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OPEN-FILE REPORT 80-UR – No. 4: BRULE COUNTY

**STATEWIDE LANDFILL STUDY:
BRULE COUNTY LANDFILL SITE CHARACTERISTICS**

by

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1996

CONTENTS

	Page
INTRODUCTION	1
Purpose and scope	1
Selection of sites	1
BRULE COUNTY LANDFILL	2
Location	2
Topography, drainage, and climate	2
Geology	2
Hydrology	3
Water quality	3
Adjacent land use and features	4
Operational and siting criteria – summary from the Office of Air Quality and Solid Waste records	4
SUMMARY	5
REFERENCES CITED	5

FIGURES

1. Sites considered for further evaluation	6
2. Location of the Brule County landfill	7
3. Locations of test holes drilled within 1 mile of the Brule County landfill	8
4. Location of a water quality sample collected within 1 mile of the Brule County landfill	9

TABLE

1. List of sites considered for further evaluation	1
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APPENDICES

Page

A. Legal locations of Brule County landfill area logs of
test holes and monitoring wells 10

B. Legal location of a Brule County landfill area water quality analysis 11

INTRODUCTION

Purpose and Scope

The purpose of this report is to summarize the geologic data, hydrologic data, and other site characteristics of the Brule County landfill. This information was compiled as a part of the Statewide Landfill Study.

In 1984, the state of South Dakota had 38 permitted solid waste landfills, both private and public, that accepted waste other than ordinary household waste. A study was undertaken in an effort to evaluate selected landfills in South Dakota and identify those that may be best suited for the disposal of these special wastes.

This study was conducted by the South Dakota Geological Survey and the Office of Air Quality and Solid Waste of the Department of Water and Natural Resources, now known as the Department of Environment and Natural Resources. The Office of Air Quality and Solid Waste contracted with the South Dakota Geological Survey for certain geological services. The South Dakota Geological Survey contribution to this study was three-fold. First, available geologic and hydrologic data from landfills in South Dakota were reviewed and evaluated. Second, monitoring well systems were designed and installed at four landfills which were selected by the Office of Air Quality and Solid Waste. Finally, the geology was evaluated in more detail at these four landfills.

Selection of Sites

Existing information concerning 38 permitted and 2 proposed landfill sites was reviewed by the Office of Air Quality and Solid Waste in order to prioritize the sites. The Office of Air Quality and Solid Waste used this preliminary screening to reduce the number of potential sites from 40 to 26 (table 1 and fig. 1).

TABLE 1. List of sites considered for further evaluation

1. Belle Fourche City	14. Miedema City
2. Brookings City - Proposed	15. Milbank City
3. Brown County	16. Miller City
4. Brule County	17. Pierre City - Proposed
5. Byre (Private)	18. Pierre City - Old Site
6. Davison County	19. Ralph Dawson (Private)
7. De Smet City	20. Rapid City
8. Gregory County	21. Sioux Falls (Runge) City
9. Haarstad (Private)	22. Vermillion City
10. Huron City	23. Walworth County
11. John Clements (Private)	24. Watertown City
12. Kadoka City	25. Winner City
13. Marshall County	26. Yankton County

Subsequently, the South Dakota Geological Survey evaluated these 26 sites and prepared a draft report describing each site. No field checking was done. Topics such as topography, drainage, climate, soils, geology, hydrology, water quality, adjacent land use, hazardous waste records, and operational practices were addressed. These reports included copies of available maps, lithologic logs, and water quality analyses. Draft copies of these unpublished reports are on file at the Department of Environment and Natural Resources in Pierre and the South Dakota Geological Survey in Vermillion. The individual report on the Brule County landfill is the basis for this report.

After the initial assessment of the 26 sites, the Office of Air Quality and Solid Waste established criteria for further prioritizing the sites. Four sites were selected for the installation of monitoring wells. The South Dakota Geological Survey conducted detailed investigations at the Brown County, Watertown City, Yankton County, and Rapid City landfills (fig. 1). A draft copy of the unpublished summary report is on file at the Department of Environment and Natural Resources in Pierre and the South Dakota Geological Survey in Vermillion. The following information was available regarding the Brule County landfill in 1986.

