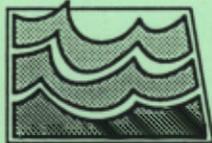


Site Suitability Review of the Watford City Landfill

by
Phillip L. Greer
North Dakota Geological Survey
and
Jeffrey Olson
North Dakota State Water Commission



Prepared by the
North Dakota Geological Survey
and the
North Dakota State Water Commission

ND Landfill Site Investigation No. 36

SITE SUITABILITY REVIEW
OF THE
WATFORD CITY LANDFILL

By Phillip L. Greer, North Dakota Geological Survey,
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North Dakota Landfill Site Investigation 36

Prepared by the NORTH DAKOTA GEOLOGICAL SURVEY
and the NORTH DAKOTA STATE WATER COMMISSION

Bismarck, North Dakota
1995

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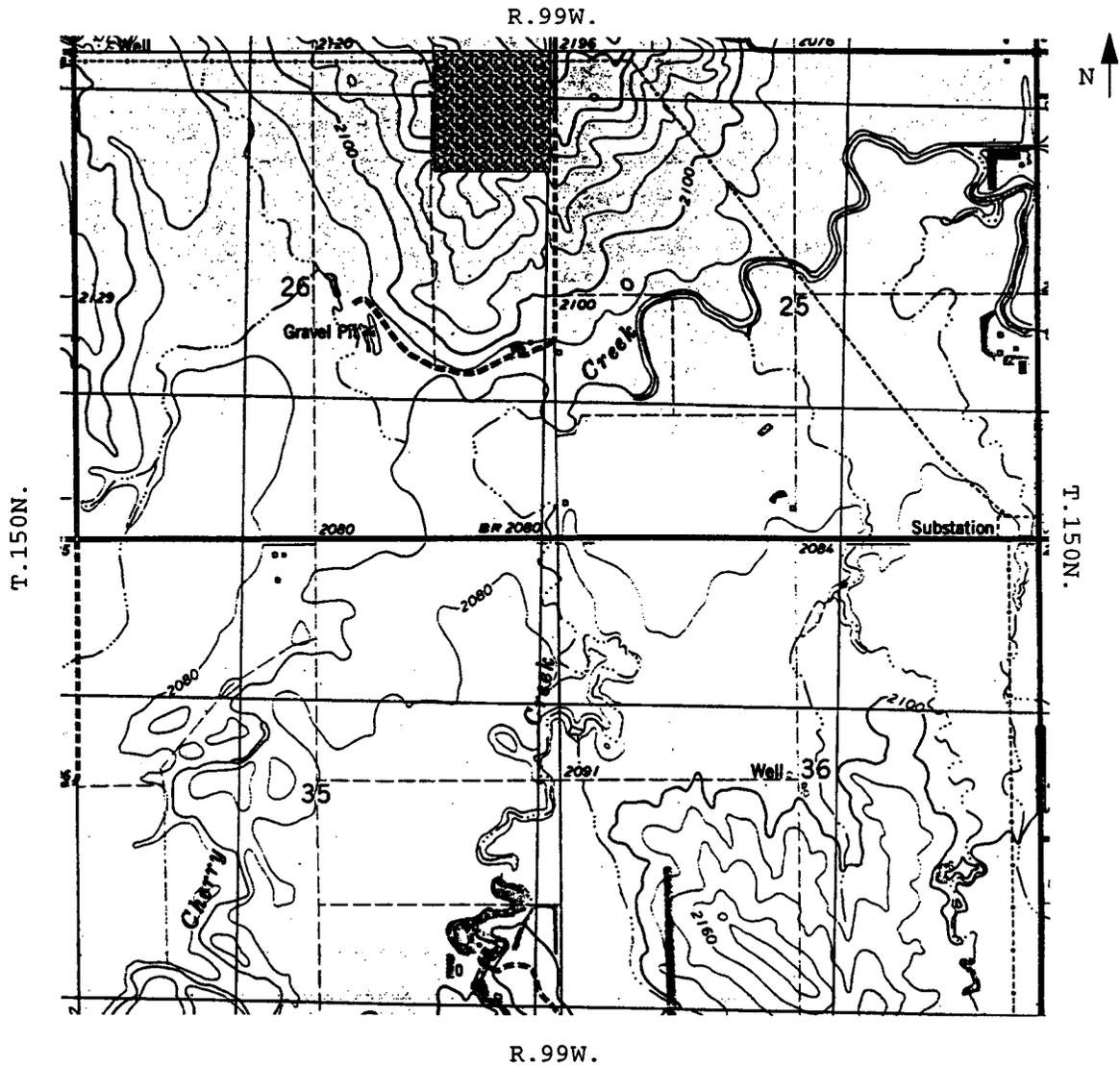
INTRODUCTION

Purpose

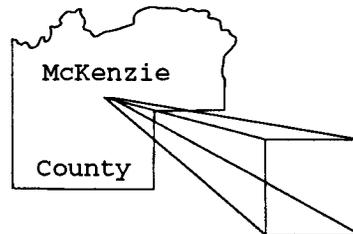
The North Dakota State Engineer and the North Dakota State Geologist were instructed by the 52nd State Legislative Assembly to conduct site-suitability reviews of the solid waste landfills in the state of North Dakota. These reviews are to be completed by July 1, 1995 (North Dakota Century Code 23-29-07.7). The purpose of this program is to evaluate site suitability of each landfill for disposal of solid waste based on geologic and hydrologic characteristics. Reports will be provided to the North Dakota State Department of Health and Consolidated Laboratories (NDS DHCL) for use in site improvement, site remediation, or landfill closure. A one time ground-water sampling event was performed at each site, and additional studies may be necessary to meet the requirements of the NDS DHCL for continued operation of solid-waste landfills. The Watford City solid-waste landfill is one of the landfills being evaluated.

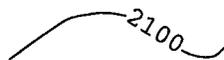
Location of the Watford City Landfill

The Watford City solid-waste landfill is located about one mile southwest of Watford City in the NE 1/4, NE 1/4, Section 26, Township 150 North, Range 99 West (Fig. 1). The landfill site encompasses approximately 40 acres.



 Landfill Boundary



 2100

Elevation in feet above
MSL (NGVD, 1929)

Figure 1. Location of the Watford City municipal landfill in the NE 1/4, NE 1/4, section 26, T.150N., R.99W.

Previous Site Investigations

Braun Engineering performed a hydrogeological study of the Watford City landfill in 1988. This study included drilling of five soil borings, installation of monitoring wells, and analysis of ground water samples. The study found that the material underlying the landfill was predominantly sand. Ground water was encountered at depths of 65 to 80 feet beneath the landfill. The chemical analyses showed no evidence of contamination, except for a detection of chloroform in one well.

Methods of Investigation

The Watford City study was accomplished by means of:

- 1) drilling test holes;
- 2) constructing and developing monitoring wells;
- 3) collecting and analyzing water samples;
- and 4) measuring water levels.

Test-Drilling Procedure

The drilling method was based on the site's geology and depth to ground water, as determined by the preliminary site evaluation. A forward rotary rig was used at the Watford City landfill because the depth to ground water was expected to be more than 70 feet. The lithologic descriptions were

determined from the drill cuttings. The water used in the drilling process was obtained from municipal water supplies.

Monitoring Well Construction and Development

Two additional monitoring wells were installed at the landfill to supplement those previously installed by Braun. One of the new wells was located in the northwest corner of the landfill to replace Braun well ST-5, which was dry. The other well was located on the south side of the site near a small ravine. The depth and intake interval of each well was selected to monitor the water level at the top of the uppermost aquifer.

Wells were constructed following a standard design (Fig. 2) intended to comply with the construction regulations of the NDS DHCL and the North Dakota Board of Water Well Contractors (North Dakota Department of Health, 1986). The wells were constructed using a 2-inch diameter, SDR21, polyvinyl chloride (PVC) well casing and a PVC screen, either 5 or 10 feet long, with a slot-opening size of 0.012 or 0.013 inches. The screen was fastened to the casing with stainless steel screws (no solvent weld cement was used). After the casing and screen were installed into the drill hole, the annulus around the screen was filled with No. 10 (grain-size diameter) silica sand to a height of two feet above the top of the screen. A two to three-foot bentonite plug was placed above the sand pack using one-half inch bentonite pellets.

