CDM Camp Dresser & McKee

consulting
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50th Anniversary 1947-1997

October 10, 1997

Fac/Perm/Co ID #	Date	Doc ID#
BCI	12/7/10	DIN

Ms. Cheryl Marks
Solid Waste Section
401 Oberlin Road
Suite 150
Raleigh, North Carolina 27605-1350

Re: Response To Comments
Buncombe County Construction and Demolition Landfill

Dear Ms. Marks:

This letter has been prepared in response to the Solid Waste Section's (SWS) technical review memorandum dated October 10, 1997 for the referenced project. In order to assist the SWS's review of this response letter, this submittal has been formatted to present the SWS's comment (in bold type) followed immediately by CDM's response.

CDM has recently completed installation of two monitoring wells, MW-9 and MW-9d, downgradient of the C&D Landfill. Boring logs, well completion records, and analytical data will be submitted to the SWS as soon as the data is available.

We trust these responses and associated support documentation are sufficient for your review. However, if any questions should arise during the review process, please do not hesitate to call for further clarification or assistance. We appreciate your assistance and expedient turnaround time in reviewing this document for Buncombe County.

Sincerely,

CAMP DRESSER & McKEE

Timothy Grant

Timothy D. Grant, P.G.

NORTH CAROLINA LICENSED SEAL 2112 GEOLOGIST TIMOTHY DAVID GRANT

Timothy Grant

10-10-97

cc: Bob Hunter, Buncombe County
Joe Wiseman, CDM
Bernie Garrett, CDM

OCT 1997 Received Solid Waste Section

OCT 1997 Received Solid Waste Section

n:\buncombe\response

1. **Page 14-18: "Based on observation of the cores, an effective porosity of about 1 to 5% has been estimated for the competent bedrock material." Explain methodologies and provide supporting documentation used to determine the effective porosity of the competent bedrock material.**

Response:

Heath (1980) estimated the secondary porosity for gneiss at 0.1%. However, a value of 1% to 5% percent was used to provide a conservative estimate of effective porosity to reflect the increased fracture density found in the upper portion of the bedrock aquifer. This value was also used for determining effective porosity for the Design Hydrogeologic Report for Cells 1-3. The upper portion of the bedrock within the drainage features is highly fractured as indicated by RQD values from the cores collected within these features during the investigation for Cells 1-3. RQD values for these cores ranged from 0 to 36 percent and averaged 13 percent. Higher RQD values were measured from cores collected at higher elevations. A 20 foot core was collected at the MW-9 location to obtain a RQD values for bedrock within the C&D Landfill area. RQD values were as follows: 9'-19' - 39%; 19'-24' - 7%; 24'-29' - 74%. These RQD values indicate that bedrock within the drainage feature in the C&D Landfill is moderately to highly fractured and that secondary porosity is likely greater than 5% . The use of 1% to 5% as an estimated of effective porosity will provide a conservative estimate of groundwater flow velocity.

2. **Page 14-20: The middle of the first paragraph states eight samples were used for volume % water to produce an average of 20.6%. What eight samples were used? Provide calculations.**

Response:

The sentence stating "and averaged 20.6 percent (eight samples)." is a typographic error and should be omitted. As shown in Table 14-3 and Appendix C, three samples were used to provide volume percent water. The volume percent water in these samples was 52%, 88%, and 98%.

3. **Page 14-22: "Vertical gradients are calculated as the difference in water level elevation between two nested piezometers, divided by the vertical distance from the midpoint of the screen of the shallower piezometer to the midpoint of the screen." What is the reference of the second screen in this statement? Provide calculations for the vertical gradients given.**

Response:

This sentence should read as follows: "Vertical gradients are calculated as the difference in water level elevation between two nested piezometers, divided by the vertical distance from the midpoint of the screen of the shallower piezometer to the midpoint of the deeper screen."

Elevations used to calculate vertical gradient are given below:

Piezometer	Groundwater Elevation	Elevation of Midpoint of Screen Interval
P-402	1964.48	1955
P-402H	1967.56	1962.9
P-404	2024.02	2011
P-404H	2022.97	2021
P-407	2045.45	2014.5
P-407H	2045.79	2035.5

Vertical gradient calculations are presented in Appendix A. The vertical gradient for P-407/P-407H has been changed. The recalculated gradient does not affect any conclusions drawn in the Geological and Hydrogeological Study.