BRULE COUNTY LANDFILL

Location

The Brule County landfill is located 1 mile south and half a mile west of Pukwana. Its legal location is SW $\frac{1}{4}$ sec. 34, T. 104 N., R. 70 W. (fig. 2).

Topography, Drainage, and Climate

The information on topography and drainage was taken from the Red Lake East Quadrangle and the Pukwana Quadrangle (United States Geological Survey, 1979 and 1983). In actuality, the present landfill surface may be significantly different because of activities at the landfill.

The topography at the Brule County landfill slopes gently to the north and east. The landfill is on a local topographic high defined by the American Creek watershed to the north and Red Lake marsh to the south. The elevation ranges from 1,620 feet (494 meters) to 1,652 feet (504 meters) for a maximum relief of 32 feet (10 meters) at the site (fig. 2).

Most surface drainages in the area ultimately empty into the Missouri River. American Creek drains into Lake Wanalain and subsequently into the Missouri River at Chamberlain. Red Lake marsh, however, does not have a surface water connection to the Missouri River. There are no intermittent streams or natural ponds within a quarter of a mile of the landfill. There are seven small stock ponds located approximately half a mile from the landfill.

The average annual temperature in Brule County is 47 degrees Fahrenheit. Precipitation averages 18 inches per year. The average annual class A pan evaporation is 53 inches. Climatological data are from Spuhler and others (1971).

Geology

There is no geologic map available for this area. However, there are seven lithologic logs from test holes drilled in the Brule County landfill and four logs from test holes drilled within 1 mile of

the landfill boundaries (fig. 3, app. A) . In general, they all indicate the presence of 0 to 2 feet of topsoil and between 30 and 120 feet of silty clay (till) depending on the total depth of the hole. The only sand or sand and gravel deposits encountered were in section 34. Test hole BSL-6, located in the southwest corner of the landfill, encountered gravel between 4 and 7 feet. Test hole BSL-7 encountered gravel between 14 and 24 feet overlying Pierre Shale from 24 to 30 feet. This was the only test hole that encountered the Pierre Shale. A well was installed in this test hole (well 1).

Only data meeting the South Dakota Geological Survey criteria were used in this study. Lithologic logs were utilized if the legal locations were known to four quarter sections (2.5 acres) and if they were located within the landfill site or within 1 mile of the site boundaries. Also, the source of a log must have been known or the log was not utilized; for example, all logs of test holes drilled by the South Dakota Geological Survey identify the drilling company as "SDGS."

Hydrology

The clay material at the base of the landfill consists primarily of till (Office of Air Quality and Solid Waste microfiche records). The permeability of till is difficult to characterize due to the highly variable nature of its physical composition and texture (i.e., grain size) in both the vertical and horizontal directions. Fractures, if any, in the upper weathered portion of the till can also contribute to significant spatial changes in permeability. Let it suffice to say that till, as a unit, generally has much lower permeability than sand. No site specific permeability data are available.

One monitoring well is located within 1 mile of the landfill (fig. 4). This well was completed in till. The depth to the water table in well 1 was recorded at 10 feet 4 inches on August 19, 1975. The total length of casing in this well is 23 feet.

Without the presence of adequately constructed monitoring wells (a minimum of three) in the proper locations and at the proper depths, the lateral hydraulic gradient and direction of potential ground water movement cannot be estimated for the landfill area. The nearest ground water supply (aquifer) is unknown.

Water Quality

No water quality data were available within the landfill. Outside of the site, however, one sample was collected from well 1 (fig. 4, app. B). The total dissolved solids concentration for this sample (collected on August 29, 1975) was 590 milligrams per liter.

Only data meeting the South Dakota Geological Survey criteria were used in this study. Water quality analyses were utilized if the legal locations were known to four quarter sections (2.5 acres) and if they were located within the landfill or within 1 mile of the site boundaries. Only wells with recorded depths less than 100 feet and with corresponding lithologic logs have been considered. This limit of 100 feet was arbitrarily chosen. It was assumed that any major changes in water quality would probably be detected within this 100-foot depth limit because of the relatively low permeability of the underlying till. Also, the analytical laboratory that produced a water quality analysis must have been known or the analysis was not utilized.