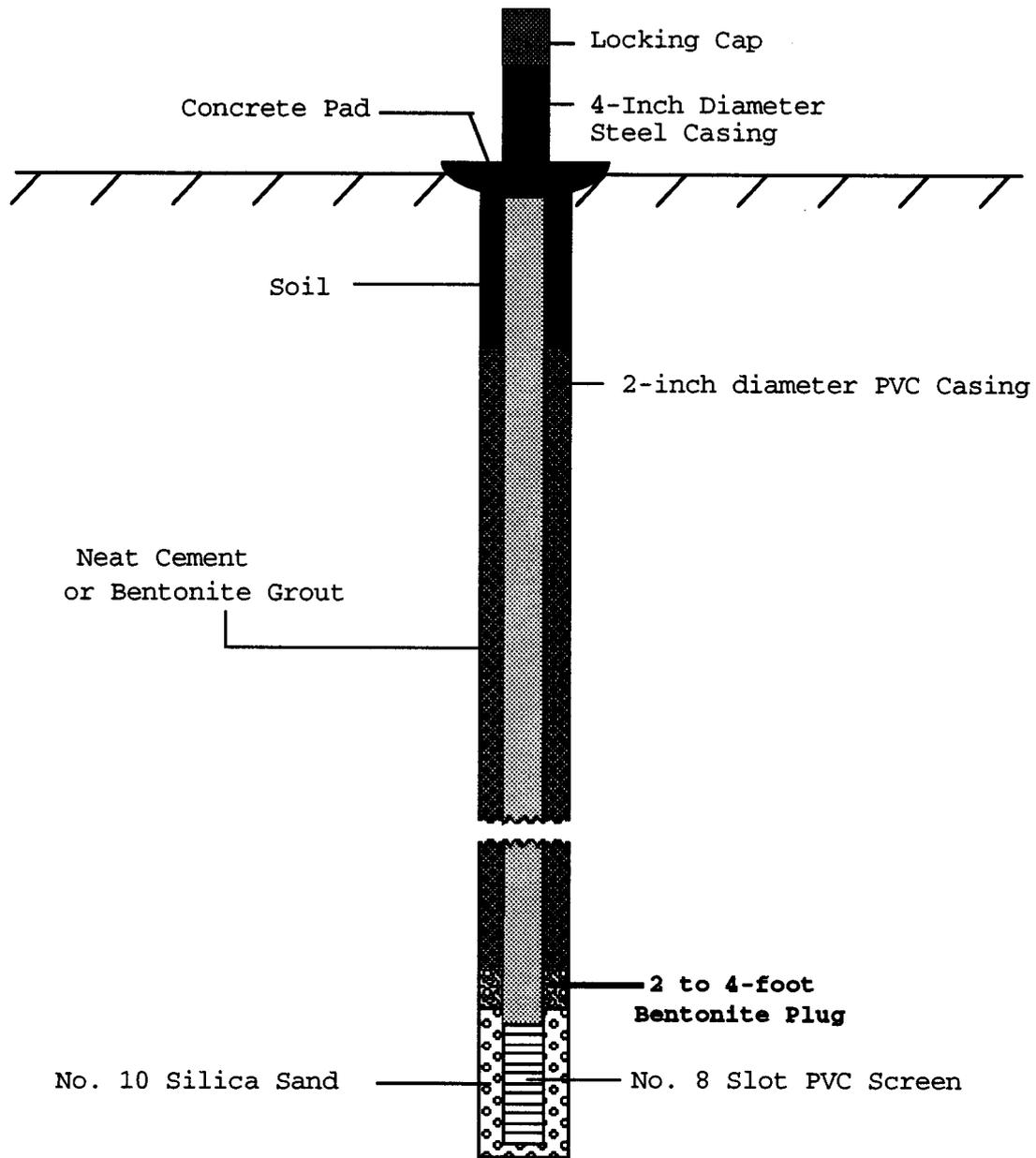


Figure 2. Construction design used for monitoring wells installed at the Watford City landfill.

High-solids bentonite grout and/or neat cement was placed above the bentonite plug to seal the annulus to approximately five feet below land surface. The remaining annulus was filled with drill cuttings. The permanent wells were secured with a protective steel casing and a locking cover protected by a two-foot-square concrete pad.

All monitoring wells were developed using a stainless steel bladder pump or a teflon bailer. Any drilling fluid and fine materials present near the well were removed to insure movement of formation water through the screen.

The Mean Sea Level (MSL) elevation was established for each well by differential leveling to Third Order accuracy. The surveys established the MSL elevation at the top of the casing and the elevation of the land surface next to each well.

Collecting and Analyzing Water Samples

Water-quality analyses were used to determine if leachate is migrating from the landfill into the underlying ground-water system. Selected field parameters, major ions, and trace elements were measured for each water sample. These field parameters and analytes are listed in Appendix A with their Maximum Contaminant Levels (MCL). MCLs are enforceable drinking water standards that represent the maximum permissible level of a contaminant as stipulated by the U.S. Environmental Protection Agency (EPA).

Water samples were collected using a bladder pump constructed of stainless steel with a teflon bladder. A teflon bailer was used in monitoring wells with limited transmitting capacity. Before sample collection, three to four well volumes were extracted to insure that unadulterated formation water was sampled. Four samples from each well were collected in high-density polyethylene plastic bottles as follows:

- 1) Raw (500 ml)
- 2) Filtered (500 ml)
- 3) Filtered and acidified (500 ml)
- 4) Filtered and double acidified (500 ml)

The following parameters were determined for each sample: Specific conductance, pH, bicarbonate, and carbonate were analyzed using the raw sample. Sulfate, chloride, nitrate*, and dissolved solids were analyzed using the filtered sample. Calcium, magnesium, sodium, potassium, iron, and manganese were analyzed from the filtered, acidified sample. Cadmium, lead, arsenic, and mercury were analyzed using the filtered double-acidified samples.

One well was sampled for Volatile Organic Compounds (VOC) analysis. This sample was collected at a different time than the standard water-quality sample. The procedure used for collecting the VOC sample is described in Appendix B. Each sample was collected with a plastic throw-away bailer and kept chilled. These samples were analyzed within

* No special preservative techniques were applied to nitrate samples and as a result reported nitrate concentrations may be lower than actual.

the permitted 14-day holding period. The standard water-quality analyses were performed at the North Dakota State Water Commission (NDSWC) Laboratory and VOC analyses were performed by the NDS DHCL.

Water-Level Measurements

Water-level measurements were taken at least three times at a minimum of two-week intervals. The measurements were taken using a chalked-steel tape or an electronic (Solnist 10078) water-level indicator. These measurements were used to determine the shape and configuration of the water table.

Location-Numbering System

The system for denoting the location of a test hole or observation well is based on the federal system of rectangular surveys of public land. The first and second numbers indicate Township north and Range west of the 5th Principle Meridian and baseline (Fig. 3). The third number indicates the section. The letters A, B, C, and D designate, respectively, the northeast, northwest, southwest, and southeast quarter section (160-acre tract), quarter-quarter section (40-acre tract), and quarter-quarter-quarter section (10-acre tract). Therefore, a well denoted by 150-099-26ABC would be located in the SW $1/4$, NW $1/4$, NE $1/4$, Section 26, Township 150 North, Range 99 West. Consecutive numbers are

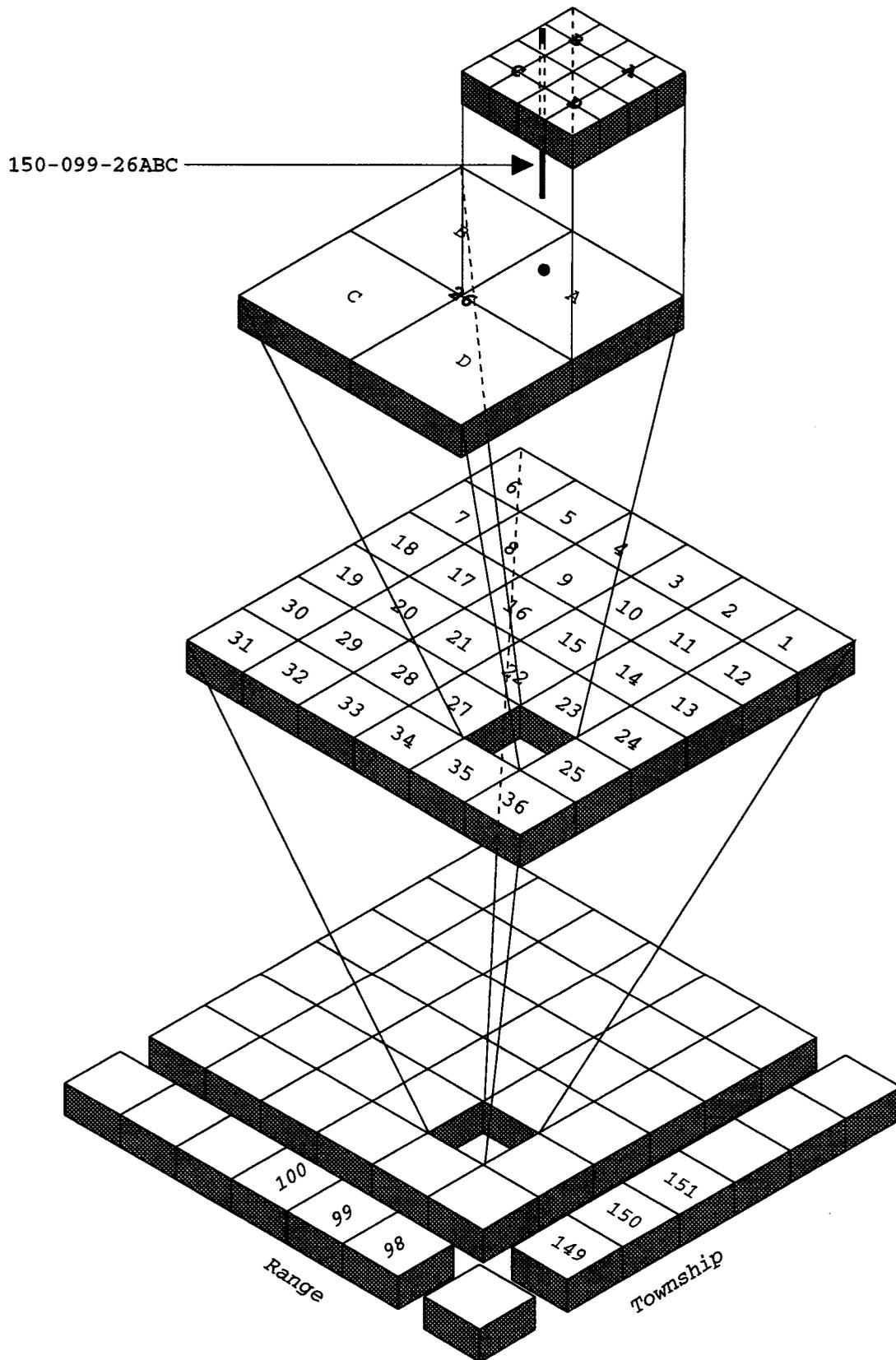


Figure 3. Location-numbering system.

added following the three letters if more than one well is located in a 10-acre tract, e.g. 150-099-26ABC1 and 150-099-26ABC2.

GEOLOGY

The Watford City landfill is located on a hilltop which is bordered on the west, south, and east sides by small valleys (Fig. 4). The hill is about 150 feet higher than the valley floors. The valleys are believed to be the preglacial channels of the Little Missouri River. Other small valleys in the Watford City area represent diversion routes for glacial meltwater (Carlson, 1985).

