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Engineers
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INVESTIGATION OF AN
ABANDONED CITY OF WAUSAU
LANDFILL

for

WISCONSIN DEPARTMENT OF
NATURAL RESOURCES

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by

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GLT187/17

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INVESTIGATION OF AN ABANDONED CITY OF WAUSAU LANDFILL

INTRODUCTION

In October 1985, CH2M HILL began a limited investigation of an abandoned City of Wausau Landfill for the Wisconsin Department of Natural Resources (DNR). This landfill is in the NW 1/4, SE 1/4, Section 23, T29N, R7E, City of Wausau, Marathon County (Figure 1).

OBJECTIVES

The objective of this investigation is to determine if contaminants from the landfill are entering the groundwater. Ultimately, the DNR is concerned about contaminants from the landfill affecting the City of Wausau water supply wells.

SCOPE

The scope of the investigation was defined by the DNR and included:

- A review of existing information available from the DNR, the City of Wausau, and published hydrogeologic information concerning the landfill, its operating history, its environmental setting, and documented contamination
- A hydrogeologic investigation in which six monitoring wells and three piezometers were to be installed
- Collection and analysis of groundwater and soil samples to determine if VOC contamination exists
- Analysis and reporting of data.

A copy of the DNR scope of work and CH2M HILL's work plan are included in Appendix A. Because of difficult drilling conditions, Gary Kulibert, the DNR's project manager, agreed to modify the scope to require installation of only one piezometer. Metals analyses, which were not included in the original scope of work, were performed on some of the soil and water samples because of foundry sand recovered from one boring.

BACKGROUND INFORMATION

PREVIOUS INVESTIGATIONS

In 1985, the Weston-Sper Technical Assistance Team prepared

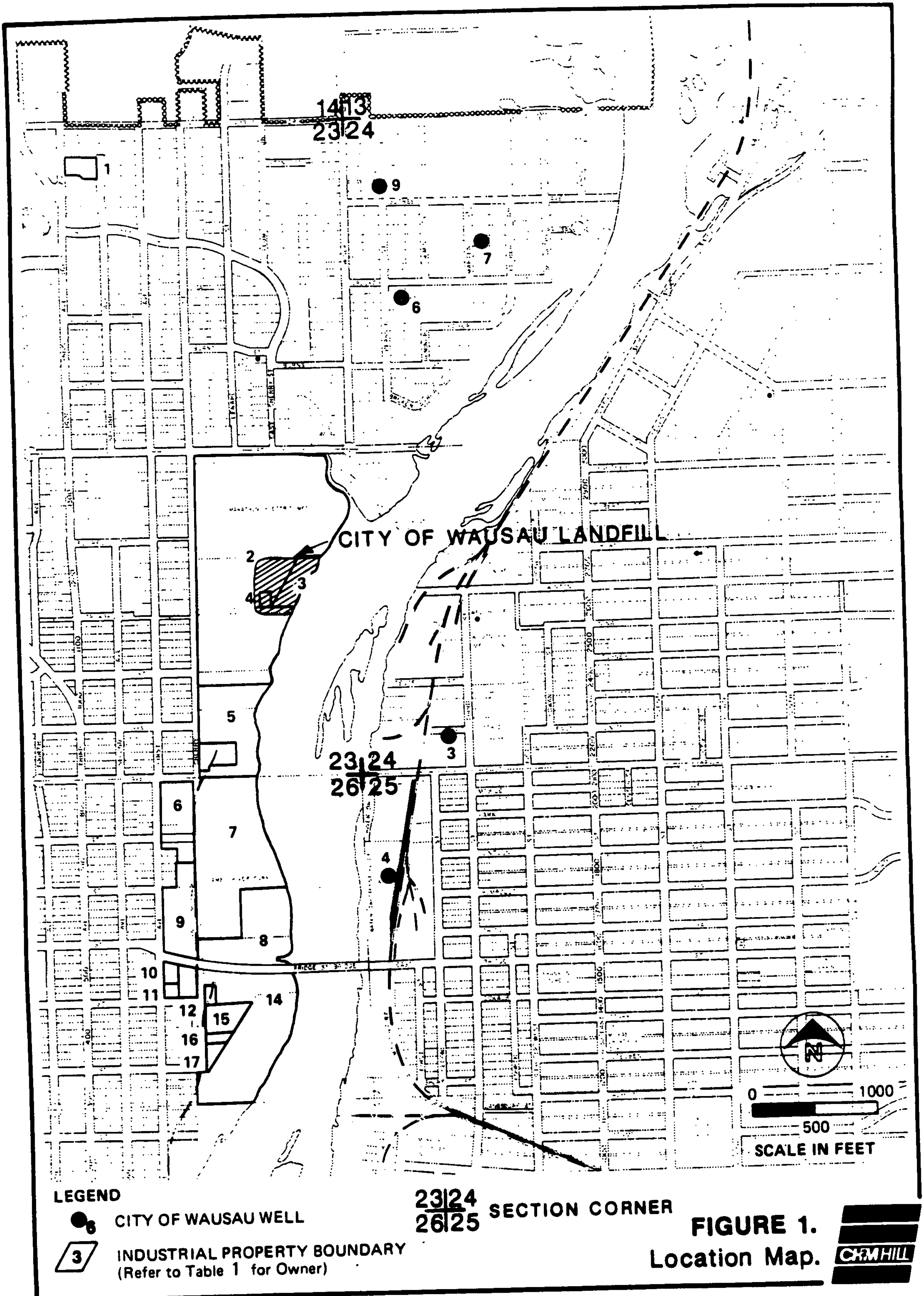


FIGURE 1.
Location Map.

Table 1
MANUFACTURING LAND OWNERSHIP WITHIN
ONE-HALF MILE OF MARATHON ELECTRIC

Map No.	Owner	Type of Activity on Property
1	George A. Digman	Insulation Firm
2	Marathon Electric Mfg.	
3	City of Wausau	Vacant Land
4	Wisconsin Public Services Corp.	Electric Substation
5	Schuette Building Center, Inc.	Lumber Yard and Building Materials Storage
6	Employers Mutual Insurance Co.	Offices and parking
7	Equitable Life Mortgage & Realty Invest.	Fiberboard containers
8	James River-Dixie Northern, Inc.	Fiberboard Containers and Printing
9	Mortenson Lumber Co.	Lumber yard
10	C.J. Crooks	Bakery Outlet
11	James A. Gierl Po-Jo Enterprises	Equipment Rental Communications Equipment
12	C.J. Crooks	Canned Goods Outlet
13	Gerritt Vander Geest	
14	S.W.E.D. Design Structures, Inc. L.C./B&K Enterprises, Inc.	Stucco and stone
15	Commonwealth Telephone Co.	Truck storage (GTE)
16	Northway Rental	Communications Rental/ Tree Experts
17	United Machine Company	Machine/Welding Shop

NOTES:
1) Map number refers to Figure 1.
2) Ownership determined from tax assessor's files.
3) Type of business refers to current business conducted on property, where known.

a report for the U.S. EPA of their investigation of volatile organic contamination in the Wausau water supply wells. Part of this investigation included the installation and sampling of monitoring wells and a seismic refraction survey in the area of city well No. 6.

Several reports from the University of Wisconsin Extension, Geological and Natural History Survey provided general background concerning the geology and hydrogeology of the site.

SITE DESCRIPTION

The City of Wausau landfill is located on the west bank of the Wisconsin River in an abandoned sand and gravel quarry. It appears that the quarry was filled to the existing ground surface, then any depressions in the surrounding area were filled to form a flat surface. The approximate boundary of the landfill is shown in Figure 2. This boundary is based on an aerial photograph taken on September 28, 1948.

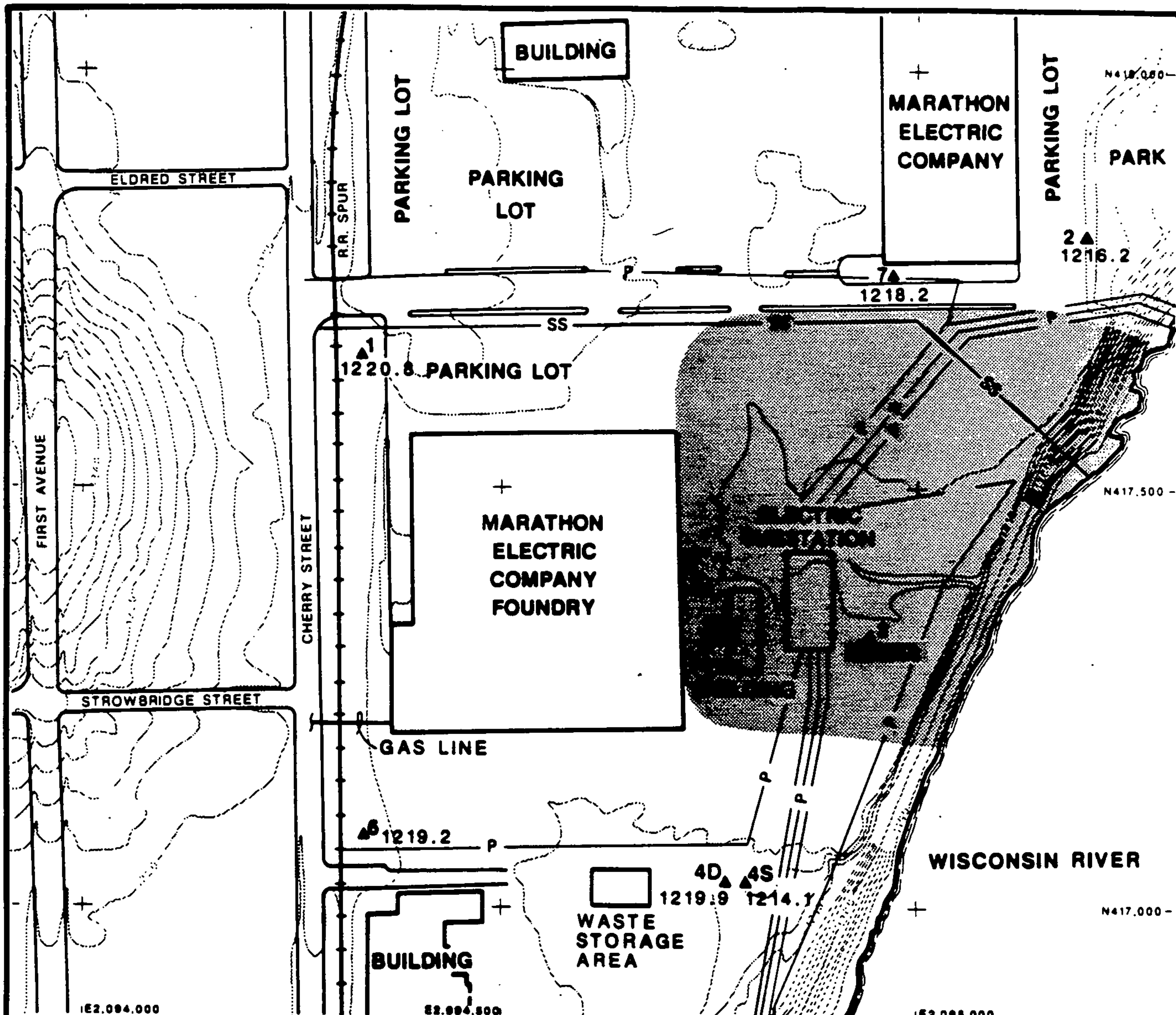
The elevation across the site ranges from 1,218 feet msl on the west to 1,210 feet msl at the top of the river bank (Figure 2), which slopes steeply to the river. The water level in the river is controlled by a dam located about 5 miles south of the landfill.

Most of the landfilled area was purchased from the City of Wausau by Marathon Electric in 1965 to provide space for parking and plant expansion. In 1969 a foundry was constructed on the southwest part of the property. This foundry was expanded to the east in 1978. To the east of the foundry, Wisconsin Public Services has an electric substation. To the north and northeast of the foundry are parking lots paved with a few inches of asphalt. As indicated in Table 1 and Figure 1, the City of Wausau retains title to the part of the filled area adjacent to the Wisconsin River.

SITE HISTORY

The landfill operated from about 1948 to 1955. During this time the landfill received residential, industrial, and commercial wastes from Wausau. People have reported seeing barrels of industrial wastes buried in the landfill (DNR, undated). There is no documentation of the amounts and types of wastes landfilled or the method of landfilling employed. Tires, demolition debris, and miscellaneous wastes were observed along the river bluff south of the landfilled area. The area north of the landfill that is currently occupied by Marathon Electric Company's offices was the site of a sawmill until about 1948 when it was purchased by its present owner.

In 1982, groundwater on the east side of the Wisconsin River was determined to be contaminated. Later it was discovered



LEGEND

APPROXIMATE AREA OF LANDFILL

TOPOGRAPHIC CONTOURS
2' CONTOUR INTERVAL

—P— OVERHEAD POWERLINES

—SS— STORM SEWER

6
1220.2 PIEZOMETER OR MONITORING WELL WITH ELEVATION OF GROUND SURFACE IN FEET MSL

NOTE: Topography from orthophotographic mapping for City of Wausau SE 1/4 Section 23 T29N, R7E prepared by Aero-Metric Engineering, Inc.

N

0 100 200
SCALE IN FEET

FIGURE 2.
Boring Location Plan.

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that well No. 6 (Figure 1), located about one-third mile northeast of the landfill, was contaminated with trichloroethylene (TCE) in the 70 to 260 parts per billion (ppb) range. Monitoring wells around well No. 6 did not detect TCE in significant concentrations. As a result of this observed contamination, potential sources, including the landfill, came under investigation.

ENVIRONMENTAL SETTING

The landfill is located on the west bank of the Wisconsin River. The soils underlying the site are outwash and alluvial sand and gravel. Bedrock underlying the site is Cambrian syenite, a rock type similar to granite with less quartz (La Berge and Meyers, 1983). The bedrock on the east side of the river is a Cambrian age rhyolite. The contact between the syenite and rhyolite is buried beneath the sand and gravel deposits the Wisconsin River valley.

Depth to the rock in the area is variable because of erosion and faulting of the bedrock. Bedrock outcrops were observed to the west of the site and a bedrock topography map based on seismic and drilling data has indicated that a bedrock ridge trending northwest-southeast may exist northeast of the site (Weston, 1985). The depth to rock in the Wisconsin River valley may be as much as 160 feet.

Both the sand and gravel deposits and the bedrock produce potable water in the Wausau area. The water supply for the City of Wausau comes from high-yield wells completed at depths of approximately 100 feet in the sand and gravel along the Wisconsin River. Well locations are shown in Figure 1. This aquifer, forming a strip about 1/2-mile wide along the Wisconsin River, has a maximum potential yield to fully developed wells in the range of 10 to 500 gallons per minute (gpm). From an area just north of the landfill and extending south through Wausau, Rothschild, and Schofield is a wider area with maximum potential yields in the 500 to 1,000 gpm range (Lippet and Hennings, 1981). Recharge to this aquifer is primarily from surface infiltration. Some recharge may also come from the underlying bedrock aquifer.

On either side of the sand and gravel aquifer, the crystalline bedrock is the major aquifer, producing maximum yields of less than 20 gpm. To the west of the landfill about a mile, this maximum yield drops to less than 5 gpm (Lippet and Hennings, 1981).

Groundwater levels in the sand and gravel aquifer appear to be closely related to levels in the Wisconsin River. Fluctuations in the river level are quickly reflected in nearby monitoring wells (Kulibert, personal communication). Water levels in monitoring wells have also been related to pumping from the City of Wausau water supply wells. While monitoring water levels in a well about 1,000 feet south of the water supply well, the Weston-Sper Technical Assistance Team correlated 6- to 12-inch fluctuation in static water levels to pumping that had occurred within the previous hour at city well No. 6 (Weston, 1985).

Figure 3 shows the generalized water table contours, consisting of both the bedrock and sand and gravel aquifers. Just north of the landfill, the contours show that groundwater flow is from the northwest to the river. At the landfill, the flow is due east through the landfill to the river.

FIELD INVESTIGATIONS

Between November 11 and November 14, 1985, six monitoring wells and one piezometer were installed at the locations shown in Figure 2. Drilling was performed by Twin Cities Testing of Wausau. The borings for monitoring wells 1, 2, 3, 4D, and 7 were advanced using 3.25-inch inside diameter hollow stem augers and a CME-45 drill rig. Soil samples were collected with a standard split-spoon sampler according to ASTM D1586 (Appendix B). The split-spoon sampler was washed in trisodium phosphate (TSP) and water between samples and the drill rig and drilling equipment were steam cleaned between each boring.

Borings 4D and 6 were advanced using mud rotary techniques and a CME-55 drill rig. Bentonite mud was used to keep the borehole open and to remove cuttings. Soil samples were collected with a split-spoon sampler in boring 4D every 5 feet from 35 to 45 feet and every 10 feet to the total depth of 106 feet. The sampler was rinsed with TSP and water between samples and the drill rig was steam cleaned prior to drilling each hole. Logs of the borings are in Appendix C.

The dense granular materials encountered in the borings made it impractical to collect undisturbed soil samples. Because of boulders or cobbles encountered at boring locations 1 and 6, the deep borings planned for these locations were not drilled.

During the drilling program, it was necessary to use drilling water from three different sources, because of contamination in local water supplies. Samples of the drilling water were taken to Zimpro Laboratory in Rothschild for analysis (Table 2). Water from all three sources was used for drilling mud in boring 6. Boring 4D was advanced using only water from Lotz Readimix. In the remaining borings, water was only used to hydrate the bentonite pellets and to mix the backfill slurry. The source of water used in these monitoring wells is indicated on the piezometer installation sketches (Appendix C).

EXPLANATION

Elevation of water table, 20-ft. interval Datum is mean sea level

Areas with 40 ft. interval

Probable location of water table

Inferred location of water table

Location of water table unknown, insufficient data

Half interval, 10-ft.

Direction of ground-water movement

Ground-water divide, approximate location

Probable ground-water divide

Federal/state lands

Data have not been field checked.

SOURCE: Lippelt & Hennings, 1981

FIGURE 3.
REGIONAL GROUNDWATER CONTOURS.

TABLE 2
VOC DATA FOR DRILL WATER
(ug/l)

	DETECTION LIMIT	TRIP BLANK	WB-HSA-1	WB-HSA-2	WB-HSA-3	WB-ROT-1	WB-ROT-2	WB-ROT-4
Chloroform	0.1	ND	68.4	0.1	0.1	70.6	0.2	ND
Dibromochloromethane	0.1	ND	0.2	ND	ND	0.2	ND	ND
Dichlorobromomethane	0.1	ND	4.5	ND	ND	4.2	ND	ND
Ethylbenzene	0.2	ND	ND	ND	ND	ND	0.4	ND
Tetrachloroethylene	0.1	ND	0.1	ND	ND	0.1	0.3	0.1
Toluene	0.1	ND	ND	0.4	0.2	0.5	1.2	ND
Trichloroethylene	0.1	ND	1.0	ND	ND	0.4	ND	ND
Vinyl Chloride	0.5	ND	ND	ND	ND	ND	0.7	ND
Dichloromethane	0.1	3.0	ND	ND	ND	ND	ND	ND
WATER SOURCE		Zimpro	Wausau	Lotz	Lotz	Wausau	Weston	Lotz

NOTES: Zimpro = Zimpro Analytical Services in Rothschild, Wisconsin
Wausau = City of Wausau water supply
Lotz = Lotz Readimix, heated water from City of Wausau supply
Weston = City of Weston water supply

Representative samples of each formation encountered were sent for physical analysis. The analyses are described in

Appendix B. The results of the analyses are summarized in Table 3 and the data sheets are in Appendix D.

The monitoring wells were installed with approximately 10 feet of screen below the current water table and 5 feet of screen above the water table to monitor fluctuations of the water table. The piezometer was installed with 5 feet of screen at the bottom of the boring. Well installation sketches are in Appendix C.

At least 100 gallons of water was pumped from each monitoring well. At wells 4D and 6, a volume of water was removed to equal at least five times that used in drilling the hole. The flow from all wells, except 1S, was free of sediment.

RESULTS OF INVESTIGATION

HYDROGEOLOGY

The material removed from the borings was primarily sand that appear to be glacial outwash or alluvial deposits from the Wisconsin River. Profiles through the borings are presented in Figures 4 and 5. Locations of the profiles are shown in Figure 6. The soil ranged from fine sand to coarse sand and gravel. Cobbles and boulders were encountered in borings 1 and 6. These may be colluvial deposits from the granite bedrock or alluvial deposits. The cuttings from the rotary rig at the bottom of boring 6 looked like chips from the granite bedrock, which may indicate that the bottom of this boring was at or near the top of rock.

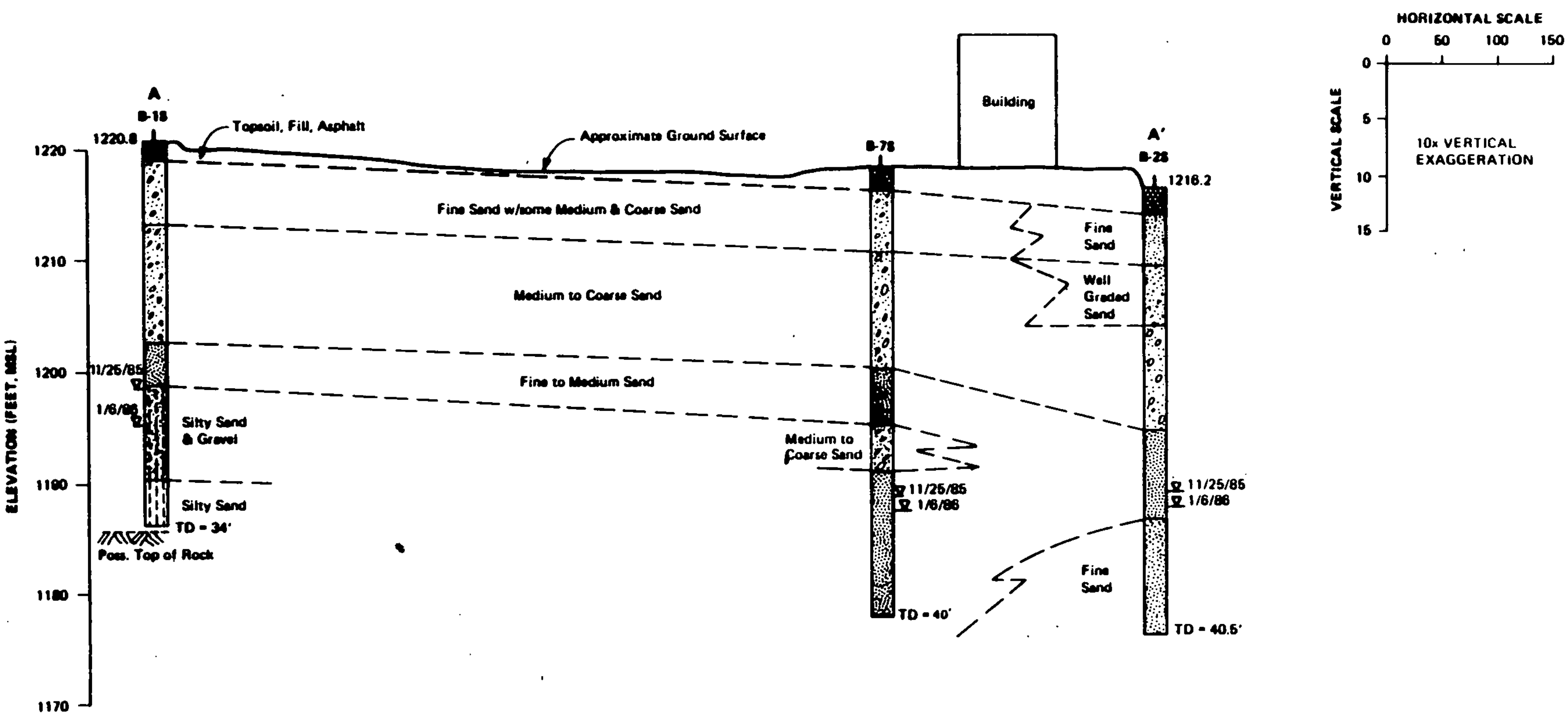
With the exception of the silty sand and gravel in boring 1S, the soils recovered from the boreholes contained less than 5 percent fine material (clay or silt). Most of the samples were poorly graded sand. All of the borings encountered fine to very fine sand near the bottom of the hole. Calculated permeabilities based on the grain size analyses ranged from 7×10^{-2} to 5×10^{-3} centimeters per second, with the poorly graded coarser sand and gravel being near the high end of this range.

Fill was encountered at locations 3 and 4. The fill at location 4 included rubbish and what appeared to be foundry sand.

Based on the groundwater and river level measurements on November 15 and 25, 1985 (Table 4 and Figure 6), it appears that the groundwater generally flows from northwest to southeast toward the river. The gradient to the west of the landfill is much greater than that under the landfill, which may be reflecting the change in transmissivity from the frac-

TABLE 3
MECHANICAL ANALYSES OF SOILS

Boring Number	Sample Number	Depth (feet)	QUANTITY OF MATERIAL IN SAMPLE Gravel	Cse Sand	Med Sand	Fine Sand	Fines	Moisture Content	USCS	Comments
1S	S-3	9.5 to 11	8.7%	16.8%	44.5%	27.4%	2.6%	9.53%	SP	
1S	S-5	19.5 to 21	0.0%	0.2%	45.6%	52.3%	1.7%	14.99%	SP	
1S	S-6	23.5 to 25	25.5%	14.3%	18.7%	17.6%	24.9%	13.87%	GM	Test run with less sample mass than required by ASTM
2S	S-3	9 to 10.5	31.9%	18.0%	36.0%	11.0%	3.1%	6.78%	SW	
3S	S-3	9.5 to 11	32.4%	17.1%	36.0%	9.5%	5.0%	4.45%	SW	
3S	S-4	14.5 to 16	2.1%	3.9%	44.0%	48.0%	2.0%	9.56%	SP	
3S	S-6	24.5 to 26	0.0%	0.0%	21.0%	78.2%	0.8%	5.38%	SP	
4S	S-4	14.5 to 16	9.2%	8.6%	31.2%	48.2%	2.8%	6.97%	SP	
4S	S-5	19.5 to 21	30.1%	16.9%	37.2%	10.6%	5.2%	4.21%	SW	
4D	S-2	39.5 to 41	8.0%	2.0%	52.2%	42.2%	2.8%	17.40%	SP	
4D	S-7	84.5 to 86	0.0%	0.1%	15.9%	80.7%	3.3%	21.59%	SP	
7S	S-5	19.5 to 21	9.6%	15.4%	46.0%	26.4%	2.6%	6.64%	SP	
7S	S-7	29.5 to 31	0.1%	0.3%	35.8%	63.1%	0.7%	19.26%	SP	



NOTE: The depth and thickness of the subsurface strata indicated on the profiles were generalized from and interpolated between the test borings. Information on actual subsurface conditions exists only at the specific locations on the dates sampled. Subsurface conditions at other locations may differ from conditions occuring at these boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

FIGURE 4.
Geologic Profile A-A'

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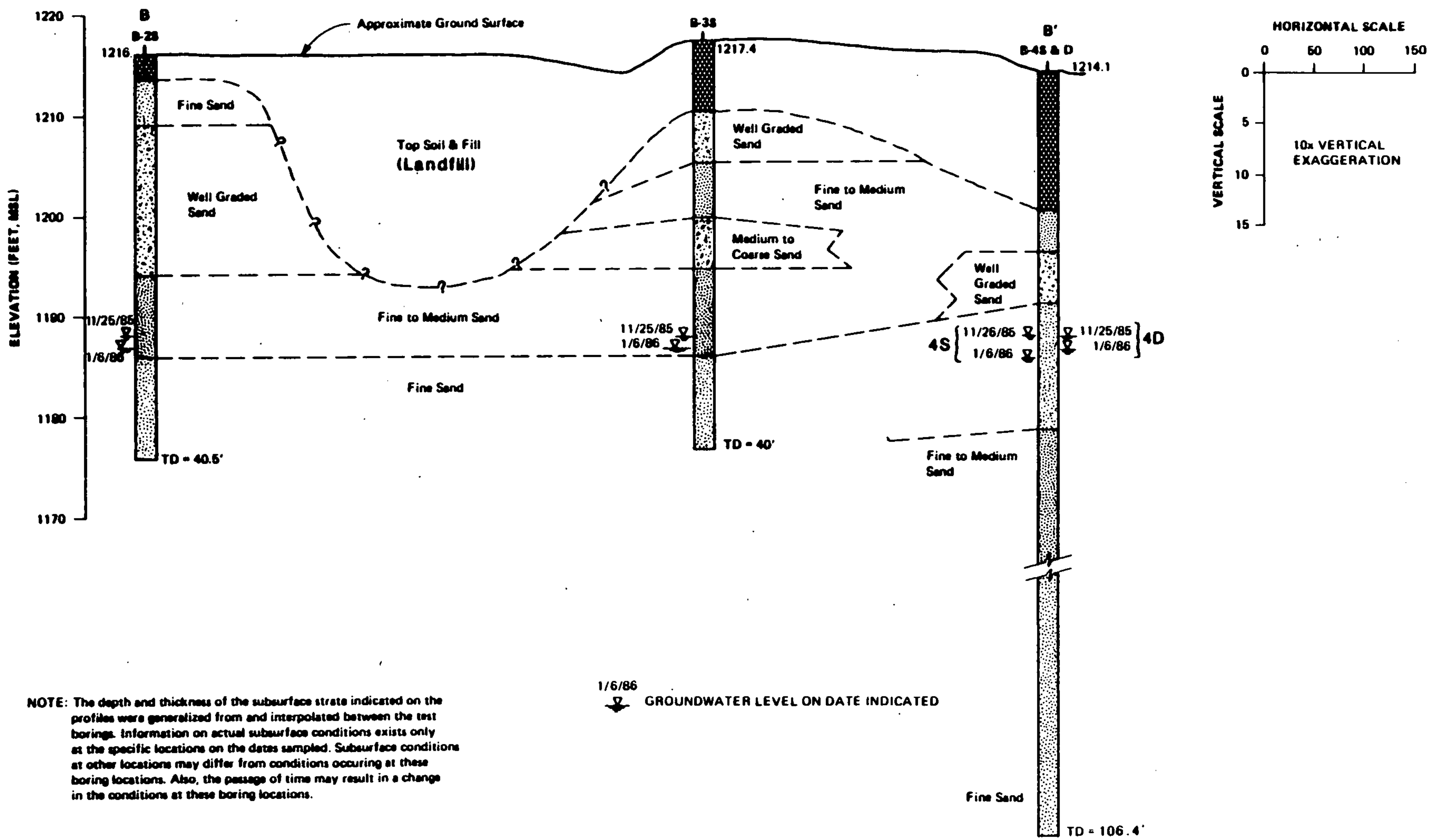

NOTE: The depth and thickness of the subsurface strata indicated on the profiles were generalized from and interpolated between the test borings. Information on actual subsurface conditions exists only at the specific locations on the dates sampled. Subsurface conditions at other locations may differ from conditions occuring at these boring locations. Also, the passage of time may result in a change in the conditions at these boring locations.