Adjacent Land Use and Features

Information about adjacent land use and features was taken from the Red Lake East Quadrangle and the Pukwana Quadrangle (United States Geological Survey, 1979 and 1983) and the General Highway Map - Brule County (South Dakota Department of Transportation, 1976).

- * The nearest surface water is Red Lake marsh located approximately 1 mile south of the site.
- * Interstate 90 - Highway 16 is located half a mile south of the site.
- * A small landing strip is located a quarter of a mile north of the site.
- * The Red Lake State Public Shooting area is located approximately 1 mile south of the site.

Operational and Siting Criteria – Summary from the Office of Air Quality and Solid Waste Records

The most common responses found on the Office of Air Quality and Solid Waste site inspection reports prior to 1986 are given in this section. Copies of the microfiche data are available from the Department of Environment and Natural Resources in Pierre.

1. Site: Brule County

2. Population served: 3,000

3. Method of disposal: Cut and fill (trench)

4. Estimated amount of waste received per unit time: 1,264 tons/year

5. Access to site:

* Fenced: Yes No Lockable gate: Yes No

* Litter fences present: Yes No

* All weather access road to site: Yes No

6. List industry present: No information available.

7. Land Use:

* Preoperational land use: Grazing

* Proposed post-operational land use: Grazing

* Current land use within a quarter of a mile radial area: Grazing

8. This landfill began operations in 1976, and it was first permitted in 1976, predating many current regulations.

SUMMARY

- * The geology at this site generally consists of 0 to 2 feet of topsoil overlying 30 to 120 feet of silty clay (till). Only 1 of 11 test holes encountered sand or gravel. Pierre Shale underlies the till.
- * One monitoring well was present near this site.
- * One water level measurement had been taken near this site.
- * One water quality analysis was available from the monitoring well located near this site.

REFERENCES CITED

- South Dakota Department of Transportation, 1976, General Highway Map Brule County, South Dakota: South Dakota Department of Transportation in cooperation with the United States Department of Transportation, (revisions as of October 31, 1978).
- Spuhler, W., Lytle, W.F., and Moe, D., 1971, Climate of South Dakota: Brookings, South Dakota, South Dakota State University Agricultural Experiment Station Bulletin 582, 30 p.
- United States Geological Survey, 1979, Red Lake East quadrangle, South Dakota: 7.5 minute series (topographic), scale 1:24,000.
- ____ 1983, Pukwana quadrangle, South Dakota: 7.5 minute series (topographic), scale 1:24,000.