The fill material in the valleys includes colluvium, lake sediment, till, and alluvium (Croft, 1985a). The lake sediment (mainly clay and silt) was deposited during periods when the channels were temporarily blocked by ice. The colluvium is recent material and also is composed mainly of clay and silt. Test holes drilled in the valleys by the State Water Commission (Croft, 1985b) typically encountered 20 to 40 feet of fine-grained sediments (colluvium, lake sediment, and till) underlain by 30 or more feet of alluvial sand and gravel. The thickest interval of sand and gravel reported was 100 feet in test hole 150-099-15DDD.

Above the valleys the geologic materials consist of Tertiary bedrock overlain in places by glacial sediments or

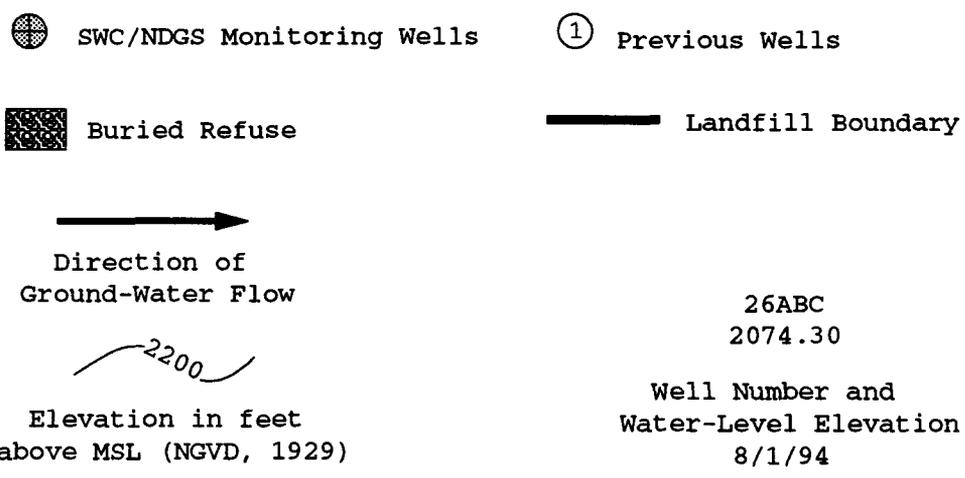
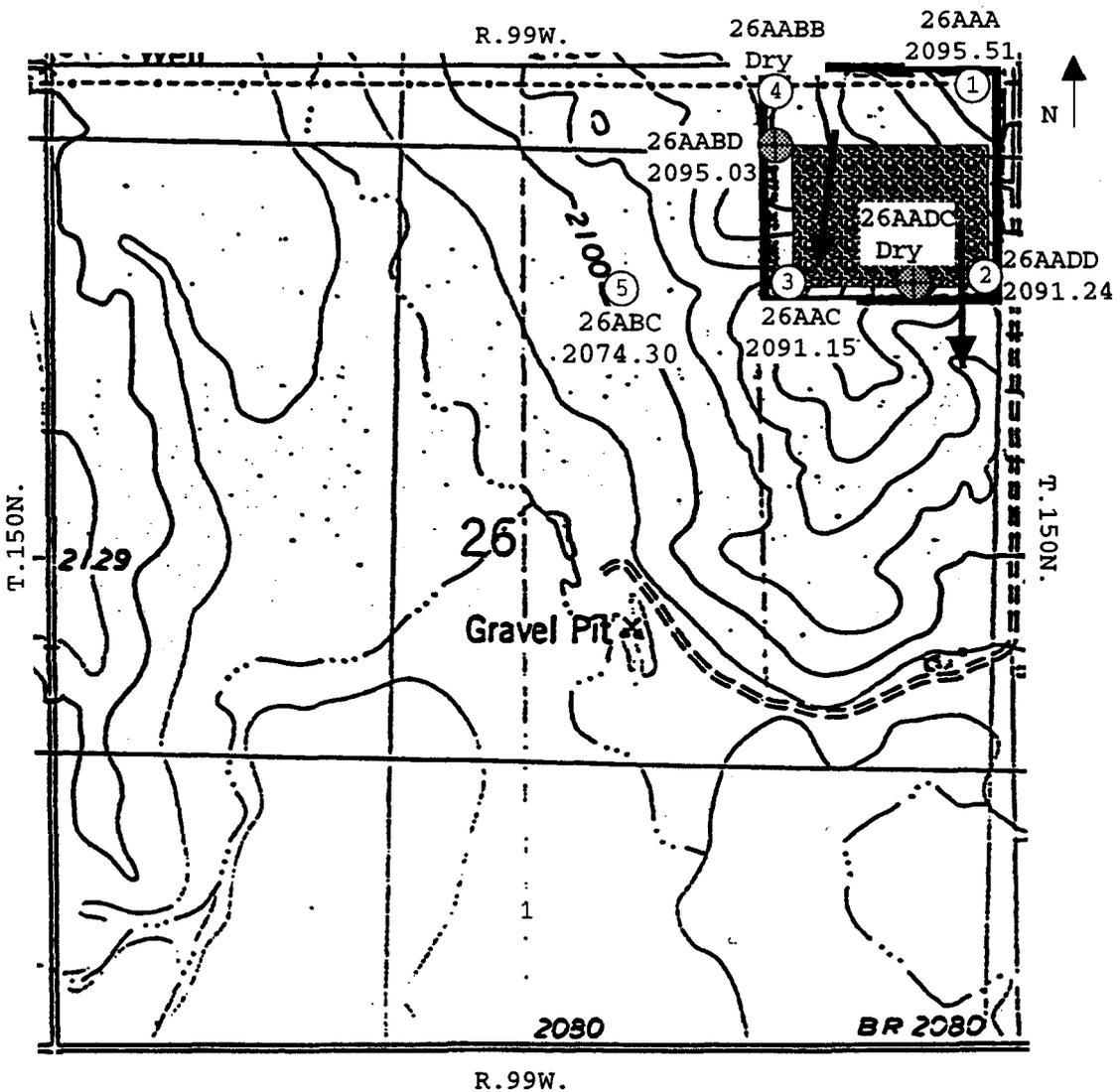


Figure 4. Location of monitoring wells and the direction of ground-water flow.

by alluvium. The bedrock is assigned to the Sentinel Butte Formation, which is composed of sand, sandstone, silt, clay, and lignite.

To the north of the landfill (north of US 85) is a long north-south trending ridge which is about the same height as the hill where the landfill is located. The topographic map of the area shows numerous gravel pits on the ridge. Although the age and origin of the gravel deposits are uncertain, they are probably alluvial terrace deposits. They are similar in topographic setting to other high-elevation gravel found along the Little Missouri and Yellowstone Rivers.

The topographic and geologic maps do not indicate any gravel deposits on the hill where the landfill is located. Two of the test borings at the landfill, 150-099-26AABD and AAA (ST-1), encountered thin (less than two feet thick) layers of gravel near the surface. These may be remnants of alluvial gravel like those found on the ridge to the north. No surficial gravel was observed in the other five test holes.

The predominant lithology underlying the landfill is sand (Fig. 5, lithologic logs in Appendix C). The sand is mostly fine-grained with a few intervals of medium-grained sand. A layer of clay was penetrated at depths of 10 to 15 feet in test holes 150-099-26AABD, AADC, and AADD (ST-2). Another layer of clay was observed at depths of 70 to 100 feet in several test holes.

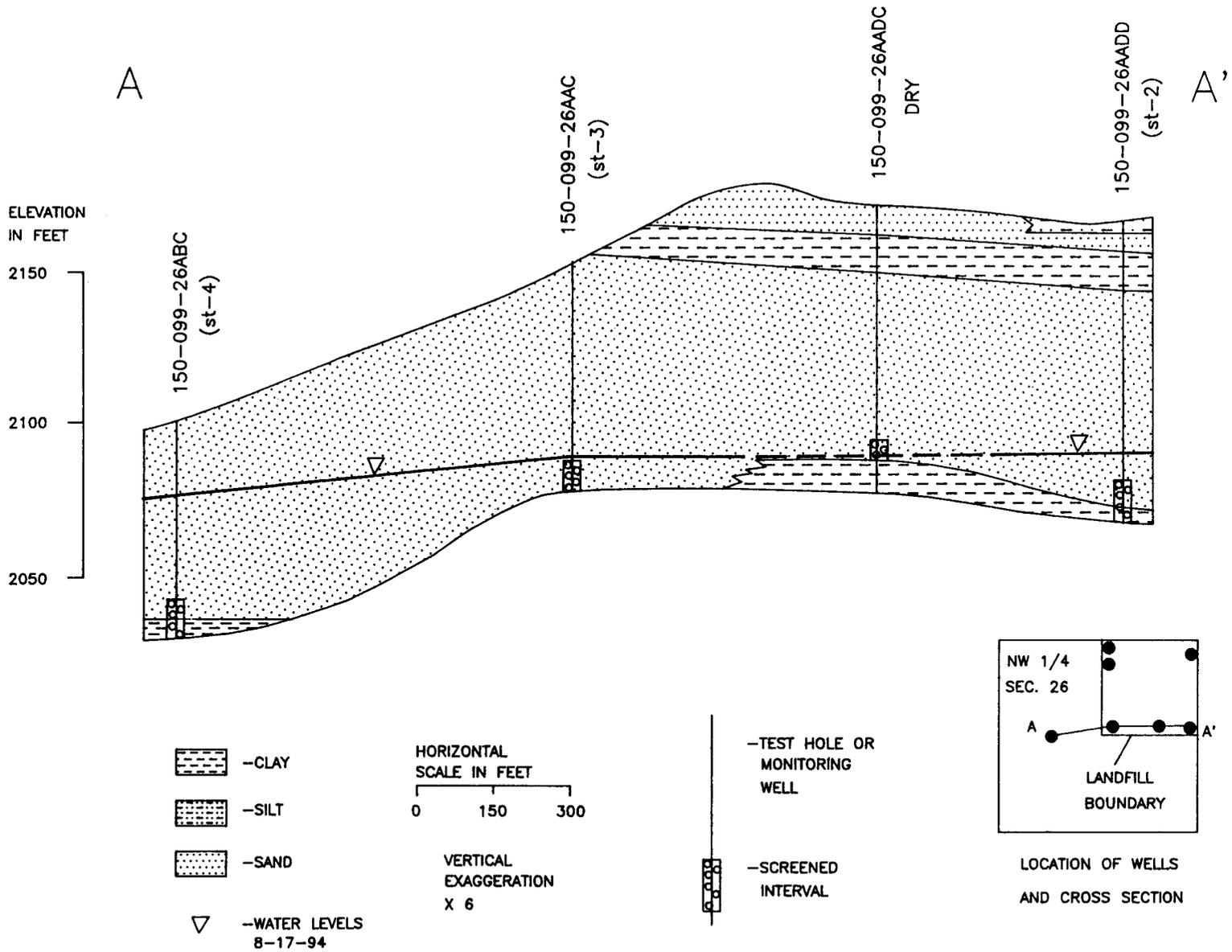


Figure 5. Geohydrologic section A-A' in the Watford City landfill.