4. **Page 14-24: Last paragraph discusses previous slug test results from Cells 1-3 area. Most of the borings in the proposed C&D landfill indicate water was encountered in rock. The hydraulic conductivities in bedrock provided are based on testing from the cells 1-3 area that indicate a great variance ranging from 0.02 ft/day to 47 ft/day. While this provides good support information, the saturated hydraulic conductivity for the hydrological study of the C&D site as noted .0504(1)(c)(I)(E)(I) also requires testing for each major lithologic unit.**

Response:

CDM has recently completed the installation of two monitoring wells (MW-9, MW-9d) north of the C&D Landfill. Slug tests were conducted on both of these wells and the results will be forwarded to the SWS as soon as they are available. Boring logs and well completion records will also be submitted.

5. **Sheet 14-5: It is unclear which groundwater data belongs to piezometer B-335 on the potentiometric map.**

Response:

ok The correct groundwater elevation for B-335 is 2016.77. The groundwater elevation of 1845.48 is incorrect. A revised Sheet 14-5 is attached.

6. **Page 14-25: The groundwater discharge location identified in the C&D Landfill area is not shown on any of the sheets submitted. Submit a revised sheet showing the discharge location. Two springs were observed in the foot print of the C&D Landfill cell during a recent site visit by the Solid Waste Section staff. If both springs in the C&D Landfill foot print are different than the one previously observed, they also need to be included on a revised sheet.**

Response:

The locations of both springs have been added to Sheet 14-1 and 14-2. French drains will be installed in each feature prior to placement of C&D debris.

7. **Page 14-26: Provide the location of the intermittent stream that flows in the western drainage feature which may be groundwater discharge from the saprolite.**

Response:

See response to item #6.

8. **Page 14-26: The first bullet under landfill construction considerations discusses the separation between the base of the landfill and the water table surface. It is the policy of the Solid Waste Section that four feet of separation also be maintained to the top of bedrock. Several rock exposures were observed in the proposed C&D landfill foot print during a recent site visit by the Solid Waste Section staff. Provide a discussion to restore the subgrade to the required four feet of separation to the top of rock.**

Response:

Some isolated rock pinnacles were exposed during cell excavation. Four feet of fill will be placed over these areas to provide the required separation.

9. **Include a sheet showing the proposed monitoring wells and surface water locations for the C&D Landfill.**

Response:

Sheet 15-1 has been revised to include an additional surface water sampling location (SW-4) downgradient of the C&D Landfill. A note has been added indicating that the background well nest, MW-1/MW-1d, is located approximately 4200 feet east of MW-9/MW-9d monitoring well nest. Installation of wells MW-9 and MW-9d has been completed. The analytical results will be submitted to the SWS as soon as the data is available.

10. **Provide a groundwater monitoring well schematic showing proposed screened interval, and construction.**

Response:

Figure 14-1, attached following this letter, provides a well schematic showing proposed well construction.

11. **Sheet 15-1: Explain the construction to the south of the proposed C&D Landfill shown on the groundwater monitoring plan.**

Response:

This area was originally intended as an access road. This road will not be constructed at this time.

12. On a sheet provide the paths of the geological cross-sections A-A' and B-B'.

Response:

Sheet 14-2 has been revised to show the locations of cross-sections A-A′ and B-B′.

13. Sheet 14-1: The legend does not provide an explanation for the heavy lines with arrows in the northeastern portion of the map located east of cell 3.

Response:

This symbol denotes a spring. An explanation has been added to the legend.

14. Table 14-1: There are discrepancies between Table 14-1 and the boring logs presented in Appendix B. Generally the screen is set as near to the bottom of the boring as possible. Explain why B-365, MW-5d, MW-7, and B-404H have 2.5 feet or more difference between the bottom elevation of the boring and the bottom elevation of the screen. What fill materials, if any, were used to confine the conduit created.