1/6/86 GROUNDWATER LEVEL ON DATE INDICATED

FIGURE 5.
Geologic Profile B-B'

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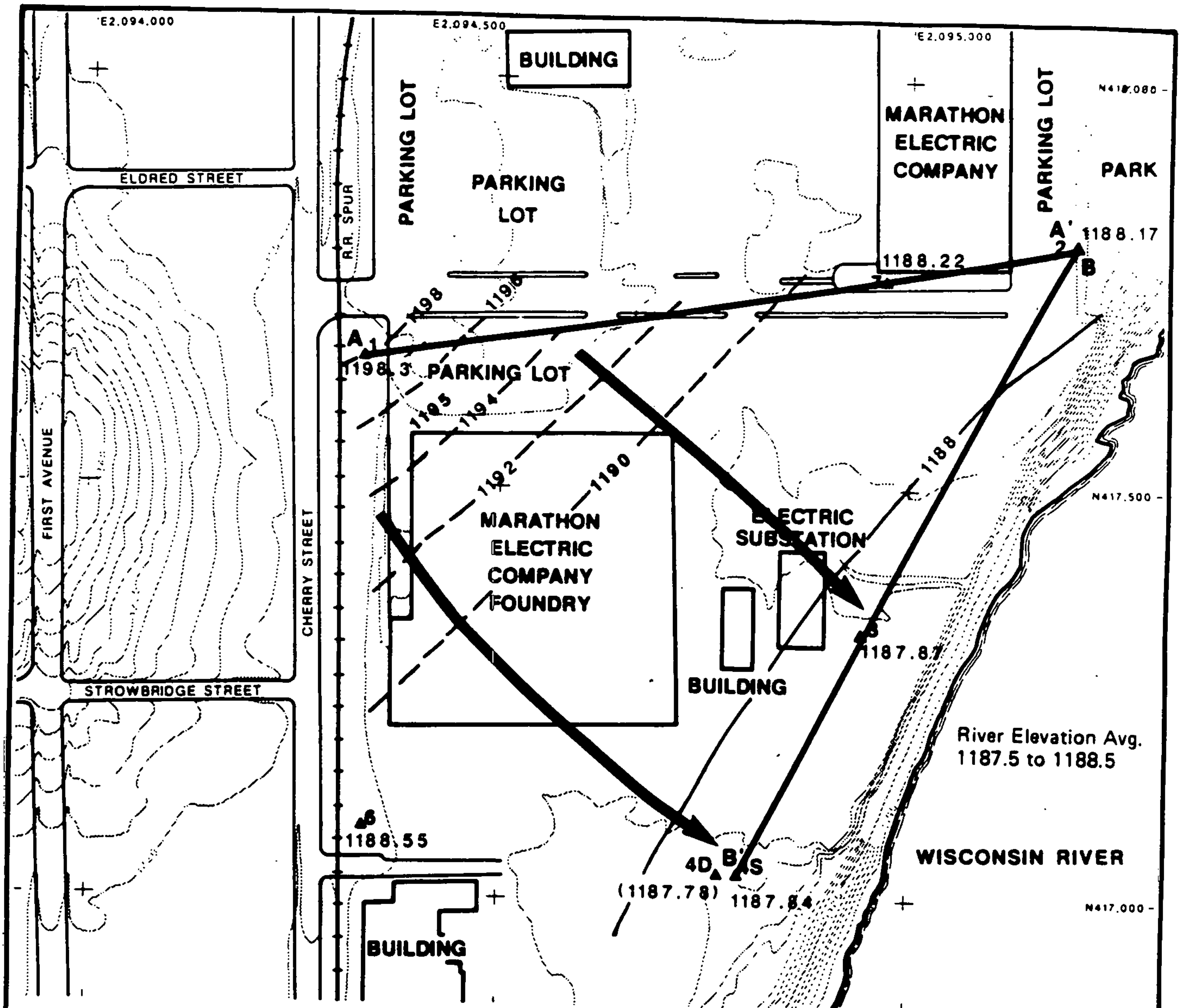
TABLE 4
WATER LEVEL MEASUREMENTS

WELL NUMBER	CASING HEIGHT (feet)	ELEVATION (feet, MSL) TOP OF CASING	TOP OF PVC	TIP OF SCREEN	GROUND SURFACE	WATER DEPTH FROM TOP OF CASING 11/15/85	11/25/85	1/06/86	GROUNDWATER ELEVATION (feet, MSL) 11/15/85	11/25/85	1/06/86
1S	2.9	1223.75	1223.64	1190.9	1220.8	24.42	25.41	28.67	1199.33	1198.34	1195.08
2S	3.1	1219.28	1219.17	1178.3	1216.2	30.23	31.11	32.26	1189.05	1188.17	1187.02
3S	2.9	1220.31	1220.14	1178.5	1217.4	31.41	32.44	33.61	1188.9	1187.87	1186.7
4S	2.8	1216.92	1216.76	1181.9	1214.1	28.50	29.08	31.28	1188.42	1187.84	1185.64
4D	2.6	1216.49	1216.26	1109.4	1213.9	*	28.71	30.11	*	1187.78	1186.38
6S	2.7	1221.89	1221.63	1179.7	1219.2	30.57	33.34	34.72	1191.32	1188.55	1187.17
7S	2.8	1221.01	1220.91	1182.2	1218.2	31.88	32.79	33.80	1189.13	1188.22	1187.21

NOTES:

Refer to Figure 2 for well locations.

* The groundwater level for 4D was not determined on 11/15/85 because the well had not had time to equilibrate after drilling.



LEGEND

1187.64 GROUNDWATER ELEVATION ON NOVEMBER 25, 1985

B B' PROFILE LOCATION

GROUNDWATER FLOW PATH

0 100 200
SCALE IN FEET

FIGURE 6.
Groundwater Contours
November 25, 1985.

tured bedrock aquifer to the sand and gravel aquifer in the river valley. The groundwater and river level measurements on January 6, 1986 (Figure 7), indicate that groundwater flow has a similar direction as in November. On January 6, river water may have been recharging a portion of the aquifer. Such recharge may occur during periods of high river stage. With the snow covered, frozen ground to prevent recharge from the surface, recharge from the river might have been more obvious than in other seasons. It would be necessary to monitor the water levels through at least one year to determine the relationship between the river water levels and the groundwater levels, and to estimate the extent of local river bank recharge which may occur during high river stages. The steep groundwater gradient to the northwest is consistent with the regional contours shown in Figure 3. The only well nest, 4S and 4D, exhibited an upward gradient at the time of the January water level measurements. This may be the result of the upward gradient from regional discharge to the river.

ENVIRONMENTAL MONITORING

Soil samples and drilling water samples were collected during the drilling program. The drilling water was only analyzed for volatile organic compounds (VOC's). The soil samples were analyzed for VOC's and three samples, including two of the suspected foundry sand and one upgradient sample, were analyzed for metals. The results of the drilling water and soils analyses are in Tables 2 and 5, respectively.

On November 25, 1985 and January 6 and 7, 1986, groundwater samples were collected for field analysis of pH, conductivity, and temperature (Table 6), and laboratory analysis of VOC's, COD, hardness, alkalinity, and dissolved iron. Samples from wells 4S, 4D, and 1 were analyzed for phenols, arsenic, barium, cadmium, chromium, lead, selenium, mercury, silver, and hardness. The results of the laboratory analyses are in Tables 7 and 8. Only contaminants that were detected in at least one sample are listed in the tables. Table 9 contains standards, criteria, and guidelines for drinking water that could be compared to the results of the groundwater analyses.

Several of the contaminants detected in the groundwater samples exceeded drinking water standards, criteria, and guidelines. Carbon tetrachloride was detected in the January sample from well 3 at a level that exceeded the Safe Drinking Water Act (SDWA) maximum contaminant levels (MCL) and the U.S. EPA Health Advisory for chronic exposure of a 10-kilogram (kg) individual. It should be noted that carbon tetrachloride was not detected in any of the samples during the November sampling round.

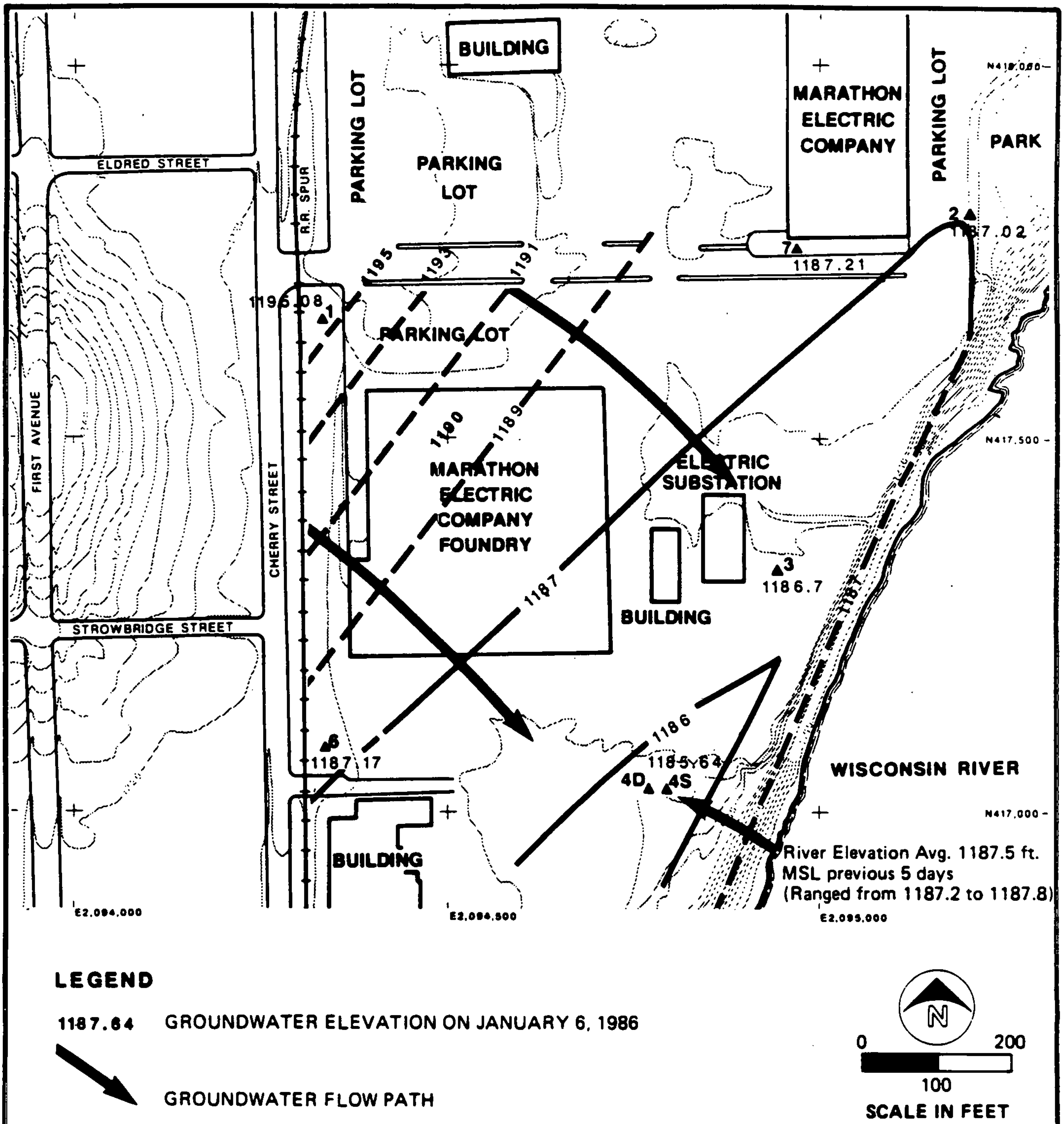


FIGURE 7.
Groundwater Contours
January 6, 1986.

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TABLE 5
SUMMARY OF CHEMICAL ANALYSIS OF SOIL
(ug/g)

	SL-B2-24	SL-HSA-3	SL-HSA-4
Cyanide	<0.11	<0.11	<0.09
Arsenic	1.02	2.16	3.42
Barium	24.2	26.3	24.7
Cadmium	<0.081	<0.077	<0.082
Chromium	2.87	2.15	1.58
Lead	1.73	3.92	6.21
Mercury	<0.008	<0.009	<0.010
Selenium	<0.10	<0.10	<0.10
Silver	0.144	<0.096	<0.102
Total Solids, %	96.18	92.71	84.65
Boring Number	2	4S	4S
Sample Depth	24 to 26.5	14.5 to 16	29.5 to 31

NOTES: Results expressed on a dry weight basis except Total Solids

ug/g = mg/kg = ppm

< = "less than" detection limit which varied with sample size

ARRIVED ON SITE AT 7:40
WEATHER: CLOUDY, 9 DEGREES F

TABLE 6
page 1 of 2
SAMPLING DATA
11/25/85

WELL NUMBER	DEPTH TO WATER * 11/15/85	11/25/85	PURGE VOLUME CALC **	ACTUAL	SAMPLING TIME	pH	CONDUCT. (uMHOS)	TEMP (degree C)
1	24.42	25.41	6.7	5 [1]	11:30	6.37	200	12
2	30.23	31.11	9	9	13:45	6.0	225	12
3	31.41	32.44	7.9	8	15:20	6.0	650	10
4S	28.5	29.08	5.35	6	16:10	6.0	1100	8
4D	28.5	28.71	64.5	70	15:30	6.0	215	10
6	30.57	33.34	9.25	7	15:45	6.0	215	8
7	31.88	32.79	6.9	9	12:40	6.0	135	12

NOTES

* MEASURED FROM TOP OF CASING

**BASED ON 5 WELL VOLUMES FROM WATER LEVEL ON 11/15/85 (gallons)

[1] PURGED TO CONSTANT CONDUCTIVITY

OVA READINGS WERE TAKEN AT ALL WELLS. THE BACKGROUND OVA READING RANGED FROM 1 TO 5 PPM (ODORS FROM THE PLANT MAY HAVE AFFECTED THE READINGS). ALL OF THE WELLS EXCEPT WELL 6, WHICH HAD A READING OF 6 PPM, WERE IN THE 0 TO 5 PPM RANGE.

ARRIVED ON SITE AT 9:20
WEATHER: CLOUDY, 10 DEGREES F
OVERNIGHT: CLEAR, -12 DEGREES F

TABLE 6
page 2 of 2
FIELD SAMPLING DATA
1/06/86

WELL NUMBER	DEPTH TO WATER 11/15/85	DEPTH TO WATER 1/06/86 *	PURGE VOLUME CALC **	PURGE VOLUME ACTUAL	SAMPLING TIME		pH	CONDUCT. (uMHOS)	TEMP (degree C)
1	24.42	28.67	6.7	1.5 [1]	10:10	D	6.95	200	7
2	30.23	32.26	9	9	11:55		6.09 [2]	225	10
3	31.41	33.61	7.9	5.5	14:00		6.27	600	6
4S	28.5	31.28	5.35	5	16:00		6.07 [2]	800	8
4D	28.5	30.11	64.5	65	10:55	D	5.96	250	6
6	30.57	34.72	9.25	10	15:30		6.10 [2]	190	5
7	31.88	33.80	6.9	5	14:15		5.69 [2]	205	8.5
BLANK					10:30	D	6.56	15	6

NOTES

* MEASURED FROM TOP OF CASING

**BASED ON 5 WELL VOLUMES FROM WATER LEVEL ON 11/15/85 (gallons)

[1] PURGED ON 1/06/86 BY PUMPING TWICE UNTIL DRY THEN WAITING FOR RECOVERY

[2] BACKED UP WITH pH PAPER

OVA READINGS WERE TAKEN AT ALL WELLS. THE BACKGROUND OVA READING RANGED FROM 4 TO 5 PPM. ALL OF THE WELLS HAD READINGS WITHIN THE BACKGROUND RANGE.

TABLE 7
CHEMICAL ANALYSES OF GROUNDWATER
NOVEMBER 25, 1985

	DETECTION LIMIT	TRIP BLANK	FIELD BLANK	WELL 1	WELL 2	WELL 3	WELL 4D	WELL 4S	WELL 6	WELL 7
VOCs (ug/l)										
Carbon Tetrachloride	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.1	ND	ND	ND	1.1	66	1.4	ND	ND	0.8
Dibromochloromethane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.3	ND	ND	ND	ND	ND	ND	0.4	ND	ND
1,2-Dichloroethylene	0.3	ND	ND	ND	3.7	ND	1.4	9.3	ND	ND
Dichloromethane	0.2	0.6	0.8	ND	0.5	0.4	0.4	0.6	1.6	1.2
Ethylbenzene	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	0.1	ND	ND	ND	0.4	0.4	0.1	0.5	0.1	ND
Toluene	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.1	ND	ND	ND	ND	2.5	0.3	ND	ND	11.5
Trichloroethylene	0.1	ND	ND	ND	280	6.9	19.7	2.0	ND	10.7
Vinyl Chloride	0.5	ND	ND	ND	ND	ND	ND	2.2	ND	ND
OTHER (mg/l)										
Alkalinity, as Calcium Carbonate	20		ND	56	34	268	66	433	66	39
Hardness, as Calcium Carbonate	1.0		ND	74.1	123.0	491.0	151.0	755.0	61.0	88.0
COD	10		ND	12	ND	17	ND	56	ND	ND
Dissolved Iron	0.004		ND	0.077	0.004	ND	0.212	0.012	0.263	0.005
Barium	0.030		0.044	ND	---	---	ND	0.200	---	---
Lead	0.050		0.285	0.192	---	---	0.122	ND	---	---

NOTES:

ND Analyzed but not detected

--- No analysis performed

TABLE 8
CHEMICAL ANALYSES OF GROUNDWATER
JANUARY 6-7, 1986

	DETECTION LIMIT	TRIP BLANK	FIELD BLANK	WELL 1	WELL 2	WELL 3	WELL 4D	WELL 4S	WELL 6	WELL 7
VOCs (ug/l)										
Carbon Tetrachloride	0.1	ND	ND	ND	ND	98	ND	ND	ND	ND
Chloroform	0.1	ND	ND	ND	1.0	57.8	1.1	ND	0.1	0.9
Dibromochloromethane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichlorobromomethane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.3	ND	ND	ND	ND	ND	ND	0.4	ND	ND
1,2-Dichloroethylene	0.3	ND	ND	ND	3.0	ND	2.5	11.4	ND	ND
Dichloromethane	0.2	ND	0.4	ND	2.0	0.2	ND	0.2	ND	0.2
Ethylbenzene	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	0.1	ND	ND	ND	ND	0.3	ND	1.1	0.1	ND
Toluene	0.1	ND	ND	0.5	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	0.1	ND	ND	ND	2.0	ND	0.1	ND	ND	18.4
Trichloroethylene	0.1	ND	ND	ND	1058	5.0	24.6	2.6	ND	12.7
Vinyl Chloride	0.5	ND	ND	ND	ND	ND	ND	3.5	ND	ND
OTHER (mg/l)										
Alkalinity, as Calcium Carbonate	20		---	39	38	228	58	324	50	35
Hardness, as Calcium Carbonate	1.0		---	36.0	94.0	326.0	143.0	401.0	52.0	98.0
COD	10		---	24	ND	ND	ND	33	ND	ND
Dissolved Iron	0.004		0.007	0.197	0.162	0.074	1.290	0.098	0.101	0.039

NOTES:
ND Analyzed but not detected

--- No analysis performed

Table 9

STANDARDS, CRITERIA AND GUIDELINES FOR DRINKING WATER

(ug/L)

	Wisconsin Groundwater Quality Standards		Safe Drinking Water Act				1980 CWA Ambient Water Criteria Quality (adjusted for drinking water[d])		U.S. EPA Health Advisories[e]			
	Enforcement	Preventive	Primary MCL	Proposed Primary MCL[b]	Final Primary RMCL	Proposed Primary RMCL[c]	Toxicity 10^{-6}	Risk 10^{-6}	1-day 10-kg	10-day 10-kg	Chronic 10-kg	Chronic 70-kg
Carbon Tetrachloride				5	0			0.42	4,000	160	71	500
Chloroform			100[a]					0.19				
1,2-Dichloroethane	0.5	0.05		5	0			0.94	740	740	740	2,600
1,2-Dichloroethene						70			2,720	2,720	1,000	3,500
Dichloromethane	150	15						0.19	13,300	1,500		
Ethylbenzene						680	2,400		21,000	21,000		
Tetrachloroethene	1	0.1						0.8		34,000	1,940	6,800
Toluene	343	68.6				2,000	15,000		18,000	6,000		
1,1,1-Trichloroethane	200	40		200	200		19,000		140,000	35,000	35,000	12,500
Trichloroethene	1.8	0.18		5	0			2.8				
Vinyl Chloride	0.015	0.005		1	0			2	2,600	2,600	13	46

- o Wisconsin Groundwater Quality Standards from Chapter NR140.
- o Safe Drinking Water Act (SDWA) - Primary Interim, Maximum Contaminant Levels (MCL's) - Enforceable drinking water standards not entirely health based.
- o SDWA Proposed Final MCL's - Enforceable drinking water standards proposed currently for volatile organic compounds (VOC's) with other chemicals to follow over time.
- o SDWA Proposed and Final Recommended Maximum Contaminant Levels (RMCL) - Nonenforceable health goals for drinking water set at a level representing "no known or anticipated adverse effects on the health of persons ... allows an adequate margin of safety."
- o SDWA Health Advisories (HA's) - Short-term risk assessments for noncarcinogen end points of toxicity. Considered to be exposure levels which will result in adverse health effects over a specified short time period (1 day, 10 day, longer term).

  EPA has used the 10-day Health Advisory as a factor in decision making for contaminated drinking water incidents.
- o Clean Water Act (CWA) Ambient Water Quality Criteria (AWQC) Adjusted - Criterion to protect human health adjusted to account for drinking water only (excludes fish ingestion).
- o SDWA Secondary MCL's - Welfare based drinking water quality goals.

a) Based on MCL for total trihalomethanes.

b) Proposed November 13, 1985
50FR 46902

c) Proposed November 13, 1985
50FR 46936

d) Adjusted so that drinking water is the only source of contaminant Superfund Public Health Evaluation Manual. U.S. EPA, 1985.

e) From the Office of Water, U.S. EPA.

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The 0.4 ug/L of 1,2-dichloroethane in the samples from well 4S exceeded the State of Wisconsin Groundwater Standard for preventive measures.

The level of tetrachloroethene in the sample taken from well 4S during January exceeded the State of Wisconsin Enforcement standards and the Clean Water Act (CWA) SDWA criteria for the 10^{-6} cancer risk. The criteria in Table 9 have been adjusted to account for drinking the water; the component of the criteria that accounts for consuming fish that live in contaminated water has been removed. The CWA criteria for the 10^{-6} cancer risk is based on a 70-kg individual drinking the contaminated water for 70 years. The state preventive standard for tetrachloroethane was met or exceeded in at least one sample taken from wells 2, 3, 6, and 4D.

The levels of trichloroethylene (TCE) in water from wells 2, 3, 4D, and 7 exceeded all standards, criteria, and guidelines. The levels detected in 4S exceeded the state's preventive standard.

The levels of vinyl chloride detected in well 4S exceeded the CWA criteria for the 10^{-6} cancer risk and the state standards.

ANALYSIS

The analytical results of the groundwater taken from some of the monitoring wells contained the chlorinated volatile compounds TCE, dichloroethylene (DCE), and vinyl chloride. TCE may biodegrade in the anaerobic environment in the subsurface to form the cis and trans isomers of 1,2-dichloroethylene, which may degrade to vinyl chloride (Mackay, et al., 1985).

At concentrations exceeding their solubility in water, compounds with specific gravities greater than water (1.63 for TCE, and 1.46 for DCE) would tend to sink into the aquifer. Further, these compounds would fall vertically in the aquifer, despite horizontal components in groundwater flow (Mackay, et al., 1985). The tendency to sink would be complemented if the dense compound were spilled in a groundwater recharge area, where there would be a downward gradient. Once the compounds are in the subsurface they may degrade and they may go into solution slowly, reducing the contaminant concentration at one point while dispersing the compound and its degradation products with groundwater movement.

The contaminants observed in the monitoring wells were at concentrations greatly below their solubilities in water. The denser contaminants in the groundwater, such as TCE, could be from a variety of sources, including:

- Groundwater moving through the landfill
- Unidentified filled areas
- A large spill in which the immiscible portion sank into the aquifer
- Small spills near or upgradient from the landfill

A large spill could affect groundwater quality if it occurred either near the landfill or some distance away. Further, it could affect groundwater quality for some time as it slowly disperses and is transported with the groundwater.

Vinyl chloride, a degradation product of TCE with a specific gravity of 0.91, was detected in well 4S. The less dense vinyl chloride would not sink into an aquifer, but rather would go into solution and move with the aquifer in a relatively small spill, or would "float" on top of the water table if the amount released exceeded its solubility limit in water. Alternatively, the vinyl chloride could be the result of the degradation of TCE carried in the groundwater to this point, where it may be rising because of its low specific gravity or because of upward groundwater gradients at this discharge point.

As part of this project, manufacturing property ownership within one-half mile of the landfill was investigated to locate other sources of contamination observed at the site. The property boundaries are shown in Figure 1 and the owner and type of business at the property, where known, is noted in Table 1. With the exception of Marathon Electric, it does not appear that there are any businesses upgradient of the landfill that could be contributing to the observed contamination. This does not rule out former businesses in the area, spills along the railroad tracks, or old filled areas. Additional monitoring wells and observation of groundwater levels, well pumping patterns, and river levels over an extended period would be necessary to determine if Marathon Electric is responsible for the observed contaminant levels. With the additional information, it may be difficult to determine if the contamination is due to Marathon Electric, the landfill, or an unknown source.

RECOMMENDATIONS

The monitoring well network detected contaminants on the north side of the landfill. Additional well nests would be needed to determine if the contamination is coming from the landfill, or is coming onto the site from other sources. The well nests should be placed to the north of the Marathon Electric Company property. The nests should include monitoring wells in the top of the water table and at least one deeper piezometer.

To get an accurate feel for the groundwater flow patterns, it would be necessary to monitor groundwater and river levels for at least one year. The flow patterns should be further refined by taking concurrent water level measurements in other monitoring wells on the west side of the Wisconsin River.

Contaminants that have or are leaving the landfill through the groundwater or the storm sewer (Figure 2) may be in the sediments adjacent to the landfill. The contaminants detected in the monitoring wells are of greater density than water and are attracted to organic material as would be found in the sediments. Since the Wisconsin River is dammed south of the site, the slower moving water might have allowed the contaminants to settle into the sediment. The sediment could be adversely affecting aquatic life and surface water quality and should be sampled. Samples should also be collected upstream of the landfill to provide background contaminant levels.

Since the extent and source of the observed contamination have not been identified, applicable remedial actions cannot be identified.

LIMITATIONS

This report has been prepared for exclusive use by the Wisconsin Department of Natural Resources specifically for investigating the release of contaminants from the City of Wausau Landfill. The analyses and recommendations contained in this report are based, in part, on the data obtained from borings. Borings indicate conditions only at specific locations and times, and only to the depths penetrated. They do not necessarily reflect variations that may exist between locations. If variations in subsurface conditions from those described are noted during additional investigations, recommendations in this report may need to be reevaluated.

CH2M HILL is not responsible for any claims, damages, or liability associated with interpretation of subsurface data or reuse of the subsurface data or engineering analyses without the express written authorization of CH2M HILL.

REFERENCES

Department of Natural Resources, undated, Preliminary Assessment Narrative for Marathon Electric, formerly City of Wausau Municipal Landfill Site.

Kulibert, Gary, personal communication to Shara McBee on October 22, 1985.

La Berge, L.G., and E.P. Meyers. "Precambrian Geology of Marathon County, Wisconsin." Wisconsin Geological and Natural History Survey Information Circular Number 45. 1983.

Lippet, I.D. and R.G. Hennings. "Irrigable Lands Inventory--Phase I Groundwater and Related Information." Wisconsin Geological and Natural History Survey Miscellaneous Paper 81-1. 1981.

Mackay, D.M., V. Roberts, and J.A. Cherry. "Transport of Organic Contaminants in Groundwater, in Environ. Sci. Technol. Vol. 19, No. 5, 1985.

Weston-Sper Technical Assistance Team. "Hydrogeological Investigation of Volatile Organic Contamination in Wausau, Wisconsin, Municipal Wells." Prepared for U.S. Environmental Protection Agency. April 1985.

Wisconsin Valley Improvement Co., Wisconsin River Levels at Bridge Street Gauge in Wausau for November 20, 1985 through November 27, 1985 and January 1 through 8, 1986.

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Appendix A
SCOPE OF WORK AND WORK PLAN

Scope of Work
For the Investigation of an Abandoned City of Wausau Landfill

This is the scope of work for the investigation of an abandoned City of Wausau landfill. The landfill is located in the NW¼, SE¼, Section 23, T29N, R7E, City of Wausau, Marathon County. The site is now occupied by Marathon Electric Company and is a parking lot for the firm.

I. Description of Work and Products. The contractor agrees to provide the following to the satisfaction of the Department:

A. Provide consultant services to investigate the contamination of the Wausau water supply by investigating the environmental impact of the abandoned landfill. The consultant will be expected to conduct the investigation, compile an Existing Conditions Report, and submit the report to the Department, using acceptable engineering methods and in conformance with the provisions of NR 180.06(1)(c).

1. The Existing Conditions Report shall include, at a minimum:

a. A plan sheet based upon a recent Department of Transportation air photo indicating the existing buildings, roads, water supplies, property ownership, etc., within a 1/2-mile radius of Marathon Electric.

b. A plan sheet indicating the existing surface features of the area within ¼ mile of the landfill. The plan shall include 2 ft. topographic contours based upon the City of Wausau topographic maps and a minimum scale of one inch = 200 feet. The surface feature plans shall also indicate existing buildings, property boundaries, roads, and water supplies, etc.

In conjunction with the topographic survey, a permanent on-site benchmark shall be installed for vertical and horizontal control. All elevations shall be related to USGS datum, and all monitoring points shall be vertically located to msl to the nearest .01 foot and horizontally to the nearest foot.

c. Two plan sheets showing geologic cross sections passing through the borings, indicating topography, boring locations, soils, bedrock, and stabilized groundwater level readings.

d. A plan sheet indicating groundwater contours and vertical gradients, superimposed on the topographic survey indicated in I.A.1b.

e. Plan sheets showing cross sections (two north/south, two east/west) passing through the borings (or based upon geophysical investigation using the recommended technique to illustrate the existing topography, boring locations, soils, bedrock, water level readings and waste disposal areas.

f. A result and discussion section discussing the extent of contamination, the potential for further degradation of the groundwater, the potential source of the contamination, additional work required, and the need for and type of remedial action indicated.

g. An appendix containing all raw data such as boring logs, well logs, soil tests, water level and groundwater quality measurements, laboratory quality assurance data, atc.

h. Ten copies of the report shall be provided to the Department's North Central District Office.

B. The consultant may be called upon for legal testimony in a court of law.

C. Field Investigations.

1. Prior to beginning the field investigation an organizational meeting shall be held between the consultant and Department personnel to clarify all issues related to the project.

2. Perform a geophysical survey of the area comprising the adjacent abandoned landfill using resistivity or another technique recommended by the consultant and approved by the Department. The purpose of the survey will be to identify soils, water levels, contaminant plumes, fill or waste disposal areas, and provide guidance for location of the soil borings and monitoring well installations.

3. Soil borings shall be performed to define soil, groundwater conditions and, where appropriate, bedrock depth.

The purpose for the borings and well installations is to assess the level of contamination by volatile organic compounds. Drilling methods and materials shall be utilized which allow for a VOC and inorganic chemical determination of the soil and groundwater.

a. A total of 6 borings will be required, three to a depth of 40 feet below the groundwater table and one boring to bedrock. These borings will be used for the installation of 6 monitoring wells.

b. Soil samples shall be collected from the borings, well installations, and piezometers using standard undisturbed soil sampling technique. Soil samples shall be collected at a maximum of every five feet and at the surface of any soil layer encountered.

c. Soils shall be classified according to the unified soil classification system, using a grain size distribution and mechanical and hydrometer analysis.

d. All soil samples shall be preserved for possible future analysis of volatile organic chemicals (VOCs).

e. Boring logs for each boring shall be provided, with special note made of appearance and odor of each sample.

4. Monitoring Well/Piezometer Installation.

a. A total of 6 monitoring wells and 3 piezometers shall be installed at locations approved by the Department.

b. Construction of the wells and piezometers shall conform to the Department's draft monitoring well installation guidelines.

c. Monitoring wells will utilize a 15-foot screen, 10 feet placed into the groundwater and 5 feet above.

d. Piezometers will utilize a five-foot well screen, scaled just above the bedrock.

e. Selected soil samples obtained during the piezometer installation may be analyzed for VOCs. Samples shall be collected every five feet and at any soil layer encountered. All samples will be preserved for future VOC analysis.

f. All wells and piezometers shall be properly developed, and the development procedures shall be documented.

g. Well construction logs shall be provided for each well. The top of each well casing shall be surveyed to msl datum.

5. Environmental Monitoring.

a. All soil and groundwater quality analysis shall be done using EPA Standard Methods. Quality control and assurance data (including the results of the trip blanks, duplicate analysis, and spiked recovery analysis and detection limits) shall be provided for all analyses.

b. Eighteen soil samples (to be selected by the Department with consultants advice) shall be analyzed for volatile organic carbon compounds. The analysis of additional soil samples may be requested.

c. Three sets of groundwater samples shall be obtained from each monitoring point and analyzed for VOCs, pH, temperature, conductivity, COD, hardness, alkalinity, and dissolved iron. The three sets of samples shall be taken 14 days apart. The Department shall be notified of the sampling and provided with the opportunity to obtain split samples.