HYDROLOGY

Surface-Water Hydrology

An intermittent stream is located about a quarter mile west of the landfill property. This stream flows to the south and discharges into Cherry Creek. Cherry Creek flows to the northeast about one-half mile south of the landfill. Both streams are down-gradient from the landfill. The landfill has been capped and there is no direct contact between the refuse and surface runoff. Neither stream should be affected by contaminant migration from the landfill.

Regional Ground-Water Hydrology

Regional aquifers near the Watford City landfill consist of bedrock and alluvial aquifers. The Tobacco Garden alluvial aquifer is located to the west, south, and east sides of the landfill. This aquifer is made up of alluvial deposits along the base of the preglacial Little Missouri valley. The aquifer discharges into Lake Sakakawea (Croft, 1985a). The glacial material consists of sand and gravel with a thickness of about 85 feet. The Tobacco Garden aquifer is characterized by a sodium-bicarbonate type water. The Tobacco Garden aquifer's down-gradient location from the landfill makes it susceptible to contaminant migration.

A portion of the Charbonneau aquifer is situated about one-mile northwest of the landfill. Locally the aquifer

underlies Timber Creek and appears to discharge into the Tobacco Garden aquifer. The Carbonneau aquifer is characterized by a sodium-bicarbonate type water (Croft, 1985). The Carbonneau aquifer should not be affected by contaminant migration due to its up-gradient location from the landfill.

The bedrock aquifers occur in the Sentinel Butte, Bullion Creek, Ludlow, and Hell Creek Formations. The Sentinel Butte/Bullion Creek aquifers range in depth from 140 to 500 feet below land surface and consist of fine to medium grained sandstone and lignite (Croft, 1985). Recharge to the Sentinel Butte/Bullion Creek aquifers is generally from precipitation and seepage from lakes and streams (Croft, 1985). Recharge to the Sentinel Butte/Bullion Creek aquifers also occurs from upward ground-water flow in underlying bedrock aquifers. The Sentinel Butte/Bullion Creek aquifers are characterized by a sodium-bicarbonate type water with elevated chloride concentrations. Increased chloride is caused by recharge from underlying bedrock aquifers (Croft, 1985).

The Ludlow aquifer underlies the Sentinel Butte/Bullion Creek aquifers and consists of fine to medium grained sandstone (Croft, 1985). The Ludlow aquifer is characterized by a sodium-bicarbonate type water (Croft, 1985). This aquifer should not be affected by contaminant migration from the landfill due to the depth and thickness of overlying low-hydraulic conductivity lithologies.

The Hell Creek aquifer underlies the Ludlow Formation at a depth of 1,100 to 1,800 feet below land surface. The Hell Creek aquifer is characterized by a sodium-bicarbonate type water. This aquifer should not be affected by contaminant migration due to the depth and thickness of overlying low-hydraulic conductivity lithologies.

Local Ground-Water Hydrology

Three test holes were drilled at the Watford City landfill with monitoring wells installed in all of them (Fig. 4). Five existing wells, four on-site and one off-site, were also used in this investigation. The seven monitoring wells were installed in unconsolidated sand of the Sentinel Butte aquifer. Four water-level measurements were taken over an eight-week period (Appendix D). Well 150-099-26AABD was dry during this study and well 150-099-26AADC did not have enough water to collect a sample. Locally ground-water flow in the Sentinel Butte aquifer is to the southwest toward an intermittent stream valley which contains the Tobacco Garden aquifer. The Sentinel Butte aquifer probably is directly connected hydraulically to the Tobacco Garden aquifer. Figure 5 indicates a thick interval of bedrock sand that occurs beneath the landfill and extends to the west into the intermittent stream valley. A ten-foot thick clay layer separates the sand of the Sentinel Butte aquifer and the buried refuse along the southern boundary of the landfill.

This clay layer was absent at monitoring wells 150-099-26AAA and 26AABB. The Sentinel Butte aquifer may be susceptible to contaminant migration from the landfill if the clay layer is not laterally extensive at the landfill site.

Water Quality

Chemical analyses of water samples are shown in Appendix F. Anomalously high concentrations of major ions were not detected in this study. The water at the Watford City landfill is characterized as a calcium-bicarbonate type. The source of the high sulfate at well 26AAA was not determined but does not appear to be due to landfill contamination because of its up-gradient location.

The trace element analyses indicated a concentration of 10 µg/L of arsenic in well 26AAC. This concentration is below the MCL but is significantly more than concentrations in the other wells. No anomalously high concentrations of trace elements were detected in this study.

The results of the VOC analyses, from well 26AAC, are shown in Appendix F. The VOC analyses detected a chloromethane concentration of 1.60 µg/L. It is inconclusive whether the source of this VOC compound is the result of laboratory contamination[†] or migration from the landfill.

[†] Beginning in September, 1994 the NDS DHCL changed their analytical procedures that lowered detection limits for VOC concentrations by one to two orders of magnitude.

CONCLUSIONS

The Watford City landfill is located on a hill about one mile southwest of Watford City. The hill is eroded from the Sentinel Butte Formation and is composed of fine-grained sand with several discontinuous layers of clay. A layer of clay is present in three test holes at depths of about 10 to 15 feet, but the clay is absent at the north end of the landfill in test holes 26AAA and 26AABB.

Bedrock aquifers occur in the Sentinel Butte Formation and in the underlying Bullion Creek, Ludlow, and Hell Creek Formations. The Sentinel Butte aquifer is potentially susceptible to contaminant migration due to the absence of an extensive clay barrier beneath the buried refuse.

The valleys to the west, south, and east of the hill on which the landfill is located were carved by the preglacial Little Missouri River. Alluvial sand and gravel deposited along the valley floor comprise the Tobacco Garden aquifer. Test holes drilled in the area suggest that a direct hydraulic connection exists between the Tobacco Garden aquifer and the Sentinel Butte aquifer.

Water-level measurements reveal that the water table in the Sentinel Butte sand occurs at depths ranging from 60 to 90 feet beneath the landfill. Locally, the direction of ground-water flow is to the southwest toward an intermittent stream valley.

Chemical analyses of water samples from the landfill indicate that the concentrations of major ions and trace elements are generally within the normal range for the Sentinel Butte aquifer. An arsenic concentration of 10 µg/L was detected in well 26AAC. This concentration is below the MCL but is higher than concentrations in the other wells and may be indicative of contaminant migration.

The volatile organic compound (VOC) analysis, from well 26AAC, detected a chloromethane concentration of 1.60 µg/L. It is inconclusive whether the VOC detection is due to laboratory contamination or migration from the landfill.

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APPENDIX A

WATER QUALITY STANDARDS
AND
CONTAMINANT LEVELS

**Water Quality Standards
and
Contaminant Levels**

Field Parameters

appearance	color/odor
pH	6-9 (optimum)
specific conductance	-----
temperature	-----

<u>Constituent</u>	<u>MCL (µg/L)</u>
Arsenic	50
Cadmium	10
Lead	50
Molybdenum	100
Mercury	2
Selenium	10
Strontium	*

*EPA has not set an MCL for strontium. The median concentration for most U.S. water supplies is 100 µg/L (Hem, 1989).

	<u>SMCL (mg/L)</u>
Chloride	250
Iron	>0.3
Nitrate	50
Sodium	20-170
Sulfate	300-1000
Total Dissolved Solids	>1000

	<u>Recommended Concentration Limits (mg/L)</u>
Bicarbonate	150-200
Calcium	25-50
Carbonate	150-200
Magnesium	25-50
Hardness	>121 (hard to very hard)

APPENDIX B

SAMPLING PROCEDURE FOR
VOLATILE ORGANIC COMPOUNDS

SAMPLING PROCEDURE FOR 40ML AMBER BOTTLES

Sample Collection for Volatile Organic Compounds

by
North Dakota Department of Health
and Consolidated Laboratories

1. Three samples must be collected in the 40ml bottles that are provided by the lab. One is the sample and the others are duplicates.
2. A blank will be sent along. Do Not open this blank and turn it in with the other three samples.
3. Adjust the flow so that no air bubbles pass through the sample as the bottle is being filled. No air should be trapped in the sample when the bottle is sealed. Make sure that you do not wash the ascorbic acid out of the bottle when taking the sample.
4. The meniscus of the water is the curved upper surface of the liquid. The meniscus should be convex (as shown) so that when the cover to the bottle is put on, no air bubbles will be allowed in the sample.

convex meniscus



5. Add the small vial of concentrated HCL to the bottle.
6. Screw the cover on with the white Teflon side down. Shake vigorously, turn the bottle upside down, and tap gently to check if air bubbles are in the sample.
7. If air bubbles are present, take the cover off the bottle and add more water. Continue this process until there are no air bubbles in the sample.
8. The sample must be iced after collection and delivered to the laboratory as soon as possible.
9. The 40 ml bottles contain ascorbic acid as a preservative and care must be taken not to wash it out of the bottles. The concentrated acid must be added after collection as an additional preservative.