Response:

Table 14-1 has been corrected and a revised table is attached following this letter. The screen intervals in B-365, MW-7 and B-404H were raised after completion of the borings to intersect either water-bearing fractures (B-365 and MW-7) or to intersect the water table (B-404H). Fill materials under the screen consists of either native materials that caved in or filter pack material. The screen in MW-5 is at the bottom of the boring as shown on the revised Table 14-1.

15. Table 14-2: Boreholes B-5, B-5A, and B-358 on Table 14-2 do not have logs included in Appendix B.

Response:

The logs for these borings are included in Appendix B.

16. Table 14-3: The remolded conductivity listed on table 14-3 does not match the text on page 14-20.

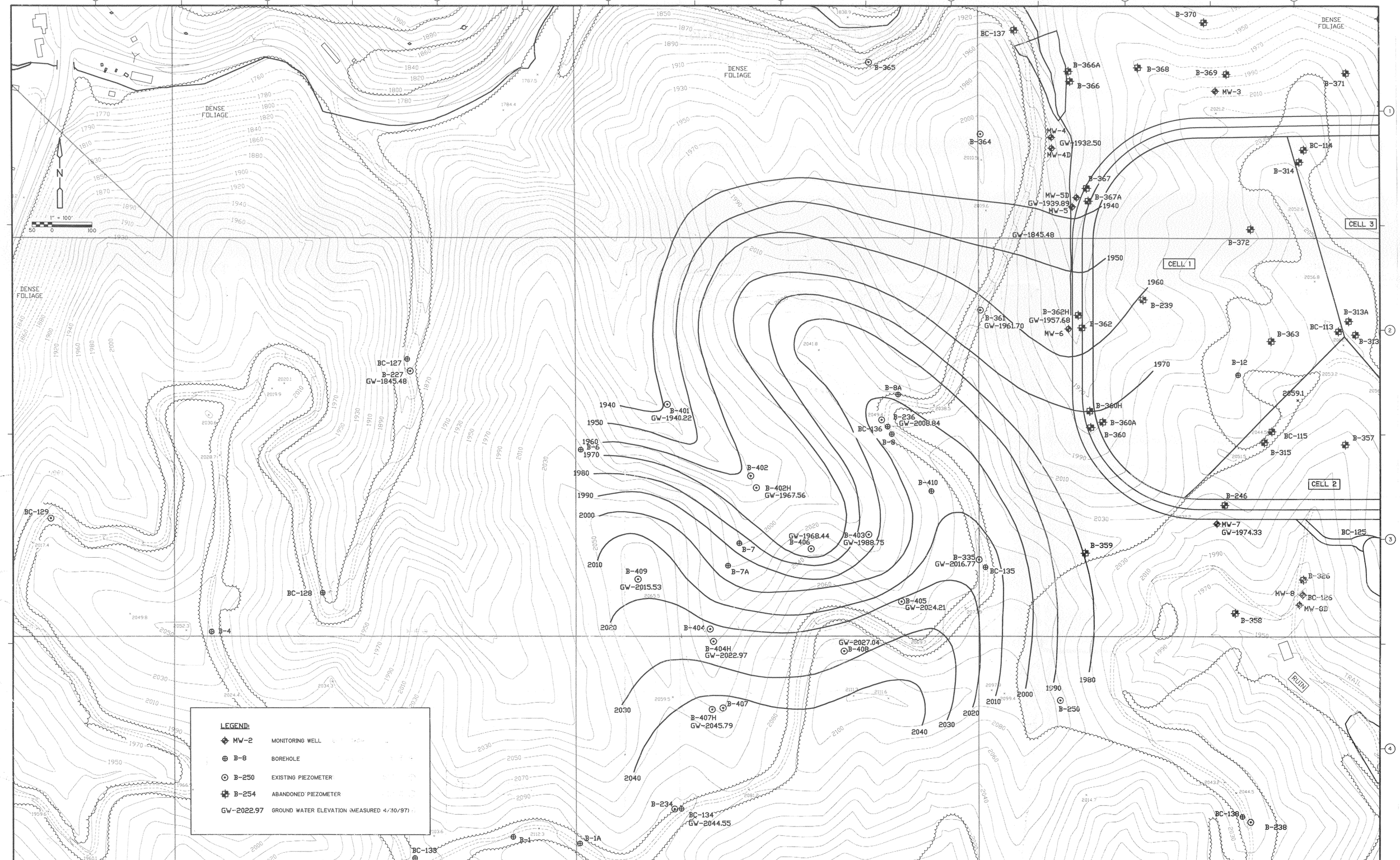
Response:

The remolded conductivity values presented in Table 14-3 are correct. The sentence on page 14-20 is modified as follows: Hydraulic conductivity of remolded soil was determined in two samples. These values ranged between 4.8×10^{-6} and 2.1×10^{-7} cm/sec.

17. **The C&D Landfill site has a complex aquifer system. The Lineament/Fracture Analysis and VLF Survey indicated lithologic contacts in the southwestern portion of the C&D cell that may control groundwater flow. Rock characterization for the western portion needs to be more detailed. Complexity of the geology appears to be greater in the western portion since there is a change in rock type and groundwater flow in rock. The lithologic change may be a function of an isograd which either should be confirmed or dispelled. Include other relevant field data concerning the rock, strike and dip, jointing, and foliation trends and any additional information gathered from cores. Additional monitoring wells in the fractured bedrock are required to adequately monitor the complex system.**

Response:

CDM is currently conducting further investigation of the western portion of the C&D landfill. The results of this investigation will be forwarded to the SWS as soon as it is available.



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: T. GRANT
DRAWN BY: J. KILLINGSWORTH
SHEET CHK'D BY: -
CROSS CHK'D BY: -
APPROVED BY: -
DATE: MAY 1997

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BUNCOMBE COUNTY
NORTH CAROLINA

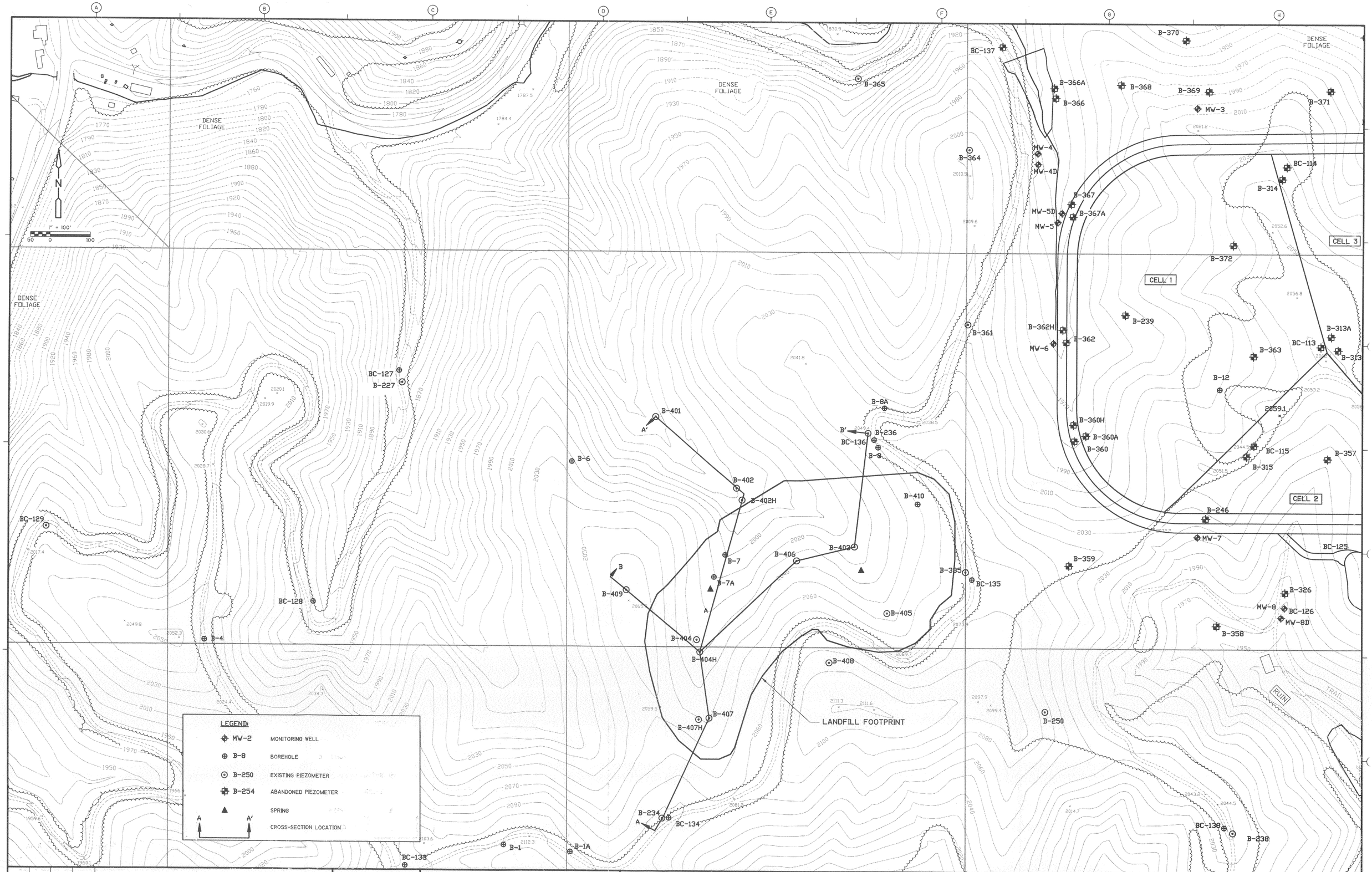
CONSTRUCTION AND DEMOLITION LANDFILL GEOLOGICAL AND HYDROGEOLOGICAL STUDY

POTENTIOMETRIC CONTOUR MAP

PROJECT NO. 6447-13772
FILE NAME: 3-3

SHEET NO.
14-5

C:\6447-00\13772\ F1014-5 10/10/97 08:39:15 0:10:41 NICK R.



LEGEND:

MW-2	MONITORING WELL
B-8	BOREHOLE
B-250	EXISTING PIEZOMETER
B-254	ABANDONED PIEZOMETER
▲	SPRING
A — A'	CROSS-SECTION LOCATION

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: T. GRANT
DRAWN BY: N. RADASANU
SHEET CHK'D BY: –
CROSS CHK'D BY: –
APPROVED BY: –
DATE: MAY 1997

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BUNCOMBE COUNTY
NORTH CAROLINA

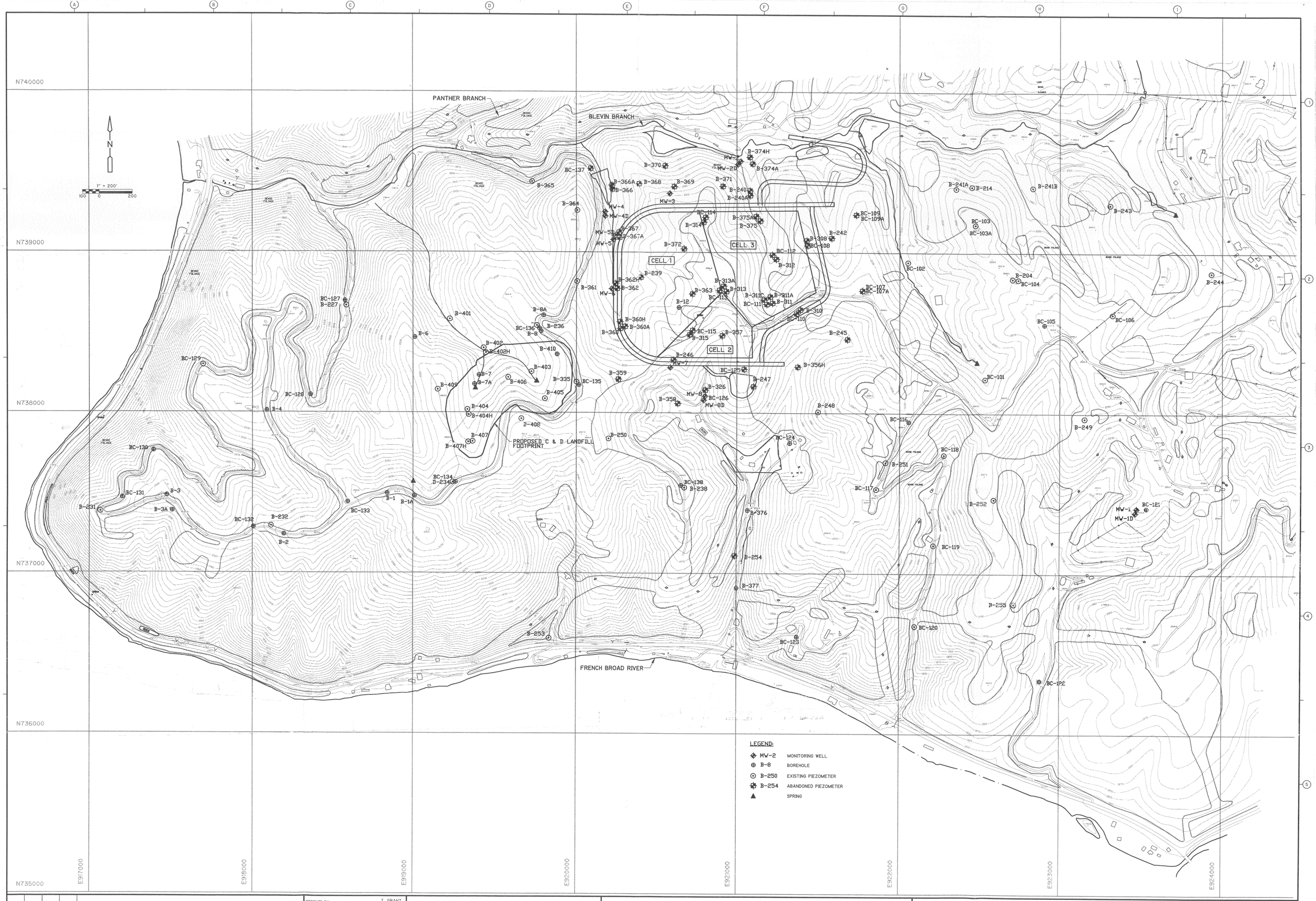
CONSTRUCTION AND DEMOLITION LANDFILL
GEOLOGICAL AND HYDROGEOLOGICAL STUDY

PIEZOMETER AND BOREHOLE LOCATION,
C & D LANDFILL

PROJECT NO. 6447-13772
FILE NAME: 14-2

SHEET NO.
14-2

C:\6447-00\13772\ FIG14-2 10/09/97 17:43:30 2:03x43 NICK R.



REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: T. GRANT
DRAWN BY: J. KILLINGSWORTH
SHEET CHK'D BY:
CROSS CHK'D BY:
APPROVED BY:
DATE: APRIL 1997

BUNCOMBE COUNTY
NORTH CAROLINA

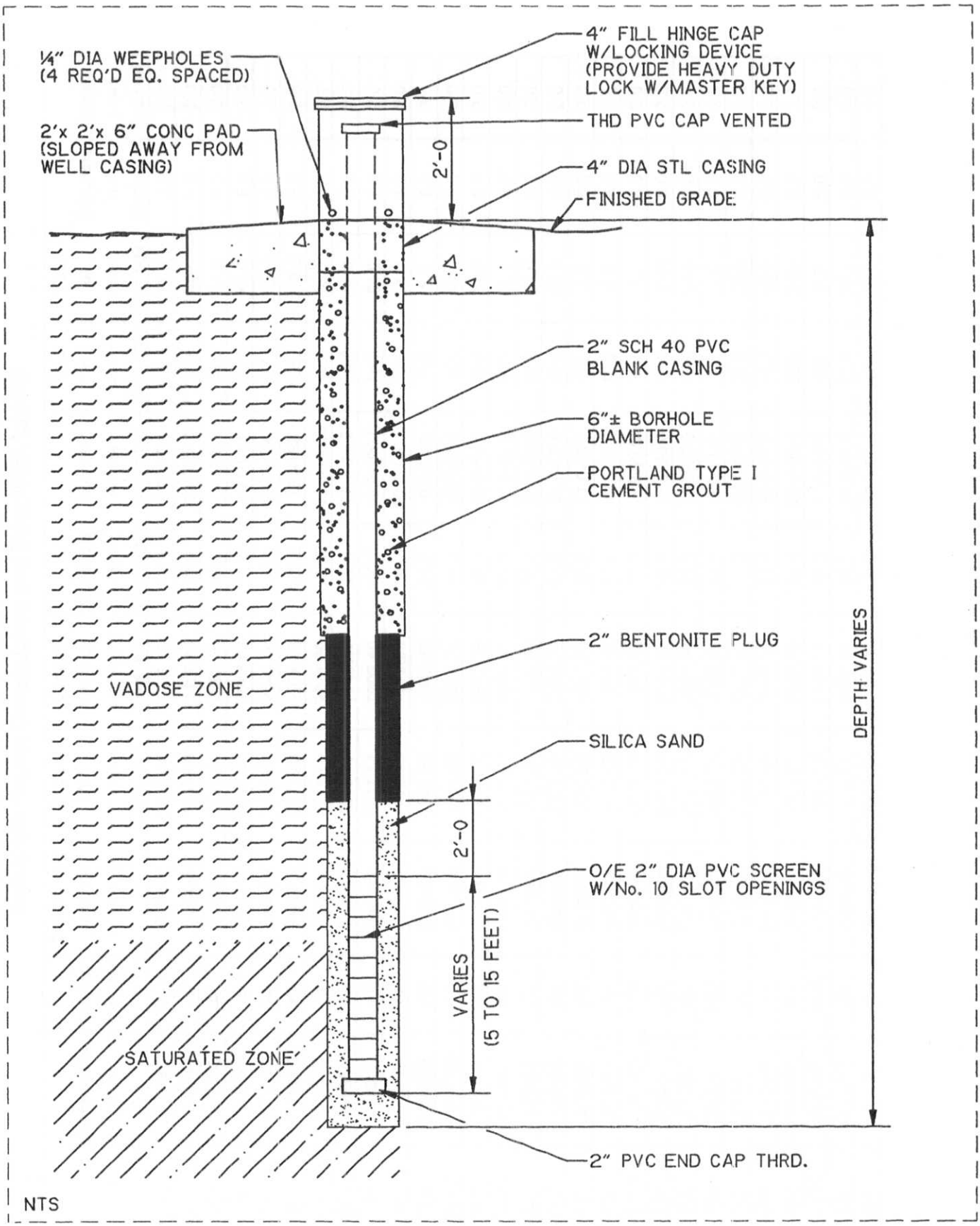
CONSTRUCTION AND DEMOLITION LANDFILL GEOLOGICAL AND HYDROGEOLOGICAL STUDY

SITE MAP

PROJECT NO. 6447-13772
FILE NAME: FIG14-1

SHEET NO.
14-1

C:\6447-00\13772\ FIG14-1 10/09/97 16:30:17 0.34:17 NICK R.



CDM Camp Dresser & McKee

Figure No. 14-1
TYPE II GROUNDWATER MONITORING WELL

CAMP DRESSER & McKEE

CLIENT BUNCOMBE CTY
PROJECT CHD LANDFILL
DETAIL VERTICAL GRADIENT

JOB NO. 6447
DATE CHECKED
CHECKED BY

COMPUTED BY
DATE 10-7-97
PAGE NO.

FORMULA: $\frac{\text{DIFFERENCE IN GROUNDWATER ELEVATION}}{\text{VERTICAL DISTANCE IN SCREEN MIDPOINTS}}$

P-402 / P-402H

$$\frac{1967.56 - 1964.48}{1962.9 - 1955} = \frac{3.08}{7.9}$$

$= -0.39$ (NEGATIVE VALUE DENOTES DOWNWARD GRADIENT)

P-404 / P-404H

$$\frac{2024.02 - 2022.97}{2021 - 2011} = \frac{1.05}{10}$$

$= 0.105$

P-407 / P-407H

$$\frac{2045.79 - 2045.45}{2035.5 - 2014.5} = \frac{0.34}{21}$$

$= -0.016$ (NEGATIVE VALUE DENOTES DOWNWARD GRADIENT)