II. Department Support

A. The Department shall assign a project manager to serve as the official representative of the Department and to resolve, in writing, any problems or policy issues.

B. The Department shall be responsible for all public information activities associated with the project.

II. SCOPE OF SERVICES

This scope of work sets forth the requirements for developing an assessment of the environmental impacts associated with the abandoned City of Wausau landvill located in Section 23, T29N, RO7E, City of Wausau, Marathon County.

(I) Consultant Responsibilities: The Consultant agrees to provide the services necessary to adequately investigate the environmental impacts of the abandoned City of Wausau landfill. The Consultant will be required to conduct the investigation, compile the information into an Existing Conditions Report, and submit 8 copies of the report to the North Central District Office located in Rhinelander and 2 copies to Bureau of Solid Waste Management in Madison. This report shall be prepared using currently accepted hydrogeologic and engineering methods and shall be in conformance with the provisions of NR 180.06(1)(c).

(A) The On-Site Field Investigation shall include:

(1) Prior to beginning the field investigation organizational meetings shall be held between the Consultant and Department personnel to clarify all issues related to the project.

(2) Site Survey

(a) An existing site conditions plan sheet shall be prepared A permanent on-site benchmark shall be established for both vertical and horizontal control, and all elevations shall be related to U. S. Geological Survey Datum. The plan sheet shall indicate the locations of the study area, site boundaries, property boundaries, filled areas, buildings, water supply wells, above and below ground utilities, man-made features, surface waters, soil borings, groundwater monitoring wells, and other pertinent information. The plan sheet shall also include a 100 foot survey grid and north arrow.

(3) Soil Borings

(a) The Consultant shall perform 9 soil borings to define the soil, bedrock and groundwater conditions at the site. The locations of the borings must be approved by the project manager prior to installation. The 9 soil borings will also be used to install monitoring wells and piezometers.

(b) Where soil conditions permit, soil samples shall be collected utilizing standard undisturbed soil sampling techniques. Samples shall not be composited for testing purposes. Soil samples shall be collected from each soil layer encountered and at maximum 5-foot intervals. All soil samples shall be described.

(c) Boring logs shall be recorded for all borings. Each log shall include soil and rock descriptions and method of sampling, sample depth, date of boring, water level measurements and dates, and soil test data. All elevations shall be corrected to USGS datum.

(d) For each major soil layer encountered, a soil sample shall be analyzed for grain size distribution (mechanical and/or hydrometer as appropriate to the soil type) and classified according to the unified soil classification system.

(4) Monitoring Wells and Piezometer Nests

(a) The Consultant shall install 6 monitoring wells and 3 piezometers. The locations of the wells must be approved by the project manager prior to installation.

(b) Monitoring wells will utilize a 15-foot screen, 10 feet placed into the groundwater and 5 feet above.

(c) Piezometers will utilize a five-foot well screen, the bottom of the screen should be just above bedrock.

(d) All wells and piezometers shall be properly developed, and the development procedures shall be documented.

(e) The construction of each well shall be recorded on logs. Well log information shall include the elevations of the pipe top, ground surface, bottom of the boring, well seals and screened interval, and a description of the well construction materials. For each well, the Department's Groundwater Monitoring Well Information Form (Form 4400-89) shall be completed.

(f) The installation of each well shall conform to the standards set forth in the Department's Bureau of Solid Waste Management document titled Guidelines for Monitoring Well Installation (April 1985).

(5) Environmental Monitoring

(a) The consultant shall collect and analyze 18 soil samples to determine the concentrations of volatile organic carbon compounds.

(b) All soil sample results shall be in units of mg/kg on a dry weight basis.

(c) The method of collecting the soil samples and the locations shall be determined by the project manager prior to commencing work.

(d) The consultant shall collect and analyze 2 sets of groundwater samples to determine the concentrations of the following constituents: VOC's, ph, COD, temperature, conductivity, hardness, alkalinity, dissolved iron. The second set of groundwater samples shall be collected 30 days after the first round is collected. In the second round of groundwater quality samples the complete volatile organic compound scan will not be required. A maximum of 5 specific compounds will be identified for analysis based on the results of the first round VOC scan.

(e) The method of collecting the groundwater samples and sample collection internval shall be determined by the project manager prior to commencing work.

(B) The Existing Conditions Report shall include:

(1) Summary Section

(a) The nature and extent of contamination at the site should be described in a way that establishes a framework for determining remedial objectives and defines criteria for selecting remedial objectives and defines criteria for selecting remedial action alternatives.

(b) A discussion of the potential for further envirionmental impact as indicated by the monitoring results.

(c) A description or tabulation of the relevant environmental criteria and standards that form the need for remedial action.

(d) A discussion of the remedial action alternatives with clear statements of their advantages and disadvantages. At the end of this comparative analysis, the recommended remedial action should be identified and the reason for its selection given.

(2) Plan Sheets Section

(a) An existing site conditions plan sheet as required by A.1.a. of this contract.

(b) A minimum of 4 geologic cross-sections passing through all borings that illustrate existing topography, soil borings, soil classification and other properties, interpreted soil stratigraphy, bedrock, monitoring wells, and stabilized water level readings.

(c) A water table map based on stabilized water level readings. The existing site conditions plan shall be used as a base for this map.

(d) A plan sheet based upon a recent Department of Transportation air photo indicating the existing buildings, roads, water supplies, property ownership, etc., within a 1/2 mile radius of Marathon Electric.

(3) Technical Data Section

(a) All technical data such as boring logs, well logs, soil tests, water level measurements, soil and groundwater analysis, horizontal and vertical groundwater gradients, laboratory quality assurance data, etc.

(II) State of Wisconsin Responsibilities: The State of Wisconsin through the Department of Natural Resources agrees to provide the following support:

(A) The Department will assign a project manager to serve as the official representative of the Department, and who will resolve in writing any problems or policy and procedure issues.

(B) The Department will be responsible for all public information activities associated with the project.

(III) Consultant's Compensation. For services requested above, the Consultant shall be paid on a time and material basis using the rate schedule shown below. Total payments to the Consultant shall not exceed $45,690 without prior written approval.

Rate Schedule

Employee Time	2.9 times actual salary
Mileage	21.5¢ per mile
Subcontractors	at cost
Meals and Lodging	at cost
Other Direct Project Costs	at cost

All requests for payment must include proper backup material to substantiate the amount requested. Fee amounts are to be itemized by employee or classification as applicable. Reimbursable expenses must be supported by copies of invoices, statements or other office records.

9/13/85

ATTACHMENT A

INTRODUCTION

On August 21, 1985, the Wisconsin Department of Natural Resources (WDNR) requested that CH2M HILL prepare a cost estimate for a limited investigation of the City of Wausau Landfill located under a parking lot owned by Marathon Electric Company. The scope of work prepared by the WDNR is included in Appendix A.

In this work plan, the tasks outlined by WDNR are further defined and a cost estimate is provided. CH2M HILL has reorganized the tasks as follows:

Task 1-Assemble Project Team
Task 2-Evaluate Existing Data
Task 3-Prepare Health and Safety Plan
Task 4-Hydrogeologic Investigation
Task 5-Environmental Monitoring
Task 6-Report Preparation

The following sections provide further definition of these tasks and budgets for each task.

OBJECTIVES

The primary objectives of this investigation are to:

- Determine, within the scope specified by the WDNR, the potential for and types of contaminants that may be leaving the City of Wausau Landfill, the extent of any existing contamination, and the potential for contamination of the Wausau water supply.

- Identify potential remedial actions that might be required at this site.

- Evaluate the need for additional investigations based on existing data and data generated by this investigation.

All tasks and subtasks are directed toward accomplishment of these objectives.

SITE INVESTIGATION

TASK 1-ASSEMBLE PROJECT TEAM

This task provides time for coordination between the WDNR and CH2M HILL in meetings, meeting preparation, and telephone conferences. The estimated budget allows for 2 people to attend 3 meetings with the WDNR. In one of these meetings, the boring lo ation plan and monitoring well installation details will be de mined by CH2M HILL and WDNR. One meeting was budgeted for a p to Wausau and the other two meetings were budgeted for tr s to Madison. An additional three mandays were budgeted fc meeting preparation and telephone conferences.

TASK 2-EVALUATE EXISTING DATA

To most efficiently execute this investigation, it will be necessary to obtain available information concerning the landfill, its operating history, its environmental setting, and documented contamination. This information will be requested from the WDNR offices in Madison and Rhinelander and from the City of Wausau. During this task, a topographic map of the site will be obtained from the City of Wausau and aerial photography will be obtained from the Wisconsin Department of Transportation.

The budget for this task allows one data collection trip to Wausau and Rhinelander. Also budgeted are five days to evaluate the data and summarize the site history and environmental setting.

TASK 3-PREPARE HEALTH AND SAFETY PLAN

A health and safety assessment will be conducted to determine if the site has potentially hazardous chemical exposure levels in the air or dangerous physical features. The resultant information will be used to select and implement adequate warnings and safeguards for investigators or other onsite visitors. All available site information will be examined to select possible sources of hazardous air emissions and potentially hazardous areas. A site visit will be conducted in conjunction with the data gathering trip to Wausau.

The health and safety assessment will be used to develop a site health and safety plan that will specify the field monitoring to be performed and the protective gear to be worn by site investigators and visitors. The plan will focus on the use of personal protective equipment to minimize exposure to hazardous materials through inhalation or direct contact when performing work on or near the site.

TASK 4-HYDROGEOLOGIC INVESTIGATION

The hydrogeologic investigation will be conducted to:

- Identify the horizontal and vertical extent of groundwater contamination to the detail allowed by the limits of the scope of this investigation

- o Acquire geologic, hydrogeologic and analytical data sufficient for a general assessment of potential future groundwater contamination

- o Gather data that will assist in determining potential remedial actions

- o Determine the scope and need for additional hydrogeologic investigations

The hydrogeologic investigation has been divided into the following subtasks:

Subtask 4.1-Install Groundwater Monitoring System
Subtask 4.2-Surveying
Subtask 4.3-Monitor Groundwater Levels
Subtask 4.4-Analysis of Hydrogeologic Data

Subtask 4.1-Install Groundwater Monitoring System

The purpose of this subtask is to drill borings, sample soil and install monitoring wells and piezometers. The locations for the monitoring wells and piezometers will be determined by CH2M HILL and the WDNR after additional site data have been obtained (Task 2). The monitoring wells and piezometers will be constructed according to the WDNR's draft monitoring well installation guidelines, unless variances from these guidelines are requested of and approved by the WDNR.

A total of six monitoring wells and three piezometers will be installed. For the purposes of this proposal, it was assumed that the three piezometers will be installed in bedrock at a depth of 100 feet, and the six monitoring wells will be installed 10 feet below the water table (assumed to be 15 feet below the ground surface). Soil samples will be collected in all borings at 5-foot intervals and five feet of rock core will be recovered from the three deep borings. This will result in an estimated 450 feet of drilling with standard penetration testing, 15 feet of rock drilling, and 450 feet of monitoring well or piezometer installation.

Borings will be logged by a geologist or hydrogeologist. Soil samples will be preserved for index testing. The index testing may include grain size distribution or Atterberg limits tests. For this cost estimate, it has been assumed that 10 Atterberg limits and 15 grain size analyses will be performed.

After the monitoring wells and piezometers have been installed, they will be developed by surging, overpumping, or airlifting to establish good hydraulic connection with the surrounding soil. Once the wells have been fully developed, aquifer response tests may be performed to obtain in situ measurements of aquifer hydraulic conductivity.

Subtask 4.2-Surveying

A permanent on-site benchmark will be established to provide horizontal and vertical control of monitoring locations. The elevation will be related to USGS datum.

Once all the monitoring wells are properly installed, their locations and elevations will be surveyed. Vertical elevations will be obtained to the nearest 0.01 foot for the top of riser, top of protective casing, and ground surface at each well.

Subtask 4.3-Monitor Groundwater Levels

The water level monitoring program will define water table gradients in the vicinity of the landfill and assess surface water and groundwater relationships. Water levels will be measured form the top of the standpipe using a steel tape, stainless steel popper, or an electric water level indicator. Measurements will be made to the nearest 0.01 foot. Groundwater and surface water level measurements will be taken at the time that the two sets of water quality samples are collected (Task 5). Travel expenses are included with those for Task 5.

Subtask 4.4-Analysis of Hydrogeologic Data

This subtask will be performed to compile and analyze the data from this investigation and other investigations that could provide insight to the hydrogeology and potential for contaminant migration from this landfill. Two north-south cross sections and two east-west cross sections will be prepared during this subtask. The direction(s) of groundwater flow will be analyzed to the extent allowed by this investigation.

TASK 5-ENVIRONMENTAL MONITORING

Groundwater samples will be collected twice from each of the monitoring wells and piezometers for field or laboratory analysis. the first round of samples will be analyzed for VOC's, pH, temperature,conductivity, COD, hardness, alkalinity, and dissolved iron. The second round of sampling will occur 30 days after the first round. Analyses will be the same except that a maximum of 5 specific compounds will be selected for analysis rather than all VOC's.

Eighteen of the soil samples collected from the soil borings will be selected by the WDNR with recommendations from CH2M HILL to be analyzed for VOC's.

The samples will likely be sent to Zimpro of Rothschild, WI for analysis. The sampling program described above will result in

18 groundwater samples plus 2 blank samples and 2 duplicate samples for a total of 22 groundwater samples. Eighteen soil samples plus 2 duplicates and 1 blank sample will be submitted for a total of 21 soil samples.

TASK 6-REPORT PREPARATION

The findings of this investigation will be summarized in a report of existing site conditions. This report will follow the requirements of the scope of work prepared by the WDNR and any additional items that are required to adequately present the data generated in this investigation. The report will include a section discussing the extent of contamination, the potential for degradation of the groundwater, an analysis of the landfill as a potential source of contamination, recommendations for additional work, and potential remedial actions for the site.

Raw data generated during the investigation will be included in appendices to the report. Eight copies of the report will be provided to the WDNR's North Central District Office in Rhinelander and 2 copies will be provided to the Bureau of Solid Waste Management in Madison.

PROJECT COST

The estimated coat to complete this project is broken down in Table 1. The assumptions used to arrive at this estimate were stated in the previous discussion. If a task or subtask appears to be going over budget or if CH2M HILL feels that the scope change is necessary to meet the objectives of this investigation, the WDNR's project manager will be contacted for a resolution of the matter in question.

Appendix B
DESCRIPTION OF FIELD METHOD

DESCRIPTION OF FIELD AND LABORATORY METHODS

Standard Penetration Test

Representative samples of materials encountered in the borings were obtained at 5-foot intervals with a standard 2-inch outside diameter split-spoon sampler, following the requirements of the Standard Penetration Test (ASTM D 1586). This test is used to characterize the consistency or density of in-place soil by measuring the penetration resistance expressed as "blow counts". The blow count is the number of blows required to advance a standard split-spoon sampler 6 inches with a 140-pound hammer falling 30 inches. The sampler is driven 18 inches, and the blow count is recorded for each 6-inch increment. The sum of the second and third increments is referred to as the N-value. Low N-values indicate soft or loose deposits, while high N-values are indictive of hard or dense materials. After the sampler has been driven and the blow counts recorded, the sampler is withdrawn from the boring to recover a disturbed soil sample.

Soil samples were examined in the field and visually classified in approximate accordance with the visual-manual proceedure for description of soils (ASTM D2488). Sampling intervals and classification of soil samples are presented in the boring logs. Field soil boring logs were revised as necessary based on laboratory testing and office examination.

Natural Water Contents

The moisture content of the soil at the time of sampling is determined in the laboratory in general accordance with ASTM D 2216.

Grain Size Analyses

Grain size analyses are performed to help classify the soil and to determine the suitability of lthe soil for use as backfill material. Grain size distriabutions are determined by sieve analysis and hydrometer analysis in approximate accoardance with ASTM D 422. The percent of soil material finer than the No. 200 sieve is determined in approximate accordance with ASTM D 1140.

Appendix C
BORING LOGS AND PIEZOMETER INSTALLATION SKETCHES

BORING AND TEST PIT LOG LEGEND:

SAMPLE TYPE:

- B - BAG SAMPLE
- J - JAR SAMPLE
- S - SPLIT BARREL (ASTM D1586 UNLESS OTHERWISE NOTED)
- W - WASH SAMPLE
- ST - SHELBY TUBE
- OT - OSTERBERG TUBE
- NX - DIAMOND CORE BARREL

STANDARD PENETRATION TEST:

6"-6"-6" - THE NUMBER OF BLOWS FOR THREE 6-INCH INCREMENTS REQUIRED FROM A 140-LB HAMMER FALLING 30 INCHES TO DRIVE A STANDARD 2-INCH O.D. SPLIT-BARREL SAMPLER (ASTM D1586)

(N) - THE SUM OF BLOWS FOR THE SECOND AND THIRD 6-INCH INCREMENTS

NOTES:

1. THE BORING AND/OR TEST PIT LOGS AND RELATED INFORMATION DEPICT SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC LOCATIONS AND DATES INDICATED. SOIL CONDITIONS AND WATER LEVELS AT OTHER LOCATIONS MAY DIFFER FROM CONDITIONS OCCURRING AT THESE BORING AND/OR TEST PIT LOCATIONS. ALSO, THE PASSAGE OF TIME MAY RESULT IN A CHANGE IN THE CONDITIONS AT THESE LOCATIONS.

2. BORINGS AND/OR TEST PITS WERE LOGGED IN THE FIELD BY A CH2M HILL ENGINEERING GEOLOGIST OR GEOTECHNICAL ENGINEER. SAMPLES WERE EXAMINED AND VISUALLY CLASSIFIED IN APPROXIMATE ACCORDANCE WITH ASTM D2488.

BORING AND TEST PIT LOG LEGEND

CH2M HILL

RECEIVED
Wis. Dept. of Natural Resources

DEC 30 1985

N. C. Dist. Hdqtrs.
RHINELANDER, WI

December 24, 1985

Gary--

We just received the Zimpro data, so I thought that I would send it for your information. I couldn't remember if I sent you the boring logs, so copies are included, along with well installation sketches and form 4400. The Guidelines for Monitoring Well Installation did not indicate which DNR office should receive the form 4400, so contact me if it needs to be sent to a different office.

Shara

ZIMPRO INC.
A SUBSIDIARY OF STERLING DRUG INC.
POLLUTION CONTROL SYSTEMS

RECEIVED
DEC 23 1985
CH2M HILL-GLO

December 18, 1985

Ms. Shara Mount McBee
CH2M Hill
310 W. Wisconsin Ave.
Suite 700
P.O. Box 2090
Milwaukee, WI 53201

Dear Shara:

Attached are the results for the samples taken during the month of November in the Wausau area.

The VOC analysis was done according to EPA Method 601, a purge and trap/gas chromatographic method using PID (9.5 eV) and Hall detectors in series for detection and quantitation.

The soil samples analyzed for VOC's were done according to the low level method for soil/sediment samples. This involves taking a weighed portion of soil, adding a specific amount of reagent water to it and analyzing by EPA Method 601 as for the water samples.

The VOC results for the water samples appear in Tables 1, 2, 4, 5, and 6 and are expressed in ug/l. Table 3 contains the VOC results for the soil samples, results are based on the dry weight of the soil and expressed in ng/g.

Analysis of alkalinity, hardness, COD, cyanide and phenols were done in accordance with EPA methods. Arsenic and selenium were done by furnace AA and mercury by cold-vapor AA methods. All other metals were analyzed by ICP emission spectroscopy. Results for the soil biomass (Table 7) are expressed in ug/g on a dry weight basis. Detection limits vary slightly for the soil samples because the sample size varied.

MILITARY ROAD
ROTHSCHILD, WISCONSIN 54474
TELEPHONE (715) 359-7211 TELEX 29-0495

Ms. Shara Mount McBee
December 18, 1985
Page 2

Results for the water samples (Table 8) are expressed in mg/l.

If you have any questions, please call.

Sincerely,

ZIMPRO INC.

Mary C. Christie-Heuser

Mary C. Christie-Heuser
Instrumentation Chemist

MCCH/ls

cc: J.W. Barr
J.R. Salkowski

Table 1
CH_2M Hill
VOC Analysis (ug/l)
November 12, 1985

	Detection Limit	WB-HSA-1	WB-ROT-1	WB-HSA-2
Benzene	Ø.2	X	X	X
Bromoform	Ø.5	X	X	X
Bromomethane	1.Ø	X	X	X
Carbon Tetrachloride	Ø.1	X	X	X
Chlorobenzene	Ø.1	X	X	X
Chloroethane	1.Ø	X	X	X
2-Chloroethylvinyl Ether	2.Ø	X	X	X
Chloroform	Ø.1	68.4	7Ø.6	Ø.1
Chloromethane	6.Ø	X	X	X
Dibromochloromethane	Ø.1	Ø.2	Ø.2	X
1,2-Dichlorobenzene	Ø.3	X	X	X
1,3-Dichlorobenzene	Ø.3	X	X	X
1,4-Dichlorobenzene	Ø.3	X	X	X
Dichlorobromomethane	Ø.1	4.5	4.2	X
1,1-Dichloroethane	Ø.1	X	X	X
1,2-Dichloroethane	Ø.3	X	X	X
1,1-Dichloroethylene	Ø.5	X	X	X
1,2-Dichloroethylene	Ø.3	X	X	X
Dichloromethane	Ø.2	X	X	X
1,2-Dichloropropane	Ø.5	X	X	X
cis-1,3-Dichloropropene	Ø.3	X	X	X
trans-1,3-Dichloropropene	1.Ø	X	X	X
Ethylbenzene	Ø.2	X	X	X
1,1,2,2-Tetrachloroethane	Ø.1	X	X	X
Tetrachloroethylene	Ø.1	Ø.1	Ø.1	X
Toluene	Ø.1	X	Ø.5	Ø.4
1,1,1-Trichloroethane	Ø.1	X	X	X
1,1,2-Trichloroethane	Ø.1	X	X	X
Trichloroethylene	Ø.1	1.Ø	Ø.4	X
Vinyl Chloride	Ø.5	X	X	X
Zimpro Analytical No.		14932	14933	14939

X = Analyzed but not detected

Table 2
CH2M Hill
VOC Analysis (ug/l)
November 14, 1985

	Detection Limit	WB-HSA-3	WB-ROT-2	WB-ROT-4
Benzene	Ø.2	X	X	X
Bromoform	Ø.5	X	X	X
Bromomethane	1.Ø	X	X	X
Carbon Tetrachloride	Ø.1	X	X	X
Chlorobenzene	Ø.1	X	X	X
Chloroethane	1.Ø	X	X	X
2-Chloroethylvinyl Ether	2.Ø	X	X	X
Chloroform	Ø.1	Ø.1	Ø.2	X
Chloromethane	6.Ø	X	X	X
Dibromochloromethane	Ø.1	X	X	X
1,2-Dichlorobenzene	Ø.3	X	X	X
1,3-Dichlorobenzene	Ø.3	X	X	X
1,4-Dichlorobenzene	Ø.3	X	X	X
Dichlorobromomethane	Ø.1	X	X	X
1,1-Dichloroethane	Ø.1	X	X	X
1,2-Dichloroethane	Ø.3	X	X	X
1,1-Dichloroethylene	Ø.5	X	X	X
1,2-Dichloroethylene	Ø.3	X	X	X
Dichloromethane	Ø.2	X	X	X
1,2-Dichloropropane	Ø.5	X	X	X
cis-1,3-Dichloropropene	Ø.3	X	X	X
trans-1,3-Dichloropropene	1.Ø	X	X	X
Ethylbenzene	Ø.2	X	Ø.4	X
1,1,2,2-Tetrachloroethane	Ø.1	X	X	X
Tetrachloroethylene	Ø.1	X	Ø.3	Ø.1
Toluene	Ø.1	Ø.2	1.2	X
1,1,1-Trichloroethane	Ø.1	X	X	X
1,1,2-Trichloroethane	Ø.1	X	X	X
Trichloroethylene	Ø.1	X	X	X
Vinyl Chloride	Ø.5	X	Ø.7	X
Zimpro Analytical No.		14983	14984	14985

X = Analyzed but not detected

Table 3
CH2M Hill
Soils
VOC Analysis (ng/g)
November 19, 1985

	Detection Limit	SL-B2-24	SL-B4S-34	SL-HSA-2	SL-HSA-3	SL-HSA-4
Benzene	0.8	X	X	X	X	X
Bromoform	2.0	X	X	X	X	X
Bromomethane	4.0	X	X	X	X	X
Carbon Tetrachloride	0.4	X	X	X	X	X
Chlorobenzene	0.4	X	X	X	X	X
Chloroethane	4.0	X	X	X	X	X
2-Chloroethylvinyl Ether	8.0	X	X	X	X	X
Chloroform	0.4	X	X	X	X	X
Chloromethane	24.0	X	X	X	X	X
Dibromochloromethane	0.4	X	X	X	X	X
1,2-Dichlorobenzene	1.2	X	X	X	X	X
1,3-Dichlorobenzene	1.2	X	X	X	X	X
1,4-Dichlorobenzene	1.2	X	X	X	X	X
Dichlorobromomethane	0.4	X	X	X	X	X
1,1-Dichloroethane	0.4	X	X	X	X	X
1,2-Dichloroethane	1.2	X	X	X	X	X
1,1-Dichloroethylene	2.0	X	X	X	X	X
1,2-Dichloroethylene	1.2	X	X	X	X	X
Dichloromethane	0.8	1.2	53.5	2.2	4.4	9.2
1,2-Dichloropropane	2.0	X	X	X	X	X
cis-1,3-Dichloropropene	1.2	X	X	X	X	X
trans-1,3-Dichloropropene	4.0	X	X	X	X	X
Ethylbenzene	0.8	X	X	X	X	X
1,1,2,2-Tetrachloroethane	0.4	X	X	X	X	X
Tetrachloroethylene	0.4	X	X	X	X	X
Toluene	0.4	X	X	X	X	X
1,1,1-Trichloroethane	0.4	X	X	X	X	X
1,1,2-Trichloroethane	0.4	X	X	X	X	X
Trichloroethylene	0.4	X	X	X	X	X
Vinyl Chloride	2.0	X	X	X	X	X
Zimpro Analytical No.		15069	15070	15071	15072	15073

X = Analyzed but not detected

Table 4
CH_2M Hill
VOC Analysis (ug/l)
November 19, 1985

	Detection Limit	Trip Blank
Benzene	Ø.2	X
Bromoform	Ø.5	X
Bromomethane	1.Ø	X
Carbon Tetrachloride	Ø.1	X
Chlorobenzene	Ø.1	X
Chloroethane	1.Ø	X
2-Chloroethylvinyl Ether	2.Ø	X
Chloroform	Ø.1	X
Chloromethane	6.Ø	X
Dibromochloromethane	Ø.1	X
1,2-Dichlorobenzene	Ø.3	X
1,3-Dichlorobenzene	Ø.3	X
1,4-Dichlorobenzene	Ø.3	X
Dichlorobromomethane	Ø.1	X
1,1-Dichloroethane	Ø.1	X
1,2-Dichloroethane	Ø.3	X
1,1-Dichloroethylene	Ø.5	X
1,2-Dichloroethylene	Ø.3	X
Dichloromethane	Ø.2	3.Ø
1,2-Dichloropropane	Ø.5	X
cis-1,3-Dichloropropene	Ø.3	X
trans-1,3-Dichloropropene	1.Ø	X
Ethylbenzene	Ø.2	X
1,1,2,2-Tetrachloroethane	Ø.1	X
Tetrachloroethylene	Ø.1	X
Toluene	Ø.1	X
1,1,1-Trichloroethane	Ø.1	X
1,1,2-Trichloroethane	Ø.1	X
Trichloroethylene	Ø.1	X
Vinyl Chloride	Ø.5	X
Zimpro Analytical No.		15Ø74

X = Analyzed but not detected

Table 5
CH_2M Hill
VOC Analysis (ug/l)
November 25, 1985

	Detection Limit	Trip Blank	Field Blank	Well 1	Well 2	Well 3
Benzene	0.2	X	X	X	X	X
Bromoform	0.5	X	X	X	X	X
Bromomethane	1.0	X	X	X	X	X
Carbon Tetrachloride	0.1	X	X	X	X	97.
Chlorobenzene	0.1	X	X	X	X	X
Chloroethane	1.0	X	X	X	X	X
2-Chloroethylvinyl Ether	2.0	X	X	X	X	X
Chloroform	0.1	X	X	X	1.1	66.
Chloromethane	6.0	X	X	X	X	X
Dibromochloromethane	0.1	X	X	X	X	X
1,2-Dichlorobenzene	0.3	X	X	X	X	X
1,3-Dichlorobenzene	0.3	X	X	X	X	X
1,4-Dichlorobenzene	0.3	X	X	X	X	X
Dichlorobromomethane	0.1	X	X	X	X	X
1,1-Dichloroethane	0.1	X	X	X	X	X
1,2-Dichloroethane	0.3	X	X	X	X	X
1,1-Dichloroethylene	0.5	X	X	X	X	X
1,2-Dichloroethylene	0.3	X	X	X	3.7	X
Dichloromethane	0.2	0.6	0.8	X	0.5	0.4
1,2-Dichloropropane	0.5	X	X	X	X	X
cis-1,3-Dichloropropene	0.3	X	X	X	X	X
trans-1,3-Dichloropropene	1.0	X	X	X	X	X
Ethylbenzene	0.2	X	X	X	X	X
1,1,2,2-Tetrachloroethane	0.1	X	X	X	X	X
Tetrachloroethylene	0.1	X	X	X	0.4	0.4
Toluene	0.1	X	X	X	X	X
1,1,1-Trichloroethane	0.1	X	X	X	2.5	X
1,1,2-Trichloroethane	0.1	X	X	X	X	X
Trichloroethylene	0.1	X	X	X	280.	6.9
Vinyl Chloride	0.5	X	X	X	X	X
Zimpro Analytical No.		15222	15223	15215	15216	15217

X = Analyzed but not detected

Table 6
CH_2M Hill
VOC Analysis (ug/l)
November 25, 1985

	Detection Limit	Well 4D	Well 4S	Well 6	Well 7
Benzene	Ø.2	X	X	X	X
Bromoform	Ø.5	X	X	X	X
Bromomethane	1.Ø	X	X	X	X
Carbon Tetrachloride	Ø.1	X	X	X	X
Chlorobenzene	Ø.1	X	X	X	X
Chloroethane	1.Ø	X	X	X	X
2-Chloroethylvinyl Ether	2.Ø	X	X	X	X
Chloroform	Ø.1	1.4	X	X	Ø.8
Chloromethane	6.Ø	X	X	X	X
Dibromochloromethane	Ø.1	X	X	X	X
1,2-Dichlorobenzene	Ø.3	X	X	X	X
1,3-Dichlorobenzene	Ø.3	X	X	X	X
1,4-Dichlorobenzene	Ø.3	X	X	X	X
Dichlorobromomethane	Ø.1	X	X	X	X
1,1-Dichloroethane	Ø.1	X	X	X	X
1,2-Dichloroethane	Ø.3	X	Ø.4	X	X
1,1-Dichloroethylene	Ø.5	X	X	X	X
1,2-Dichloroethylene	Ø.3	1.4	9.3	X	X
Dichloromethane	Ø.2	Ø.4	Ø.6	1.6	1.2
1,2-Dichloropropane	Ø.5	X	X	X	X
cis-1,3-Dichloropropene	Ø.3	X	X	X	X
trans-1,3-Dichloropropene	1.Ø	X	X	X	X
Ethylbenzene	Ø.2	X	X	X	X
1,1,2,2-Tetrachloroethane	Ø.1	X	X	X	X
Tetrachloroethylene	Ø.1	Ø.1	Ø.5	Ø.1	X
Toluene	Ø.1	X	X	X	X
1,1,1-Trichloroethane	Ø.1	Ø.3	X	X	11.5
1,1,2-Trichloroethane	Ø.1	X	X	X	X
Trichloroethylene	Ø.1	19.7	2.Ø	X	1Ø.7
Vinyl Chloride	Ø.5	X	2.2	X	X
Zimpro Analytical No.		15218	15219	1522Ø	15221

X = Analyzed but not detected

Table 7

CH_2M Hill
Soil Borings

	SL-B2-24	SL-HSA-3	SL-HSA-4
Cyanide, ug/g	<0.11	<0.11	<0.09
Arsenic, ug/g	1.02	2.16	3.42
Barium, ug/g	24.2	26.3	24.7
Cadmium, ug/g	<0.081	<0.077	<0.082
Chromium, ug/g	2.87	2.15	1.58
Lead, ug/g	1.73	3.92	6.21
Mercury, ug/g	<0.008	<0.009	<0.010
Selenium, ug/g	<0.10	<0.10	<0.10
Silver, ug/g	0.144	<0.096	<0.102
Total Solids, %	96.18	92.71	84.65
Analytical No.	15069	15072	15073

Note: Results expressed on a dry weight basis except Total Solids

ug/g = mg/kg = ppm

< = "less than" detection limit varied with sample size

Table 8
Well Water Samples
CH_2M Hill

	Detection Limit	Field Blank	Well #1	Well #2	Well #3	Well #4D	Well #4S	Well #6	Well #7
Alkalinity, mg/l as $CaCO_3$	20.	X	56.	34.	268.	66.	433.	66.	39.
Hardness, mg/l as $CaCO_3$	1.0	X	74.1	123.	491.	151.	755.	61.	88.
COD, mg/l	10.	X	12.	X	17.	X	56.	X	X
Diss. Fe, mg/l	0.004	X	0.077	0.004	X	0.212	0.012	0.263	0.005
Arsenic, mg/l	0.005	X	X	–	–	X	X	–	–
Barium, mg/l	0.030	0.044	X	–	–	X	0.200	–	–
Cadmium, mg/l	0.004	X	X	–	–	X	X	–	–
Chromium, mg/l	0.017	X	X	–	–	X	X	–	–
Lead, mg/l	0.050	0.285	0.192	–	–	0.122	X	–	–
Mercury, mg/l	0.0004	X	X	–	–	X	X	–	–
Selenium, mg/l	0.005	X	X	–	–	X	X	–	–
Silver, mg/l	0.005	X	X	–	–	X	X	–	–
Cyanide, mg/l	0.020	X	X	–	–	X	X	–	–
Total Phenols, mg/l	0.050	X	X	–	–	X	X	–	–
Analytical No.		15223	15215	15216	15217	15218	15219	15220	15221

X = Analyzed but not detected

– = Not analyzed

State of Wisconsin
Department of Natural Resources

GROUNDWATER MONITORING WELL INFORMATION FORM

Chapter 144, Wis. Stats.
Form 4400-89 2-84

Facility Name	Facility ID Number	Date	Completed By (Name and Firm)
City of Wausau Landfill		12/03/85	[illegible] / CH2M Hill

Well Name	Well ID Number (DNR No.)	Well Location	N	S	E	W	Date Established	Well Casing Diam.	Well Casing Type	Elevations: Top of Well Casing	Elevations: Ground Surface	Elevations: Screen Top	Reference: MSL (✓)	Reference: Site Datum (✓)	Screen Length	Screen Material	Well Depth	PIEZ	OW	PW	LYS	Other
1		417,600	✓				11/11/85	2"	P	122[illegible]	1220.8	1205.9	✓		15'	PVC	30.9		✓			
		2,094,335			✓																	
2		417,810	✓				11/11/85	2"	P	12[illegible].17	12[illegible]	1193.3	✓		15'	PVC	40.5'		✓			
		2,095,205			✓																	
3		417,330	✓				11/12/85	2"	P	1220.[illegible]	1217.4	1193.5	✓		15'	PVC	39.5'		✓			
		2,094,945			✓																	
4S		417,035	✓				11/13/85	2"	P	1216.76	12[illegible]	1196.9	✓		15'	PVC	35'		✓			
		2,094,775			✓																	
4D		417,035	✓				11/15/85	2"	P	1216.26	1213.9	1114.4	✓		5'	PVC	106'	✓				
		2,094,780			✓																	
6		417,085	✓				11/1[illegible]/85	2"	P	1221.63	1219.2	1194.7	✓		15'	PVC	49.5'		✓			
		2,094,340			✓																	
7		417,775	✓				11/12/85	2"	P	1220.91	121[illegible]	11[illegible]	✓		15'	PVC	40'		✓			
		2,094,9[illegible]			✓																	

Location Coordinates Are:

☐ Grid System

State Plane Coordinate
☐ Northern
☒ Central

Received In:

District: ____________ Area: ____________ Bureau: ____________

By: ____________

SMS Use:

File Maint. Completed: ____________ Date

Other: ____________

FILE NO.

PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF- WDNR

INSTALLED BY IHJ

DATE 11/12/85

PROJECT NO. L20303.AO

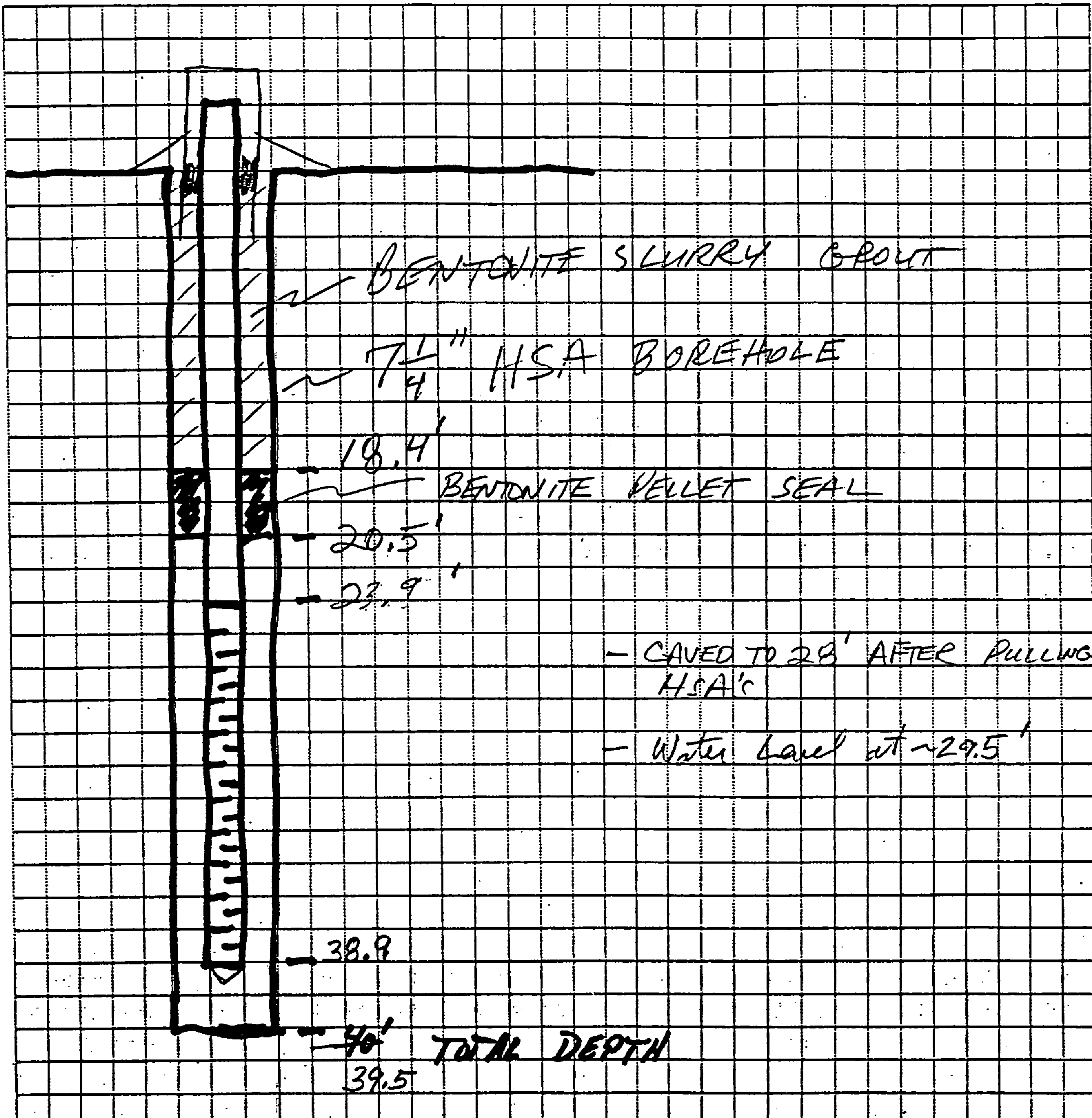
CHECKED BY

DATE

BORING NO. B-3S

COORDINATES

PIEZOMETER NO. B-3S



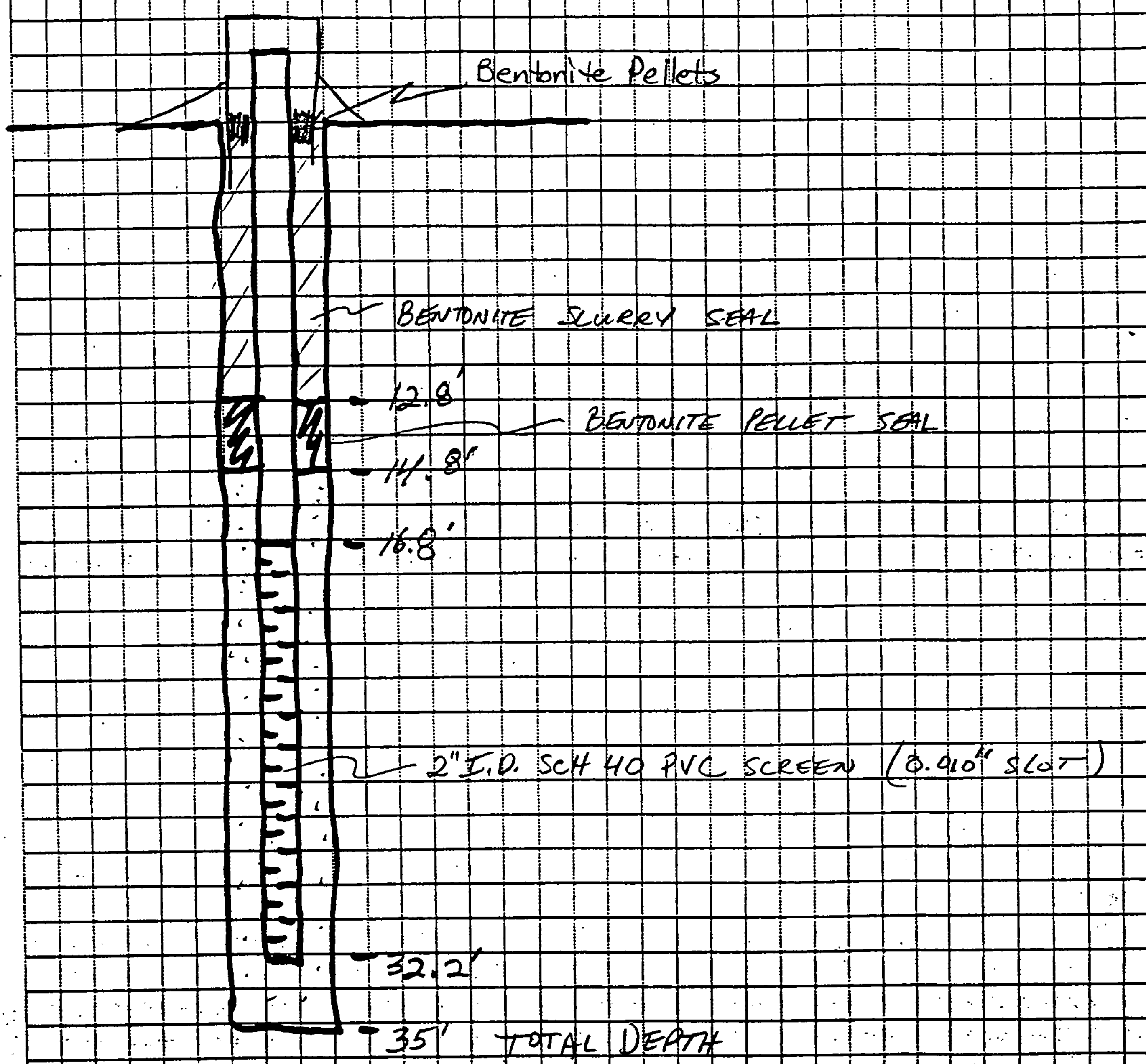
M05J12.R0119

CH2M HILL

FILE NO.
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - WDNR
INSTALLED BY I.H. Johnson DATE 11/13/85
PROJECT NO. L20303.AD
CHECKED BY DATE
BORING NO. B-4S
COORDINATES
PIEZOMETER NO. B-4S



M05J12.R0119

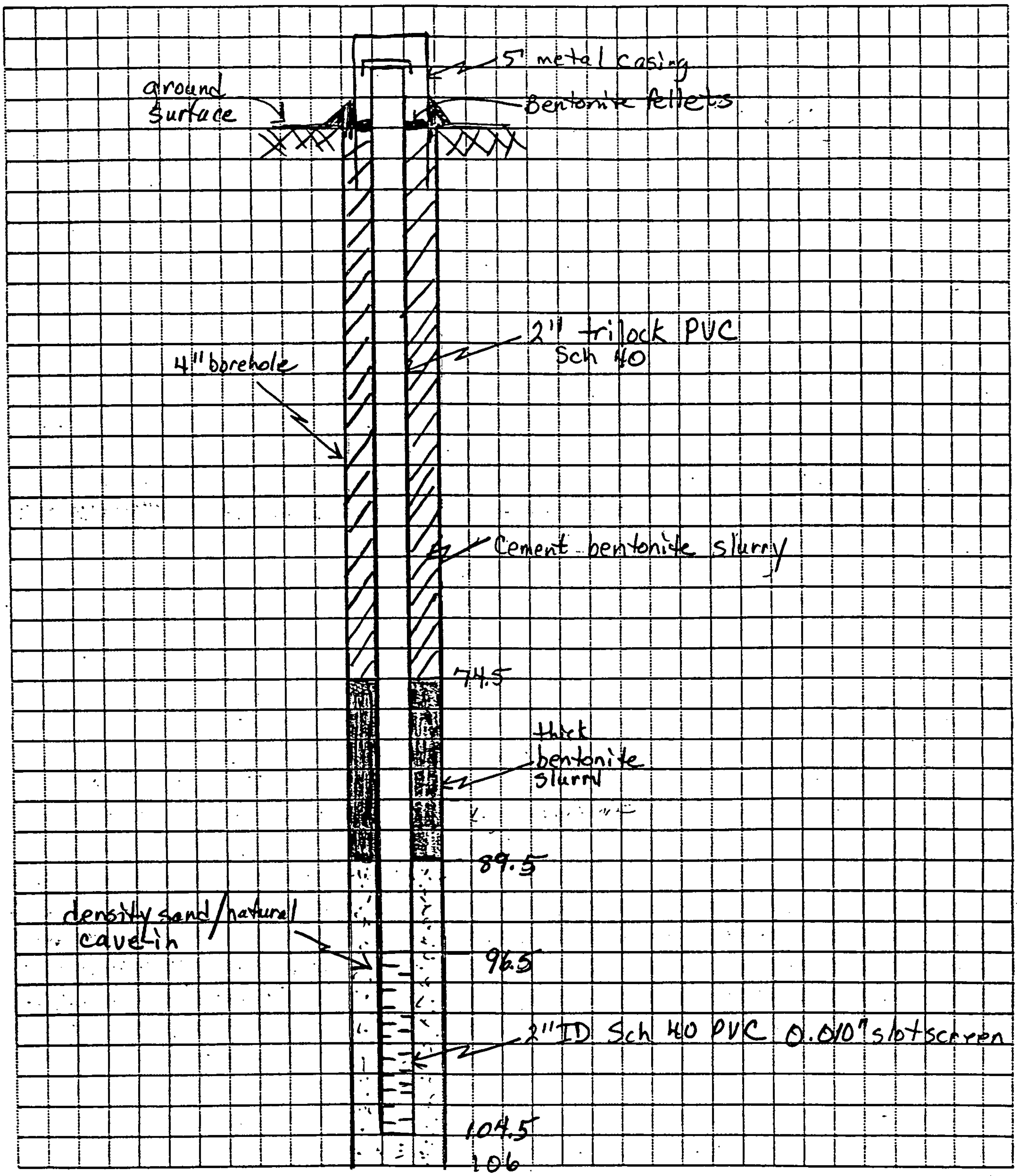
CH2M HILL

FILE NO.
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME City of Wausau Landfill
PROJECT NO. L20303.A0
BORING NO. 4D
PIEZOMETER NO.

INSTALLED BY SM McBee DATE 11/15/85
CHECKED BY DATE
COORDINATES



M05J12.R0119

CH2M HILL

FILE NO.
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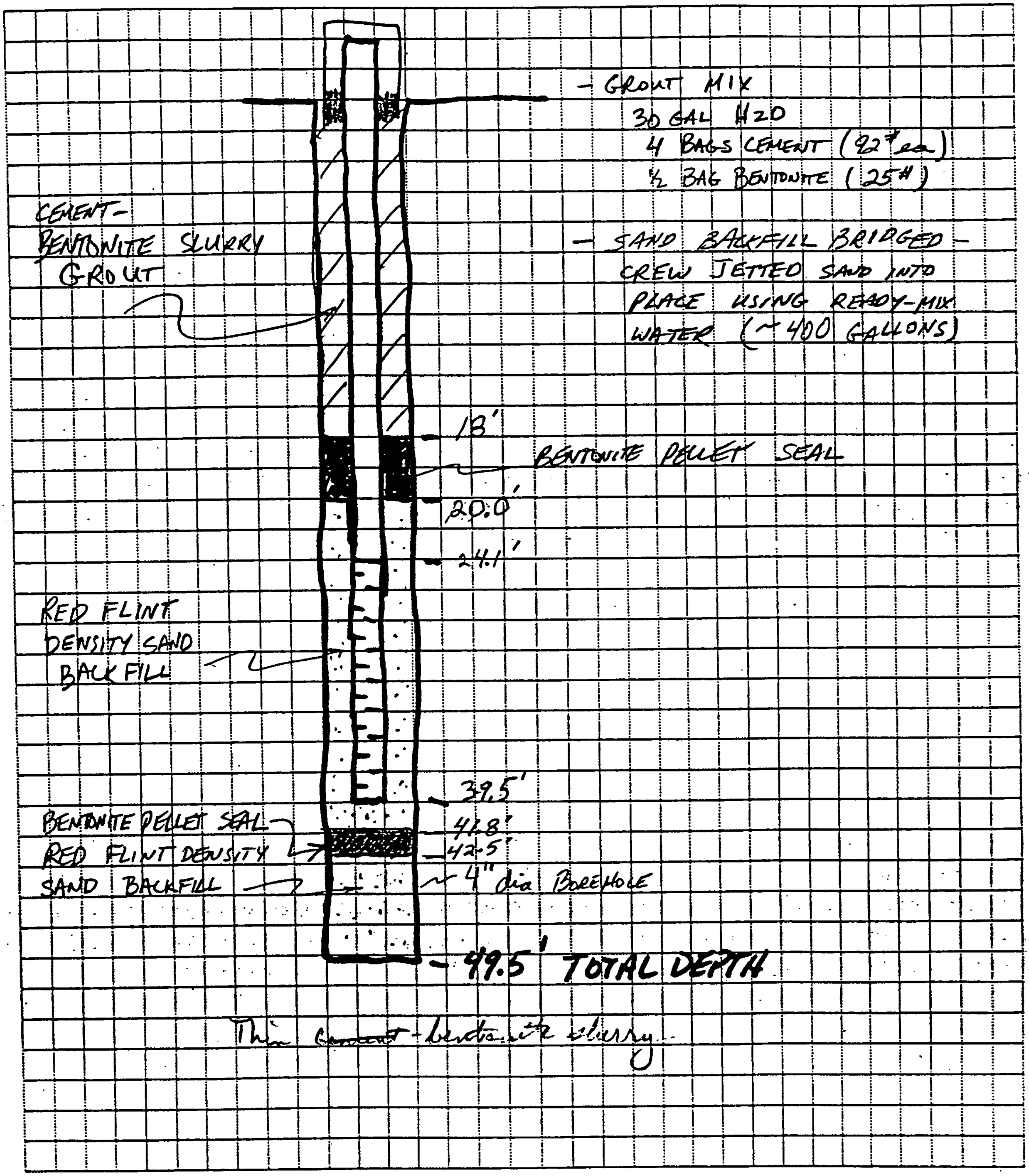
6/

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - WDNR
INSTALLED BY I. H. Johnson DATE 11/13/85
PROJECT NO. L20303.A0
CHECKED BY DATE
BORING NO. B-6
COORDINATES
PIEZOMETER NO. B-6



M05J12.R0119

CH2M HILL

FILE NO. ______
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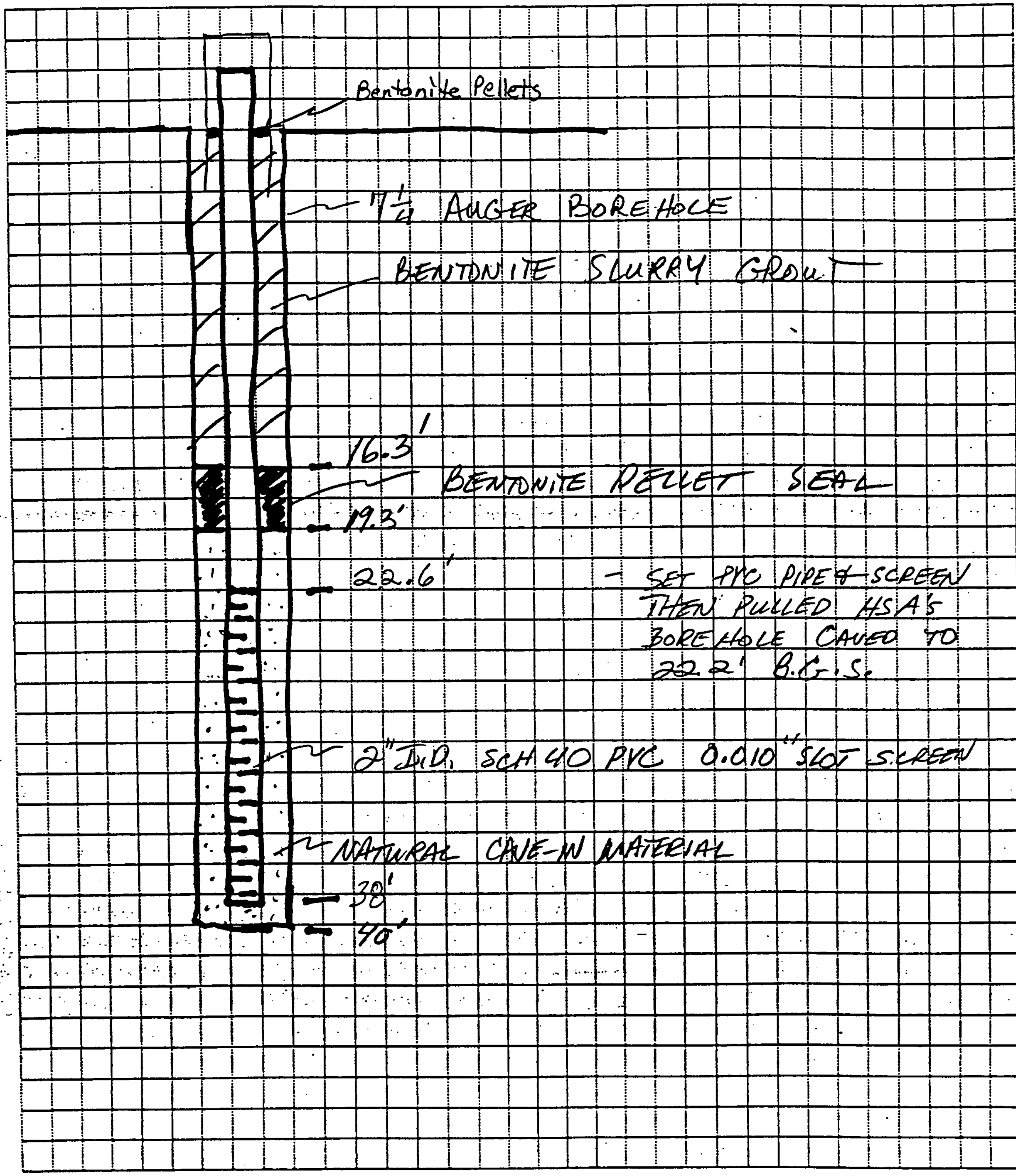
PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - Wis. DNR
PROJECT NO. 120303.A0
BORING NO. B-75
PIEZOMETER NO. B-75

INSTALLED BY IHJ DATE 11/12/85
CHECKED BY ______ DATE ______
COORDINATES ______



M05J12.R0119

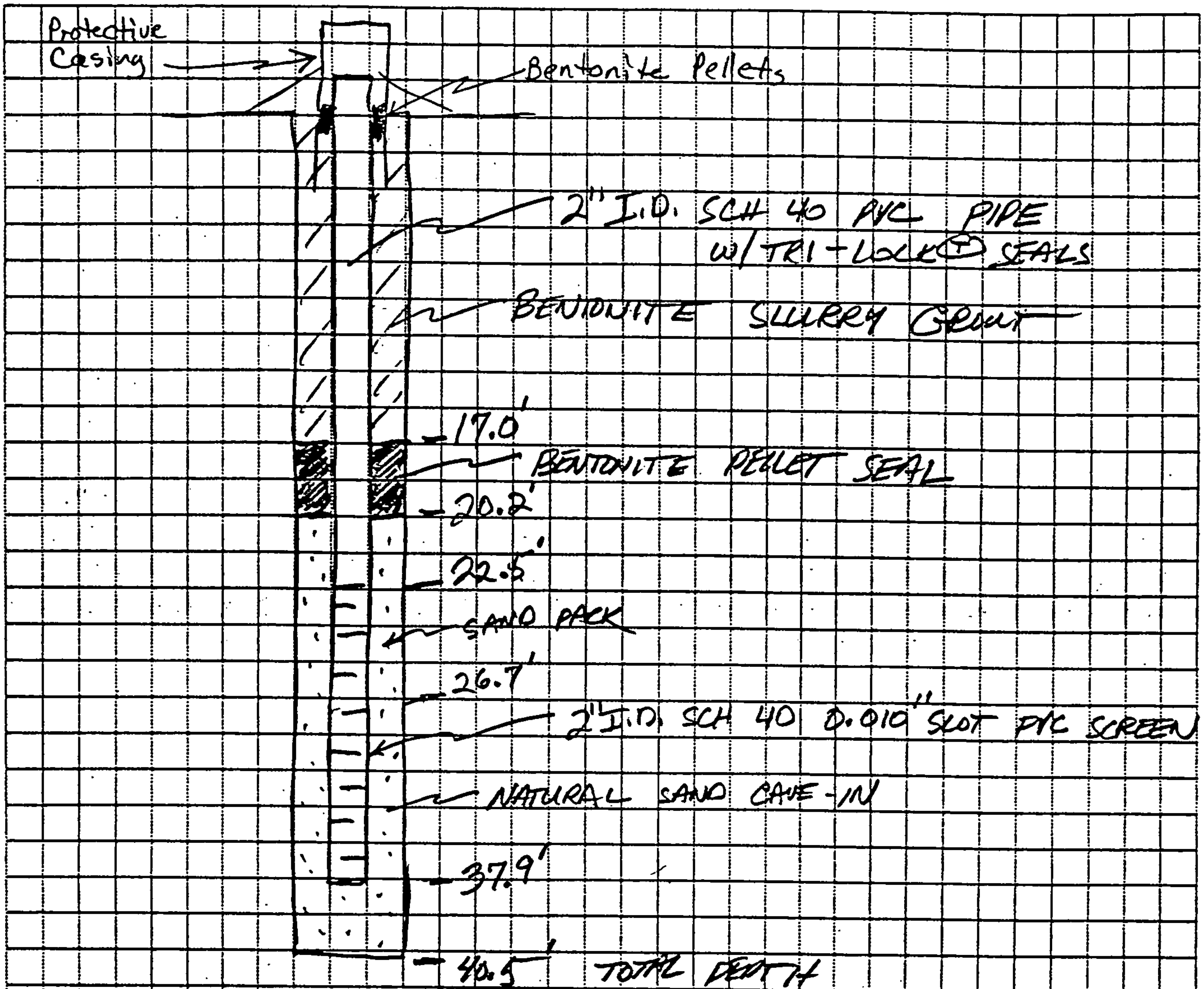
CH2M HILL

FILE NO.

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF
PROJECT NO. L20303.A0
BORING NO. B-25
PIEZOMETER NO. B-25

INSTALLED BY I.H.J DATE 11/11/85
CHECKED BY DATE
COORDINATES



SET PVC PIPE + SCREEN IN THE HSA'S, THEN PULLED THE HSA'S - BORE HOLE CAVED TO 26.7' B.G.S. PLACED SANDPACK TO 20.2' B.G.S.