APPENDIX C

LITHOLOGIC LOGS
OF WELLS AND TEST HOLES

150-099-26AABD

NDSWC

Date Completed:	5/16/94	Purpose:	Observation Well
L.S. Elevation (ft):	2171.08	Well Type:	2" PVC
Depth Drilled (ft):	82	Aquifer:	Sentinel Butte-Tongue
		River	
Screened Interval (ft):	71-81	Source:	
		Owner:	Watford City

Lithologic Log

Unit	Description	Depth (ft)
SAND	fine grained.	0-2
CLAY	trace of sand and pebbles, moderate yellowish brown, 10YR5/4, till.	2-4
GRAVEL	fine grained.	4-5
CLAY	trace of sand and pebbles, moderate yellowish brown, 10YR5/4.	5-6
SAND	fine grained, pale brown, 5YR5/2, Sentinel Butte Formation.	6-13
CLAY	silty, moderate yellowish brown, 10YR5/4.	13-27
CLAY	olive gray, 5Y4/1.	27-42
SAND	fine grained, moderate yellowish brown, 10YR5/4.	42-55
SAND	fine grained, clayey, dark yellowish brown, 10YR4/2.	55-61
SAND	fine grained, moderate yellowish brown, 10YR5/4.	61-63
SANDSTONE	fine grained, pale yellowish brown, 10YR6/2.	63-72
SAND	fine grained, clayey, moderate yellowish brown, 10YR5/4.	72-77

SAND	fine grained, silty, medium gray N5.	77-81
SHALE	pale brown, 5YR5/2.	81-82

150-099-26AADC

NDSWC

Date Completed:	5/16/94	Purpose:	Observation Well
L.S. Elevation (ft):	2173.48	Well Type:	2" PVC
Depth Drilled (ft):	95	Aquifer:	Sentinel Butte-Tongue
		River	
Screened Interval (ft):	79-84	Source:	
		Owner:	Watford City

Lithologic Log

Unit	Description	Depth (ft)
SAND	fine grained, moderate yellowish brown, 10YR5/4, Sentinel Butte Formation.	0-8
SHALE	fragments, dark yellowish orange, 10YR6/6.	8-15
CLAY	olive gray, 5Y4/1.	15-18
CLAY	dark yellowish brown, 10YR4/2.	18-20
SAND	fine to medium grained, moderate yellowish brown, 10YR5/4.	20-32
SAND	fine grained, moderate yellowish brown, 10YR5/4.	32-67
SAND	fine grained, silty, dark yellowish orange, 10YR6/6.	67-71
SAND	fine grained, silty, olive gray, 5Y4/1.	71-84
CLAY	medium gray, N5.	84-86
CLAY	grayish brown, organic rich, 5YR3/2.	86-88
CLAY	medium gray, N5.	88-94
CLAY	grayish green, 10GY5/2.	94-95

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-1 (26AAA) LOCATION: See Attached Sketch DATE: 8/23/88 SCALE: 1" = 4'
--	--

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2188.9	0					
2186.4	2½	CL	SILTY CLAY, low plasticity, lense of gravel, brown, dry			Surface elevations were provided by McKenzie County.
				27		
		SP	SAND, fine to medium, brown, dry, medium dense (Coarse Alluvium)		22	
					27	
2179.9	9					
		SP	SAND, fine to medium grained, trace of lignite, lense of shale, brown, moist, dense (Coarse Alluvium)		25	
					35	
					25	
					100/0.4'	
					100/0.6'	
					100/0.8'	
					43	
					2	
2158.9	30					
					60	
			Cont.			

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-1 Cont. LOCATION: See Attached Sketch DATE: 8/23/88 SCALE: 1"=4'
--	---

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2158.9	30					
2156.9	32		Cont.			
		SP	SAND, fine to medium grained, brown, moist, very dense (Sandstone)	47		
				48		
				36		
				60		
				47		
				49		
				54		
				42		
				60		
				100		
2128.9	60			63		
			Cont.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-1 Cont. LOCATION: See Attached Sketch
DATE: 8/23/88	SCALE: 1" = 4'

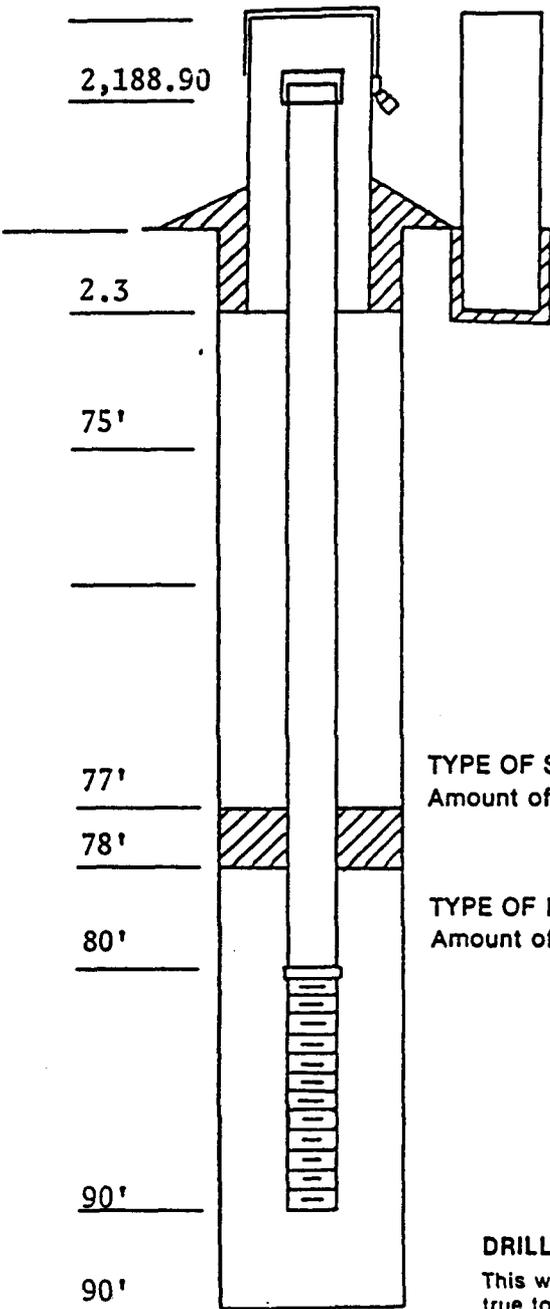
Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2128.9	60		Cont.			
				63		
				71		
2113.4	75½			72		
		SP	SAND, fine to medium grained, brown, waterbearing, very dense (Sandstone)			
				48		
2098.9	90					
			End of Boring. Monitoring Well Installed.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

MONITORING WELL FIELD DATA SHEET

Client City of Watford City Proj. No. BND 88-102 Location City Landfill
 Well Number ST-1 Well Location SE Corner of Landfill Date of Installation 8/26/88
 Date of Revision _____ Crew KD, WS B.M. Location & Elev. (± 0.01) _____

Stick up above ground (to 0.1') _____
 Top of riser pipe (w/o cap) Elev. ($\pm 0.01'$) 2,188.90
 Ground surface Elev. ($\pm 0.1'$) _____
 Depth to bottom of surface seal 2.3
 Approximate water level before installation 75'
 Approximate depth to first water encountered in drilling _____
 Depth to top of seal 77'
 Depth to bottom of seal 78'
 Depth to top of screen 80'
 Depth to bottom of screen 90'
 Depth to bottom of boring 90'



BUMPER POST: _____ Protective Cover: _____
 4" x 4" x 7' Wood _____ Type Steel
 4" x 7' black _____ Length 4'
 capped steel _____ Lock # 2106

Type of sealing material Concrete

RISER PIPE: _____
 Type PVC
 Diameter 2"
 Total Length 82'
 Sections Used 8'
 Couplings _____
 Cap Yes X No _____

NEAT CEMENT GROUT ABOVE SEAL
 Amount of material used 1 yard
 Proportions 8 gallons water, 6 bag cement
50 lbs. mud

TYPE OF SEALING MATERIAL: _____
 Amount of material used _____

TYPE OF FILTER MATERIAL: Silica Sand
 Amount of material used 100 lbs.

SCREEN: 1
 Type PVC
 Slot Size _____
 Length 10'
 Diameter 2"
 Plug/Point Plug

DRILLER'S CERTIFICATION
 This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Braun Engineering Testing 406
 Driller's or Firm's Name Certificate No.

Bismarck, North Dakota
 Address

[Signature] Dec 1, 1988
 Signed by Date

Method of advance:
 HSA X I.D. 3-3/4"
 Casing _____ I.D. _____
 Tricone X O.D. _____

Method of development:
 Air _____
 Jet _____ Surge _____ Bail _____



LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-2 (26AADD) LOCATION: <p style="text-align: center;">See Attached Sketch</p>
DATE: 8/30/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth 0.	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2169.8	0	ML	SILT, brown, dry (Topsoil)			
2169.3	0.5	ML	SANDY SILT, brown, dry			
2165.8	4	ML		10		
		SP	SAND, fine to medium grained, trace of silt, brown, moist, medium dense (Coarse Alluvium)	13		
				18		
				11		
2157.8	12					
		CL	SANDY CLAY, low plasticity, trace of gravel, trace of lignite, seam of sand, brown, moist, medium to rather stiff (Fine Alluvium)	11		
				11		
				6		
2145.8	24					
		SP	SAND, fine to medium grained, trace of lignite, brown, moist, medium dense to dense (Coarse Alluvium)	21		
2139.8	30					
				40		
			Cont.			