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0	Possible Residuum - Brown Slightly Micaceous Silty Fine to Coarse SAND with Fine Roots - Moist	1895.0±		
3.0	Partially Weathered Rock Sampled as Green Black Slightly Micaceous Fine to Coarse SAND and Rock Fragments	1890.0±	5; 50/2.0"	
8.0	Auger Refusal at 8.0 Feet. Boring Termianted at 8.0 Feet. No Ground Water Encountered at Time of Boring.	1885.0±	50/3.0"	

TEST BORING RECORD

BORING NUMBER B-5
DATE DRILLED 10-12-90
PROJECT NUMBER 56-0605
PROJECT BUNCOMBE COUNTY
PAGE 1 OF 1

LAW ENGINEERING

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

DEPTH (FT.)	DESCRIPTION	ELEVATION (FT.)	PENETRATION - BLOWS/FOOT (0 10 20 30 40 60 80 100)	
0.0	Possible Residuum - Brown Slightly Clayey Slightly Micaceous Silty Fine to Coarse SAND with Fine Roots - Moist	1900.0±		6
3.0	Residuum - Very Dense Tan Black Silty Micaceous Fine to Medium SAND with Rock Fragments	1895.0±		52
6.0	Partially Weathered Rock Sampled as Green Black Silty Micaceous Fine to Coarse SAND with Rock Fragments			50/5.0"
				50/2.0"
10.0	Auger Refusal at 10.0 Feet. Boring Terminated at 10.0 Feet. Offset 10 Feet North From B-5. No Ground Water Encountered at Time of Boring.	1890.0±		

TEST BORING RECORD

BORING NUMBER B-5A
DATE DRILLED 10-12-90
PROJECT NUMBER 56-0605
PROJECT BUNCOMBE COUNTY
PAGE 1 OF 1

LAW ENGINEERING

SEE KEY SHEET FOR EXPLANATION OF SYMBOLS AND ABBREVATIONS USED ABOVE

CAMP DRESSER & McKEE INC.

Client Buncombe County Site Proposed Landfill Job No. 6447-010 Soil Bore/ Well No. **B-358**

Drill Contractor Caldwell Drilling Drilling Method Air Rotary Date Drilled 10/17/94

Piez/Casing Size & Type 2" PVC Screened Length/Interval 52-62' Total Depth 62'

Field Geologist/Technician FW Stickup 4.4' Casing Elevation 1961.01 Static Water Level 3.6' ags

DEPTH (feet)	Lithology	DESCRIPTION Lithological Description from Cuttings	USCS	Drilling Comments	Samples	Water Level	WELL CONSTRUCTION
		See Log B-358H		*10' HSA refusal.*			
20		*No sample descriptions available.*		10-18' hard rock 18' softer.			
40							
60				55'- water.			
		Drilled to 62'.					
80							
100							
120							
140							

Drill Rig Type Tamrock T25K2W Borehole Diameter 6"

CAMP DRESSER & McKEE INC.

Client Buncombe County Site Proposed Landfill Job No. 6447-010 Soil Bore/ Well No. **B-358H**

Drill Contractor Metro Drill Inc. Drilling Method Hollow Stem Auger Date Drilled 10/17/94

Piez/Casing Size & Type NA Screened Length/Interval NA Total Depth 10.0'

Field Geologist/Technician FW Stickup NA Casing Elevation 4984.36 Static Water Level Dry

DEPTH (feet)	Lithology	DESCRIPTION Grain size - Lithology: Color, cements, bedding, odor, miscellaneous, (plasticity, hardness, textural maturity,etc.)	USCS	Blow Count 6",6",6"	Samples	Water Level	WELL CONSTRUCTION
		Bag sample at 0-2'.					
		Sandy silt w/ some clay, med red-brown, relict gneiss texture, sand fine-med grained, moist.	ML	10,11,12			
		PWR at 8'.					
10		Weathered gneiss, crumbles easily in hand to sandy silt, marble colored, slightly moist.	ML	20,50/5"			
		Borehole refusal at 10.0' bgs.					
20							
30							
40							
50							
60							
70							

Drill Rig Type Acker AD-2 Borehole Diameter 6"