M05J12.R0119

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L 20303.A0	1S	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Hollow stem augers/CME-45

WATER LEVEL AND DATE 22.5' 11/11/85 START 0900 11/11/85 FINISH 1015 11/11/85 LOGGER Johnson/McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		0.0 – 1.5	S-1	18"	4-6-10 (16)	Topsoil, brown, sandy		Background OVA reading (<.2 ppm)
		2.0 – 3.5	S-2	15"	11-16-17 (33)	Sand, fine to med. grained, brown, moist, dense, tr cse sd		
	5							
	10	9.5 – 11.0	S-3	10"	7-10-10 (20)	Sand, fine to coarse grained, brown, moist, medium density (SP) 8.7% gr 88.7% sd 2.6% fines		.2 OVA (background)
	15	14.5 – 16.0	S-4	10"	8-13-16 (29)	As above		.2 OVA (background)
	20	19.5 – 21.0	S-5	17"	7-11-15 (26)	Sand, fine to medium, brown, moist medium (SP) 98.3% fine to med sd 1.7% fines		background OVA
	25	23.5 – 25.0	S-6	1"	25/1"	Silty sand + gravel, fine sand, gray, wet (gm) 25.5% gr 49.6% sd 24.9% fines		Rough drilling at ≈23.5' Possibly coarse gravel. Water at 27.4' 10:00 After driving S-7 water level at 22.5' at 10:45
	30	29.5 – 31.0	S-7	1"	50/2"	See next page		

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
L20303.A0	.1S	2	2

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Hollow stem augers / CME-45

WATER LEVEL AND DATE START 11/11/85 FINISH 11/11/85 LOGGER Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		29.5–31.0	S-7	1"	50/2"	Silty sand, brown-gray, some gravel		
						34'		Auger refusal
	35					Bottom of boring		

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
L20303.A0	B-2S	1	2

SOIL BORING LOG

PROJECT: W[illegible] LF - [illegible]　LOCATION:
ELEVATION:　DRILLING CONTRACTOR: Twin City Testing
DRILLING METHOD AND EQUIPMENT: CME 45 Rig 3¼" I.D. HSA (7¼" O.D.) STD. "SPLIT SPOONS
WATER LEVEL AND DATE: 27.7' 11/11/85　START: 15:00 - 11/11/85　FINISH: 11/11/85　LOGGER: J.H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION (NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL)	SYMBOLIC LOG	COMMENTS (DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION)
	0	1.5	S-1	10"	2-2-3 (5)	FILL, SAND, DK. BROWN, TR. ORGANICS MOIST		OVA BACKGROUND ~3.5 ppm
	5	4.0 – 5.5	S-2	12"	4-7-8 (15)	SAND, LT. BROWN, FINE, MOIST, (SP)		OVA READING BACKGROUND
	10	7.0 – 10.5	S-3	8"	4-8-11 (19)	SAND, LT. BROWN, FINE TO CSE, MOIST (SW) 31.9% gr 65% sd 3.1% fines		OVA READING BACKGROUND
	15	14.0 – 15.5	S-4	4"	4-8-13 (21)	SAND, LT. BROWN, MED. TO CSE. MOIST, ~20% F GRAVEL (SP)		OVA READING BACKGROUND
	20	19.0 – 20.5	S-5	7"	7-9-10 (19)	SAND, LT. BROWN, MED. TO CSE, MOIST (SP)		OVA READING BACKGROUND
	25	24.0 – 25.5	S-6	7"	7-7-9 (16)	SAND, LT. BROWN, FINE TO MED, MOIST		OVA READING BACKGROUND
	30	29 – 30.4	S-7	6"	2-4-4 (8)			OVA READING BACKGROUND WATER AT 27.8' at 15:52 WATER AT 27.7 at 16:00

CH2M HILL

PROJECT NUMBER	BORING NUMBER B-2S	SHEET 2 OF 2

SOIL BORING LOG

PROJECT WAUSAU LF - DNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY TESTING

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH LOGGER J.H. JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							
		34.0						
	35	35.5	S-8	10"	3-4-6 (10)	SAND, LT. BRN, FINE, WET, (SP)		OVA READING BACKGROUND
		39.0						
	40	40.5		0"				NO RECOVERY
						Bottom of boring 40.5'		

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-3S	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Wausau LF LOCATION

ELEVATION DRILLING CONTRACTOR Twin City Testing

DRILLING METHOD AND EQUIPMENT 7¼" OD Hollow stem augers / CME-45

WATER LEVEL AND DATE 29.5' 11/12/85 START 14:30-11/12 FINISH 1600 11/12/85 LOGGER I.H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0–1.5	S1	15"	3-3-4 (7)	FILL, BLACK, SAND, GRAVEL, SILT, SOME CINDERS, MOIST		OVA NOT WORKING PROPERLY - [illegible]
	5	4.5–6.0	S-2	8"	14-14-16 (30)	FILL, MOTTLED, BROWN AND GRAY, SAND, SOME CINDERS ~7'		
	10	9.5–11.0	S-3	10"	15-18-22 (40)	SAND, LT. BROWN, fine TO CSE., moist (SW) 32.4% gr 62.6% sd 5% fines ~12'		ROUGH DRILLING AT ~12' B.G.S. POSSIBLY COARSE GRAVEL OR COBBLES
	15	14.5–16.0	S-4	14"	5-8-10 18	SAND, LT. BROWN, FINE, MOIST Some coarse sand (SP) 2.1% gr 95.9% sd 2.0% fines		
	20	19.5–21.0	S-5	5"	30-20/.2	SAND, LT. BROWN, MED. TO CSE, MOIST TO WET, (SP) ~22.5'		GRAVEL LODGED IN BOTTOM OF THE SPLIT SPOON
	25	24.5–26.0	S-6	15"	4-5-6 (11)	SAND, LT. BROWN, FINE TO MED, MOIST (SP) 21% med sd 78.2% fine sd 0.8% fines		
	30	29.5–31.0	S-7	8"	4-7-8 (15)	SAND, LT. BROWN, FINE TO MED. WET, SP		WATER @ 29.5' B.G.S. AT 15:46 [illegible]

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-35	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Wausau LF - Wis. DNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY

DRILLING METHOD AND EQUIPMENT 3¼ I.D. / 7¼" O.D.) HSA's, CME 45 RIG,

WATER LEVEL AND DATE START FINISH LOGGER I. H. JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							
		34.5				SAND, LT. BROWN, FINE, WET		
	35		S-8					
		36.0						
	40					BOTTOM OF BOREHOLE @ 40'		COMPLETE DRILLING AT 1600 HRS

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET	OF
L20303.A0	B-45	1	2

SOIL BORING LOG

PROJECT [illegible] LF - WDNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY

DRILLING METHOD AND EQUIPMENT CME 45 RIG, [illegible]

WATER LEVEL AND DATE 25' 11/13/85 START 0900-11/13 FINISH 11/13 LOGGER J.H. JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0 - 1.5	S-1	2"	3-4-5 (9)	FILL, SILTY SAND, GRAY, SOME CLAY, MOIST		OVA BACKGROUND ~3ppm
	5	4.5 - 6.0	S-2	5"	5 5 9 (14)	FILL, SAND, WOOD CHIPS, MOIST		PIECES OF PAPER + PLASTIC IN AUGER CUTTINGS
	10	9.5 - 11.0	S-3	2"	1-2-3 (5)	FILL, SAND, DK GRAY MISC. SILT CLAY MOIST TO WET ~14'		OVA READING ~50ppm OFF AUGER [illegible] 0ppm ON BACKFLUSH POSSIBLY METHANE
	15	14.5 - 16.0	S-4	10"	10-10-11 (21)	SAND, FINE, TO MED, LT BROWN, MOIST (SP) 9.2% gr 88% sd 2.8% fines		
	20	19.5 - 21.0	S-5	12"	13-16-20 (36)	SAND, FINE TO CSE, LT. BROWN, MOIST (SW) 30.1% gr 64.7% sd 5.2% fines		OVA READING ~4 to 5ppm (~1 to 2 ABOVE BACKGROUND) IN HSA & FROM SPLIT SPOON SAMPLE
	25	24.5 - 26.0	S-6	15"	8-8-13 (21)	SAND, FINE		WATER LEVEL AT 25' B.G.S. @ 10:50 HRS
	30	29.5 - 31.0	S-7	19"	18-17-2[illegible] 40	SAND, FINE, LT. BROWN, WET (SP)		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-45	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Wausau LF - WDNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH LOGGER I.H Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30					SAND, FINE, LT. BROWN, WET, SP		
	35					BOTTOM OF BOREHOLE @ 35'		
	40							

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	4D	SHEET 1 OF 3

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Bentonite mud rotary/CME-55

WATER LEVEL AND DATE START [illegible] FINISH 11/10-11/14/85 LOGGER SM McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						See log of 4S for 0-35'		
8:17	35	34 – 36.5	S-1	7"	3-4-6 (10)	Sand, f to m, moist, brown tr gravel		
	40	39.5 – 41	S-2	9"	6-7-12 (19)	Sand, fine to medium tr. gr, moist, brown (SP) 8.0% gr 89.2% sd 2.8% fines		
	45	44.5 – 46	S-3	9"	9-12-14 (26)	as above		Stopped work to fix AW plate
	50							
	55	54.5 – 56	S-4	10"	9-9-20 (29)	Sand, fine to med. grained, moist, brown		
	60							

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	4D	SHEET 2 OF 3

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Mud rotary / CME-55

WATER LEVEL AND DATE START FINISH LOGGER SM McGee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	65	64.5–66	S-5	10"	13-11-9 (20)	Sand, fine to med, brown, wet		
	70							Broke down drill string to remove [illegible]
								Stopped drilling to mix clean mud
	75	74.5–76	S-6	15"	8-9-11 (20)	Sand, fine, brown, wet		
	80							
	85	84.5–86	S-7	14"	11-19-32 (51)	As above (SP) 15.9% med sd 80.7% fine sd 3.3% fines		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	4D	SHEET 3 OF 3

SOIL BORING LOG

PROJECT City of Wausau landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Mud rotory / CME-55

WATER LEVEL AND DATE START FINISH LOGGER SM McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	95	94.5–96	S-8	15"	13-16-23 (39)	Sand, fine, moist, brown		
	100							
	105	104.5–106.4	S-9	10"	34-52-50/.4 102/6.4"	As above		
						Bottom of boring 106.4'		
	110							

REV 11/82 FORM D1586

PROJECT NUMBER	BORING NUMBER	SHEET	OF
L20303.A0	B-6D	1	

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Bentonite mud rotary / CME-55/75, 3 7/8" tricone

WATER LEVEL AND DATE START 11/11/85 FINISH LOGGER S McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						<u>Sand</u> little if any gravel		Description from driller's comments Refer to log of B-6S Wyogel bentonite
	10							
	20							
	30							
								"boulder"
	40					Cobbley sand and gravel		
								44' lost ≈ 50% of drilling fluid
						47.5		
						Granite boulder or top of rock		11/11/85
	50					**Bottom of boring** 49.5'		11/12/85

This boring was drilled ≈5' from original location after tricone bit sheared off in hole at 55'.

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-7S	SHEET 1 OF

SOIL BORING LOG

PROJECT Wausau LF - WIS. DNR LOCATION

ELEVATION DRILLING CONTRACTOR Twin City Testing

DRILLING METHOD AND EQUIPMENT 3¼" I.D. HSA (7¼" O.D.), CME 45 RIG, STD SPLIT SPOONS

WATER LEVEL AND DATE 29.5' 11/12 START 0930 - 11/12 FINISH LOGGER I.H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0 – 1.5	S-1	12"	1-3-5 (8)	FILL, DK. GRAY TO BROWN, ORGANIC SILTY SAND ~2.0'		OVA BACKGROUND ~5 PPM
	5	4.5 – 6.0	S-2	10"	15-30-15/.2'	SAND, fine TO CSE, LT. BROWN, ~10% FINE GRAVEL, MOIST, (SP) ~7.5'		OVA READING ~5.5 PPM IN HSA
	10	9.5 – 11.0	S-3	12"	9-16-18 (34)	SAND, MED. TO CSE, LT. BROWN, ~10% FINE GRAVEL, (SP)		OVA READING BACKGROUND OVA [illegible] TO ~5.5 PPM
	15	14.5 – 16.0	S-4	9"	18-22-14 (36)	SAND, MED. TO CSE, LT. BROWN, ~30% FINE TO MED. GRAVEL, MOIST TO WET (AT BOTTOM) (SP)		OVA READING BACKGROUND
	20	19.5 – 21.0	S-5	10"	5-11-16 (27)	SAND, MED.-fine, LT. BROWN, MOIST, (SP) 9.6% gr 87.8% sd 2.6% fines		OVA READING BACKGROUND
	25	24.5 – 26.0	S-6	8"	12-13-13 (26)	SAND, MED. TO CSE., LT BROWN, MOIST, (SP) ~27'		OVA READING [illegible] TO 8PPM IN [illegible] ~[illegible] to 3 p[illegible] background
	30	29.5 –	S-7	8"	7-10-11 (21)	SAND, MED. TO fine, LT. BROWN, WET (SP), 35.8% med sd, 63.1% fine sd		OVA [illegible] BACKGROUND [illegible]

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET
L20303.A0	S-7S	SHEET – OF –

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY TESTING

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START 0930 – 11/12 FINISH LOGGER [illegible]

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							WATER LEVEL AT 29.5 at 10:55
	35	34.5 – 36.0	S-8	8	4-7-8 (15)	SAND, FINE TO MED, LT. BROWN, WET (SP)		OVA READING BACKGROUND (<5.5ppm)
								DRILLED TO 40' W/O SPLIT SPOON SAMPLING BECAUSE OF FLOWING SAND IN HOLE - SET WELL TO 40' [illegible]
	40					BOTTOM OF BOREHOLE @ 40.0		
	45							

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER L 20303.A0

BORING NUMBER 1S

SHEET 1 OF 2

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Hollow stem augers/CME-45

WATER LEVEL AND DATE 22.5' 11/11/85 START 0900 11/11/85 FINISH 1015 11/11/85 LOGGER Johnson/McGee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		0.0–1.5	S-1	18"	4-6-10 (16)	Topsoil, brown, sandy		Background OVA reading (.2 ppm)
		2.0–3.5	S-2	15"	11-16-17 (33)	Sand, fine to med. grained, brown, moist, dense, tr crse sd		
	5							
	10	9.5–11.0	S-3	10"	7-10-10 (20)	Sand, fine to coarse grained, brown, moist, medium density (SP) 8.7% gr 88.7% sd 2.6% fines		.2 OVA (background)
	15	14.5–16.0	S-4	10"	8-13-16 (29)	As above		.2 OVA (background)
	20	19.5–21.0	S-5	17"	7-11-15 (26)	Sand, fine to medium, brown, moist medium (SP) 98.3% fine to med sd 1.7% fines		background OVA
	25	23.5–25.0	S-6	1"	25/1"	Silty sand + gravel, fine sand, gray, wet (GM) 25.5% gr 49.6% sd 24.9% fines		Rough drilling at ≈22.5' Possibly coarse gravel. Water at 27.4' 10:00 After driving S-7 water level at 22.5' at 10:45
	30	29.5–31.0	S-7	1"	50/2"	See next page		

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	1S	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Hollow stem augers / CME-45

WATER LEVEL AND DATE START 11/11/85 FINISH 11/11/85 LOGGER Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
		29.5 – 31.0	S-7	1"	50/2"	Silty sand, brown-gray, some gravel		
						34'		Auger refusal
	35					Bottom of boring		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-25	SHEET 1 OF 2

SOIL BORING LOG

PROJECT W... LF - ... DIF LOCATION

ELEVATION DRILLING CONTRACTOR Twin City Testing

DRILLING METHOD AND EQUIPMENT CME 45 ... 3¼" I.D. HSA (7½" O.D.) STD. "SPLIT SPOONS

WATER LEVEL AND DATE 27.7' 11/11/85 START 15:50 - 11/11/85 FINISH 11/11/85 LOGGER J.H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	1.5	S-1	10"	2-2-3 (5)	FILL, SAND, DK. BROWN, TR. ORGANICS MOIST		OVA BACKGROUND ~3.5 ppm
	5	4.0 – 5.5	S-2	12"	4-7-8 (15)	SAND, LT. BROWN, FINE, MOIST, (SP)		OVA READING BACKGROUND
	10	9.0 – 10.5	S-3	8"	4-8-11 (19)	SAND, LT. BROWN, FINE TO CSE, MOIST (SW) 31.9% gr 65% sd 3.1% fines		OVA READING BACKGROUND
	15	14.0 – 15.5	S-4	4"	4-8-13 (21)	SAND, LT. BROWN, MED. TO CSE, MOIST, ~20% F GRAVEL (SP)		OVA READING BACKGROUND
	20	19.0 – 20.5	S-5	7"	7-9-10 (19)	SAND, LT. BROWN, MED. TO CSE, MOIST (SP)		OVA READING BACKGROUND
	25	24.0 – 25.5	S-6	7"	7-7-9 (16)	SAND, LT. BROWN, FINE TO MED, MOIST		OVA READING BACKGROUND
	30	29 – 30.5	S-7	6"	2-4-4 (9)			OVA READING BACKGROUND WATER AT 27.8' at 15:52 WATER AT 27.7 at 16:00

CH2M HILL

PROJECT NUMBER

BORING NUMBER B-25

SHEET 2 OF 2

SOIL BORING LOG

PROJECT WAUSAU LF - DNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY TESTING

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START FINISH LOGGER J.H. JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							
	35	34.0 – 35.5	S-8	10"	3-4-6 (10)	SAND, LT. BRN, FINE, WET, (SP)		OVA READING BACKGROUND
	40	39.0 – 40.5		0"				NO RECOVERY
						Bottom of boring 40.5'		

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-35	SHEET 1 OF 2

SOIL BORING LOG

PROJECT Wausau LF LOCATION

ELEVATION DRILLING CONTRACTOR Twin City Testing

DRILLING METHOD AND EQUIPMENT 7¼" OD Hollow stem augers / CME-45

WATER LEVEL AND DATE 29.5' 11/12/85 START 14:30-11/12 FINISH 1600 11/12/85 LOGGER I.H. Jo[illegible]

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0–1.5	S1	15"	3-3-4 (7)	FILL, BLACK, SAND, GRAVEL, SILT, SOME CINDERS, MOIST		OVA NOT WORKING PROPERLY - [illegible] LOG
	5	4.5–6.0	S-2	8"	14-14-16 (30)	FILL, MOTTLED, BROWN AND GRAY, SAND, SOME CINDERS ~7'		
	10	9.5–11.0	S-3	10"	15-18-22 (40)	SAND, LT. BROWN, fine TO CSE., moist (SW) 32.4% gr 62.6% sd 5% fines ~12'		ROUGH DRILLING AT ~12' B.G.S. POSSIBLY COARSE GRAVEL OR COBBLES
	15	14.5–16.0	S-4	14"	5-8-10 18	SAND, LT. BROWN, FINE, MOIST Some coarse sand (SP) 2.1% gr 95.9% sd 2.0% fines		
	20	19.5–21.0	S-5	5"	30-20/.2	SAND, LT. BROWN, MED. TO CSE, MOIST TO WET, (SP) ~22.5'		GRAVEL LODGED IN BOTTOM OF THE SPLIT SPOON
	25	24.5–26.0	S-6	15"	4-5-6 (11)	SAND, LT. BROWN, FINE TO MED, MOIST (SP) 21% med sd 78.2% fine sd 0.8% fines		
	30	29.5–31.0	S-7	8"	4-7-8 (15)	SAND, LT. BROWN, FINE TO MED WET SP		WATER @ 29.5' B.G.S. AT 15:[illegible]

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-35	SHEET 2 OF 2

SOIL BORING LOG

PROJECT Wausau LF - Wis. DNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY

DRILLING METHOD AND EQUIPMENT 3¼ I.D. (7¼" O.D.) HSA'S, CME 45 RIG,

WATER LEVEL AND DATE START FINISH LOGGER I. H JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							
	35	34.5–36.0	S-8			SAND, LT. BROWN, FINE, WET		
	40					BOTTOM OF BOREHOLE @ 40'		COMPLETE DRILLING AT 1600 HRS.

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-45	SHEET 1 OF 2

SOIL BORING LOG

PROJECT [illegible] LF - WDNR LOCATION

ELEVATION DRILLING CONTRACTOR TWIN CITY

DRILLING METHOD AND EQUIPMENT CME 45 RIG, [illegible]

WATER LEVEL AND DATE 25' 11/13/85 START 0900-11/13 FINISH 11/13 LOGGER J. H. JOHNSON

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0 – 1.5	S-1	2"	3-4-5 (9)	FILL, SILTY SAND, GRAY, SOME CLAY, MOIST		OVA BACKGROUND ~3ppm
	5	4.5 – 6.0	S-2	5"	5 5 9 (14)	FILL, SAND, WOOD CHIPS, MOIST		PIECES OF PAPER & PLASTIC IN AUGER CUTTINGS
	10	9.5 – 11.0	S-3	2"	1-2-3 (5)	FILL, SAND, DK GRAY MISC. SILT CLAY MOIST TO WET ~14'		OVA READING ~5ppm OFF AUGER [illegible] 0ppm ON BACKFLUSH POSSIBLY METHANE
	15	14.5 – 16.0	S-4	10"	10-10-11 (21)	SAND, FINE TO MED, LT BROWN, MOIST (SP) 9.2% gr 88% sd 2.8% fines		
	20	19.5 – 21.0	S-5	12"	13-16-20 (36)	SAND, FINE TO CSE, LT. BROWN, MOIST (SW) 30.1% gr 64.7% sd 5.2% fines		OVA READING ~4 to 5ppm (~1 to 2 ABOVE BACKGROUND) IN HSA & FROM SPLIT SPOON SAMPLE
	25	24.5 – 26.0	S-6	15"	8-8-13 (21)	SAND, FINE		WATER LEVEL AT 25' B.G.S. @ 10:50 HRS
	30	29.5 – 31.0	S-7	19"	13-13-[illegible] ([illegible])	SAND, FINE, LT. BROWN, WET (SP)		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET
L20303.A0	B-45	2 OF —

SOIL BORING LOG

PROJECT: Wausau LF – WDNR LOCATION:

ELEVATION: DRILLING CONTRACTOR: TWIN CITY

DRILLING METHOD AND EQUIPMENT:

WATER LEVEL AND DATE: START: FINISH: LOGGER: J. H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30					SAND, FINE, LT. BROWN, WET, SP		
	35					BOTTOM OF BORING @ 35		
	40							

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	SHEET
L20303.A0	4D	1 OF 3

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Bentonite mud rotary / CME-55

WATER LEVEL AND DATE START 7-3- FINISH 11/10-11/14/85 LOGGER SM McGee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						See log of 4s for 0-35'		
8:12	35	34 - 36.5	S-1	7"	3-4-6 (10)	Sand, f to m, moist, brown tr gravel		
	40	39.5 - 41	S-2	9"	6-7-12 (19)	Sand, fine to medium tr. gr, moist, brown (SP) 8.0% gr 89.2% sd 2.8% fines		
	45	44.5 - 46	S-3	9"	9-12-14 (26)	as above		Stopped work to fix AW plate
	50							
	55	54.5 - 56	S-4	10"	9-9-20 (29)	Sand, fine to med. grained, moist, brown		
	60							

REV 11/82 FORM D1586

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	4D	SHEET 2 OF 3

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Mud rotary / CME-55

WATER LEVEL AND DATE START FINISH LOGGER SM McGee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	65	64.5–66	S-5	10"	13-11-9 (20)	Sand, fine to med, brown, wet		
	70							Broke down drill string [illegible]
								Stopped drilling to mix clean mud
	75	74.5–76	S-6	15"	8-9-11 (20)	Sand, fine, brown, wet		
	80							
	85	84.5–86	S-7	14"	11-19-32 (51)	As above (SP) 15.9% med sd 80.7% fine sd 3.3% fines		

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	4D	SHEET 3 OF 3

SOIL BORING LOG

PROJECT City of Wausau landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Mud rotary / CME-55

WATER LEVEL AND DATE START FINISH LOGGER SM McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	95	94.5–96	S-8	15"	13-16-23 (39)	Sand, fine, moist, brown		
	100							
	105	104.5–106.4	S-9	10"	34-52-50/.4 102/6.4"	As above		
						Bottom of boring 106.4'		
	110							

CH2M HILL

PROJECT NUMBER L20303.A0

BORING NUMBER B-6D

SHEET 1 OF

SOIL BORING LOG

PROJECT City of Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR Twin Cities Testing

DRILLING METHOD AND EQUIPMENT Bentonite mud rotary / CME-55/75, 3 7/8" tricone

WATER LEVEL AND DATE START 11/11/85 FINISH LOGGER S McBee

ELEVATION	DEPTH BELOW SURFACE	SAMPLE: INTERVAL	SAMPLE: TYPE AND NUMBER	SAMPLE: RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
						Sand little if any gravel		Description from driller's comments Refer to log of B-6S Wyogel bentonite
	10							
	20							
	30							
						Cobbley sand and gravel		"boulder"
	40							44' lost ≈ 50% of drilling fluid
						47.5' Granite boulder or top of rock		11/11/85
	50					Bottom of boring 49.5'		11/12/85

This boring was drilled ≈5' from original location after tricone bit sheared off in hole at 55'.

CH2M HILL

PROJECT NUMBER	BORING NUMBER	
L20303.A0	B-7S	SHEET 1 OF -

SOIL BORING LOG

PROJECT Wausau LF - WIS. DNR LOCATION

ELEVATION DRILLING CONTRACTOR Twin City Testing

DRILLING METHOD AND EQUIPMENT 3¼" I.D. HSA (7¼" O.D.), CME 45 RIG, STD SPLIT SPOONS

WATER LEVEL AND DATE 29.5' 11/12 START 0930 - 11/12 FINISH LOGGER I.H. Johnson

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION: NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	0	0.0-1.5	S-1	12"	1-3-5 (8)	FILL, DK. GRAY TO BROWN, ORGANIC SILTY SAND ~2.0'		OVA BACKGROUND ~5 PPM
	5	4.5-6.0	S-2	10"	15-30-15/.2'	SAND, fine TO CSE, LT. BROWN, ~10% FINE GRAVEL, MOIST, (SP) ~7.5'		OVA READING ~5.5 PPM IN HSA
	10	9.5-11.0	S-3	12"	9-16-18 (34)	SAND, MED. TO CSE, LT. BROWN, ~10% FINE GRAVEL, (SP)		OVA READING BACKGROUND OVA [illegible] TO ~5.5 PPM
	15	14.5-16.0	S-4	9"	18-22-14 (36)	SAND, MED. TO CSE, LT. BROWN, ~30% FINE TO MED. GRAVEL, MOIST TO WET (AT BOTTOM) (SP)		OVA READING BACKGROUND
	20	19.5-21.0	S-5	10"	5-11-16 (27)	SAND, MED.-fine, LT. BROWN, MOIST, (SP) 9.6% gr 87.8% sd 2.6% fines		OVA READING BACKGROUND
	25	24.5-26.0	S-6	8"	12-13-13 (26)	SAND, MED. TO CSE., LT BROWN, MOIST, (SP) ~27'		OVA READING [illegible] TO 8 PPM IN [illegible] ~2 to 3 p[illegible] background
	30	29.5-	S-7	8"	7-10-11 (21)	SAND MED. TO fine, LT. BROWN, WET (SP) 35.8% med sd, 63.1% fine sd		OVA [illegible] BACKGROUND [illegible]

CH2M HILL

PROJECT NUMBER L20303.A0

BORING NUMBER S-7S

SHEET 2 OF —

SOIL BORING LOG

PROJECT Wausau Landfill LOCATION

ELEVATION DRILLING CONTRACTOR [illegible] TESTING

DRILLING METHOD AND EQUIPMENT

WATER LEVEL AND DATE START 0930 - 11/12 FINISH LOGGER [illegible]

ELEVATION	DEPTH BELOW SURFACE	SAMPLE INTERVAL	SAMPLE TYPE AND NUMBER	SAMPLE RECOVERY	STANDARD PENETRATION TEST RESULTS 6"-6"-6" (N)	SOIL DESCRIPTION NAME, GRADATION OR PLASTICITY, PARTICLE SIZE DISTRIBUTION, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY, USCS GROUP SYMBOL	SYMBOLIC LOG	COMMENTS DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS AND INSTRUMENTATION
	30							WATER LEVEL AT 29.5 at [illegible]
	35	34.5 – 36.0	S-8	8	4-7-8 (15)	SAND, FINE TO MED, LT. BROWN, WET (SP)		OVA READING BACKGROUND (5.5ppm)
								DRILLED TO 40' W/O SPLIT-SPOON [illegible]
	40					BOTTOM OF BOREHOLE 40.0		[illegible] IN [illegible] WELL TO [illegible]
	45							

Facility Name	Facility ID Number	Date	Completed By (Name and Firm)
City of Wausau Landfill		12/03/85	SHARA McBEE / CH2M Hill

Well Name	Well ID Number (DNR No.)	Well Location	N	S	E	W	Date Established	Well Casing Diam.	Well Casing Type	Elevations: Top of Well Casing	Elevations: Ground Surface	Elevations: Screen Top	Reference: MSL (✓)	Reference: Site Datum (✓)	Screen Length	Screen Material	Well Depth	Type of Well: PIEZ	OW	PW	LYS	Other
1		417,660 2,094,335	✓		✓		11/11/85	2"	P	1223.64	1220.8	1205.9	✓		15'	PVC	30.9		✓			
2		417,810 2,095,205	✓		✓		11/11/85	2"	P	1219.17	1216.2	1193.3	✓		15'	PVC	40.5'		✓			
3		417,330 2,094,945	✓		✓		11/12/85	2"	P	1220.14	1217.4	1193.5	✓		15'	PVC	39.5'		✓			
4S		417,035 2,094,795	✓		✓		11/13/85	2"	P	1216.76	1214.1	1196.9	✓		15'	PVC	35'		✓			
4D		417,035 2,094,780	✓		✓		11/15/85	2"	P	1216.26	1213.9	1114.4	✓		5'	PVC	106'	✓				
6		417,085 2,094,340	✓		✓		11/13/85	2"	P	1221.63	1219.2	1194.7	✓		15'	PVC	49.5'		✓			
7		417,775 2,094,970	✓		✓		11/12/85	2"	P	1220.91	1216.2	1197.2	✓		15'	PVC	40'		✓			

Location Coordinates Are:

☐ Grid System

State Plane Coordinate
☐ Northern
☒ Central

Received In:

District: ______ Area: ______ Bureau: ______

By: ______

SMS Use:

File Maint. Completed: ______
Date

Other: ______

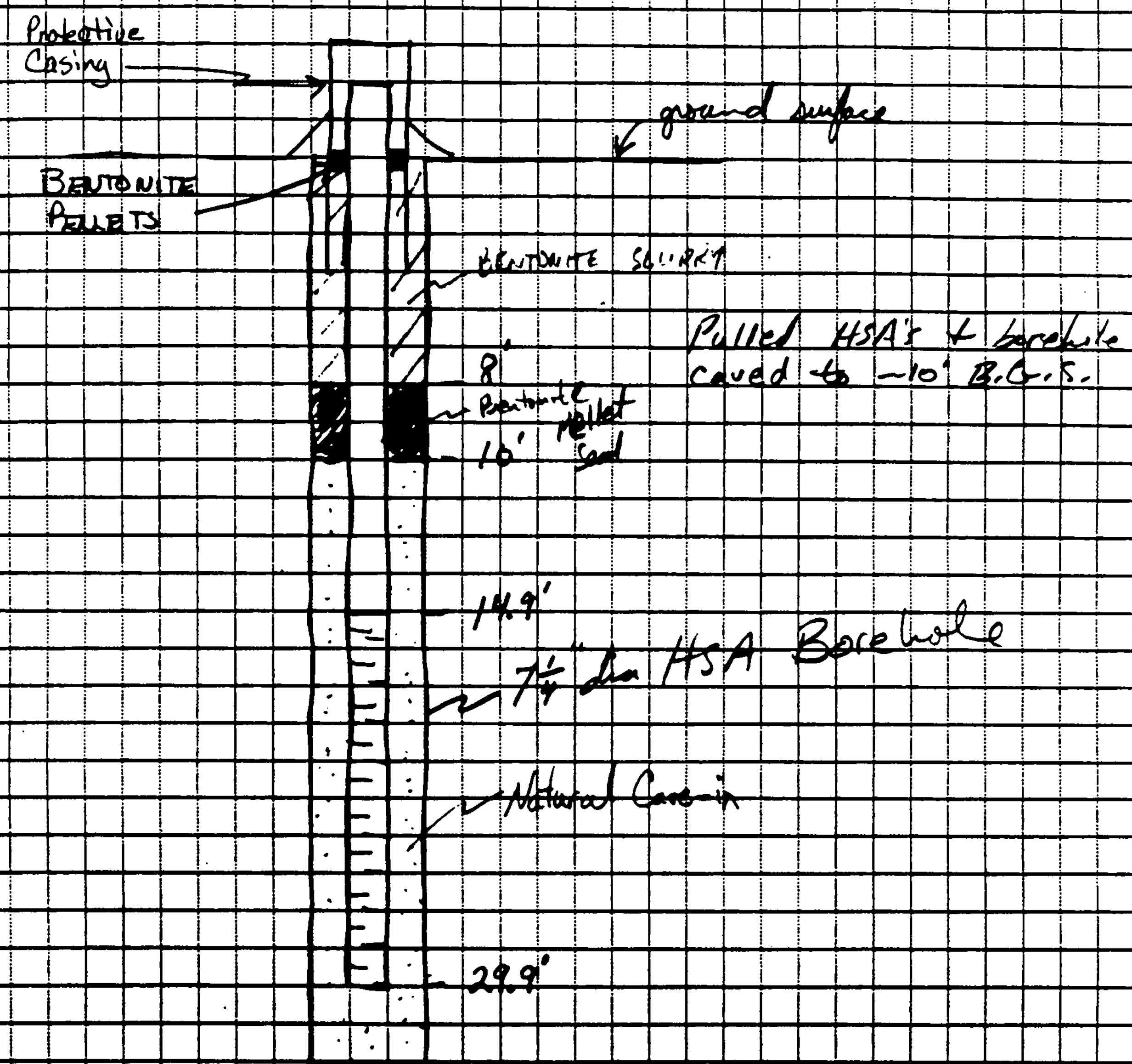
CH2M HILL

FILE NO.
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau
PROJECT NO. L20303.A0
BORING NO. B-1S
PIEZOMETER NO. B-1S

INSTALLED BY IHJ
DATE 11-3-
CHECKED BY
DATE
COORDINATES



M05J12.R0119

CH2M HILL

FILE NO. ______

PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF

INSTALLED BY I.H.J

DATE 11/11/85

PROJECT NO. L20303.A0

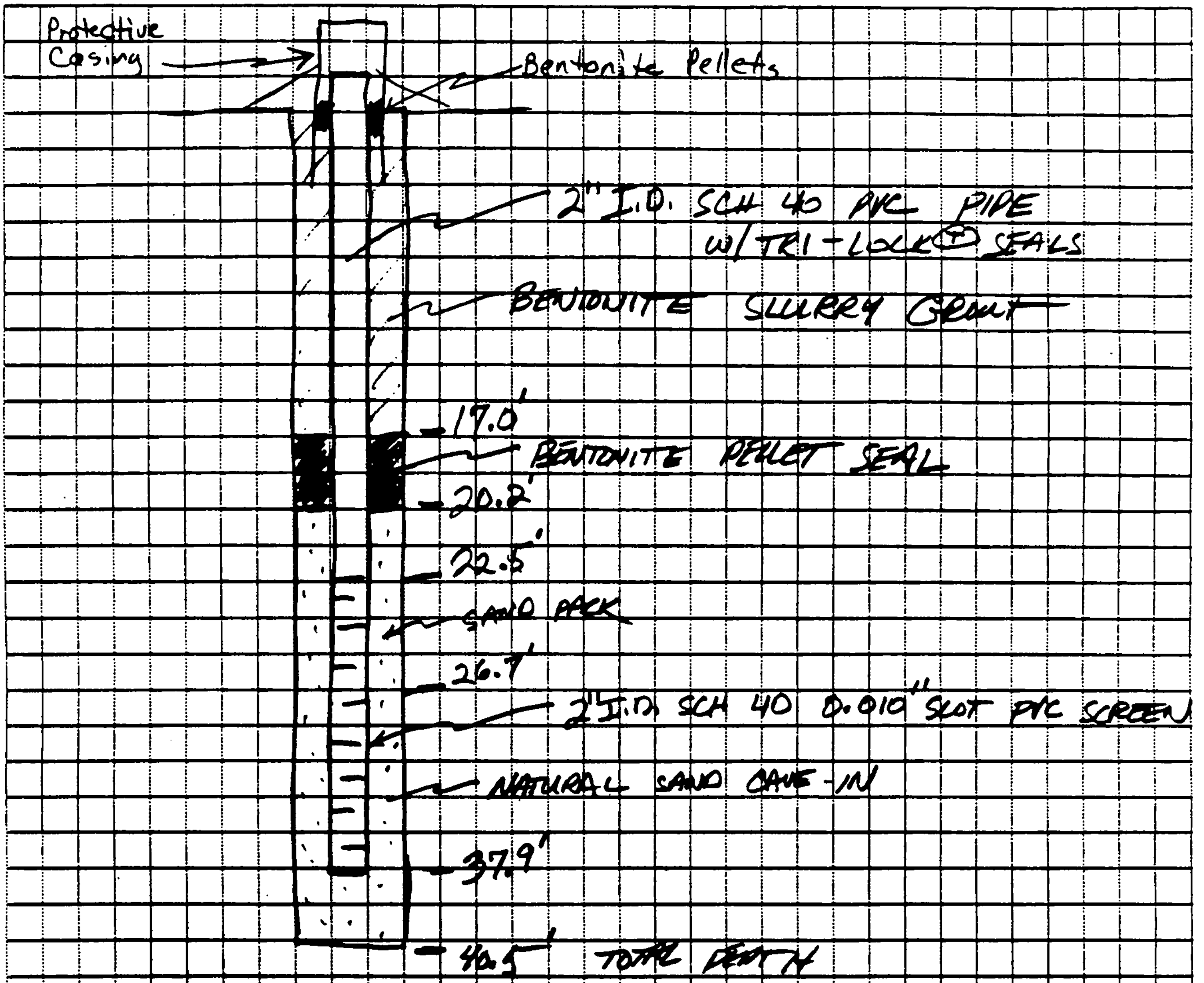
CHECKED BY ______

DATE ______

BORING NO. B-2S

COORDINATES ______

PIEZOMETER NO. B-2S



SET PVC PIPE + SCREEN IN THE HSA'S, THEN PULLED THE HSA'S - BOREHOLE CAVED TO 26.7' B.G.S. PLACED SANDPACK TO 20.2' B.G.S.