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watfor City, North Dakota	BORING: ST-2 Cont. LOCATION: See Attached Sketch
DATE: 8/30/88	SCALE: 1" = 4'

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2139.8	30		Cont.			
				38		
2130.8	39					
		SP	SAND, fine to medium grained, brown, moist, dense to very dense (Sandstone).	67		
					100/0.8'	
				55		
				37		
2109.8	60					
				51		
			Cont.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-2 Cont. LOCATION: See Attached Sketch
DATE: 8/30/88	SCALE: 1" = 4'

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2109.8	60		Cont.			
			trace of gravel	90		
					100/0.8'	
					100/0.8'	
					100/0.9'	
2085.8	84					
		SP	SAND, fine to medium grained, wet, very dense (Sandstone)	63		
2079.8	90				100/0.9'	
			Cont.			

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-2 Cont. LOCATION: <p style="text-align: center;">See Attached Sketch</p>
DATE: 8/30/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2079.8	90		Cont.			
				64		
2070.8	99					
2068.3	10½	CH	FAT CLAY, blueish gray, moist, hard (Bedrock)	40		
			End of Boring. Monitoring Well Installed.			

MONITORING WELL FIELD DATA SHEET

Client City of Watford City Proj. No. BND 88-102 Location City Landfill
 Well Number ST-2 Well Location NE Corner Date of Installation 8/26/88
 Date of Revision _____ Crew KD, WS B.M. Location & Elev. (± 0.01) _____

Stick up above ground (to 0.1')

Top of riser pipe (w/o cap) Elev. (± 0.01 ') 2,169.84

Ground surface Elev. (± 0.1 ') _____

Depth to bottom of surface seal 2.7

Approximate water level before installation 80' to 100'

Approximate depth to first water encountered in drilling 80'

Depth to top of seal 87'

Depth to bottom of seal 88'

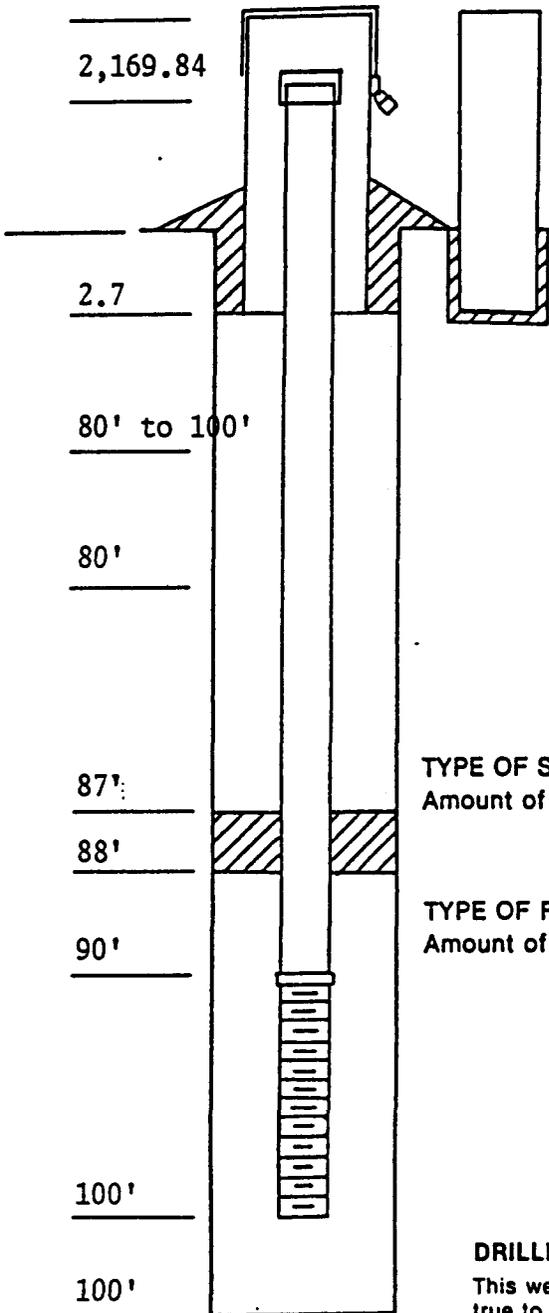
Depth to top of screen 90'

Depth to bottom of screen 100'

Depth to bottom of boring 100'

Method of advance:
 HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone X O.D. 5"

Method of development:
 Jet _____ Surge _____ Air _____
 Bail X



BUMPER POST: _____ Protective Cover: _____
 4" x 4" x 7' Wood _____ Type Steel
 4" x 7' black _____ Length 5'
 capped steel _____ Lock # 2106

Type of sealing material Concrete

RISER PIPE: _____
 Type PVC
 Diameter 2"
 Total Length 90'
 Sections Used 9'
 Couplings _____
 Cap Yes X No _____

NEAT CEMENT GROUT ABOVE SEAL
 Amount of material used 45 gallons
 Proportions 40 lbs. Bentonite, 200 lbs. Ceme
50 gallons Water

TYPE OF SEALING MATERIAL: Bentonite
 Amount of material used 5 lbs.

TYPE OF FILTER MATERIAL: Silica Sand
 Amount of material used 120 lbs.

SCREEN: 1
 Type PVC
 Slot Size 10
 Length 10'
 Diameter 2"
 Plug/Point Plug

DRILLER'S CERTIFICATION

This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Braun Engineering Testing 406
 Driller's or Firm's Name Certificate No.

Bismarck, North Dakota
 Address

[Signature] Dec 1, 1988
 Signed by Date



LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-3 (26AAC) LOCATION: See Attached Sketch
DATE: 8/31/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2154.2	0					
			SANDY SILT, very low plasticity, brown, dry, medium	8		
2150.2	4					
		SP	SAND, fine grained, moist, loose to very dense (Coarse Alluvium)	6		
				22		
				28		
				29		
				35		
				50		
				65		
				48		
				37		
				42		
2124.2	30					
				53		
			Cont.			

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-3 Cont. LOCATION: <p style="text-align: center;">See Attached Sketch</p>
DATE: 8/31/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2124.2	30		Cont.			
				69		
2114.2	40			40		
		SP	SAND, fine to medium grained, trace of lignite, gravel, moist, very dense (Sandstone).			
				55		
				65		
						100/0.8'
2094.2	60					
						100/0.8'
			Cont.			

LOG OF BORING



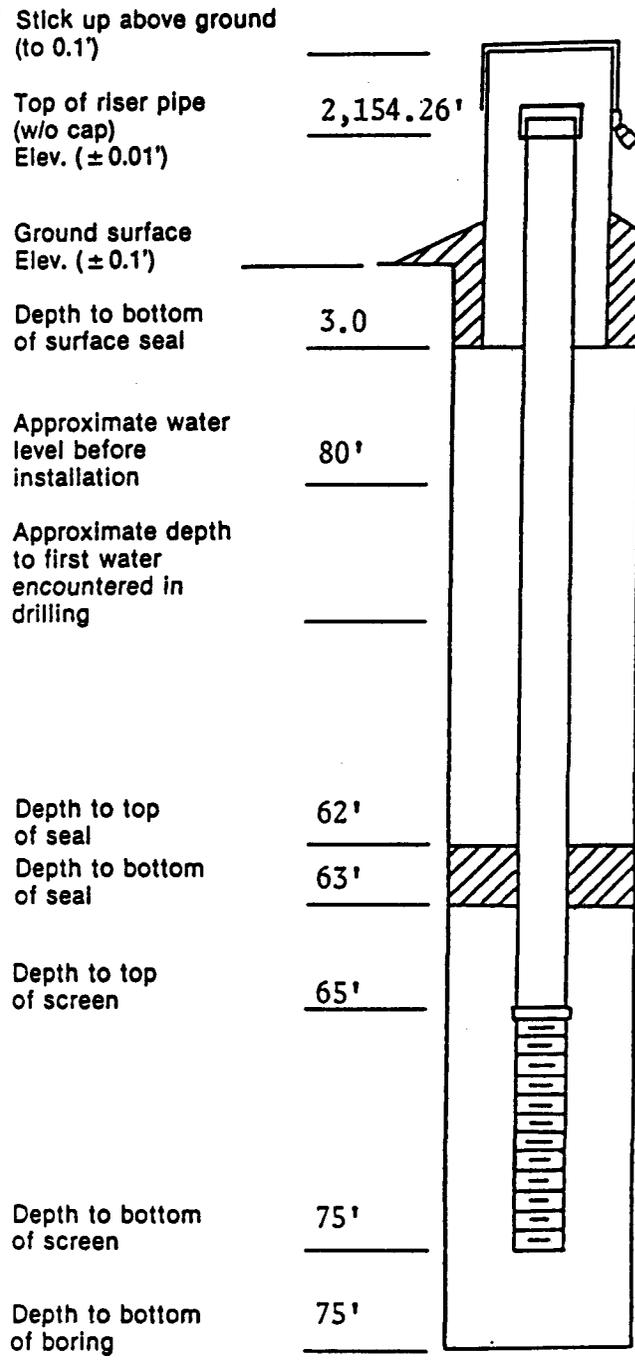
PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-3 Cont. LOCATION: See Attached Sketch
DATE: 8/31/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2094.2	60					
2089.2	65		Cont.			
				53		
		SP	SAND, fine to medium grained with lenses of clay, brown, moist			
				100		
2080.2	74					
2078.7	75½	SP	SAND, fine grained, moist, very dense (Sandstone)			
				100	/0.5'	
			End of Boring.			

