossing would be just 0.5 miles west of the South Dakota-Wyoming State line in Section 16, T. 40 N., R. 60 W. (see Map Volume, Map 35). This parcel is in Niobrara County on the north side of the Cheyenne River but south of Twentyone Divide and east of the confluence of Twentyone Draw and the Cheyenne River. The area between Robbers Roost Creek and State Highway 18 in Niobrara County is state-owned lands. The state-owned parcels between the highway and the creek include the SW of Section 9 and Section 16, T. 40 N., R. 61 W. (see Map Volume, Map 36). Two miles west of Morrissy Alternative C would cross state-owned land in Section 16, T. 41 N., R. 63 W. This section is located in Weston County and south of the Cheyenne River Road (see Map Volume, Map 40).

State-owned lands would be crossed north of Grieves Road in the Wildcat Creek drainage. This parcel (Section 36, T. 42 N., R. 65 W.) is located approximately 0.6 miles northeast of "the Nose" in Weston County (see Map Volume, Maps 41 and 42). The next state-owned parcel that Alternative C would cross would be Section 16, T. 42

N., R. 66 W. This section is located in the Black Thunder Creek drainage near the School Draw confluence in Weston County about 0.3 miles north of Thunder Creek (see Map Volume, Map 43).

In Campbell County state-owned lands would be crossed about 3 miles east of the T in Section 36, T. 43 N., R. 69 W. (see Map Volume, Map 47) in the Little Thunder Creek drainage. The next crossing of state-owned land would be at the T of Alternative C in Sections 33, 28, and 29, T. 43 N., R. 69 W. (see Map Volume, Map 48). These parcels are located in the Little Thunder Creek drainage.

No state lands would be crossed by Alternative C on the southern leg. Section 36, T. 45 N., R. 70 W. is a state-owned section that would be crossed by the northern leg about 2 miles northeast of the Keeline Road crossing. About 0.5 miles southeast of the end of the spur to the Coal Creek Mine Alternative C would cross state-owned land in Section 16, T. 46 N., R. 70 W. (see Map Volume, Map 60). Also, the spur to the Cordero Mine would terminate on state-owned lands in Section 36, T. 47 N., R. 71 W. (see Map Volume, Map 61). This section is just south of the Belle Fourche River and west of Saddle Horse Butte in Campbell County. Finally, the north end of the northern leg, including the spur to the Belle Ayr Mine, would cross through a small portion of a state-owned section in Section 36, T. 48 N., R. 71 W. (see Map Volume, Map 63). This section is crossed by Caballo Creek.

Angostura Unit. Approximately 3.1 miles of Alternative C would cross through the Angostura Unit. All lands which would be crossed within the unit are privately-owned.

2.2.3.3. Alternative C Route Variations. During coordination and field inspections with Federal and state agencies it was suggested that 3 portions of Alternative C could result in unacceptable and perhaps irreplaceable impacts to wetland/riparian areas and important wildlife habitats in South Dakota. These 3 areas included:

- Cheyenne River pinch points on the SMS Ranch in Pennington County east of Holcomb Flats;
- Spring Creek drainage in Custer County west of Phiney Flat; and
- Hay Canyon in Fall River County northeast of Smithwick.

As a result of coordination with the agencies DM&E reevaluated the alignment for Alternative C to determine if there were variations in the route which were economically and technically feasible and which reduced impacts to wetland/riparian areas and wildlife habitats. DM&E was successful in identifying route variations which would avoid much of the impact within Spring Creek and

Hay Canyon. However, they could not identify an economically and technically feasible alternative that avoided the Cheyenne River pinch points on the SMS Ranch.

Two route variations are discussed below. The Phiney Flat Route Variation would avoid construction within the Spring Creek drainage while the W G Flat Route Variation would avoid construction within Hay Canyon. Figure 2-1 shows the general location of the route variations. More detailed maps are provided in the Map Volume.

Phiney Flat Route Variation. The Alternative C alignment through the Spring Creek drainage is shown in the Map Volume on Maps 10 and 11. This route variation would avoid construction within the Spring Creek drainage by routing the railroad onto Phiney Flat generally following the Spring Creek Road. Table 2-3 shows land ownership for Alternative C with the Phiney Flat Route Variation. The route variation would increase the length of Alternative C by about 0.8 miles.

The Phiney Flat Route Variation would deviate from Alternative C beginning in the SE of Section 17, T. 2 S., R. 12 E. in Pennington County just west of Creston Road (see Map Volume, Map 9). The variation would proceed south crossing Creston Road and Spring Creek in the SE of Section 20, T. 2 S., R. 12 E. South of Spring Creek the route variation would cross from Pennington into Custer County. On the east side of Spring Creek and Spring Creek Road the variation would proceed up an unnamed draw to the top of Phiney Flat (see Map Volume, Map 10). In Section 32, T. 2 S., R. 12 E. the variation would be located west of a small impoundment before turning to the southwest and running just east of Spring Creek Road in the NE of Section 5, T. 3 S., R. 12 E. (see Map Volume, Map 10). The variation would proceed south and then southwest across the top of Phiney Flat crossing River Road in the SW of Section 23, T. 3 S., R. 11 E. (see Map Volume, Map 11). In the middle of Section 23 the variation would turn to the west and cross the southern half of Sections 21 and 22 and the north half of Section 29, T. 3 S., R. 11 E. Spring Creek would be crossed in the SE of Section 21, T. 3 S., R. 11 E. The route variation would rejoin Alternative C in the NE of Section 29, T. 3 S., R. 11 E. (see Map Volume, Map 12).

The beginning of the route variation in Sections 17 and 20, T. 2 S., R. 12 E. (see Map Volume, Map 9) would be constructed on NFS lands. All other lands which would be crossed by the Phiney Flat Route Variation are privately-owned. On top of Phiney Flat the route variation would pass just west of NFS lands in the NW of Section 8, T. 3 S., R. 12 E. directly adjacent to Spring Creek Road. This route variation would not affect lands within the Angostura Unit.

W G Flat Route Variation. This route variation was designed to avoid Hay Canyon. The Alternative C route through Hay Canyon is shown in the Map Volume on Maps 20 through 22. Land ownership for Alternative C with the W G Flat Route Variation is provided on Table 2-4. Alternative C with the W G Flat Route Variation would be 1.2 miles shorter than Alternative C.

The W G Flat Route Variation would deviate from Alternative C in the SE of Section 25, T. 6 S., R. 8 E. in Custer County about 1.3 miles north of the Custer-Fall River County line (see Map Volume, Map 19). The origin would be located on the southern edge of Harrison Flat. From the origin the route variation would turn to the southwest and cross Lame Johnny Creek in the SW of Section 35, T. 6 S., R. 8 E. (see Map Volume, Map 70). The variation would cross from Custer into Fall River County in the NW of Section 2, T. 7 S., R. 8 E. and generally follow the route for Alternative B through the NE of Section 3, T. 7 S., R. 8 E. In the middle of Section 3 the route variation would deviate from the Alternative B route and turn south and cross the Cheyenne River in the NW of Section 10, T. 7 S., R. 8 E. (see Map Volume, Map 70). On the south side of the river the route variation would continue south then southwest across the Cheyenne River flood plain and climb up onto W G Flats in the NE of Section 16, T. 7 S., R. 8 E. Once on W G Flat the route variation would proceed south on the ridge line between W G Draw and Iron Draw (see Map Volume, Map 124). The route continues south on W G Flat running about 4 miles east of Oral. In the NE of Section 19, T. 8 S., R. 8 E. the route variation would cross the headwaters of Plumb Creek (see Map Volume, Map 22). The route follows the ridge line between Plumb Creek and the West Fork of Hay Canyon until it rejoins Alternative C in the SW of Section 31, T. 8 S., R. 8 E. just west of Smithwick (see Map Volume, Map 23).

Except for a portion of the north half of Section 10, T. 7 S., R. 8 E. which is public land (see Map Volume, Map 70), the entire route variation would cross only privately-owned lands. Approximately 7.1 miles of the Angostura Unit would be crossed by this route variation including 0.1 miles of public lands and 7 miles of private lands.

2.2.4 Alternative D. During public scoping for this project a number of comments were received that suggested DM&E construct the new railroad using existing railroad corridors in South Dakota and Wyoming. DM&E has stated that a route using existing railroad corridors is neither economically or technically feasible. If this alternative was selected by the agencies DM&E has stated it would abandon the project. Nonetheless, based on comments received from the public, the agencies have decided to evaluate in the EIS whether environmental benefits would be realized by using existing railroad corridors to implement the project.

Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.4	2.4	1.5	1.2	4.9	1.8
Forest Service	5.3	3.7	32.8	25.0	38.1	13.8
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	132.6	92.4	87.3	66.5	219.9	80.1
Total	143.4	100	131.2	100	274.6	100

Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	3.5	2.5	1.5	1.2	5.0	1.8
Forest Service	6.1	4.3	32.8	25.0	38.9	14.3
State	2.1	1.5	9.6	7.3	11.7	4.3
Private	129.7	91.7	87.3	66.5	217.0	79.6
Total	141.4	100	131.2	100	272.6	100

In reviewing this section it is important to remember that the route selected for analysis as Alternative D was not provided by DM&E. Rather, the alternative was defined by the Forest Service. DM&E has not been able to identify an alternative using existing corridors that they believe is technically and economically feasible.

Instead of proceeding along the Cheyenne River valley toward Smithwick Alternative D would follow DM&E's existing main line from Wall to Rapid City. In Rapid City the alternative would turn south and follow the existing Black Hills Subdivision Branch Line to Smithwick. From Smithwick to the Wyoming border Alternative D would follow the same route as described for Alternative C in Section 2.2.3.1. However, instead of turning to the west into Wyoming near Burdock as described for Alternatives B and C, Alternative D would continue parallel to the BNSF railroad corridor through Newcastle and Moorcroft and on to Donkey Creek east of Gillette. At Donkey Creek the alternative would turn south and proceed to each of the SPRB mines using essentially the same route described for Alternative C.

It is generally agreed by the agencies that it would not be prudent to construct a heavy haul railroad through Rapid City. However, because a viable option around the city has not been identified, Alternative D utilizes the route of DM&E's existing main line and Black Hills Subdivision Branch Line, both of which pass directly through Rapid City. Similarly, it is recognized that it would be difficult to construct and operate a second heavy haul railroad directly adjacent to but outside of BNSF's existing railroad right-of-way through Upton, Osage, Moorcroft and

Newcastle, Wyoming. If Alternative D was selected it would be likely that new routes around these communities would be required. However, because of the lack of identified route variations, Alternative D assumes construction parallel to BNSF's existing right-of-way through these communities.

2.2.4.1 Alternative D Route. This alternative would originate at the same point as Alternatives B and C. However, instead of proceeding north and west around Wall, this alternative would utilize DM&E's existing main line alignment which passes through the Town of Wall. West of the Wall Pedro Road crossing, the existing main line turns south and passes just north of Creighton Road and west of 1st Street. South of 1st Street the existing main line roughly parallels Main Street through town (see Map Volume, Map 1). The existing main line crosses 4th Avenue just west of Main Street. South of 4th Avenue the main line is aligned between Main Street and Crown Street directly west of Wall Drug. Loop 90 is crossed by the main line about 0.2 miles west of Main Street. South of the Loop 90 crossing, the main line crosses I-90 in the NE of Section 6, T. 1 S., R. 16 E.

South of the I-90 crossing the main line turns west and then northwest as it proceeds up the Bull Creek drainage toward Wasta (see Map Volume, Map 1). In the NE of Section 2, T. 1 S., R. 15 E. the existing main line would be crossed by Alternatives B and C. The existing main line continues northwest up the Bull Creek drainage making a number of crossings of the creek. In Section 20, T. 1 N., R. 15 E. the main line is aligned adjacent to I-90 (see Map Volume, Map 2). The main line runs

generally parallel to the interstate to the NW of Section 12, T. 1 N., R. 14 E. where it crosses (see Map Volume, Map 3). About 1 mile northwest of the I-90 crossing the main line turns to the west and crosses the Cheyenne River in the NW of Section 2, T. 1 N., R. 14 E. The main line continues west and parallels the north bank of the Cheyenne River through the NW of Section 3 before turning southwest still parallel to the river through the NE of Section 4, T. 1 N., R. 14 E. (see Map Volume, Map 4). In this area the main line is aligned between the river and Elm Springs Road and is northeast of Wasta.

As can be seen in the Map Volume on Map 4, DM&E's existing main line passes through the southern edge of the Town of Wasta - generally between the town and the Cheyenne River. The existing alignment is located on the southeast side of Baseline Road. I-90 is again crossed just east of the Wasta interchange. South of Wasta the main line continues in a southwestern direction between Baseline Road and the Cheyenne River flood plain. In the SE of Section 8, T. 1 N., R. 14 E. the main line is directly adjacent to the Cheyenne River (see Map Volume, Map 4). The main line continues on the western side of the Cheyenne River flood plain to the NE of Section 19, T. 1 N., R. 14 E. where Baseline Road is crossed. South of the crossing the main line turns to the south and continues along the western edge of the Cheyenne River flood plain to Boxelder Creek in the SE of Section 30, T. 1 N., R. 14 E. Near the confluence of the creek with the Cheyenne River the main line turns to the west, leaving the Cheyenne River flood plain and proceeds up the Boxelder Creek drainage.

Boxelder Creek is crossed in the NW of Section 31, T. 1 N., R. 14 E. and in the NW of Section 36, T. 1 N., R. 13 E. (see Map Volume, Maps 4 and 83). The main line continues to the west on the north side of Boxelder Creek to Owanka (see Map Volume, Map 83). The main line passes directly south of Owanka and crosses Owanka Road in the NW of Section 29, T. 1 N., R. 13 E. Boxelder Creek is again crossed on the west side of Owanka and the main line is aligned directly adjacent to the creek through the NE of Section 25, T. 1 N., R. 12 E. near the Owanka Cemetery (see Map Volume, Map 84). The main line turns to the northwest and continues on the south side of Boxelder Creek through the SE of Section 24, T. 1 N., R. 12 E. The creek is crossed by the main line in the NW of Section 24 and the main line is aligned directly adjacent to the north side of the creek through the NE of Section 25 and the SW of Section 14, T. 1 N., R. 12 E. The main line crosses back and forth across the creek in Sections 15 and 16, T. 1 N., R. 12 E. (see Map Volume, Map 84).

In the SW of Section 6, T. 1 N., R. 12 E. the main line crosses Sharpe Road. At this point DM&E's main line is approximately 3 miles south of I-90 Exit 84 (see Map Volume, Map 85). The main line continues to the west on

the north side of the Boxelder Creek drainage to New Underwood, South Dakota. In the north half of Section 2, T. 1 N., R. 11 E. the main line crosses Libertine Road approximately 1.5 miles south of I-90. Knuppe Road is crossed about 1 mile east of New Underwood. In the NE of Section 31, T. 2 N., R. 11 E. the existing main line passes south of New Underwood. A Avenue is crossed on the south side of town and the main line runs between Elm Street and Orin Avenue and Boxelder Creek (see Map Volume, Map 86).

After passing south of New Underwood the main line continues to the west in the Boxelder Creek drainage crossing the creek in the NW of Section 31, T. 2 N., R. 11 E. and in the NE of Sections 35 and 34, T. 2 N., R. 10 E. At this point the main line is about 0.5 miles south of I-90 (see Map Volume, Map 87). Boxelder Creek is again crossed in the SW of Section 28, T. 2 N., R. 10 E. Spevak Road is crossed in the SW of Section 29, T. 2 N., R. 10 E. and McCain School Road is crossed in the SW of Section 30, T. 2 N., R. 10 E. Milke Road is crossed in the NW of Section 27, T. 2 N., R. 9 E. about 1.5 miles east of Box Elder, South Dakota. On the west side of Milke Road the main line is aligned directly adjacent to and on the south side of Old Highway 14-16 and crosses Spruce Drive and Cottonwood Drive on the east side of Box Elder. The main line crosses through Box Elder on the south side of Old Highway 14-16 and on the north side of Front Street. In town the main line crosses Oak Street and Cedar Street. West of town the main line crosses South Gate Drive and Cobble Road.

About 2 miles west of Box Elder the main line turns south and begins to parallel I-90 on the south side (see Map Volume, Map 89). Boxelder Creek is crossed in the SW of Section 23, T. 2 N., R. 8 E. The main line proceeds in a southwest direction leaving the Boxelder Creek drainage and crossing Elk Creek Road in the SW of Section 27, T. 2 N., R. 8 E. about 0.2 miles south of I-90 Exit 61. West of the Elk Creek Road crossing the main line continues west directly south of Elgin Street and crosses U.S. Highway 16 as the existing main line enters Rapid City (see Map Volume, Map 90).

The main line passes through Rapid City following the route shown in the Map Volume on Map 90. On the west side of U.S. Highway 16 the main line crosses Century Road and turns to the southwest. The main line passes north of Pheasant Drive and Meadowlark Road and crosses Lacrosse Street north of Monroe Street. The main line continues in a southwest direction through Rapid City crossing Milwaukee Street north of North Street and New York Street west of East Boulevard. The main line crosses Omaha Street on the east side of the downtown area and east of 5th Street.

At this point Alternative D departs the main line and follows DM&E's existing Black Hills Subdivision Branch

Line to Smithwick. On the south side of Omaha Street the branch line crosses 2nd and 1st streets and then East Boulevard. The crossings occur between Main Street and Omaha Street. On the east side of East Boulevard the branch line turns to the southwest and crosses Maple Street directly north of Main Street. On the east side of Maple Street the branch line parallels Main Street on the north side and crosses Steele Avenue. The branch line continues southwest between Saint Joseph Street and Cherry Avenue to the crossing of Saint Patrick Street. South of Saint Patrick Street the branch line is aligned between State Highway 79 and the service road to the Campbell Street crossing. Once across Campbell Street the branch line turns more to the south and follows State Highway 79 to the east to the intersection with County Road 217 where the branch line turns to the southeast and parallels the north side of the county road and leaves the Rapid City area.

The branch line follows County Road 217 to the NW of Section 28, T. 1 N., R. 8 E. where the branch line turns to the southeast and enters the Dry Creek drainage crossing Dry Creek in the SW of Section 27, T. 1 N., R. 8 E. (see Map Volume, Map 91). In the SE of Section 27 the branch line crosses Warren Lamb Road. South of the crossing the branch line continues to the south running about 1 mile east of Old Folsom Road. In the NW of Section 2, T. 1 S., R. 8 E. the branch line departs the Dry Creek drainage and turns south and then southwest crossing Antelope Creek Road in the SW of Section 11, T. 1 S., R. 8 E. (see Map Volume, Map 92). In the SE of Section 15, T. 1 S., R. 8 E., south of Coyote Draw, the branch line converges with Old Folsom Road. The branch line follows the east side of Old Folsom Road through Section 22, T. 1 S., R. 8 E. before turning west and crossing Spring Creek in the NW of Section 27, T. 1 S., R. 8 E.

Once across Spring Creek the branch line turns southeast and then southwest and proceeds toward Ajax, South Dakota (see Map Volume, Map 93). The branch line passes directly east of Ajax about 1 mile east of State Highway 79. Daughenbaugh Road is crossed at Ajax. The branch line proceeds in a southwest direction south of Ajax approaching within approximately 0.2 miles of State Highway 79 in the NW of Section 17, T. 2 S., R. 8 E. In the SW of Section 8, T. 2 S., R. 8 E. the branch line enters the headwaters of Billover Creek and follows the drainage south to Hermosa, South Dakota crossing from Pennington into Custer County.

The branch line passes on the east side of Hermosa (see Map Volume, Map 94). State Highway 40, the major thoroughfare through Hermosa, is crossed just east of 2nd Street. One mile south of Hermosa the branch line crosses State Highway 36 at its intersection with State Highway 79 (see Map Volume, Map 94). From this point the branch line begins to follow State Highway 79 to the

south for about 3 miles. In the SW of Section 18, T. 3 S., R. 8 E., just north of the County Road 7 crossing, the branch line turns to the southeast and leaves State Highway 79. L7 Draw is crossed in the NE of Section 29, T. 3 S., R. 8 E. and Dry Creek is crossed in the NE of Section 7, T. 4 S., R. 8 E. South of Dry Creek, County Road 18 is crossed in the SW of Section 7. About 1 mile south of County Road 18 the branch line turns to the southwest and passes through Fairburn, South Dakota on the north side of 1st Street. Just west of Fairburn the branch line crosses County Road 719.

On the west side of Fairburn the branch line enters the French Creek drainage and proceeds to the southwest on the north side of the creek to the center of Section 26, T. 4 S., R. 7 E. where the branch line turns to the south and leaves the drainage. South of French Creek the branch line intersects and begins to parallel State Highway 79 in the SW of Section 27, T. 4 S., R. 7 E. The branch line follows the highway for approximately 1.5 miles to the southwest. In the NE of Section 4, T. 5 S., R. 7 E. the branch line turns to the south and leaves State Highway 79. The branch line enters the Lame Johnny Creek drainage in the NW of Section 22, T. 5 S., R. 7 E. and follows the creek to the south making a number of crossings (see Map Volume, Map 98). In the SE of Section 3, T. 6 S., R. 7 E. the branch line crosses Dry Creek about 0.1 miles west of its confluence with Lame Johnny Creek. South of the Dry Creek crossing the branch line runs adjacent to County Road 17 through Sections 10 and 16, T. 6 S., R. 7 E. In the NW of Section 21, T. 6 S., R. 7 E. the branch line leaves the county road and proceeds south to Buffalo Gap, South Dakota (see Map Volume, Map 99). The branch line is aligned on the east side of Buffalo Gap between Beaver Creek and First Street. Beaver Creek is crossed on the north side of town. The branch line crosses Main Street just east of First Street. South of Main Street the branch line follows County Road 101 to the south in the Beaver Creek drainage. The branch line runs on the west side of Beaver Creek between County Roads 6291 and 17 to the NW of Section 16, T. 7 S., R. 7 E. where the branch line crosses Beaver Creek (see Map Volume, Map 100). As the branch line continues south it crosses Beaver Creek a number of times in Sections 16 and 22, T. 7 S., R. 7 E.

In the SE of Section 22, T. 7 S., R. 7 E. the branch line turns to the south and proceeds toward Oral. The branch line route from Oral to Smithwick is precisely the same as that described for Alternative B in Section 2.2.2.1 (see Map Volume, Map 72). Beginning at Smithwick (see Map Volume, Map 73) Alternative D would follow the route for Alternative C described in Section 2.2.3.1 to the South Dakota-Wyoming State line (see Map Volume, Maps 22 through 34).

Alternative D would again deviate from the Alternative C route beginning in the NE of Section 25, T. 7 S., R. 1 E.

in Fall River County (see Map Volume, Map 34). Rather than turning west at this point up the Cheyenne River, Alternative D would continue parallel to the BNSF and County Road 6463 to the northwest to Burdock. The alternative would cross Pass Creek in the NW of Section 10, T. 7 S., R. 1 E. (see Map Volume, Map 101). About 1.3 miles north of the Pass Creek crossing the alternative would leave Fall River and enter Custer County. In the NE of Section 33, T. 6 S., R. 1 E. the alternative would be about 0.4 miles west of the Black Hills National Forest and west of Beaver Creek. The alternative would continue to the northwest parallel to BNSF and County Road 769 to Dewey, South Dakota. About 2 miles north or Dewey the alternative would enter Weston County, Wyoming (See Map Volume, Map 102). In Wyoming the alternative would proceed next to the BNSF corridor up the Line Creek drainage to the center of Section 28, T. 42 N., R. 60 W. where the alternative turns to the north. In the north half of Section 16, T. 42 N., R. 60 W. the alternative turns to the northwest and continues parallel to the BNSF (see map Volume, Map 103) avoiding steep terrain to the west and the Black Hills National Forest.

In the south half of Section 30, T. 43 N., R. 60 W. the alternative would cross Whoopup Creek and Whoopup Canyon Road (see Map Volume, Map 104). North of Whoopup Canyon Road the alternative converges with Old U.S. Highway 85 on the east side of Stockade Beaver Creek. The alternative parallels the highway and BNSF through Section 13, T. 43 N., R. 61 W. but turns to the north and away from the highway in the SW of Section 12, T. 43 N., R. 61 W. From this point the alternative is routed up the Stockade Beaver Creek drainage crossing the creek in the SW of Section 1, T. 43 N., R. 61 W. (see Map Volume, Map 105). The alternative continues to the north on the west side of Stockade Beaver Creek to Section 15, T. 44 N., R. 61 W. At this point the creek turns to the east and the alternative continues next to the BNSF corridor to the north and crosses Old U.S. Highway 85 in the NE of Section 10, T. 44 N., R. 61 W. (see Map Volume, Map 106). The alternative follows Old U.S. Highway 85 and turns to the northwest as it approaches Newcastle. East of Newcastle the alternative crosses U.S. Highway 85 just south of Summit Avenue. West of the highway crossing the alternative would cross Faye Avenue and Divide Avenue north of Sheridan Street and adjacent to BNSF. West of Divide Avenue the alternative turns to the northwest and crosses the Highway 16 bypass east of Douglas Street. Main Street would be crossed just west of South Railway Avenue. North of Main Street the alternative would pass east of Pine Street before crossing Little Oil Creek and turning to the west, south of Cambria Street. The alternative would continue west parallel to BNSF and between Cambria Street and West Railroad Street. On the west side of Newcastle the alternative is located between Sunset Street and North Railroad Street. The alternative runs north of Main Street and U.S. Highway 16 as it leaves Newcastle.

West of Newcastle the alternative proceeds to the northwest roughly parallel to and on the north side of U.S. Highway 16 (see Map Volume, Map 108). In the NE of Section 22, T. 45 N., R. 62 W. the alternative would cross Fourmile Creek and Oil Creek would be crossed in the SW of Section 16, T. 45 N., R. 62 W. The alternative would continue northwest adjacent to BNSF and U.S. Highway 16 past the Newcastle Airport in Section 9, T. 45 N., R. 62 W. Beginning in Section 6, T. 45 N., R. 62 W. the alternative would follow BNSF up the Skull Creek drainage passing east of the Pedro Oil Field (see Map Volume, Map 109). In Section 9, T. 46 N., R. 63 W. the alternative would follow the BNSF through Osage (see Map Volume, Map 110). The alternative would be aligned to the east of town between Taylor Avenue and Nefsey Avenue. Skull Creek Road would be crossed in the middle of Osage. North of Skull Creek Road Alternative D would follow the BNSF on the east side of Nefsey Avenue. North of Osage the alternative turns to the northwest crossing the headwaters of Turner Creek in the NW of Section 4, T. 46 N., R. 63 W. (see Map Volume, Map 110).

Northwest of Osage the alternative is routed up Turner Creek and crosses Iron Creek in the NE of Section 25, T. 47 N., R. 64 W. Pump Creek would be crossed in the NW of Section 23, T. 47 N., R. 64 W. (see Map Volume, Map 111). Jerome Creek and Spring Creek would be crossed upstream of their confluences with Pine Creek northwest of Pine Ridge and southeast of Upton. U.S. Highway 16 would be crossed by Alternative D in the NE of Section 7, T. 47 N., R. 64 W. about 2.5 miles southeast of Upton (see Map Volume, Map 113). The alternative would cross through Upton adjacent to BNSF on the south side of the town between Second Street and Nester Road. Hay Creek Road would be crossed south of Second Street. Northwest of Hay Creek Road the alternative is aligned between Lincoln Street and First Street. Pine Street would be crossed just north of South Railway Avenue and Iron Creek would be crossed on the northwest side of town.

The alternative continues to the northwest parallel to the south of U.S. Highway 16. In the SW of Section 21, T. 48 N., R. 65 W. the alternative would cross Haul Road. North of the Haul Road crossing the alternative would continue on the south side of U.S. Highway 16, crossing Patrick Creek and Wind Creek before entering Crook County in the SW of Section 33, T. 49 N., R. 66 W. (see Map Volume, Map 116).

Alternative D would continue northwest adjacent to BNSF toward Moorcroft. In the NW of Section 23, T. 49 N., R. 67 W. the alternative would cross Buffalo Creek Road about 1 mile southwest of U.S. Highway 16. In the SE of Section 9, T. 49 N., R. 67 W. the alternative would approach U.S. Highway 16 and run between the highway and Rush Creek. The alternative would continue

northwest up the Rush Creek drainage to Moorcroft (see Map Volume, Map 118). Warbonnet Road would be crossed in the NE of Section 8, T. 49 N., R. 67 W. The alternative would continue toward Moorcroft running between Rush Creek Road and U.S. Highway 16. The alternative would pass south of East Railroad Avenue and cross Bighorn Avenue southeast of town. The alternative would continue west parallel to BNSF on the south side of U.S. Highway 16. In the SE of Section 36, T. 50 N., R. 68 W. Alternative D would be approximately 0.1 miles of the intersection of State Highway 16/14 and I-90 at Exit 153.

West of Moorcroft the alternative is aligned on the south side of I-90 and State Highway 51 (see Map Volume, Map 118). The alternative would cross the Belle Fourche River in the NW of Section 36, T. 50 N., R. 68 W. and Shipwheel Road in the NE of Section 35, T. 50 N., R. 68 W. Both crossings would occur directly adjacent to I-90.

The alternative would enter the Donkey Creek drainage in the NE of Section 35, T. 50 N., R. 68 W. The first crossing of Donkey Creek would occur within this quarter section directly adjacent to and south of I-90. After the Donkey Creek crossing the alternative turns to the west and continues up the Donkey Creek drainage adjacent to the BNSF toward Gillette. The alternative is located on the north side of Donkey Creek and directly south of I-90 to the SW of Section 30, T. 50 N., R. 49 N. where the alternative leaves Crook and enters Campbell County (see Map Volume, Map 119). In Section 27, T. 50 N., R. 69 W. I-90 turns to the northwest and the alternative continues west adjacent to the BNSF and State Highway 51. In the SE of Section 28, T. 50 N., R. 69 W. the alternative would cross Stewart Road and Donkey Creek. On the west side of Donkey Creek the route is aligned on the south side of the creek and north of State Highway 51 toward Rozet, Wyoming.

The alternative would cross Adon Road in the SW of Section 30, T. 50 N., R. 69 W. about 0.1 miles north of Rozet (see Map Volume, Map 120). West of the Adon Road crossing the alternative continues in a western direction and crosses to the south of State Highway 51 in the SW of Section 26, T. 50 N., R. 70 W. The alternative continues west on the south side of State Highway 51 and adjacent to BNSF to the NE of Section 29, T. 50 N., R. 70 W. In this quarter section the BNSF and the Alternative D route would turn to the south and proceed up Dry Donkey Creek on the west side of the Rochelle Hills (see Map Volume, Map 121). The alternative would follow the existing BNSF route up Dry Donkey Creek for about 12 miles to the south to the Belle Ayr Mine (see Map Volume, Map 63). From the Belle Ayr Mine Alternative D would continue to the south providing service to the same mines described for Alternatives B and C. For the northern mines the route varies from that described above for Alternatives B and C. The route to these mines is shown

in th Map Volume on Maps 61 through 63. However, the southern SPRB mines would be serviced by this alternative using the same route described above for Alternative C.

2.2.4.2 Alternative D Land Ownership. Table 2-5 shows land ownership for Alternative D. As can be seen from the table, Alternative D is about 86 miles longer than Alternative C and 70 miles longer than Alternative B. Nearly 90 percent of the route is privately-owned. Crossing of NFS lands would be reduced by over 20 and 10 miles, respectively, when compared with Alternatives B and C.

Bureau of Land Management. Alternative D would cross only 1.3 miles of public lands in South Dakota. No public lands would be crossed on DM&E's existing main line or the Black Hills Subdivision Branch Line. Public lands would be crossed near Edgemont. The first parcel is located in the NW of Section 22, T. 9 S., R. 3 E. (see Map Volume, Map 29) southeast of Edgemont. A second parcel of public lands would be crossed in the SE of Section 22, T. 8 S., R. 2 E. adjacent to the BNSF northwest of Edgemont (see Map Volume, Map 32). A third public land parcel would be crossed just south of the Fall River-Custer County line in the SW of Section 4, T. 7 S., R. 1 E. (see Map Volume, Map 101).

About 1.7 miles of public lands would be crossed in Wyoming. The first parcel is located in the NE of Section 13, T. 43 N., R. 61 W. just east of Stockade Beaver Creek in Weston County (see Map Volume, Map 105). Public lands would also be crossed in the Stockade Beaver Creek drainage in the SW of Section 23, T. 44 N., R. 61 W. (see Map Volume, Map 106). Just after the alternative crosses from Weston into Crook County, public lands would be crossed. These lands are shown in the Map Volume on Map 116 and include the SW of Section 33 and the SE of Section 32, T. 49 N., R. 66 W. A 40-acre parcel of public lands would be crossed in the SE of Section 15, T. 49 N., R. 67 W. in the headwaters of Rush Creek southeast of Moorcroft. A second 40-acre isolated parcel would be crossed in the headwaters of the Timber Creek drainage in the SW of Section 33, T. 49 N., R. 70 W. (see Map Volume, Map 123). Similar to Alternative C this alternative would cross a 40-acre parcel of public lands north of Hay Lakes in Campbell County (see Map Volume, Map 59). The parcel is located in the SW of Section 26, T. 46 N., R. 70 W.

Forest Service. No NFS lands would be crossed by Alternative D on BGNG. However, 26.7 miles would be crossed on TBNG in Wyoming. Alternative D would first cross NFS lands about 1 mile north of Osage (see Map Volume, Maps 110, 111 and 112). These NFS lands include the crossing of Turner Creek, Little Turner Creek, Pump Creek, and Spring Creek south of Upton. This block of NFS lands is located west of Pine Ridge.

**Table 2-5
Summary of Land Ownership (in Miles) for Alternative D**

Land Owner	South Dakota		Wyoming		Total	
	Miles	Percent of State	Miles	Percent of State	Miles	Percent of Total
BLM	1.3	0.7	1.7	0.9	3.0	0.8
Forest Service	0	0	26.7	14.8	26.7	7.4
State	2.0	1.1	8.8	4.9	10.8	3.0
Private	176.0	98.2	143.5	79.4	319.5	88.8
Total	179.3	100	180.7	100	360.0	100

Additional NFS lands would be crossed in northern Weston County in Sections 3, 4 and 12, T. 48 N., R. 66 W., just south of the Patrick Creek crossing and at the West Fork of Wind Creek crossing (see Map Volume, Maps 115 and 116). The remainder of the NFS lands which would be crossed by this alternative are the same as those described for the northern and southern legs of Alternative C in Section 2.2.3.2 above.

State of South Dakota. Alternative D would cross 2 miles of state lands in South Dakota. The first parcel is located on the Black Hills Subdivision Branch Line. The parcel is located about 2 miles north of Buffalo Gap and includes Section 16, T. 6 S., R. 7 E. (see Map Volume, Map 99). A second 160-acre parcel would be crossed about 2 miles south of Buffalo Gap in the Beaver Creek drainage (see Map Volume, Map 100). This parcel includes the NE of Section 8, T. 7 S., R. 7 E. However, DM&E owns the right-of-way through both of these parcels. If construction could be confined entirely to DM&E's property, state lands would not be affected at these locations.

Similar to Alternative C this alternative would cross state lands southeast of Edgemont. The crossings include the east half of Section 36, T. 9 S., R. 3 E. in the Plum Creek drainage and the NE of Section 8 in T. 9 S., R. 3 E. about 2.5 miles southeast of Edgemont (see Map Volume, Maps 28 and 30).

State of Wyoming. Alternative D would cross nearly 9 miles of state-owned lands in Wyoming. The first parcel, Section 16, T. 42 N., R. 60 W., would be crossed in Weston County about 3.5 miles south of the Whoopup Creek crossing (see Map Volume, Map 103). The second parcel includes the crossing of Jerome Creek west of Pine Ridge and southeast of Upton (see Map Volume, Map 112). This parcel includes all of Section 16, T. 47 N., R. 64 W. A parcel of state lands would be crossed in the Rush Creek drainage where the alternative converges with U. S. Highway 16 in the SW of Section 9, T. 49 N., R. 67 W. about 2 miles southeast of Moorcroft. The west side of Moorcroft (Section 36, T. 50 N., R. 68 W.) is also state lands. This parcel includes the crossing of the Belle Fourche River (see Map Volume, Map 118). State lands would be crossed in the Piney Creek drainage in Section

16, T. 48 N., R. 70 W. north of the Belle Ayr Mine (see Map Volume, Map 123). The remainder of the state lands which would be crossed by Alternative D are the same as those described in Section 2.2.3.2 for the northern and southern legs of Alternative C.

Angostura Unit. Approximately 2.6 miles of Alternative D would cross through the unit. Only private lands would be affected by the alternative in the unit.

2.3 Mine Loop Options

2.3.1 North Antelope West Mine Loop Option.

This mine spur option would take off from the southern leg to provide service to the North Antelope and Rochelle mines (see Map Volume, Map 53). The North Antelope West Mine Loop option would depart from Alternative C's south leg in the SW of Section 32, T. 41 N., R. 70 W. This spur would loop north and around to the east paralleling the south side of the existing UP/BNSF mine tracks in the NW of Section 32, T. 41 N., R. 70 W. This loop continues east for about 1.5 miles staying immediately south of the UP/BNSF track and would merge with this track in the NE of Section 33, T. 41 N., R. 70 W. This mine loop option would cross 2.4 miles of private lands.

2.3.2 North Antelope East Mine Loop Option. The exact location of this spur is currently unknown. For purposes of this report it was assumed that the spur would follow existing rail service (see Map Volume, Map 53) up the Porcupine Creek drainage and terminate in the NW of Section 27, T. 41 N., R. 70 W. This mine loop would cross 1.5 miles of private lands.

2.3.3 Black Thunder South Mine Loop Option.

The Black Thunder South Mine Loop would be in the NE of Section 23, T. 43 N., R. 70 W. where it would depart from Alternative C. At this point the loop would curve to the northwest for about 0.5 miles. In the NW of Section 23, T. 43 N., R. 70 W. the loop would proceed in a southwest direction where it would cross State Highway 450 and North Prong Little Thunder Creek. In the NW of Section 27, T. 43 N., R. 70 W. the loop would curve to the northwest and proceed in this direction for approximately

2 miles where it would join the existing load out facilities at the Black Thunder Mine. This mine loop option is DM&E's preferred route. This mine loop would cross 3.1 miles on TBNG, 0.7 miles of State of Wyoming lands and 3.3 miles of private land.

2.3.4 Black Thunder North Mine Loop Option. In the NE of Section 23, T. 43 N., R. 70 W. this mine loop option would turn to the northwest and parallel the north side of North Prong Little Thunder Creek for approximately 1.5 miles to the Black Thunder Mine in Section 17, T. 43 N., R. 70 W. (See Map Volume, Map 14). This option could conflict with the Black Thunder Mine's development plans for their Thunder Cloud lease located on the north side of State Highway 450. This mine loop would cross 3.1 miles on TBNG, 2.7 miles of State of Wyoming land and 1.2 miles of private land.

2.4 Proposed Yard Sites

DM&E has identified 3 yard sites which are essential for efficient operation of Alternative C. Although required, similar yard sites have not been identified for Alternatives B and D. Impacts from yards necessary for operation of Alternatives B and D are not analyzed in this report.

2.4.1 Wall Yard. The proposed location of this 70-acre yard is shown in the Map Volume on Map 1. The yard site is located in Pennington County and extends from the west side of Wall Pedro Road to just north of the proposed crossing of I-90. The yard site is north of the Town of Wall and the Wall Land Field and would be located in Section 31, T. 1 N., R. 16 E. and Sections 35 and 36, T. 1 N., R. 15 E. Only private lands would be affected by this yard.

2.4.2 Edgemont Interchange Yard. The interchange yard would be located in Fall River County northeast of Edgemont (see Map Volume, Map 31). The yard would originate in the NE of Section 31, T. 8 S., R. 3 E. and extend to the northeast adjacent to BNSF to the SW of Section 20, T. 8 S., R. 3 E. The yard would cross Red Canyon Creek south of Bell Ranch. Only private lands would be affected by the 70-acre yard.

2.4.3 Western Yard. An approximately 250-acre yard is proposed for the west end of Alternative C in Wyoming. The yard would straddle the Campbell and Weston County line. The location of the yard is shown in the Map Volume on Map 47. The yard spans (east to west) from Section 4, T. 42 N., R. 68 W. to Section 35, T. 43 N., R. 69 W. and includes approximately 71 acres of NFS lands, 78 acres of state lands and 101 acres of private lands. The yard site is located south of the Little Thunder Creek. Several intermittent tributaries to the creek are located within the yard site including Hansen Draw. The yard site is about 0.5 miles south of State Highway 450.

2.5 Construction

2.5.1 Assumptions Regarding Construction Disturbance. The new railroad would be constructed according to current main line railroad standards and would be comprised of continuously-welded rail on hardwood or concrete ties. Typical cross-sections of the construction and operation rights-of-way are included as Figures 2-2 and 2-3. Figure 2-2 provides a cross section for single track and Figure 2-3 shows how double track for sidings would be configured.

The track would be supported on approximately 12 inches of ballast and 12 inches of sub-ballast. The area disturbed during construction would range from 200 to 1,000 feet in width, depending primarily on the need to cut and fill to obtain the desired grade. An area exceeding 600 feet in width would be rare.

2.5.2 Construction Techniques and Schedule. Construction of the new railroad would be a 3 year project. Assuming regulatory approvals are issued in a timely manner, the work would be initiated in the Spring of 2001 and continue through 2003. Some activities would occur year-round while others would be seasonally restricted by weather.

The first step in construction of the new railroad would be the purchase of the right-of-way or issuance of a right-of-way from the land management agency. Where necessary the right-of-way would be fenced in advance of construction. The major steps in completing construction of the new railroad are as follows:

- establish the Edgemont Interchange Yard to allow a connection with BNSF for delivery of construction materials;
- bridge construction (including highway overpasses, cattle passes, required drainage, etc.);
- construction of railroad grade;
- track construction; and
- clean up and restoration.

The Edgemont Interchange Yard would serve construction activities working in both directions. From this centralized location work crews would proceed both east toward Wall and west toward the SPRB mines in Wyoming. The yard would be the receipt point for much of the materials used to construct the railroad which would be shipped to Edgemont by rail. The yard may contain a pre-cast plant for fabrication of concrete rail ties, concrete box culverts, etc.

It would take approximately 6 months to get the pre-cast plant and yard up and running. Work is anticipated to begin setting up the yard and pre-cast plant in early 2001 as soon as regulatory approvals for the project and financing are secured.

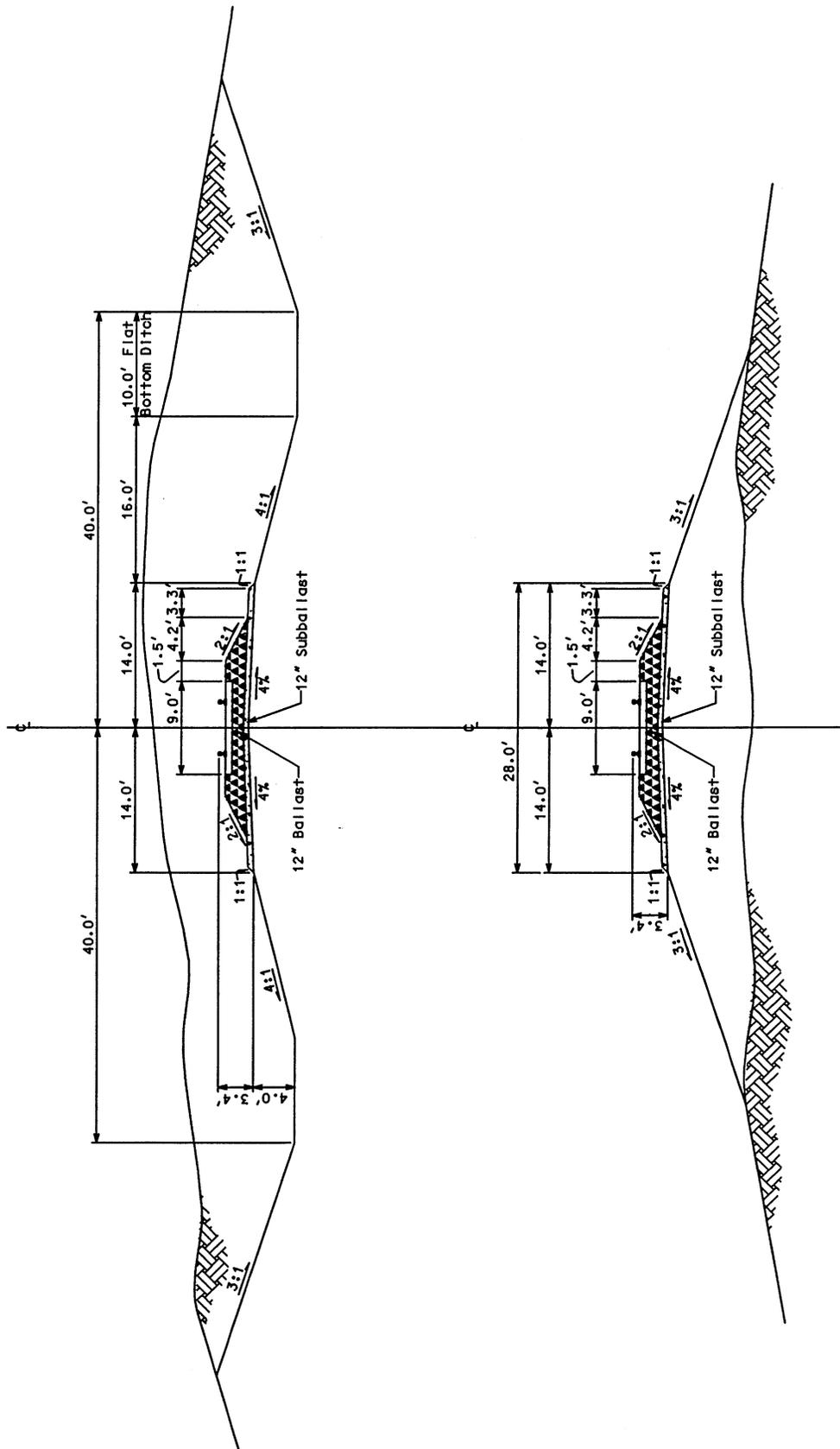


Figure 2-2
 Typical Cross-section of Single Track Configuration

Bridge construction would begin at various locations along the new railroad both east and west of Edgemont in about May, 2001. These crews precede all other construction activities and are responsible for installing bridges, major road crossings, livestock crossings and culverts. This is the only activity associated with construction that is anticipated to occur all year long. Other activities would occur only when weather conditions permit. Five to seven bridge crews may be working at any time. However, these crews would be spread over the entire new railroad and only 1 crew is expected to be working in an area at any time. These crews use a variety of equipment including cranes, dozers, loaders, etc. Much of their work involves concrete so generators powering heaters and lights would be located at most of the construction sites.