CH2M HILL

FILE NO.

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF- WDNR

INSTALLED BY IHJ

DATE 11/12/85

PROJECT NO. L20303.AO

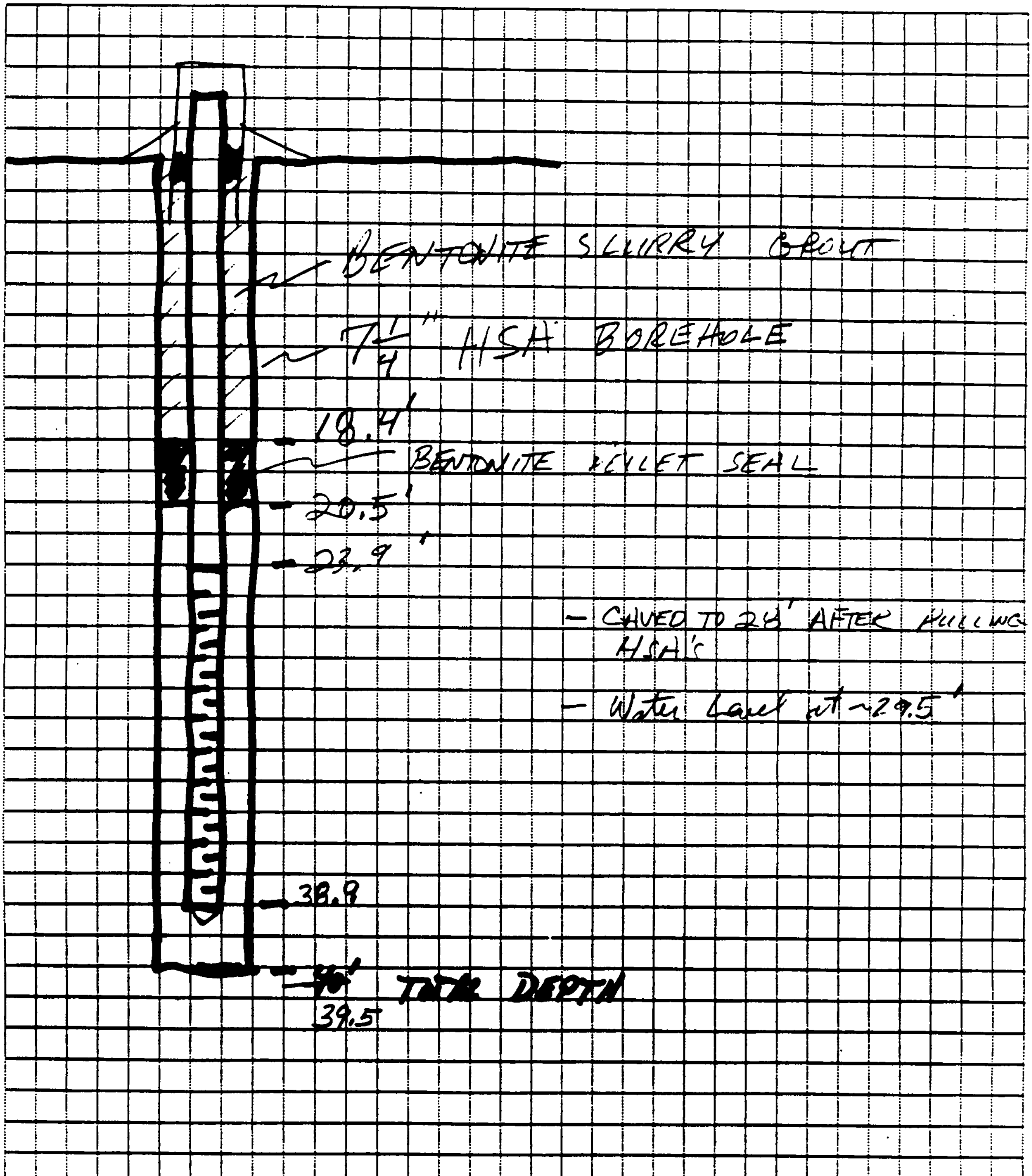
CHECKED BY

DATE

BORING NO. B-3S

COORDINATES

PIEZOMETER NO. B-3S



M05J12.R0119

CH2M HILL

FILE NO. ____

PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - WDNR

PROJECT NO. 620303.A0

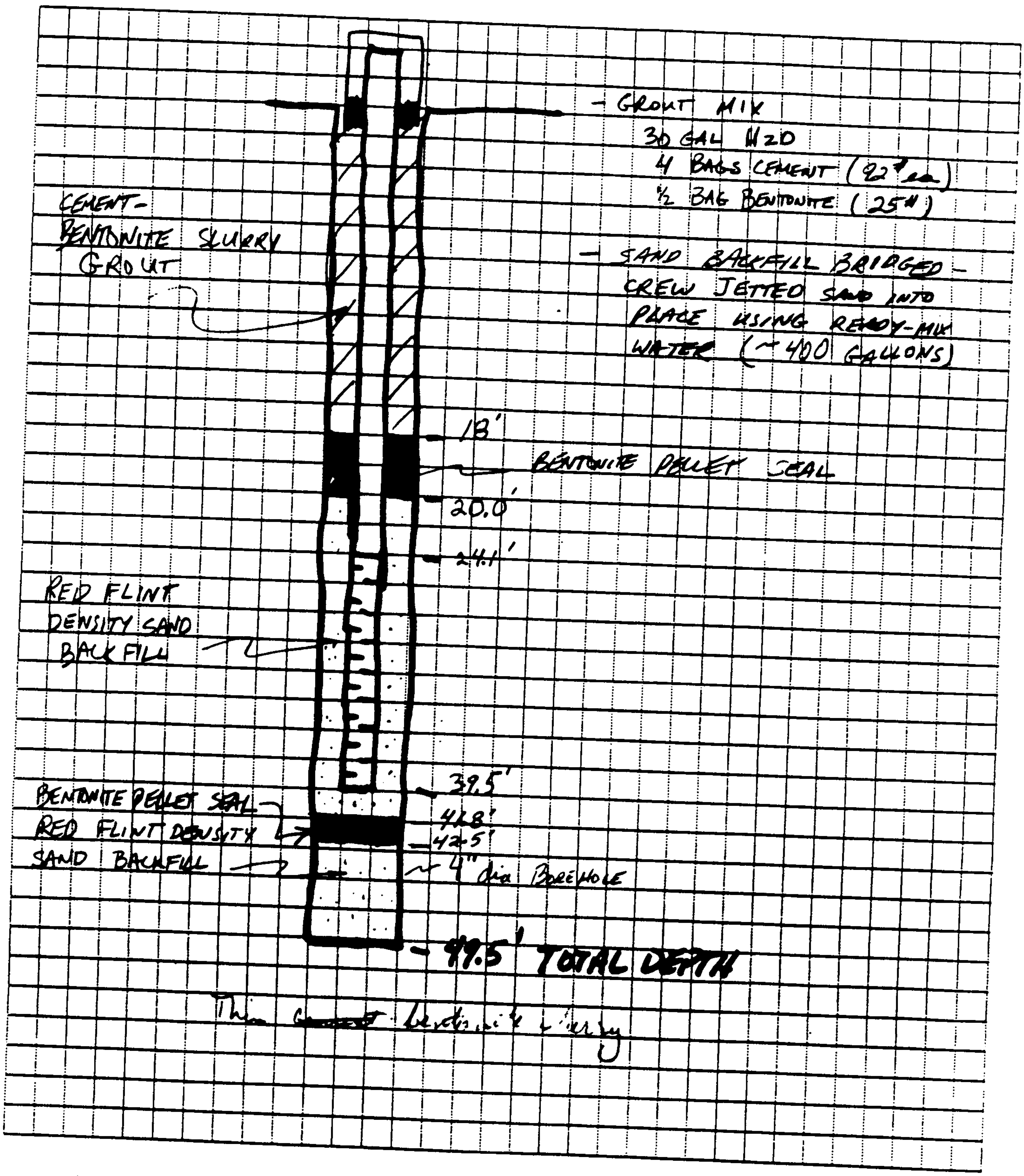
BORING NO. B-6

PIEZOMETER NO. B-6

INSTALLED BY I. H. Johnson DATE 11/13/85

CHECKED BY ____ DATE ____

COORDINATES ____



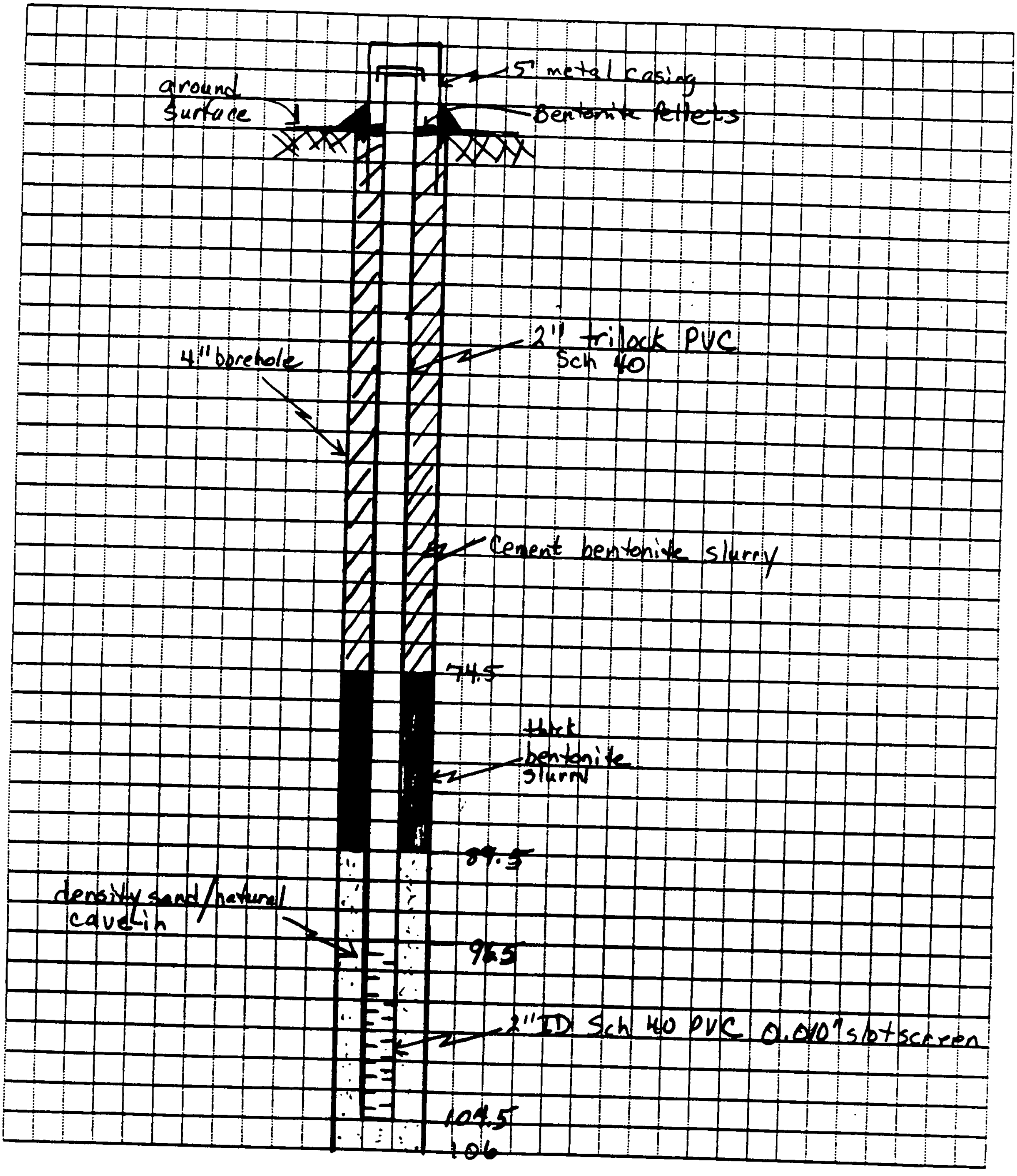
CH2M HILL

FILE NO.
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME City of Wausau Landfill
PROJECT NO. L20303.A0
BORING NO. 4D
PIEZOMETER NO.

INSTALLED BY SM McBee DATE 11/15/85
CHECKED BY DATE
COORDINATES

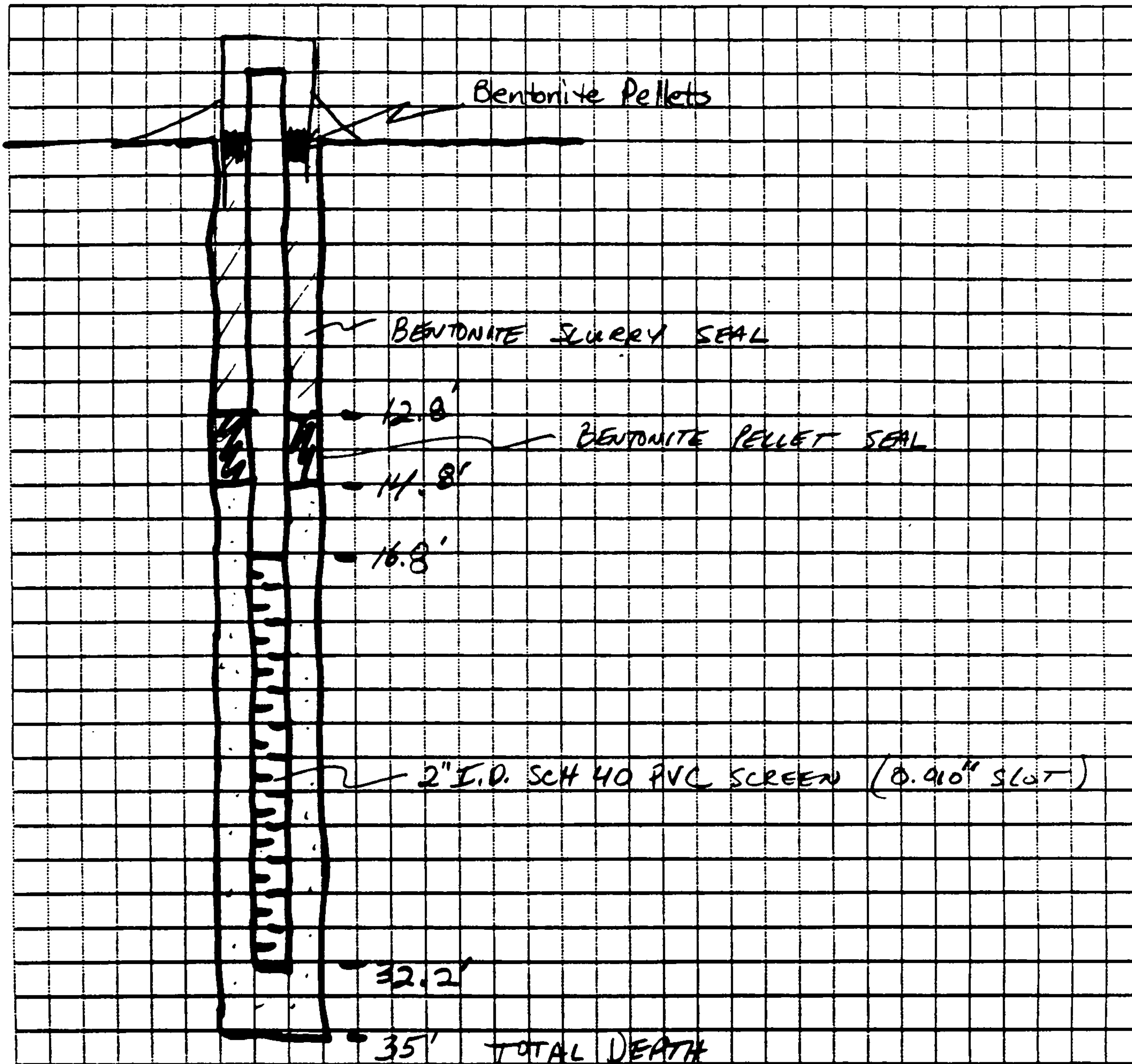


CH2M HILL

FILE NO. ________
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - WDNR
INSTALLED BY I.H.Johnson
DATE 11/13/85
PROJECT NO. L20303.A0
CHECKED BY ________
DATE ________
BORING NO. B-4S
COORDINATES ________
PIEZOMETER NO. B-4S



M05J12.R0119

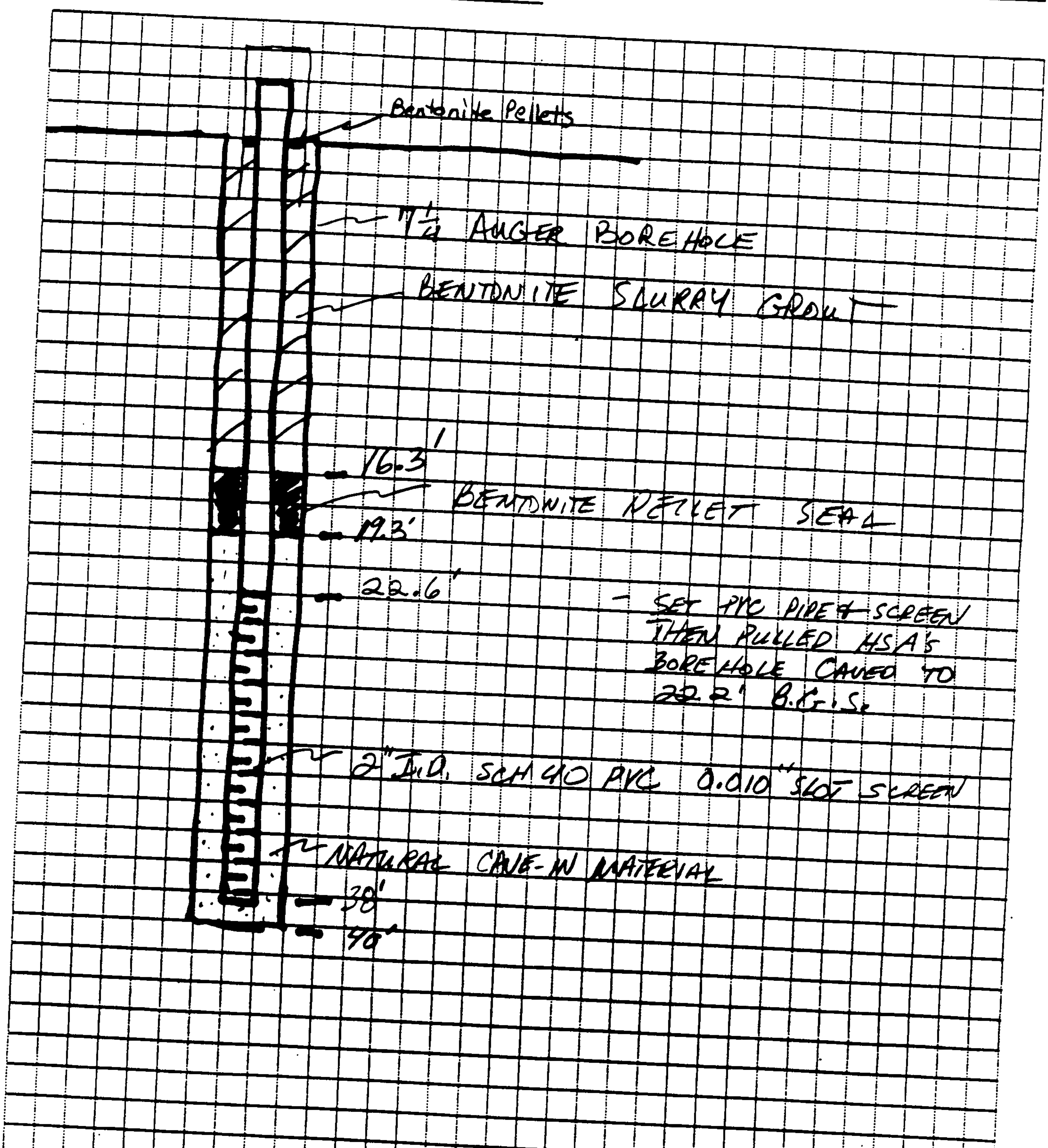
CH2M HILL

FILE NO. ________
PAGE 1 OF 1

PIEZOMETER INSTALLATION SKETCH

PROJECT NAME Wausau LF - Wis. UNR
PROJECT NO. L20303.A0
BORING NO. B-7S
PIEZOMETER NO. B-7S

INSTALLED BY IHJ DATE 11/12/85
CHECKED BY ________ DATE ________
COORDINATES ________



Appendix D
GEOTECHNICAL ANALYSES OF SOILS

CH2M HILL

SIEVE ANALYSIS

PROJECT NUMBER: L20303.A0

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 15 9.5 to 11.0

TYPE OF SAMPLE: SMALL BOTTLE SAMPLE NO. S-3

GROSS WET MASS TOTAL SAMPLE 483.0 TARE MASS 154.3 PAN NO. T NET WET MASS TOTAL SAMPLE

GROSS DRY MASS TOTAL SAMPLE 454.4 TARE MASS 154.3 PAN NO. T NET DRY MASS TOTAL SAMPLE, A 300.1

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
3/4	154.3	154.3	0.0	0.0	0.0	0.0	100	
1/2	158.7	154.3	4.4	4.4	1.5	1.5	98.5	
3/8	160.3	158.7	1.6	6.0	0.5	2.0	98.0	

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 300.1

DRY MASS [redacted] AFTER WASH 292.9

CONVERSION FACTOR, $F = \frac{C}{D} =$ N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	180.5	160.3	20.2		26.2	6.7	8.7	91.3	
8	219.3	180.5	38.8		65.0	12.9	21.7	78.3	
16	274.7	219.3	55.4		120.4	18.5	40.1	59.9	
30	336.4	274.7	61.7		182.1	20.6	60.7	39.3	
50	389.1	336.4	52.7		234.8	17.6	78.2	21.8	
100	440.3	389.1	51.2		286.0	17.1	95.3	4.7	
200	446.7	440.3	6.4		292.4	2.1	97.4	2.6	
PAN	447.1	446.7	0.4		292.8				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		T	
GROSS WET MASS	gms	483.0	
GROSS DRY MASS		454.4	
MOISTURE MASS		28.6	
TARE MASS		154.3	
DRY SOIL MASS		300.1	
MOISTURE CONTENT	%	9.53	

REMARKS: Post Wash Weight = 447.2 - 154.3

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY: Jim Emery DATE: 12/4&5/85 COMPUTED BY: Jim Emery DATE: 12/8/85 CHECKED BY: DATE:

SHEET ___ OF ___

CH2M HILL

PROJECT NUMBER L20303.A0

PARTICLE-SIZE ANALYSIS

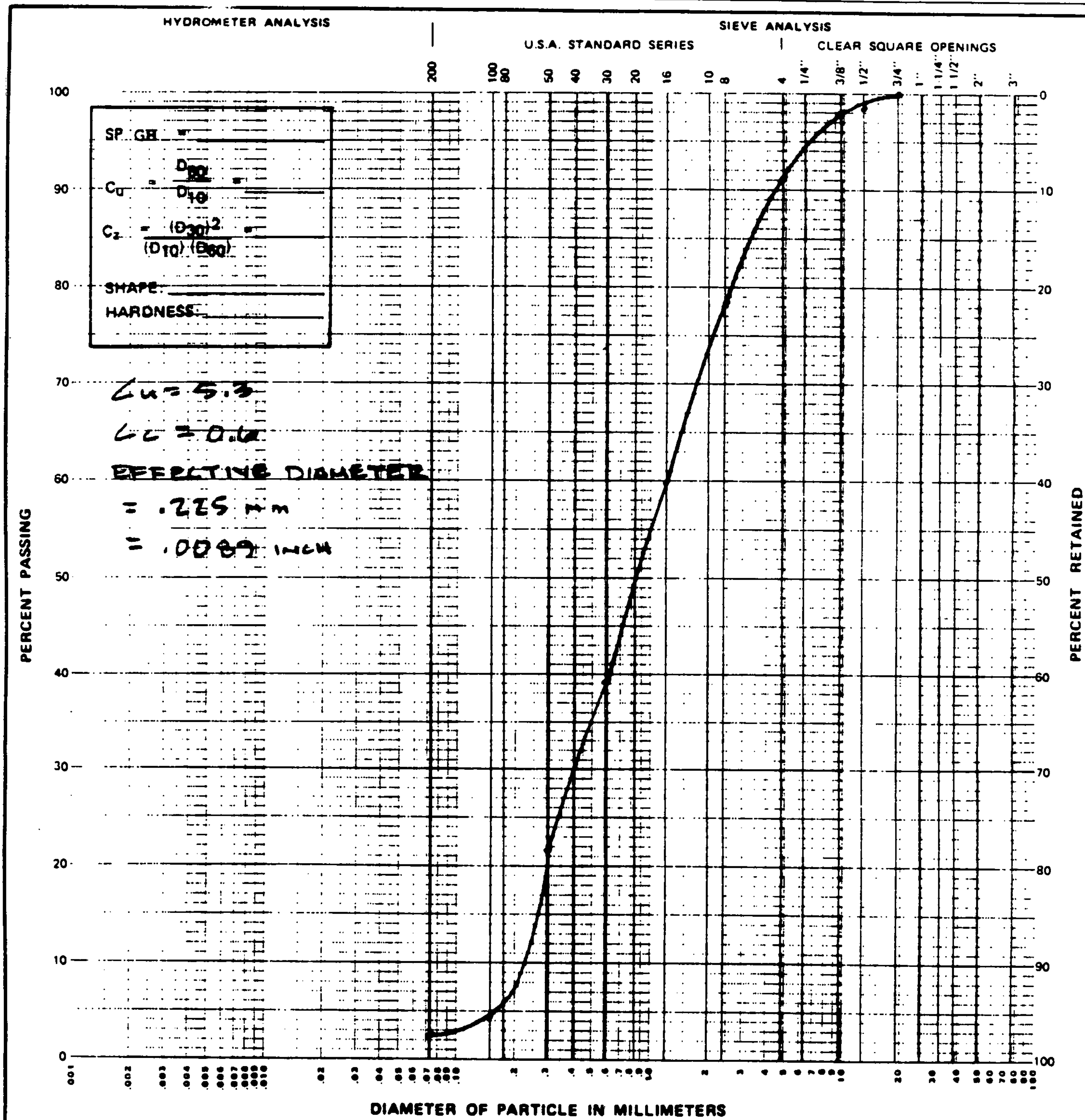
ASTM D422

PROJECT DESCRIPTION Nausau Landfill

MATERIALS LABORATORY Denver

SAMPLE LOCATION: 9' to 11' SAMPLE NO. S-3

TYPE OF SAMPLE: ___



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION Poorly Graded Sand (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

CH2M HILL

SIEVE ANALYSIS

PROJECT NUMBER L20303.A0

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 15 19⁵ to 21⁰

TYPE OF SAMPLE: SMALL BOTTLE SAMPLE NO. S-5

GROSS WET MASS TOTAL SAMPLE 450.8 TARE MASS 155.4 PAN NO. 7 NET WET MASS TOTAL SAMPLE ______

GROSS DRY MASS TOTAL SAMPLE 412.3 TARE MASS 155.4 PAN NO. 7 NET DRY MASS TOTAL SAMPLE, A 256.9

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 256.9

DRY MASS [redacted] AFTER WASH 252.8

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	155.5	155.5	0.0		0.0	0.0	0.0	100	
8	155.9	155.5	0.4		0.4	0.2	0.2	99.8	
16	156.7	155.9	0.8		1.2	0.3	0.5	99.5	
30	166.7	156.7	10.0		11.2	3.9	4.4	95.6	
50	365.3	166.7	198.6		209.8	77.3	81.7	18.3	
100	404.6	365.3	39.3		249.1	15.3	97.0	3.0	
200	408.0	404.6	3.4		252.5	1.3	98.3	1.7	
PAN	408.2	408.0	0.2		252.7				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		7	
GROSS WET MASS	gms	450.8	
GROSS DRY MASS		412.3	
MOISTURE MASS		38.5	
TARE MASS		155.4	
DRY SOIL MASS		256.9	
MOISTURE CONTENT	%	14.99	

REMARKS: POST WASH WEIGHT = 408.3 - 155.5

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12/4&5/85	Jim Emery	12/8/85		

SHEET ___ OF ___

CH2M HILL

PROJECT NUMBER L20303.AO

PARTICLE-SIZE ANALYSIS

ASTM D422

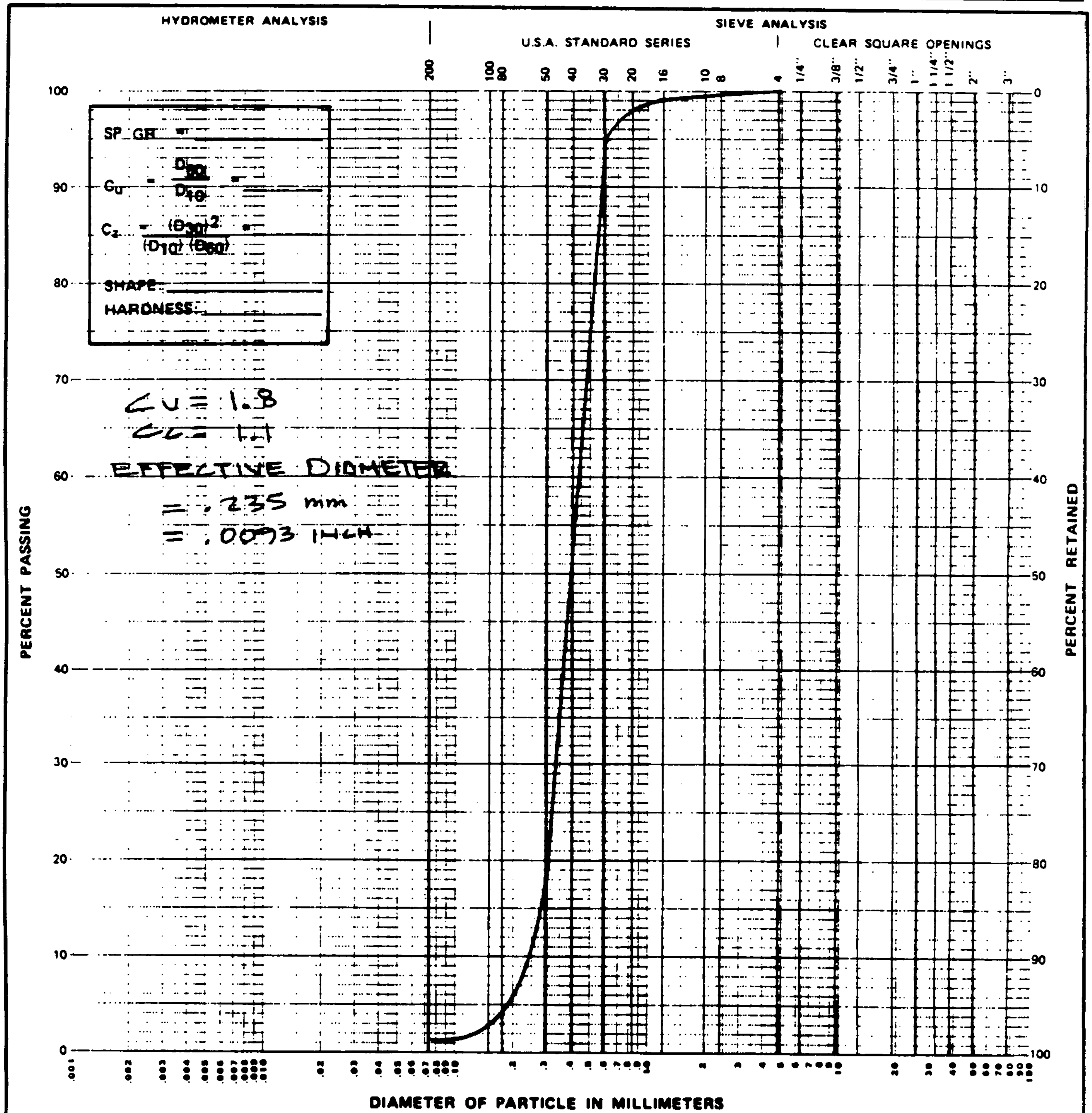
PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 1S 19' to 21'

SAMPLE NO. S-5

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
[illegible]	[illegible]	[illegible]	[illegible]		

CH2M HILL

L 20303.A0

HYDROMETER ANALYSIS WITH SIEVE

ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 15 23.5 to 25.0 SAMPLE NO. S-6

TYPE OF SAMPLE: (Very Small amount submitted sample for this test.)