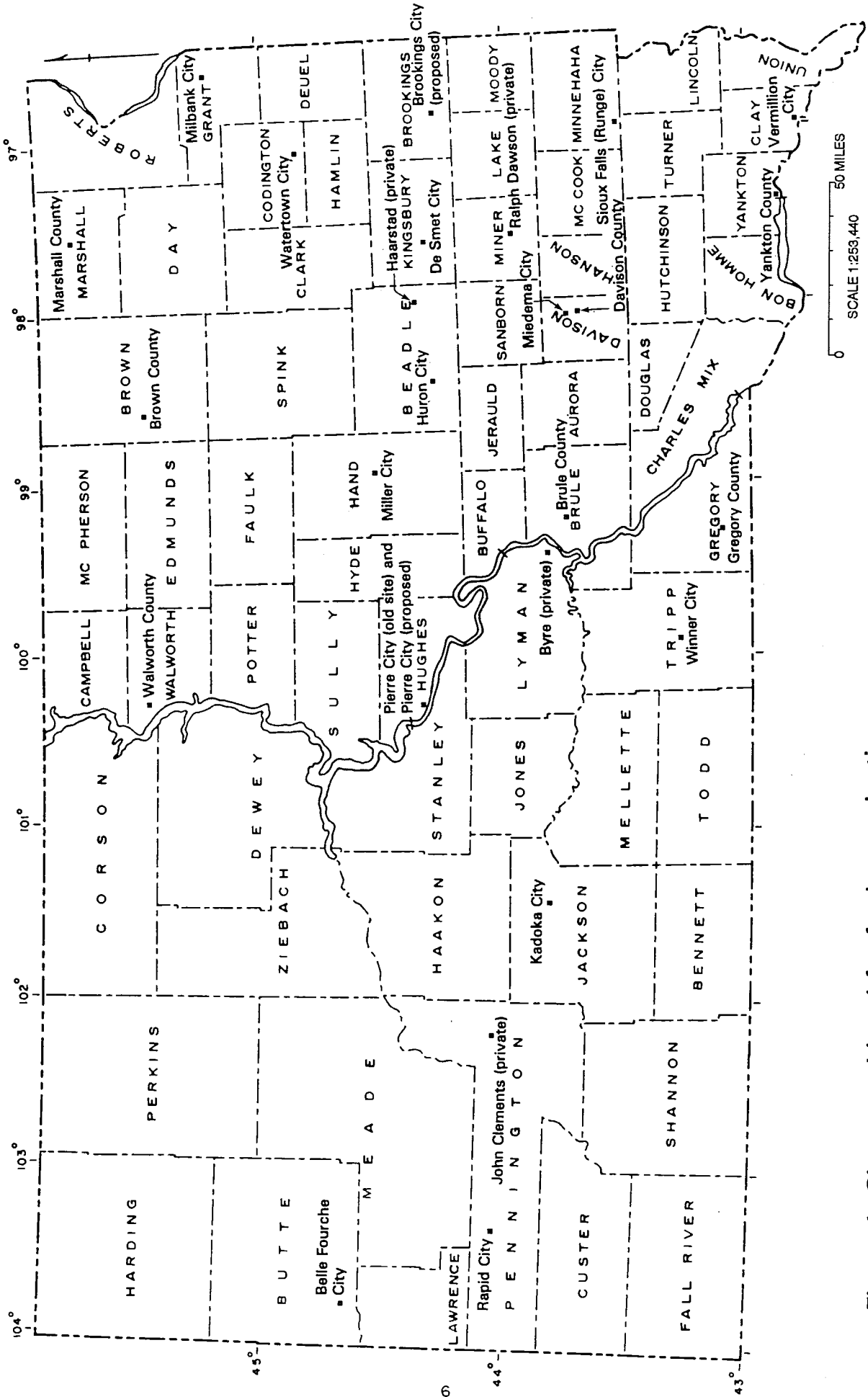
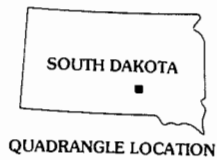