MONITORING WELL FIELD DATA SHEET

Client City of Watford City Proj. No. BND 88-102 Location City Landfill
 Well Number ST-3 Well Location SW Corner of Landfill Date of Installation 8/26/88
 Date of Revision _____ Crew KD, WS B.M. Location & Elev. (± 0.01) _____



BUMPER POST:
 4" x 4" x 7' Wood _____
 4" x 7' black capped steel _____
Protective Cover:
 Type Steel
 Length 4'
 Lock # 2106

Type of sealing material _____
RISER PIPE:
 Type PVC
 Diameter 2"
 Total Length 65'
 Sections Used 7'
 Couplings _____
 Cap Yes X No _____

NEAT CEMENT GROUT ABOVE SEAL
 Amount of material used _____
 Proportions 1/2 bag Mud, 2 bags Cement
50 gallons water

TYPE OF SEALING MATERIAL: _____
 Amount of material used _____
TYPE OF FILTER MATERIAL: Silica Sand
 Amount of material used _____

SCREEN:
 Type PVC
 Slot Size _____
 Length 10'
 Diameter 2"
 Plug/Point _____

DRILLER'S CERTIFICATION
 This well was drilled under my jurisdiction and this report is true to the best of my knowledge.
Braun Engineering Testing 406
 Driller's or Firm's Name Certificate No.
Bismarck, North Dakota
 Address _____
 Signed by [Signature] Date Dec 1, 1988

Method of advance:
 HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone X O.D. _____

Method of development:
 Air _____
 Jet _____ Surge _____ Ball _____



LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-4 (26AABB) LOCATION: See Attached Sketch
DATE: 8/26/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2169.8	0					
2167.8	2	SM	SILTY SAND, fine grained, brown, dry			
2157.8	12	SP	SAND, fine to medium grained, brown, dry, dense (Coarse Alluvium)	10		
				22		
				26		
				42		
				32		
2139.8	30	SP	SAND, fine to medium grained, lenses of clay, trace of lignite, brown, moist, dense to very dense	29		
				32		
				82		
				32		
				33		
			Cont.			

LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-4 Cont. LOCATION: See Attached Sketch
DATE: 8/26/88 SCALE: 1" = 4'	

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2139.8	30					
			Cont.			
2134.8	35			49		
		SP	SAND, fine to medium grained, brown, moist, very dense (Sandstone)			
				59		
				81		
				84		
				74		
2109.8	60			62		
			Cont.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

LOG OF BORING



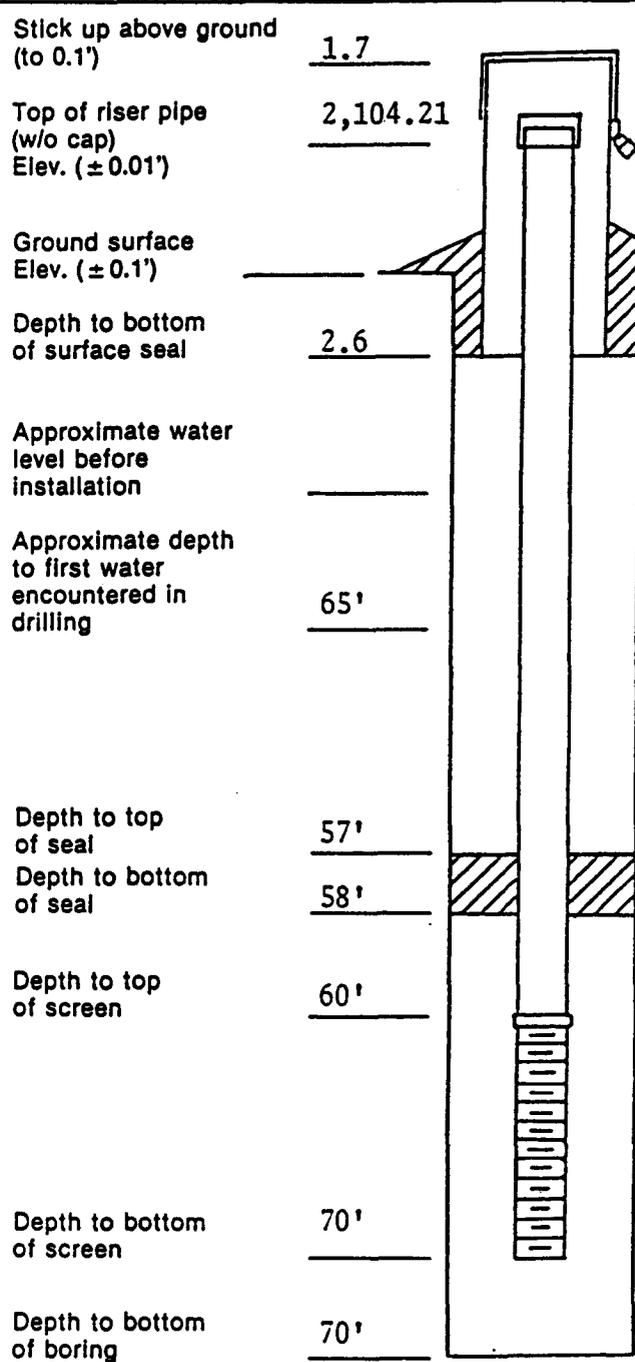
PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-4 Cont. LOCATION: <p style="text-align: center;">See Attached Sketch</p>
DATE: 8/26/88 SCALE: 1" = 4'	

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2109.8	60					
2105.8	64		Cont.			
2100.8	69	SP	SAND, fine to medium grained, seam of lignite, gravel, water-bearing, very dense (Sandstone)	60		
2099.3	70½	CH	FAT CLAY, medium plasticity, gravel, moist, hard (Bedrock)	76		
			End of Boring.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

MONITORING WELL FIELD DATA SHEET

Client City of Watford City Proj. No. BND 88-102 Location City Landfill
 Well Number ST-4 Well Location SW Corner of Landfill Date of Installation 8/29/88
 Date of Revision _____ Crew KD, WS B.M. Location & Elev. (± 0.01) _____



BUMPER POST:
 4" x 4" x 7' Wood _____ Type _____
 4" x 7' black capped steel _____ Length _____
 Lock # _____

Type of sealing material _____

RISER PIPE:
 Type PVC
 Diameter 2"
 Total Length 60'
 Sections Used 6'
 Couplings _____
 Cap Yes X No _____

NEAT CEMENT GROUT ABOVE SEAL
 Amount of material used 50 Gallons
 Proportions 200 lbs. cement, 50 lbs. bentonite

TYPE OF SEALING MATERIAL: Bentonite Pellets
 Amount of material used 3 lbs.

TYPE OF FILTER MATERIAL: Silica Sand
 Amount of material used 100 lbs.

SCREEN: Slotted
 Type PVC
 Slot Size _____
 Length 10'
 Diameter 2"
 Plug/Point Plug

DRILLER'S CERTIFICATION
 This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Braun Engineering Testing 406
 Driller's or Firm's Name Certificate No.

Bismarck, North Dakota
 Address

[Signature] Dec 1, 1988
 Signed by Date

Method of advance:
 HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone X O.D. _____

Method of development:
 Air _____
 Jet _____ Surge _____ Bail _____



LOG OF BORING



PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-5 (26ABC) LOCATION: See Attached Sketch
DATE: 9/2/88 SCALE: 1" = 4'	

(See Report and Standard Plates for evaluation and descriptive terminology.)

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2178.1	0					
		SM	SILTY SAND			
2176.1	2					
		SP	SAND, fine to medium grained, brown, dry, medium dense (Coarse Alluvium)	11		
				11		
2171.1	7					
		SP	SAND, fine to medium grained, brown, moist, loose to medium dense (Coarse Alluvium)	11		
				7		
				8		
2164.1	14					
		SC	CLAYEY SAND, brown, moist, loose (Coarse Alluvium)	5		
2159.1	19					
		SP	SAND, fine to medium grained, brown, moist, seams of gravel, medium dense (Coarse Alluvium)	14		
				12		
2149.1	29					
2148.1	30	SP	SAND, fine to medium grained,*	16		

*brown, waterbearing

LOG OF BORING



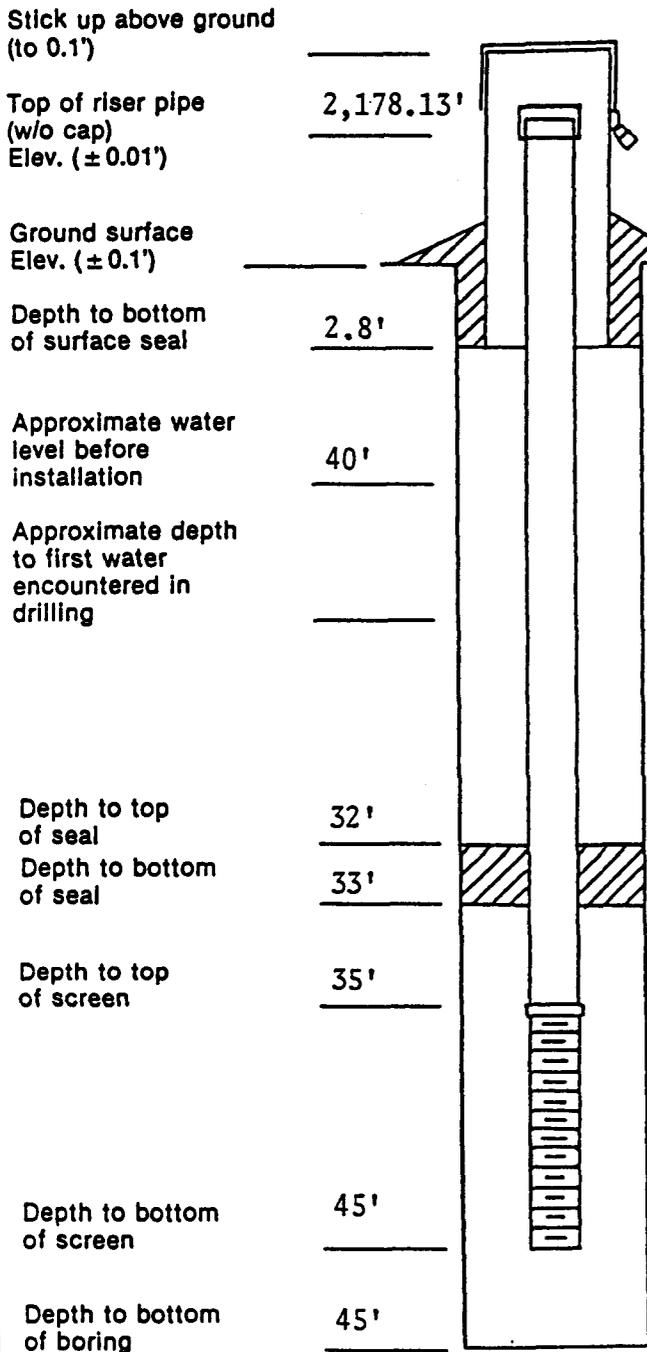
PROJECT: BND 88-102 Environmental Evaluation Watford City Landfill Watford City, North Dakota	BORING: ST-5 Cont. LOCATION: See Attached Sketch
DATE: 9/2/88 SCALE: 1" = 4'	

Elev.	Depth	ASTM D2487 Symbol	Description of Materials (ASTM D2488)	BPF	WL	Tests or Notes
2148.1	30		Cont.			
2144.1	34					
		SP	SAND, fine to medium grained, trace of gravel, gray, water-bearing, loose to medium dense (Coarse Alluvium)	25		
				5		
2132.6	45½			5		
			End of Boring.			

(See Report and Standard Plates for evaluation and descriptive terminology.)

MONITORING WELL FIELD DATA SHEET

Client City of Watford City Proj. No. BND 88-102 Location City Landfill
 Well Number ST-5 Well Location Out in Field West of Landfill Date of Installation 8/29/88
 Date of Revision _____ Crew KD, WS B.M. Location & Elev. (± 0.01) _____



BUMPER POST:
 4" x 4" x 7' Wood _____
 4" x 7' black capped steel _____
Protective Cover:
 Type Steel
 Length _____
 Lock # 2106

Type of sealing material Concrete

RISER PIPE:
 Type PVC
 Diameter 2"
 Total Length 35'
 Sections Used 3-1/2'
 Couplings No
 Cap Yes X No _____

NEAT CEMENT GROUT ABOVE SEAL
 Amount of material used 50 gallons
 Proportions 1/2 mud (50 lbs.), 200 lbs.
50 gallons water, Cement

TYPE OF SEALING MATERIAL: Bentonite Pellets
 Amount of material used 4 lbs.

TYPE OF FILTER MATERIAL: Silica Sand
 Amount of material used _____

SCREEN:
 Type PVC
 Slot Size .010
 Length 10'
 Diameter 2"
 Plug/Point Plug

DRILLER'S CERTIFICATION
 This well was drilled under my jurisdiction and this report is true to the best of my knowledge.

Braun Engineering Testing 406
 Driller's or Firm's Name Certificate No.
Bismarck, North Dakota
 Address

Signed by [Signature] Date Dec 1, 1988

Method of advance:
 HSA _____ I.D. _____
 Casing _____ I.D. _____
 Tricone X O.D. _____

Method of development:
 Air _____
 Jet _____ Surge _____ Bail _____



APPENDIX D

WATER-LEVEL TABLES

Watford City Water Levels
6/22/94 to 8/30/94

150-099-26AAA MP Elev (msl,ft)=2188.39
Sentinel Butte-Tongue River Aquifer SI (ft.)=80-90

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	93.70	2094.69	08/17/94	93.01	2095.38
07/18/94	92.73	2095.66	08/30/94	93.24	2095.15
08/01/94	92.88	2095.51			

150-099-26AABB MP Elev (msl,ft)=2177.74
Sentinel Butte-Tongue River Aquifer SI (ft.)=60-70

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	0.00	2177.74	08/17/94	0.00	2177.74
07/14/94	0.00	2177.74	08/30/94	0.00	2177.74
08/01/94	0.00	2177.74			

150-099-26AABD MP Elev (msl,ft)=2172.5
Sentinel Butte-Tongue River Aquifer SI (ft.)=71-81

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	0.00	2172.50	08/17/94	77.49	2095.01
07/18/94	77.38	2095.12	08/30/94	77.56	2094.94
08/01/94	77.47	2095.03			

150-099-26AAC MP Elev (msl,ft)=2153.83
Sentinel Butte-Tongue River Aquifer SI (ft.)=65-75

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	63.00	2090.83	08/17/94	62.66	2091.17
07/18/94	62.66	2091.17	08/30/94	62.72	2091.11
08/01/94	62.68	2091.15			

150-099-26AADC MP Elev (msl,ft)=2175.32
Sentinel Butte-Tongue River Aquifer SI (ft.)=79-84

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	0.00	2175.32	08/17/94	0.00	2175.32
07/18/94	0.00	2175.32	08/30/94	0.00	2175.32
08/01/94	0.00	2175.32			

150-099-26AADD MP Elev (msl,ft)=2169.41
Sentinel Butte-Tongue River Aquifer SI (ft.)=90-100

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	0.00	2169.41	08/17/94	78.16	2091.25
07/18/94	78.13	2091.28	08/30/94	78.23	2091.18
08/01/94	78.17	2091.24			

150-099-26ABC

MP Elev (msl,ft)=2103.57

Sentinel Butte-Tongue River Aquifer

SI (ft.)=35-45

Date	Depth to Water (ft)	WL Elev (msl, ft)	Date	Depth to Water (ft)	WL Elev (msl, ft)
06/22/94	31.50	2072.07	08/17/94	29.47	2074.10
07/18/94	29.10	2074.47	08/30/94	29.64	2073.93
08/01/94	29.27	2074.30			

APPENDIX E

MAJOR ION AND TRACE-ELEMENT
CONCENTRATIONS

Watford City Water Quality Major Ions

Location	Screened Interval (ft)	Date Sampled	(milligrams per liter)																Spec					
			SiO ₂	Fe	Mn	Ca	Mg	Na	K	HCO ₃	CO ₃	SO ₄	Cl	F	NO ₃	B	TDS	Hardness CaCO ₃	as NCH	% Na	SAR	Cond (µmho)	Temp (=C)	pH
150-099-26AAA	80-90	06/22/94	14	0.43	0.1	85	72	98	7.1	349	0	380	29	0.3	2.1	0.02	860	510	220	29	1.9	1200	11	8.32
150-099-26AAC	65-75	06/22/94	16	0.12	0.02	60	70	25	4.2	488	0	43	5	0.2	5.1	0.02	515	440	38	11	0.5	1100	13	9.22
150-099-26AADD	90-100	08/08/94	20	0.13	0.04	99	50	24	8.9	460	0	42	10	0.1	4.2	0.04	485	450	76	10	0.5	1230	10	
150-099-26ABC	35-45	06/22/94	17	0.1	0.07	61	30	71	5	434	0	76	1.9	0.3	3.8	0.07	480	280	0	35	1.8	809	14	

Trace Element Analyses

Location	Date Sampled	(micrograms per liter)						
		Selenium	Lead	Cadmium	Mercury	Arsenic	Molybdenum	Strontium
150-099-26AAA	06/22/94	2	0	0	0.1	0	9	690
150-099-26AAC	06/22/94	1	2	0	0	10	4	510
150-099-26AADD	06/22/94	2	0	0	0	1	0	610
150-099-26ABC	06/22/94	0	0	0	0.1	0	2	530

APPENDIX F

VOLATILE ORGANIC COMPOUNDS
FOR WELL 150-099-26AAC

Volatile Organic Compounds
and
Minimum Concentrations

Concentrations are based only on detection limits. Anything over the detection limit indicates possible contamination.

Constituent	Chemical Analysis µg/L
Benzene	<0.5
Vinyl Chloride	<0.5
Carbon Tetrachloride	<0.5
1,2-Dichloroethane	<0.5
Trichloroethylene	<0.5
1,1-Dichloroethylene	<0.5
1,1,1-Trichloroethane	<0.5
para-Dichlorobenzene	<0.5
Acetone	<50
2-Butanone (MEK)	<50
2-Hexanone	<50
4-Methyl-2-pentanone	<50
Chloroform	<0.5
Bromodichloromethane	<0.5
Chlorodibromomethane	<0.5
Bromoform	<0.5
trans-1,2-Dichloroethylene	<0.5
Chlorobenzene	<0.5
m-Dichlorobenzene	<0.5
Dichloromethane	<0.5
cis-1,2-Dichloroethylene	<0.5
o-Dichlorobenzene	<0.5
Dibromomethane	<0.5
1,1-Dichloropropene	<0.5
Tetrachlorethylene	<0.5
Toluene	<0.5
Xylene(s)	<0.5
1,1-Dichloroethane	<0.5
1,2-Dichloropropane	<0.5
1,1,2,2-Tetrachloroethane	<0.5
Ethyl Benzene	<0.5
1,3-Dichloropropane	<0.5
Styrene	<0.5
Chloromethane	1.60*
Bromomethane	<0.5
1,2,3-Trichloropropane	<0.5
1,1,1,2-Tetrachloroethane	<0.5
Chloroethane	<0.5
1,1,2-Trichloroethane	<0.5

* Constituent Detection

VOC Constituents cont.

2,2-Dichloropropane	<0.5
o-Chloroluene	<0.5
p-Chlorotoluene	<0.5
Bromobenzene	<0.5
1,3-Dichloropropene	<0.5
1,2,4-Trimethylbenzene	<0.5
1,2,4-Trichlorobenzene	<0.5
1,2,3-Trichlorobenzene	<0.5
n-Propylbenzene	<0.5
n-Butylbenzene	<0.5
Naphthalene	<0.5
Hexachlorobutadiene	<0.5
1,3,5-Trimethylbenzene	<0.5
p-Isopropyltoluene	<0.5
Isopropylbenzene	<0.5
Tert-butylbenzene	<0.5
Sec-butylbenzene	<0.5
Fluorotrichloromethane	<0.5
Dichlorodifluoromethane	<5
Bromochloromethane	<0.5
Allylchloride	<5
2,3-Dichloro-1-propane	<5
Tetrahydrofuran	<50
Pentachloroethane	<5
Trichlorotrifluoroethane	<5
Carbondisulfide	<5
Ether	<5
trans-1,3-Dichloropropene	<0.5

* Constituent Detection