				HYGROSCOPIC MOISTURE CONTENT	
MASS PER DRY SAMPLE	28.98	JAR NO.	0	CAN NO.	
HYGROSCOPIC MOISTURE, %	6.23	HYDROMETER NO.	68-3922	GROSS WET MASS	28.98
CORRECTED DRY MASS HYDROMETER SAMPLE, (M)	27.28	DISPERSING AGENT	$Na(PO_3)_6$	GROSS DRY MASS	27.28
		AMOUNT USED	125 mL	MOISTURE MASS	1.70
% PASSING NO. 10 SIEVE, (B)	60.21	SPECIFIC GRAVITY, G_s (a)	2.70	TARE MASS	0.00
				DRY SOIL MASS	27.28
				MOISTURE CONTENT	6.23

MASS OF A TOTAL SOIL REPRESENTED BY MASS OF SOIL USED IN HYDROMETER TEST, (W): $W = \frac{M}{B} \times 100 =$ 45.31

Reading Time DAY	HR	MIN	T Elapsed Time (minutes)	r Hydrometer Reading	t Temp. °F	°C	H Composite Hydrometer Correction	R Corrected Hydrometer Reading	P % Soil in Suspension	L Effective Depth (cm)	K K Value from Chart 4	D Diameter of Particle (mm)	
7	08	58	0	–	72.6	22.6	–	–	–	–	–	–	
	09	00	2	13.5	72.6	22.6	6.3	7.2	15.8	14.7	.01303	.0363	
		03	5	11.3	72.6	22.6	6.3	5.0	11.0	15.1	.01303	.0226	
		13	15	10.3	72.7	22.6	6.3	4.0	8.8	15.2	.01303	.0131	
		28	30	9.5	72.8	22.7	6.3	3.2	7.1	15.3	.01302	.0093	
	09	58	60	8.9	73.0	22.8	6.2	2.7	5.8	15.4	.01300	.0066	
	13	08	250	—	-	-	—	—	—	—	—	—	
8	08	58	1440	7.0	73.0	22.8	6.2	0.8	1.7	15.8	.01300	.0014	
07	12	02	184	8.1	72.6	22.6	6.3	1.8	4.0	15.6	.01303	.0038	post wash 35.27

1/2	—	33.00	33.00	0.0	0.0	0.0	0.0	—	100
3/8	—	38.95	33.00	5.95	5.95	12.72	12.72	—	87.3
4		44.92	38.95	5.97	11.92	12.76	25.48		74.5

MATERIAL RETAINED ON 75 μm SIEVE ... (partially overwritten)

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED INDIVIDUAL	NET MASS RETAINED ACCUMULATIVE	PERCENT RETAINED INDIVIDUAL	PERCENT RETAINED ACCUMULATIVE	ACCUMULATIVE PERCENT PASSING	REMARKS
8	50.75	44.92	5.83	17.75	12.46	37.94	62.1	
10	51.62	50.75	0.87	18.62	1.86	39.79	60.2	
16	54.46	51.62	2.84	21.46	6.07	45.86	54.1	
30	57.55	54.46	3.09	24.55	6.60	52.47	47.5	
50	62.05	57.55	4.50	29.05	9.62	62.09	37.9	
100	65.54	62.05	3.49	32.54	7.46	69.54	30.5	
200	68.16	65.54	2.62	35.16	5.60	75.14	24.9	
PAN	68.29	68.16	0.13	35.29				

REMARKS: (SHOW UNITS OF MEASUREMENT) Taken Dry Moist

Air Dry in tare 222 (total (t) #10 Also) 11 Glass

weight of Sample wet = 86.28 - 33.00 = 53.28

weight of Dry Sample = 27.28 + 19.51 = 46.79

~~initial moisture content~~ = 13.87

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Evans	12/7&8/85	Jim Evans	12/10/85		

LAB FORM D422B 2/78

CH2M HILL

SHEET ____ OF ____

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 2S 9' to 10' SAMPLE NO. S-3

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 467.2 TARE MASS 153.8 PAN NO. 217 NET WET MASS TOTAL SAMPLE ____

GROSS DRY MASS TOTAL SAMPLE 447.3 TARE MASS 153.8 PAN NO. 217 NET DRY MASS TOTAL SAMPLE, A 293.5

COARSE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS ____

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
1	153.8	153.8	0.0	0.0	0.0	0.0	100	
3/4	209.8	153.8	56.0	56.0	19.1	19.1	80.9	
1/2	None Retained – Not reported on plot.							
3/8	218.9	209.8	9.1	65.1	3.1	22.2	77.8	

FINE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS, C ____

DRY MASS [redacted] PRIOR TO WASH, D 293.5

DRY MASS [redacted] AFTER WASH 284.7

CONVERSION FACTOR, $F = \frac{C}{D} =$ N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	247.3	218.9	28.4		93.5	9.7	31.9	68.1	
8	292.8	247.3	45.5		139.0	15.5	47.4	52.6	
16	330.9	292.8	38.1		177.1	13.0	60.3	39.7	
30	373.5	330.9	42.6		219.7	14.5	74.9	25.1	
50	421.7	373.5	48.2		267.9	16.4	91.3	8.7	
100	433.5	421.7	11.8		279.7	4.0	95.3	4.7	
200	438.1	433.5	4.6		284.3	1.6	96.9	3.1	
PAN	438.6	438.1	0.5		284.8				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		217	
GROSS WET MASS	gms	467.2	
GROSS DRY MASS		447.3	
MOISTURE MASS		19.9	
TARE MASS		153.8	
DRY SOIL MASS		293.5	
MOISTURE CONTENT	%	6.78	

REMARKS: POST WASH WEIGHT = 438.5 - 153.8

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12\4&5\85	Jim Emery	12\8\85		

CH2M HILL

SHEET __ OF __

PROJECT NUMBER L20303.AO

PARTICLE-SIZE ANALYSIS

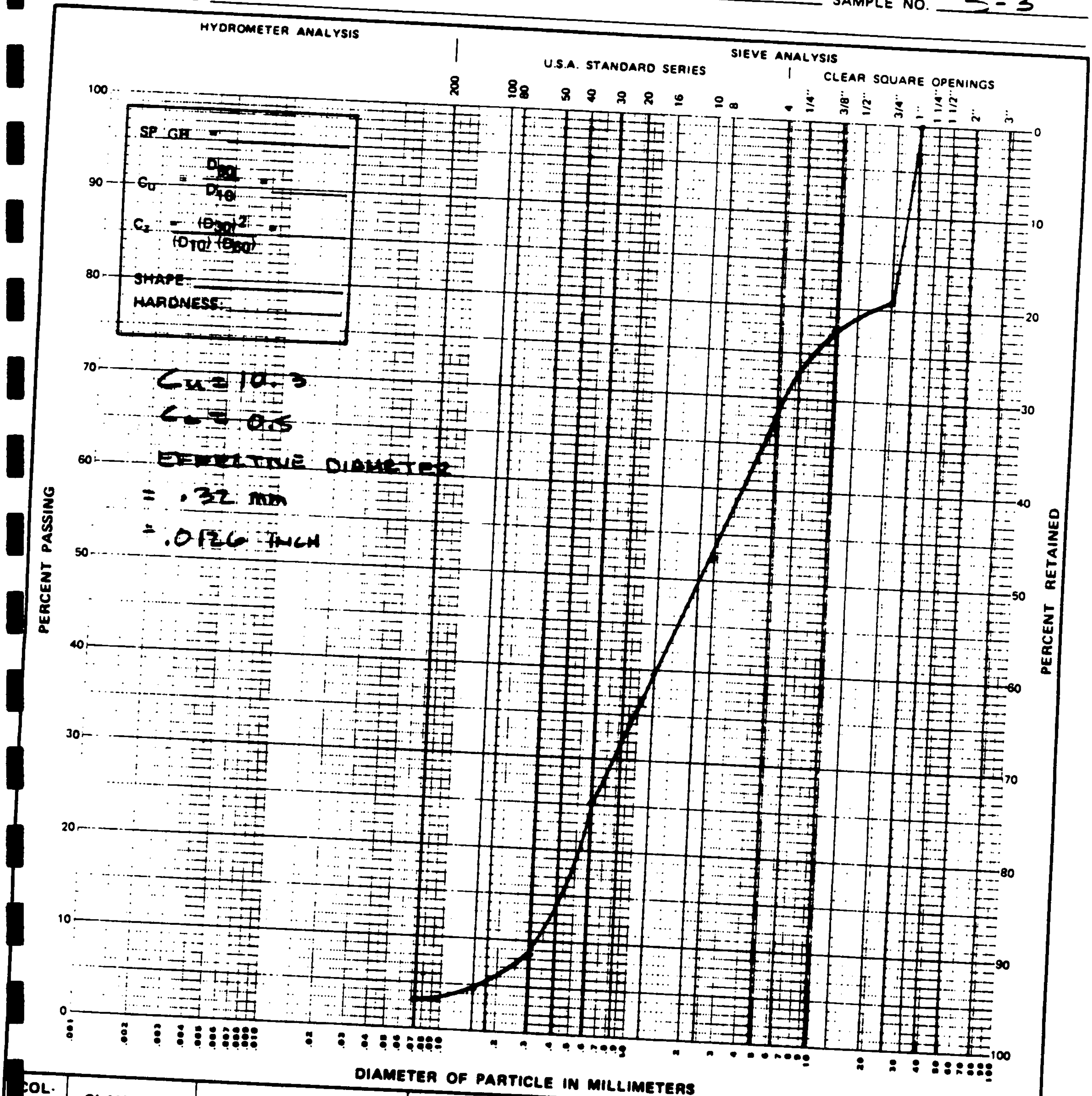
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: Z-5 9.0 to 10.5

TYPE OF SAMPLE: SAMPLE NO. S-3



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION WELL GRADED SAND (SW)

TESTED BY: Jim Evans DATE: 12/26/86 COMPUTED BY: DATE: CHECKED BY:

CH2M HILL

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 35 9½ to 11½ SAMPLE NO. S-3

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 449.7 TARE MASS 149.0 PAN NO. U NET WET MASS TOTAL SAMPLE ______

GROSS DRY MASS TOTAL SAMPLE 436.9 TARE MASS 149.0 PAN NO. U NET DRY MASS TOTAL SAMPLE, A 287.9

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
1	149.0	149.0	0.0	0.0	0.0	0.0	100	
3/4	160.6	149.0	11.6	11.6	4.0	4.0	96.0	
1/2	190.4	160.6	29.8	41.4	10.4	14.4	85.6	
3/8	200.2	190.4	9.8	51.2	3.4	17.8	82.2	

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 287.9

DRY MASS [redacted] AFTER WASH 274.0

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	242.3	200.2	42.1		93.3	14.6	32.4	67.6	
8	281.1	242.3	38.8		132.1	13.5	45.9	54.1	
16	319.5	281.1	38.4		170.5	13.3	59.2	40.8	
30	372.6	319.5	53.1		223.6	18.4	77.7	22.3	
50	405.1	372.6	32.5		256.1	11.3	89.0	11.0	
100	415.9	405.1	10.8		266.9	3.8	92.7	7.3	
200	422.5	415.9	6.6		273.5	2.3	95.0	5.0	
PAN	423.0	422.5	0.5		274.0				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		U	
GROSS WET MASS	gms	449.7	
GROSS DRY MASS		436.9	
MOISTURE MASS		12.8	
TARE MASS		149.0	
DRY SOIL MASS		287.9	
MOISTURE CONTENT	%	4.45	

REMARKS: POST WASH WEIGHT = 423.0 - 149.0

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12\4&5\85	Jim Emery	12\8\85		

SHEET ___ OF ___

CH2M HILL

PROJECT NUMBER L20302.A0

PARTICLE-SIZE ANALYSIS

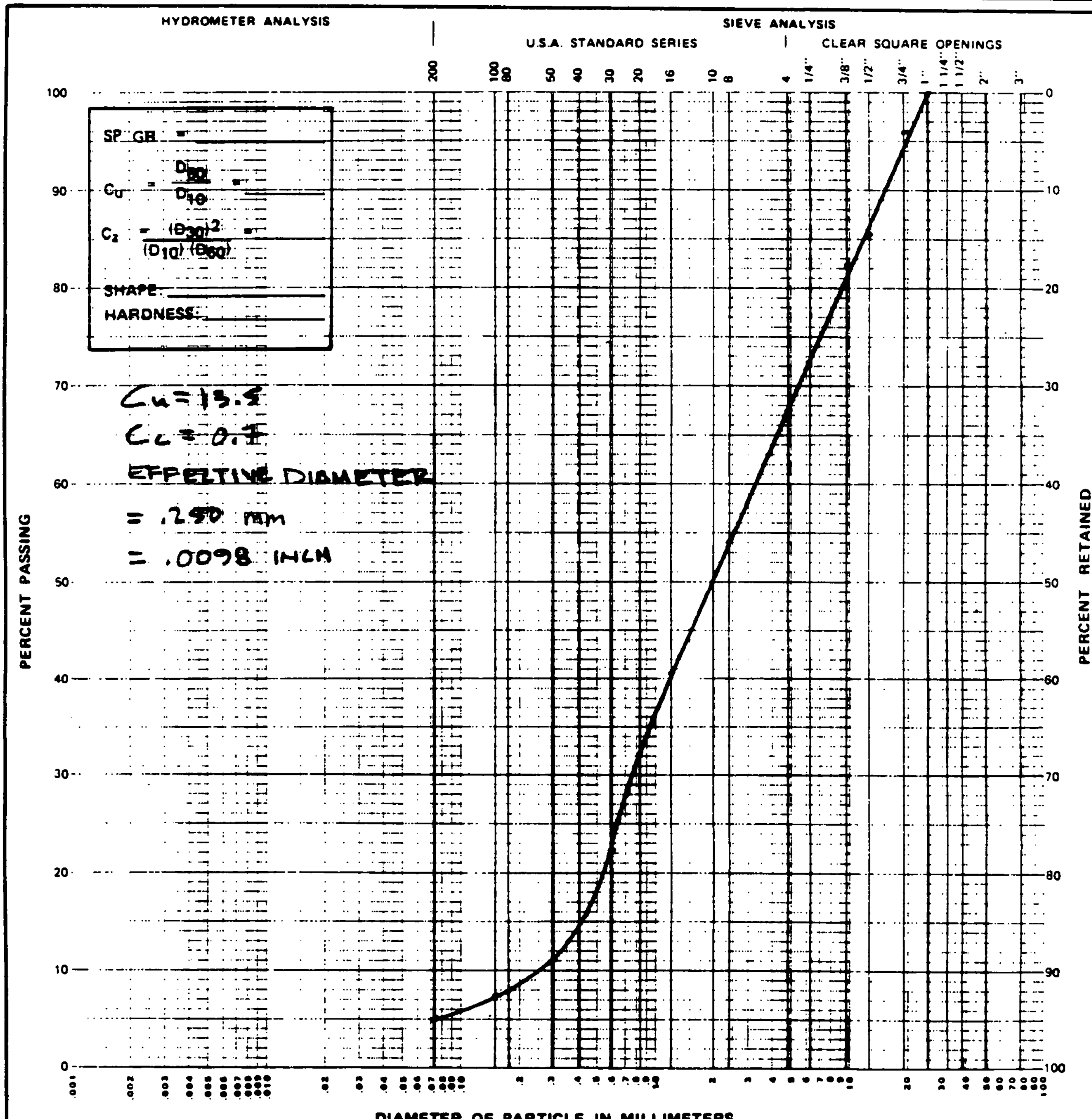
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 3 S 9.5 to 11.0 SAMPLE NO. S-3

TYPE OF SAMPLE: ___



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION WELL GRADED SAND (SW)

CH2M HILL

L20303.AO

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 3S 14.5 to 16.0

TYPE OF SAMPLE: SMALL BOTTLE

SAMPLE NO. S-4

GROSS WET MASS TOTAL SAMPLE 398.8 TARE MASS 149.0 PAN NO. M NET WET MASS TOTAL SAMPLE ______

GROSS DRY MASS TOTAL SAMPLE 377.0 TARE MASS 149.0 PAN NO. M NET DRY MASS TOTAL SAMPLE, A 228.0

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
3/8	149.2	149.2	0.0	0.0	0.0	0.0	100	

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 228.0

DRY MASS [redacted] AFTER WASH 223.7

CONVERSION FACTOR, $F = \frac{C}{D} =$ N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	154.1	149.2	4.9		4.9	2.1	2.1	97.9	
8	160.4	154.1	6.3		11.2	2.8	4.9	95.1	
16	173.1	160.4	12.7		23.9	5.6	10.5	89.5	
30	214.7	173.1	41.6		65.5	18.2	28.7	71.3	
50	309.7	214.7	95.0		160.5	41.7	70.4	29.6	
100	369.4	309.7	59.7		220.2	26.2	96.6	3.4	
200	372.7	369.4	3.3		223.5	1.4	98.0	2.0	
PAN	372.8	372.7	0.1		223.6				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		M	
GROSS WET MASS	gms	398.8	
GROSS DRY MASS		377.0	
MOISTURE MASS		21.8	
TARE MASS		149.0	
DRY SOIL MASS		228.0	
MOISTURE CONTENT	%	9.56	

REMARKS: Post WASH WEIGHT = 372.9 - 149.2

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12\4&5\85	Jim Emery	12\8\85		

LAB FORM D422A 2/73

CH2M HILL

SHEET ___ OF ___

PROJECT NUMBER L20203.A0

PARTICLE-SIZE ANALYSIS

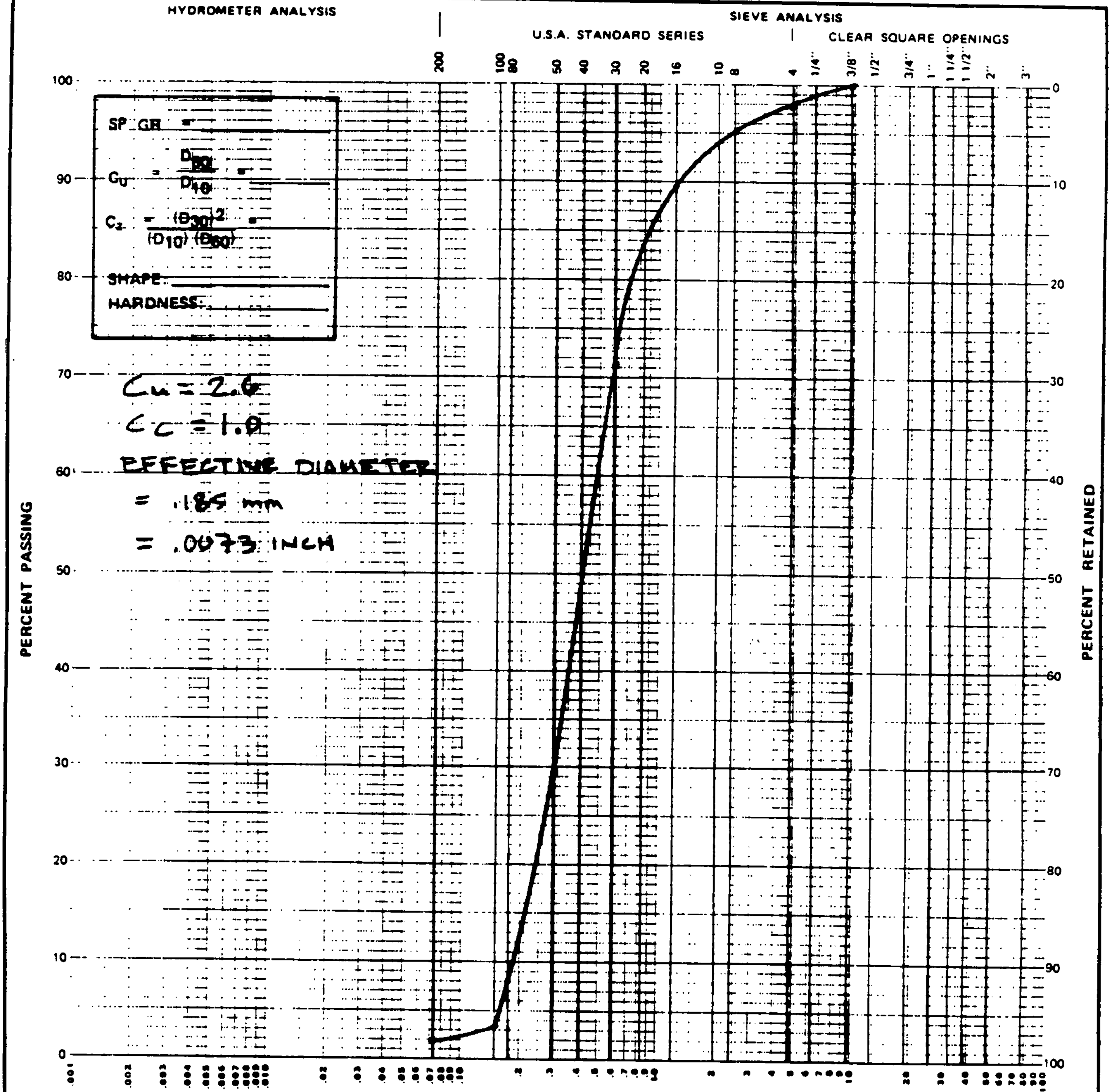
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 3 S 14' to 16' SAMPLE NO. S-4

TYPE OF SAMPLE: ___



COLLOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

CH2M HILL

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 35 24.5 to 26.0

SAMPLE NO. S-6

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 416.5 TARE MASS 169.6 PAN NO. 223 NET WET MASS TOTAL SAMPLE

GROSS DRY MASS TOTAL SAMPLE 403.9 TARE MASS 169.6 PAN NO. 223 NET DRY MASS TOTAL SAMPLE, A 234.3

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 234.3

DRY MASS [redacted] AFTER WASH 232.6

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	169.7	169.7	0.0		0.0	0.0	0.0	100	
8	169.8	169.7	0.1		0.1	4.3×10^{-2}	4.3×10^{-2}	100	
16	169.9	169.8	0.1		0.2	4.3×10^{-2}	0.1	99.9	
30	170.8	169.9	0.9		1.1	0.4	0.5	99.5	
50	286.1	170.8	115.3		116.4	49.2	49.7	50.3	
100	398.1	286.1	112.0		228.4	47.8	97.5	2.5	
200	402.2	398.1	4.1		232.5	1.7	99.2	0.8	
PAN	402.3	402.2	0.1		232.6				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		223	
GROSS WET MASS	gms	416.5	
GROSS DRY MASS		403.9	
MOISTURE MASS		12.6	
TARE MASS		169.6	
DRY SOIL MASS		234.3	
MOISTURE CONTENT	%	5.38	

REMARKS:

Post WASH WEIGHT = 402.3 - 169.7

NOTES:

1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12/4&5/85	Jim Emery	12/8/85		

LAB FORM D422A 2/78

SHEET __ OF __

CH2M HILL

PROJECT NUMBER: L20303.A0

PARTICLE-SIZE ANALYSIS

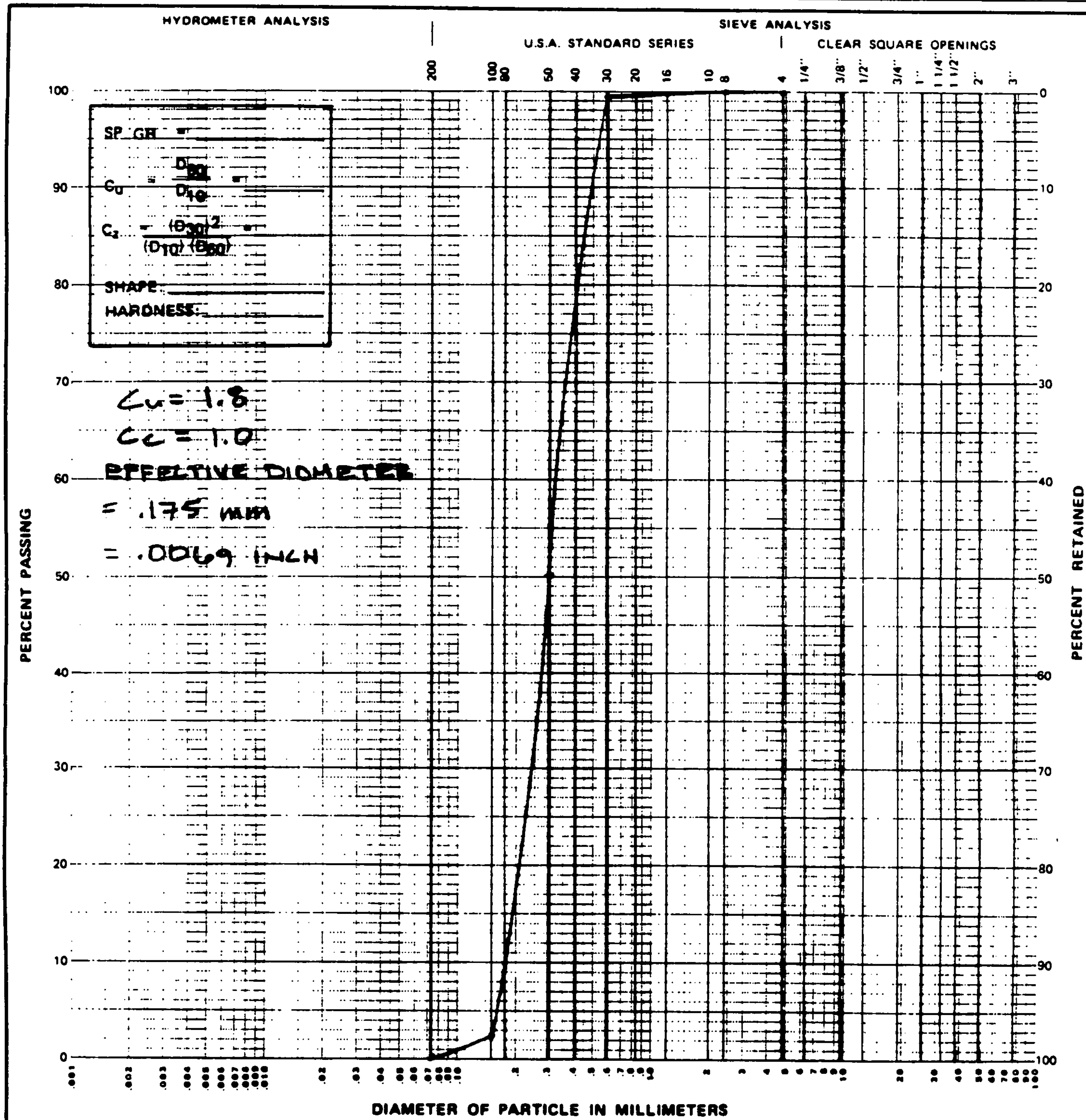
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 3S 24$\frac{5}{-}$ to 26$\frac{0}{-}$ SAMPLE NO. S-6

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

CH2M HILL

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 4S 14' to 16'   SAMPLE NO. S-4

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 300.7 TARE MASS 151.9 PAN NO. P NET WET MASS TOTAL SAMPLE ____

GROSS DRY MASS TOTAL SAMPLE 291.0 TARE MASS 151.9 PAN NO. P NET DRY MASS TOTAL SAMPLE, A 139.1

COARSE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS ____

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
3/4	152.0	152.0	0.0	0.0	0.0	0.0	100	
1/2	156.3	152.0	4.3	4.3	3.1	3.1	96.9	
3/8	159.2	156.3	2.9	7.2	2.1	5.2	94.8	

FINE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS, C ____

DRY MASS [redacted] PRIOR TO WASH, D 139.1

DRY MASS [redacted] AFTER WASH 135.5

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	164.8	159.2	5.6		12.8	4.0	9.2	90.8	
8	174.3	164.8	9.5		22.3	6.8	16.0	84.0	
16	185.0	174.3	10.7		33.0	7.7	23.7	76.3	
30	203.1	185.0	18.1		51.1	13.0	36.7	63.3	
50	239.3	203.1	36.2		87.3	26.0	62.8	37.2	
100	283.9	239.3	44.6		131.9	32.1	94.8	5.2	
200	287.2	283.9	3.3		135.2	2.4	97.2	2.8	
PAN	287.4	287.2	0.2		135.4				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		P	
GROSS WET MASS	gms	300.7	
GROSS DRY MASS		291.0	
MOISTURE MASS		9.7	
TARE MASS		151.9	
DRY SOIL MASS		139.1	
MOISTURE CONTENT	%	6.97	