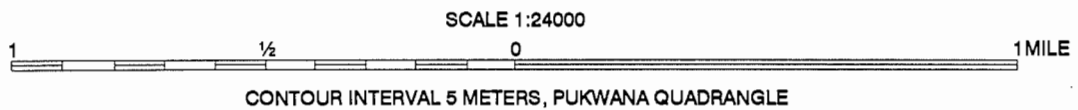
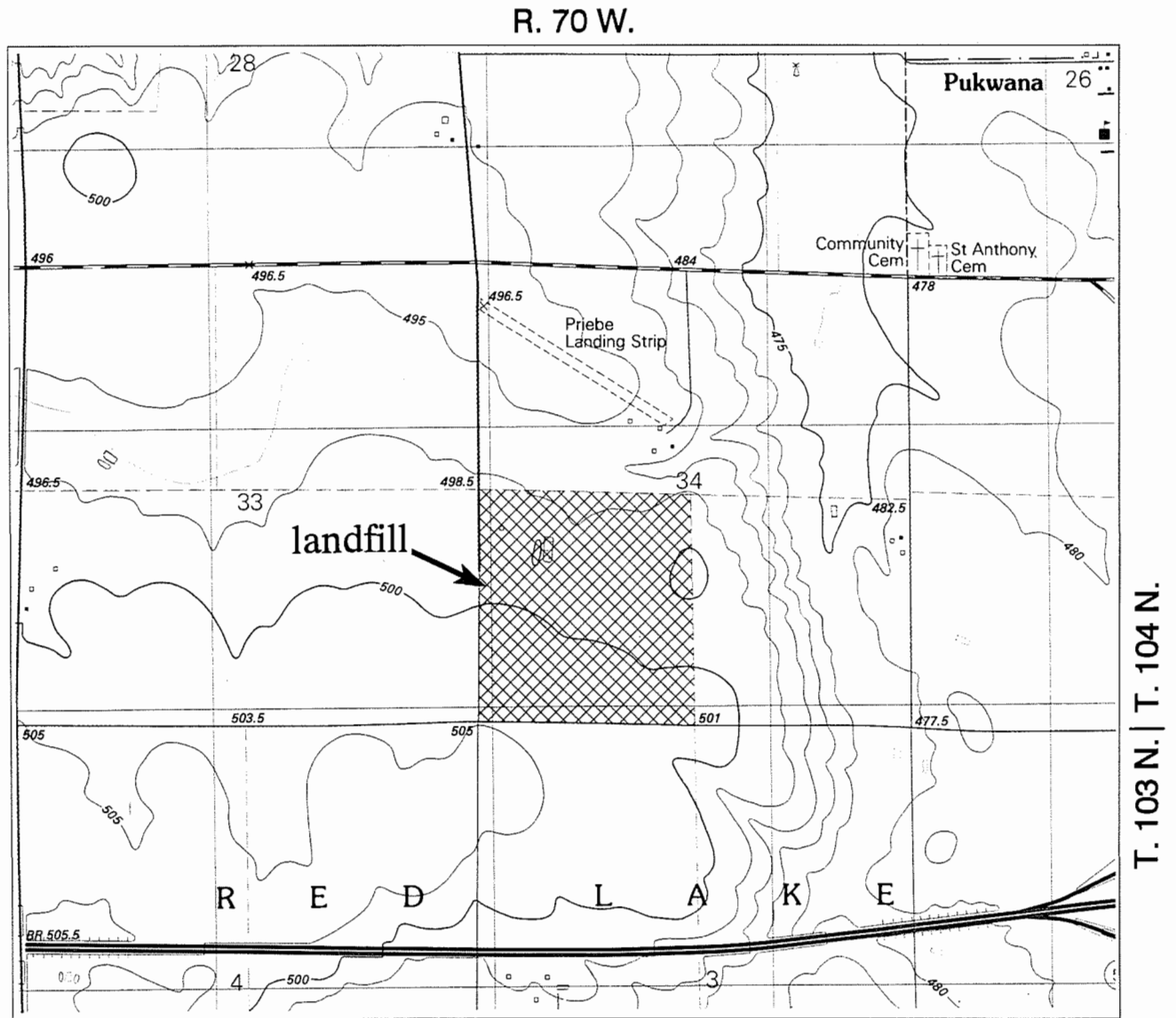


Figure 1. Sites considered for further evaluation.

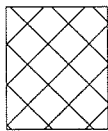
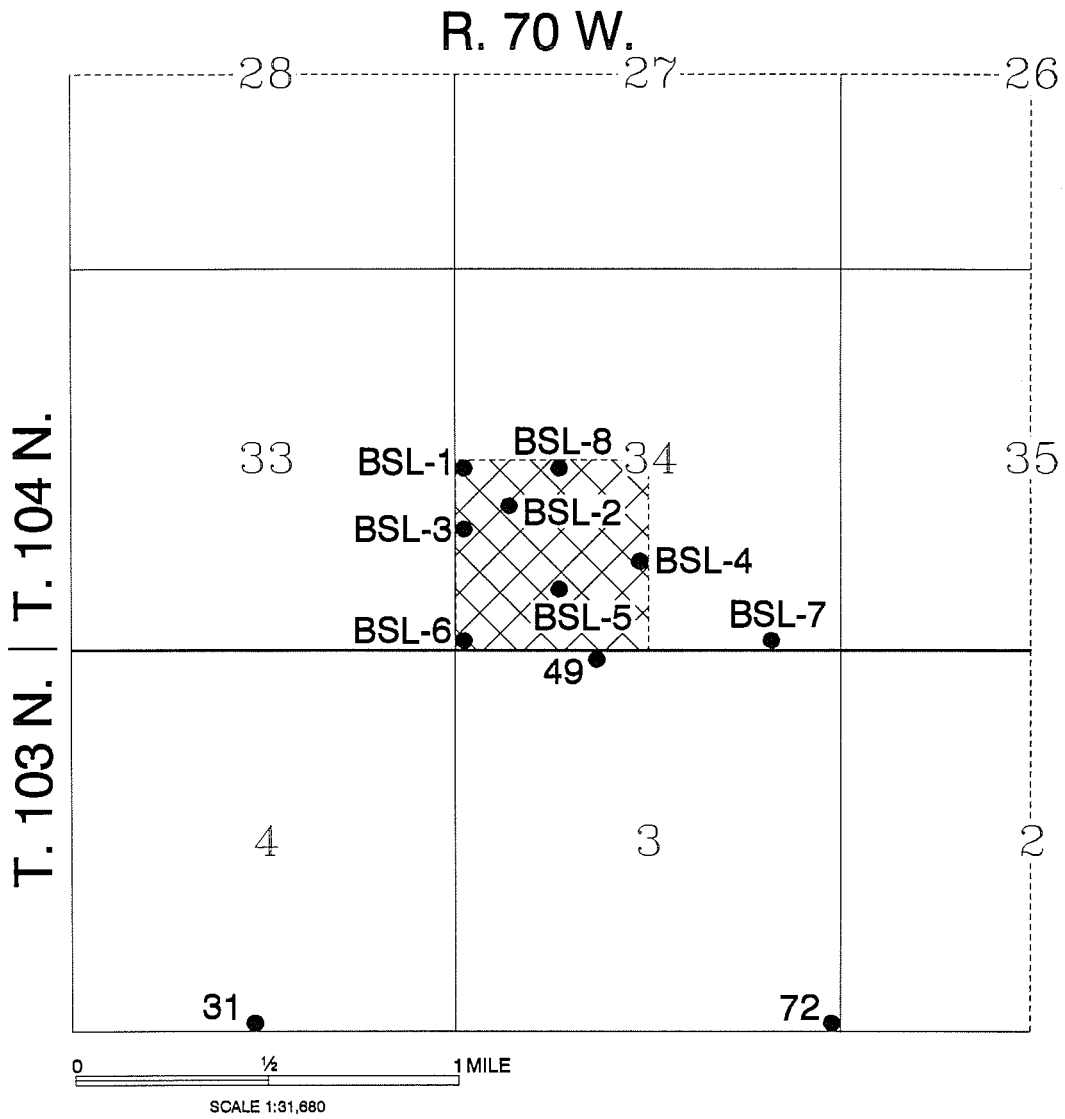


Landfill location: SW $\frac{1}{4}$ sec. 34,
T. 104 N., R. 70 W.
Brule County



Adapted from United States
Geological Survey (1983)

Figure 2. Location of the Brule County landfill.



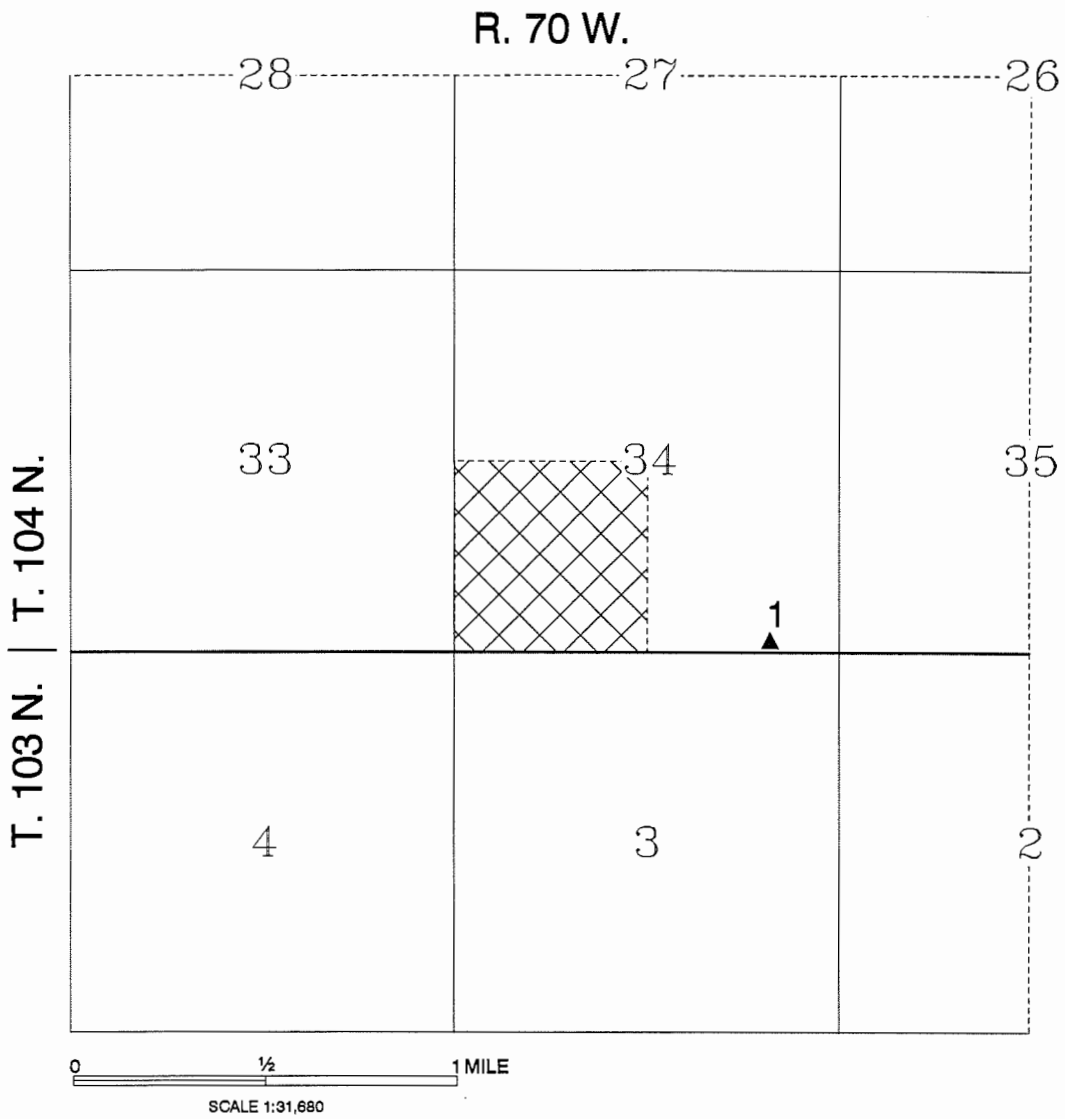
Landfill

Landfill location: SW $\frac{1}{4}$ sec. 34,
T. 104 N., R. 70 W.
Brule County



BSL-3● Test hole. Letters and numbers are the test hole identifier.

Figure 3. Locations of test holes drilled within 1 mile of the Brule County landfill.



Landfill

Landfill location: SW $\frac{1}{4}$ sec. 34,
T. 104 N., R. 70 W.
Brule County



▲ 1 Monitoring well. The number is the well identifier.

Figure 4. Location of a water quality sample collected within 1 mile of the Brule County landfill.

APPENDIX A

Legal locations of Brule County landfill area logs of test holes and monitoring wells

Listed below are the legal locations of those test holes and wells cited in this report. Please contact the South Dakota Geological Survey if a copy of a lithologic log is needed.

NE NW NE NW sec. 03, T. 103 N., R. 70 W.

SE SE SE SE sec. 03, T. 103 N., R. 70 W.

SE SE SE SW sec. 04, T. 103 N., R. 70 W.

NW NW NE SW sec. 34, T. 104 N., R. 70 W.

SW NE NW SW sec. 34, T. 104 N., R. 70 W.

NW NW NW SW sec. 34, T. 104 N., R. 70 W.

NW SW NW SW sec. 34, T. 104 N., R. 70 W.

SW SW SW SW sec. 34, T. 104 N., R. 70 W.

NE NE SE SW sec. 34, T. 104 N., R. 70 W.

SW NW SE SW sec. 34, T. 104 N., R. 70 W.

SW SE SE SE sec. 34, T. 104 N., R. 70 W.

APPENDIX B

Legal location of a Brule County landfill area water quality analysis

Listed below is the legal location of the water quality analysis which was cited in this report. Please contact the South Dakota Geological Survey if a copy of the analysis is needed.

SW SE SE SE sec. 34, T. 104 N., R. 70 W.