The bridge crews would work double shifts from about 7 a.m. to midnight. Work would occur 6 days weekly. Although construction would typically stop after midnight, equipment maintenance crews would be working between midnight and 7 a.m. Lights could be used at construction sites throughout the night.

The construction of the railroad subgrade would occur separately from the bridge construction crews. Earthwork would not occur when the ground is frozen so this construction activity is anticipated to be limited to about mid-April to mid-November. Seasonal conditions may change these dates. Between 5 and 7 construction spreads would be required to complete the earthwork. Construction spreads would be working both east and west of Edgemont simultaneously. Each spread would consist of scrapers, front-end loaders, power shovels or draglines, trucks, and other equipment. Belly dumps would be used to transport material between cut and distant fill areas. The spreads would work double shifts starting at 7 a.m. and ending at midnight. Maintenance of equipment would occur after midnight. Work would occur 6 days weekly. Lights would be required all night in areas where maintenance is occurring and from dark to midnight in other areas where equipment and crews are working.

Grading of the subgrade would begin with clearing and grubbing of the right-of-way followed by the removal and storage of topsoil. The entire right-of-way would be cleared and grubbed so that no organic material or vegetation is hauled to embankments. Disposal of vegetation would be determined on a case-by-case basis after consultation with landowners and appropriate county, state and Federal officials. Blasting within the right-of-way may be required to fracture material if ripping with a dozer is not possible. Throughout construction, water trucks would distribute water along the graded area for dust control and soil compaction.

The goal of designing the right-of-way is to have the "cut and fill" balance, as near as practicable. However,

excess material can only be economically transported so far which results in the requirement for waste and borrow. Also, excavated cut material may be unsuitable for use as fill and may require disposal. DM&E has refined the alignments to reduce the need to haul borrow or waste material making for more cost-effective construction. However, it is likely that borrow and disposal sites will be necessary. Borrow areas, averaging 5 acres in size, would be established only when fill material is needed in addition to that provided during excavation of the track bed. The locations of borrow and disposal sites are currently unknown. However, the construction contractors would not locate borrow or disposal sites in environmentally sensitive areas including sites with significant cultural or historical resources, wetlands, sensitive species, etc. After grading is complete, reclamation work would commence beginning with the placement of topsoil on side slopes. Disturbed areas would be seeded and mulched.

Assuming timely issuance of approvals, actual construction of the rail would commence in May, 2002 from Edgemont heading west and August, 2002 from Edgemont heading east. Completion of the track is anticipated in October, 2003. The ties, rail and ballast used in construction would be shipped from the Edgemont Interchange Yard on material trains. Work crews would lay welded rail and initial ballast would be installed. When rail laying work is completed, signal and communication facilities would be installed. Final ballast placement and clean-up would complete the construction activity.

2.5.3 Construction Water Use. The primary needs for water during construction would be for compaction and dust control. No estimate is currently available on total water need. However, water sources have been tentatively identified. In Wyoming water would come primarily from private sources and the mines. Additional water may be withdrawn from the Cheyenne River, if available, under temporary use agreements. In South Dakota water sources would include private sources and possibly the Cheyenne River, if available, under temporary use agreements.

Most of the water for the project is expected to come from private sources. Private water sources include existing wells, stock ponds, etc. DM&E would reimburse landowners for use of their water and would use the water only in compliance with state law. Water would be moved along the construction right-of-way using standard irrigation piping. Temporary water storage pits would be excavated at a number of locations within the construction right-of-way. With the possible exception of the Cheyenne River, water would not be withdrawn from streams or rivers.

2.5.4 Estimated Work Force and Construction Housing. Between 600 and 1,000 workers would be

employed during construction of the new railroad. However, this workforce would be spread over the entire length of the new alignment. A typical spread would employ about 50 workers, including truck drivers, equipment operators and laborers. DM&E would take steps to maximize the use of local labor resources. Local labor pools in Edgemont, Rapid City, Douglas, Gillette and tribal labor sources would be utilized to the maximum extent practicable. Housing is not available locally to accommodate the expected immigrant work force. Therefore, the contractors expect that it will be necessary to install temporary mancamps to house the workers. The locations of these camps cannot be currently predicted. However, they would not be located in environmentally sensitive areas such as at wetlands, cultural sites, etc.

2.5.5 Surface Drainage. Precast and cast in place concrete box culverts or corrugated metal pipe may be used to provide drainage under the railroad. Drainage of natural flow under the railroad would be designed based on the 100-year storm event where headwater does not exceed either 1 foot above top of pipe or above the subgrade shoulder point. Corrugated metal pipe under the railroad would be a minimum of 36 inch diameter.

2.5.6 Utility Crossings. The new railroad would cross a number of utilities including powerlines, telephone cables, oil flow lines, water lines, gas lines, miscellaneous buried conduits, etc. DM&E will be responsible for identifying these crossings prior to construction. Once the exact location of the utilities are known, DM&E will contact the utility owner and develop a plan as to how the crossing would be constructed. Various options exist including relocating the utility, burying the utility deeper, changing the utility from buried to overhead, raising an overhead utility, etc. If the affected utility is on NFS or public lands, the Forest Service and BLM would be involved in developing the crossing plan. Appropriate approvals, such as special use permits, Sundry Notice, etc., may be required.

2.6 Operations

2.6.1 Analysis Assumptions Regarding Operational Traffic. DM&E estimates that trains will consist of 115 to 135 cars with either three 6,000 hp locomotives or four 4,000 hp locomotives. Combined, the trains would be approximately 6,400 to 7,740 feet long. Speeds will be 45 mph for loaded east bound trains and 49 mph for empty west bound trains. Market factors will determine the train traffic on the new railroad. Therefore, the analysis considers 3 levels of operations:

- 8 total trains daily, 4 loaded and 4 empty, 5 running during daylight hours and 3 at night;

- 18 total trains daily, 9 loaded and 9 empty, 11 running during daylight hours and 7 at night; and
- 34 total trains daily, 17 loaded and 17 empty, 21 running during daylight hours and 13 at night.

2.6.2 Analysis Assumptions Regarding Noise Area of Influence. Noise from operation of the new railroad will vary in intensity based on areas where the whistle would be used. Estimates of instantaneous noise levels at specific distances from the railroad are provided on Table 2-6. The estimated noise levels were provided by Burns & McDonnell (STB's third-party EIS contractor) and are based on monitored noise levels from Conrail and other railroads.

2.6.3 Fence/Cattle Guard Maintenance. Fences would be maintained on an as-needed basis and would be inspected annually except in areas where more frequent inspection is warranted (i.e., near yards). Cattleguard maintenance would occur during the regular track maintenance program. Track maintenance would occur in compliance with the Federal Railroad Administration's Safety Standards. Those requirements include daily, weekly or monthly inspection depending on the level of traffic in each segment.

2.6.4 Permanent Road Access Needs/Maintenance Responsibilities. At sidings it is anticipated that access along the track will be required. At these locations switches would be installed that would require maintenance and fuel (electric and propane). DM&E would be responsible for maintaining access to these sites and access is anticipated to occur wholly within the right-of-way.

2.6.5 Noxious Weed Control. Following revegetation DM&E would implement a noxious weed control program. This program would be designed to control all state-declared noxious weeds. DM&E would spray herbicide annually on its right-of-way in order to prevent the spread of any noxious weeds to adjoining lands, taking into account the appropriate spraying sequence and formulations with respect to the terrain and site characteristics. Use of herbicides would comply with appropriate Federal, state and local laws and only certified applicators would be employed in use of herbicides on railroad property or easement.

2.6.6 Fire Control Plan/Responsibilities. Fire control is an integral part of DM&E's Emergency Response Plan and Safety Plan. Fire control includes maintenance of locomotives and maintenance of fire breaks on both sides of the track pursuant to DM&E's Fire Prevention and Control Plan.

Table 2-6
Whistle and Non-Whistle Noise Estimates

Predicted Noise Level	Distance From Centerline with Whistle (feet/miles)	Distance From Centerline without Whistle (feet/miles)
60 dBA	16,000/3.0	5,700/1.08
50 dBA	27,000/5.1	13,000/2.46
40 dBA	39,000/7.4	23,000/4.36
32 dBA	49,000/9.3	32,000/6.06

CHAPTER THREE - AFFECTED ENVIRONMENT

3.1 Introduction

This chapter describes those components of the existing environment that could be affected by construction, operation and maintenance of the alternatives. Emphasis is provided for those resources which could be significantly impacted. Where practicable, information is provided in tabular format for ease of comparison between the alternatives. Numerous maps are provided to show the relationship between the alternatives and sensitive natural resources in the impact analysis areas.

Information in this section was gathered from a number of sources including Federal and state agencies in South Dakota and Wyoming. Where information is readily available in other documents prepared to address environmental impacts from DM&E's proposed project, it is not typically repeated here. Rather, a reference to the information source is provided.

Each of the natural resource descriptions in this chapter attempts to provide the same level of detail for each of the alternatives. For instance, this chapter contains gross-scale wetland crossing impact estimates for each of the alternatives based on National Wetland Inventory (NWI) mapping. Much more precise mapping of wetlands has been completed by DM&E for Alternative C and the route variations to support the COE 404 permit application. However, detailed wetland mapping has not been completed for Alternatives B and D - thus the need for the more general NWI-based comparison of wetland impacts contained in this report.

3.2 Climate

Tables 3-1 and 3-2 show average (1961-1990) monthly precipitation and temperature from 7 monitoring stations located in the general vicinity of the alternatives (4 in South Dakota and 3 in Wyoming). In the eastern portion of the project area, the climate is variable and unpredictable with temperatures ranging from -40 °F to 116 °F in Badlands National Park in Pennington County. At Wasta, average monthly temperature is lowest during December (23.2 °F) and January (21 °F). Most of the 15 to 17 inches of annual precipitation fall just before and during the warmer months, often in the form of torrential thunderstorms. May (2.61 inches) and June (2.83 inches) are typically the wettest months in Wasta while December (0.39 inches), January (0.31 inches) and February (0.4 inches) are the driest.

Wind Cave National Park is located in Custer County about 7 miles north of Hot Springs and about 12 miles

northwest of Alternatives B and C and 2.5 miles west of Alternative D. An extensive climate description for the park is available from the National Park Service (NPS).¹ In the park, snowfall averages 30 inches annually (November through March). January is usually the coldest month, but March often brings the most snow. Occasional high winds can make for extra chilly weather during spring (April and May). Consistent spring-like weather generally occurs in late April, but some snow is possible. May usually brings the most precipitation - about 3 inches. Like May, June can be a rainy month. Severe thunderstorms are common in June and July and occur occasionally in August. Fall (September and October) days are warm and nights are cool. Snow is common in late fall.

A monthly weather summary for Wind Cave National Park is provided below:

- January is the coldest month. The average high and low are 37.4 °F and 10.7 °F, respectively. Temperatures below zero are common. Average snowfall for January is 6.6 inches.
- February brings an average of 5.9 inches of snow. The average high is 41.8 °F and the average low is 14.5 °F.
- March brings the warmest winter temperatures, but the most snow. The average high and low are 49.7 °F and 21.4 °F. Snowfall averages 7.4 inches.
- April is a variable time. There is warm weather mixed with cold and snowy days. Precipitation increases with an average of 1.78 inches. The average high and low are 61 °F and 32 °F.
- May can be a wet month with an average of 2.95 inches of rain. Temperatures are often pleasant - average high and low are 70.7 °F and 41.7 °F.
- June is characterized by dramatic thunderstorms. June is slightly wetter than May with an average precipitation of 3.05 inches. The average high is 81 °F and the average low is 51 °F.
- July is the warmest month of the year with an average high of 89.3 °F and average low of 57.2 °F. Hail and thunderstorms are common.
- August is similar to July, but drier, and there are fewer thunderstorms. The average high and low are 88.1 °F and 54.9 °F.
- September weather is often very pleasant with an average high of 78.4 °F and an average low of 44.6 °F. September is a little drier than the summer months.

¹ Additional information can be found at <http://www.nps.gov/wica>

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
South Dakota													
Rapid City	0.28	0.4	0.92	2.01	3.02	2.75	2.49	2.21	1.21	1.22	0.54	0.37	17.42
Hot Springs	0.3	0.4	0.79	1.63	2.82	2.8	2.62	1.34	1.36	0.97	0.44	0.36	15.83
Oelrichs	0.4	0.48	1.04	1.95	2.98	2.91	2.21	1.59	1.26	1.03	0.55	0.47	16.87
Wasta	0.31	0.4	0.96	1.88	2.61	2.83	1.96	1.61	1.19	1.18	0.52	0.39	15.84
Wyoming													
Douglas Aviation	0.4	0.4	0.77	1.59	2.32	1.66	1.53	0.74	1.07	0.71	0.62	0.39	12.2
Lusk	0.58	0.52	1.21	2.23	2.7	2.19	1.91	1.15	1.26	1.02	0.63	0.58	15.98
Newcastle	0.39	0.51	0.6	1.54	2.4	2.49	1.88	1.55	1.15	0.91	0.57	0.56	14.55

Source: High Plains Climate Center at <http://hpccsun.unl.edu/home.html>

Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
South Dakota													
Rapid City	22.9	26.1	34.1	44.6	55.3	65.5	72.5	69.8	59	47.8	33.7	24.6	46.3
Hot Springs	25.2	29.7	36.8	47.4	56.9	66.6	73.5	71.7	61.7	50.6	36.6	27.0	48.6
Oelrichs	22.7	28.2	36.2	47.3	57.2	67.1	74.8	73.0	62.5	50.3	35.5	24.8	48.3
Wasta	21.0	26.6	35.5	47.8	58.3	68.1	75.3	73.2	61.9	49.8	35.0	23.2	48.0
Wyoming													
Douglas Aviation	22.9	27.6	34.3	43.3	52.7	63.0	70.6	68.3	57.7	46.3	33.6	24.4	45.4
Lusk	21.7	26.4	32.9	42.9	52.1	62.5	69.7	67.3	56.7	46.1	32.3	23.4	44.5
Newcastle	22.0	26.5	34.9	45.7	55.9	66.1	73.5	71.1	59.9	48.1	34.1	23.7	46.8

Source: High Plains Climate Center at <http://hpccsun.unl.edu/home.html>

- October is often a mixture of warm and cold days. The average high is 65.8 °F and the average low is 33.6 °F. Precipitation is light although some snow can occur, especially late in the month.
- November often brings snow. The average high temperature is 49.5 °F and the average low temperature is 22.5 °F.
- December is generally a dry month. Snow averages 6 inches. It is the second coldest month with an average high of 39.8 °F and an average low of 14.1 °F.

In eastern Wyoming, the climate is generally dry and temperate. Typically, the days are dry and sunny with weather fronts coming from the Pacific Ocean. Higher elevations experience lower average temperatures and higher average precipitation.

Average annual precipitation ranges from a low of 10.59 inches at Keeline to nearly 23 inches in the Black Hills at Alva. In this part of the state, about 20 percent of the precipitation generally occurs as snow from November through March. About 60 percent is received as rain from April through July. Temperatures can be extreme in both summer and winter. According to the BLM (1998), the lowest recorded temperature in the region is -30 °F and the highest is 105 °F. Average temperature in the region is 46 °F.

At Newcastle, average annual precipitation is 14.55 inches. The driest month is January (0.39 inches) and the wettest months are May (2.4 inches) and June (2.49 inches). The coldest months are December (23.7 °F) and January (22 °F). The warmest months are July (73.5 °F) and August (71.1 °F).

3.3 Socioeconomic Resources

3.3.1 Impact Analysis Area. The area evaluated for socioeconomic impacts includes the 8 counties which could be crossed by the alternatives, including Pennington, Custer and Fall River counties, South Dakota and Niobrara, Weston, Converse, Campbell and Crook counties, Wyoming. In addition, information is provided for Shannon County, South Dakota (Pine Ridge Indian Reservation) because of its close proximity to the alternatives. Data presented in this section is primarily from the Bureau of the Census (BOC). Additional information was provided by the states.

3.3.2 Population. The information presented in this section was obtained from the BOC's Population Estimates Program. The information was made available on July 10, 1999 and can be reviewed at <http://www.census.gov>. Table 3-3 summarizes July 1, 1998 estimated population, and population change between July 1, 1997 and July 1, 1998, for the counties in the impact analysis area.

South Dakota and Wyoming are very sparsely populated and the state's populations changed very little between 1997 and 1998. According to BOC estimates, just over 100,000 people reside in the 3 counties in the impact analysis area in South Dakota while almost 60,000 people reside in the 5 counties in the Wyoming impact analysis area. Pennington County, which includes Rapid City, has the largest population. In fact, more people reside in Pennington County than in all of the other counties in the impact analysis area, combined.

Between 1997 and 1998, all the South Dakota counties in the impact analysis area had above state-average growth. Fall River County grew by 1.8 percent during the period and was the 6th fastest growing county in the state. However, in absolute terms, total Fall River County population increased by only 124 individuals. Shannon County showed the second largest growth rate at 1.2 percent.

Wyoming counties in the impact analysis area are generally less populated than those in South Dakota. Campbell County, with about 32,000 residents, has the highest population. Niobrara County is the least populated with only about 2,700 people. Weston County lost population between 1997 and 1998 while Niobrara, Campbell and Crook counties experienced population growth. Converse County population between 1997 and 1998 was essentially unchanged.

As can be seen on Table 3-4, except for Shannon County, the population in the impact analysis area is predominantly white non-hispanic. Custer, Niobrara, Weston and Crook counties are over 95 percent white

non-hispanic. Fall River, Converse and Campbell counties are over 90 percent white non-hispanic and Pennington County is about 86 percent white non-hispanic. Only 4.8 percent of Shannon County is white non-hispanic.

Hispanics and American Indians are the next most common races found in the impact analysis area. The largest hispanic populations are found in Pennington and Campbell counties. Nearly 94 percent of the population in Shannon County is American Indian. Shannon County is home to the Pine Ridge Indian Reservation. American Indians comprise nearly 8 percent of the population of Pennington County but a relatively small portion (3.3 percent) of Custer County's population even though the county is adjacent to the reservation. Fall River County has a higher percentage (about 6 percent) of American Indians. Very few blacks are found in any of the counties. Blacks comprise only about 2 percent of the population in Pennington County.

3.3.3 Employment. The size of the labor force varies significantly across the counties in the impact analysis area (see Table 3-5). The largest labor force is located in Pennington and Campbell counties. The smallest labor force is in Niobrara County. For most of the counties, the labor force increases somewhat in the summer and decreases during the winter months. However, the magnitude of the labor force change between months varies considerably. Custer County shows the most change in the labor force from month-to-month. In 1998, the difference between the peak and low monthly total labor force in Custer County was 1,407 workers. This is significant considering that average monthly total labor force in Custer County is only 3,274 workers. On-the-other-hand, Campbell County demonstrated the most stable monthly total labor force between months. Monthly total employment over the year fluctuated by less than 1,000 workers. This is a relatively small change considering that county average monthly employment was over 18,500 workers.

Unemployment for 1998 for each of the counties in the impact analysis area is provided on Table 3-6. As can be seen on the table, unemployment is seasonally dependent with the highest unemployment rate occurring in all the counties, except Shannon County, during the winter months and then dropping sharply during the summer months.

In 1998 in the South Dakota counties, average annual unemployment ranged from a low of 2.6 percent to a high of 12.1 percent. The highest unemployment was in Shannon County and the lowest was Pennington County. All counties, except Shannon County, experienced the highest unemployment during the winter months, typically January through March.

Table 3-3
County Population Estimates for July 1, 1998 and Population Change from July 1, 1997 to July 1, 1998

State/County	July 1, 1998 Estimate	July 1, 1997 Estimate	Population Change 1997-1998	Percent Population Change 1997-1998
South Dakota	738,171	737,755	416	<0.1
Pennington County	87,702	87,071	631	0.7
Custer County	6,930	6,896	34	0.5
Shannon County	12,183	12,040	143	1.2
Fall River County	7,133	7,009	124	1.8
Wyoming	480,907	480,043	864	0.2
Niobrara County	2,706	2,645	61	2.3
Weston County	6,472	6,508	-36	-0.6
Converse County	12,337	12,332	5	0.0
Campbell County	32,465	32,071	394	1.2
Crook County	5,829	5,820	9	0.2

Table 3-4
1997 Population Estimate by Age, Sex and Race for Counties in the Impact Analysis Area

	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Crook	Converse	Campbell
White Non-Hispanic Male	37,299	3,380	324	3,420	1,242	3,183	2,899	5,659	15,593
Percent of county total	42.6	48.5	2.7	47.9	47.4	48.9	49.7	45.9	48.3
White Non-Hispanic Female	37,813	3,246	264	3,088	1,315	3,108	2,825	5,804	14,855
Percent of county total	43.1	46.6	2.2	43.2	50.2	47.7	48.5	47.1	46.1
Hispanic (of any race) Male	1,399	38	71	71	25	59	31	319	570
Percent of county total	1.6	0.6	0.6	1.0	1.0	0.9	0.5	2.6	1.8
Hispanic (of any race) Female	1,215	48	82	89	13	46	33	322	543
Percent of county total	1.4	0.7	0.7	1.2	0.5	0.7	0.6	2.6	1.7
Black Male	1,112	10	4	15	2	8	1	14	52
Percent of county total	1.3	0.1	<0.1	0.2	<0.1	0.1	<0.1	0.1	0.2
Black Female	782	6	4	20	6	0	1	11	39
Percent of county total	0.9	<0.1	<0.1	0.3	0.2	<0.1	<0.1	<0.1	0.1
Amer. Indian, Eskimo, & Aleut Male	3,095	110	5,619	182	7	39	17	72	220
Percent of county total	3.5	1.6	46.3	2.5	0.3	0.6	0.3	0.6	0.7
Amer. Indian, Eskimo, & Aleut Female	3,624	119	5,765	226	8	54	18	62	208
Percent of county total	4.1	1.7	47.5	3.2	0.3	0.8	0.3	0.5	0.6
Asian and Pacific Islander Male	521	4	4	13	1	3	1	30	95
Percent of county total	0.6	<0.1	<0.1	0.2	<0.1	<0.1	<0.1	0.2	0.3
Asian and Pacific Islander Female	791	11	3	20	2	9	2	25	82
Percent of county total	0.9	0.2	<0.1	0.3	<0.1	0.1	<0.1	0.2	0.3
Total 1997 Population	87,651	6,972	12,140	7,144	2,621	6,509	5,828	12,318	32,257

**Table 3-5
Total 1998 Labor Force by Month for Counties in the Impact Analysis Area**

Sector	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
January	45,577	2,792	3,281	3,364	1,126	3,202	6,241	2,716	18,706
February	45,595	2,737	3,291	3,295	1,146	3,264	6,365	2,748	19,019
March	46,034	2,781	3,388	3,392	1,169	3,253	6,393	2,789	19,236
April	46,462	2,876	3,173	3,398	1,293	3,278	6,474	2,890	19,066
May	47,664	3,477	3,263	3,534	1,309	3,287	6,476	3,042	18,942
June	48,780	4,032	3,523	3,758	1,291	3,360	6,571	3,214	19,530
July	49,260	4,144	3,390	3,894	1,262	3,274	6,834	3,157	19,311
August	48,490	4,044	3,490	3,768	1,305	3,292	6,958	3,086	19,336
September	47,807	3,631	3,459	3,677	1,319	3,408	6,662	3,114	18,883
October	47,554	3,095	3,546	3,618	1,374	3,454	6,648	3,097	19,353
November	47,426	2,934	3,519	3,600	1,413	3,513	6,673	3,171	19,377
December	46,511	2,742	3,425	3,453	1,320	3,446	6,458	2,971	19,326
Annual Average	47,254	3,274	3,394	3,562	1,278	3,336	6,563	2,999	19,174

South Dakota data were provided by Labor Market Information Center, South Dakota Department of Labor, Aberdeen, South Dakota. Wyoming data can be obtained at <http://lmi.state.wy.us/>

**Table 3-6
1998 Unemployment Rate by Month for Counties in the Impact Analysis Area**

Month	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
January	4.0	8.9	8.8	6.4	3.5	6.9	6.0	8.0	5.7
February	3.5	7.5	7.9	4.2	3.1	7.0	6.3	8.6	6.2
March	3.3	7.4	8.3	5.4	2.9	6.5	6.7	8.5	6.1
April	2.9	5.0	8.4	3.1	3.4	5.3	5.9	5.6	4.8
May	2.4	4.1	7.9	2.2	2.8	4.4	4.5	4.6	4.6
June	2.4	2.7	19.5	2.2	2.5	4.8	5.3	4.5	4.8
July	2.0	2.1	22.1	2.3	2.9	3.6	5.2	4.2	4.5
August	1.8	2.2	21.5	1.8	2.5	4.1	4.5	3.7	4.1
September	2.0	2.3	11.0	1.7	1.6	3.6	4.2	3.8	4.3
October	2.0	2.7	9.8	2.2	2.8	3.8	4.4	4.1	4.3
November	2.5	5.2	10.0	3.0	2.8	4.1	5.3	4.6	4.6
December	2.3	6.3	9.5	2.5	2.8	3.8	5.1	5.0	4.2
Annual Average	2.6	4.4	12.1	3.0	2.8	4.8	5.3	5.3	4.8

South Dakota data were provided by Labor Market Information Center, South Dakota Department of Labor, Aberdeen, South Dakota. Wyoming data can be obtained at <http://lmi.state.wy.us/>

For example, even though annual average unemployment in Fall River County was only 3 percent, during January, February and March, unemployment was 6.4, 4.2 and 5.4 percent, respectively. Summer unemployment during 1998 in Fall River County was less than 2 percent in August and September. The same trend applies in Custer County. However, in 1998 Custer County experienced relatively high unemployment rates from early winter through early spring. Unemployment in Custer County exceeded 5 percent from January through April and in November and December, 1998. Peak unemployment reached 8.9 percent. The unemployment

pattern in Shannon County is the exact opposite of that in other South Dakota counties in the impact analysis area. In Shannon County, annual unemployment averaged 12.1 percent in 1998 (see Table 3-6). However, peak unemployment was during the summer months, particularly June through August, when unemployment reached about 20 percent. Unemployment rate peaked in July at 22.1 percent. In 1998, the lowest unemployment rate was reached in February and May at 7.9 percent.

Unemployment in the 5 Wyoming counties in the impact analysis area also varies by season. In 1998, Converse and Crook counties had the highest unemployment rate of all the Wyoming counties in the impact analysis area (see Table 3-6), but the rate was very similar to Weston and Campbell counties. Average unemployment for the year in Converse and Crook counties was 5.3 percent. In March, Converse County's unemployment rate peaked at 6.7 percent, however, the rate was below 5 percent in May through October. Crook County had the highest unemployment rate in any month (8.6 percent in February). However, the rate was below 5 percent in May through November. Campbell County's unemployment rate exceeded 5 percent in January through March, 1998 but was below 5 percent from April through December. The 1998 annual average unemployment rate for Campbell County was 4.8 percent. Weston County unemployment exceeded 5 percent for January through April, 1998 but was below 5 percent from May through December. Niobrara County had the lowest unemployment rate. Unemployment in 1998 did not exceed 3.5 percent in any month and averaged only 2.8 percent for the year.

Employment by sector for each county in the impact analysis area is provided on Table 3-7. South Dakota data is provided for 1997.² In Pennington County, the largest employment sector is services followed by retail trade. Services sector employment includes lodging, personal services (such as laundry, beauty shops, funeral homes, etc.), auto and appliance repair, entertainment (bowling, theaters, etc.), health services (clinics, hospital, etc.), legal services, etc. These sectors provide approximately 55 percent of all the jobs in Pennington County. Government is the third largest source of employment in Pennington County representing about 14 percent of total employment. Services, government and retail trade are also the largest employment sectors in Custer County. These 3 sectors provide nearly 85 percent of the county's total employment. Nearly 35 percent of the county's total employment is in the government sector which is the largest employment sector.

Services and government provide 84 percent of total employment in Shannon County (note: estimated employment for the agriculture and wholesale trade sectors are not available for Shannon County and have been excluded from the total employment estimate). Government, particularly the Federal government, is the largest employment sector in Fall River County, providing nearly 44 percent of total county employment. The Federal government employed 580 workers (23 percent of the total county employment) in Fall River County during 1997. Retail trade is also an important source of employment in the county.

Sector employment during 1998 for Wyoming counties in the impact analysis area is presented on Table 3-7.³ Government is the largest employer in Niobrara County and provides about 49 percent of total county employment. Retail trade and services are also important employment sectors. Combined, these sectors provide about 31 percent of total county employment. Government is also the largest employment sector in Weston County, representing 32 percent of total county employment. Services and retail trade combined represent about 32 percent. Mining and manufacturing are also important sources of employment in Weston County, providing about 13 and 10 percent, respectively, of total county employment.

Government, mining and retail trade are the principal employment sectors in Converse County. Combined, these sectors provide over 60 percent of total county employment. Services is also important, providing nearly 12 percent of the county's total employment. Mining is the largest employment sector in Campbell County - 25 percent of Campbell County employment is directly related to mining. Services, retail trade, construction and government are also large employers. Combined, these sectors provide 60 percent of total county employment.

3.3.4 Income. Table 3-8 provides estimates of median household income for each county in the impact analysis area. Median household income in South Dakota is estimated at \$29,426. Wyoming median household income is estimated to be slightly higher than South Dakota at \$30,673. Median household income in Pennington and Custer counties exceed the state average by 14.8 and 2 percent, respectively. Fall River County median household income is about 10 percent less than the state average, whereas, Shannon County is about 39 percent less than the state average. Pennington County median household income is nearly twice that of Shannon County.

² South Dakota employment data is available from the South Dakota Labor Market Information Center's homepage at <http://www.state.sd.us/dol/lmic>

³ This information is available from the State of Wyoming at <http://eadiv.state.wy.us/almanac>

Sector	South Dakota 1997				Wyoming 1998				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
Agriculture and Forestry	276	7	(1)	56	11	10	74	18	92
Mining	241	19	0	32	36	269	687	301	4,133
Construction	2,798	96	86	33	34	51	329	83	1,583
Manufacturing	4,428	48	0	100	0	207	81	223	416
TCPU	1,878	73	22	67	30	163	380	117	762
Wholesale Trade	2,583	12	(1)	19	29	15	115	28	767
Retail Trade	11,334	511	215	579	163	388	820	283	2,798
FIRE	1,785	52	140	70	22	67	112	46	375
Services	13,079	502	1,639	458	76	281	500	157	2,391
Government	6,273	710	829	1,097	378	671	1,140	631	3,037
Total	44,675	2,029	2,934	2,511	779	2,122	4,238	1,887	16,354

TCPU = Transportation, Communications and Public Utilities
 FIRE = Finance, Insurance and Real Estate
 1 = Data is confidential and not available to the public

	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
Median household income	\$33,779	\$30,112	\$18,070	\$26,501	\$25,682	\$33,003	\$34,464	\$31,645	\$45,852
Difference from State Average	+\$4,353	+\$686	-\$11,356	-\$2,925	-\$4,991	+\$2,330	+\$3,791	+\$972	+\$15,179

Source: BOC's Small Area Income and Poverty Estimates Program. Released February, 1999. Data is available on BOC's web site at <http://www.census.gov>

All the counties in Wyoming, except Niobrara County, exceed the state median household income. Weston County is nearly 8 percent higher than the state average while Campbell County is almost 50 percent higher. Niobrara County median household income is nearly 16 percent less than the state average and median income in Campbell County is almost twice that of Niobrara County. Crook County is similar to the state average.

3.3.5 Poverty. Table 3-9 summarizes BOC's 1995 model-based poverty estimates for the counties in the impact analysis area. The estimates were released in February, 1999. To put these estimates in perspective, they are compared to state averages for South Dakota and Wyoming.

In South Dakota, the state average for people of all ages in poverty is 13.7 percent. Except for Shannon County, all counties in the impact analysis area in South Dakota are within 2 percentage points of the state

average for people of all ages in poverty. Shannon County has 46.7 percent of all ages and nearly 60 percent of people under 18 and children in poverty.

For Shannon County, the estimate for people of all ages in poverty is nearly 3.5 times higher than the state average. Because of poverty and a county minority population exceeding 50 percent (American Indian), the U.S. Environmental Protection Agency (EPA) has listed Shannon County as an Environmental Justice Focus Area.⁴

The Wyoming state average for people of all ages in poverty is 11.5 percent. Although Niobrara County is 5 percentage points higher than the state average, all other Wyoming counties in the impact analysis area are below the state average. Niobrara County is also 8 percentage points higher than the state average of 15.7 percent for people under age 18 in poverty.

⁴ See map at <http://www.epa.gov/region08/gif/ej.gif>

**Table 3-9
1995 Model-Based Poverty Estimates for Counties in the Impact Analysis Area**

	South Dakota				Wyoming				
	Pennington	Custer	Shannon	Fall River	Niobrara	Weston	Converse	Crook	Campbell
People of all ages in poverty/Percent of county population	11,962 13.6%	819 12.1%	5,527 46.7%	1,004 14.9%	423 16.5%	630 9.6%	1,394 11.4%	564 9.7%	2,557 7.9%
People under age 18 in poverty/ Percent of county population	5,246 21.3%	311 17.4%	3,134 57.1%	355 20.9%	143 23.7%	225 12.1%	568 15%	219 12.6%	1,133 10.2%
Related children age 5-17 in families in poverty/Percent of county population	3,252 19.5%	209 15.3%	2,199 59.6%	227 17.4%	88 18.8%	145 10%	345 11.9%	136 10.4%	668 8%

Poverty estimates are available at the BOC's web site at <http://www.census.gov>

Even though the Wyoming county poverty estimates are well below the 30 percent poverty level used by EPA to identify Environmental Justice Focus Areas, EPA did identify a portion of northeastern Converse County as a focus area. This area consists of the BOC's Block Numbering Area (BNA) 9561 which is shown on Figure 3-1.

BNA 9561 is made up of 6 individual block groups. According to the 1990 Census of Population and Housing, Block Groups 5 and 6 exceed 30 percent of the population below the poverty level. These block groups are also shown on Figure 3-1. Even though neither below poverty level block group would be crossed by the alternatives, BNA 9561 would be crossed by all the alternatives.

According to the 1990 Census of Population and Housing, Block Group 5 had a median household income of \$11,250 and a per capita income of \$2,965. All 51 people in 14 families in the block group for whom poverty status was determined by the census were determined to be below the poverty level. This included 29 persons 18 years and over but younger than 65 years and 22 children under 5 years of age.

Median household income for Block Group 6 was only \$4,999 but per capita income was \$3,500. Poverty status was determined for 2 people in this block group. Both were determined by the census to be below the poverty level. Both were determined to be older than 18 but less than 65 years of age.

The alternatives would be constructed through BNA 9561 in Block Group 1 (see Figure 3-1). Median household income in 1989 for this block group was \$18,750 and per capita income was \$9,527. No segment of the population in Block Group 1 was determined to be below the poverty level.

3.4 Transportation

3.4.1 Impact Analysis Area. The impact analysis area for transportation resources includes all public roads which would be crossed by the alternatives.

3.4.2 Affected Environment. Tables 3-10 through 3-14 provide lists of the major Federal, state, county and city highways, roads and streets which would be crossed by the alternatives. In addition to these major roads, the alternatives would also cross a number of less-traveled public roads. The Forest Service provides access for a number of uses on NFS lands, including hunting, recreation, livestock operations, oil and gas operations, mining, etc. Roads maintained by the Forest Service (grassland roads) which would be crossed by the alternatives are listed on Tables 3-15 through 3-17.

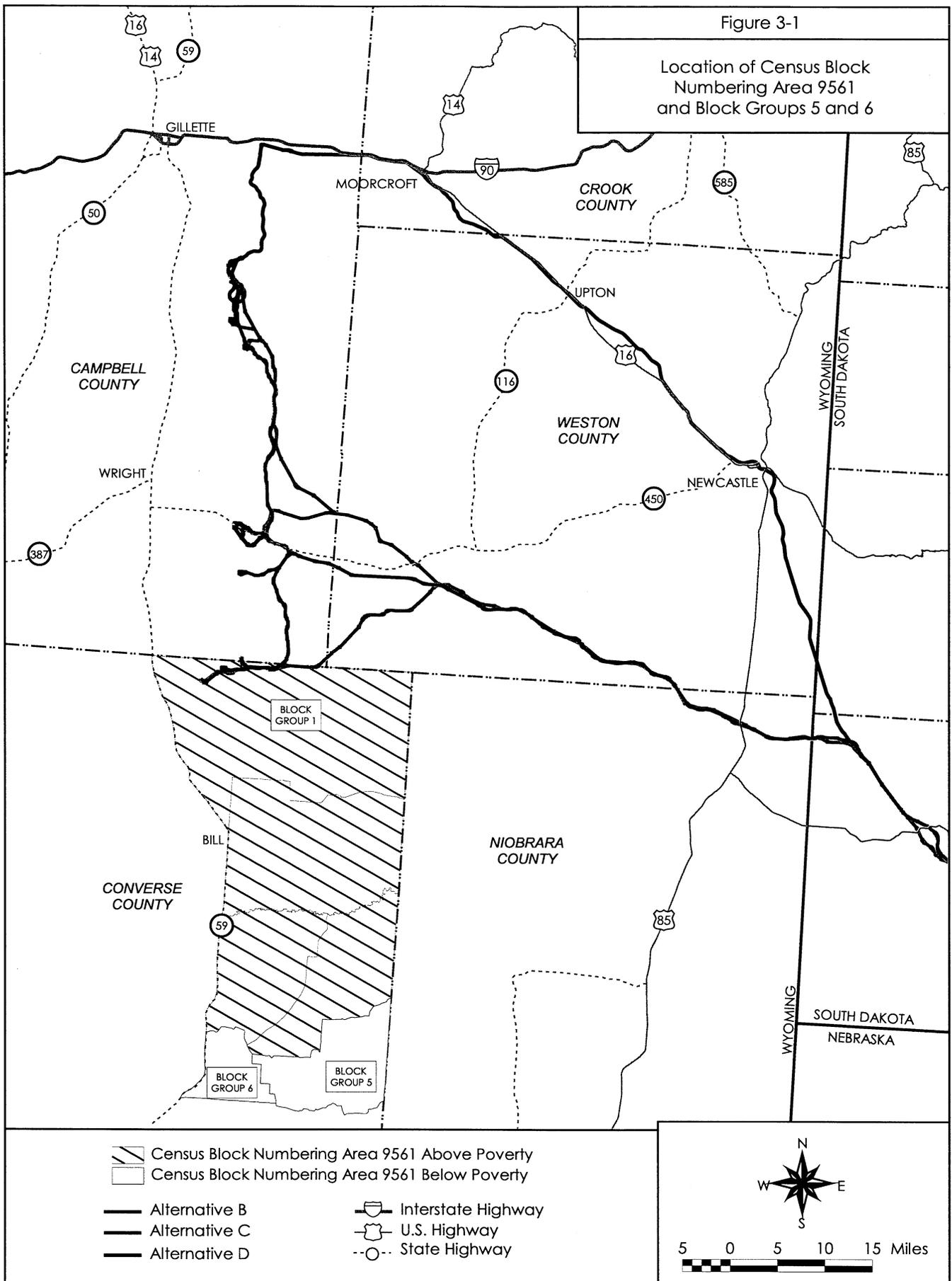
The grassland road crossings listed for Alternative C in Table 3-16 are the same as those which would be crossed by the Phiney Flat and W G Flat Route variations. However, the Phiney Flat Route Variation would cross Grassland Road 7060 (County Road 121) in 4 locations and the W G Flat Route Variation would not cross Grassland Road 7049 at all.

The mine loop options are excluded from the crossing tables. The Black Thunder South Mine Loop would cross State Highway 450 in Section 23, T. 43 N., R. 70 W. in Campbell County, Wyoming. No other state, county or grassland roads would be crossed by this option. The Black Thunder North option would not cross any state, county or grassland roads.

The North Antelope West Mine Loop would cross one major road, Irwin Road, in the Section 33, T. 41 N., R. 70 W. in Converse County. No state, county or grassland roads would be crossed by the North Antelope East Mine Loop.

Figure 3-1

Location of Census Block Numbering Area 9561 and Block Groups 5 and 6



**Table 3-10
Major Roads Which Would be Crossed by Alternative B**

Road Name	Legal Location	Road Name	Legal Location
South Dakota		Fall River County (continued)	
Pennington County		County Road 6463	SW/SW Section 25, T. 8 S., R. 2 E.
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.	County Road 6463	SE/ NW Section 31, T. 7 S., R. 2 E.
I-90	SE/NE Section 35, T. 1 N., R. 15 E.	County Road 6463	NE/NW Section 23, T. 7 S., R. 1 E.
Baseline Road	NW/SE Section 35, T. 1 N., R. 15 E.	Wyoming	
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.	Niobrara County	
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.	Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.	Township Road/Pipe Road	SW/SE Section 9, T. 40 N., R. 61 W.
State Highway 44	NW/SW Section 3, T. 2 S., R. 12 E.	U.S. Highway 85	NE/SE Section 8, T. 40 N., R. 61 W.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.	Weston County	
Custer County		Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
County Road 121 (Spring Creek Road)	SE/SW Section 15, T. 3 S., R. 11 E.	Cheyenne River Road (Morrisey Road)	NE/NE Section 23, T. 41 N., R. 63 W.
State Highway 40	NE Section 25, T. 4 S., R. 10 E.	Grieves Road (Cheyenne River Road)	NE/NE Section 5, T. 41 N., R. 64 W.
County Road 21 (Cottonwood Cutoff)	SE/SW Section 7, T. 6 S., R. 9 E.	Dull Center Road (Bruce Road)	SW/NW Section 19, T. 42 N., R. 65 W.
County Road 719 (148 th Ave.)	NW/SW Section 18, T. 6 S., R. 9 E.	Lynch Road	NE/SE Section 21, T. 42 N., R. 67 W.
County Road 719 (268 th Street)	SW/SE Section 13, T. 6 S., R. 9 E.	State Highway 450	NW/NE Section 33, T. 43 N., R. 67 W.
County Road 656 (Riverside Road)	SW/SW Section 24, T. 6 S., R. 8 E.	Rochelle Road	NW/NW Section 30, T. 42 N., R. 67 W.
Fall River County		Rochelle Hills Road	SW/NW Section 17, T. 41 N., R. 68 W.
County Road 2G	NW/NW Section 2, T. 7 S., R. 8 E.	Campbell County	
County Road 2	SW/SE Section 27, T. 7 S., R. 7 E.	Keeline Road	SW/NE Section 1, T. 43 N., R. 69 W.
County Road 14	SW/SE Section 11, T. 8 S., R. 7 E.	Keeline Road	NE/NW Section 1, T. 43 N., R. 69 W.
County Road 2	SE/SE Section 25, T. 8 S., R. 7 E.	Little Thunder Road	SW/NW Section 1, T. 43 N., R. 70 W.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.	Keeline Road	SW/NW Section 20, T. 44 N., R. 69 W.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.	T-7 Road	SW/SE Section 4, T. 46 N., R. 70 W.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.	T-7 Road	SE/NE Section 31, T. 47 N., R. 70 W.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.	Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
County Road 79	SW/SW Section 19, T. 9 S., R. 7 E.	Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
County Road 6	NW/NE Section 30, T. 9 S., R. 6 E.	Bishop Road	SE/SW Section 25, T. 48 N., R. 71 W.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.	State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.	Little Thunder Road	NW/NE Section 30, T. 43., R. 69 W.
County Road 6C	NE/SW Section 29, T. 9 S., R. 5 E.	School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
State Highway 71	SW/SW Section 35, T. 9 S., R. 4 E.	School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
County Road 3292	SW/SW Section 23, T. 9 S., R. 3 E.	Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
County Road 6E	SW/SE Section 6, T. 9 S., R. 3 E.	Converse County	
Old U.S. Highway 18 (A Street)	SE/SE Section 36, T. 8 S., R. 2 E.	Irwin Road	NW/SE Section 33, T. 41 N., R. 70 W.
U.S. Highway 18	NW/SE Section 36, T. 8 S., R. 2 E.		

**Table 3-11
Major Roads Which Would be Crossed by Alternative C**

Road Name	Legal Location	Road Name	Legal Location
South Dakota		Fall River County (continued)	
Pennington County		County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.	County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
I-90	SE/NE Section 35, T. 1 N., R. 15 E.	County Road 6463	SE/SE Section 15, T. 7 S., R. 1 E.
Baseline Road	NW/SE Section 35, T. 1 N., R. 15 E.	Wyoming	
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.	Niobrara County	
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.	Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.	Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.	U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.	Weston County	
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.	Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.	Cheyenne River Road (Morrisey Road)	NE/NE Section 23, T. 41 N., R. 63 W.
Custer County		Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
County Road 121 (Spring Creek Road)	SW/SE Section 15, T. 3 S., R. 11 E.	Cheyenne River Road (Grieves Road)	SE/SE Section 32, T. 42 N., R. 64 W.
State Highway 40	NW/NE Section 31, T. 3 S., R. 10 E.	Dull Center Road (Bruce Road)	SW/NW Section 19, T. 42 N., R. 65 W.
County Road 18 (French Creek Road)	NE/NW Section 6, T. 5 S., R. 9 E.	Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
County Road 21 (Cottonwood Cutoff)	SW/SW Section 7, T. 6 S., R. 9 E.	Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
County Road 719 (148 th Ave.)	SW/NW Section 18, T. 6 S., R. 9 E.	Campbell County	
County Road 719 (268 th Ave.)	SW/SE Section 13, T. 6 S., R. 9 E.	State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
County Road 656 (Riverside Road)	SW/SE Section 24, T. 6 S., R. 8 E.	Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
Fall River County		Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
County Road 2C	NW/NE Section 11, T. 8 S., R. 8 E.	Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.	T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.	Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.	Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.	School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.	Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
County Road 6	NE/SE Section 30, T. 9 S., R. 6 E.	Piney Creek Road (Mackey Road)	SE/NW Section 32, T. 42 N., R. 69 W.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.	School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.	Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
County Road 6C	SE/NW Section 29, T. 9 S., R. 5 E.	Converse County	
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.	Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.	Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
Old U.S. Highway 18 (County Road - 6463)	SE/NE Section 31, T. 8 S., R. 3 E.	Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.
U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.		

Table 3-12
Major Roads Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Road Name	Legal Location	Road Name	Legal Location
South Dakota		Fall River County (continued)	
Pennington County		U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.	County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
I-90	SE/NE Section 35, T. 1 N., R. 15 E.	County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
Baseline Road	NW/SE Section 35, T. 1 N., R. 15 E.	County Road 6463	SE/SE Section 15, T. 7 S., R. 1 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.	Wyoming	
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.	Niobrara County	
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.	Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.	Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.	U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.	Weston County	
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.	Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
Creston Road	NW/NW Section 20, T. 2 S., R. 12 E.	Morrisey Road	NE/NE Section 23, T. 41 N., R. 63 W.
Custer County		Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
County Road 121	NE/NE Section 7, T. 3 S., R. 12 E.	Grieves Road	SE/SE Section 32, T. 42 N., R. 64 W.
County Road 121	SE/SW Section 7, T. 3 S., R. 12 E.	Dull Center Road	SW/NW Section 19, T. 42 N., R. 65 W.
County Road 121	SE/NE Section 13, T. 3 S., R. 11 E.	Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
County Road 121	SW/SW Section 13, T. 3 S., R. 11 E.	Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
State Highway 40	NW/NE Section 31, T. 3 S., R. 10 E.	Campbell County	
County Road 18	NE/NW Section 6, T. 5 S., R. 9 E.	State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
County Road 21	SW/SW Section 7, T. 6 S., R. 9 E.	Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
County Road 719	SW/NW Section 18, T. 6 S., R. 9 E.	Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
County Road 719	SW/SE Section 13, T. 6 S., R. 9 E.	Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
County Road 656	SW/SE Section 24, T. 6 S., R. 8 E.	T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
Fall River County		Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
County Road 2C	NW/NE Section 11, T. 8 S., R. 8 E.	Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.	School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.	Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.	Piney Creek Road	SE/NW Section 32, T. 42 N., R. 69 W.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.	School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.	Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
County Road 6	NE/SE Section 30, T. 9 S., R. 6 E.	Converse County	
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.	Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.	Irwin Road	NW/SW Section 33, T. 41 W., R. 70 W.
County Road 6C	SE/NW Section 29, T. 9 S., R. 5 E.	Irwin Road	NE/SW Section 33, T. 41 W., R. 70 W.
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.		
County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.		
Old U.S. Highway 18	SE/NE Section 31, T. 8 S., R. 3 E.		

Table 3-13
Major Roads Which Would be Crossed by Alternative C With the W G Route Variation

Road Name	Legal Location	Road Name	Legal Location
South Dakota		Fall River County (continued)	
Pennington County		County Road 3292	SE/SW Section 23, T. 9 S., R. 3 E.
Township Road	NW/NW Section 31, T. 1 N., R. 16 E.	Old U.S. Highway 18 (County Road - 6463)	SE/NE Section 31, T. 8 S., R. 3 E.
I-90	SE/NE Section 35, T. 1 N., R. 15 E.	U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
Baseline Road	NW/SE Section 35, T. 1 N., R. 15 E.	County Road 6463	NW/SW Section 25, T. 8 S., R. 2 E.
Jensen Road	NE/NE Section 13, T. 1 N., R. 14 E.	County Road 6463	SE/NW Section 31, T. 7 S., R. 2 E.
Baseline Road	SE/SE Section 19, T. 1 N., R. 14 E.	County Road 6463	SE/SE Section 15, T. 7 S., R. 1 E.
Baseline Road	SW/NE Section 31, T. 1 N., R. 14 E.	Wyoming	
State Highway 44	NE/SW Section 3, T. 2 S., R. 12 E.	Niobrara County	
Creston Road	SE/SE Section 4, T. 2 S., R. 12 E.	Old Highway 85	NW/NW Section 24, T. 40 N., R. 61 W.
Creston Road	NE/SW Section 9, T. 2 S., R. 12 E.	Township Road/Pipe Road	SE/SW Section 9, T. 40 N., R. 61 W.
Creston Road	NW/NW Section 16, T. 2 S., R. 12 E.	U.S. Highway 85	SE/SE Section 8, T. 40 N., R. 61 W.
Custer County		Weston County	
County Road 121	SW/SE Section 15, T. 3 S., R. 11 E.	Morrisey Road	NW/NE Section 30, T. 41 N., R. 62 W.
State Highway 40	NW/NE Section 31, T. 3 S., R. 10 E.	Morrisey Road	NE/NE Section 23, T. 41 N., R. 63 W.
County Road 18	NE/NW Section 6, T. 5 S., R. 9 E.	Cheyenne River Road	NE/NW Section 4, T. 41 N., R. 64 W.
County Road 21	SW/SW Section 7, T. 6 S., R. 9 E.	Grieves Road	SE/SE Section 32, T. 42 N., R. 64 W.
County Road 719	SW/NW Section 18, T. 6 S., R. 9 E.	Dull Center Road	SW/NW Section 19, T. 42 N., R. 65 W.
County Road 719	SW/SE Section 13, T. 6 S., R. 9 E.	Lynch Road	NE/SE Section 6, T. 42 N., R. 67 W.
County Road 656	SW/SE Section 24, T. 6 S., R. 8 E.	Piney Creek Road	NW/SW Section 6, T. 42 N., R. 67 W.
Fall River County		Campbell County	
County Road 2G	NW/NW Section 2, T. 7 S., R. 8 E.	State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.
County Road 2B	SW/SW Section 10, T. 7 S., R. 8 E.	Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.
County Road 2B	NW/NW Section 15, T. 7 S., R. 8 E.	Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.
County Road 2B	SW/SW Section 16, T. 7 S., R. 8 E.	Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.
County Road 2A	SW/SE Section 20, T. 7 S., R. 8 E.	T-7 Road	SW/NW Section 30, T. 47 N., R. 70 W.
County Road 2D	SE/SW Section 29, T. 7 S., R. 8 E.	Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.
County Road 2E	SE/SE Section 6, T. 8 S., R. 8 E.	Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.
County Road 2C	SE/SE Section 7, T. 8 S., R. 8 E.	School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
County Road 2F	SE/SW Section 19, T. 8 S., R. 8 E.	Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
County Road 2	NW/SW Section 31, T. 8 S., R. 8 E.	Piney Creek Road	SE/NW Section 32, T. 42 N., R. 69 W.
County Road 1	SW/SW Section 31, T. 8 S., R. 8 E.	School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
County Road 19	SW/NW Section 23, T. 9 S., R. 7 E.	Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
U.S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.	Converse County	
County Road 79	NW/NW Section 30, T. 9 S., R. 7 E.	Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
County Road 6	NE/SE Section 30, T. 9 S., R. 6 E.	Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
County Road 6	SW/SW Section 22, T. 9 S., R. 5 E.	Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.
County Road 6	SW/SE Section 20, T. 9 S., R. 5 E.		
County Road 6C	SE/NW Section 29, T. 9 S., R. 5 E.		
State Highway 71	SW/SW Section 26, T. 9 S., R. 4 E.		

**Table 3-14
Major Roads Which Would be Crossed by Alternative D**

Road Name	Legal Location	Road Name	Legal Location
South Dakota		Pennington County (continued)	
Pennington County		Warren Lamb Road	NW/NE Section 27, T. 1 S., R. 8 E.
Baseline Road	NE/NE Section 6, T. 1 S., R. 16 E.	Antelope Creek Road	SE/SW Section 11, T. 1 S., R. 8 E.
I-90 Loop (South Blvd.)	SW/NW Section 6, T. 15 S., R. 16 E.	Lower Spring Creek Road	NW/NE Section 27, T. 1 S., R. 8 E.
I-90	SW/NE Section 6, T. 1 S., R. 16 E.	Daughenbaugh Road	SE/SE Section 5, T. 2 S., R. 8 E.
I-90	SE/SW Section 1, T. 1 N., R. 14 E.	Custer County	
Jensen Road	SW/NW Section 1, T. 1 N., R. 14 E.	U.S. Highway 40 (Main)	NW/NE Section 32, T. 2 S., R. 8 E.
I-90	NE/NE Section 8, T. 1 N., R. 14 E.	Vilas Road	NE/NW Section 32, T. 2 S., R. 8 E.
Baseline Road	SE/NE Section 19, T. 1 N., R. 14 E.	County Road - 6	SW/SW Section 32, T. 2 S., R. 8 E.
173 rd Avenue (Owanka Road)	NW/NW Section 29, T. 1 N., R. 13 E.	County Road - 7	NW/NW Section 19, T. 3 S., R. 8 E.
Sharpe Road	NE/SE Section 6, T. 1 N., R. 12 E.	County Road -18	SE/SW Section 7, T. 4 S., R. 8 E.
Libertine Road	NW/NE Section 2, T. 1 N., R. 12 E.	French Creek Road (County Road -719)	NW/SW Section 19, T. 4 S., R. 8 E.
Knuppe Road	NW/SW Section 33, T. 2 N., R. 11 E.	County Road - 656	NW/SE Section 29, T. 6 S., R. 7 E.
161 st Avenue (A. Ave.)	SW/NE Section 31, T. 2 N., R. 11 E.	Dewey Road	SE/NE Section 18, T. 6 S., R. 1 E.
Garrett Road	SW/NW Section 36, T. 2 N., R. 10 E.	Fall River County	
Spevak Road	NW/SW Section 29, T. 2 N., R. 10 E.	County Road -2	SW/SE Section 27, T. 7 S., R. 7 E.
Melke Road	NW/NW Section 27, T. 2 N., R. 9 E.	County Road - 14	SW/SE Section 11, T. 8 S., R. 7 E.
Spruce Drive	SW/SW Section 21, T. 2 N., R. 9 E.	County Road - 2	NW/NW Section 31, T. 8 S., R. 8 E.
Cottonwood Drive	SW/SE Section 20, T. 2 N., R. 9 E.	County Road - 2	NW/SW Section 31, T. 8 S., R. 8 E.
Cedar Street	SW/SW Section 20, T. 2 N., R. 9 E.	County Road - 1	SW/SW Section 31, T. 8 S., R. 8 E.
Cobler Road	SW/SW Section 19, T. 2 N., R. 9 E.	County Road - 19	SW/NW Section 23, T. 9 S., R. 7 E.
Elk Creek Road	SW/SW Section 27, T. 2 N., R. 8 E.	U. S. Highway 18	SW/SW Section 21, T. 9 S., R. 7 E.
Eglin Street	NW/SE Section 32, T. 2 N., R. 8 E.	County Road - 79	NW/NW Section 30, T. 9 S., R. 7 E.
I-16t	NW/NE Section 32, T. 2 N., R. 8 E.	County Road - 6	NE/SE Section 30, T. 9 S., R. 6 E.
Century Road	NW/NW Section 32, T. 2 N., R. 8 E.	County Road - 6	SW/SW Section 22, T. 9 S., R. 5 E.
North Lacrosse Street	SW/NE Section 31, T. 2 N., R. 8 E.	County Road - 6	SW/SE Section 20, T. 9 S., R. 5 E.
Milwaukee Street	NE/SW Section 31, T. 2 N., R. 8 E.	County Road - 6c	SE/NW Section 29, T. 9 S., R. 5 E.
Maple Avenue	SW/NW Section 31, T. 2 N., R. 8 E.	State Highway 71	SW/SW, Section 26, T. 9 S., R. 4 E.
East Blvd. North	NE/SE Section 36, T. 2 N., R. 7 E.	County Road 3292	SE/SW, Section 23, T. 9 S., R. 3 E.
New York Street	SE/SE Section 36, T. 2 N., R. 7 E.	County Road 6463 (Old Highway 18)	SE/NE, Section 31, T. 8 S., R. 3 E.
Omaha Street	SW/SE Section 36, T. 2 N., R. 7 E.	U.S. Highway 18	NE/NW Section 31, T. 8 S., R. 3 E.
2 nd Street	NW/NE Section 1, T. 1 N., R. 7 E.	County 6463	NW/SW Section 25, T. 8 S., R. 2 E.
1 st Street	NW/NE Section 1, T. 1 N., R. 7 E.	County 6463	SE/NW Section 31, T. 7 S., R. 2 E.
East Blvd.	NE/NE Section 1, T. 1 N., R. 7 E.	County 6463	SW/SE Section 4, T. 7 S., R. 1 E.
Maple Avenue	NW/NW Section 6, T. 1 N., R. 8 E.	Wyoming	
Steele Ave.	NW/SE Section 6, T. 1 N., R. 8 E.	Weston County	
E. Saint Charles Street	SE/SE Section 6, T. 1 N., R. 8 E.	Whoopup Canyon Road	NE/SW Section 30, T. 43 N., R. 60 W.
E. Saint Patrick Street	SE/SE Section 6, T. 1 N., R. 8 E.	Old Highway 85	SW/NE Section 10, T. 44 N., R. 61 W.
Campbell Street	SW/NE Section 8, T. 1 N., R. 8 E.	U. S. Highway 85	SW/SE Section 28, T. 45 N., R. 61 W.

**Table 3-14
Concluded**

Road Name	Legal Location	Road Name	Legal Location
Weston County (continued)		Campbell County (continued)	
Faye Ave.	SE/SW Section 28, T. 45 N., R. 61 W.	School Creek Road	SE/NW Section 6, T. 42 N., R. 69 W.
U. S. Highway 16 By Pass	NE/SE Section 29, T. 45 N., R. 61 W.	Reno County Road	SW/SW Section 6, T. 42 N., R. 69 W.
West Main Street	SW/NE Section 29, T. 45 N., R. 61 W.	Piney Creek Road (Mackey Road)	SE/NW Section 32, T. 42 N., R. 69 W.
Walker Ave.	NE/NW Section 29, T. 45 N., R. 61 W.	School Creek Road	SW/NW Section 6, T. 42 N., R. 69 W.
Williams Ave.	NE/NW Section 29, T. 45 N., R. 61 W.	Reno County Road	NE/NE Section 11, T. 42 N., R. 70 W.
Grove Ave.	NE/NE Section 30, T. 45 N., R. 61 W.	Converse County	
Oil Creek Road	NE/NW Section 16, T. 45 N., R. 62 W.	Irwin Road	NE/SW Section 32, T. 41 N., R. 70 W.
E. Rail Road Street	NE/NE Section 16, T. 46 N., R. 63 W.	Irwin Road	NW/SW Section 33, T. 41 N., R. 70 W.
Skull Creek Rd.	SE/NE Section 9, T. 46 N., R. 63 W.	Irwin Road	NE/SW Section 33, T. 41 N., R. 70 W.
Baroid Road	SW/SW Section 30, T. 47 N., R. 63 W.		
Highway 16	NE/NW Section 7, T. 47 N., R. 64 W.		
Highway 116	SW/SE Section 35, T. 48 N., R. 65 W.		
Pine Street	NE/SW Section 35, T. 48 N., R. 65 W.		
Thorn Road	SE/NW Section 11, T. 48 N., R. 66 W.		
Crook County			
Buffalo Creek Road (King Road)	NW/NW Section 23, T. 49 N., R. 67 W.		
Warbonnet Road	NW/NE Section 8, T. 49 N., R. 67 W.		
South Big Horn Ave.	NE/NW Section 6, T. 49 N., R. 67 W.		
Donkey Creek Road	NE/SE Section 30, T. 50 N., R. 68 W.		
Wessex Road	NW/SW Section 30, T. 50 N., R. 68 W.		
Campbell County			
State Highway 51 (14/16)	SW/SE Section 27, T. 50 N., R. 69 W.		
Stewart Road	SW/SW Section 27, T. 50 N., R. 69 W.		
Adon Road	SW/SW Section 30, T. 50 N., R. 70 W.		
Svaling Road	NE/SW Section 26, T. 50 N., R. 70 W.		
State Highway 51 (14/16)	NE/SE Section 27, T. 50 N., R. 70 W.		
Timber Creek Road	SW/SW Section 5, T. 49 N., R. 70 W.		
Timber Creek Road	SW/SE Section 7, T. 49 N., R. 70 W.		
Bishop Road	SE/SW Section 25, T. 48 N., R. 71 W.		
Bishop Road	SE/SE Section 26, T. 48 N., R. 71 W.		
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.		
Bishop Road	SW/SW Section 25, T. 48 N., R. 71 W.		
T-7 Road	SE/SE Section 24, T. 47 N., R. 71 W.		
Keeline Road	SW/SW Section 11, T. 44 N., R. 70 W.		
Little Thunder Road	SW/SE Section 35, T. 44 N., R. 70 W.		
State Highway 450	SW/NW Section 29, T. 43 N., R. 69 W.		
Little Thunder Road	NW/NE Section 30, T. 43 N., R. 69 W.		

Table 3-15 National Forest System (Grassland) Roads Which Would be Crossed by Alternative B		
Grassland Road Number	County	Legal Location
Buffalo Gap National Grassland		
Grassland Road 7068	Pennington	NE/SW Section 9, T. 2 S., R. 12 E.
Grassland Road 7067	Pennington	NE/SE Section 17, T. 2 S., R. 12 E.
Grassland Road 7060/Custer County Road 121	Custer	SE/SW Section 15, T. 3 S., R. 11 E.
Grassland Road 7053	Custer	SE/NW Section 27, T. 4 S., R. 10 E.
Grassland Road 7053	Custer	NE/NE Section 33, T. 4 S., R. 10 E.
Grassland Road 7053	Custer	SW/SE Section 33, T. 4 S., R. 10 E.
Grassland Road 7042	Custer	NE/NE Section 13, T. 5 S., R. 9 E.
Grassland Road 7042	Custer	SW/NE Section 13, T. 5 S., R. 9 E.
Grassland Road 7042	Custer	NE/SE Section 14, T. 5 S., R. 9 E.
Grassland Road 7046/Custer County Road 719	Custer	NW/SW Section 18, T. 6 S., R. 8 E.
Grassland Road 7046/Custer County Road 656	Custer	SW/SW Section 24, T. 6 S., R. 9 E.
Thunder Basin National Grassland		
Grassland Road 937/Lynch Road	Weston	NE/SE Section 21, T. 42 N., R. 67 W.
Grassland Road 933	Weston	SW/NW Section 17, T. 41 N., R. 68 W.
Grassland Road 973	Campbell	SE/SW Section 29, T. 41 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/NE Section 1, T. 43 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	NE/NW Section 1, T. 43 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/NW Section 20, T. 44 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T., 42 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

Table 3-16 National Forest System (Grassland) Roads Which Would be Crossed by Alternative C and the Route Variations		
Grassland Road Number	County	Legal Location
Buffalo Gap National Grassland		
Grassland Road 7068	Pennington	NE/SW Section 9, T. 2 S., R. 12 E.
Grassland Road 7067	Pennington	NE/SE Section 17, T. 2 S., R. 12 E.
Grassland Road 7060/Custer County Road 221	Custer	SW/SE Section 15, T. 3 S., R. 11 E.
Grassland Road 2048	Custer	SE/SE Section 27, T. 3 S., R. 10 E.
Grassland Road 7064	Custer	NE/NW Section 7, T. 5 S., R. 9 E.
Grassland Road 7046/Custer County Road 719	Custer	SW/NW Section 18, T. 6 S., R. 8 E.
Grassland Road 7046/Custer County Road 656	Custer	SW/SE Section 24, T. 6 S., R. 9 E.
Grassland Road 7049	Fall River	NW/NW Section 24, T. 7 S., R. 8 E.
Grassland Road 7049	Fall River	SW/NW Section 24, T. 7 S., R. 8 E.
Grassland Road 7049	Fall River	SW/NW Section 24, T. 7 S., R. 8 E.
Thunder Basin National Grassland		
Grassland Road 937/ Lynch Road	Weston	NE/SE Section 5, T. 42 N., R. 67 W.
Grassland Road 973	Campbell	SE/SE Section 17, T. 41 N., R. 69 W.
Grassland Road 1618	Campbell	NW/NE Section 8, T. 41 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T. 42 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/SW Section 11, T. 44 N., R. 70 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

**Table 3-17
National Forest System (Grassland) Roads Which Would be Crossed by Alternative D**

Grassland Road Number	County	Legal Location
Thunder Basin National Grassland		
Grassland Road 914/Baroid Road	Weston	SW/SW Section 30, T. 47 N., R. 63 W.
Grassland Road 973	Campbell	SE/SE Section 17, T. 41 N., R. 69 W.
Grassland Road 1618	Campbell	NW/NE Section 8, T. 41 N., R. 69 W.
Grassland Road 968/School Creek	Campbell	SE/NW Section 6, T. 42 N., R. 69 W.
Grassland Road 930/Keeline Road	Campbell	SW/SW Section 11, T. 44 N., R. 70 W.
Grassland Road 968/School Creek	Campbell	SW/NW Section 6, T., 42 N., R. 69 W.

3.5 Land Use

3.5.1 Impact Analysis Area. The USGS's National Cartographic Information Center distributes cartographic/geographic data files as part of the national mapping program. Part of that data includes land use and land cover. The basic source of land use and land cover compilation data are National Aeronautics & Space Administration (NASA) high-altitude aerial photographs and national high-altitude photography program photographs, usually at scales smaller than 1:60,000. For purposes of analyzing land uses potentially affected by the alternatives, 1:250,000 scale land use and land cover data were used.⁵

3.5.2 Affected Environment. USGS land use and land cover types in the vicinity of the alternatives are shown on Figures 3-2 (South Dakota) and 3-3 (Wyoming). Table 3-18 provides a summary of land use and land cover types which would be affected by Alternative B including the miles which would be crossed within each type. Tables 3-19 through 3-21 provide the same information for Alternative C and Alternative C with the Phiney Flat and W G Flat Route variations, respectively. Land use and land cover is summarized for Alternative D on Table 3-22.

The Black Thunder North Mine Loop would cross 3 land use and land cover types: herbaceous rangeland; industrial; and strip mines, quarries and gravel pits. The Black Thunder South Mine Loop would cross the same land use and land cover types but would also affect nonforested wetlands (see discussion of problems associated with the accuracy of this classification on page 3-26). The North Antelope East Mine Loop would cross cropland and pasture, herbaceous rangeland and shrub and brush rangeland. The North Antelope West Mine Loop would cross cropland and pasture and herbaceous rangeland.

⁵ 1:250,000 and limited 1:100,000 scale land use and land cover data can be downloaded from the USGS's GeoData web site at <http://edc.usgs.gov/doc/edchome/ndcddb/ndcddb.html>

The Wall Yard would occupy 3 land use and land cover types: residential; mixed urban or built-up land; and cropland and pasture. The Edgemont Interchange Yard would be constructed within a herbaceous rangeland land use and land cover type. The Western Yard site consists of a mixture of herbaceous rangeland and small amounts of cropland and pasture.

Affected land use and land cover types are briefly described below:

Residential. Residential land uses range from high density, represented by the multiple-unit structures of urban cores, to low density, where homes are on lots of more than an acre and on the periphery of urban expansion. Areas of sparse residential land use, such as farmsteads, are typically included in categories to which they are related.

All alternatives would cross areas with residential land uses. Alternatives B and C (including the route variations) would only cross approximately 0.3 miles of residential areas in South Dakota. Neither alternative would cross areas classified by the USGS as residential in Wyoming. Alternative D would cross almost 6 miles of residential areas - mostly along DM&E's existing main line through Rapid City and adjacent to the BNSF through Newcastle and Moorcroft.

All the alternatives (including the route variations) would cross an area classified as residential at Smithwick in Fall River County in Section 31, T. 8 S., R. 8 E. and Section 6, T. 9 S., R. 8 E. Through the Smithwick area, the alternatives would be constructed on DM&E's existing Black Hills Subdivision Branch Line. The new railroad would replace the existing branch line adjacent to Smithwick.

Alternative B is routed directly adjacent to an area classified by USGS as residential in Fall River County east of Edgemont in Section 36, T. 8 S., R. 2 E. and Section 6, T. 9 S., R. 3 E. A number of residences are located within 0.1 miles or less of Alternative B at this location.

Figure 3-2

Land Use and Land Cover for South Dakota

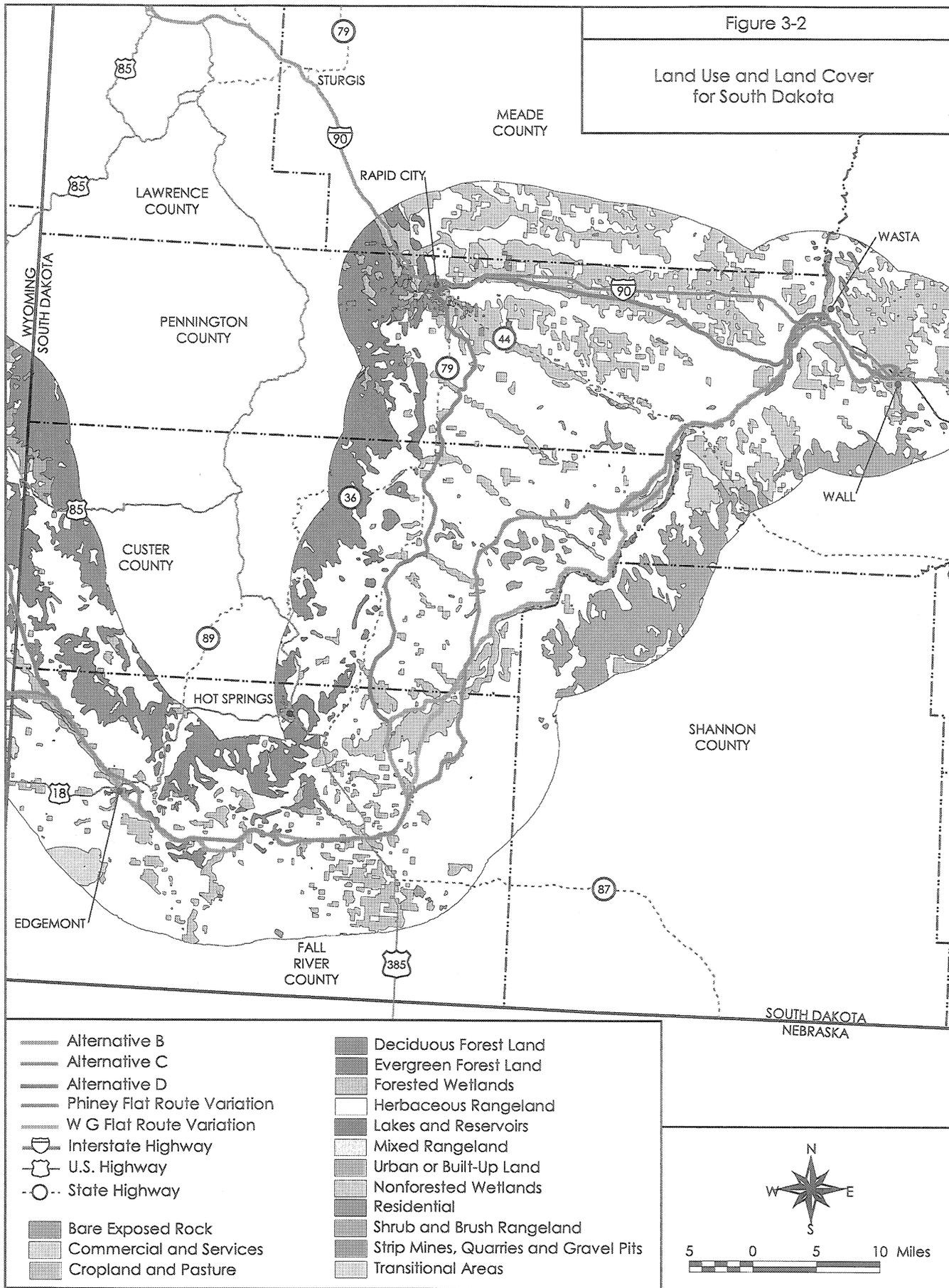
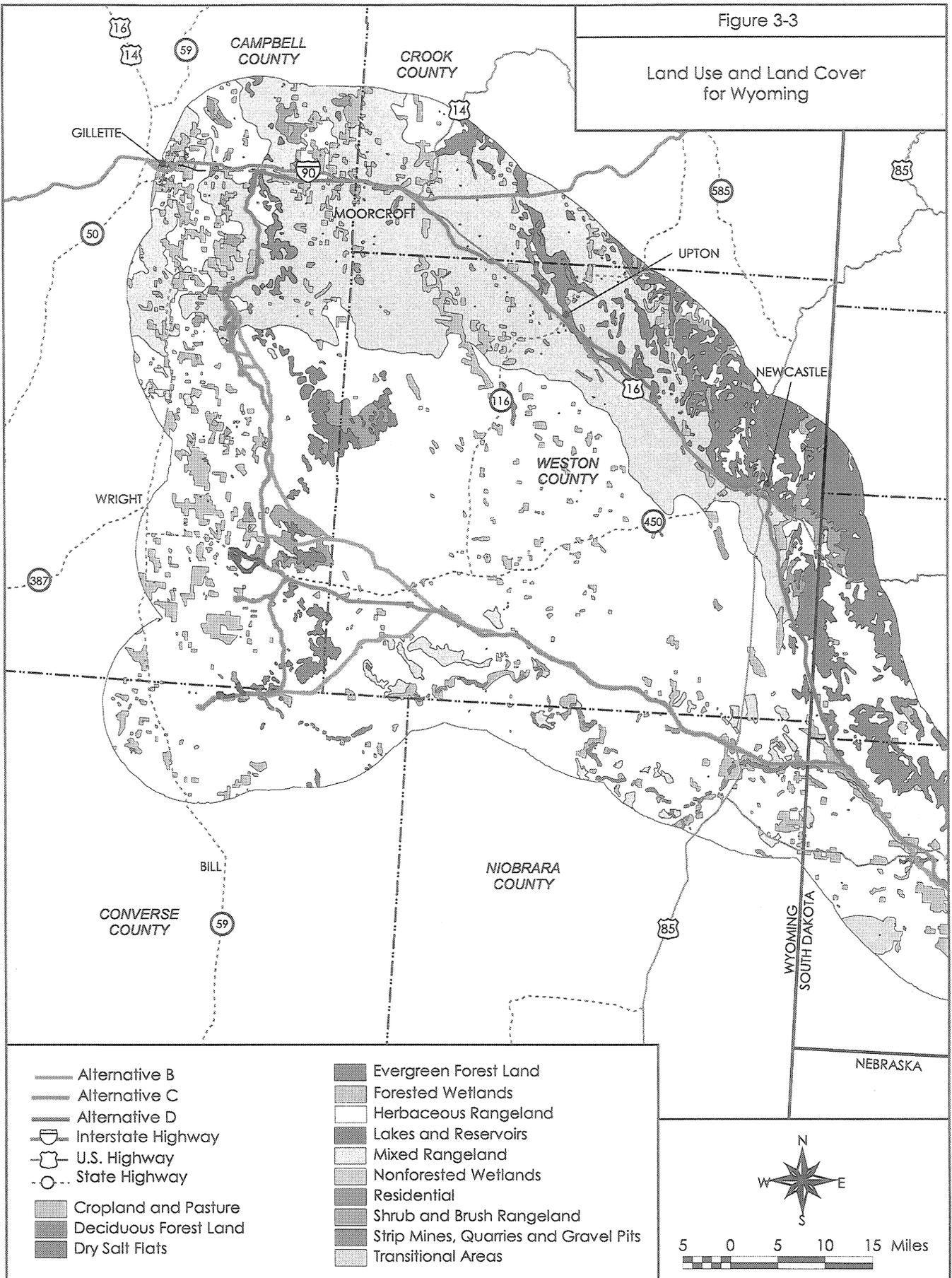


Figure 3-3

Land Use and Land Cover for Wyoming



**Table 3-18
Land Use and Land Cover Classifications Which Would be Crossed by Alternative B**

	Miles Crossed by Land Ownership					State Total (miles)	Percent of State
	Forest Service	DOE (1)	BLM	State	Private		
South Dakota							
Residential					0.3	0.3	0.2
Transportation, Communications and Utilities					0.1	0.1	0.1
Mixed Urban or Built-Up Land					0.2	0.2	0.1
Cropland and Pasture	<0.1			0.2	20.3	20.5	14.1
Other Agricultural Land					0.1	0.1	0.1
Herbaceous Rangeland	15.3	0.3	3.2	2.5	92.3	113.6	78.4
Evergreen Forest Land			0.1		2.3	2.4	1.7
Forested Wetlands	0.8				2.6	3.4	2.3
Nonforested Wetlands	0.2				3.3	3.5	2.4
Strip Mines, Quarries, and Gravel Pits					0.8	0.8	0.6
Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Industrial							
Cropland and Pasture	0.7				7.0	7.7	5.1
Herbaceous Rangeland	34.5		2.4	6.6	84.5	128.0	84.7
Shrub and Brush Rangeland	0.1			0.8	3.7	4.6	3.0
Mixed Rangeland	0.2		<0.1		9.8	10.0	6.6
Deciduous Forest Land					0.5	0.5	0.3
Strip Mines, Quarries, and Gravel Pits	0.1				0.3	0.4	0.3
Total	35.6		2.4	7.4	105.8	151.2	100
1 = DOE lands would only be crossed in South Dakota							

Alternative D would, by far, have the largest impact on residential areas. The alternative would cross through residential areas at its origin in Wall. Residential areas are located on both sides of DM&E's existing main line through the town. Residences are located adjacent to the track along Main Street and on the north and south sides of 4th Avenue. Additional residential areas are located next to the existing track along Myrtle Avenue and adjacent to the north and west sides of 7th Avenue west of Main Street.

Through Wasta DM&E's existing track crosses just south of town between Baseline Road and the Cheyenne River and the town's sewage lagoon. Residential areas are located north of the existing track, generally on the north side of Baseline Road. The existing main line also passes directly south of New Underwood between Elm Street and Boxelder Creek. Residences are located adjacent to Elm Street and Pine Street to the north of the existing main line. In addition, scattered residences are located south of the existing main line along A Avenue both north and south of Boxelder Creek.

West of Melke Road, Alternative D approaches the Town of Box Elder. On the east side of town a number of residences have been constructed south of Old Highway 14-16 and DM&E's existing main line. Residences are located south of Line Road adjacent to Willow Drive, Pine Drive, Spruce Drive, Circle Drive, Cottonwood Drive and Aspen Drive. All these residences are less than 0.1 miles south of the existing main line.

DM&E's existing main line passes north of the Town of Box Elder on the north side of Front Street. Residences are located in close proximity to the existing main line south of Front Street between Ash Street and Cedar Street. West of the town, residential areas are located north of the existing main line and south of I-90 and Ellsworth Air Force Base. These residential areas are located on the north side of Box Elder Road from about South Gate Road on the east to approximately Exit 63 on I-90 to the west. Throughout this area, DM&E's existing main line is located on the south side of Old Highway 14-16 whereas the majority of the residences are north of the highway.

**Table 3-19
Land Use and Land Cover Classifications Which Would be Crossed by Alternative C**

	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture			0.5	19.9	20.4	14.3
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	5.2	2.7	1.5	100.6	110.0	77.1
Shrub and Brush Rangeland				<0.1		
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.8	1.8	1.3
Nonforested Wetlands				4.3	4.3	3.0
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

As was discussed previously, this alternative assumes that DM&E's existing main line and the Black Hills Subdivision Branch Line through Rapid City are rebuilt as a heavy haul railroad. Much of these existing routes cross through or adjacent to residential areas. In reality, if these lines were to be rebuilt, an alternative alignment around Rapid City would be required.

On the northeast side of Rapid City, DM&E's existing main line passes directly north of Mockingbird Lane and Meadowlark Road. A number of additional residences are located south of the alternative east of LaCrosse Street and north of Adams Street including along Pheasant Drive. West of LaCrosse Street and east of Milwaukee Street, residential areas are located adjacent to the existing main line along Monroe Street, Racine Street and Waterloo Street. North of North Street the existing main line is aligned adjacent to residences along Herman Street, Maple Avenue and Watertown Street.

On the south side of Rapid City, along the Black Hills Subdivision Branch Line and adjacent to Saint Joseph

Street and State Highway 79, residential areas are located directly east of the existing branch line along Cherry Avenue, Saint James Street, Saint Cloud Street and Franklin Street. Generally, these areas are located north of Saint Patrick Street. Additional residential areas are in close proximity to the branch line east of Campbell Street and north of Saint Francis Street.

Residential areas are located east and west of the existing branch line through Hermosa. The closest residences are located east of 2nd Street and south of Main Street (State Highway 40). All of Hermosa is located within about 0.5 miles of the branch line. Around Fairburn, the existing branch line runs north of 1st and 2nd streets. Residences are located along both streets with most of the town located to the south of the branch line. All of the town is within about 0.3 miles of the branch line.

No residential areas would be affected by Alternative D between south of Smithwick and where the alternative deviates from Alternative C near the South Dakota-Wyoming State line. However, north of the alternative's

**Table 3-20
Land Use and Land Cover Classifications Which Would be Crossed by Alternative C With the Phiney Flat Route Variation**

	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture			0.5	25.1	25.6	17.9
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	4.4	2.7	1.5	97.2	105.8	73.7
Shrub and Brush Rangeland				<0.1	<0.1	<0.1
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.6	1.6	1.1
Nonforested Wetlands				4.3	4.3	3.0
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

departure from Alternative C, the USGS has mapped the area crossed near Dewey as residential. In this area, Alternative D would be constructed directly adjacent to the BNSF. All the residences around Dewey would be located within 0.2 miles of the alternative.

Alternative D would cross through residential areas in Newcastle. On the east side of town, the alternative would be constructed adjacent to the BNSF and south of Old Highway 85. Residential areas are located on the north side of Old Highway 85 in this area along Oak Street, Gray Boulevard, Cedar Street and Ash Street. The alternative would again approach residential areas on the west side of the Highway 16 bypass near Seneca Avenue. North of Main Street, residential areas are located on both sides of the alternative including areas north of Cambria Street and Railroad Street and south of Sunset Street and Railroad Street. In fact, it may be difficult to route the alternative on the north side of the BNSF through Newcastle north of the Highway 16 bypass without impacting residences along Cambria Street and Timber Avenue/Railroad Street.

If the alternative was routed on the south side of BNSF through Newcastle, equally severe impacts would occur to residences located on Sunset Street. Consequently, unless DM&E could find a way to construct the alternative within BNSF's existing right-of-way, the route evaluated through Newcastle for this alternative may not be feasible.

Through Osage the alternative is routed on the east side of BNSF. Osage is located west of the BNSF. However, the entire town is situated within 0.5 miles of the alternative. The closest residences are located along Nefsy Avenue between McGrew Street and Sheridan Street on the south end of town.

Upton is located east of the BNSF. Alternative D is routed between the BNSF and the town and the entire town is located within about 0.5 miles of the alternative. The alternative would pass on the southwest side of Upton southwest of First Street adjacent to BNSF. Most of the residences in Upton are located northeast of Second Street.

Table 3-21
Land Use and Land Cover Classifications Which Would be Crossed by Alternative C With the W G Flat Route Variation

	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				0.3	0.3	0.2
Transportation, Communications and Utilities				0.1	0.1	0.1
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture		0.1	0.5	24.3	24.9	17.6
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland	5.2	2.7	1.5	97.7	107.1	75.7
Shrub and Brush Rangeland				<0.1	<0.1	<0.1
Deciduous Forest Land		0.3	0.1	0.3	0.7	0.5
Evergreen Forest Land		0.4		2.6	3.0	2.1
Forested Wetlands				1.8	1.8	1.3
Nonforested Wetlands				1.5	1.5	1.1
Bare Exposed Rock	0.9			0.8	1.7	1.2
Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Industrial						
Cropland and Pasture	0.7			8.6	9.3	7.1
Herbaceous Rangeland	31.8	1.5	8.8	68.2	110.3	84.1
Shrub and Brush Rangeland			0.7	1.2	1.9	1.4
Mixed Rangeland			0.1	9.3	9.4	7.2
Evergreen Forest Land	0.3				0.3	0.2
Total	32.8	1.5	9.6	87.3	131.2	100

Alternative D would pass on the southwest side of Moorcroft between Rush Creek and Railroad Avenue. A number of residences are located north of Railroad Street, east and west of Yellowstone Avenue. These residences may preclude construction of the alternative on the north side of the BNSF through town. For Alternative D to be feasible, it may be necessary to cross to the south side of BNSF east of Moorcroft. The area near the intersection of Big Horn Avenue and Railroad Street is particularly tight.

Industrial. This category includes a wide array of land uses from light manufacturing to heavy manufacturing plants. Light industrial areas may be directly in contact with urban areas; many are found at airports or in relatively open country. Heavy industries use raw materials such as iron ore, timber or coal. Included are steel mills, pulp and lumber mills, electric power generating stations, oil refineries and tank farms, chemical plants, and brick making plants. Stockpiles of raw materials and waste-product disposal areas are

usually visible, along with transportation facilities capable of handling heavy materials. In South Dakota, Alternative D would cross 2 areas classified as industrial in and adjacent to Rapid City (0.5 miles, combined).

Transportation, Communications and Utilities. These land uses occur to some degree within all of the other urban or built-up categories and actually can be found within many other categories. Unless they can be mapped separately by the USGS, they usually are considered an integral part of the land use within which they occur. According to the USGS, any statistical summary of the area of land uses in this category typically represents only a partial data set. Major transportation routes and areas greatly influence other land uses, and many land use boundaries are outlined by them. The types and extent of transportation facilities in a locality determine the degree of access and influence both the present and potential use of the area. Highways and railways are characterized by areas of activity connected in linear patterns.

**Table 3-22
Land Use and Land Cover Classifications Which Would be Crossed by Alternative D**

	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Residential				3.8	3.8	2.1
Commercial and Services				3.3	3.3	1.8
Industrial				0.5	0.5	0.3
Transportation, Communications and Utilities				0.5	0.5	0.3
Mixed Urban or Build-Up Land				1.8	1.8	1.0
Cropland and Pasture				42.3	42.3	23.6
Other Agricultural Land				0.2	0.2	0.1
Herbaceous Rangeland		0.9	2.0	116.2	119.1	66.4
Deciduous Forest Land				0.5	0.5	0.3
Evergreen Forest Land		0.4		1.9	2.3	1.3
Forested Wetlands				1.3	1.3	0.7
Nonforested Wetlands				3.3	3.3	1.8
Bare Exposed Rock				0.1	0.1	0.1
Strip Mines, Quarries, and Gravel Pits				0.3	0.3	0.2
Total		1.3	2.0	176.0	179.3	100
Wyoming						
Residential				2.1	2.1	1.2
Commercial and Services				0.5	0.5	0.3
Industrial				0.6	0.6	0.3
Transportation, Communications and Utilities			0.9	9.9	10.8	6.0
Mixed Urban or Built-Up Land				0.1	0.1	0.1
Cropland and Pasture	<0.1		0.2	8.2	8.4	4.6
Other Agricultural Land				0.1	0.1	0.1
Herbaceous Rangeland	20.0	0.1	4.3	44.4	68.8	38.0
Shrub and Brush Rangeland		<0.1		1.4	1.4	0.8
Mixed Rangeland	5.5	1.6	3.4	68.8	79.3	43.8
Evergreen Forest Land	1.1			5.9	7.0	3.9
Strip Mines, Quarries, and Gravel Pits	0.1			1.5	1.6	0.9
Total	26.7	1.7	8.8	143.5	180.7	100

The highways include rights-of-way, areas used for interchanges, and service and terminal facilities. Rail facilities include stations, parking lots, roundhouses, repair and switching yards, and related areas, as well as overland track and spur connections of sufficient width for delineation at mapping scale. Communications and utilities areas (such as those involved in processing, treatment and transportation of water, gas, oil and electricity) and areas used for airwave communications are also included in this category. Pumping stations, electric substations, and areas used for radio, radar, or television antennas are the major types. Small facilities,

such as those associated with an industrial or commercial land use, are included within the larger category with which they are associated. Long-distance gas, oil, electric, telephone, water, or other transmission facilities rarely constitute the dominant land use of the lands with which they are associated.

Alternatives B and C (including the route variations) would cross 0.1 miles of this category in Pennington County at the crossing of I-90 west of Wall in Section 35, T. 1 N., R. 15 E. Alternative D would cross 0.5 miles of this category in the I-90 corridor at Wall and near Wasta.

In Wyoming, 10.8 miles of this category would be crossed by Alternative D in the Donkey Creek drainage near Rozet. The area includes the joint BNSF/State Highway 51 corridor. The area containing the Newcastle airport also contains lands of this classification.

Mixed Urban or Built-Up Land. This category includes developments along transportation routes and in cities, towns, and built-up areas where land uses cannot be mapped individually. Residential, commercial, industrial, and occasionally other land uses may be included. Farmsteads, intermixed with strip or cluster settlements, are included within the built-up land, but other agricultural land uses are excluded. All the alternatives would cross this category north of Wall just west of Pedro Wall Road in Section 31, T. 1 N., R. 16 E. Alternatives B and D would cross approximately 0.2 miles of this category at Oral in Sections 27 and 34, T. 7 S., R. 7 E. within DM&E's Black Hills Subdivision Branch Line. Alternative D would cross this category east of Rapid City and in downtown Rapid City generally on the north side of Rapid Creek between Omaha Street and North Street. In Wyoming, this land use and land cover category would be crossed in Upton and Moorcroft by Alternative D.

Cropland and Pasture. This category includes cropland harvested, including bush fruits; cultivated summer-fallow and idle cropland; land on which crop failure occurs; cropland in soil-improvement grasses and legumes; cropland used only for pasture in rotation with crops; and pasture on land more or less permanently used for that purpose. Both Alternatives B and C would cross about 20 miles of the cropland and pasture category in South Dakota. Both the Phiney Flat and WG Flat route variations would cross an additional 5 miles of this land use and land cover category. Alternative D would cross over 42 miles of this category in South Dakota. In Wyoming, approximately 7 to 10 miles of this category would be crossed by all of the alternatives.

Other Agricultural Land. This land use includes farmsteads, holding areas for livestock such as corrals, breeding and training facilities on horse farms, farm lanes and roads, ditches and canals, small farm ponds, and similar uses associated with other agricultural land uses. Small amounts (0.1 mile for Alternative B and 0.2 mile for all of the other alternatives) of this category would be crossed in South Dakota. Alternative D would cross a small amount of this category (0.1 mile) in Wyoming.

Herbaceous Rangeland. The herbaceous rangeland category encompasses lands dominated by naturally occurring grasses and forbs as well as those areas of actual rangeland which have been modified to include grasses and forbs as their principal cover, when the land is managed for rangeland purposes and not managed

using practices typical of pastureland. It includes the tall grass, short grass, bunch grass and other grass regions. Typical occurrences of grasslands include such species as bluestems, grama grasses, wheatgrasses, needlegrasses and fescues. This is the dominant land use category crossed in both states by Alternatives B and C (including the route variations). It comprises approximately 70 to 80 percent of these alternatives. It is also the dominant land use land cover which would be crossed by Alternative D in South Dakota. However, in Wyoming, mixed range is more common than herbaceous range along Alternative D.

Shrub and Brush Rangeland. This type includes shrubs found in arid and semiarid regions characterized by xerophytic vegetation types with woody stems such as big sagebrush, shadscale and greasewood. Where highly alkaline soils are present, halophytes such as saltbush may occur. Also included in this category are areas with mountain mahogany and scrub oaks. This category would be mostly crossed in Wyoming and becomes more prevalent as the alternatives move toward the west.

Mixed Rangeland. When more than one-third of either herbaceous or shrub and brush rangeland species occur in an area, it is classified by the USGS as mixed rangeland. This type is more common in the northern portions of the project area in northern Campbell and Weston counties. Alternatives B and C would cross this category north of the Belle Fourche River crossing on the northern legs of the alternatives. Alternative D would cross a much larger amount of this category (approximately 80 miles) - mixed rangeland is the predominant land use and land cover type which would be affected by this alternative in Wyoming.

Deciduous Forest Land. This forest type includes all forested areas having a predominance of trees that lose their leaves at the end of the frost-free season or at the beginning of the dry season. Oaks and aspen stands are included in this category. Cottonwoods, which are more typical of wetlands, are not included in this type. This type is associated primarily with the Cheyenne River drainage. About 0.7 and 0.5 miles of this type would be crossed by Alternative C (including the route variations) and D, respectively, in South Dakota and about 0.5 miles would be crossed by Alternative B in Wyoming.

Evergreen Forest Land. In the impact analysis area, this type includes all forested areas in which the trees are predominantly coniferous. All alternatives would cross this category in Fall River County southeast of Edgemont on the south side of the Black Hills. Seven miles of this category would be crossed by Alternative D in Wyoming. Most of these areas are located on the western edge of the Black Hills near Clifton, Newcastle and Osage,

Wyoming. Also included is the area known as Pine Ridge near Upton.

Nonforested Wetlands. These wetlands are dominated by wetland herbaceous vegetation or are nonvegetated. These wetlands include wet meadows and wet prairies. Due to the scale of the USGS land use and land cover mapping, the estimates for this category are considered unreliable. Refer to Section 3.16 for a better estimate of potential wetland impacts by type. Detailed descriptions of wetlands that are located adjacent to Alternative C (including the route variations) can be found in the COE 404 application wetland delineation reports prepared by DM&E.

Forested Wetlands. These wetlands are dominated by woody vegetation. In the project area, forested wetlands are typically dominated by cottonwood and willow. Due to the scale of the USGS mapping, the estimates for this category are considered unreliable. Refer to Section 3.16 for a better estimate of potential wetland impacts by type.

Bare Exposed Rock. This category includes areas of bedrock exposure, scarps, talus, slides and other accumulations of rock without vegetative cover. Much of Badlands National Park is characterized as this type. About 1.7 miles of this category would be crossed by Alternative C (including the route variations) in South Dakota northwest of Badlands National Park and west of Horsehead Creek and south of Angostura Reservoir. Alternative D would also cross this category west of Horsehead Creek.

Strip Mines, Quarries and Gravel Pits. Those extractive mining activities that have significant surface expression are identified in this category. Vegetative cover and overburden are removed to expose minerals. Current mining activity is not always distinguishable, and inactive, unreclaimed, and active strip mines, quarries, borrow pits, and gravel pits are included in this category until other cover or use has been established. Unused pits or quarries that have been flooded are placed in the appropriate water category.

Alternative D would cross through clay pits near Colloid and Bentley, Wyoming which are identified by USGS as this category. Clay pits would also be crossed by this alternative southeast of Upton near the Little Turner Creek crossing. In South Dakota, Alternative D would cross through gravel pits on the Cheyenne River east of Wasta that are included in this category. Immediately east of Edgemont, Alternative B would cross through an area which contains uranium tailings and ponds being reclaimed by DOE.

3.6 Recreation Resources

3.6.1 Impact Analysis Area. Any area directly impacted or potentially affected by operating noise from the alternatives is included in the recreation impact analysis area.

3.6.2 Recreation Activities. The eastern portion of the project area contains recreation resources of national significance (see Figure 1-1). Included are well-known and heavily visited national parks such as Badlands and Wind Cave. Many tourists are initially attracted to the Black Hills by Mount Rushmore. However, other area recreation destinations, such as Custer State Park, Black Hills National Forest and Angostura Reservoir State Recreation Area, also attract large numbers of visitors. Consequently, recreation is very important to the economy of western South Dakota.

3.6.2.1 National Forest System Lands. Many of the recreation opportunities in the general project area are located on NFS lands. In most cases, recreation activities on NFS lands are unstructured and dispersed. Except as noted below, there are few developed recreation sites in close proximity to any of the alternatives.

Many of the recreation amenities TBNG and BGNG offer are unquantifiable and unmeasurable. Because of the vastness of the lands and predominantly dispersed types of recreation that occur, it is difficult to determine actual use numbers for any particular activity and area. Although the majority of the use occurs during the big game hunting seasons in the fall, recreation use occurs year-round due to the limited snowfall on the grasslands. The recent Northern Great Plains Land and Resource Management Plan Revision effort has publicized the values of these lands to the attention of the general public. This new public interest in the grasslands will undoubtedly result in increased visitation over the next decade by those seeking grassland types of experiences, as these types of public lands are few and unique.

Two of the greatest attractions to dispersed recreationist on the national grasslands are the vastness and undeveloped character of these areas. What sights and sounds of humankind that currently exist are generally diminished and become mostly insignificant across the landscape due to the expansiveness of the areas. These areas offer an escape from the constant barrage of human caused noise that most people in their everyday lives experience. The largeness and primitive appearing landscapes on the grasslands also offer an escape from the sights of human developments that most people live with on a daily basis.

Another recreation related experience the grasslands offer is a night sky that is not diminished by ambient night light pollution. The horizon to horizon sky during the numerous clear nights on these lands provides brilliantly clear views of the stars and other celestial objects. Again, these areas offer this experience that is not available in rural and urban areas.

BGNG provides excellent backcountry opportunities including the Cheyenne River and Redshirt RARE II areas. One non-motorized area, Indian Creek, is also a good backcountry area. Fishing opportunities are rapidly declining as many small reservoirs age and become more shallow due to siltation. Railroad Buttes provides an excellent off-highway vehicle area, but concerns have been expressed about resource damage and conflicts with other uses. Agate hunting, birdwatching and wildlife viewing are popular on BGNG. Big game and upland bird hunting are popular, as is shooting prairie dogs. The National Grasslands Visitor Center in Wall draws thousands of visitors to interpretive displays. The Black Hills and Badlands National Park are within driving distances of BGNG. As such, highways that cross BGNG carry tens of thousands of visitors into the area every year. State Highways 240 and 44 provide a scenic loop through the BGNG and Badlands National Park.

The Forest Service, as part of its Northern Great Plains Management Plans Revision, estimated recreation use on BGNG. This area receives more recreation use than any other national grassland evaluated in the plans revision. Annual mean visitor days by recreation use on BGNG is listed on Table 3-23. Motorized travel/viewing scenery is the most popular recreation use comprising nearly 94 percent of all recreation visitor days on BGNG. Picnicking and big game hunting are the second most frequent recreation uses on the grassland - combined, however, these 2 uses represent only about 3.2 percent of the total recreation visitor days. Camping and small game hunting are relatively small uses and individually represent less than 1 percent of the total recreation visitor days.

Similar recreational opportunities are found on TBNG, although few developed sites exist. BGNG receives over 2.5 times more recreational visitor days than TBNG. Scattered ownership patterns and limited legal public access across private lands hinders some recreational opportunities on NFS lands on TBNG. Over half (51.5 percent) of the recreation use on TBNG is associated with motorized travel and viewing scenery (see Table 3-23). Roads constructed to service oil and gas production facilities provide improved motorized access for recreationists. TBNG contains some of the largest coal deposits in the nation, much of it being strip mined on sites within the grassland. Many people drive to these mines to view the mining process.

Big game hunting (primarily for mule deer and pronghorn) is a very important recreation use on TBNG. Considering the short season of use associated with big game hunting, the use still accounts for nearly 15 percent of all recreation visitor days on the grassland. Prairie dog shooting is popular and attracts participants from across the nation. Camping is a relatively important use and represents 8 percent of total recreation visitor days. Largemouth bass and trout fishing are available at several sites on the grassland.

During the past 10 years, the Douglas Ranger District has undertaken an aggressive land exchange program to dispose of isolated tracts of the TBNG and consolidate the public land base. This effort has resulted in almost 100,000 acres being exchanged. The intent of this effort has been to improve public access to these lands, provide more contiguous public lands for recreation uses, improve overall land management efficiency, and consolidate large areas of these lands to provide expansive public grassland settings.

Recreation on NFS lands is currently managed to provide desired experiences to visitors using the Recreation Opportunity Spectrum (ROS). The key to providing most recreational experiences and opportunities is the setting and how the setting is managed. ROS is a system for planning and managing recreation resources that categorizes recreation opportunities into 6 classes. Each class is defined in terms of the degree to which it satisfies certain recreation experience needs based on: 1) the extent to which the natural environment has been modified; 2) the type of facilities provided; 3) the degree of outdoor skills needed to enjoy the area; and 4) the relative density of recreation use. ROS classification for BGNG and TBNG are summarized on Table 3-24. The current ROS classifications for NFS lands, in relation to the alternatives, are shown on Figures 3-4 (BGNG) and 3-5 (TBNG).

Table 3-25 lists current ROS classification for NFS lands which would be crossed by the alternatives. As is indicated on the table, several ROS classifications are not crossed by the alternative centerline but are located in close proximity (within 500 feet). Only the Western Yard would affect NFS lands. The ROS classification for the 71 acres of NFS lands located within the proposed Western Yard site is roaded natural.

The following is a description of ROS classes which are located within the impact analysis area for the alternatives:

Semi-Primitive Nonmotorized. These lands provide the most primitive recreation opportunities offered on NFS lands in the impact analysis area and are found only on BGNG. This ROS classification consists of approximately

Table 3-23
Annual Mean Recreation Use on Buffalo Gap and Thunder Basin National Grasslands (1)

Recreation Use	BGNG		TBNG	
	Thousands of Recreation Visitor Days	Percent of Total Recreation Visitor Days	Thousands of Recreation Visitor Days	Percent of Total Recreation Visitor Days
Camping	1.4	0.8	5.1	8.0
Motorized travel/viewing scenery	155.6	93.9	33.0	51.5
Picnicking	2.7	1.6	0.0	0
Hiking/horseback riding	0.9	0.5	1.4	2.2
Big game hunting	2.7	1.6	9.4	14.7
Upland game hunting	0.3	0.2	2.9	4.5
Small game hunting	1.3	0.8	4.5	7.0
Waterfowl hunting	0.4	0.2	3.3	5.1
Fishing	0.4	0.2	4.5	7.0
Total	165.7		64.1	

1 = five-year annual mean (1992-1996)

Table 3-24
Acres of National Forest System Lands by ROS Classification for Buffalo Gap and Thunder Basin National Grasslands (1)

ROS Classification	BGNG		TBNG	
	Acres	Percent of Total Grassland	Acres	Percent of Total Grassland
Semi-Primitive Nonmotorized	18,720	3.2	0	0
Semi-Primitive Motorized	124,860	21.2	27,070	4.9
Roaded Natural	405,310	68.8	444,620	79.9
Primitive	0	0	0	0
Rural	40,220	6.8	70,690	12.7
Urban	0	0	14,050	2.5
Total	589,110	100	556,430	100

1 = Acres provided are for the current Medicine Bow and Nebraska National Forest Plans (Forest Service, 1984 and 1995).

18,720 acres on BGNG and comprises about 3 percent of the total grassland acres (see Table 3-24). These lands, although not crossed directly by any of the alternative centerline, are within 500 feet of Alternative B. The Indian Creek Rare II Area, located in Sections 9, 16 and 21, T. 4 S., R. 11 E. in Pennington County on the north boundary of the Pine Ridge Indian Reservation (see Figure 3-6), is designated as semi-primitive nonmotorized. The semi-primitive nonmotorized area is separated from Alternative B by the Cheyenne River. These lands are located on the east side of the river just north of the Pennington-Shannon County line. Alternative B in this area is routed west of the river across Battle Creek on NFS lands in Custer County.

Semi-primitive non-motorized lands are characterized by a predominantly natural or natural-appearing environment of moderate to large size. Interaction between recreational users is low, but there is often evidence of other users. The area is managed in such a

way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized recreation is not permitted, but local roads used for other resource management activities may be present on a limited basis. Use of such roads is restricted to minimize impacts on recreational opportunities.

Semi-Primitive Motorized. This ROS classification is characterized by a predominantly natural or natural-appearing environment of moderate to large size. The concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum on-site controls and restrictions may be present, but would be subtle. Motorized use of local primitive or collector roads with predominantly natural surfaces and trails suitable for motor bikes is permitted.

Both BGNG and TBNG contain areas that have been classified as semi-primitive motorized, although these lands are much more prevalent on BGNG - over 21

Figure 3-4

Recreation Opportunity Spectrum
Classifications for Buffalo Gap
National Grassland

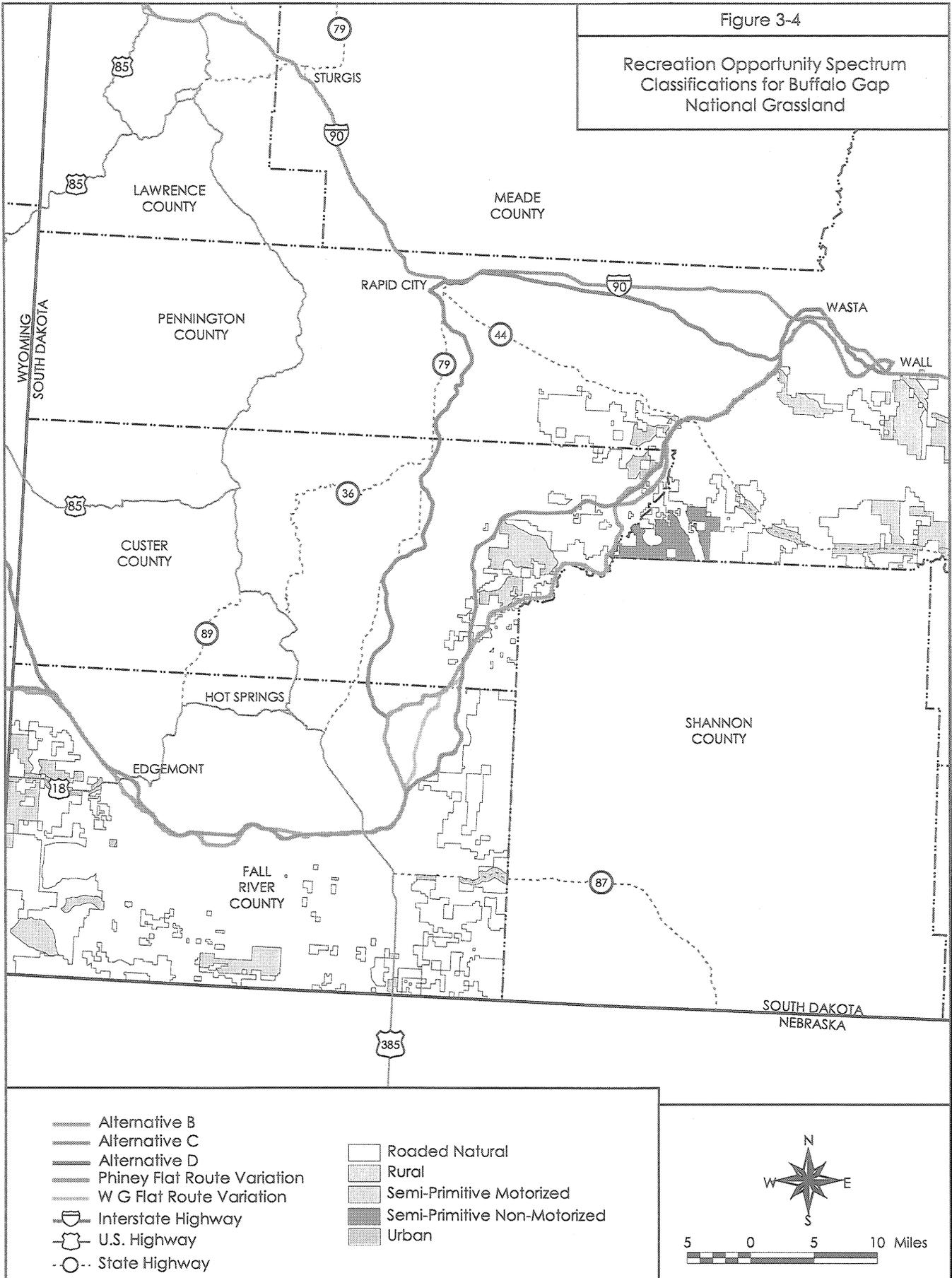


Figure 3-5

Recreation Opportunity Spectrum
Classifications for Thunder Basin
National Grassland

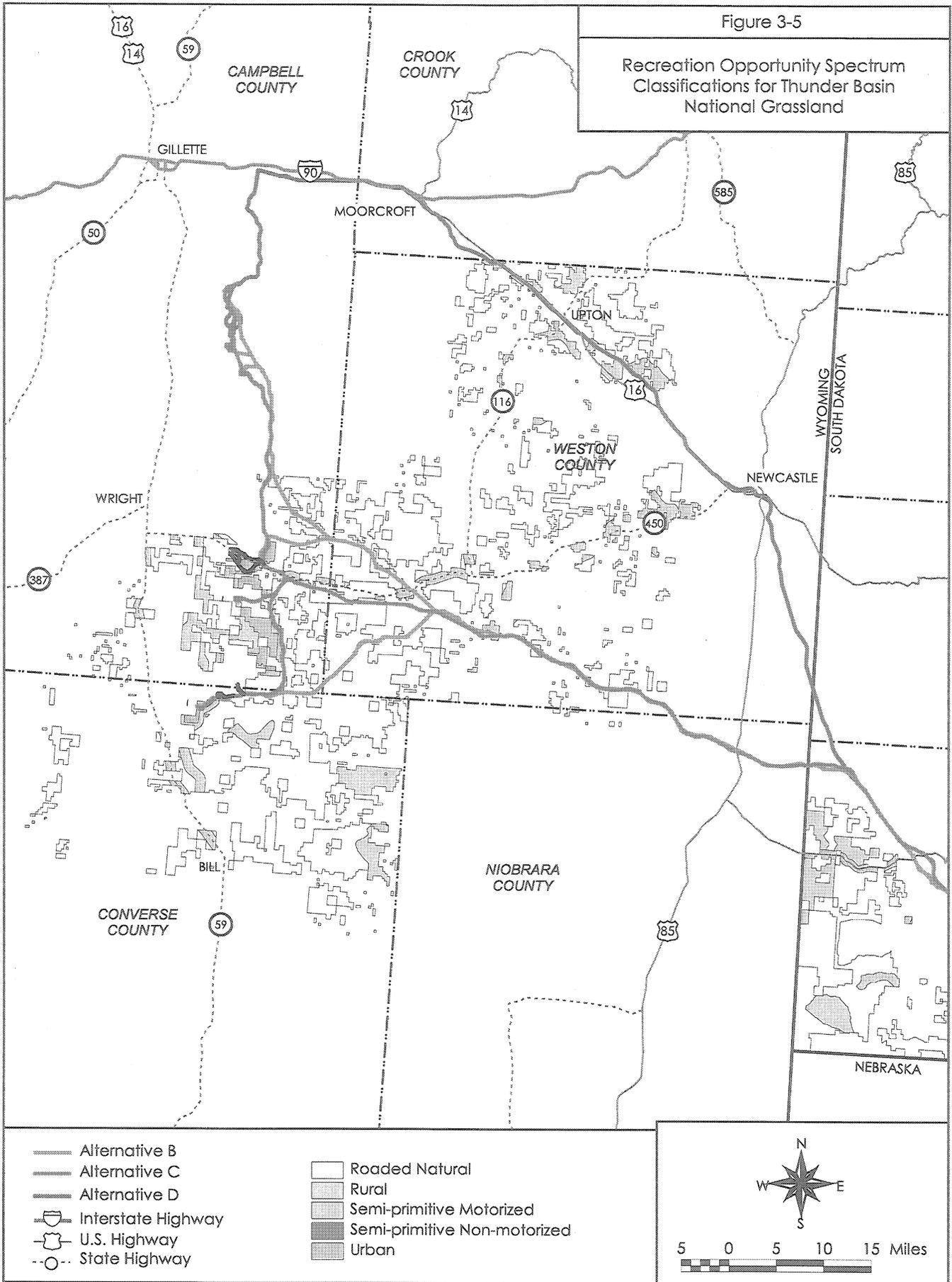
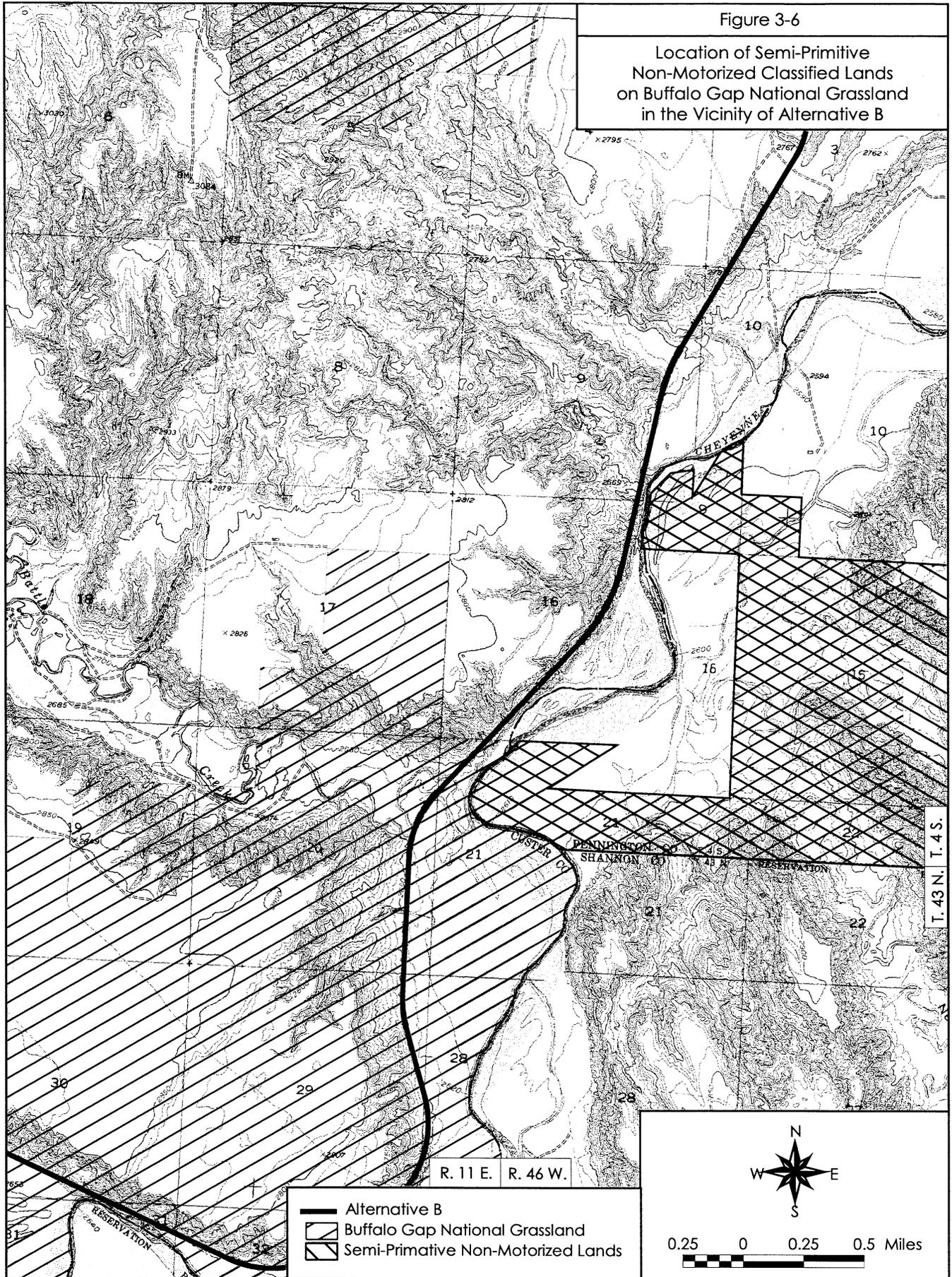


Figure 3-6

Location of Semi-Primitive
Non-Motorized Classified Lands
on Buffalo Gap National Grassland
in the Vicinity of Alternative B



	Alternative B		Alternative C (1)		Alternative C With the Phiney Flat Route Variation		Alternative D		Black Thunder North Mine Loop		Black Thunder South Mine Loop	
	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent	Miles	Percent
Buffalo Gap National Grasslands												
Semi-Primitive Nonmotorized	(2)	0	0	0	0	0	0	0	0	0	0	0
Semi-Primitive Motorized	1.6	9.8	0.8	13.1	0.4	7.5	0	0	0	0	0	0
Roaded Natural	14.7	90.2	5.3	86.9	4.9	92.5	0	0	0	0	0	0
Rural	(2)	0	(2)	0	(2)	0	0	0	0	0	0	0
Total	16.3	100	6.1	100	5.3	100	0	0	0	0	0	0
Thunder Basin National Grasslands												
Roaded Natural	26.4	74.1	20.3	61.9	20.3	61.9	9.6	35.9	0	0	0	0
Rural	3.8	10.7	6.0	18.3	6.0	18.3	10.6	39.7	0	0	0.1	3.2
Urban	5.4	15.2	6.5	19.8	6.5	19.8	6.5	24.4	0.6	100	3.0	96.8
Total	35.6	100	32.8	100	32.8	100	26.7	100	0.6	100	3.1	100
1 = Alternative C with the W G Flat Route Variation would be the same as Alternative C. 2 = Although this ROS designation is not crossed by the alternative centerline, it does occur within 500 feet of the alternative centerline. 3 = Note the North Antelope Mine Loop options do not cross NFS lands.												

percent of BGNG has been classified as semi-primitive motorized (see Table 3-24). These areas include all NFS lands north and northeast of the Sage Creek Wilderness Area in the vicinity of Anderson Draw; the area east of Railroad Buttes and south of Creston; areas in northern Custer County just east of Phiney Flat and Spring Creek; the Red Shirt area east of the Cheyenne River in Custer County; and NFS lands west of Edgemont and north of U.S. Highway 18 in Fall River County. Alternatives B and C (including the W G Flat Route Variation) would cross 1.6 and 0.8 miles of semi-primitive motorized lands on BGNG, respectively (see Table 3-25).

Alternatives B and C would cross this ROS classification on the west side of Phiney Flat in the Spring Creek drainage in Section 6, T. 3 S., R. 12 E. and Section 1, T. 3 S., R. 11 E. in Custer County. Alternative C (including both route variations) would cross additional lands classified as semi-primitive motorized northeast of the Dry Creek crossing in Custer County in Section 4, T. 4 S., R. 9 E. about 1 mile northwest of the Redshirt RARE II Area. Alternative B also would cross this ROS classification on the southern end of the Cheyenne River RARE II Area in Section 22, T. 5 S., R. 9 E. adjacent to the Cheyenne River. Alternative C with the Phiney Flat Route Variation would only cross 0.4 miles of semi-primitive motorized lands (0.4 miles less than Alternative C and Alternative C with only the W G Flat Route Variation). Semi-primitive motorized lands within the Spring Creek drainage would be avoided by this route

variation. However, this ROS classification would still be crossed in the vicinity of Dry Creek, as noted above.

On TBNG, about 27,000 acres (4.9 percent) of the grasslands have been designated as semi-primitive motorized. This ROS classification has been applied to lands in and east of the Red Hills roadless area east of Fiddleback Ranch and the Miller Hills south of North Lance Creek Road in Converse County (see Figure 3-5). These lands would not be directly affected by the alternatives on TBNG - at their closest the alternatives would approach within 2.5 miles of semi-primitive motorized ROS classified lands southeast of the Antelope Mine.

Roaded Natural. The majority of the lands on BGNG (69 percent) and TBNG (80 percent) are classified as roaded natural. These areas are characterized by predominantly natural-appearing environments with moderate evidence of the sights and sounds of people. Such evidence usually harmonizes with the natural environment. Interaction between users may be moderate to high with evidence of other users prevalent. Resource modification and utilization practices are evident, but harmonize with the natural environment. Conventional motorized use is allowed and incorporated into construction standards and design of facilities. About 90 percent of Alternative B and 87 percent of Alternative C (including the W G Flat Route Variation) on BGNG would cross lands classified as roaded natural (see Table

3-25). Nearly 93 percent of Alternative C with the Phiney Flat Route Variation would cross this ROS classification. On TBNG, about 74 percent of the lands which would be crossed by Alternative B; about 62 percent of the lands which would be crossed by Alternative C; and about 36 percent of the lands which would be crossed by Alternative D are classified as roaded natural.

Rural. This ROS classification would not be affected directly by the alternatives on BGNG, but would be crossed by all alternatives on TBNG. Alternative B would cross 3.8 miles of these lands; Alternative C would cross 6.0 miles; and Alternative D would cross 10.6 miles. The rural classification is characterized by a natural environment that has been substantially modified by development of structures, vegetative manipulation or pastoral agricultural development. Resource modification and utilization practices may be used to enhance specific recreational activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate user densities are present away from developed sites. Facilities for intensified motorized use and parking are available. The Black Thunder North Mine Loop would cross 0.1 mile of these lands.

Urban. The area is characterized by a substantially urbanized environment, although the background may have natural-appearing elements. Renewable resource modification and utilization practices are often used to enhance specific recreational opportunities. Vegetative cover is often exotic and manicured. Sights and sounds of humans are predominant on the site. Large numbers of users can be expected both on the site and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site. This ROS classification does not occur in close proximity to the alternatives on BGNG. However, on TBNG, areas associated with active coal mining are classified as urban. Alternatives B, C, and D would cross 5.4, 6.5 and 6.5 miles, respectively, of this ROS classification on TBNG. The Black Thunder North Mine Loop would cross 0.6 miles of these lands and the Black Thunder South Mine Loop would cross 3.0 miles.

3.6.2.2 Public Lands. The BLM has not identified any significant recreation sites or opportunities in the general vicinity of the alternatives on public lands. In South Dakota, public lands are in a scattered and isolated pattern, thus, this land has a supplemental role in the overall recreational activities. The BLM has 2 recreation sites in South Dakota - one near Sturgis and

the other near Belle Fourche. Neither is near the alternatives.

In the Newcastle Field Office area, recreation is unstructured and dispersed in nature. There are no developed recreation sites on public lands in the area administered by the field office. The primary recreational activity is big game hunting for mule deer and pronghorn. Prairie dog shooting is increasing in popularity. Additional recreation use of public lands is made through sightseeing, camping (generally associated with hunting), photography, and other casual uses such as rock-hounding. The draft EIS for the Newcastle RMP (BLM, 1998) identifies the main emphasis in the recreation program as acquisition of access to existing public land with higher recreation potential through exchanges or purchases of access agreements. According to the draft EIS, of the public land in the area managed by the field office, 60 percent has legal access; however, only 38 percent has practical vehicle access.

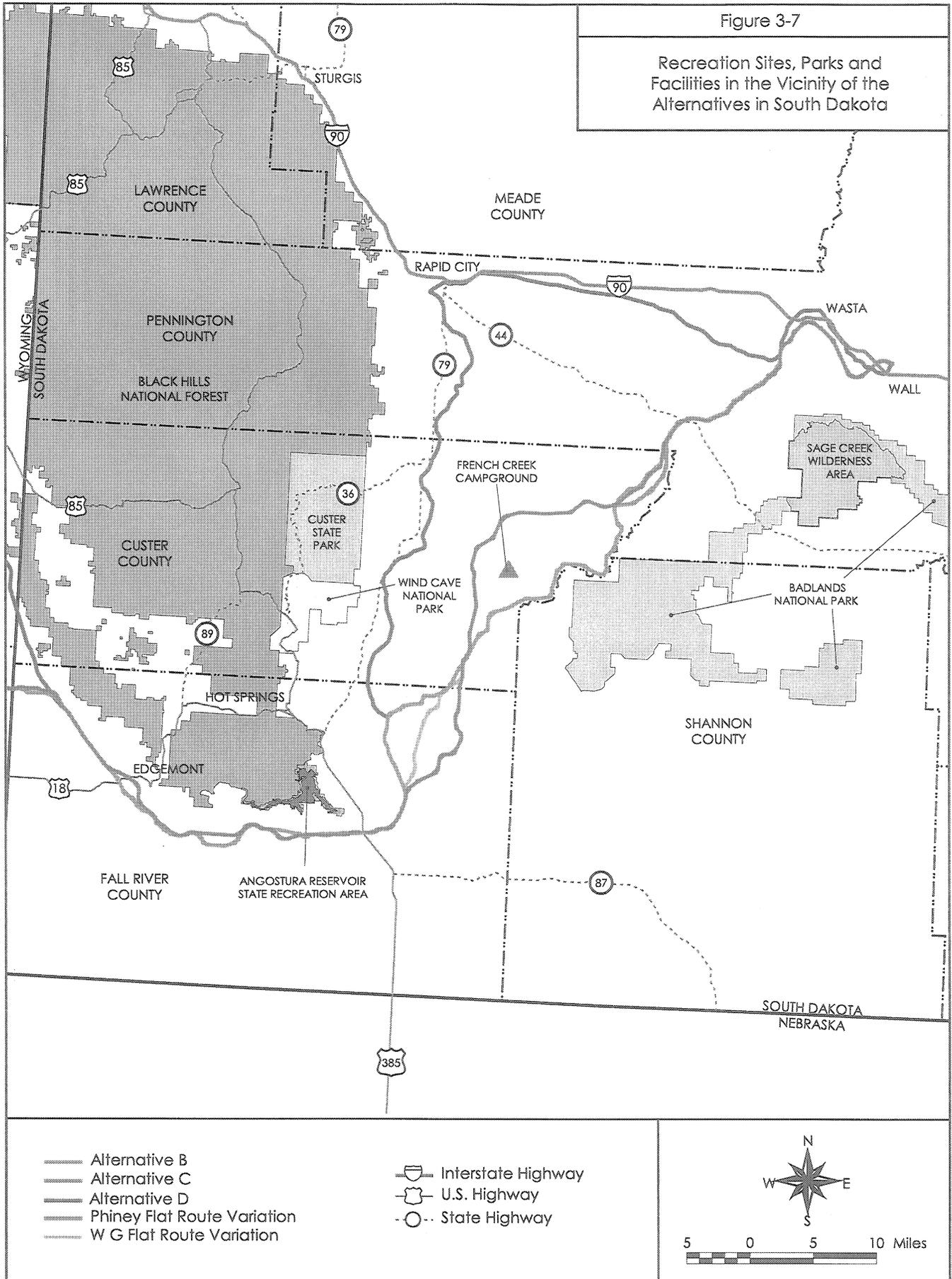
The area managed by the Buffalo Field Office offers diverse opportunities for several types of recreation including hunting, fishing, ORV use, sightseeing and wildlife observation. Most of the recreation use is focused on the southern Big Horn Mountains and in the Powder River Breaks country (BLM, 1984). Public lands in the Buffalo Field Office which would be affected by the alternatives are located on the northern legs and consists of small, isolated parcels adjacent to the coal mines. Consequently, they provide only insignificant recreation opportunity.

3.6.3 Parks, Recreation Sites and Facilities. In South Dakota, the alternatives would be constructed in the general vicinity of a number of recreation sites and facilities. Alternative B is routed less than a mile from Badlands National Park in Pennington County. Alternative D would be constructed about 2.7 miles east of Custer State Park and 2.5 miles east of Wind Cave National Park between Fairbairn and Buffalo Gap. Alternative D would approach within 1 mile of Black Hills National Forest near the South Dakota-Wyoming State line. Angostura State Recreation Area is located approximately 2 miles north of all the alternative routes near the crossing of U.S. Highway 385 near Horsehead Creek west of Smithwick. Recreation sites, parks and facilities in the vicinity of the alternatives in South Dakota are shown on Figure 3-7.

Badlands National Park. Figure 3-8 shows the proximity of Alternative B to the boundary of Badlands National Park. At its closest point, Alternative B would be constructed about 3,700 feet north of the park in Section 32, T. 43 N., R. 4 S. The Cheyenne River separates the park from the alternative at this location.

Figure 3-7

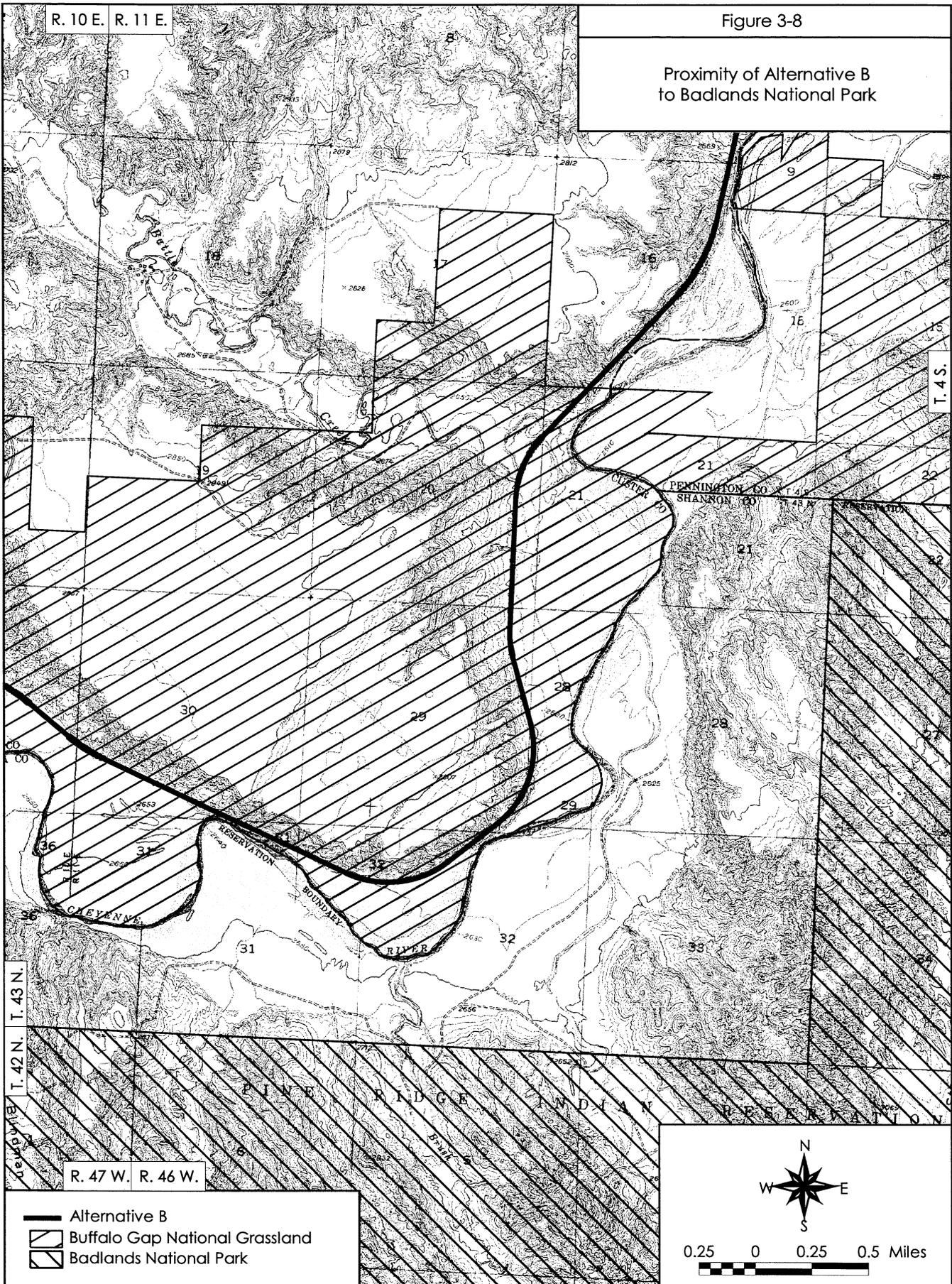
Recreation Sites, Parks and Facilities in the Vicinity of the Alternatives in South Dakota



R. 10 E. R. 11 E.

Figure 3-8

Proximity of Alternative B to Badlands National Park



R. 47 W. R. 46 W.

- Alternative B
- Buffalo Gap National Grassland
- Badlands National Park



0.25 0 0.25 0.5 Miles

The park was designated a national monument in 1939 and redesignated a national park in 1978. A portion of the park (Sage Creek) was designated as wilderness in 1976. Badlands National Park preserves a diversity of significant resources. These resources include the best known Oligocene fossil deposits contained within archetypical Big Badlands formations, a rich and varied cultural history spanning from paleo-Indian occupation through the early twentieth century homesteading period, and an expansive mixed-grass prairie ecosystem. Other qualities, most notably the wilderness character, quiet, solitude, vastness, and natural processes, provide visitors with a setting for exploration and appreciation through experiences such as hiking, camping, wildlife viewing, scenic drives and vistas, research and educational opportunities, and quiet contemplation.

There are approximately 1.3 million visitors per year. Highest visitation is from mid-June through September; lowest from mid-November through March.

Wind Cave National Park. The general location of Wind Cave National Park is shown on Figure 3-7. In the general vicinity of the park, Alternative D would be constructed within DM&E's existing Black Hills Subdivision Branch Line. At its closest, the existing branch line is about 2.5 miles from the park (see Figure 3-9). State Highway 79 separates the alternative from the park.

Wind Cave National Park was created on January 3, 1903. It was the 7th national park and the first created to protect a cave. The park at that time was small and there were no bison, elk, or pronghorn. They came later as the park boundaries expanded. One of the world's longest and most complex caves and 28,295 acres of mixed-grass prairie, ponderosa pine forest and associated wildlife are the main features of the park. The cave is well known for its outstanding display of box work, an unusual cave formation composed of thin calcite fins resembling honeycombs. The park's mixed-grass prairie is home to native wildlife such as bison, elk, pronghorn, mule deer, coyotes and prairie dogs.

Custer State Park. Located directly north of Wind Cave National Park (see Figure 3-9), Custer State Park encompasses 73,000 acres of the Black Hills. The state park is known for its spectacular terrain and abundant wildlife. Favorite outdoor activities include hiking 7,242-foot Harley Peak, mountain biking, horseback riding, rock climbing, fishing, chuck wagon suppers and jeep rides to view bison. The park contains a significant bison population. The park includes scenic drives such as the Needles Highway. Alternative D would approach within 2.7 miles of the park. In the vicinity of the park, the alternative would be constructed within DM&E's existing Black Hills Subdivision Branch Line.

Angostura Reservoir State Recreation Area. As can be seen on Figure 3-7, the alternatives would pass south of Angostura Reservoir State Recreation Area. At their closest, the alternatives would be located about 1.8 miles south of the recreation area (see Figure 3-10). The warmwater springs found near Angostura have drawn visitors for more than 10,000 years. Legends describe a fierce battle between the Dakota and Cheyenne people to control the area's health restoring springs. White immigrants who came to the area quickly realized the benefits of the mineral-laden springs and settled in the area.

This recreation area is managed by the SDGFP. It is located along the shoreline of Angostura Reservoir. In 1949, the BOR completed an earth-filled and concrete dam across the Cheyenne River. The dam was built for irrigation purposes, but paved the way for recreation. The reservoir is well known for its walleye, smallmouth bass and crappie fishing. The lake also supports northern pike, largemouth bass, perch and bluegill. The state recreation area features a 78-slip marina, beach club and floating convenience store. Four campgrounds provide 163 campsites.

Black Hills National Forest. Northwest of Edgemont, in Section 25, T. 7 S., R. 1 E., all the alternatives would approach within 2 miles of the national forest boundary. In this area, the alternatives are routed directly adjacent to BNSF's existing railroad. Near Dewey, Alternative D would approach within 1 mile of the national forest. The alternative would also be constructed adjacent to BNSF in this area. Recreation opportunities abound on the more than 1.2 million acres of the Black Hills National Forest. Summer is the most popular vacation season in the Black Hills. The national forest provides over 100 developed recreation sites, including camp and picnic grounds, swimming beaches, boat launches and scenic overlooks.

According to the forest plan for the national forest (Forest Service, 1996), the "Southern Hills Forest and Grassland Areas" is managed as Category 5.1A. These areas are managed for sustainability of the physical, biological and visual values associated with areas of woody vegetation and open grassland. Habitat and vegetation are managed to achieve and maintain the desired conditions for wildlife, livestock and vegetation. The area has a ROS classification of roaded natural (see Section 3.6.2.1). Recreation in the area is dispersed and there are no developed recreation sites.

French Creek Campground. In Custer County, about 9.5 miles east of Fairbairn off County Road 18, the Forest Service has established a campground (see Figure 3-7). The campground is located in Section 34, T. 4 S., R. 9 E. At its closest, Alternative B would be located

Figure 3-9

Proximity of Alternative D to Wind Cave National Park and Custer State Park



- Alternative D
- ▨ Wind Cave National Park
- ▩ Custer State Park

R. 8 E. R. 7 E.

approximately 3.5 miles from the campground. Alternative C is routed about 4 miles from the campground.

Historic Dorr Homestead. No parks, recreation sites or facilities occur in close proximity to any of the alternatives in Wyoming. However, the Forest Service recently acquired the historic Dorr Homestead in a land acquisition. The homestead is located approximately 7 miles south of the southern legs of the alternatives in Section 6, T. 39 N., R. 69 W. The homestead includes a turn of the century home and period school house, outbuildings, corals and windmill. The Forest Service intends to stabilize and improve the buildings located on the site. The Forest Service is currently proposing to restore the main building for public use under a fee system to provide a developed recreation opportunity on TBNG.

3.6.4 Wilderness and Inventoried Roadless Areas.

3.6.4.1 Wilderness Areas. There are no areas designated as wilderness or wilderness study areas in the general vicinity of the alternatives in Wyoming. However, Alternatives B and C would be constructed approximately 6.2 miles north of the Sage Creek Wilderness Area located inside Badlands National Park. The location of the wilderness area in relation to the alternatives is shown on Figure 3-11.

3.6.4.2. Inventoried Roadless Areas. The Forest Service is required by 36 CFR ¶ 219 to inventory, evaluate and consider all roadless areas for possible inclusion in the national Wilderness Preservation System. In June, 1977 the Forest Service initiated a comprehensive process to identify roadless and undeveloped land areas in the national forest system. The purpose of identifying these roadless areas was to evaluate their suitability as wilderness and for inclusion in the National Wilderness Preservation System. The comprehensive process was titled the "Roadless Area Review and Evaluation II" and is most commonly known as RARE II. To be considered a roadless area, the following criteria had to be present:

- the area had to be larger than 5,000 acres or, if smaller, contiguous to a designated wilderness or primitive area;
- the area could not contain improved roads maintained for travel by standard passenger-type vehicles; and
- the area had to be inventoried by the Forest Service for possible inclusion in the National Wilderness Preservation System.

No roadless areas were identified on TBNG during RARE II or during the 1980s planning effort (Forest Service, 1999c - see Appendix C). Three RARE II areas

were identified on BGNG in South Dakota during preparation of the 1984 forest plan: Indian Creek (24,670 acres), Red Shirt (9,700 acres) and Cheyenne River (7,570 acres). The locations of these RARE II areas are shown on Figure 3-12.

As part of the National Great Plains Management Plans Revision, the Forest Service completed an updated inventory of areas which are essentially undeveloped in character and roadless. Areas identified with undeveloped character became part of the roadless inventory for evaluation as potential wilderness. The plans revision inventory process identified several roadless areas that were not identified in previous analyses. In total, 5 areas on BGNG and 3 on TBNG were identified that meet the Forest Service's roadless inventory criteria (Forest Service, 1999c). In addition, in the Wall Ranger District, the Indian Creek Area (24,670 acres) was identified as meeting the Forest Service's roadless inventory criteria. RARE II and inventoried roadless areas that occur in the vicinity of the alternatives are listed on Table 3-26. Recently inventoried roadless areas located on BGNG are shown on Figure 3-12. Roadless areas on TBNG are shown on Figure 3-13.

Of the inventoried roadless areas identified on TBNG, the Forest Service's proposed grassland plan (Forest Service, 1999b) recommends 8,460 acres of Cow Creek Buttes as wilderness. On BGNG, the Forest Service's proposed grassland plan recommends the Red Shirt Area (15,970 acres) as wilderness (Forest Service, 1999a).

Alternative B would be located in or adjacent to 3 inventoried roadless areas in Custer County on BGNG: Indian Creek; Red Shirt; and Cheyenne River (see Figure 3-12). Alternative B would pass approximately 650 feet to the west of the Indian Creek RARE II Area in Section 9, T. 4 S., R. 11 E. (see Figure 3-14). The alternative is located west of the Cheyenne River whereas the RARE II area is located to the east.

The Indian Creek RARE II Area is located about 5 miles west of Scenic, South Dakota and 37 miles southeast of Rapid City. The area is by far the most remote, rugged and inaccessible on the entire Wall Ranger District. Topography consists of intermingled badlands and grassland table terrain, with drainages off of the tables deeply incised and eroded, exposing cliffs of multi-colored clays. Large flat flood plains lie below the tables. This area does not exhibit the sharp, serrated pinnacles of nearby Badlands National Park. Rather, badlands terrain is more rounded in shape and very sparsely vegetated. Three ridge lines, which create distinctive landmarks, cross the area north to south. Two of them exhibit tabletop characteristics - Heutmacher and Zebell Tables. The third isn't named and is not generally flat on top. The 2 main drainages are Indian Creek and

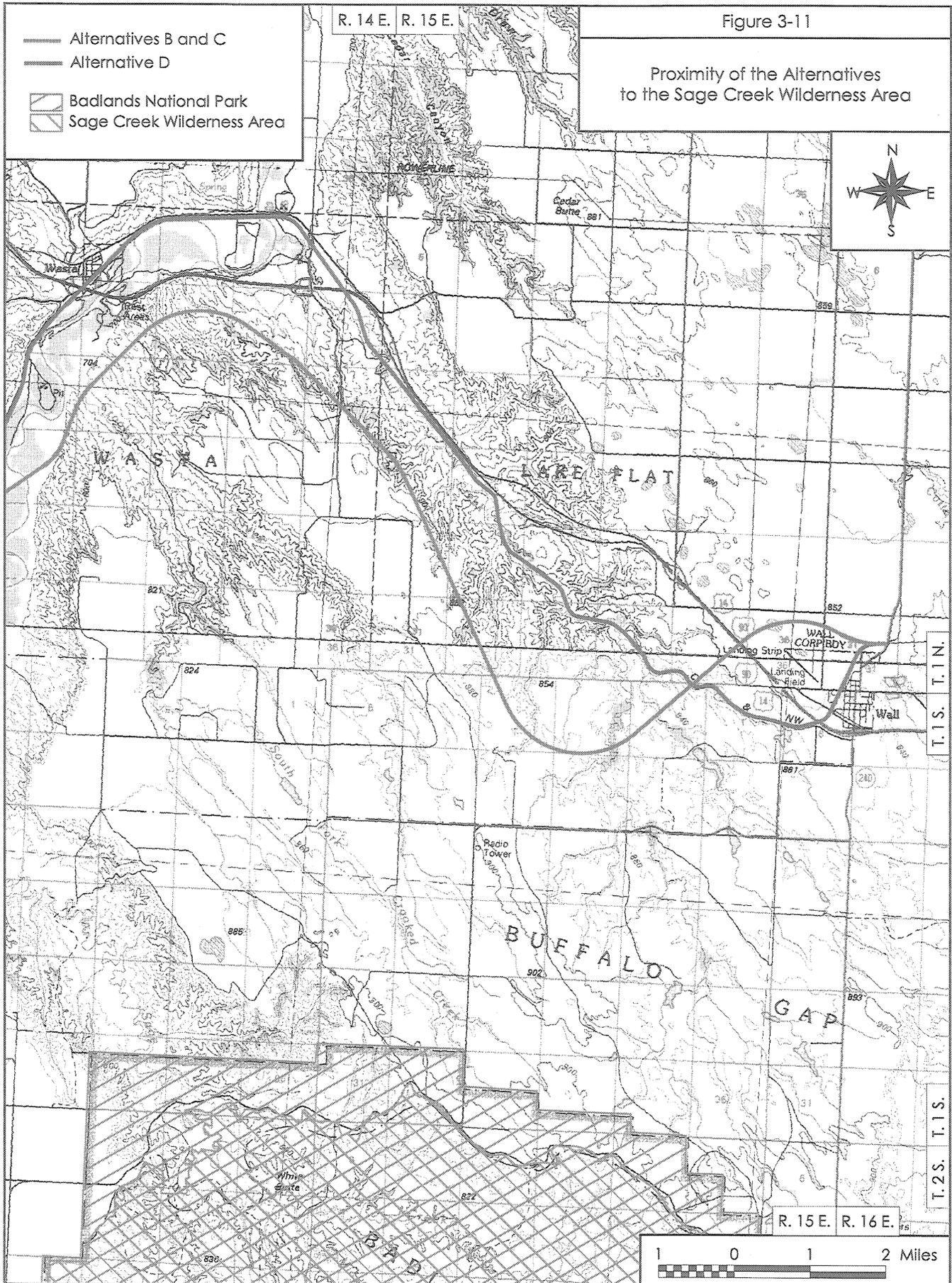
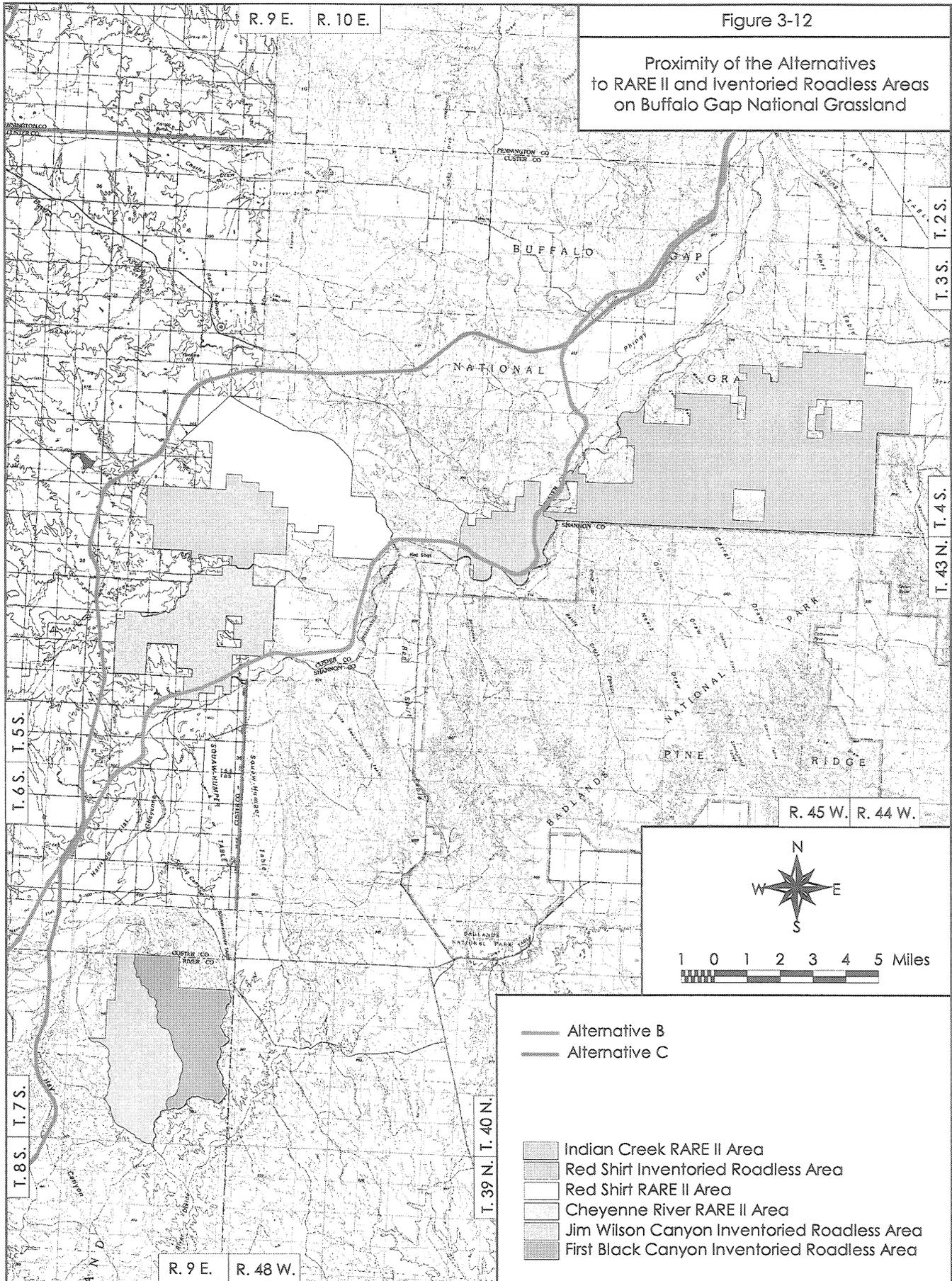


Figure 3-12

Proximity of the Alternatives
to RARE II and Inventoried Roadless Areas
on Buffalo Gap National Grassland

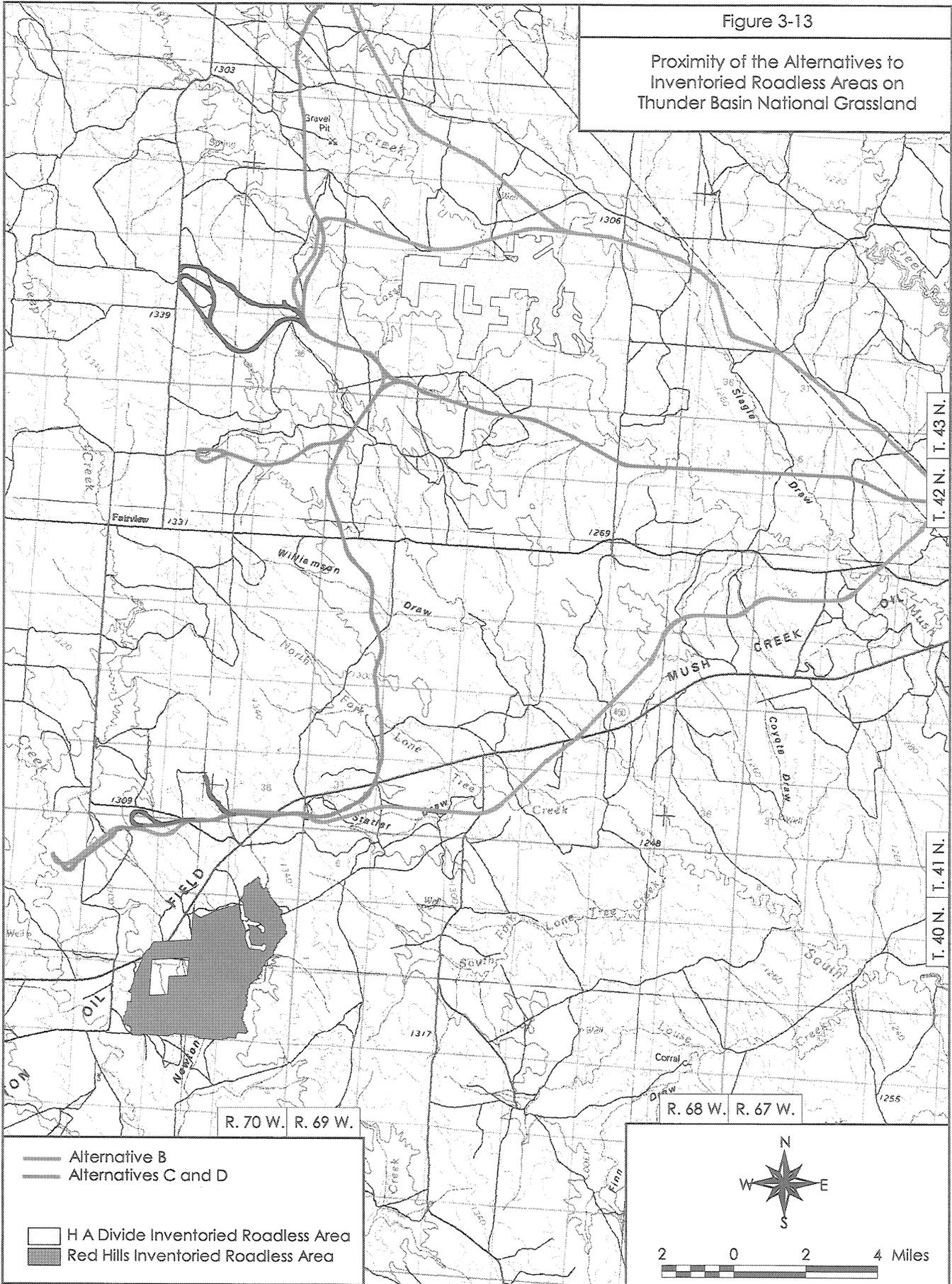


— Alternative B
— Alternative C

- Indian Creek RARE II Area
- Red Shirt Inventoried Roadless Area
- Red Shirt RARE II Area
- Cheyenne River RARE II Area
- Jim Wilson Canyon Inventoried Roadless Area
- First Black Canyon Inventoried Roadless Area

Figure 3-13

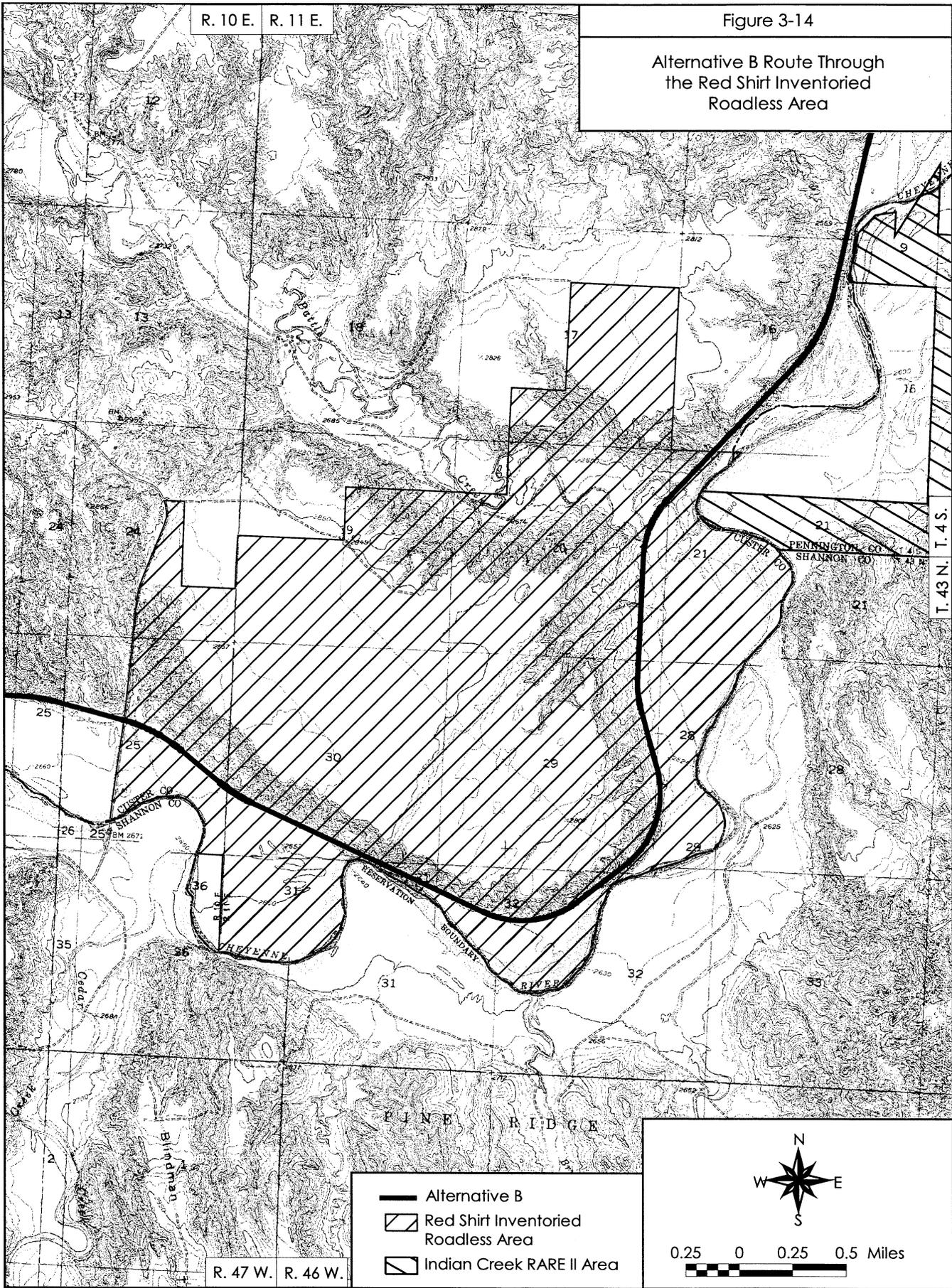
Proximity of the Alternatives to Inventoried Roadless Areas on Thunder Basin National Grassland



R. 10 E. R. 11 E.

Figure 3-14

Alternative B Route Through the Red Shirt Inventoried Roadless Area



R. 47 W. R. 46 W.

-  Alternative B
-  Red Shirt Inventoried Roadless Area
-  Indian Creek RARE II Area



0.25 0 0.25 0.5 Miles

**Table 3-26
RARE II and Inventoried Roadless Areas Which are Adjacent to or Which Would be Crossed by the Alternatives**

	Alternative B		Alternative C (1)		Alternative C W G Flat Route Variation		Alternative D	
	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)	Miles Crossed	Approaches Within (miles)
Buffalo Gap National Grasslands								
Red Shirt Inventoried Roadless Area	4.8			0.7		0.7		6.8
Red Shirt RARE II Area	0.6			0.4		0.4		7.5
Cheyenne River RARE II Area	1.9			0.3		0.3		7.2
Jim Wilson Canyon Inventoried Roadless Area		3.0		1.5		2.3		8.8
First Black Canyon Inventoried Roadless Area		3.5		2.7		2.8		10.7
Indian Creek RARE II Area		0.1		1.1		0.4		14.3
Thunder Basin National Grasslands								
H A Divide Inventoried Roadless Area		<0.1		1.2		1.2		1.8
Red Hills Inventoried Roadless Area		1.8		1.7		1.7		1.7
Cow Creek Buttes Inventoried Roadless Area		15.7		16.4		16.4		16.4
1 = Includes Phiney Flat Route Variation.								

Big Corral Draw which flow north and west into the Cheyenne River. Elevation ranges from 3,000 feet along the ridge lines to 2,600 feet along the Cheyenne River, which intermittently forms the western boundary of the area. Agate beds can be found in the area as can significant fossil deposits. The well known Sheep Mountain Table lies outside of the area to the east.

Alternative B would enter the Red Shirt Inventoried Roadless Area in Section 21, T. 4 S., R. 11 E. at the intersection of Shannon, Pennington and Custer counties and north of the Battle Creek confluence with the Cheyenne River. The alternative would continue through the roadless area for approximately 4.8 miles (see Figure 3-14). The alternative would leave the roadless area in Section 25, T. 4 S., R. 10 E. Alternative B would continue west approximately 2.2 miles, running north of the Cheyenne River, and would then enter the Red Shirt RARE II Area about 4,200 feet northwest of the Village of Red Shirt (see Figure 3-15). The alternative would proceed southwest on the west side of the Cheyenne River through the RARE II area through Sections 27 and 28, T. 4 S., R. 10 E.

The 18,320-acre Red Shirt Area lies about 16 miles southeast of Hermosa and about 13 miles east of Fairbairn. The Red Shirt Area consists of the Red Shirt RARE II Area identified during development of the Nebraska National Forest Plan (Forest Service, 1984) and the inventoried roadless area identified in the recent draft

plans revision (Forest Service, 1999c). The Forest Service's proposed grassland plan for BGNG (Forest Service, 1999a) recommends a portion of the RARE II area, a portion of the inventoried roadless area, and the area between the RARE II and inventoried roadless areas (not identified as roadless in the inventory) as wilderness (see Figure 3-16).

The topography of the Red Shirt Area is varied, consisting of gently rolling grasslands or highly vegetated tabletop buttes with steep, dissected slopes exposing layers of color-banded clays of reds and shades of white and gray. Elsewhere, sparsely vegetated, mounded, clay badlands terrain and beds of agates exist. Natural seeps frequently occur along some of the hillsides. The elevation of the area ranges from between 2,700 to 3,200 feet. This area is the most western extension of the White River Badlands on BGNG. Recreational opportunities include rock hounding, hunting, horseback riding and hiking. Other uses include livestock grazing and the gathering of sacred and medicinal plants and herbs by American Indians. One permittee currently grazes bison.

Northeast of Harrison Flat, Alternative B would cross the Cheyenne River RARE II Area (see Figure 3-12). The alternative would enter the RARE II area in Section 14, T. 5 S., R. 9 E. (see Figure 3-17). The alternative would proceed west nearly 2 miles through the RARE II area and north of the Cheyenne River. The alternative would exit the RARE II area in Section 2, T. 5 S., R. 9 E.

Figure 3-15

Alternative B Route Through
the Red Shirt RARE II Area

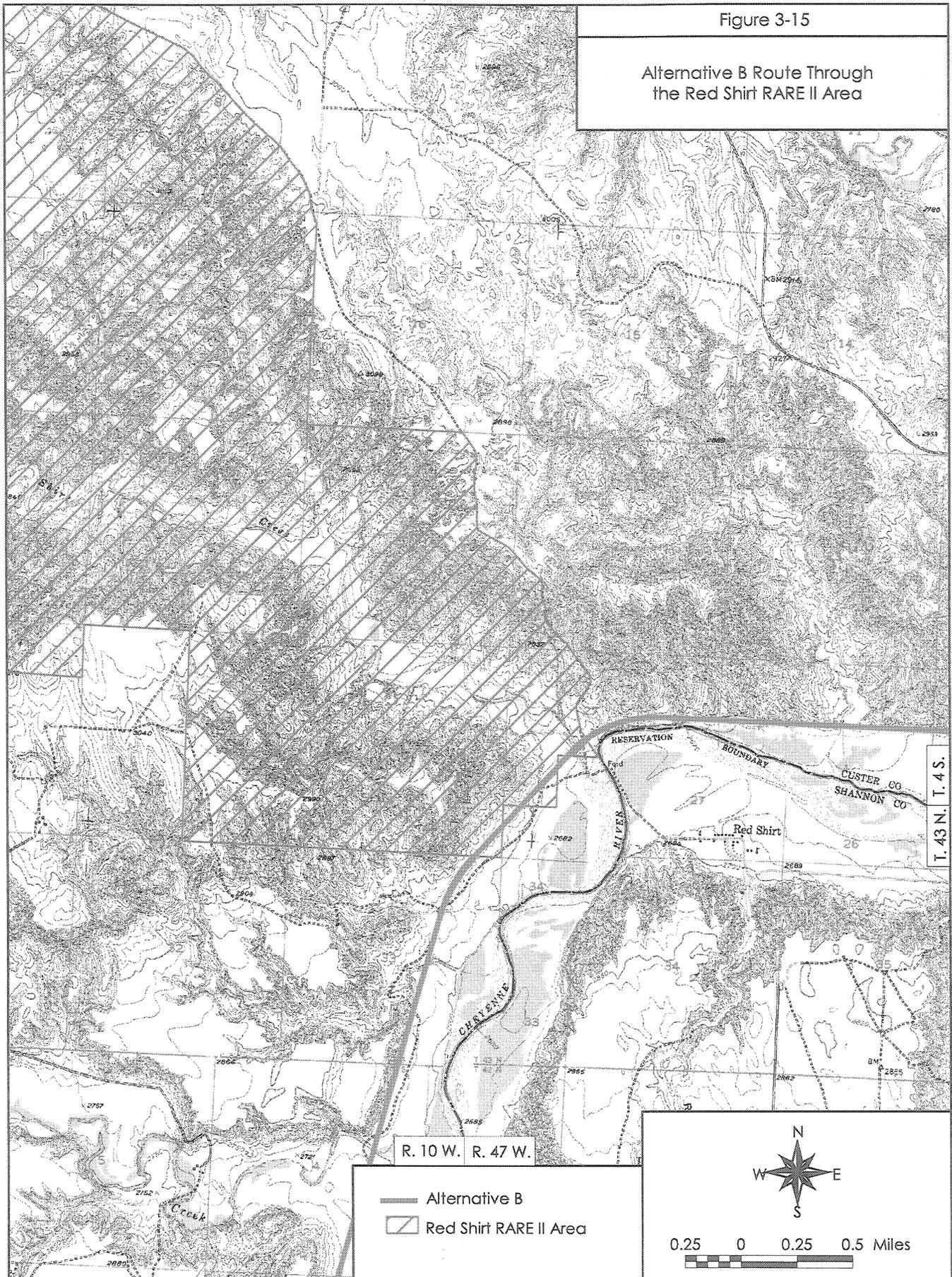


Figure 3-16

Alternative B Route Through That
Portion of the Red Shirt Area
Recommended for Wilderness by
the Proposed Buffalo Gap Grassland Plan

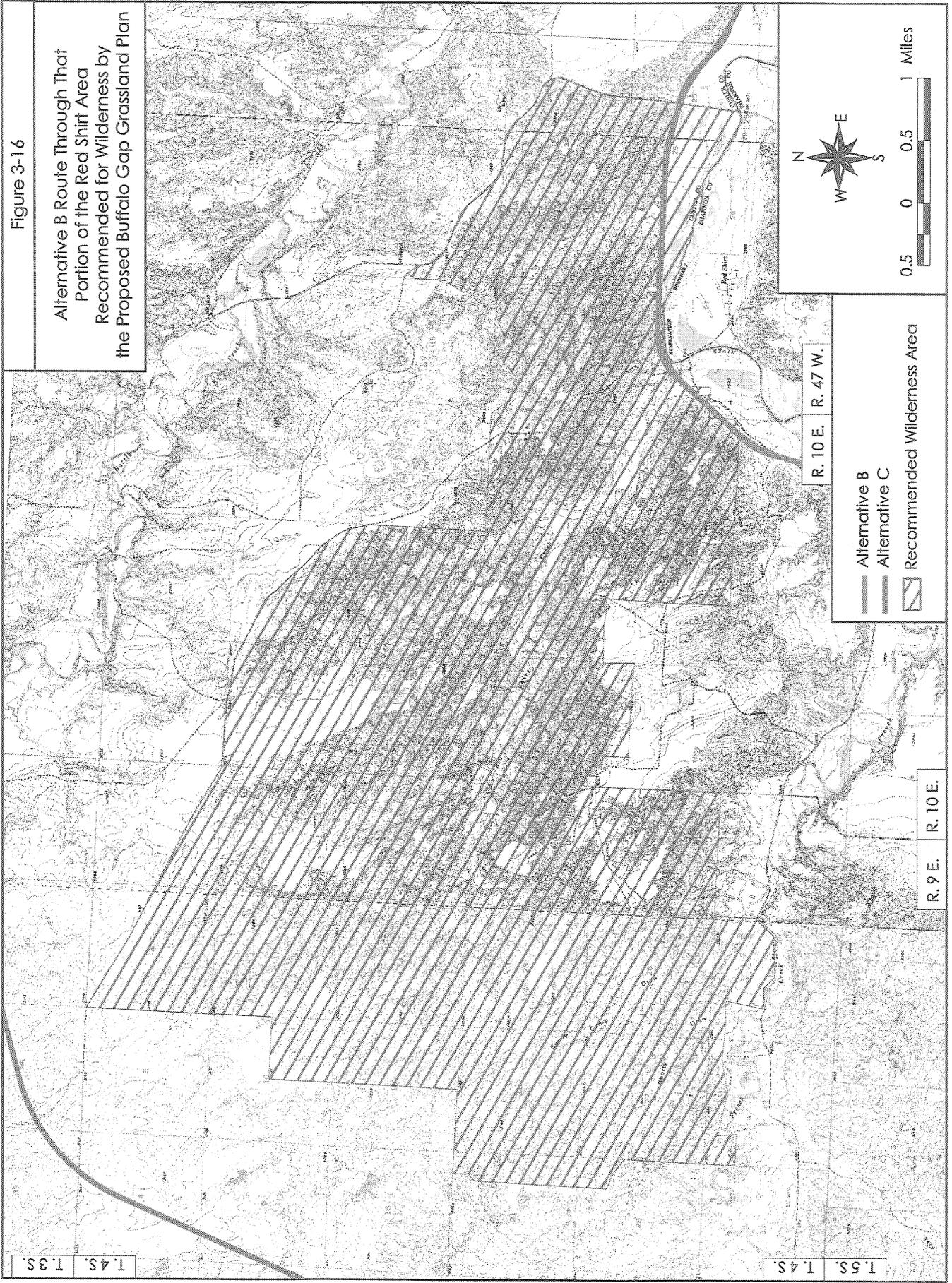
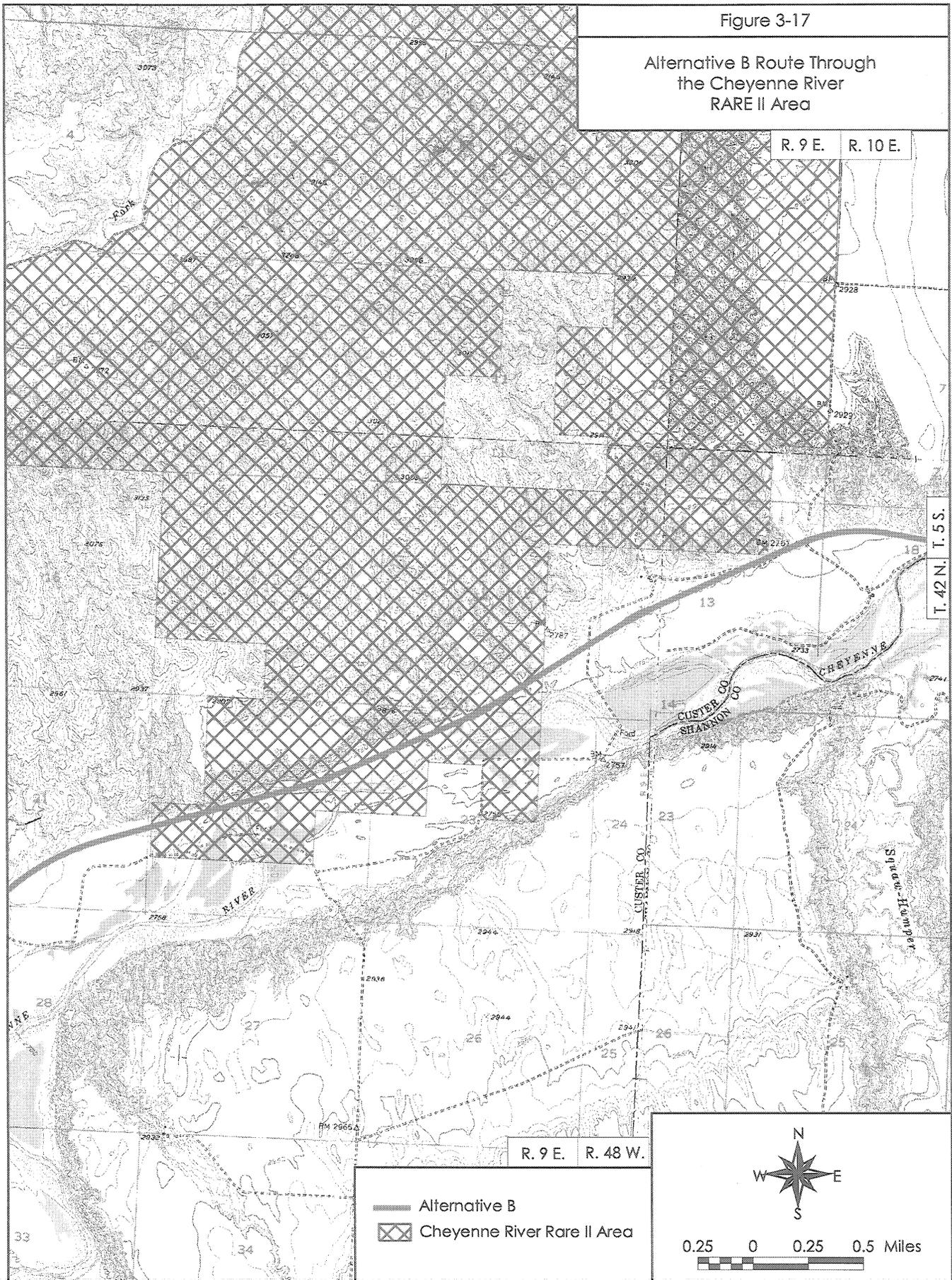


Figure 3-17

Alternative B Route Through
the Cheyenne River
RARE II Area



The 7,570-acre Cheyenne River RARE II Area lies about 15 miles southeast of Hermosa and about 6 miles southeast of Fairburn. The topography of the area consists of gently rolling grasslands or highly vegetated tabletop buttes with steep, dissected slopes exposing layers of color-banded clays of reds and shades of white and gray. Sparsely vegetated, mounded, clay badlands terrain and beds of agates are also present. The elevation of the area ranges from between 2,750 and 3,300 feet. The dominant feature in the northern portion of the area is the Chalk Hills Ridge, exhibiting side slopes of white shale clays. This ridge runs in a northeasterly or southwesterly direction and is the most visible landmark in the northern portion of the area. The dominant feature in the southern portion is the Cheyenne River itself. Between the Chalk Hills and Cheyenne River are rolling grasslands dominated by western wheatgrass. Recreational opportunities include rock hounding, hunting, horseback riding, canoeing, prairie dog shooting and hiking. Livestock are grazed in the area.

Three inventoried roadless areas were identified on TBNG. These include HA Divide (5,060 acres); Red Hills (6,840 acres); and Cow Creek Buttes (10,450 acres). Figure 3-13 shows the locations of these inventoried roadless areas. None would be crossed by the alternatives.

Alternative B would approach within 1,400 feet of the H A Divide Inventoried Roadless Area as the northern leg enters Campbell County in Section 1, T. 42 N., R. 69 W. (see Figure 3-18). In addition, the spur to Jacobs Ranch Mine would pass directly north of the area as it traverses up H A Creek. In Section 2, T. 42 N., R. 69 W., the spur would approach within 150 feet of the roadless area. The spur would be located less than 1,000 feet of the north boundary of the roadless area in Section 9, T. 42 N., R. 43 N.

The H A Divide is located about 37 miles southeast of Gillette and about 16 miles east of Wright. H A Divide is characterized by a single, large mesa with color-banded buttes tapering away from the mesa. Side slopes on the mesa and area buttes display shale and limestone escarpments. The elevation of the area is around 4,500 feet. The top of the mesa is vegetated with ponderosa pine and Rocky Mountain juniper. Side slopes are partially barren. In general, H A Divide is a mixed-grass prairie, blended with sagebrush, limited cottonwood, some greasewood, ponderosa pine and Rocky Mountain juniper. Wildlife includes prairie dogs, pronghorn antelope, mule and white-tailed deer, grassland birds, raptors (including the bald eagle and peregrine falcon), reptiles and amphibians. Livestock grazing and hunting are frequent activities in the area.

At their closest, the southern legs of the alternatives would be routed about 1.7 miles north of the Red Hills

Inventoried Roadless Area (see Figure 3-19). The Red Hills are located south of Antelope Creek in this area and the alternatives would be constructed north of or within the Antelope Creek drainage. The Red Hills Inventoried Roadless Area is located about 42 miles north of Douglas and about 10 miles north of Bill.

The area is characterized by rolling sage- and grass-covered hills, red scoria escarpments and buttes, dissected by mostly easterly flowing drainages. The area's elevation is between about 4,800 feet and 5,000 feet. The Red Hills Area is a visible landmark on TBNG. This area is a mixed-grass prairie, blended with sagebrush, cottonwood, greasewood, ponderosa pine and Rocky Mountain juniper. Wildlife includes prairie dogs, pronghorn antelope, mule and white-tailed deer, grassland birds, raptors, reptiles and amphibians.

Miller Hills Public Proposed Wilderness Area is about 8 miles south of the southern leg of the alternatives. The Cow Creek Buttes Inventoried Roadless Area is at least 15 miles south of the southern leg.

3.6.5 National Natural Landmarks. No areas designated or proposed as national natural landmarks occur in close proximity to any of the alternatives. In South Dakota, Cathedral Spires and Limber Pine Natural Area are located in Custer State Park in Fall River County. Both are more than 10 miles from the closest alternative (Alternative D). Mammoth Site of Hot Springs is located in the City of Hot Springs which, at its closest point, is more than 10 miles from any of the alternatives. In Wyoming, Lance Creek Fossil Area is located over 25 miles from the alternatives in Niobrara County.

3.6.6 Wild and Scenic Rivers. The National Wild and Scenic Rivers Act of 1968 (P.L. 90-542; 16 U.S.C. 1271-1287, as amended) is designed to preserve certain rivers and streams with outstanding natural, heritage, or recreational features in a free-flowing condition for the enjoyment of current and future generations. At the end of 1997, the national Wild and Scenic Rivers System included 154 streams totaling 10,759 miles. However, to date, no streams or rivers in western South Dakota or eastern Wyoming have been included in the system.⁶

Designated rivers and streams are classified as wild, scenic, or recreational. The Wild and Scenic Rivers Act defines these terms as follows:

- wild rivers - rivers or sections of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive and waters unpolluted. These represent vestiges of primitive America.

⁶ A list of wild and scenic rivers can be found at <http://www.nps.gov/rivers/wildriverslist.html>

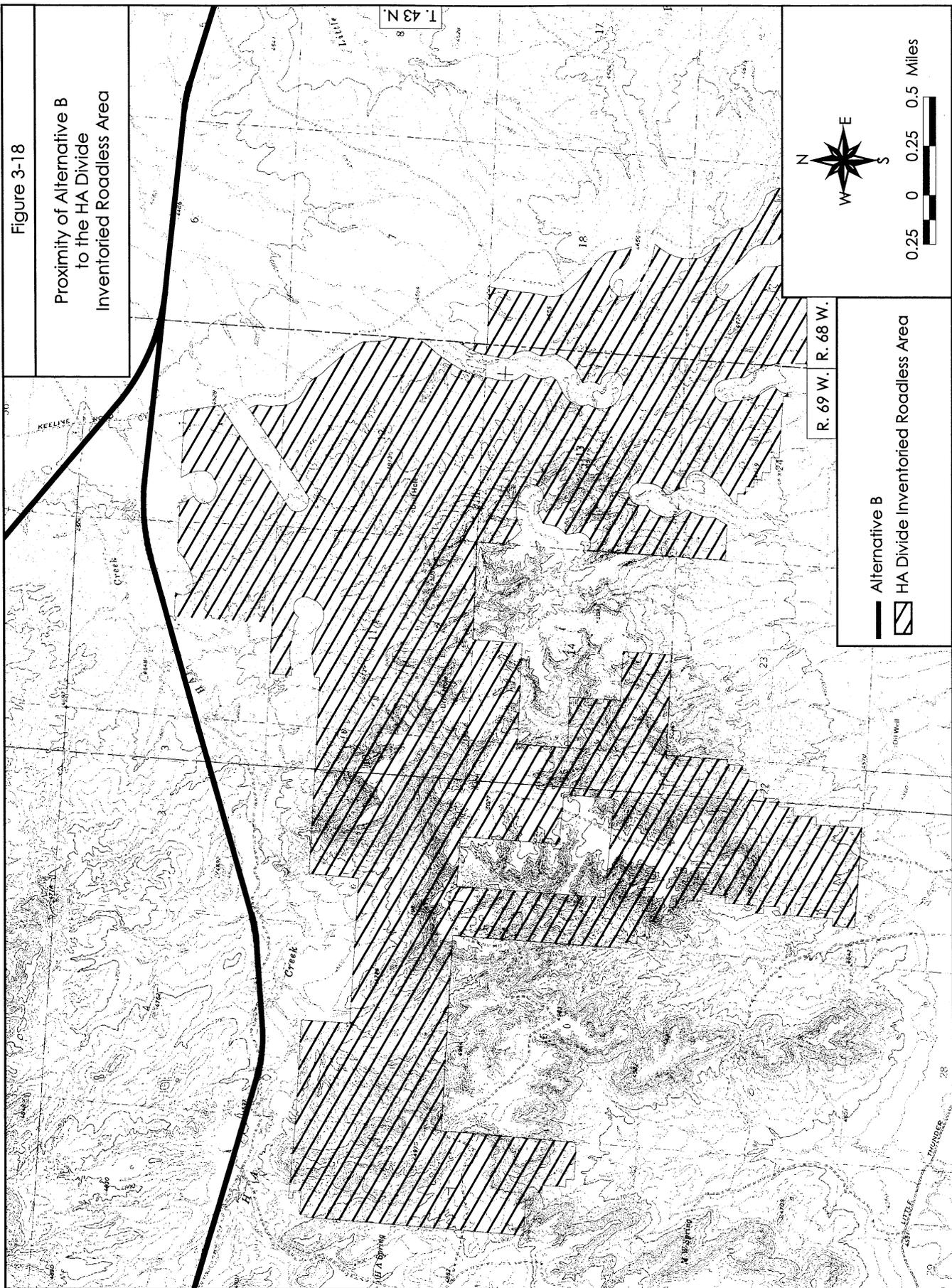
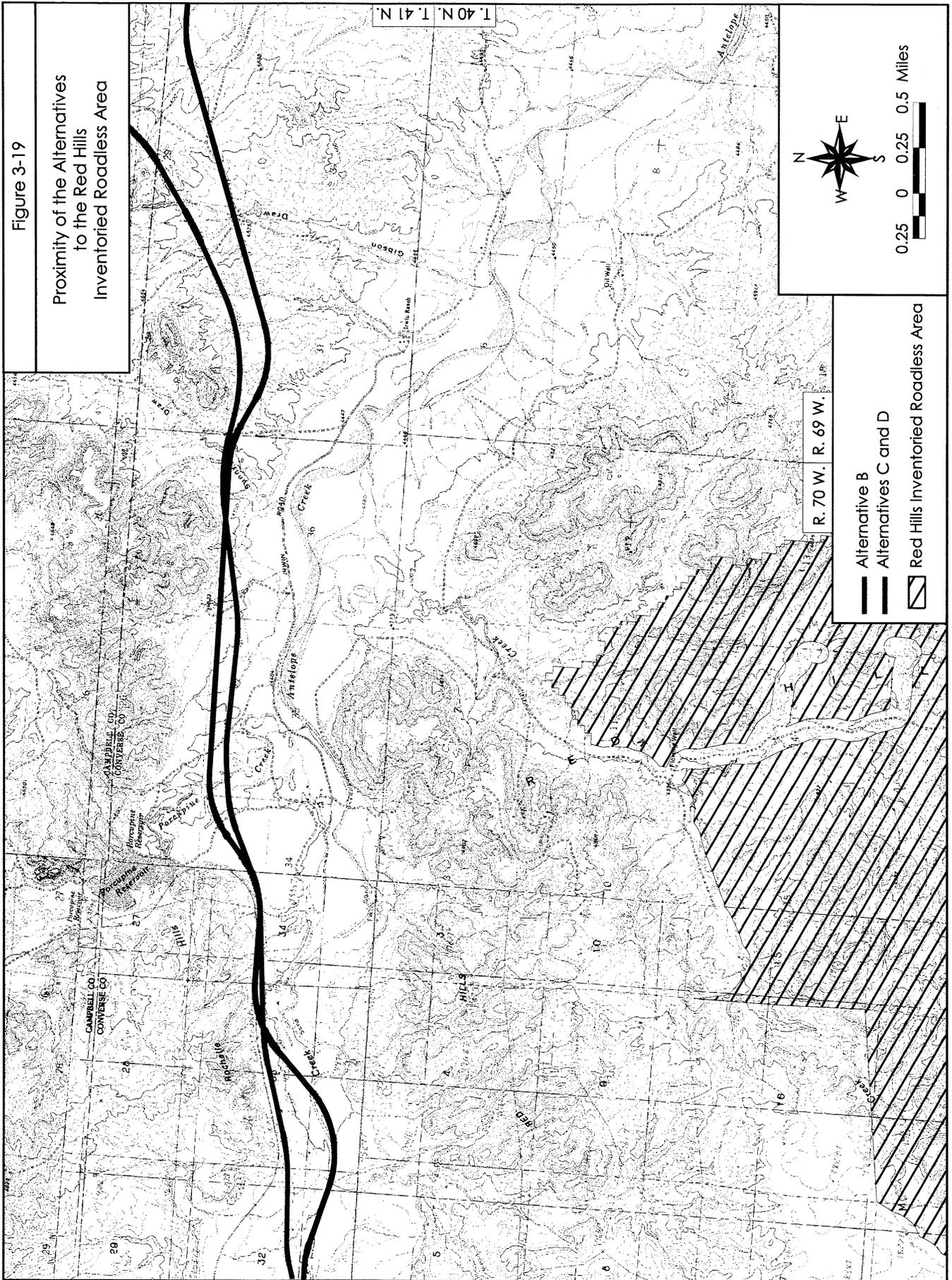


Figure 3-19

Proximity of the Alternatives to the Red Hills Inventoried Roadless Area



- Alternative B
- Alternatives C and D
- Red Hills Inventoried Roadless Area



0.25 0 0.25 0.5 Miles

- scenic rivers - rivers or sections of rivers free of impoundments, with shorelines or watersheds still largely undeveloped, but accessible in places.
- recreational rivers - rivers or sections of rivers readily accessible by road or railroad, that may have some development along their shoreline and that may have undergone some impoundments or diversions in the past.

A 4-step process is required before a river can be included in the system. The first step is an evaluation of a river's "eligibility." This evaluation must consider the area within 0.25 miles of the high water mark on both sides of a river and other features outside the corridor, if their inclusion is essential for the protection of the river's outstandingly remarkable values. The second step is to classify eligible stretches of the river as potential wild, scenic, or recreational segments based on specific criteria that help determine the appropriate potential classification. The third step is to evaluate the eligible river for "suitability." This evaluation considers possible Congressional inclusion of the river in the National Wild and Scenic River System in terms of social and economic values, effects on other resources and effects on private lands and other uses of the area. Finally, an evaluation is made as to whether or not a recommendation for inclusion of segments of the river should be made to Congress. When Congress does designate a river for inclusion, a final boundary for the corridor is established and a management plan is developed.

As part of the plans revision, the Forest Service conducted a systematic review of all 6th level watersheds on the grasslands. The GIS computer program mapped all the 6th level watersheds on a scale of 1:126,720. An interdisciplinary team on each ranger district then reviewed the major streams within each 6th level watershed for free-flowing characteristics and evaluated the free-flowing segments using Forest Service Region 2 criteria to determine if segments had any outstandingly remarkable characteristics. Eligibility determination criteria indicating an outstanding rating could include scenic, recreation, geology, fisheries, wildlife, prehistoric, historic and ecological/vegetative. No streams or rivers on TBNG were determined to have outstandingly remarkable features. However, both the Cheyenne River and Rapid Creek on BGNG were determined to have outstandingly remarkable features.

The Forest Service has determined that about 8 miles of the Cheyenne River is eligible under the scenic classification on BGNG. The eligible section of this river is located from Section 27, T. 4 S., R. 10 E. to Section 21, T. 4 S., R. 11 E. This includes the entire portion of the river generally south of Battle Creek to Red Shirt (see Figure 3-20). This river section holds the potential for classification as scenic. Outstandingly remarkable

features include significant fisheries and wildlife resources, scenic qualities and recreational values.

The inventory found the river to be highly scenic. A number of visually appealing habitats are visible from the river, including juniper breaks, cottonwood flood plains, and badlands topography. There is opportunity for increased recreational use of the river, including canoeing in a relatively pristine setting. The stream flow is somewhat controlled by Angostura Reservoir and some fences cross the river corridor, as does State Highway 44 in Section 26, T. 4 S., R. 10 E. The Old Highway 44 bridge also crosses the river corridor and, although it no longer transports traffic, it does have some historic and scenic value. Some utility lines and the Village of Red Shirt may be visible from some locations along the river.

However, the preferred alternative presented in the plans revision draft EIS (Alternative 3) does not propose designating this section of the Cheyenne River as wild and scenic. In fact, the draft EIS (Forest Service, 1999c) recognizes that railroad Alternative B may cut across this stretch of the Cheyenne River. The Draft EIS states "*degradation of the scenic and recreational backcountry characteristics of this stretch of the river could occur in lieu of designation should the proposed railway go through this National Forest Service river corridor.*"

The portion of Rapid Creek determined to be eligible is located in Section 35, T. 1 S., R. 11 E. well west or south of the alternatives.

3.7 Research Natural Areas

3.7.1 Impact Analysis Area. Any research natural areas (RNA) directly impacted or potentially affected by operating noise from the alternatives is included in the impact analysis area.

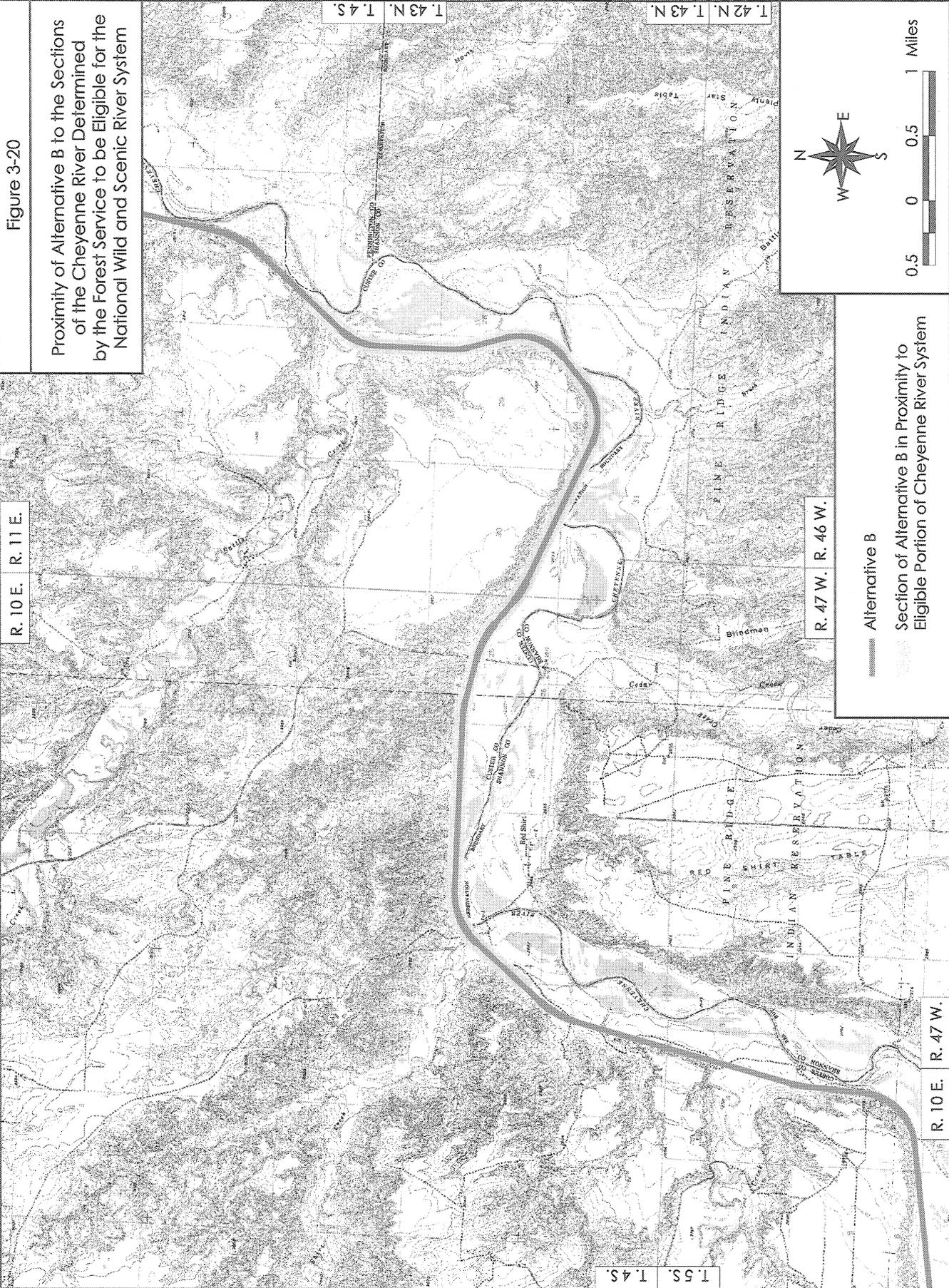
3.7.2 Affected Environment. The Forest Service defines RNAs as follows:

A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention.

RNAs are NFS lands that are permanently protected for the purposes of maintaining biological diversity, conducting non-manipulative research, monitoring to determine the effects of management on similar ecosystems and fostering education. They may also assist in implementing provisions of special acts such as the Endangered Species Act and the National Forest Management Act. RNAs are established on NFS lands as part of the continuing land and resource

Figure 3-20

Proximity of Alternative B to the Sections of the Cheyenne River Determined by the Forest Service to be Eligible for the National Wild and Scenic River System



management planning process.⁷ The objectives of RNAs are to:

- Preserve a wide spectrum of pristine representative areas that typify important forest, shrubland, grassland, alpine, aquatic, geological, and similar natural situations that have special or unique characteristics of scientific interest and importance that, in combination, form a network of ecological areas for research, education and maintenance of biological diversity.
- Preserve and maintain genetic diversity.
- Protect against serious environmental disruptions.
- Serve as reference areas for the study of succession.
- Provide on-site and extensive educational activities.
- Serve as baseline areas for measuring long-term ecological changes.
- Serve as control areas for comparing results from manipulative research.
- Monitor the effects of resource management techniques and practices.

There are currently no RNAs on TBNG nor in the vicinity of the alternatives on BGNG. However, during the plans revision, the Forest Service identified additional potential RNAs based on potential community types that exist on the grasslands. On both BGNG and TBNG, the Forest Service worked with The Nature Conservancy to develop ecological field evaluations to arrive at establishment protocols. The *Rare Plant Communities of the Northern Great Plains* assessment and *Northern Great Plains Assessment Map*, both prepared by The Nature Conservancy, were used to aid in the determination of potential RNAs. All RNAs were nominated regardless of current management practices occurring in the area; that is, current management did not diminish the conditions to a point that the areas could not meet the established RNA criteria. These include:

- quality - how well a site represents the targeted ecosystem type or projected biodiversity elements.
- condition - how much the site has been degraded or altered from natural or optimal conditions.
- viability - the likelihood of long-term survival for the ecosystem and its protected biodiversity.
- defensibility - extent to which the ecosystem and biodiversity elements can be protected from extrinsic human factors.

The plans revision inventory identified a potential RNA about 2.8 miles south of the southern leg of Alternative B on TBNG. The Antelope Creek Potential RNA contains 1,090 acres and was considered based on its botanical value. The location of the potential RNA in relation to the alternative is shown on Figure 3-21. Under the Forest

Service's preferred alternative (Alternative 3) for the proposed TBNG Grassland Plan, the Antelope Creek Area is not nominated as an RNA.

The Antelope Creek area is located about 16 miles northwest of Bill. According to the Forest Service (1999c), the area is in reasonably good ecological condition and contains a high quality example of a plains stream ecosystem. The area includes Antelope Creek and the Dry Fork of the Cheyenne River. Vegetation includes plains cottonwood woodlands, shrub vegetation of plains silver sagebrush and black greasewood, grasslands of prairie sandreed and needle-and-thread, and wet meadows of leafy bulrush and alkali cordgrass.

The proposed BGNG Grassland Plan identified a potential RNA in the Hay Canyon Area. However, like Antelope Creek on TBNG, the area is not nominated as an RNA under the Forest Service's draft EIS preferred alternative. The Hay Canyon Pasture Potential RNA is located about 7 miles northeast of Smithwick and about 1.1 miles southeast of Alternative C (see Figure 3-22). It was also considered because of its botanical value. In the area's drier uplands, short and mixed-grass communities are prevalent. The lower drainage ways exhibit more vegetative growth and a few isolated cottonwood trees. Wetlands in the potential RNA are in reasonable condition and a healthy prairie dog population is scattered across the area.

The South Pasture RNA (777 Allotment) was proposed and nominated on the BGNG under the preferred grassland plan alternative because of its botanical value. The RNA is located about 7 miles east of Fairburn and approximately 0.7 miles southeast of Alternative C (see Figure 3-22). This 1,570 acre RNA is characterized by nearly level to rolling hills to very steep badlands and gently sloping alluvial fans. Dominate vegetation includes western wheatgrass and needle-and-thread. Juniper breaks and shrub patches are also present, as well as deciduous riparian woodlands along French Creek. Current use of the area includes short-duration grazing by bison.

3.8 Visual Resources

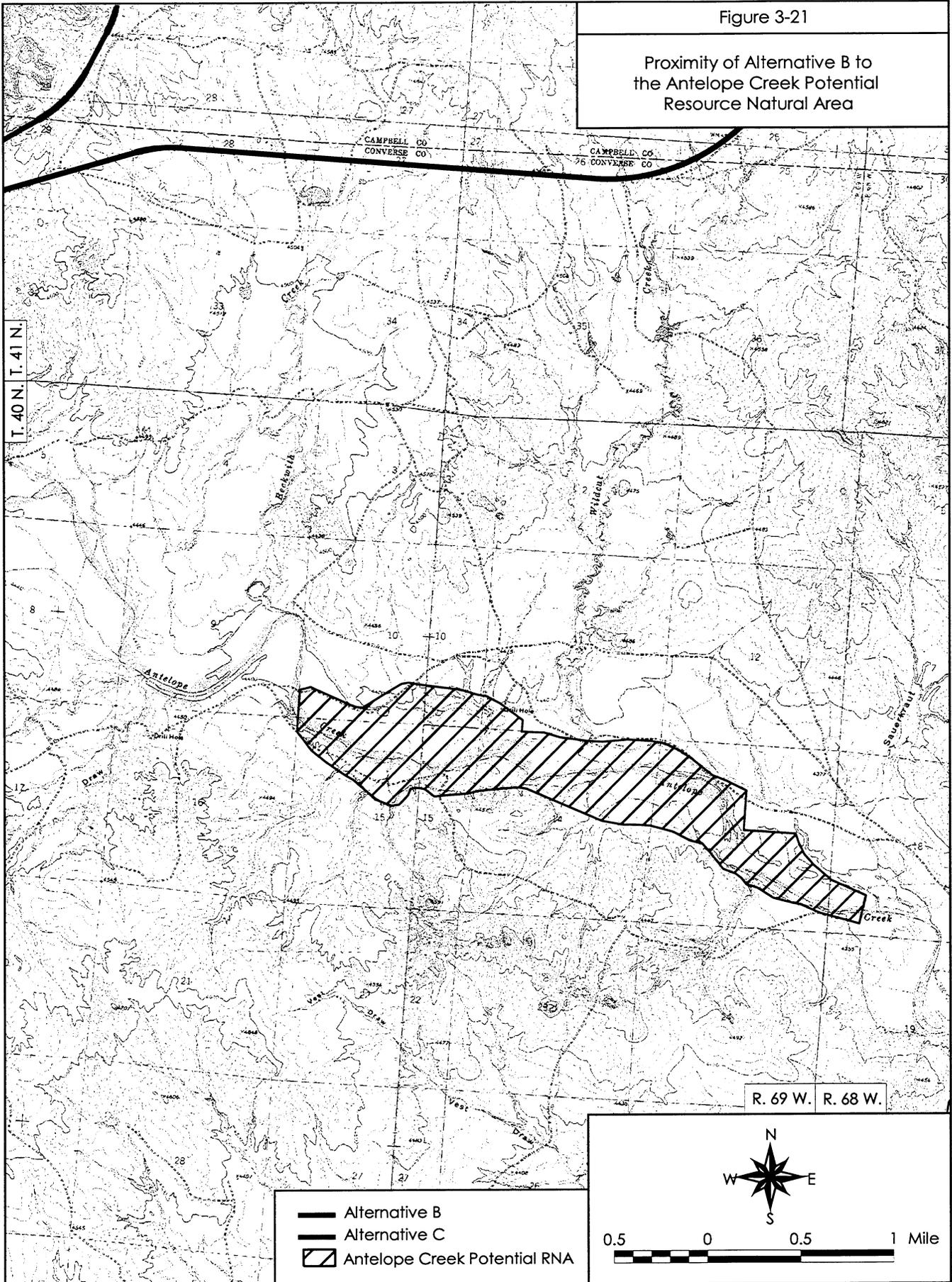
3.8.1 Impact Analysis Area. Generally, the impact analysis area for visual resources includes areas from which the operating railroad would be visible. In most cases, specific descriptions are limited to NFS lands because these are the only areas which would be directly affected by the alternatives which have established visual management objectives.

As discussed under the recreation resources section, the national grasslands offer vast and undeveloped appearing landscapes. Although the VQO system attempts to quantify and provide management direction

⁷ Pursuant to 36 CFR ¶ 219.25.

Figure 3-21

Proximity of Alternative B to the Antelope Creek Potential Resource Natural Area



- Alternative B
- Alternative C
- ▨ Antelope Creek Potential RNA

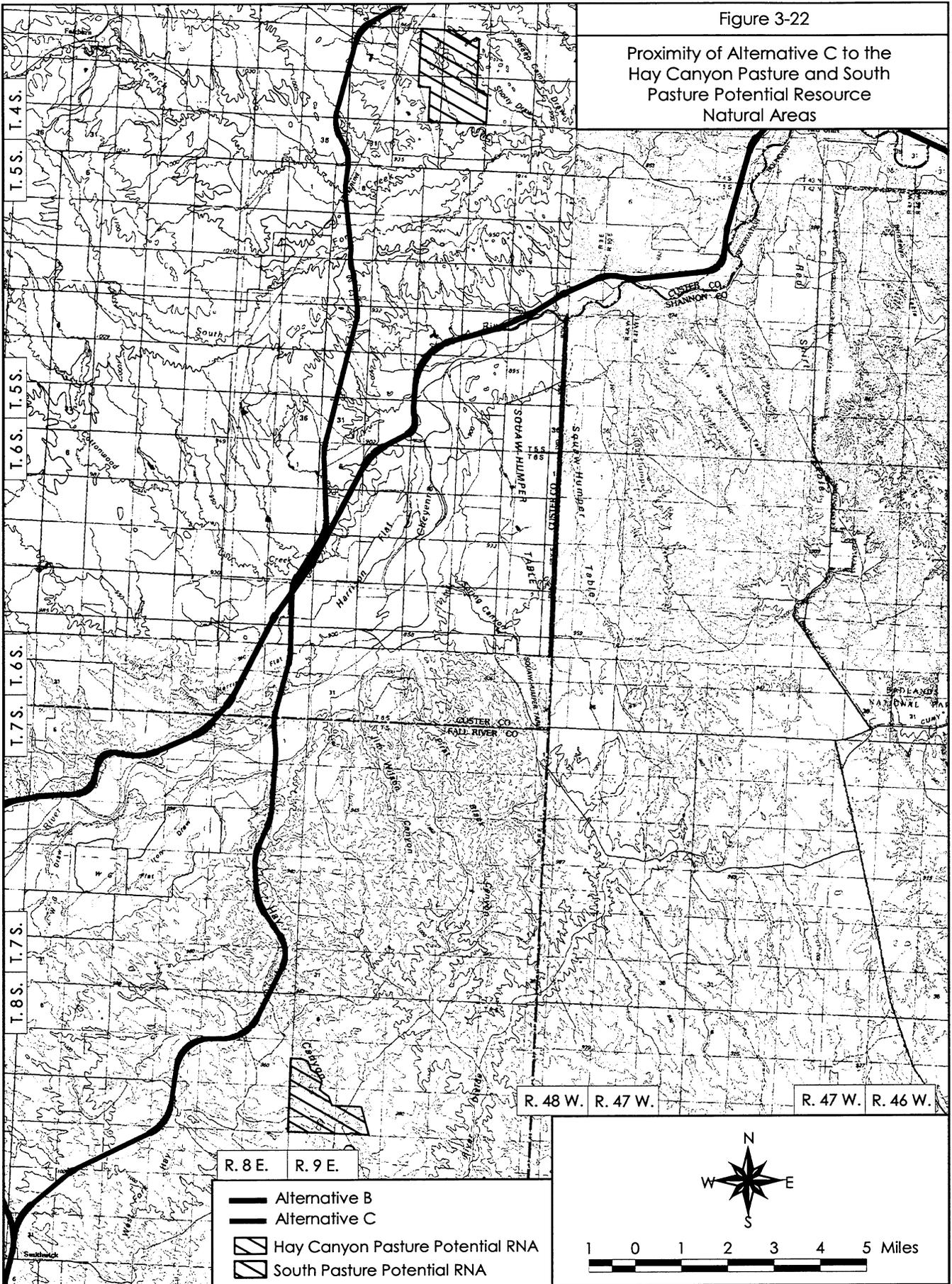
R. 69 W. R. 68 W.



0.5 0 0.5 1 Mile

Figure 3-22

Proximity of Alternative C to the Hay Canyon Pasture and South Pasture Potential Resource Natural Areas



for the visual resources, the expansiveness of these lands tend to diminish much of the existing human developments when viewed on a landscape or background level. Other than in the vicinity of the existing coal mines on the western flank of the grassland, this diminishing effect of developments is due in part to the relatively small scale developments that exist, such as windmills and oil wells. The primitive appearing landscapes on the grasslands offer a valuable, yet diminishing resource on these lands.

3.8.2 Affected Environment. The visual setting of the impact analysis area is quite variable. Some areas are very remote and show little or no human intrusions. Other areas, such as the route for Alternative D through Rapid City, are metropolitan in nature and existing visual impacts dominate the landscape. Natural landscapes range from dry desert-like areas to evergreen forests.

Many portions of the alternatives would be constructed adjacent to or would replace existing railroads, including the majority of Alternative D and, for the most part, the northern and southern legs of all the alternatives. In these areas, human activities are obvious - an operating railroad already exists at the site. The general types of visual intrusions from the project would be very similar to those that are currently occurring. It is recognized that the frequency of the visual intrusions may increase.

Only NFS lands in the impact analysis area have visual quality management objects. NFS lands on both BGNG and TBNG have been assigned VQOs. Historically, the Forest Service has used VQOs to define acceptable degrees of alteration of the natural landscape. The degree of alteration permitted using the VQO system is measured in terms of the changes in visual contrast with the surrounding landscape. The 5 VQOs used by the Forest Service, in descending order of allowable contrast, are:

- preservation
- retention
- partial retention
- modification
- maximum modification

Landscapes with a preservation designation have the highest scenic quality and are most sensitive to change. Small changes in visual contrast are generally considered unacceptable within this VQO. Maximum modification is assigned to areas which have the lowest scenic quality and which are not typically sensitive to change. Major changes in visual contrast are acceptable within this VQO. Two VQOs would be affected on NFS lands by the alternatives - modification and partial retention. The miles of each of the VQOs which would be crossed by the alternatives are summarized on Table 3-27.

As can be seen on the table, between 80 and 90 percent of the lands which would be crossed by the alternatives on BGNG currently have a modification VQO. Relatively large changes in visual contrast are allowed in this VQO. In fact, changes in visual contrast to the degree that management activities dominate the landscape are allowed in this VQO. However, facilities, buildings, roads, signs, etc., are still required to borrow from the adjacent environment in terms of the materials, textures and colors used. For example, large clear cuts and powerlines may dominate the landscape but their visual impact should still be minimized in places using mitigation measures such as dulling metal surfaces, reseeding, leaving scattered tree groups, etc.

The partial retention VQO has been applied to only between 10 and 20 percent of the NFS lands which would be crossed by the alternatives. These areas are typically restricted to riparian corridors and other waterbodies. Less change in visual contrast is allowed in this VQO than in modification. While management activities are allowed to dominate the landscape under the modification VQO, in partial retention areas management activities are expected to be subordinate to the natural environment. Management activities are not anticipated to attract the attention of the casual observer in this VQO.

For the plans revision, the Forest Service inventoried BGNG and TBNG under a new scenic management system. Unlike the VQOs currently in place, mapping under the new system incorporates viewing distance zones, concern level, scenic attractiveness (indicator of intrinsic scenic beauty of a landscape), scenic class (determined by combining the scenic attractiveness with distance zone and concern levels) and existing scenic integrity (state of naturalness).

In the proposed BGNG and TBNG grassland plans, scenic integrity levels (SIL) were assigned to each of the proposed management prescription areas (see Section 1.4.1.3). The miles which would be crossed by the alternatives in each of the SILs are listed on Table 3-27. The SILs which would be crossed by the alternatives are described below:

- High - human activity is not scenically evident;
- Moderate - valued landscape character appears slightly altered;
- Low - valued landscape character appears moderately altered.

Under the proposed grassland plans, the SILs are predominately moderate or low for lands which would be crossed by the alternatives. In fact, for Alternative B only about 10 percent of the NFS lands which would be crossed have a high SIL. The percentage of high SIL is even lower for Alternative C and the route variations (about 6 percent). No NFS lands classified with a high

Table 3-27 Miles of Visual Quality Objective Which Would be Crossed by the Alternatives on National Forest System Lands							
Visual Quality Objective/SIL Class	Alternative B	Alternative C	Alternative C with Phiney Flat Route Variation	Alternative C with W G Flat Route Variation	Alternative D	Black Thunder North Mine Loop	Black Thunder South Mine Loop
Buffalo Gap National Grassland							
Modification VQO	13.7	5.4	4.9	5.4	0	0	0
Partial Retention VQO	2.6	0.7	0.4	0.7	0	0	0
Thunder Basin National Grassland							
Modification VQO	30.7	28.4	28.4	28.4	22.7	0.6	2.7
Partial Retention VQO	4.9	4.4	4.4	4.4	4.0	<0.1	0.4
1999 Proposed National Grasslands Plan for Thunder Basin and Buffalo Gap National Grasslands							
High SIL	4.7	2.4	2.4	2.4	0	0	0
Moderate SIL	0	0.6	0.6	0.6	4.7	0	0
Moderate SIL in foreground and middleground, Low SIL in background of scenic classes 1-2; Low SIL in all areas scenic classes 3-7	16.6	12.4	12.4	12.4	7.9	0	0
Low SIL	30.6	23.5	22.7	23.5	14.1	0.6	3.1

SIL would be crossed by Alternative D or by any of the mine loop options.

3.9 Cultural and Historic Resources

The EIS for this project will contain a complete analysis of potential impacts to cultural resources. The reader is referred to that document for information regarding this resource.

3.10 Air Quality

3.10.1 Impact Analysis Area. The impact analysis area for air quality includes eastern Wyoming and western South Dakota.

3.10.2 Affected Environment. Very detailed information describing existing air quality in eastern Wyoming and western South Dakota is being developed to support modeling of potential impacts from the project. This modeling is being conducted by STB for the EIS. This section provides a general overview of existing air quality in the area. For more detail, please refer to the technical report prepared to support the modeling results presented in the EIS.

Background Air Quality. Air quality in the vicinity of the alternatives is generally considered excellent. Air quality programs are managed by the Wyoming Department of Environmental Quality (WDEQ), Air Quality

Division in Wyoming and by the SDENR, Air Quality Program in South Dakota. Both agencies have primacy from the EPA to implement regulatory provisions of the Clean Air Act.

The EPA has established National Ambient Air Quality Standards (NAAQS) which are absolute nationwide limits on the amounts of certain pollutants that may be present in the air. The State of Wyoming has developed its own standards (Wyoming Ambient Air Quality Standards - WAAQS) for the national pollutants and others. WAAQS are at least as stringent as the EPA standards. The State of South Dakota has not developed standards in addition to the NAAQS - therefore, the NAAQS apply in South Dakota. Standards for criteria pollutants currently in effect for both states are listed on Table 3-28. The air quality impact analysis area is in attainment for all NAAQS and WAAQS.

Very little background ambient air quality data is available for the counties which would be crossed by the alternatives. According to the BLM (1998), in the Newcastle Field Office area measured background concentrations of NO₂ were 2 µg/m³. For SO₂, the 24-hour measured background concentration was 9 µg/m³, while the annual average was 1 µg/m³. TSP was less than half the WAAQS at 62.5 µg/m³ and the 24-hour average PM₁₀ concentration was only 10 µg/m³. The 1- and 8-hour background concentrations for CO were 3,500 and 1,500 µg/m³, respectively.

Table 3-28
Criteria Pollutants and Applicable Ambient Air Quality Standards in $\mu\text{g}/\text{m}^3$ for South Dakota and Wyoming

Criteria Pollutant	Averaging Period	NAAQS and South Dakota	WAAQS
Nitrogen dioxide (NO_2)	annual	100	100
Sulfur dioxide (SO_2)	3-hour	1,300	1,300
	24-hour	365	260
	annual	80	60
Total suspended particulates (TSP)	24-hour	N/A	150
Particulate matter less than 10 micrometers in diameter (PM_{10})	24-hour	150	150
	annual	50	50
Carbon monoxide (CO)	1-hour	40,000	40,000
	8-hour	10,000	10,000
Ozone (O_3)	1-hour	235	160

WDEQ began a NO_2 monitoring program at Gillette in March, 1996 and discontinued it in May, 1997 (BLM, 1999). The average for the entire period was $16.5 \mu\text{g}/\text{m}^3$. Data for NO_2 was also collected at the Belle Ayr Mine and the Black Thunder Mine (see Figure 1-1). The average for the entire period at the Black Thunder Mine was $15.6 \mu\text{g}/\text{m}^3$, while the Belle Ayr data showed an average of $19.4 \mu\text{g}/\text{m}^3$.

In EPA's Aerobatic Information Retrieval System (AIRS) database,⁸ additional PM_{10} background concentrations are provided for Campbell and Converse counties. Between 1993 and 1998 in Campbell County, the maximum 24-hour average PM_{10} was typically below $70 \mu\text{g}/\text{m}^3$. However, in 1995 ($112 \mu\text{g}/\text{m}^3$) and 1996 ($101 \mu\text{g}/\text{m}^3$), the maximum 24-hour background concentration exceeded $100 \mu\text{g}/\text{m}^3$ but did not exceed the WAAQS. Annual average PM_{10} during the monitoring period never exceeded $30 \mu\text{g}/\text{m}^3$. Converse County data is available from AIRS for 1997 and 1998. Like Campbell County, during these years annual average PM_{10} concentration did not exceed $30 \mu\text{g}/\text{m}^3$. Maximum 24-hour concentration was below $60 \mu\text{g}/\text{m}^3$ for both years.

The only current air quality monitoring station in South Dakota in the vicinity of the alternatives is in Rapid City.⁹ The AIRS database includes PM_{10} for 1993 through 1998 for this site. In all years, except 1998, the maximum 24-hour PM_{10} concentration exceeded $100 \mu\text{g}/\text{m}^3$. The peak maximum 24-hour concentration was reached during 1994 at $144 \mu\text{g}/\text{m}^3$ which is just below the NAAQS. The peak annual average was also recorded during 1994 at $46 \mu\text{g}/\text{m}^3$. Over the years for which data is available, the annual average background concentration varied between 37 and $46 \mu\text{g}/\text{m}^3$.

⁸ The AIRS data base can be accessed through <http://www.epa.gov>

⁹ A map of air quality monitoring stations in South Dakota can be found at <http://www.state.sd.us/denr/DES/AirQuality/airmap.htm>

Class I Airsheds. Prevention of significant deterioration (PSD) standards have been established which serve to keep areas which have very good air quality from being degraded to NAAQS by allowing only certain increments (increases) above existing background air quality conditions. PSD allowable increments are not the same for all areas of the country. For purposes of allowable increments, areas of the country have been designated as either Class I or Class II. Examples of Class I areas are national parks and wilderness areas larger than 5,000 acres and other areas designated by the states or Indian tribes. Class I areas are designed to have the best air quality and, therefore, have the smallest allowable increments. Class II areas have larger allowable increments. All the alternatives would be constructed through PSD Class II areas. However, air pollutants disperse from sources (such as locomotive engines) and affect air quality away from the source. Concerns have been raised about the potential for pollutants generated by the locomotives to affect nearby Class I areas where the increment is lower.

Two Class I areas, Wind Cave National Park and the Sage Creek Wilderness Area (within Badlands National Park), exist in relatively close proximity to the alternatives. Both Class I areas are located in South Dakota and are shown on Figure 2-1. Alternative D would be constructed less than 3 miles east of Wind Cave National Park in Custer County. The Sage Creek Wilderness Area is located approximately 6.2 miles south of Alternatives B and C west of Wall in Pennington County.

Air Quality Related Values (AQRVs), which include the potential air pollutant effects on visibility and the acidification of surface waterbodies, are of concern for PSD Class I areas and some PSD Class II areas. Visibility impairment occurs as a result of the scattering and absorption of light by air pollution. This decreases the distance of what we see in addition to degrading the color, clarity, and contrast of the various scenes. Primary particles, such as soot/elemental carbon from wood combustion, and primary gaseous emissions [for example

nitrous oxides (NOx) from engines], reduce visibility. Humidity can also significantly increase the effect of pollution on visibility.

Since 1987, EPA has supported the Interagency Monitoring of Protected Visual Environments (IMPROVE) network in cooperation with the NPS, Forest Service, BLM, USFWS, and state agencies. One of the principal purposes of the IMPROVE network is to gather data that can be used to identify sources of impairment on an individual site, regional and national scale. This network began with 20 long-term monitoring sites in 1987 and now includes over 40 sites in parks and wilderness areas across the nation.

There is an IMPROVE monitoring site in Badlands National Park. The Badlands IMPROVE monitoring site ranks nearly in the middle of the range from cleanest to dirtiest monitoring sites in the nation (ranked 22 out of 42 total sites). The visibility degradation, like many rural western areas, is largely due to sulfate, organic and soot aerosols. Visibility at the Badlands National Park IMPROVE site is generally considered to be only average.

Atmospheric deposition (acid rain) is monitored as part of the National Acid Deposition Program/National Trends Network near Newcastle. Data from this site shows that current deposition rates are well below those that are considered potentially damaging to vegetation (BLM, 1998).

State and Federal Regulatory Programs. South Dakota and Wyoming do not currently regulate emissions from locomotives. However, the 1990 Clean Air Act amendments included a specific mandate for EPA to regulate these emissions. According to the EPA, unregulated locomotives are estimated to contribute almost 5 percent of the total nationwide emissions of nitrous oxides (NOx), which is more than 10 percent of the nationwide mobile sources of NOx emissions. EPA has determined that locomotives are one of the largest remaining unregulated sources of NOx emissions in the nation.

EPA is finalizing emission standards for NOx, hydrocarbons, carbon monoxide, particulate matter, and smoke for newly manufactured and remanufactured diesel-powered locomotives and locomotive engines. EPA has predicted that these new standards, which take effect in 2000, will achieve approximately a 66 percent reduction in NOx emissions. Hydrocarbon and particulate matter will be reduced by about 50 percent.

3.11 Geology and Paleontological Resources

3.11.1 Impact Analysis Area. For purposes of assessing impacts to geology and paleontological

resources, an area including 500 feet on both sides of the alternative centerlines was evaluated.

3.11.2 Geology Affected Environment. The alternatives would be constructed entirely within the Upper Missouri Basin Broken Lands of the Interior physical subdivision (Radbruch-Hall *et al.*, 1976). Tables 3-29 through 3-33 list the formations which would be crossed by the alternatives. A brief description of each formation is provided in Table 3-34 (Love and Christiansen, 1985).

In South Dakota, 30 to 42 percent of the alternative routes would cross the Pierre Shale which was deposited during middle Cretaceous times. A large percentage of Alternatives B (44 percent) and C (35 percent) would cross quaternary alluvium where they are adjacent to and within the Cheyenne River flood plain. Alternative D follows the Cheyenne River flood plain to a lesser degree (10 percent of the route). Most of the other formations which would be crossed in South Dakota consist of Cretaceous shales with a lesser amount of limestone. Near the Wyoming-South Dakota State line, the alternatives are aligned to the southwest of the Black Hills which are a domed uplift with the oldest rocks exposed in the center and both sides having progressively younger strata outward. All of the alternatives would cross a portion of the domal uplift, although on the outer edge. At the outer edge of the dome, the alternatives would cross through the Greenhorn limestone where there may be karst terrain present. In western South Dakota and adjacent parts of Wyoming, Paleozoic and Cretaceous carbonate rocks, arched steeply upwards, encircle the structural dome that forms the Black Hills. Caves and open fissures are common and a few caves contain many miles of passages. However, most of the cave passages and fissures in the Black Hills area only extend up to 3,000 feet in length and are generally less than 150 feet in depth (Davies *et al.*, 1984).

In Wyoming, the principal formation which would be crossed by the alternatives is the Fort Union. The Fort Union consists of the Lebo, Tullock and Tongue River members and was deposited during early Tertiary times. More than 60 percent of Alternatives B and C and approximately 45 percent of Alternative D would cross this formation through Wyoming. The Lance Formation, deposited in late cretaceous times, is the second most frequently crossed formation for Alternatives B and C.

The second most frequently crossed formation for Alternative D is the Greenhorn Formation and Belle Fourche Shales. Other formations existing to a lesser degree on the alternatives consist of early to middle cretaceous deposits such as the Pierre Shale and Mowry Shale.

**Table 3-29
Miles of Formations Which Would be Crossed by Alternative B**

Formation	Miles Crossed by Land Ownership					State Total (miles)	Percent of State
	Forest Service	DOE	BLM	State	Private		
South Dakota							
Alluvium and Colluvium	16.3		0.9	2.1	44.4	63.7	44.1
White River Group					1.2	1.2	0.8
Pierre Shale	<0.1		1.3		46.9	48.2	33.3
Niobrara Formation, Carlile Shales and Greenhorn Limestone					6.8	6.8	4.7
Carlile Shale					0.7	0.7	0.5
Greenhorn Formation					0.2	0.2	0.1
Belle Fourche Shale		0.3	1.1	0.6	14.0	16.0	11.0
Belle Fourche and Mowry Shales					0.9	0.9	0.6
Mowry Shales					1.3	1.3	0.9
Skull Creek Shale and Inyan Kara Group					1.8	1.8	1.2
Unknown					4.1	4.1	2.8
South Dakota Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Alluvium and Colluvium					1.2	1.2	0.8
Wasatch Formation, Main Body	1.6				4.1	5.7	3.8
Fort Union: Tongue River and Lebo Members				0.1	2.0	2.1	1.4
Fort Union: Lebo Member	24.7		1.4	2.2	56.2	84.5	55.8
Fort Union: Tullock Member	3.6			1.1	14.8	19.5	12.9
Lance Formation	5.7			2.1	13.0	20.8	13.8
Fox Hills Sandstone			1.0		6.4	7.4	4.9
Pierre Shale				0.9	2.8	3.7	2.4
Niobrara Formation and Carlile Shale					1.5	1.5	1.0
Greenhorn Formation and Belle Fourche Shale				1.0	3.8	4.8	3.2
Wyoming Total	35.6		2.4	7.4	105.8	151.2	100

The Black Thunder North Mine Loop would cross 3.6 miles of the Fort Union Lebo member and 0.90 miles of the main body of the Wasatch Formation. The Black Thunder South Mine Loop would cross 3.9 miles of the Lebo member of the Fort Union Formation and 3.2 miles of the main body of the Wasatch Formation. The North Antelope East and West mine loops would cross 1.5 and 2.4 miles of the Fort Union Lebo member, respectively.

No earthquake epicenters have been mapped in the immediate vicinity of Alternatives B and C (Hammond, 1993 and Case *et. al.*, 1995). According to Case *et. al.* (1995), the Alternative D route passes adjacent to (within 5 miles) 2 earthquake epicenters between Newcastle and Gillette. The first earthquake was in May, 1926 and has been given an intensity of IV on the Modified Mercalli Intensity Scale (see below for definition). The second earthquake occurred in February, 1972 and had a body

wave magnitude of 4.3 (on a scale of 2.0 to 7.5) for relative earthquake size.

Seismic risk maps have been developed to define zones of maximum expected damage in an attempt to show the relative earthquake hazards to people and structures. All alternatives are located well within Seismic Risk Zone 1 which predicts "minor damage, Intensity V and VI on the Modified Mercalli Scale". The Modified Mercalli (MM) scale is defined below as:

MM IV	Felt indoors by many during the day, outdoors by few. At night, some persons are awakened. Dishes, windows and doors are disturbed; walls make cracking sound. Sensation like heavy truck striking building; standing vehicles are rocked noticeably.
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Table 3-30 Miles of Formations Which Would be Crossed by Alternative C						
Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.8	1.2	1.1	44.2	49.3	34.6
White River Group	1.4			9.4	10.8	7.6
Pierre Shale	1.9	0.7	0.8	49.4	52.8	37.0
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.3
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.5	0.2	10.5	12.2	8.6
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.8
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

MM V Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.

MM VI Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Nearly all of the earthquakes in Wyoming have been due to movements of faults. None of the alternatives would cross any suspected active faults (Case, 1997). All the alternatives would cross inactive faults identified by Love and Christiansen (1985) south of Newcastle near Morrisey.

In both Wyoming and South Dakota, significant portions of the alternatives would cross the Pierre Shale Formation which has high landslide susceptibility

(Radbruch-Hall *et. al*, 1976). In these areas, cutting or loading of slopes or anomalously high precipitation may cause landsliding involving more than 15 percent of the rock or soil.

3.11.3 Paleontological Resources Affected Environment. In the vicinity of the alternatives are world-famous paleontological deposits. In fact, the Badlands of South Dakota are considered to be the birthplace of the science of vertebrate paleontology. Badlands National Park formations date from the late Eocene and Oligocene epochs, the Age of Mammals. Ancestors of the modern day rhinoceros, horse, pig, cat, and many other species are present. There are also early birds, reptiles, and invertebrates found in various strata.

The fossil fauna on BGNG is very diverse because it contains both marine vertebrate and invertebrates. Most

Table 3-31
Miles of Formations Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.0	1.3	1.1	38.9	43.2	30.2
White River Group	1.4			9.4	10.8	7.5
Pierre Shale	1.9	0.7	0.8	56.3	59.8	41.7
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.3
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.4	0.2	10.5	12.1	8.4
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.8
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

of the rocks exposed within BGNG contain the remnants of ancient marine animals, such as plesiosaurs, mosasaurs, toothed diving birds, large sea turtles, sharks, sting rays, a wide variety of fish, and a myriad of invertebrates such as clams, oysters, ammonites, coral, and barnacles. Inventories concentrating on the Late Cretaceous marine sediments, primarily exposed on the western portion of BGNG, located 63 paleontological localities that are primarily marine vertebrates. Another inventory concentrating on the Tertiary units on BGNG located 25 fossil localities on the Fall River Ranger District.

About 1 mile southwest of Hot Springs, on the U.S. Highway 18 Bypass, is the Mammoth Site which has one of the largest concentrations of Columbian mammoth bones found to date in the western hemisphere. The site is approximately 26,000 years old and is believed to have

been a sinkhole fed by springs. Mammoths, giant short-faced bears, and other mammals entered the pond, became trapped by the slippery, steep banks and died of starvation.

The investigation of paleontological resources on TBNG is relatively recent; however, the Lance Formation, primarily to the south of the grassland, has been heavily investigated since at least 1888. Approximately 25 miles south of the alternatives in Niobrara County is the Lance Creek Fossil Area which was nominated as a National Natural Landmark in 1966. The Lance Formation in the Lance Creek area has produced skulls and skeletons of horned dinosaurs, duckbilled dinosaurs, and primitive mammals. The American Museum of Natural History and the University of California Museum of Paleontology have collected and identified many specimens of fish, amphibians, turtles, lizards, snail, crocodiles, birds and

Table 3-32
Miles of Formations Which Would be Crossed by Alternative C With the W G Flat Route Variation

Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium	2.8	1.4	1.1	43.5	48.8	34.5
White River Group	1.4			9.4	10.8	7.6
Pierre Shale	1.9	0.7	0.8	48.8	52.2	36.9
Niobrara Formation, Carlile Shales and Greenhorn Limestone				6.2	6.2	4.4
Carlile Shale				0.9	0.9	0.6
Greenhorn Formation				0.2	0.2	0.1
Belle Fourche Shale		1.4	0.2	10.5	12.1	8.6
Belle Fourche and Mowry Shales				3.1	3.1	2.2
Mowry Shales				1.2	1.2	0.9
Skull Creek Shale and Inyan Kara Group				1.8	1.8	1.3
Unknown				4.1	4.1	2.9
South Dakota Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Alluvium and Colluvium			0.5	1.2	1.7	1.3
Wasatch Formation, Main Body	1.6		0.1	6.7	8.4	6.4
Fort Union: Tongue River and Lebo Members			0.1	2.0	2.1	1.6
Fort Union: Lebo Member	22.1	0.1	4.6	41.5	68.3	52.2
Fort Union: Tullock Member	2.7		1.1	8.0	11.8	9.0
Lance Formation	6.4		1.7	14.1	22.2	16.8
Fox Hills Sandstone		1.3		6.2	7.5	5.7
Pierre Shale		0.1	1.0	2.4	3.5	2.7
Niobrara Formation and Carlile Shale				1.5	1.5	1.1
Greenhorn Formation and Belle Fourche Shale			0.5	3.7	4.2	3.2
Wyoming Total	32.8	1.5	9.6	87.3	131.2	100

mammals, but little dinosaur material. Additional localities and specimens are still being discovered and described.

The Lance Formation may also provide important information about how and why dinosaurs became extinct. Sites have been identified in eastern Wyoming with rock layers that are believed to contain material from a comet or meteorite that hit the earth about 65 million years ago.

Marine reptiles and fish are found in deposits of Mesozoic age throughout the area managed by the BLM's Newcastle Field Office (BLM, 1998). Jurassic dinosaurs (giant sauropods, the carnivore Allosaurus, and early duckbills) along with primitive mammals and other animals occur in the Morrison Formation where it outcrops around the Black Hills.

Table 3-34 contains a column which identifies the Probable Fossil Yield Classification (PFYC) for each formation which would be crossed by the alternatives. PFYC is a planning tool developed by the Forest Service wherein geological units, usually at the formation or member level, are classified according to the probability of yielding paleontological resources that are of concern. The classification is based largely on how likely a geologic unit is to produce vertebrate fossils of terrestrial (i.e. nonmarine) origin. As is shown on Table 3-34, 2 PFYCs would be crossed by the alternatives. These PFYCs are described below:

Class 3. This class contains fossiliferous sedimentary geologic units whose fossil content varies in significance, abundance, and predictable occurrence. Also included are sedimentary units of unknown fossil

**Table 3-33
Miles of Formations Which Would be Crossed by Alternative D**

Formation	Miles Crossed by Land Ownership				State Total (miles)	Percent of State
	Forest Service	BLM	State	Private		
South Dakota						
Alluvium and Colluvium		0.3		18.4	18.7	10.4
White River Group				24.4	24.4	13.6
Pierre Shale			0.3	69.6	69.9	39.0
Niobrara Formation, Carlile Shales and Greenhorn Limestone			0.1	8.0	8.1	4.5
Carlile Shale			1.4	17.6	19.0	10.6
Greenhorn Formation				2.0	2.0	1.1
Belle Fourche Shale		1.0	0.2	9.3	10.5	5.9
Belle Fourche and Mowry Shales				20.8	20.8	11.6
Mowry Shales				1.2	1.2	0.7
Skull Creek Shale and Inyan Kara Group				3.0	3.0	1.7
Unknown				1.7	1.7	0.9
South Dakota Total		1.3	2.0	176.0	179.3	100
Wyoming						
Alluvium and Colluvium	0.2	0.2	2.9	20.9	24.2	13.4
Wasatch Formation, Main Body	1.6		0.5	10.6	12.7	7.0
Fort Union: Tongue River and Lebo Members		0.2	1.6	16.1	17.9	9.9
Fort Union: Lebo Member	18.7	0.1	2.6	41.9	63.3	34.9
Fort Union: Tullock Member				0.5	0.5	0.3
Lance Formation				3.0	3.0	1.7
Fox Hills Sandstone			0.4	0.3	0.7	0.4
Pierre Shale	0.6	1.2	0.1	10.7	12.6	7.0
Niobrara Formation and Carlile Shale	0.3			4.1	4.4	2.4
Greenhorn Formation and Belle Fourche Shale	3.5	<0.1		28.6	32.1	17.8
Cloverly and Morrison				1.2	1.2	0.7
Gravel, pediment and fan deposits				1.4	1.4	0.8
Newcastle Sandstone and Skull Creek Shale	1.8	<0.1	0.7	4.2	6.7	3.7
Wyoming Total	26.7	1.7	8.8	143.5	180.7	100

potential. This classification is primarily marine origin with sporadic known occurrences of vertebrate fossils (other than fish scales and shark teeth). Vertebrate fossils and significant nonvertebrate fossils are known to occur inconsistently - predictability known to be low. The class area may be poorly studied and/or poorly documented - potential yield cannot be assigned without ground reconnaissance. Ground disturbing activities on Class 3 will require sufficient mitigation to determine whether significant paleontological resources occur in the area of the alternatives. Mitigation beyond initial findings will range from no further mitigation necessary to full and continuous monitoring of significant localities during the action.

Class 5. The land manager's highest concern for paleontological resources should focus on this classification. This class is identified as highly fossiliferous geologic units that regularly and predictably produce vertebrate fossils and/or scientifically significant nonvertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts. Vertebrate fossils and/or scientifically significant nonvertebrate fossils are known and documented to occur consistently, predictably, and/or abundantly. This class may have extensive exposed outcrops which erode easily and which may form badlands. These areas are likely to be poached. Mitigation of ground disturbing activities is required and may be intense.

Table 3-34
Description and Probable Fossil Yield Classification of Formations Which Would be Crossed by the Alternatives

Formation	Probable Fossil Yield Classification	Description
Alluvium and Colluvium	3	Clay, silt, sand, and gravel in flood plains, fans, terraces, and slopes.
Gravel, Pediment and Fan Deposits	3	Mostly locally derived clasts. Includes some glacial deposits along east flank of Wind River Range. Locally includes some Tertiary gravels.
White River Group	5	Brule clay and Chadron formation; gravel at base.
Wasatch Formation, Main Body	5	Variiegated red to gray, brown and gray mudstone and sandstone; conglomeratic lenses.
Fort Union: Tongue River and Lebo Members	3	Thick beds of yellow sandstone interbedded with gray and black shale and many coal beds. Dark-gray clay shale and concretionary sandstone.
Fort Union: Lebo Member	3	Dark-gray clay shale and concretionary sandstone.
Fort Union: Tullock Member	3	Soft gray sandstone, gray and brown carbonaceous shale, and thin coal beds.
Lance Formation	5	Brown and gray sandstone and shale; thin coal and carbonaceous shale beds.
Fox Hills Sandstone	3	Light-colored sandstone and gray sandy shale containing marine fossils.
Pierre Shale	3	Dark-gray concretionary marine shale; contains several bentonite beds.
Niobrara Formation	5	Light-colored limestone and gray to yellow speckled limey shale.
Carlile Shale	5	Dark-gray sandy shale.
Greenhorn Formation	5	Light-colored limestone, marl, and limey sandstone interbedded with gray concretionary shale.
Belle Fourche Shale	3	Black soft bentonitic concretionary shale.
Mowry Shale	3	Silvery-gray hard siliceous shale containing abundant fish scales and bentonite beds.
Newcastle Sandstone	3	Gray sandstone and sandy shale containing some bentonite and coal.
Skull Creek Shale	3	Black soft fissile shale.
Cleverly Formation	5	Rusty to light-gray sandstone containing lenticular chert-pebble conglomerate interbedded with variegated bentonitic claystone.
Inyan Kara Group	5	Rusty to light-gray sandstone containing lenticular chert-pebble conglomerate interbedded with variegated bentonitic claystone.
Morrison Formations	5	Dully variegated siliceous claystone, nodular white limestone, and gray silty sandstone.

Proposed Thunder Basin Paleontological Special Interest Area. As was discussed in Section 1.4.1.3, Alternatives B and C would cross 2.0 and 2.4 miles, respectively, of proposed Management Prescription Area 2.1c identified in the proposed TBNG Grassland Plan (Forest Service, 1999b). Figure 3-23 shows the routes of the alternatives through this proposed management area. The proposed TBNG Grassland Plan identifies this area as a special interest area. Consistency of the alternatives with this proposed management prescription is discussed on Table 15 in Appendix A of this report.

This 5,140-acre site features a high concentration of fossil remains from the late Cretaceous Period ending about 65 million years ago. The site is within the Lance Formation, which is composed of 2,600 feet of dull-gray sandy shales alternating with lenticular, light-colored sandstones and thin lignite beds. The Lance Formation has a very good potential to produce a large variety of

fossils of excellent research value. This is the most productive fossil-bearing site on the TBNG. The proposed grassland plan places management emphasis on interpretation and education of geology and paleontology.

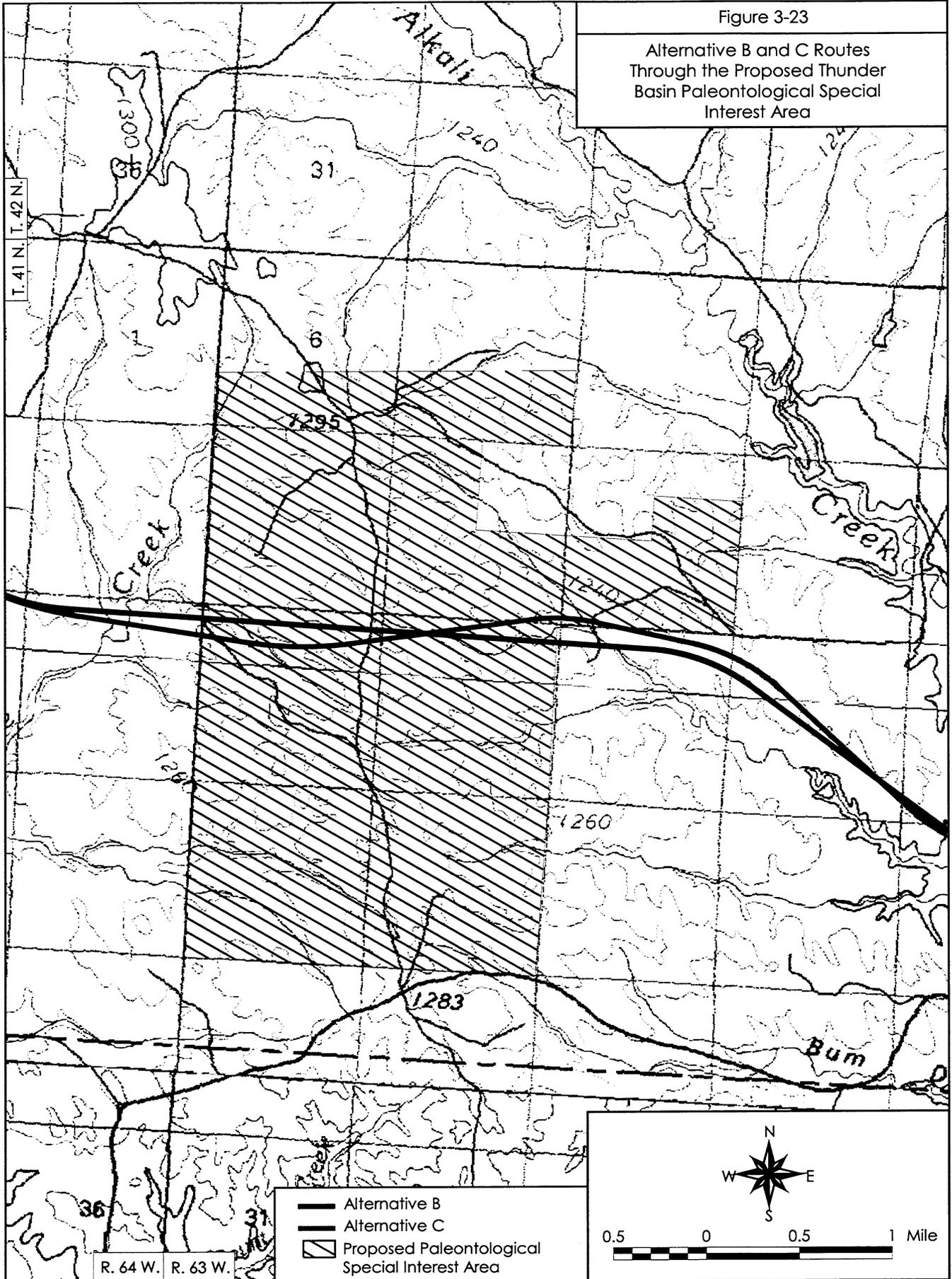
3.12 Water Resources

3.12.1 Impact Analysis Area. The impact analysis area for water resources includes the aquifers which would be crossed by the alternatives. In addition, all perennial and intermittent drainages, as shown on USGS 7.5-minute quad maps, are considered in the analysis of impacts to surface waters.

3.12.2 Groundwater. The entire project area is underlain by the Northern Great Plains aquifer system which includes most of North Dakota and South Dakota as well as eastern Montana and northeastern Wyoming.

Figure 3-23

Alternative B and C Routes
Through the Proposed Thunder
Basin Paleontological Special
Interest Area



The major aquifers of the Northern Great Plains aquifer system are sandstones of Tertiary and Cretaceous age and carbonate rocks of Paleozoic age. These aquifers, along with regional confining units that separate some of them, form one of the largest confined aquifer systems in the United States (USGS, 1996).

Groundwater is obtained primarily from wells completed in unconsolidated deposit aquifers that consist mostly of sand and gravel, and from wells completed in semi-consolidated and consolidated rock aquifers, chiefly sandstone and limestone. Most wells in the project area are on privately-owned land and are used for irrigation. Shallow groundwater is absent or scarce in most of the area, but can be obtained from the larger stream valleys including the Cheyenne River and the Belle Fourche River valleys. There are larger, reliable sources of deep groundwater for municipal and industrial use, but they are generally too deep for stock or domestic use.

The aquifers in unconsolidated deposits which support shallow wells are primarily limited to the areas surrounding the Cheyenne and Belle Fourche rivers. These are productive aquifers where they consist of sand and gravel and are the source of water for thousands of shallow wells. These aquifers are very important sources of water because they are located in flat lowlands in rural and urban areas where population is concentrated. Wells in these aquifers generally yield from 10 to 20 gallons per minute which is adequate to supply domestic and livestock watering needs.

For Alternatives B and C, the aquifers exposed to the land surface include the lower Cretaceous aquifers in small bands near the flanks of the Black Hills, the upper Cretaceous aquifers and the Lower Tertiary aquifers in eastern Wyoming. Much of the alternative routes are underlain by the Pierre Shale which is a confining layer of impermeable rock. Alternative D would cross similar aquifers exposed to the land surface but also Paleozoic aquifers and crystalline rocks as it passes through the Black Hills uplift.

Groundwater is sometimes pumped from large capacity wells to supplement surface water during times of drought or during seasons of the year when surface water is in short supply and in many areas, groundwater is the only source of water for irrigation. As a result of excessive withdrawal, ground water levels and artesian pressures have declined significantly in some areas. Programs have been enacted by state governments to prevent further groundwater development by limiting the number of wells in certain areas (USGS, 1996).

In both Wyoming and South Dakota, agricultural use (primarily irrigation) is the largest use category. In South Dakota, public supply is the second largest use. In Wyoming, the second largest use category is mining.

There are 3 major withdrawal sites in the vicinity of the project alternatives (USGS, 1996). Pennington County is a major fresh groundwater withdrawal site (50 to 115 million gallons per day in 1985) for public supply, rural domestic and commercial use. Campbell and Niobrara counties are also major fresh groundwater withdrawal sites (10 to 50 million gallons per day in 1985) for irrigation and industrial use. Campbell County also is a withdrawal site for public supply.

3.12.3 Surface Water. In addition to the information provided in this report, DM&E is preparing a 404 permit application which will address potential impacts to waters of the U.S. Included in that report are plan and profile drawings of proposed bridge structures across major streams and rivers as well as results of hydrology studies which will be used to size water conveyance structures under the railroad bed.

The area which would be crossed by the alternatives is drained by many small streams which all empty into 2 encircling rivers, the Belle Fourche and Cheyenne. The Belle Fourche, rising in Wyoming, first flows north-eastward, then swings abruptly around the Bearlodge Mountains to continue in a southeasterly direction. The Cheyenne, also rising in Wyoming, flows toward the southeast, then turns northeastward along the southern Black Hills to receive the Belle Fourche some 50 miles east of the Black Hills. About 60 miles farther downstream, the Cheyenne empties into Lake Oahe on the Missouri River.

Alternatives B and C would follow the Cheyenne River flood plain for a large portion of their routes through South Dakota and into Wyoming. Alternative D would cross the Cheyenne River between Wall and Wasta, but then would take a northern route to Rapid City using the Box Elder Creek drainage. All of the alternatives would cross the Belle Fourche River in Wyoming. Several smaller perennial streams would be crossed by the alternatives which are tributary to either the Cheyenne River or the Belle Fourche River. However, the vast majority of the stream and river crossings for all of the alternatives are intermittent or ephemeral waters.

It has been determined that between 6 and 27 percent of precipitation in the Black Hills is available for streamflow (Forest Service, 1996). Snowfall is important for soil-mantle recharge in the Black Hills. It is less important in terms of total streamflow. The melting of accumulated snow adds to the sharp increase of channel flow occurring in April, but it has been found that the greatest water yield occurred from the rains of April, May and June.

Most of the precipitation increase between May and June goes to rapidly increasing evapotranspiration rather than to water yield. Between July and September,

decreases in water yield are greater than the decline in precipitation. During most years, precipitation between October and April does little more than replenish soil moisture. The result is that most streams in this area are intermittent or ephemeral (Forest Service, 1996).

Nine hydrologic units (USGS, 1974 and 1978) would be crossed by the alternatives (see Figure 3-24). Tables 3-35 through 3-39 provide a listing of perennial streams which would be crossed by each alternative by hydrologic unit and Tables 3-40 through 3-44 present a listing of perennial streams that are adjacent to (within 50 feet) the alternatives and may be affected by construction (although not crossed). Tables 3-45 through 3-49 show the number of intermittent streams which would be crossed or affected by (within 50 feet) each alternative by landowner.

None of the 4 proposed mine loops would cross perennial streams. The Black Thunder North, Black Thunder South, North Antelope East and North Antelope West would cross 9, 12, 4 and 2 intermittent streams, respectively.

Surface Water Quality - South Dakota. The SDENR has established beneficial uses of waters of the state. The beneficial use classifications of surface waters of the state, shown in Table 3-50, do not limit the actual use of such waters. The classifications designate the minimum quality at which the surface waters of the state are to be maintained and protected. According to Steinke (1999), all waters of the state have at least a beneficial use designation of 9 and 10 (see Table 3-50). Even though the waters may not meet the quality standards of Class 9 or 10, dischargers to those water would be required to meet quality standards of Class 9 and 10. Table 3-51 provides the classifications (where classifications have been designated) for streams and rivers crossed by the alternatives in South Dakota.

Surface Water Quality - Wyoming. The Wyoming Environmental Quality Council, pursuant to W.S. 35-11-101 through 1304, has promulgated regulations for quality standards for Wyoming surface waters. The objectives of the Wyoming pollution control program are outlined in W.S. 35-11-102 and are specifically designed to maintain the best possible quality of waters commensurate with the designated use. The state has designated 4 classes of surface water. Streams which would be crossed by the alternatives that have been rated by the state are listed in Table 3-52. Any waters which are unlisted have the same classification as the first listed water to which it is tributary.

Definitions for stream classifications for perennial streams which would be crossed by the alternative are listed below:

Class 2 - Those surface waters, other than those classified as Class 1, which are determined to (i) be presently supporting game fish; or (ii) have the hydrologic and natural water quality potential to support game fish; or (iii) include nursery areas or food sources for game fish.

Class 4 - Those surface waters, other than those classified as Class 1, which are determined to not have the hydrologic or natural water quality potential to support fish including all intermittent and ephemeral streams. Class 4 waters receive protection for agricultural uses and wildlife watering.

South Dakota and Wyoming 305(b) Water Quality Assessment. Section 303(d) of the Clean Water Act requires states to identify waters which are not supporting their designated uses, and/or which need to have a Total Maximum Daily Load (TMDL) established to support their uses. In South Dakota, SDENR is responsible for gathering information and preparing the 305(b) Water Quality Assessment. Table 3-53 lists the stream segments which would be crossed by the alternatives which are on the 303(d) waterbody list.

SDENR has developed a system of prioritization criteria for TMDL calculations. Included in these factors are the required elements of "the severity of the pollution and the uses to be made of such waters". The priorities are as follows:

Priority 1	High
Priority 2	Medium
Priority 3	Low
Priority 0	Not Targeted

The Cheyenne River has been given a priority of 2, whereas Rapid Creek and Box Elder Creek have been given priority 3 for TMDL development. These waters are not on the 1998-2000 Biennium Targeted TMDL Waters list. This means that presently there are no plans to calculate TMDLs for these waters in the next 2 years (Steinke, 1999).

In Wyoming, the WDEQ, Water Quality Division has responsibility for gathering information and preparing the 305(b) Water Quality Assessment. A comparison of the Wyoming 303(d) Waterbody List with the alternative crossings shows that the only water on the list is the Belle Fourche River in Section 36, T. 50 N., R. 68 W. on Alternative D. According to Parfitt (1999), this portion of the Belle Fourche River is on the 303(d) list because of impairment from fecal coliform. Plans to either calculate TMDLs or develop a Watershed Management Plan are being evaluated by the Conservation District in conjunction with the WDEQ, Water Quality Division.

Table 3-35

Perennial Streams Which Would be Crossed by Alternative B

Hydrologic Unit/Number	Perennial Stream by Land Ownership				Legal Location	Total Perennial Crossings
	Forest Service	BLM	State	Private		
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109	Spring Creek Spring Creek Spring Creek			Spring Creek Spring Creek	Sec. 20, T. 2 S., R. 12 E. Sec. 20, T. 2 S., R. 12 E. Sec. 20, T. 2 S., R. 12 E. Sec. 29, T. 2 S., R. 12 E. Sec. 32, T. 2 S., R. 12 E. Sec. 15, T. 3 S., R. 11 E.	25
	Battle Creek Cheyenne River Cheyenne River			Beaver Creek Cheyenne River Sand Creek Sand Creek Sand Creek Sand Creek Sand Creek	Sec. 22, T. 7 S., R. 7 E. Sec. 27, T. 7 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 24, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E. Sec. 25, T. 8 S., R. 7 E.	3
Angostura Reservoir - 10120106				Plum Creek Cottonwood Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 6, T. 9 S., R. 3 E. Sec. 36, T. 8 S., R. 2 E.	3
Hat - 10120108				Hat Creek Hat Creek Hat Creek	Sec. 36, T. 9 S., R. 4 E. Sec. 36, T. 9 S., R. 4 E. Sec. 36, T. 9 S., R. 4 E.	3
Beaver - 10120107			Beaver Creek		Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	6	0	1	28		35

Table 3-35
Concluded

Hydrologic Unit	Perennial Stream by Land Ownership				Total Perennial Crossings
	Forest Service	BLM	State	Private	
Wyoming					
Upper Belle Fourche - 10120201				Belle Fourche River Belle Fourche River Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	6
Upper Cheyenne - 10120103					0
Antelope - 10120101					0
Wyoming Total	0	0	0	6	6

Table 3-36
Concluded

Hydrologic Unit	Perennial Stream by Land Ownership				Total Perennial Crossings
	Forest Service	BLM	State	Private	
Wyoming					
Beaver - 10120107					0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	4
Upper Cheyenne - 10120103					0
Antelope - 10120101					0
Wyoming Total	0	0	0	4	4

Table 3-37
 Perennial Streams Which Would be Crossed by Alternative C With the Phiney Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership			Private	Legal Location	Total Perennial Crossings
	Forest Service	BLM	State			
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek	Sec. 20, T. 1 N., R. 14 E. Sec. 31, T. 1 N., R. 14 E.	2
Rapid - 10120110				Rapid Creek	Sec. 3, T. 2 S., R. 12 E.	1
Middle Cheyenne Spring - 10120109				Spring Creek Battle Creek Cheyenne River Unnamed Stream Sand Creek Sand Creek Sand Creek	Sec. 20, T. 2 S., R. 12 E. Sec. 31, T. 3 S., R. 10 E. Sec. 1, T. 7 S., R. 8 E. Sec. 31, T. 8 S., R. 8 E.	7
Angostura Reservoir - 10120106				Plum Creek Plum Creek Plum Creek Cheyenne River	Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E. Sec. 25, T. 9 S., R. 3 E. Sec. 31, T. 8 S., R. 3 E.	4
Hat - 10120108				Hat Creek	Sec. 25, T. 9 S., R. 4 E.	1
Beaver - 10120107				Beaver Creek	Sec. 16, T. 7 S., R. 1 E.	1
South Dakota Total	0	0	0	16		16
Wyoming						
Beaver - 10120107						0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	Sec. 31, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	4
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	4		4

Table 3-38
Concluded

Hydrologic Unit	Perennial Stream by Land Ownership				Total Perennial Crossings
	Forest Service	BLM	State	Private	
Wyoming					
Beaver - 10120107					0
Upper Belle Fourche - 10120201				Belle Fourche River Caballo Creek Caballo Creek Caballo Creek	4
Upper Cheyenne - 10120103				Sec. 31, T. 47 N., R. 70 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W. Sec. 35, T. 48 N., R. 71 W.	0
Antelope - 10120101					0
Wyoming Total	0	0	0	4	4

Table 3-39

Perennial Streams Which Would be Crossed by Alternative D

Hydrologic Unit	Perennial Stream by Land Ownership			Total Perennial Crossings		
	Forest Service	BLM	State			
South Dakota						
Private						
Legal Location						
Middle Cheyenne Elk - 10120111				Cheyenne River	Sec. 2, T. 1 N., R. 14 E.	13
				Boxelder Creek	Sec. 31, T. 1 N., R. 14 E.	
				Boxelder Creek	Sec. 36, T. 1 N., R. 13 E.	
				Boxelder Creek	Sec. 30, T. 1 N., R. 13 E.	
				Boxelder Creek	Sec. 24, T. 1 N., R. 12 E.	
				Boxelder Creek	Sec. 15, T. 1 N., R. 12 E.	
				Boxelder Creek	Sec. 16, T. 1 N., R. 12 E.	
				Boxelder Creek	Sec. 31, T. 2 N., R. 11 E.	
				Boxelder Creek	Sec. 35, T. 2 N., R. 10 E.	
				Boxelder Creek	Sec. 34, T. 2 N., R. 10 E.	
				Unnamed Stream	Sec. 28, T. 2 N., R. 10 E.	
				Boxelder Creek	Sec. 27, T. 2 N., R. 9 E.	
				Boxelder Creek	Sec. 23, T. 2 N., R. 8 E.	
Rapid - 10120110				Unnamed Stream	Sec. 36, T. 2 N., R. 7 E.	4
				Unnamed Stream	Sec. 36, T. 2 N., R. 7 E.	
				Rapid Creek	Sec. 36, T. 2 N., R. 7 E.	
				Dry Creek	Sec. 27, T. 1 N., R. 8 E.	
Middle Cheyenne Spring - 10120109				Spring Creek	Sec. 27, T. 1 S., R. 8 E.	16
				Battle Creek	Sec. 32, T. 2 S., R. 8 E.	
				French Creek	Sec. 26, T. 4 S., R. 7 E.	
				Beaver Creek	Sec. 29, T. 6 S., R. 7 E.	
				Beaver Creek	Sec. 16, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 16, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
				Beaver Creek	Sec. 22, T. 7 S., R. 7 E.	
	Angostura Reservoir - 10120106				Cheyenne River	
				Sand Creek	Sec. 24, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 24, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
				Sand Creek	Sec. 25, T. 8 S., R. 7 E.	
Hat - 10120108				Plum Creek	Sec. 25, T. 9 S., R. 3 E.	1
				Plum Creek	Sec. 25, T. 9 S., R. 3 E.	
				Plum Creek	Sec. 25, T. 9 S., R. 3 E.	
				Cheyenne River	Sec. 31, T. 8 S., R. 3 E.	
South Dakota Total	0	0	0	Hat Creek	Sec. 25, T. 9 S., R. 4 E.	38

Table 3-39
Concluded

Hydrologic Unit	Perennial Stream by Land Ownership				Total Perennial Crossings
	Forest Service	BLM	State	Private	
Wyoming					
Beaver - 10120107				Stockade Beaver Creek Unnamed Stream Little Oil Creek Little Oil Creek Little Oil Creek Cambria Creek Unnamed Stream Poison Creek	8
Upper Belle Fourche - 10120201			Belle Fourche River Caballo Creek	Donkey Creek Donkey Creek Caballo Creek Caballo Creek Caballo Creek	11
Upper Cheyenne - 10120103				Belle Fourche River Belle Fourche River Belle Fourche River	0
Antelope - 10120101					0
Wyoming Total	0	0	2	17	19

Table 3-40
 Summary of Perennial Streams Directly Adjacent to Alternative B

Hydrologic Unit	Perennial Stream by Land Ownership				Legal Location	Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private		
South Dakota						
Middle Cheyenne Elk - 10120111						0
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109	Battle Creek Cheyenne River				Sec. 20, T. 4 S., R. 11 E. Sec. 31, T. 4 S., R. 11 E.	2
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	2	0	0	0		2
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-41
 Summary of Perennial Streams Directly Adjacent to Alternative C

Hydrologic Unit	Perennial Stream by Land Ownership				Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	
South Dakota					
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	2
Rapid - 10120110					0
Middle Cheyenne Spring - 10120109				Spring Creek Spring Creek Spring Creek Spring Creek Spring Creek	5
Angostura Reservoir - 10120106					0
Hat - 10120108					0
Beaver - 10120107					0
South Dakota Total	0	0	0	7	7
Wyoming					
Upper Belle Fourche - 10120201					0
Upper Cheyenne - 10120103					0
Antelope - 10120101					0
Wyoming Total	0	0	0	0	0

Table 3-42
 Summary of Perennial Streams Directly Adjacent to Alternative C With the Phiney Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership				Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private	
South Dakota					
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	2
Rapid - 10120110					0
Middle Cheyenne Spring - 10120109					0
Angostura Reservoir - 10120106					0
Hat - 10120108					0
Beaver - 10120107					0
South Dakota Total	0	0	0	2	2
Wyoming					
Upper Belle Fourche - 10120201					0
Upper Cheyenne - 10120103					0
Antelope - 10120101					0
Wyoming Total	0	0	0	0	0

Table 3-43
 Summary of Perennial Streams Directly Adjacent to Alternative C With the W G Flat Route Variation

Hydrologic Unit	Perennial Stream by Land Ownership				Legal Location	Total Adjacent Perennial Streams
	Forest Service	BLM	State	Private		
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Cheyenne River	Sec. 33, T. 1 S., R. 13 E. Sec. 32, T. 1 S., R. 13 E.	2
Rapid - 10120110						0
Middle Cheyenne Spring - 10120109				Spring Creek Spring Creek Spring Creek Spring Creek	Sec. 29, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 31, T. 2 S., R. 12 E. Sec. 1, T. 3 S., R. 11 E. Sec. 1, T. 3 S., R. 11 E.	5
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	7		7
Wyoming						
Upper Belle Fourche - 10120201						0
Upper Cheyenne 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	0		0

Table 3-44
 Summary of Perennial Streams Directly Adjacent to Alternative D

Hydrologic Unit	Perennial Stream by Land Ownership			Total Adjacent Perennial Streams		
	Forest Service	BLM	State			
Private						
Legal Location						
South Dakota						
Middle Cheyenne Elk - 10120111				Cheyenne River Boxelder Creek Boxelder Creek Boxelder Creek	Sec. 4, T. 1 N., R. 14 E. Sec. 24, T. 2 N., R. 8 E. Sec. 24, T. 2 N., R. 8 E. Sec. 23, T. 2 N., R. 8 E.	4
Rapid - 10120110				Rapid Creek	Sec 6, T. 1 N., R. 8 E.	1
Middle Cheyenne Spring - 10120109				Beaver Creek Beaver Creek	Sec 29, T. 6 S., R. 7 E. Sec. 9, T. 7 S., R. 7 E.	1
Angostura Reservoir - 10120106						0
Hat - 10120108						0
Beaver - 10120107						0
South Dakota Total	0	0	0	7		7
Wyoming						
Beaver - 10120107				Stockade Beaver Creek Stockade Beaver Creek Unnamed Stream	Sec. 26, T. 44 N., R. 61 W. Sec. 23, T. 44 N., R. 61 W. Sec. 15, T. 46 N., R. 63 W.	3
Upper Belle Fourche - 10120201						0
Upper Cheyenne - 10120103						0
Antelope - 10120101						0
Wyoming Total	0	0	0	3		3

Table 3-45					
Number of Intermittent Streams Which Would be Crossed or Affected by Alternative B					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		3		36	39
Rapid				3	3
Middle Cheyenne Spring	34	1	1	76	112
Angostura Reservoir	3	2	4	134	143
Hat				14	14
Beaver					0
Upper Belle Fourche		1	1	54	56
Upper Cheyenne	88		7	147	242
Antelope	14			48	62
Total	139	7	13	512	671

Table 3-46					
Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	17			174	191
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	121	5	21	490	637

Table 3-47					
Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C With the Phiney Flat Route Variation					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	6			149	155
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	110	5	21	465	601

Table 3-48 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative C With the W G Flat Route Variation					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk		2		33	35
Rapid				8	8
Middle Cheyenne Spring	17			121	138
Angostura Reservoir	5	3	6	132	146
Hat				7	7
Beaver					0
Upper Belle Fourche			3	31	34
Upper Cheyenne	55		12	74	141
Antelope	44			31	75
Total	121	5	21	437	584

Table 3-49 Number of Intermittent Streams Which Would be Crossed or Affected by Alternative D					
	Forest Service	BLM	State	Private	Total
Middle Cheyenne Elk				77	77
Rapid				13	13
Middle Cheyenne Spring			11	97	108
Angostura Reservoir			3	97	100
Hat				7	7
Beaver	7		11	98	116
Upper Belle Fourche	4	3	7	122	136
Upper Cheyenne	33		0	42	75
Antelope	44			31	75
Total	88	3	32	584	707

Table 3-50 Beneficial Uses of Waters of the State of South Dakota and Water Quality Standards	
Class	Beneficial Use
1	Domestic water supply waters
2	Coldwater permanent fish life propagation waters
3	Coldwater marginal fish life propagation waters
4	Warmwater permanent fish life propagation waters
5	Warmwater semipermanent fish life propagation waters
6	Warmwater marginal fish life propagation waters
7	Immersion recreation waters
8	Limited contact recreation waters
9	Fish and wildlife propagation, recreation, and stock watering waters
10	Irrigation waters
11	Commerce and industry waters

Stream or River Name	Stream Segment	Beneficial Use
Cheyenne River	from confluence with the Belle Fourche River to confluence with the Fall River	5, 7, 8
Cheyenne River	from Angostura Reservoir to Wyoming border	5, 8
Hat Creek	from Cheyenne River to Nebraska border	5, 8
Battle Creek	from Cheyenne River to S.D. Highway 79	6, 8
Box Elder Creek	from Cheyenne River to Sec. 30, T. 1 N., R. 13 E. of the Black Hills Meridian	6, 8
Rapid Creek	from Cheyenne River to Sec. 15, T.1 N., R.8 E. of the Black Hills Meridian	4, 7, 8
Spring Creek	from the Cheyenne River to S.D. Highway 79	4, 8

Stream	Water Quality Classification
Belle Fourche River	2
Caballo Creek	2
Donkey Creek	2
Little Oil Creek	4
Cambria Creek	4
Stockade Beaver Creek	2

	Stream Segment	Crossing Location	Priority
Alternative B	Cheyenne River	Section 36, T. 8 S., R. 2 E. Section 20, T. 1 N., R. 14 E.	2
	Rapid Creek	Section 3, T. 2 S., R. 12 E.	3
Alternative C (including route variations)	Cheyenne River	Section 31 & 32, T. 8 S., R. 3 E. Section 20., T. 1 N., R. 14 E.	2
	Rapid Creek	Section 3, T. 2 S., R. 12 E.	3
Alternative D	Cheyenne River	Sections 31 & 32, T. 8 S., R. 3 E. Section 2, T. 1 N., R. 14 E.	2
	Box Elder Creek	Section 24, T. 1 N., R. 12 E. Section 15, T. 1 N., R. 12 E. Section 16, T. 1 N., R. 12 E. Section 31, T. 2 N., R. 11 E. Section 35, T. 2 N., R. 10 E. Section 34, T. 2 N., R. 10 E. Section 28, T. 2 N., R. 10 E. Sections 26 & 33, T. 2 N., R. 8 E.	3

Surface Water Quantity. The USGS maintains gauging stations at various locations which measure streamflow. Table 3-54 presents data from gauging stations which are located in the vicinity of alternative crossings.

3.13 Soil Resources

3.13.1 Impact Analysis Area. For purposes of determining impacts to soils, the analysis area was

defined as a 500 foot wide buffer on either side of the alternative centerline.

3.13.2 Affected Environment. U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) soil surveys were used to identify the soil types and characteristics along the alternative alignments. The 7 soil surveys that were used are listed in Table 3-55. Digital data was used when it was available from either the NRCS or the Forest Service. Where only paper maps

Table 3-54
USGS Stream Gauging Station Streamflow Data for Streams Which Would be Crossed by the Alternatives

Station	Legal Location	USGS Station Number	Drainage Area (square miles)	Average Annual Mean Discharge (cfs)	Highest Daily Mean Discharge (cfs)	Annual Mean Discharge (cfs)	Lowest Average Monthly Streamflow (cfs)	Highest Average Monthly Streamflow (cfs)
Cheyenne River at Edgemont, SD	Section 36 T. 8 S., R. 2 E.	06395000	7,143	81.3	24,000 5/20/78	434 1962	7.85 Dec&Jan	253 June
Hat Creek near Edgemont, SD	Section 25 T. 9 S., R. 4 E.	06400000	1,044	16.6	8,350 6/16/67	112 1967	1.15 Oct	70.9 June
Battle Creek below Hermosa, SD	Sec. 3 T. 4 S., R. 10 E.	06406500	285	22.1	1,760 5/23/52	60.8 1997	9.06 Dec	75.9 June
Rapid Creek near Farmingdale, SD	Section 19 T. 1 S., R. 11 E.	06421500	602	76.4	2,860 6/10/72	269 1997	46.3 Sept.	173 June
Spring Creek near Hermosa, SD	Section 21 T. 1 S., R. 8 E.	06408500	199	7.15	3,300 6/10/72	46.6 1997	1.14. Jan	40.6 June
Cheyenne River near Wasta	Section 2 T. 1 N., R. 14 E.	07423500	12,800	346	19,200 6/16/67	1,143 1997	116 Dec	976 June

USGS, (1997 and 1999).

**Table 3-55
Soil Surveys for Counties Which Would be Crossed by the Alternatives**

Soil Survey	Date Published	Digital Data and Source
Soil Survey of Custer and Pennington counties (Prairie Parts), South Dakota	1996	NRCS
Soil Survey of Fall River County, South Dakota	1982	None
Soil Survey of Custer and Pennington Counties, (Black Hills Part), South Dakota	1990	None
Soil Survey of Niobrara County, Wyoming	Preliminary, not yet published	None
Soil Survey of Weston County, Wyoming	1990	Forest Service (TBNG)
Soil Survey of Crook County, Wyoming	1983	None
Soil Survey of Campbell County (Southern Part), Wyoming	Not published	NRCS and Forest Service (TBNG)

were available, the published or preliminary surveys were digitized and then analyzed using GIS to determine the soil mapping units that would be crossed by the alternatives.

All of the alternatives would be constructed within the Northwestern Great Plains which is semi-arid with total annual precipitation ranging from about 12 to 16.5 inches. About 75 percent of this precipitation usually falls between April and September, which coincides with the growing season for most plants and crops. Relative humidity over the project area can be low and averages between about 50 and 65 percent throughout the year. Wind can be significant with north or northwesterly winds prevailing. Wind velocity averages about 13 miles per hour annually. The estimated annual pan evaporation for the area is 60 to 65 inches of water.

In Wyoming, the frost-free period of the project area is a maximum of about 137 days (which is the longest in the state) and decreases with increasing elevation. In South Dakota, the frost-free period ranges from 114 to 160 days (NRCS, 1982, 1986 and 1996a; and BLM, 1985 and 1998).

In South Dakota, the alternatives would cross the Pierre Hill physiographic division of the Northwestern Great Plains which is generally characterized as gently to strongly sloping with steep sloping drainages. Highly dissected hills and uplands border the Cheyenne River and associated alluvial plains. Stream patterns are primarily dendritic and exhibit little structural control (NRCS, 1982; and BLM, 1985).

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In Wyoming, the landscape which would be crossed by the alternatives is generally characterized as tablelands and wide, shallow valleys and low rolling hills. However, eroded buttes, badlands, scoria (burnt coal) mounds and salt pans also occur.

The characteristics of the soil are determined by 5 primary factors. These factors are parent material, climate, living organisms, time and topography. Of these factors, parent material and topography have the largest influence on soil variation. The soils in the project area formed in parent material composed of residuum of clayey shale, silty shale, sandstone, siltstone and limestone. Some soils formed in alluvium and in loess deposits. Parent materials affect many of the chemical and physical properties of the soil such as color, texture, and reaction. Soils formed from shales typically have fine textures while soils formed from sandstone materials typically have coarse textures. Alluvial soils along flood

plains typically have mixed textures that vary with depth and the conditions during deposition. Soil texture affects the strength, permeability, and water and nutrient holding capacity of the soil. The chemical properties inherent in the parent material also affect the soil's chemical characteristics. For example, marine shales typically are saline or sodic and acid soils form on acid shales. Climate directly affects the rate of chemical and physical weathering. The semi-arid climate in eastern Wyoming and western South Dakota, which is characterized by cold winters, hot summers and summer precipitation, favors the growth of grasses and the resulting accumulation of organic matter in the upper part of the soil. It also favors a moderately slow rate of weathering or soil formation. Climate patterns are fairly consistent along the alternative routes. However, climatic differences occur between the west- and south-facing slopes and the north- and east-facing slopes due to the amount of direct solar radiation these aspects receive. The prairie grasses in the project area have more influence than other living organisms on soil formation although earthworms, insects and borrowing animals (especially prairie dogs) help to keep the soil open and porous.

Topography affects soil formation by affecting drainage, runoff, erosion, plant cover and soil temperature. Soil on steeper slopes typically have shallower and more calcareous profiles because much of the rainfall is lost through runoff and does not penetrate the soil surface. Soil erosion is higher on steep slopes than on less sloping soils where eroded particles tend to accumulate and produce thicker soil profiles. Soils along drainages, flood plains or in depressions may be prone to flooding or water ponding. Depending on site-specific conditions, these soils can have a wide range of characteristics because they are alluvial soils formed from a mixture of materials. For example, some soils may be saline or sodic in poorly drained areas where salts accumulate and are not leached from the soil profile. In other areas, soils may be highly productive because their chemical and physical characteristics are not limiting to plant growth. Alluvial soils are typically deeper, have mixed textures and receive more moisture than other upland soils.

The oldest soils occur on landscapes that have been stable for the longest time. The youngest soils are those in which natural erosion removes nearly as much soil material as is formed or are alluvial soils which receive new material each time the area is flooded (NRCS, 1982).

Soil Limitations. The soils which would be crossed by the alternatives have been classified into 7 sensitive soil groups based on the soil properties that are most relevant to construction, environmental impact and impact mitigation. These sensitive soil groups have been defined

according to NRCS guidelines (NRCS, 1996b) and are listed on Table 3-56. Table 3-57 provides a summary of the miles of each soil group which would be crossed by the alternatives. Tables 3-58 through 3-62 provide miles of soil groups which would be crossed by each of the alternatives by landowner.

Each of the soil groups are discussed below:

Group 1 includes soils that are either saline or sodic. These soils occur where soluble salts are concentrated in the soil profile. Salt crystal growth (white crusts) on the soil surface is common on saline soils in dry seasons and slick spots (areas barren of vegetation) may occur on sodic soils. High concentrations of salts interfere with the absorption of water by plants because the osmotic pressure in the soil solution is nearly as high as or higher than the plant's cells.

Salts may also interfere with the nutrient uptake of plants causing deficiencies. Sodic soils have high sodium concentrations which tend to disperse organic matter and clay particles reducing the soil's permeability and aeration. Reclamation of soils in this group is difficult and requires plant species which are adapted to these conditions. Because of their salt content, sediments from soils in this group have a high potential to impair water quality.

The soils in Group 2 have either a high or severe water erosion potential. These soils are characterized by having rapid water runoff and non-cohesive textures that are easily transported by water. These soils generally are moderately or steeply sloping, have shallow soil depths or are sparsely vegetated. Most of the sediment discharge in the project area occurs during a few days of the year during short periods of rapid runoff resulting from summer thunderstorms or snowmelt. These soils likely contribute to water quality problems in streams of the project area.

Group 3 consists of soils with a high wind erosion potential. These are generally dry soils with loamy sand textures and little vegetation cover. These soils may appear stabilized but when disturbed, have the potential to erode or blowout and be extremely difficult to stabilize.

Soils in Group 4 have low reclamation potential because they are shallow to bedrock, have a low available water capacity (AWC), or have a significant content of coarse fragments in their profiles. Shallow soils have a reduced root zone for plants to acquire water and nutrients for establishment and growth. Soils with low AWC are droughty because of their coarse textures or depth to bedrock or restrictive layer which limits their water holding or storage capacity. Soils with high contents of coarse fragments (i.e., greater than 35

Soil Limiting Property	Parameter Value	Sensitive Soil Group	Limiting Characteristic/Potential Hazard
Saline	Moderately to strongly saline (>8 mmhos/cm)	Group 1	Reduced reclamation potential and water quality impacts
Sodic	SAR ≥ 13 or natric horizon	Group 1	Reduced reclamation potential and water quality impacts
High water erosion hazard	High-Severe	Group 2	Sedimentation impacts; reduced reclamation potential; and loss of soil productivity
High wind erosion hazard	High-Severe	Group 3	Reduced reclamation potential: loss of soil productivity
Shallow to bedrock	Moderate < 40 inches (soft or hard)	Group 4	Reduced reclamation potential
Coarse fragments > 3 inches	> 35 percent	Group 4	Reduced reclamation potential
Low AWC	Low to very low (0-6")	Group 4	Reduced reclamation potential
Hydric	Yes	Group 5	Wetness
Prime farmland	Yes	Group 6	Highly productive soils taken out of production
Slope	> 15 percent	Group 7	Reduced reclamation potential; larger cuts and fills; and sedimentation

Limiting Soil Property	Soil Group	Alternative B (miles)	Alternative C (miles)	Alternative C With Phiney Flat Route Variation (miles)	Alternative C With W G Flat Route Variation (miles)	Alternative D (miles)
Saline	Group 1	26.2	21.8	21.7	21.7	32.8
Sodic	Group 1	20.4	18.2	18.5	18.7	16.7
High water erosion hazard	Group 2	112.0	95.4	94.2	93.9	100.0
High wind erosion hazard	Group 3	19.2	19.2	19.2	22.0	10.8
Shallow to bedrock	Group 4	129.2	117.8	116.7	116.2	124.1
High coarse fragment content	Group 4	8.8	12.5	12.5	12.5	16.9
Low AWC	Group 4	156.7	143.9	142.6	145.5	157.5
Hydric	Group 5	1.4	1.0	1.0	1.0	1.4
Prime farmland	Group 6	28.7	30.0	31.3	27.2	38.6
Steep	Group 7	103.8	91.1	89.9	91.2	78.0

1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups is larger than the actual length of the alternative. Soils which do not have limiting properties are not included.

percent fragments larger than 3 inches) have less soil volume to hold moisture and nutrients.

The soils in Group 5 are hydric. Hydric soils are defined as soils that are wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants. Areas with hydric soils that meet the wetland hydrology and plant community criteria are considered jurisdictional wetlands. These soils are rare in semi-arid areas and they typically support unique plant

communities which provide important biological habitats and add to the diversity of the landscape.

Group 6 are prime farmland soils which are defined as those soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops and that are available for these uses. The soil's qualities, growing season and moisture supply are those needed for a well-managed soil to produce an economical and sustained high yield of

Table 3-58
Sensitive Soil Groups Which Would be Crossed by Alternative B (1)

Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership					
		Private	Forest Service	BLM	State	DOE	Total
South Dakota							
Saline	Group 1	10.1	1.5	0.0	0.0	0.0	11.6
Sodic	Group 1	6.3	0.0	0.0	0.0	0.0	6.3
High water erosion hazard	Group 2	39.1	7.0	2.9	2.1	0.3	51.4
High wind erosion hazard	Group 3	7.0	1.5	0.0	0.0	0.0	8.5
Shallow to bedrock	Group 4	54.0	8.3	3.2	2.5	0.3	68.3
Low AWC	Group 4	81.4	11.8	3.4	2.6	0.3	99.5
Hydric	Group 5	1.1	0.2	0.0	0.0	0.0	1.3
Prime farmland	Group 6	27.6	0.7	0.2	0.2	0.0	28.7
Steep	Group 7	44.9	7.0	2.7	2.1	0.3	57.0
Wyoming							
Saline	Group 1	10.8	3.2	0.0	0.6	0.0	14.6
Sodic	Group 1	10.3	3.2	0.0	0.6	0.0	14.1
High water erosion hazard	Group 2	42.0	14.1	2.1	2.4	0.0	60.6
High wind erosion hazard	Group 3	7.4	2.2	0.0	1.1	0.0	10.7
Shallow to bedrock	Group 4	39.8	15.9	1.4	3.8	0.0	60.9
High coarse fragment content	Group 4	6.8	1.2	0.8	0.0	0.0	8.8
Low AWC	Group 4	39.1	14.9	1.9	1.3	0.0	57.2
Hydric	Group 5	0.1	0.0	0.0	0.0	0.0	0.1
Steep	Group 7	33.6	9.7	1.9	1.6	0.0	46.8
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.							

crops. These soils have been identified because of their highly productive character. Industrial development on these soils would remove them from crop production or prevent their future use if they are not currently in production.

Soils in Group 7 have slopes greater than 15 percent. Construction activities on these soils typically result in proportionately larger disturbance because of the need for larger cut and fill slopes. In addition, these soils are easily eroded because of their slope and higher runoff potential. These conditions also contribute to the slopes being more difficult to revegetate because their higher runoff and erosion potential can damage newly seeded areas or established vegetation. These slopes generally receive less effective moisture and, depending on the slope's aspect (i.e., south and west facing slopes), they can receive more solar radiation which increases soil temperatures and evapotranspiration causing them to be drier. These conditions are detrimental to revegetation efforts when moisture is limiting. Another factor which hampers the revegetation potentials on these slopes is

that some seeding methods, such as drill seeding using typical farm tractors, can be restricted because this equipment may not be able to safely work on these slopes. These conditions would require the use of more expensive seeding methods such as hydroseeding or broadcasting which may be less effective.

3.14 Vegetation Resources

3.14.1 Impact Analysis Area. For purposes of determining impacts to vegetation, the impact analysis area was defined as a 500 foot wide buffer on both sides of the alternative centerline.

3.14.2 Affected Environment. In the portion of the Northern Great Plains where the alternatives would be constructed, the dominate vegetation is characterized as shortgrass or mixed-grass prairie. The project area is in a broad transition area between the plains of the central United States and range physiographic provinces to the west. It occupies a north-south transition area between the southern and middle Rocky Mountains. Plants

Table 3-59
Sensitive Soil Groups Which Would be Crossed by Alternative C (1)

Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	9.0	1.0	0.2	0.0	10.2
Sodic	Group 1	5.9	0.2	0.2	0.0	6.3
High water erosion hazard	Group 2	35.7	3.1	1.7	1.0	41.5
High wind erosion hazard	Group 3	7.9	0.0	0.2	0.0	8.1
Shallow to bedrock	Group 4	57.9	4.5	2.5	1.4	66.3
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	81.8	5.3	2.9	1.4	91.4
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	29.4	0.0	0.1	0.5	30.0
Steep	Group 7	41.8	2.4	1.9	1.0	47.1
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.						

common to the Black Hills and Northern Great Plains (such as hawthorn, big bluestem, little bluestem and creeping juniper) and plants characteristic of the southern and central great plains (such as buffalo grass, blue grama and prickly pear cactus) are represented in plant communities which would be crossed by the alternatives. In addition, portions of the area also have plants common to the Intermountain Basin, such as sagebrush communities, greasewood, rabbitbrush, Sandberg bluegrass, prairie junegrass and bluebunch wheatgrass (BLM, 1998).

Tables 3-63 through 3-67 provide the miles of each vegetation type which would be crossed by the alternatives. The estimates are based on USGS 1:250,000 Land Use Land Cover Data described in Section 3.5.1.

Grassland Type. This is the dominate vegetation type which would be crossed by the alternatives, accounting for about 80 percent of the vegetation which

would be crossed by Alternatives B and C. Grassland vegetation in the project area can be subdivided into 2 major divisions - the shortgrass and the mixed-grass prairie. The shortgrass prairie is dominated by blue grama and buffalo grass. It occurs intermixed with the mixed-grass prairie, possibly as a result of overgrazing. Pricklypear cactus, yucca, fringe sage and scarlet globemallow are common in this type.

The mixed grasses can be divided into several types, but all are characterized by needle-and-thread grass, western wheatgrass, blue grama, Sandberg bluegrass, threadleaf sedge, needleleaf sedge, junegrass, green needlegrass, Indian ricegrass, pricklypear cactus, fringed sage, scarlet globemallow, purple coneflower, white aster, blazing star, goldenrod, beardtongue, Hood phlox and various species of milkvetch. Species diversity in the mixed-grass prairie is high with as many as 50 species per hectare. In the foothills this type is generally dominated by bluebunch wheatgrass, little bluestem and sideoats grama.

Table 3-60
Sensitive Soil Groups Which Would be Crossed by Alternative C With the Phiney Flat Route Variation (1)

Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.7	1.2	0.2	0.0	10.1
Sodic	Group 1	6.2	0.2	0.2	0.0	6.6
High water erosion hazard	Group 2	35.1	2.5	1.7	1.0	40.3
High wind erosion hazard	Group 3	7.9	0.0	0.2	0.0	8.1
Shallow to bedrock	Group 4	57.4	3.9	2.5	1.4	65.2
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	80.9	4.9	2.9	1.4	90.1
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	30.7	0.0	0.1	0.5	31.3
Steep	Group 7	41.2	1.8	1.9	1.0	45.9
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.						

On sandy soils, Indian ricegrass, prairie sandreed, sand dropseed, sand sagebrush and yucca are common. Saline soils are dominated by halophytes such as alkali sacaton, fourwing saltbush, greasewood and inland saltgrass. In some areas, the grasslands change (gradually or abruptly) into sagebrush shrublands. Small parcels of tallgrass prairie, supporting big bluestem, Canada wildrye, little bluestem, Indiangrass, prairie drop seed, sideoats grama and switchgrass also may occur on sandy soils or along streams (Knight, 1994).

Big Sagebrush Shrubland. The big sagebrush shrubland type occurs on the lowlands to the west and south of the Black Hills. Several other species of sagebrush species are also present including silver sage, sand sagebrush and fringed sagebrush. Rabbitbrush is also abundant, especially on eroded or disturbed sites, and greasewood is typical where soils are fine textured and alkaline, such as in depressions or on flood plains. Understory species include western wheatgrass, blue grama, prairie junegrass, needle-and-thread grass,

Sandberg bluegrass, pricklypear cactus and scarlet globemallow. This is the dominate type which would be crossed by Alternative D in Wyoming, accounting for 45 percent of the vegetation crossed.

Coniferous Woodland. This woodland type occurs in the south of the Black Hills and on river breaks in the Northern Great Plains to the east of the Black Hills. This type is dominated by Rocky Mountain juniper but ponderosa pine is often an overstory species. Other common shrub species include current, skunkbush sumac and yucca. The understory species are common prairie species including needle grass, blue grama and sideoats grama.

Deciduous Woodland. Woody draws occur in ravines in South Dakota, south and east of the Black Hills. Common shrubs in these draws typically include: green ash, chokecherry, skunkbush sumac, wild rose, western snowberry, wild plum, silver buffaloberry and sliver sagebrush. Trees may include green ash, American elm,

Table 3-61
Sensitive Soil Groups Which Would be Crossed by Alternative C With the W G Flat Route Variation (1)

Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.9	1.0	0.2	0.0	10.1
Sodic	Group 1	6.4	0.2	0.2	0.0	6.8
High water erosion hazard	Group 2	34.2	3.1	1.7	1.0	40.0
High wind erosion hazard	Group 3	10.7	0.0	0.2	0.0	10.9
Shallow to bedrock	Group 4	56.3	4.5	2.5	1.4	64.7
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	83.3	5.3	3.0	1.4	93.0
Hydric	Group 5	1.0	0.0	0.0	0.0	1.0
Prime farmland	Group 6	26.6	0.0	0.1	0.5	27.2
Steep	Group 7	41.9	2.4	1.9	1.0	47.2
Wyoming						
Saline	Group 1	7.1	4.3	0.1	0.1	11.6
Sodic	Group 1	7.3	4.5	0.0	0.1	11.9
High water erosion hazard	Group 2	35.9	14.3	1.4	2.3	53.9
High wind erosion hazard	Group 3	7.6	2.6	0.0	0.9	11.1
Shallow to bedrock	Group 4	35.8	10.2	1.0	4.5	51.5
High coarse fragment content	Group 4	7.4	4.4	0.0	0.6	12.4
Low AWC	Group 4	35.4	14.4	1.0	1.7	52.5
Steep	Group 7	29.0	12.4	1.2	1.4	44.0
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.						

boxelder, hawthorn, Rocky Mountain juniper and dwarf juniper. Except for cottonwood, these areas are characteristic of riparian areas. These areas provide important wildlife habitat and forage and shade for livestock.

Riparian and Wetlands. Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent waterbodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctly different vegetative species than adjacent areas; and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland (USFWS, 1997). In layman's terms, they are the green zones along the banks of rivers and streams and around springs, bogs, wet meadows, lakes and ponds. Riverine riparian ecosystems overlap a great deal with some wetland classifications, however, some riparian areas may not be flooded or saturated at some

time each year nor do they necessarily have predominantly hydrophytic cover as wetlands must have. Riverine riparian areas serve to transport water and eroded materials from the landscape. In comparison with upland areas, riparian areas tend to be wetter, to have more nutrients available to them and to be more frequently subject to catastrophic water flow. These conditions are expressed in their nutrient rich soils and lush growth of vegetation. Common plant species in riparian areas include plains cottonwoods, willows, green ash, chokecherry, western snowberry, wild plum, sliver sagebrush, box elder, buffaloberry and skunkbush sumac as well as wet meadows and irrigated and sub-irrigated pastures or hay fields. These areas provide important wildlife habitat and are used heavily by livestock for grazing, watering, shade and travel.

Bare Exposed Ground. Areas of very little or no vegetation are present in the project area on rock outcrops and slick spots, which are typically small depressional areas of sodic soils and badlands areas.

Table 3-62
Sensitive Soil Groups Which Would be Crossed by Alternative D (1)

Limiting Soil Property	Soil Group	Miles Crossed by Land Ownership				
		Private	Forest Service	BLM	State	Total
South Dakota						
Saline	Group 1	8.4	0.0	0.1	0.1	8.6
Sodic	Group 1	7.8	0.0	0.1	0.1	8.0
High water erosion hazard	Group 2	24.0	0.0	0.0	0.4	24.4
High wind erosion hazard	Group 3	6.9	0.0	0.0	0.0	6.9
Shallow to bedrock	Group 4	49.3	0.0	1.3	1.3	51.9
High coarse fragment content	Group 4	0.1	0.0	0.0	0.0	0.1
Low AWC	Group 4	76.9	0.0	1.4	1.3	79.6
Hydric	Group 5	1.2	0.0	0.0	0.0	1.2
Prime farmland	Group 6	37.0	0.0	0.1	0.6	37.7
Steep	Group 7	28.1	0.0	1.0	0.3	29.4
Wyoming						
Saline	Group 1	19.4	3.0	0.8	1.0	24.2
Sodic	Group 1	6.5	1.8	0.0	0.4	8.7
High water erosion hazard	Group 2	57.9	13.6	1.7	2.4	75.6
High wind erosion hazard	Group 3	3.2	0.6	0.0	0.1	3.9
Shallow to bedrock	Group 4	57.0	10.9	1.7	2.6	72.2
High coarse fragment content	Group 4	11.6	4.4	0.0	0.8	16.8
Low AWC	Group 4	58.2	15.8	1.5	2.4	77.9
Hydric	Group 5	0.2	0.0	0.0	0.0	0.2
Prime farmland	Group 6	0.3	0.0	0.0	0.6	0.9
Steep	Group 7	35.9	10.4	1.1	1.2	48.6
1 = Some soils may have more than one limiting property and therefore may be in more than one soil group. Consequently, the total miles of soil groups may be larger than the actual length of the alternative. Soils which do not have limiting properties are not included.						

Cultivated Crops. After the grassland type, cultivated crops, pastures and hay fields are generally the next most common vegetation type that would be crossed by the alternatives. The major crops in the project area include: oats, winter wheat, grain sorghum, corn, alfalfa hay and sunflowers. Table 3-68 provides the typical range in yields in western South Dakota and eastern Wyoming for these crops.

Strip Mines. In Wyoming, the alternatives would traverse coal mine permit areas that have been reclaimed. These reclaimed areas have been reseeded with both native and introduced grasses, shrubs and forbs. Typical species may include western wheatgrass, thickspike wheatgrass, pubescent wheatgrass, little bluestem, blue grama, sideoats grama, alfalfa, sweet clover, yarrow, big sagebrush and fringe sagebrush.

Noxious Weeds. Invasions of noxious weeds reduce or eliminate native plant species. The Federal Noxious Weed Act of 1974 authorizes the Secretary of Agriculture to use an integrated weed management approach to control and contain the spread of noxious weeds on NFS lands and from NFS lands to adjacent lands. Currently, management plans direct managers to treat noxious and exotic species on a priority basis. Control is emphasized on newly infested areas, priority areas and minor infestations. Table 3-69 lists the noxious weeds in the Northern Great Plains by state based on inventory results provided by the Forest Service in the plans revision. On BGNG, Canada thistle infestation is about 280 acres of which 147 acres is treated. Hoary cress and Russian knapweed individually infest approximately 25 acres on the grassland. Ten and 15 acres, respectively, are treated.

**Table 3-63
Vegetation Types Which Would be Crossed by Alternative B**

Vegetation Type	Miles Crossed by Land Ownership					Total (miles)	Percent
	Forest Service	DOE	BLM	State	Private		
South Dakota							
Developed Lands (Residential, Industrial, etc.)	0.0	0.0	0.0	0.0	0.6	0.6	0.4
Cropland and Pastures	<0.1	0.0	0.0	0.2	20.4	20.6	14.2
Grasslands	15.3	0.3	3.2	2.5	92.3	113.6	78.4
Big Sagebrush Shrublands	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.0	0.0	0.1	0.0	2.3	2.4	1.7
Riparian and Wetlands (1)	1.0	0.0	0.0	0.0	5.9	6.9	4.8
Strip Mines/Quarries	0.0	0.0	0.0	0.0	0.8	0.8	0.5
Total	16.3	0.3	3.3	2.7	122.3	144.9	100
Wyoming							
Developed Lands (Residential, Industrial, etc.)	0.0		0.0	0.0	0.0	0.0	0.0
Cropland and Pastures	0.7		0.0	0.0	7.0	7.7	5.1
Grasslands	34.5		2.4	6.6	84.5	128.0	84.6
Big Sagebrush Shrublands	0.3		0.0	0.8	13.5	14.6	9.7
Deciduous Woodlands	0.0		0.0	0.0	0.5	0.5	0.3
Coniferous Woodlands	0.0		0.0	0.0	0.0	0.0	0.0
Riparian and Wetlands (1)	0.0		0.0	0.0	0.0	0.0	0.0
Strip Mines	0.1		0.0	0.0	0.3	0.4	0.3
Total	35.6		2.4	7.4	105.8	151.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.							

Currently, TBNG has a 1995 inventory of noxious weed species totaling approximately 3,715 acres. Treatment levels on TBNG between 1994 to 1996 was only 160 acres per year. Leafy spurge, spotted knapweed, Canada thistle and musk thistle were treated during this period.

3.15 Grazing Resources

3.15.1 Impact Analysis Area. The impact analysis area for grazing on Federal lands (NFS and public lands) includes 100 feet either side of the proposed centerline for each alternative. Federally-managed pastures or allotments and buffered areas which would be crossed by the alternatives were included in the analysis area.

3.15.2 Affected Environment. Livestock grazing is a traditional, permitted use on NFS and public lands. The grazing allotments which would be crossed by the alternatives are listed on Tables 3-70 through 3-73. In South Dakota, all of the Forest Service's allotments are administered by the BGNG, Fall River Ranger District. All of the BLM allotments in South Dakota are administered by the South Dakota Field Office. In Wyoming, all of the

Forest Service allotments are administered by TBNG, Douglas Ranger District. The BLM allotments in Wyoming are either managed by the Newcastle or Buffalo Field Offices. Private grazing lands which would be crossed by the alternatives are not included in Tables 3-70 through 3-73. Allotment pastures that are denoted as private on these tables are those that the alternative alignment would cross only on private lands within that allotment pasture.

The land management objective on the Federal grazing allotments is to provide livestock forage while providing for wildlife, recreation and other uses of natural resources. These allotments are used either by grazing associations or individual ranchers. A grazing association is a grazing permittee user group organized to assist with administering grazing use. The grazing associations have a set of rules guiding their operation. These include a grazing agreement, rules of management and a set of by-laws. Individuals not part of a grazing association have grazing use administered through a direct grazing permit system. All of the BLM allotments are administered through a direct grazing permit with individual ranchers. The dependence of individual ranch operations on forage

**Table 3-64
Vegetation Types Which Would be Crossed by Alternative C**

Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation, etc.)	0.0	0.0	0.0	0.5	0.5	0.4
Croplands and Pastures	0.0	0.0	0.5	20.1	20.6	14.4
Grasslands	5.2	2.7	1.5	100.6	110.0	77.1
Big Sagebrush Shrublands	0.0	0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.4
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	6.1	6.1	4.3
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.3
Total	6.1	3.4	2.1	131.0	142.6	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation, etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Cropland	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

produced on Federal grazing leases varies in the project area from almost nothing to critical, depending primarily on the acreage leased. The Federal leases are typically important in satisfying season forage needs (BLM, 1984).

In South Dakota, Alternative B would cross 25 Forest Service and 7 BLM allotments or allotment pastures. In Wyoming, this alternative would cross 55 Forest Service and 4 BLM allotments or allotment pastures. Alternative C in South Dakota would cross 13 Forest Service and 6 BLM allotments/pastures and in Wyoming would cross 46 Forest Service and 4 BLM allotments/pastures. Alternative D would not cross any Forest Service-administered allotments in South Dakota, however, 3 BLM allotments would be crossed. In Wyoming, Alternative D would cross 39 Forest Service and 6 BLM allotments/pastures.

Cattle is the principal livestock grazed on these allotments, however, sheep, horses and bison graze several of the allotments. The carrying capacity of the allotments varies from about 1.7 to 11.9 acres/animal use month (AUM), with the average of all allotments being

about 4.5 acres per AUM. An AUM is defined as the amount of forage required to sustain a 1,000-pound animal for 1 month and is equivalent to about 800 pounds of air-dry forage. The carrying capacity of the allotments varies with soil type, vegetation type (forage production), slope and water availability. The amount of rock, roads, waterbodies, bare ground or other areas in the allotment that do not provide forage for livestock use also affect the carrying capacity. The season-of-use varies by allotment and operator. Grazing may begin as early as March and extend through December on some allotments. For most operations the total grazing period on public and private lands is April to November (7 to 8 months), however some allotments are used year-long. Livestock are generally fed hay and supplements on winter pastures (BLM, 1998 and 1985).

Numerous range improvements have been constructed on the allotments to improve cattle distribution and forage use. These improvements include water developments (such as wells, pipelines, reservoirs, catchments and developed springs) fences, corrals, and cattle guards. Allotments are monitored periodically to

Table 3-65 Vegetation Types Which Would be Crossed by Alternative C With the Phiney Flat Route Variation						
Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.4	0.4	0.3
Croplands and Pastures	0.0	0.0	0.5	25.4	25.9	18.0
Grasslands	4.4	2.7	1.5	97.1	105.7	73.7
Big Sagebrush Shrublands	0.0	0.0	0.0	0.1	0.1	0.1
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.5
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	5.9	5.9	4.1
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.2
Total	5.3	3.4	2.1	132.6	143.4	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Croplands and Pastures	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

determine range condition, production and trend. The ecological range condition reflects the current vegetation composition of the rangeland in relation to the potential climax plant community. The potential plant community is determined by evaluating relict range sites, grazed areas with known records of past use, available literature on soils and ecology of the area and historical narratives and photographs.

Range trend is defined as the direction of change in range condition observed over time. Trend is usually expressed as improving, stable or declining. In the evaluation of trend, the following indicators of range condition are considered: presence, vigor, and reproduction of desirable and less desirable forage species; utilization levels; litter accumulation and evidence of accelerated erosion. Declining trend may be caused by or accelerated by overstocking, improper season of use, and poor livestock distribution. Other causes include drought and invasion of noxious weeds or pests. Improved trend in range condition generally results when grazing management provides for physiological needs of desirable forage plants. According to the BLM (1984,

1985 and 1998) and Forest Service (1999c), current range condition is generally good and is in a stable or slightly upward trend. This is especially true when compared to the turn of the century when unregulated grazing and drought caused extensive rangeland degradation.

In both South Dakota and Wyoming, the public lands are typically isolated and scattered 40- to 80-acre parcels that are surrounded by private lands and generally are not accessible to the public. The ranchers using these parcels generally have a low percentage of public land in their total operations.

Implementation of the Phiney Flat Route Variation would affect the same allotments as Alternative C except it would not cross the Reed (FRRD 97 or FRRD 98) or Circle C (FRRD 38) allotments on BGNG. The WG Flat Route Variation would affect all of the allotments as would Alternative C, except it would not cross the Sand Creek Allotment (FRRD 181) on the BGNG. In addition, this variation would cross BLM allotment number 7329 (record number 8428) and the alignment would cross immediately

Table 3-66
Vegetation Types Which Would be Crossed by Alternative C With the W G Flat Route Variation

Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.5	0.5	0.4
Croplands and Pastures	0.0	0.1	0.5	24.5	25.1	17.8
Grasslands	5.2	2.7	1.5	97.7	107.1	75.7
Big Sagebrush Shrublands	0.0	0.0	0.0	<0.1	<0.1	<0.1
Deciduous Woodlands	0.0	0.3	0.1	0.3	0.7	0.5
Coniferous Woodlands	0.0	0.4	0.0	2.6	3.0	2.1
Riparian and Wetlands (1)	0.0	0.0	0.0	3.3	3.3	2.3
Bare Exposed Ground	0.9	0.0	0.0	0.8	1.7	1.2
Total	6.1	3.5	2.1	129.7	141.4	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.0	0.0	0.0	0.0
Cropland	0.7	0.0	0.0	8.6	9.3	7.1
Grasslands	31.8	1.5	8.8	68.2	110.3	84.1
Big Sagebrush Shrublands	0.0	0.0	0.8	10.5	11.3	8.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	0.3	0.0	0.0	0.0	0.3	0.2
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.0	0.0	0.0	0.0	0.0	0.0
Total	32.8	1.5	9.6	87.3	131.2	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16.						

adjacent to a 160-acre BLM parcel. This Federal parcel within allotment 7329 has 18 AUMs and is grazed from November through April by cattle.

The Black Thunder North Mine Loop would cross 5 pastures in 2 allotments. These include: the Stringer allotment's North Highway pasture, the Little Thunder allotment's Mine pasture as well as the 2 Kerr-McGee Mine pastures and the #4 pasture in the Kerr-McGee allotment. The Black Thunder South Mine Loop would cross 3 pastures in 2 allotments. These include: the Stringer allotment's North Highway pasture and the Little Thunder allotment's Mine and West Peck pastures.

3.16 Wetland and Riparian Resources

3.16.1 Impact Analysis Area. For purposes of determining impacts to wetlands, the analysis area was defined as a 500 foot wide buffer on each side of the alternative centerline. Information provided in this section was taken from NVI Maps developed by the USFWS at 1:24,000 scale. Additional wetland delineations are currently being performed by DM&E to support the 404 permit application. These additional delineations are

using low-level aerial photography of the centerline for Alternative C (including the route variations) along with selective field verification. Wetland delineation reports for Alternative C have been prepared for Wyoming and western South Dakota. The COE is in the process of verifying the wetland delineation results.

3.16.2 Affected Environment. The principal riparian resources near the alternatives in South Dakota are the Cheyenne River, Rapid Creek, Spring Creek, Boxelder Creek, Lame Johnny Creek, Beaver Creek, Battle Creek, French Creek, Sand Creek, Hay Canyon, Horsehead Creek, Dry Creek, Hat Creek, Plum Creek and Beaver Creek. In Wyoming, riparian resources are less prevalent but include Alkali Creek, Lodge Creek, Black Thunder Creek, Little Thunder Creek, School Creek, Antelope Creek, Porcupine Creek, Caballo Creek, Donkey Creek and the Belle Fourche River.

Riparian Resources. Riparian or stream corridors are complex ecosystems which include the land, plants, animals, and a network of streams within them. They perform a number of ecological functions such as modulating streamflow, storing water, removing harmful

Vegetation Type	Miles Crossed by Land Ownership				Total (miles)	Percent
	Forest Service	BLM	State	Private		
South Dakota						
Developed Lands (Residential, Industrial, Transportation etc.)		0.0	0.0	9.9	9.9	5.5
Croplands and Pastures		0.0	0.0	42.5	42.5	23.7
Grasslands		0.9	2.0	116.2	119.1	66.3
Big Sagebrush Shrublands		0.0	0.0	0.0	0.0	0.0
Deciduous Woodlands		0.0	0.0	0.5	0.5	0.3
Coniferous Woodlands		0.4	0.0	1.9	2.3	1.3
Riparian and Wetlands (1)		0.0	0.0	4.6	4.6	2.6
Bare Exposed Rock		0.0	0.0	0.1	0.1	0.1
Strip Mines		0.0	0.0	0.3	0.3	0.2
Total		1.3	2.0	176.0	179.3	100
Wyoming						
Developed Lands (Residential, Industrial, Transportation etc.)	0.0	0.0	0.9	13.2	14.1	7.8
Cropland	0.0	0.0	0.2	8.3	8.5	4.7
Grasslands	20.0	0.1	4.3	44.4	68.8	38.1
Big Sagebrush Shrublands	5.5	1.6	3.4	70.2	80.7	44.6
Deciduous Woodlands	0.0	0.0	0.0	0.0	0.0	0.0
Coniferous Woodlands	1.1	0.0	0.0	5.9	7.0	3.9
Riparian and Wetlands (1)	0.0	0.0	0.0	0.0	0.0	0.0
Strip Mines	0.1	0.0	0.0	1.5	1.6	0.9
Total	26.7	1.7	8.8	143.5	180.7	100
1 = A more accurate estimate of wetlands which would be crossed by this alternative can be found in Section 3.16:						

Crop	Unit/Acre	Production Range
Oats	Bushels	17 to 46
Alfalfa hay	Tons	0.7 to 2.0
Cool-season grass pastures	Animal Unit Month	1.2 to 3.4
Winter wheat	Bushels	16 to 45
Grain sorghum	Bushels	15 to 41
Corn	Bushels	70 to 135

materials from water, and providing habitat for aquatic and terrestrial plants and animals. Stream corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Streams and riparian corridors evolve in concert with and in response to surrounding ecosystems. Changes within a surrounding ecosystem (e.g., water-

shed) will impact the physical, chemical, and biological processes occurring within a stream corridor.

Stream systems normally function within natural ranges of flow, sediment movement, temperature, and other variables, in what is termed dynamic equilibrium. When changes in these variables go beyond their natural ranges, dynamic equilibrium may be lost, often resulting in adjustments in the ecosystem that might conflict with

**Table 3-69
Noxious Weeds Which are Known to Occur in the Vicinity of the Alternatives**

Common Name	Scientific Name	South Dakota	Wyoming
Absenth wormwood	<i>Artemisia absinthum</i>	X	
Canada thistle	<i>Cirsium arvense</i>	X	X
Common burdock	<i>Arctium minus</i>		X
Dalmatian toadflax	<i>Linaria daimatica</i>		X
Diffuse knapweed	<i>Centaurea diffusa</i>		X
Dyers wood	<i>Isatis tinctoria</i>		X
Field bindweed	<i>Convolvulus arvensis</i>	X	
Hoary cress	<i>Cardaria spp</i>	X	X
Horse nettle	<i>Solanum carolanense</i>	X	
Houndstongue	<i>Cynoglossum officinale</i>		X
Leafy spurge	<i>Euphorbia esula</i>	X	X
Musk thistle	<i>Carduus nutans</i>		X
Oxeye daisy	<i>Chrysanthemum leucanthemum</i>		X
Perennial pepperweed	<i>Lepidium latifolium</i>	X	X
Perennial sowthistle	<i>Sonchus arvensis</i>	X	X
Plumeless thistle	<i>Carduus acanthoides</i>		X
Quackgrass	<i>Agropyron repens</i>		X
Russian knapweed	<i>Centaurea repens</i>	X	X
Saltcedar	<i>Tamarix ramosissima</i>		X
Scotch thistle	<i>Cytisus scoparius</i>		X
Skeletonleaf bursage	<i>Ambrosia tomentosa</i>		X
Spotted knapweed	<i>Centaurea maculosa</i>		X
Squarrose knapweed	<i>Centaurea virgata</i>	X	
Yellow starthistle	<i>Centaurea solstitialis</i>	X	
Yellow toadflax	<i>Linaria vulgaris</i>		X

societal needs. In some circumstances, a new dynamic equilibrium may eventually develop, but the time frames in which this happens can be lengthy, and the changes necessary to achieve this new balance significant.

Riparian ecosystems overlap a great deal with some wetland classifications, however, riparian areas may not be flooded or saturated at some time each year nor do they necessarily have predominately hydrophytic cover as wetlands must have.

Common plant species in riparian areas include plains cottonwoods, willows, green ash, chokecherry, western snowberry, wild plum, sliver sagebrush, box elder, buffaloberry and skunkbush sumac as well as wet meadows and irrigated and sub-irrigated pastures or hay fields. These areas provide important wildlife habitat and are used heavily by livestock for grazing, watering, shade and travel.

Wetlands. Wetlands are a subset of riparian areas and are subject to protection under a number of Federal laws. The EPA and COE use the following definition of wetland for administering the Clean Water Act's Section 404 permit program for dredge and fill activities:

"Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas"

Wetlands have 3 essential characteristics: hydrophytic vegetation, hydric soils and wetland hydrology. The USFWS has developed a list of wetland plant species (Reed, 1988) and the NRCS has developed a list of hydric soils and characteristics that are used in delineation.

**Table 3-70
Allotments Which Would be Crossed by Alternative B**

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Creston	FRRD 41	558.0	Fall River RD	Private	Private	Private	
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
Reed	FRRD 98	1195.4	Fall River RD	125	Cattle	2.6-3.3	406.2
Circle C	FRRD 38	837.7	Fall River RD	219	Cattle	4.0-5.0	186.2
Reed	FRRD 97	556.4	Fall River RD	125	Cattle	2.6-3.3	188.6
Hardpan	FRRD 396	2350.6	Fall River RD	Private	Private	Private	
Kaiser	FRRD 79	2954.6	Fall River RD	136	Cattle	2.2-2.5	1257.3
Hardpan	FRRD 397	2521.7	Fall River RD	300	Cattle	3.95	638.4
Red Shirt	FRRD 100	1475.8	Fall River RD	175	Cattle	3.9-5.0	331.6
Hardpan	FRRD 426	339.9	Fall River RD	No Grazing	No Grazing	No Grazing	
Red Shirt	FRRD 99	1061.9	Fall River RD	175	Cattle	3.9-5.0	238.6
Chalk Hills	FRRD 8	4992.2	Fall River RD	466	Cattle	6	832.0
Chalk Hills	FRRD 13	1197.1	Fall River RD	466	Cattle	5	239.4
Likewise	FRRD 81	156.5	Fall River RD	39	Cattle	1.7	92.1
Chalk Hills	FRRD 14	175.2	Fall River RD	466	Cattle	4.7	37.3
Chalk Hills	FRRD 17	574.8	Fall River RD	466	Cattle	4.0	143.7
Likewise	FRRD 80	492.3	Fall River RD	39	Cattle	3.3	149.2
Chalk Hills	FRRD 11	229.6	Fall River RD	466	Cattle	4.7	48.9
Chalk Hills	FRRD 10	347.6	Fall River RD	466	Cattle	2.2	158.0
Bondurant	FRRD 33	1198.3	Fall River RD	160	Cattle	2.2	544.7
ND Misc	FRRD 451	82.3	Fall River RD	No Authorized Use			
Chalk Hills	FRRD 12	836.7	Fall River RD	466	Cattle	5.0	167.3
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.2
Chalk Hills	FRRD 1	659.5	Fall River RD	466	Cattle	1.7	387.9
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	4.0	230.8
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57.0 (1)
Mosier/Tepaske John/ 8428		240 (1)	BLM South Dakota		Cattle	6.7-10 (1)	32.0 (1)
River Allotment/Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0 (1)	98.0 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8.0 (1)
Maude Walter		127.8 (1)	BLM South Dakota		Cattle	6.4	20 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5 (1)	22 (1)
Wyoming							
Ostlund/ 270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Keeline /271	Black Thunder	25702.5	Douglas RD	822	Cattle	6.2	4145.6
Ostlund/270	Castle Rock	700.7	Douglas RD	20	Cattle	5	140.1
Ostlund/270	East	1719.9	Douglas RD	105	Cattle	4.9	351.0
Ostlund/270	Diamond L	2956.6	Douglas RD	Private	Private	Private	

**Table 3-70
Continued**

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Keeline/271	East Black Thunder	9224.3	Douglas RD	510	Cattle	6.5	1419.1
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
West Cellars/10	South	2756.7	Douglas RD	300	Cattle	5	551.3
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Kerr-McGee/214	Kerr-McGee Mine	115.5	Douglas RD	0	None	0	0
Gordon/262	Summer	5379.4	Douglas RD	167	Cattle	5.6	960.6
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Gordon/262	Private	861.1	Douglas RD	Private	Private	Private	
Gordon/262	Spring	1265.5	Douglas RD	167	Cattle	3.1	408.2
Gordon/262	South Winter	1498.9	Douglas RD	150	Cattle	2.3	651.7
Gordon/262	North Winter	459.3	Douglas RD	64	Cattle	4.5	102.1
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	195	Cattle	3.9	478.8
Lynch/222	Winter	1472.6	Douglas RD	125	Cattle	4.5	327.2
Lynch/222	Yearling	1335.9	Douglas RD	Private	Private	Private	
Lynch/222	Calf	573.1	Douglas RD	Private	Private	Private	
Wildcat Creek/398	Fisher	2043.9	Douglas RD	155	Cattle	3.9	524.1
Lynch/222	Heifer	833.0	Douglas RD	42	Cattle	7.2	115.7
Lynch/222	Calving	1376.2	Douglas RD	175	Cattle	3.4	404.8
Lynch/222	Private	76.3	Douglas RD	Private	Private	Private	
Lynch/222	Private	12.3	Douglas RD	Private	Private	Private	
Lynch/222	Field	336.4	Douglas RD	Private	Private	Private	
Lynch/222	Little Frog Creek	2575.9	Douglas RD	170	Cattle	4.3	599.0
Lynch/222	Bull	319.5	Douglas RD	15	Cattle	4.1	77.9
Grieves /352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
Lynch/222	Big Frog Creek	1729.3	Douglas RD	170	Cattle	4.2	411.7
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
South Rochelle Hills/272	Dry Lake	1975.5	Douglas RD	86	Cattle	10.1	195.6
Irwin/212	East	7500.2	Douglas RD	338	Cattle	4.9	1530.7
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8

Table 3-70 Concluded							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Rosecrans/299	Rochelle Hills	2677.8	Douglas RD	193	Cattle	6.3	425.0
Rosecrans/299	Rough Draw Enclosure	5.6	Douglas RD	0	None	0	0
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Spring Creek	3959.2	Douglas RD		Cattle	4.2	942.6
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
Irwin/212	Middle Beckwith	420.0	Douglas RD	163	Cattle	3.2	131.3
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	607.1	Douglas RD	0	None	0	0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	0
Smith Claude		122.1 (1)	BLM Newcastle		Cattle/bison	6.8	18 (1)
Christensen Chris		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)
Michael Harris		440.0	BLM Newcastle	18	Cattle	6.7	66.1
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
Dry Creek Ranch/ 7143		681.3	BLM Buffalo		Cattle	4.1	168

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands.

Table 3-71
Allotments Which Would be Crossed by Alternative C and Alternative C With the W G Flat Route Variation

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
ND Misc	FRRD 420	177.6	Fall River RD	0	None	2.7	65.7
Reed	FRRD 98	1195.4	Fall River RD	125	Cattle	2.6-3.3	406.2
Circle C	FRRD 38	837.7	Fall River RD	219	Cattle	4.0-5.0	186.2
Reed	FRRD 97	556.4	Fall River RD	125	Cattle	2.6-3.3	188.6
Red Shirt	FRRD 106	2156.8	Fall River RD	175	Cattle	5	431.4
Red Shirt	Unknown	40.3	Fall River RD	175	Cattle	5	8.0
Triple Seven	FRRD 25	1426.9	Fall River RD	1300	Bison	2.7	528.5
South Fork	FRRD 115	663.0	Fall River RD	Private	Private	Private	
Chalk Hills	FRRD 5	989.7	Fall River RD	466	Cattle	5.0	197.9
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.3
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	.4	230.8
Sand Creek (2)	FRRD 181	1388.3	Fall River RD	0	None	0	0
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5	22 (1)
Maude Walter		12(1)	BLM South Dakota		Cattle	6.4	20
BLM 7329/8428 (3)		160.0	BLM South Dakota		Cattle	8.8	18
Wyoming							
Ostlund/270	Thomas (NW)	1528.1	Douglas RD	Private	Private	4.9/6.0	280.4
Ostlund/270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Ostlund/270	Bull	1593.1	Douglas RD	150	Cattle	6.0	265.5
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
Keeline/271	South Burdwick	2841.1	Douglas RD	150	Cattle	11.7	242.8

Table 3-71 Continued							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Small/220	Little Thunder	632.9	Douglas RD	100	Cattle	3.7	171.1
Keeline/271	Bull	1358.3	Douglas RD	12	Cattle	3.6	377.3
Keeline/271	Piney Creek	3509.0	Douglas RD	160	Cattle	2.2	1595.0
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	4.6	40.8
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9
School Creek/240	Calf	1098.3	Douglas RD	100	Cattle	5	219.6
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	155	Cattle	3.9	478.8
Wildcat Creek/398	Fisher	2043.9	Douglas RD	195	Cattle	3.9	524.0
Teckla/298	North	1855.8	Douglas RD	192	Cattle	11.9	155.9
Teckla/298	South	1899.0	Douglas RD	192	Cattle	11.9	159.6
Grieves/352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
Teckla/298	West Beckwith Enclosure	2.9	Douglas RD	0	Cattle	0	0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	
Smith Claud		122.1 (1)	BLM Newcastle		Cattle/bison	6	18 (1)
Christensen Chris 4051		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)

**Table 3-71
Concluded**

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
Michael Harris 4333		440 (1)	BLM Newcastle	18	Cattle	6.7	66.1 (1)
Dale Osborn/ 7410		40.0 (1)	BLM Buffalo	27	Cattle	6.7	6 (1)
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands. Total Acres and AUMs provided from grazing permits.

2 = Allotment would not be impacted by the WG Flat Route Variation.

3 = Allotment is only affected by the WG Flat Route Variation.

**Table 3-72
Allotments Which Would be Crossed by Alternative C With the Phiney Flat Route Variation**

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
Gilmore	FRRD 63	2510.4	Fall River RD	85	Cattle	2.7-5.0	652.1
ND Misc	FRRD 420	177.6	Fall River RD	0	None	2.7	65.7
Red Shirt	FRRD 106	2156.8	Fall River RD	175	Cattle	5	431.4
Red Shirt	Unknown	40.3	Fall River RD	175	Cattle	5	8.0
Triple Seven	FRRD 25	1426.9	Fall River RD	1300	Bison	2.7	528.5
South Fork	FRRD 115	663.0	Fall River RD	Private	Private	Private	
Chalk Hills	FRRD 5	989.7	Fall River RD	466	Cattle	5.0	197.9
Chalk Hills	FRRD 2	868.8	Fall River RD	466	Cattle	4.0	217.3
Stumer	FRRD 116	923.2	Fall River RD	63	Cattle	4	230.8
Sand Creek	FRRD 181	1388.3	Fall River RD	0	None	0	0
DDD/Soderquist 8292		185.3 (1)	BLM South Dakota		Cattle	3.3	57 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.0	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wasta/Schell 8413		80 (1)	BLM South Dakota		Cattle	4.4	18 (1)
Beaver Creek/ Andersen Edwin 8032		120 (1)	BLM South Dakota		Cattle	5.5	22 (1)
Maude Walter		12(1)	BLM South Dakota		Cattle	6.4	20
Wyoming							
Ostlund/270	Thomas (NW)	1528.1	Douglas RD	Private	Private	4.9/6.0	280.4
Ostlund/270	Cottonwood	3002.8	Douglas RD	225	Cattle	4.9	612.8
Ostlund/270	Bull	1593.1	Douglas RD	150	Cattle	6.0	265.5
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
Stringer/273	North Highway	244.9	Douglas RD	25	Cattle	6.8	36.0
Stringer/273	Stringer	829.7	Douglas RD	25	Cattle	4.5	184.4
School Creek/240	Little Thunder	4467.5	Douglas RD	220	Cattle	3.5	1276.4
School Creek/240	Lovin	2378.4	Douglas RD	300/60	Sheep/cattle	4.3	553.1
Keeline/271	South Burdwick	2841.1	Douglas RD	150	Cattle	11.7	242.8
Small/220	Little Thunder	632.9	Douglas RD	100	Cattle	3.7	171.1
Keeline/271	Bull	1358.3	Douglas RD	12	Cattle	3.6	377.3
Keeline/271	Piney Creek	3509.0	Douglas RD	160	Cattle	2.2	1595.0

Table 3-72 Concluded							
Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	4.6	40.8
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9
School Creek/240	Calf	1098.3	Douglas RD	100	Cattle	5	219.6
Sewell/394	Calving	2861.7	Douglas RD	264	Cattle	3.7	773.4
Bruce/313	Calf	1883.7	Douglas RD	100	Cattle	4.3	438.1
Wildcat Creek/398	Shook	1867.5	Douglas RD	155	Cattle	3.9	478.8
Wildcat Creek/398	Fisher	2043.9	Douglas RD	195	Cattle	3.9	524.0
Teckla/298	North	1855.8	Douglas RD	192	Cattle	11.9	155.9
Teckla/298	South	1899.0	Douglas RD	192	Cattle	11.9	159.6
Grieves/352	Wildcat	2694.1	Douglas RD	250	Cattle	4	673.5
AU7/365	Lodgepole	6105.0	Douglas RD	300	Cattle	4.2	1453.6
Teckla/298	West Beckwith Enclosure	2.9	Douglas RD	0	Cattle	0	0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
Shaw/395	Summer	4316.9	Douglas RD	300	Cattle	4.2	1027.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Shaw/395	North	1620.4	Douglas RD	312	Cattle	4.2	385.8
AU7/365	Stud	635.0	Douglas RD	127	Cattle	4.2	151.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
Jacob's/213	Railroad	1033.2	Douglas RD	0	None	0	
School Creek/240	Mine	994.1	Douglas RD				
School Creek/240	South Basin	2467.9	Douglas RD				
School Creek/240	South Pasture	575.8	Douglas RD				
Smith Claud		122.1 (1)	BLM Newcastle		Cattle/bison	6	18 (1)
Christensen Chris 4051		551.4 (1)	BLM Newcastle	17/86	Cattle/sheep	6.6	83.5 (1)
Michael Harris 4333		440 (1)	BLM Newcastle	18	Cattle	6.7	66.1 (1)
Dale Osborn/ 7410		40.0 (1)	BLM Buffalo	27	Cattle	6.7	6 (1)

1 = Allotment acres and AUMs only include the BLM acres and AUMs from the BLM parcels affected within the allotment and does not consider private lands. Total Acres and AUMs provided from grazing permits.

**Table 3-73
Allotments Which Would be Crossed by Alternative D**

Allotment	Pasture	Allotment Size (acres)	Administration	Total Stock	Kind	Acres/AUM	AUMs in Pasture
South Dakota							
8377- 7274		80.0 (1)	BLM South Dakota		Cattle	5	16 (1)
River Allotment/ Hinesley Ted 8133		480 (1)	BLM South Dakota		Cattle	4.8-5.6	98 (1)
Breakneck Hill/ B&H Ranches		40 (1)	BLM South Dakota		Cattle	5	8 (1)
Wyoming							
East Upton-Osage Community - 4	South	3087.6	Douglas RD	98	Cattle	5.8	532.3
Middle Upton-Osage Community - 5	#3	4170.0	Douglas RD	170	Cattle	6.9	604.3
Middle Upton-Osage Community - 5	#2	3306.3	Douglas RD	170	Cattle	6.9	479.2
West Upton-Osage #6	South	2231.3	Douglas RD	77 Cattle, 600 sheep	Cattle & Sheep	4.2	531.3
Oliver - 380	North	454.1	Douglas RD	300 sheep	Sheep	4.2	108.1
Huckins - 397	1	98.2	Douglas RD	31	Cattle	6.2	15.8
Mirich - 372	Railroad	78.2	Douglas RD	4	Cattle -Bulls	4.5	17.4
Mirich - 372	Bush	144.6	Douglas RD	38	Cattle	4.5	32.1
North Antelope/205	Meadow	271.6	Douglas RD	8/60	Horse/sheep	2.4	113.2
North Antelope/205	North Horse	166.6	Douglas RD	Managed as part of Meadow		2.4	69.4
North Antelope/205	Red Hills	2895.6	Douglas RD	500	Sheep	3.8	762.0
North Antelope/205	Reno	2003.8	Douglas RD	400	Sheep	4.6	435.6
North Antelope/205	South Horse	135.3	Douglas RD	Managed as part of Meadow		2.4	56.4
Irwin/212	House	690.1	Douglas RD	162	Cattle	4.7	146.8
Irwin/212	Winter	4478.3	Douglas RD	286	Cattle	4.9	913.9
Jacob's/213	Railroad	607.1	Douglas RD	0	None	0	
Kerr-McGee/214	Kerr-McGee Mine	7397.8	Douglas RD	0	None	0	0
Kerr-McGee/214	6	463.1	Douglas RD	335	Cattle	4.1	113.0
Kerr-McGee/214	3, 4 and 5	2294.5	Douglas RD	770	Cattle	4.7-5.3	458.9
School Creek/240	Buck	591.2	Douglas RD	20	Cattle	10.1	58.5
School Creek/240	Meadow	187.9	Douglas RD	Private	Private	Private	Private
School Creek/240	Rock	601.3	Douglas RD	200	Sheep	4.5	133.6
School Creek/240	Thornburg I	4344.2	Douglas RD	100	Cattle	4.9	886.6
School Creek/240	Thornburg II	976.0	Douglas RD	200	Sheep	7.4	131.9