REMARKS: Post WASH WEIGHT = 287.5 - 152.0

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12/4&5/85	Jim Emery	12/8/85		

SHEET ___ OF ___

CH2M HILL

PROJECT NUMBER: L20303.A0

PARTICLE-SIZE ANALYSIS

ASTM D422

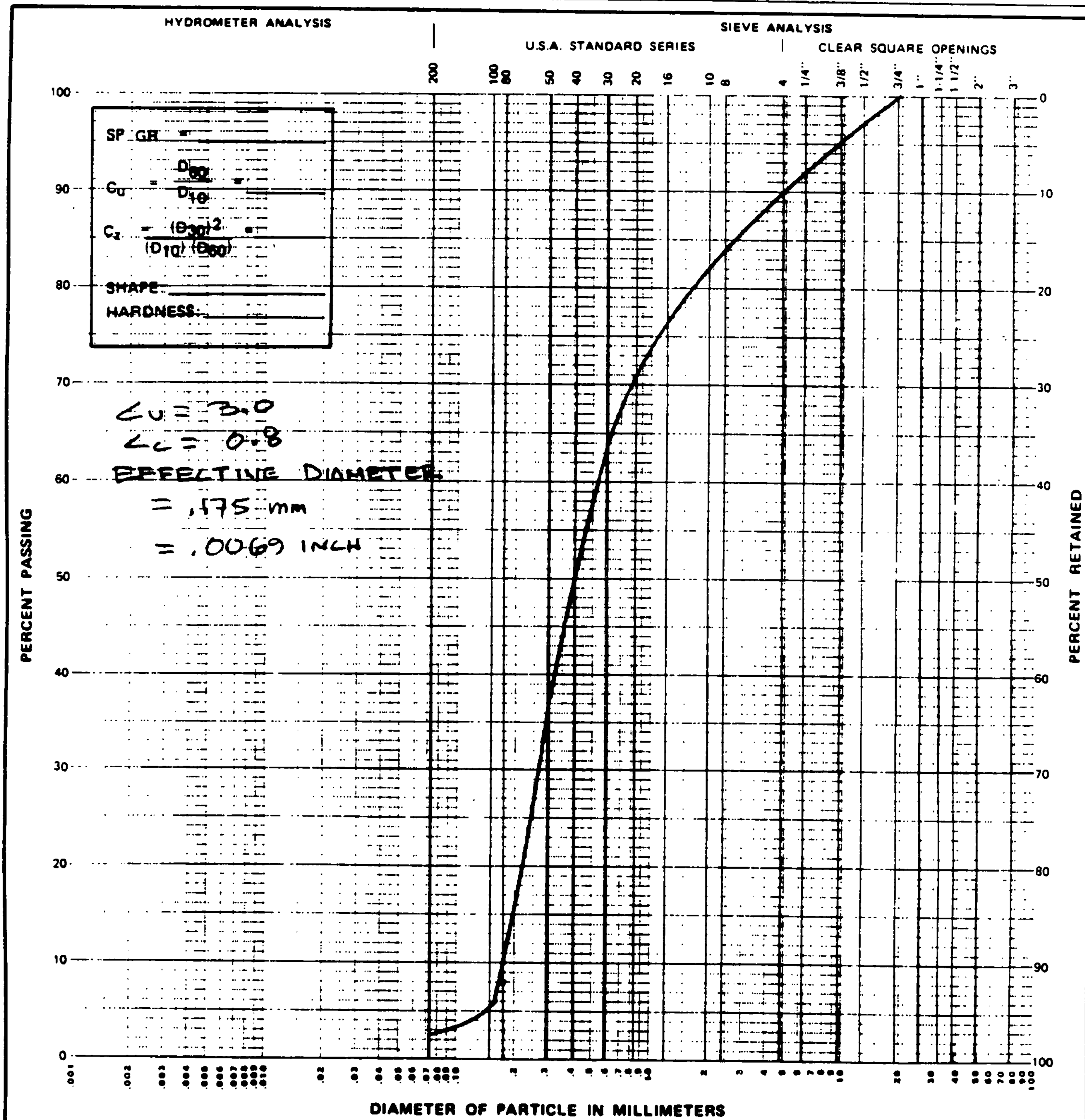
PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 4S

SAMPLE NO. S-4

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

CH2M HILL

PROJECT NUMBER L20303.AO

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 4S 19.5 to 21.0

TYPE OF SAMPLE: SMALL BOTTLE — SAMPLE NO. S-5

GROSS WET MASS TOTAL SAMPLE 458.2 TARE MASS 154.0 PAN NO. X NET WET MASS TOTAL SAMPLE ____

GROSS DRY MASS TOTAL SAMPLE 445.9 TARE MASS 154.0 PAN NO. X NET DRY MASS TOTAL SAMPLE, A 291.9

COARSE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS ____

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED INDIVIDUAL	NET MASS RETAINED ACCUMULATIVE	PERCENT RETAINED INDIVIDUAL	PERCENT RETAINED ACCUMULATIVE	ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
1	154.2	154.2	0.0					
3/4	166.6	154.2	12.4	0.0	0.0	0.0	100	
1/2	191.8	166.6	25.2	12.4	4.2	4.2	95.8	
3/8	201.9	191.8	10.1	37.6	8.6	12.9	87.1	
				47.7	3.5	16.3	83.7	

FINE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS, C ____

DRY MASS [redacted] PRIOR TO WASH, D 291.9

DRY MASS [redacted] AFTER WASH 278.0

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED INDIVIDUAL, E (AS RECORDED)	(F)	NET MASS RETAINED INDIVIDUAL (TOTAL BASIS)	PERCENT RETAINED INDIVIDUAL	PERCENT RETAINED ACCUMULATIVE	ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
4	242.1	201.9	40.2		87.9	13.8	30.1	69.9	
8	281.5	242.1	39.4		127.3	13.5	43.6	56.4	
16	320.2	281.5	38.7		166.0	13.3	56.9	43.1	
30	377.0	320.2	56.8		222.8	19.5	76.3	23.7	
50	413.7	377.0	36.7		259.5	12.6	88.9	11.1	
100	424.1	413.7	10.4		269.9	3.6	92.5	7.5	
200	430.9	424.1	6.8		276.7	2.3	94.8	5.2	
PAN	432.1	430.9	1.2		277.9				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		X	
GROSS WET MASS	gms	458.2	
GROSS DRY MASS		445.9	
MOISTURE MASS		12.3	
TARE MASS		154.0	
DRY SOIL MASS		291.9	
MOISTURE CONTENT	%	4.21	

REMARKS: Post WASH WEIGHT = 432.2 - 154.2

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY: Jim Emery DATE: 12/4&5/85 COMPUTED BY: Jim Emery DATE: 12/8/85 CHECKED BY: DATE:

LAB FORM D422A

SHEET __ OF __

CH2M HILL

PROJECT NUMBER L20302.A0

PARTICLE-SIZE ANALYSIS

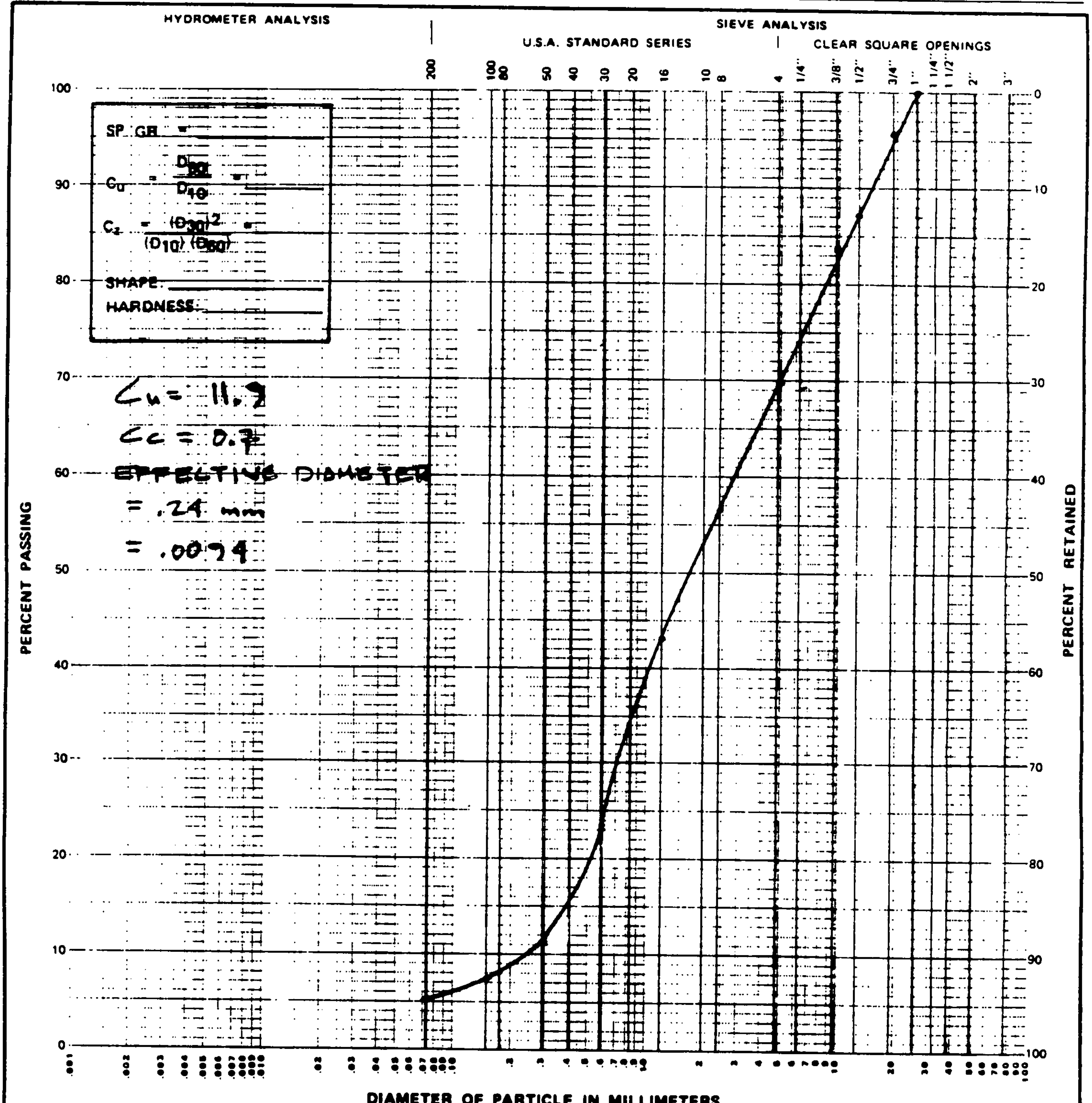
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 4S 19^{5} to 21^{0} SAMPLE NO. S-5

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION WELL GRADED SAND (SW)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
[illegible]	[illegible]	[illegible]			

CH2M HILL

7 DEC

NOT 40 (Fourty)

L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: B(40) 39½ to 41 (4D Z on Lid) SAMPLE NO. S-2

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 461.1 TARE MASS 150.1 PAN NO. Z NET WET MASS TOTAL SAMPLE ______

GROSS DRY MASS TOTAL SAMPLE 415.0 TARE MASS 150.1 PAN NO. Z NET DRY MASS TOTAL SAMPLE, A 264.9

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
3/8	150.2	150.2	0.0	0.0	0.0	0.0	100	

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 264.9

DRY MASS [redacted] AFTER WASH 258.1

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	152.3	150.2	2.1		2.1	0.8	0.8	99.2	
8	155.2	152.3	2.9		5.0	1.1	1.9	98.1	
16	166.6	155.2	11.4		16.4	4.3	6.2	93.8	
30	214.5	166.6	47.9		64.3	18.1	24.3	75.7	
50	340.9	214.5	126.4		190.7	47.7	72.0	28.0	
100	397.6	340.9	56.7		247.4	21.4	93.4	6.6	
200	407.6	397.6	10.0		257.4	3.8	97.2	2.8	
PAN	408.2	407.6	0.6		258.0				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		Z	
GROSS WET MASS	gms	461.1	
GROSS DRY MASS		415.0	
MOISTURE MASS		46.1	
TARE MASS		150.1	
DRY SOIL MASS		264.9	
MOISTURE CONTENT	%	17.40	

REMARKS: Pst WASH WEIGHT = 408.3 - 150.2

(Soil exploration Co. on Label)

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12\4&5\95	Jim Emery	12\8\95		

LAB FORM D422A 2/78

SHEET __ OF __

CH2M HILL

PROJECT NUMBER L20302.A0

PARTICLE-SIZE ANALYSIS

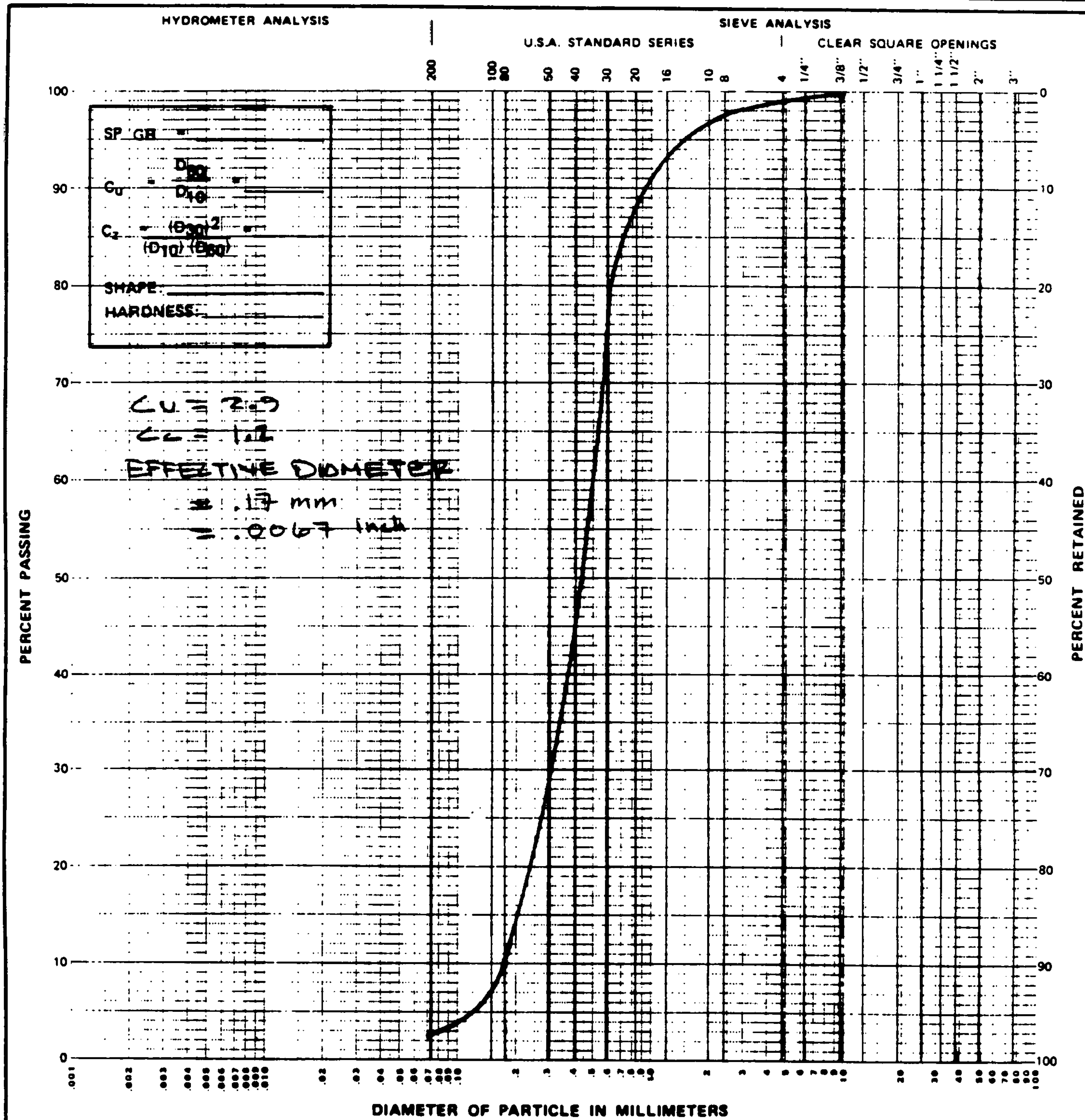
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: B4D 39.3 to 40.0 SAMPLE NO. S-2

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

SHEET ___ OF ___

CH2M HILL

PROJECT NUMBER L 20303.A0

PARTICLE-SIZE ANALYSIS

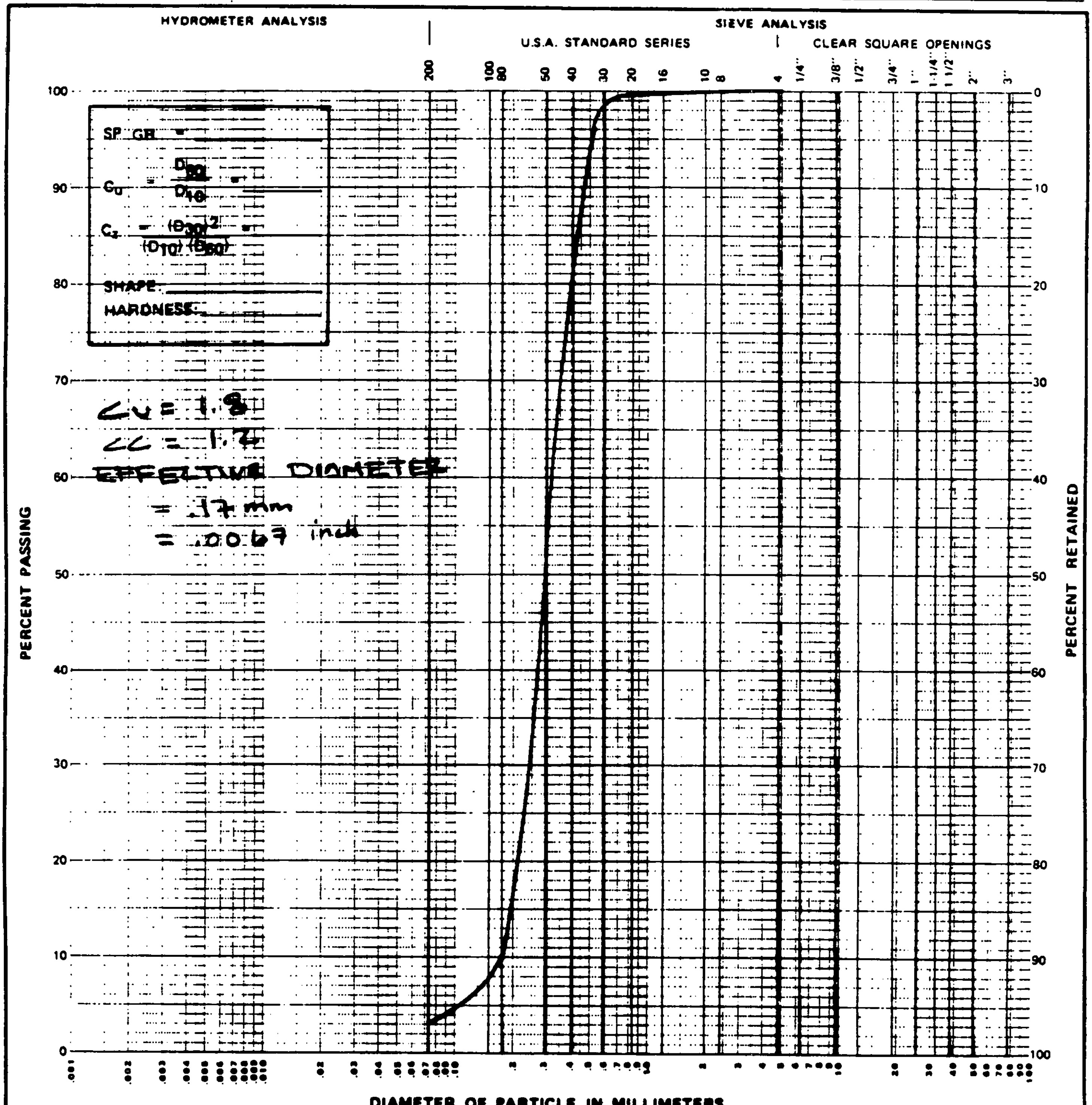
ASTM D422

PROJECT DESCRIPTION: WAUSAU

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: B-4D 84^5 to 86^2 SAMPLE NO. S-7

TYPE OF SAMPLE: ___



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADED SAND (SP)

TESTED BY: DATE: COMPUTED BY: DATE: CHECKED BY: DATE:

CH2M HILL

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 7S 19.5 to 21.0

TYPE OF SAMPLE: SMALL BOTTLE SAMPLE NO. S-5

GROSS WET MASS TOTAL SAMPLE 467.6 TARE MASS 167.3 PAN NO. 220 NET WET MASS TOTAL SAMPLE

GROSS DRY MASS TOTAL SAMPLE 448.9 TARE MASS 167.3 PAN NO. 220 NET DRY MASS TOTAL SAMPLE, A 281.6

COARSE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS ______

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
1/2	167.4	167.4	0.0	0.0	0.0	0.0	100	
3/8	175.9	167.4	8.5	8.5	3.0	3.0	97.0	

FINE FRACTION: NET WET MASS ______ MOISTURE, % ______ NET DRY MASS, C ______

DRY MASS [redacted] PRIOR TO WASH, D 281.6

DRY MASS [redacted] AFTER WASH 274.8

CONVERSION FACTOR, F = C/D = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	194.3	175.9	18.4		26.9	6.5	9.6	90.4	
8	228.2	194.3	33.9		60.8	12.0	21.6	78.4	
16	269.3	228.2	41.1		101.9	14.6	36.2	63.8	
30	326.6	269.3	57.3		159.2	20.3	56.5	43.5	
50	414.6	326.6	88.0		247.2	31.3	87.8	12.2	
100	435.7	414.6	21.1		268.3	7.5	95.3	4.7	
200	441.8	435.7	6.1		274.4	2.2	97.4	2.6	
PAN	442.1	441.8	0.3		274.7				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		220	
GROSS WET MASS	gms	467.6	
GROSS DRY MASS		448.9	
MOISTURE MASS		18.7	
TARE MASS		167.3	
DRY SOIL MASS		281.6	
MOISTURE CONTENT	%	6.64	

REMARKS:

Post WASH WEIGHT = 442.2 - 167.4

NOTES:

1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Emery	12/5/85	Jim Emery	12/8/85		

CH2M HILL

SHEET ___ OF ___

PROJECT NUMBER L20303.A0

PARTICLE-SIZE ANALYSIS

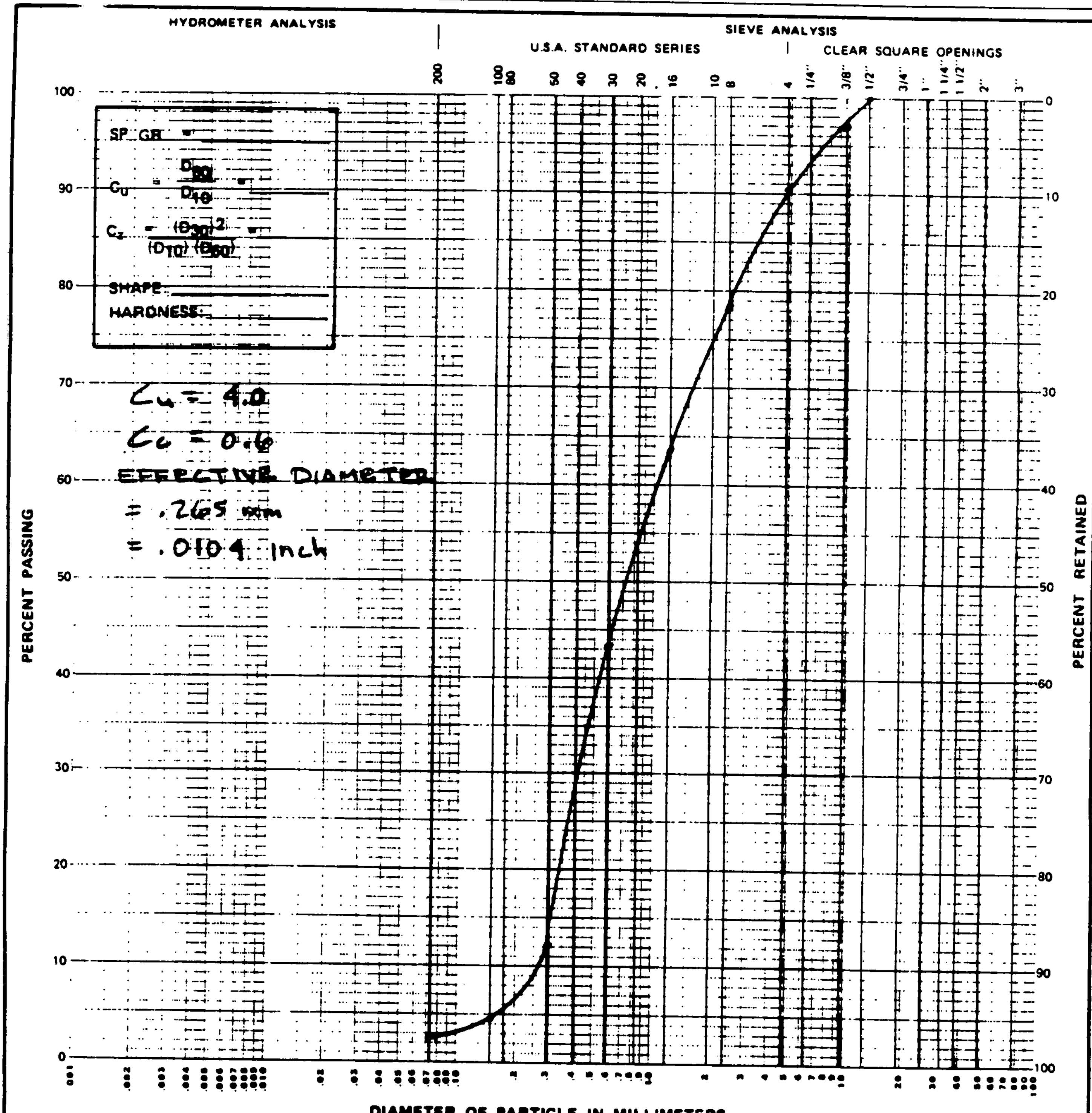
ASTM D422

PROJEC[T DE]SCRIPTION: WAUSAU LANDFILL

MATER[IAL/L]ABORATORY: DENVER

SAMPL[E LOC]ATION: 7S 19' to 21' SAMPLE NO. S-5

TYPE [OF S]AMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION POORLY GRADED SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:

CH2M HILL

PROJECT NUMBER L20303.A0

SIEVE ANALYSIS

ASTM D422/C136

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 7S 29.5 to 31.0 SAMPLE NO. S-7

TYPE OF SAMPLE: SMALL BOTTLE

GROSS WET MASS TOTAL SAMPLE 425.9 TARE MASS 155.3 PAN NO. 8 NET WET MASS TOTAL SAMPLE ____

GROSS DRY MASS TOTAL SAMPLE 382.2 TARE MASS 155.3 PAN NO. 8 NET DRY MASS TOTAL SAMPLE, A 226.9

COARSE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS ____

STANDARD SIEVE DESIGNATION	GROSS MASS	TARE MASS	NET MASS RETAINED		PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL	ACCUMULATIVE	INDIVIDUAL	ACCUMULATIVE		
3/8	155.3	155.3	0.0	0.0	0.0	0.0	100	

FINE FRACTION: NET WET MASS ____ MOISTURE, % ____ NET DRY MASS, C ____

DRY MASS [redacted] PRIOR TO WASH, D 226.9

DRY MASS [redacted] AFTER WASH 225.4

CONVERSION FACTOR, F = $\frac{C}{D}$ = N/A

STANDARD SIEVE DESIGNATION	INDIVIDUAL GROSS MASS	TARE MASS	NET MASS RETAINED			PERCENT RETAINED		ACCUMULATIVE PERCENT PASSING	SPECIFICATIONS
			INDIVIDUAL, E (AS RECORDED)	(F)	INDIVIDUAL (TOTAL BASIS)	INDIVIDUAL	ACCUMULATIVE		
4	155.5	155.3	0.2		0.2	0.1	0.1	99.9	
8	156.3	155.5	0.8		1.0	0.4	0.5	99.5	
16	159.0	156.3	2.7		3.7	1.2	1.6	98.4	
30	190.3	159.0	31.3		35.0	13.8	15.4	84.6	
50	319.8	190.3	129.5		164.5	57.1	72.5	27.5	
100	377.0	319.8	57.2		221.7	25.[illegible]	97.7	2.3	
200	380.6	377.0	3.6		225.3	1.6	99.3	0.7	
PAN	330.7	330.6	0.1		225.4				

MOISTURE CONTENT DATA	UNITS		
CAN NO.		8	
GROSS WET MASS	gms	425.9	
GROSS DRY MASS		382.2	
MOISTURE MASS		43.7	
TARE MASS		155.3	
DRY SOIL MASS		226.9	
MOISTURE CONTENT	%	19.26	

REMARKS: POST WASH WEIGHT = 380.7 - 155.3

NOTES:
1. SHOW UNITS OF MEASUREMENT.

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE:
Jim Eikers	12/4&5/85	Jim Eikers	12/6/85		

CH2M HILL

SHEET ___ OF ___

PROJECT NUMBER L20303.AO

PARTICLE-SIZE ANALYSIS

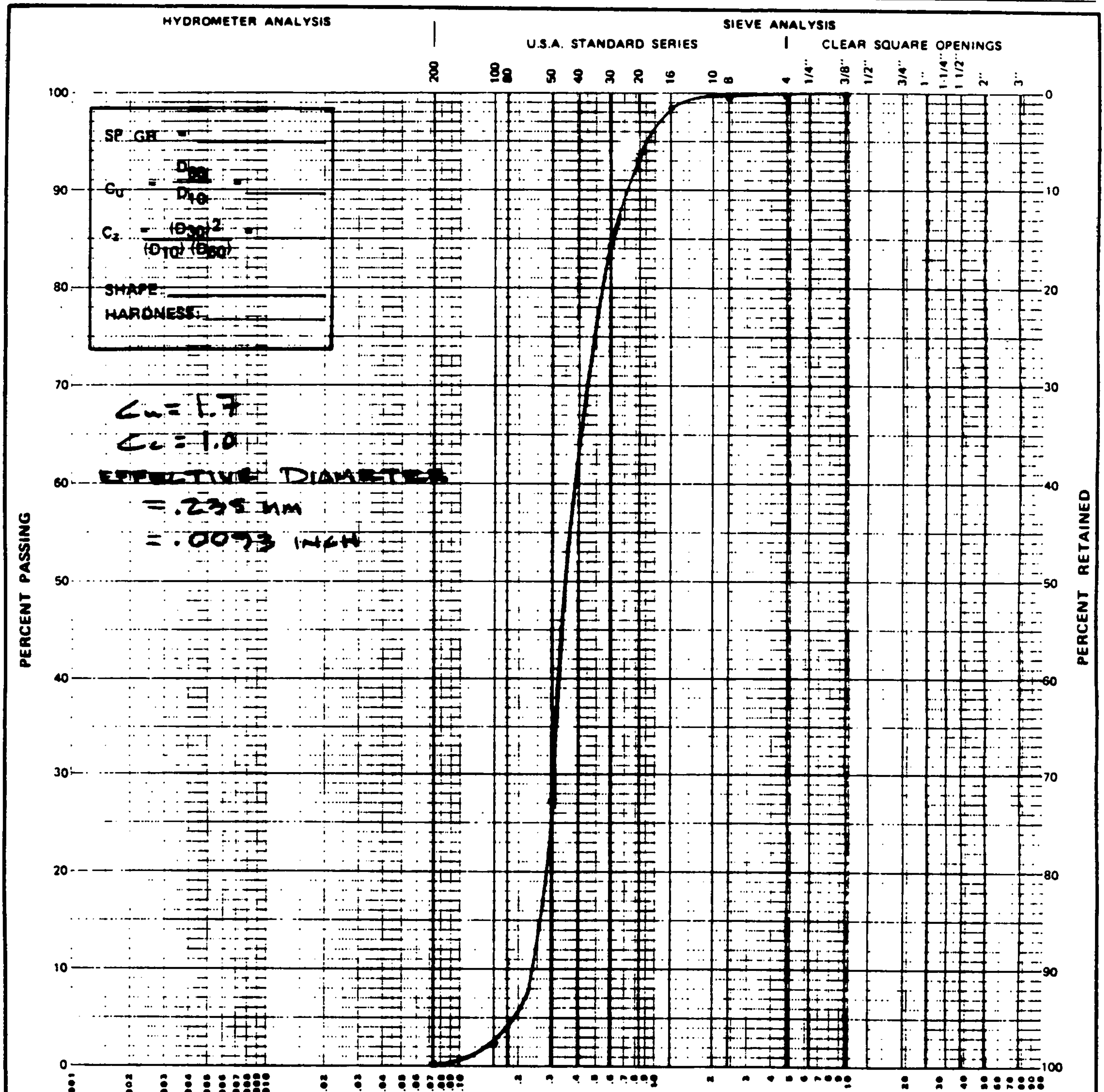
ASTM D422

PROJECT DESCRIPTION: WAUSAU LANDFILL

MATERIALS LABORATORY: DENVER

SAMPLE LOCATION: 7S 29⁵ to 31⁰ SAMPLE NO. S-7

TYPE OF SAMPLE:



COL-LOIDS	CLAY SIZE	SILT SIZE	SAND			GRAVEL	COBBLES
			FINE	MEDIUM	COARSE		

SAMPLE CLASSIFICATION: POORLY GRADE SAND (SP)

TESTED BY:	DATE:	COMPUTED BY:	DATE:	CHECKED BY:	DATE: