



SOLID WASTE ENGINEERING AND MANAGEMENT

Joyce Engineering, Inc.
436 Spring Garden Street
Greensboro, North Carolina 27401
Tel (910) 230-1992
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TELEFAX TRANSMISSION

TO: MATT GAMBLE

FAX: (919) 733-4810

Table with 3 columns: Fac/Perm/Co ID #, Date, Doc ID#. Values: 9704, 08/02/2011, DIN 14658

FROM: MATT TISCHLER

RE: WILKES Co. LF.

JEI PROJECT NO. 356.00 TASK NO. 02

DATE: 7-22-98

TOTAL PAGES SENT (INCLUDING COVER PAGE): 4

ORIGINAL TO FOLLOW: [X] NO [] 1ST CLASS MAIL PRIORITY [] OVERNIGHT

MESSAGE: MATT, PLEASE HOLD FOR FURTHER DISCUSSIONS CONCERNING THE WILKES Co. LF. DRAW # I WILL CALL.

Thanks, MATT T.

CALL (336) 230-1992 TO REPORT TRANSMISSION PROBLEMS OR FAX REPLY TO (336) 230-1998.

APPENDIX A
FRACTURE TRACE ANALYSIS

WILKES COUNTY LANDFILL
FRACTURE TRACE ANALYSIS
WESTINGHOUSE PROJECT NO. 4112-90-121

Prepared For:
Wilkes County Landfill
Wilkes County, North Carolina

Prepared By:
Westinghouse Environmental and Geotechnical Services, Inc.
P.O. Box 7668
Charlotte, NC 28241-7668

April 19, 1990

Westinghouse Environmental
and Geotechnical Services, Inc.

April 18, 1990



3500-B Regency Parkway
P.O. Box 1308
Cary, North Carolina 27512
(919) 481-0397
FAX (919) 481-0809

Westinghouse Environmental
and Geotechnical Services, Inc.
P.O. Box 7668
Charlotte, N.C. 28241

Attention: Mr. Jack Amar

Reference: Wilkes County Landfill
Fracture Trace Analysis
Westinghouse Project No. 4112-90-121

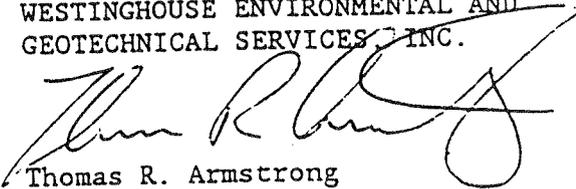
Dear Jack:

Enclosed are the results of the fracture trace analysis completed for the proposed Wilkes County landfill. In summary, the study revealed no evidence of a fault trace extending through the proposed landfill site. The fault zones found in the general area are part of the Brevard Fault zone as mapped on the N.C. Geological Map. The Brevard Fault is not an active fault zone and has not been active in recent geological time.

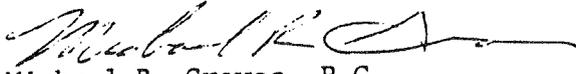
If you have any questions please call.

Sincerely,

WESTINGHOUSE ENVIRONMENTAL AND
GEOTECHNICAL SERVICES, INC.



Thomas R. Armstrong
Staff Geologist



Michael R. Groves, P.G.
Senior Hydrogeologist

TRA/MRG/jjr
Enclosures
cc: Bobby Lutfy
N.C. Solid Waste Branch

WILKES COUNTY LANDFILL
FRACTURE TRACE ANALYSIS
4112-90-121

A fracture trace study was undertaken in the area of the proposed Wilkes County Landfill in an effort to determine if any major fault trends or fractures were evident in or under the proposed landfill acreage. This area is within the Brevard fault zone, a series of well defined and previously mapped thrust faults trending roughly east to west.

Initially a topographic map of the area was acquired and any trends such as stream direction or linear hill crests were identified. A geologic map of the area was also reviewed to determine approximate location of major faults in this area. The location of the faults on the geologic map correlated very well with the edges of the Yadkin River and other well defined linear valleys and ridges that were obvious on the topographic map. The faults were marked on the topographic map along with locations where access to them in the field might be possible, such as road cuts or in stream beds.

The first site of interest in the field was an excavation at the southwestern entrance to the landfill off Highway 268. This has been designated Site 1 on the topographic map and the photos.

The predominant feature of this Site was a dark grey to black, massive, and heavily weathered metavolcanic (photo 1, 1a) that was found between layers of red clay with white bands which are remnant gneiss characteristics. The strike of the metavolcanic, is N 87 E and it dips to the southeast at 42 degrees while the fracture face that is exposed strikes parallel to the bedding and dips to the northwest at 74 degrees. The strikes and dips of the fracture faces are recorded on the topographic map presented as Figure 1.



Site 2 is at the same excavation as Site 1, approximately 100 feet to the southeast, and is composed of a heavily weathered schist or gneiss. The bedding planes of this rock are striking N 55 W and dipping 36 degrees to the southwest. The well defined fracture face shown in photos 2 and 2a, strikes N 54 E and dips 63 degrees to the southeast. Photo 2b displays a small anticlinal feature immediately to the south of the fractures measured in photo 2 and 2a.

At this time, two traverses of the site were completed and the approximate routes taken were recorded on the topographic map as T1 and T2. No outcrops were encountered on the site although the crests of all hills and the sides of any steep valleys were inspected.

Site 3 is located at a point just north of the substation on the Roaring River. As shown in photos 3 and 3a a small falls in the river exists at this point. The strike of the rock is N 65 E and dips to the southeast at 68 degrees. These measurements are approximates as access to the rock was impossible. This outcrop appears to be a resistant bed that been exposed by erosion and not by faulting. The evidence of this is that hills but no valleys are associated with this feature on either side of the river. If there was an upthrown and downthrown block associated with this feature a linear valley would be expected at this point.

As the river was followed upstream a series of submerged outcrops were observed that trended approximately East to West and are displayed in photos 4, 4a, and 4b.

Photos 5, 5a, and 5b display the best evidence for fault block movement. The outcrops shown are light grey banded gneiss and strike N 80 E to due East while dipping 70 degrees to the south. The rocks are on the downstream edge of a well defined linear valley trending approximately N 70 E which probably



represents the down thrown block of a reverse fault. The valley associated with this feature is steep sided on the south side and gently dipping on the north as shown in photos 9 and 9a. A possible explanation for this is presented in Figure 2 which display the upthrown block of a reverse fault representing the steep side of the valley and the downthrown block as the gently dipping side.

Sites 6 and 11 are located at an abrupt turn in the river, where for a short distance it parallels the strike of the outcropping rocks. There is no other direct evidence at this location of any faulting along strike.

Site 7 is located at the base of another valley that is possibly fault controlled. This valley also displays the steep southern side and the more gently dipping northern side.

Site 8 is on trend with the crest of the southern side of the valley described at site 5. The photo taken at this Site displays what may represent a small fault scarp. This feature may also have been created by the landowner as his property was exceptionally flat for this area.

Site 10 was a portion of the river just to the south of another well defined linear valley and on trend with the photos taken at Site 9. The photo displays another very linear falls across the course of the river. Access to the area where the valley intersected the stream was not possible.

The only other evidence of faulting in this area was found at Site 12 on the Bugaboo Creek. This location was directly below the power lines shown on the topographic map. The gneiss outcrop at this location displayed strikes of N 68 W to N 14 E and appears as a drag fold. The fault associated with this fold would trend north to south and parallels the course of the creek.



Fractures in what seemed to be the undisturbed portion of this outcrop trended predominately N 68 W and dipped 80 degrees to the northeast. Other minor fracture planes were measured at N 20 E and dipped 66 degrees to the northwest.

Further investigation of the fractures in the area of the proposed landfill included an analysis of the surface drainage pattern. The pattern was traced from the topographic maps of the area and is presented in Figure 3. The proposed landfill site lies immediately north of the Yadkin River in the Brevard fault zone. Due to the change in topography and geology south of the Yadkin River from the Brevard fault zone to the Inner Piedmont, only the drainage pattern in the area predominantly north of the river was traced. The very strong lineations evident in the stream drainage indicate an environment controlled by underlying structure. Therefore, forty random drainage lineations were selected, numbered, and their orientations were measured. The location of the selected lineations is shown in Figure 4. The number of each feature and its orientation is presented in Table 1 with the total number of features falling into each incremental group of 30 degrees. The data from Table 1 was compiled and presented in a rose diagram (Figure 5). The data represents only the frequency that a feature of certain orientation was measured and does not account for the magnitude of individual lineations. The rose diagram reveals that the most frequently encountered orientation is NNW to SSE. This direction is perpendicular to the major fault trends in the area which are represented by the second most commonly encountered angle of orientation, ENE to WSW.



CONCLUSIONS

Due to the highly active history of this area small faults and fractures are going to be found in abundance. The major fault traces that we are most concerned with appear to be associated with linear surface expressions such as valleys and ridges and thereby easily located. The predominant fracture planes that have been measured in the field display directions approximately 30 degrees from the fault traces, while the predominant orientation of the surface features measured on the topographic map show strikes approximately 90 degrees from that of the faults. These are common angles for fractures associated with faults. In our opinion, although the proposed landfill lies within the Brevard fault zone, a heavily faulted area with many associated fractures, the results of this analysis did not reveal evidence of a major fracture trace or fault trending through the acreage proposed for the landfill.



WILKES COUNTY LANDFILL
 ORIENTATION OF SURFACE FEATURES
 WESTINGHOUSE JOB NO.4112-90-121

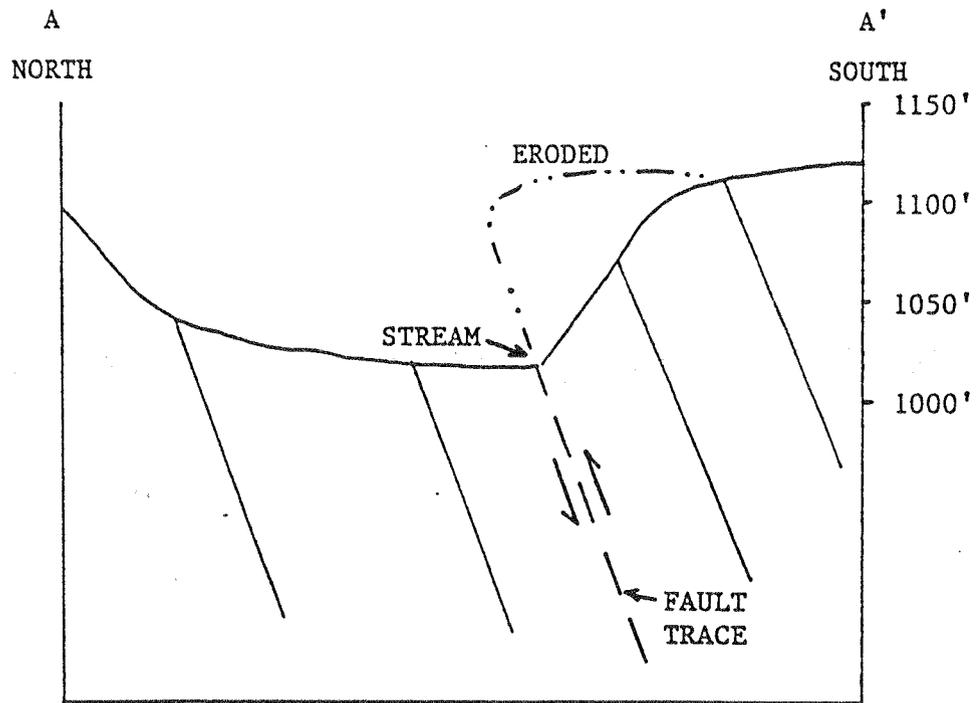
TABLE NO. 1

<u>Feature No.</u>	<u>*Azimuth (degrees)</u>	<u>Feature No.</u>	<u>Azimuth</u>
1	350	21	69
2	88	22	69
3	66	23	344
4	325	24	340
5	74	25	57
6	347	26	281
7	1	27	325
8	281	28	337
9	347	29	333
10	70	30	68
11	359	31	333
12	51	32	68
13	326	33	56
14	327	34	61
15	324	35	309
16	317	36	332
17	333	37	70
18	41	38	334
19	337	39	335
20	337	40	314

<u>GROUP NO.</u>	<u>ANGLE OF ORIENTATION 30 DEGREE INCREMENTS</u>	<u>TOTAL NUMBER OF FEATURES</u>
1	0-30, 180-210	1
2	30-60, 210-240	4
3	60-90, 240-270	10
4	90-120, 270-300	2
5	120-150, 300-330	8
6	150-180, 330-360	15



SITE 9



PROJECT

WILKES COUNTY LANDFILL



Westinghouse

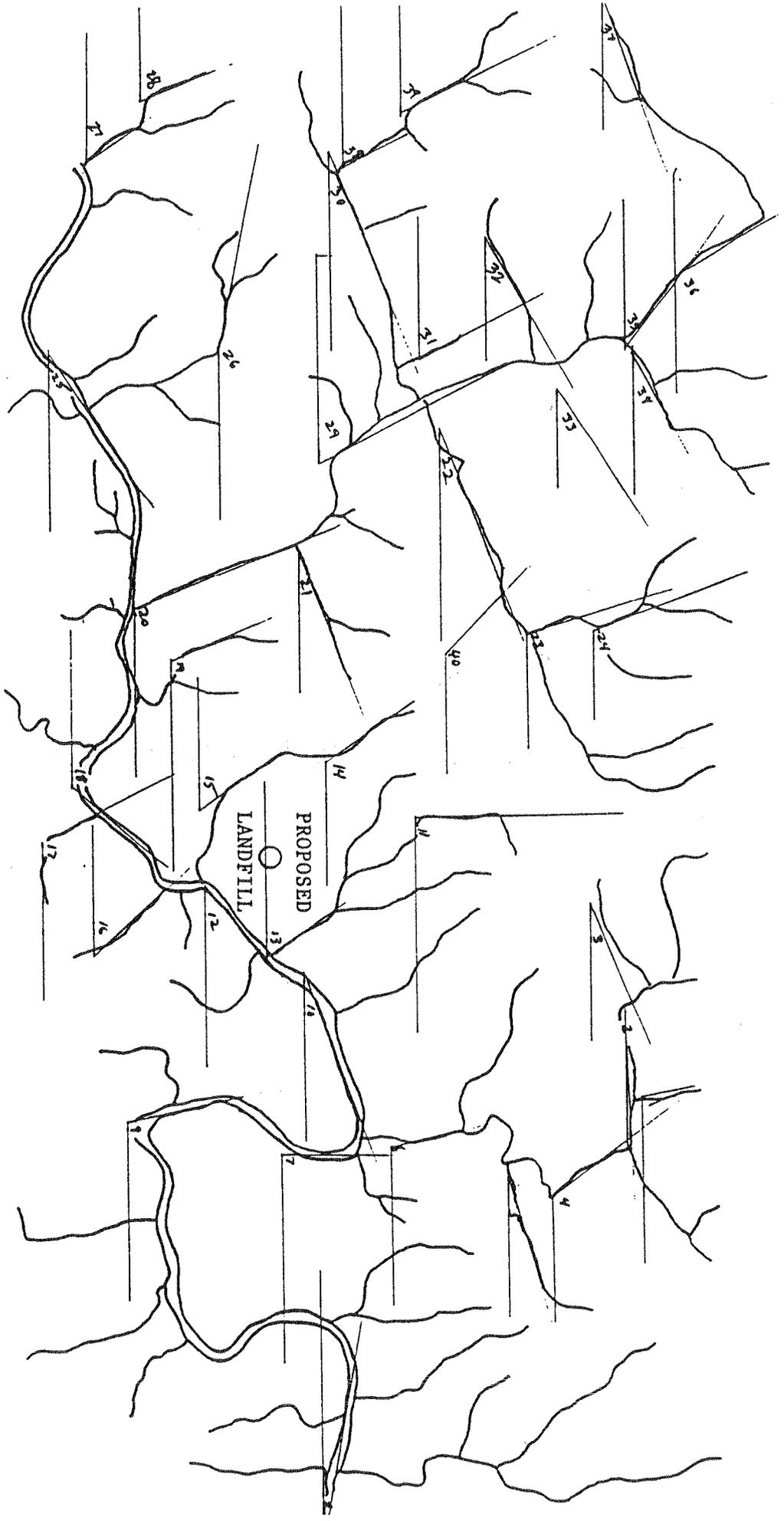
SCALE: 1" = 500'

JOB NO: 4112-90-121

FIG. NO: 2

JAN-PA 580 51 577

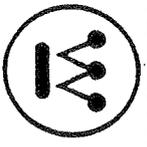
North



ORIENTATION OF TOPOGRAPHIC FEATURES

PROJECT

Wilkes County Landfill



Westinghouse

SCALE: 1" = 4,000 ft.

JOB NO: 4112-90-121

FIG NO: 4

LAW

LAWGIBB Group Member 

FACSIMILE TRANSMITTAL SHEET

LAW ENGINEERING & ENVIRONMENTAL SERVICES, INC.
2801 Yorkmont Road
Charlotte, North Carolina 28208
704-357-8600

To: Matt Gamble From: Rob Thompson
 Company: Solid Waste Section Date transmitted: 7/22/98
 Fax Number: 919-733-4810 Telephone: 704-357-8600
 Subject: Boring logs/Wall Const. Records Fax Number: 704-357-1622
 No. pages transmitted (incl. cover) 14 Hard Copy to Follow: Yes No
 CC: _____

Urgent For Review Please Comment Please Reply Please Recycle

COMMENTS:

Matt -

Here are boring logs of well construction
Records for the recently installed monitoring
wells at the Cleveland County Landfill.
Please call if you have any questions or
need more information.

Rob

CONFIDENTIALITY NOTICE: This message is intended only for the use of the individual or entity to which it is addressed, and may contain information that is privileged, confidential, and exempt from disclosure under applicable law. If the reader of this message is not the intended recipient, or the employee or agent responsible for delivering the message to the intended recipient, you are hereby notified that any dissemination, distribution, or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone and return the original message to us at the above address via the U.S. Postal Service. Thank you.

NORTH CAROLINA DEPARTMENT OF ENVIRONMENT, HEALTH AND NATURAL RESOURCES
DIVISION OF ENVIRONMENTAL MANAGEMENT - GROUNDWATER SECTION
P.O. BOX 27687 - RALEIGH, NC 27611-7687
PHONE (919)733-3221

FOR OFFICE USE ONLY			
Quad. No.	_____	Serial No.	_____
Lat.	_____	Long.	_____
Minor Basin	_____		
Basin Code	_____		
Header Ent.	_____	GW-1 Ent.	_____

WELL CONSTRUCTION RECORD

DRILLING CONTRACTOR LAW Eng. & Env. Services, Inc.
DRILLER REGISTRATION NUMBER 332

STATE WELL CONSTRUCTION PERMIT NUMBER: _____

1. WELL LOCATION: (Show sketch of the location below)

Nearest Town: Shelby

County: Cleveland

(Road, Community, or Subdivision and Lot No.)

2. OWNER Cleveland County Landfill
ADDRESS 1609 Airport Road
(Street or Route No.)
Shelby North Carolina 28150
City or Town State Zip Code

Depth From To DRILLING LOG MW-13
Formation Description

3. DATE DRILLED 5/2/98 USE OF WELL monitoring

4. TOTAL DEPTH 23 feet CUTTINGS COLLECTED Yes No

5. DOES WELL REPLACE EXISTING WELL? Yes No

6. STATIC WATER LEVEL: 10.26 FT. above TOP OF CASING.
TOP OF CASING IS 1.51 FT. below ABOVE LAND SURFACE.

See attached boring log

7. YIELD (gpm): N/A METHOD OF TEST N/A

8. WATER ZONES (depth): N/A

9. CHLORINATION: Type N/A Amount N/A

10. CASING:

From	To	Depth	Diameter	Wall Thickness or Weight/Ft.	Material
0	8	Ft.	2"	Sch 40	PVC

If additional space is needed use back of form.

11. GROUT:

From	To	Depth	Material	Method
0	4	Ft.	portland cement	pour
4	6	Ft.	bentonite hole plug	pour

LOCATION SKETCH

(Show direction and distance from at least two State Roads, or other map reference points)

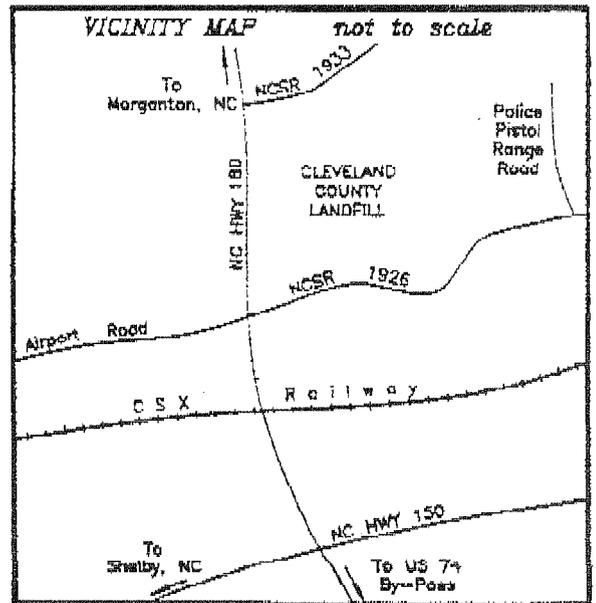
12. SCREEN:

From	To	Depth	Diameter	Slot Size	Material
8	23	Ft.	2	in. 0.010 in.	PVC

13. GRAVEL PACK:

From	To	Depth	Size	Material
6	25	Ft.	#1	silica sand

14. REMARKS: _____

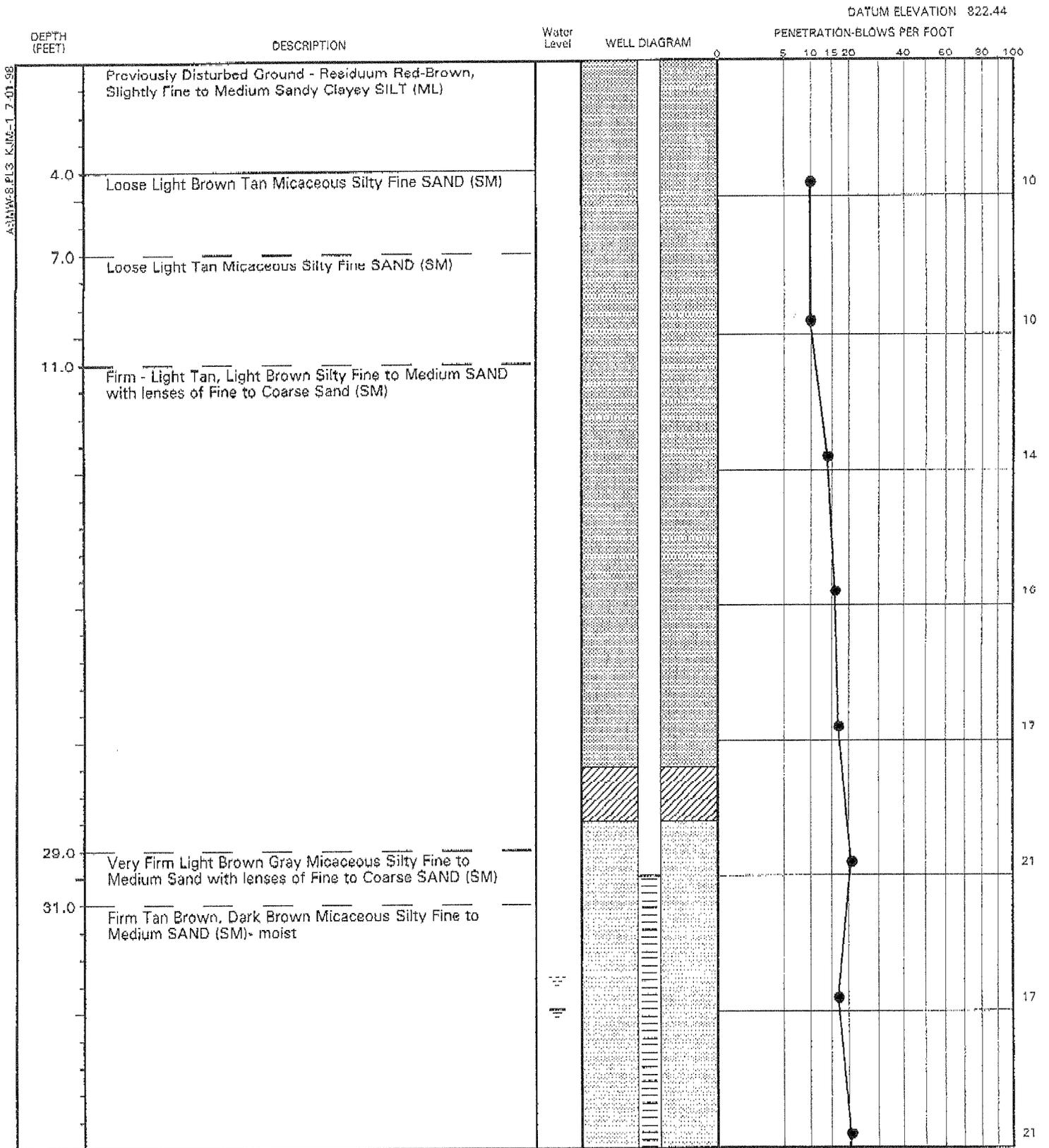


I DO HEREBY CERTIFY THAT THIS WELL WAS CONSTRUCTED IN ACCORDANCE WITH 15 NCAC 2C. WELL CONSTRUCTION STANDARDS. AND THAT A COPY OF THIS RECORD HAS BEEN PROVIDED TO THE WELL OWNER.

[Signature]

6/12/98

BORING LOG



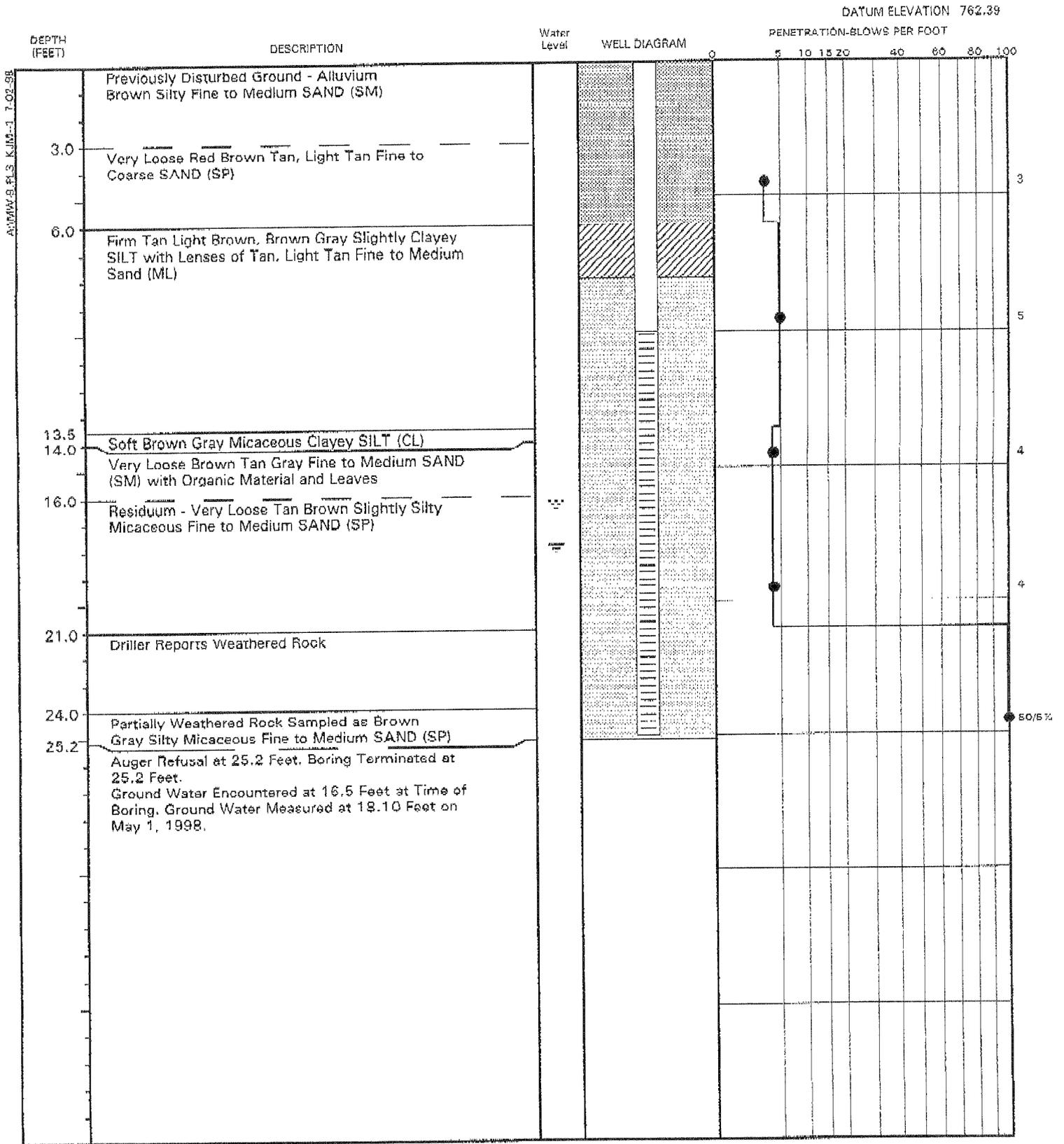
REMARKS:

DRILLED BY LAW
 LOGGED BY RT
 CHECKED BY KJM

BORING NUMBER MW-8
 DATE DRILLED 4/28/98
 JOB NAME Clev. Co. LF
 JOB NUMBER 56-453208



BORING LOG



REMARKS:

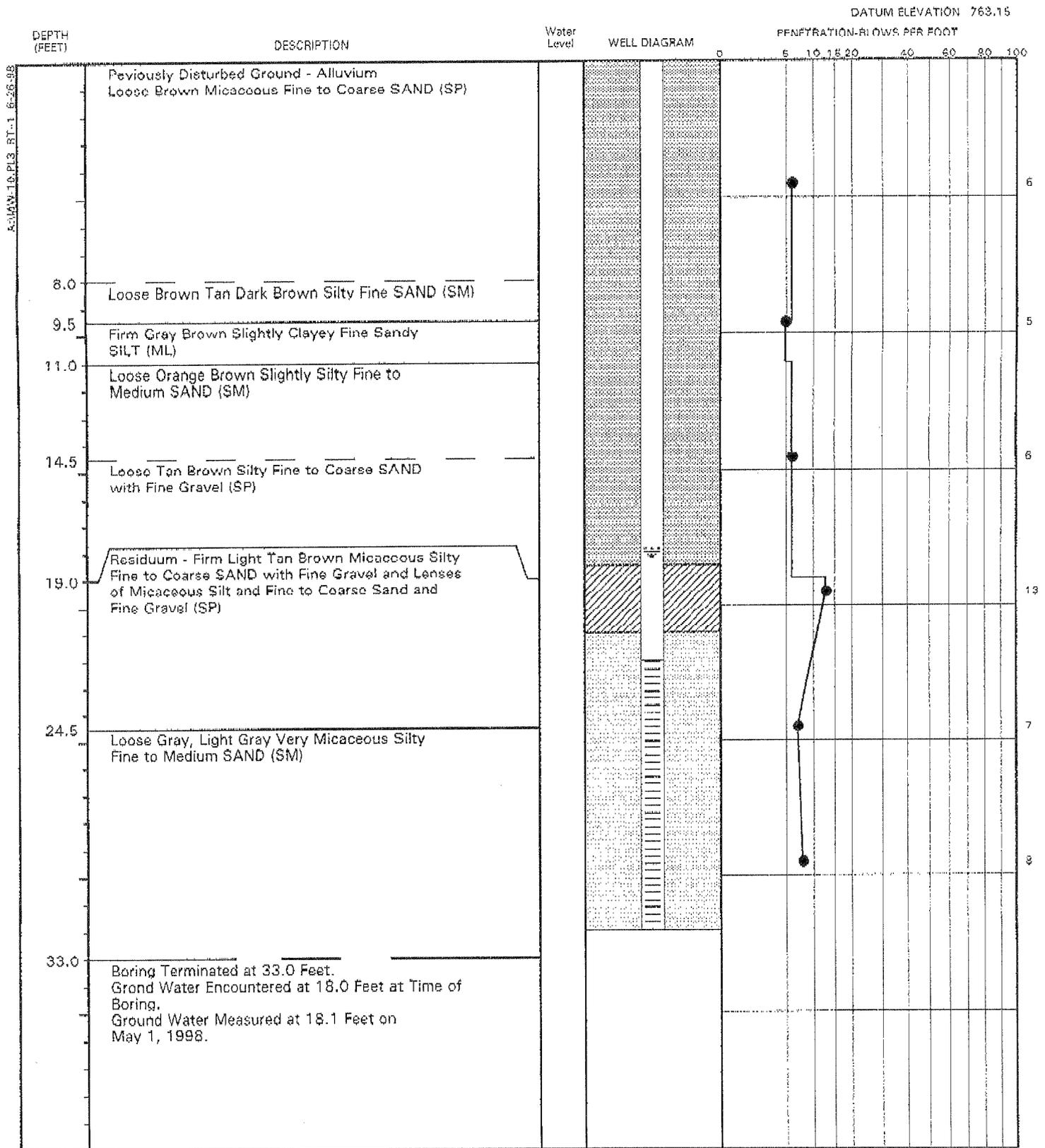
Drilled with 8-inch Hollow-Stem Augers. Set 2-inch Schedule 40 PVC with 15 Feet of 0.010-inch Slotted Screen to 25.0 Feet. Sand to 8.0 Feet, Bentonite Seal to 6.0 Feet, Grout to Ground Surface. Set Lockable Steel Cover.

DRILLED BY LAW
 LOGGED BY RT
 CHECKED BY KJM

BORING NUMBER MW-9
 DATE DRILLED 4/29/98
 JOB NAME Clev. Co. LF
 JOB NUMBER 56-453208



BORING LOG



REMARKS:

Drilled with 8 inch Hollow Stem Augers. Set 2-inch Schedule 40 PVC with 10 Feet of 0.010-inch Slotted Screen to 32.0 Feet. Sand to 21.0 Feet, Bentonite Seal to 18.5 Feet, Grout to Ground Surface. Set Lockable Steel Cover.

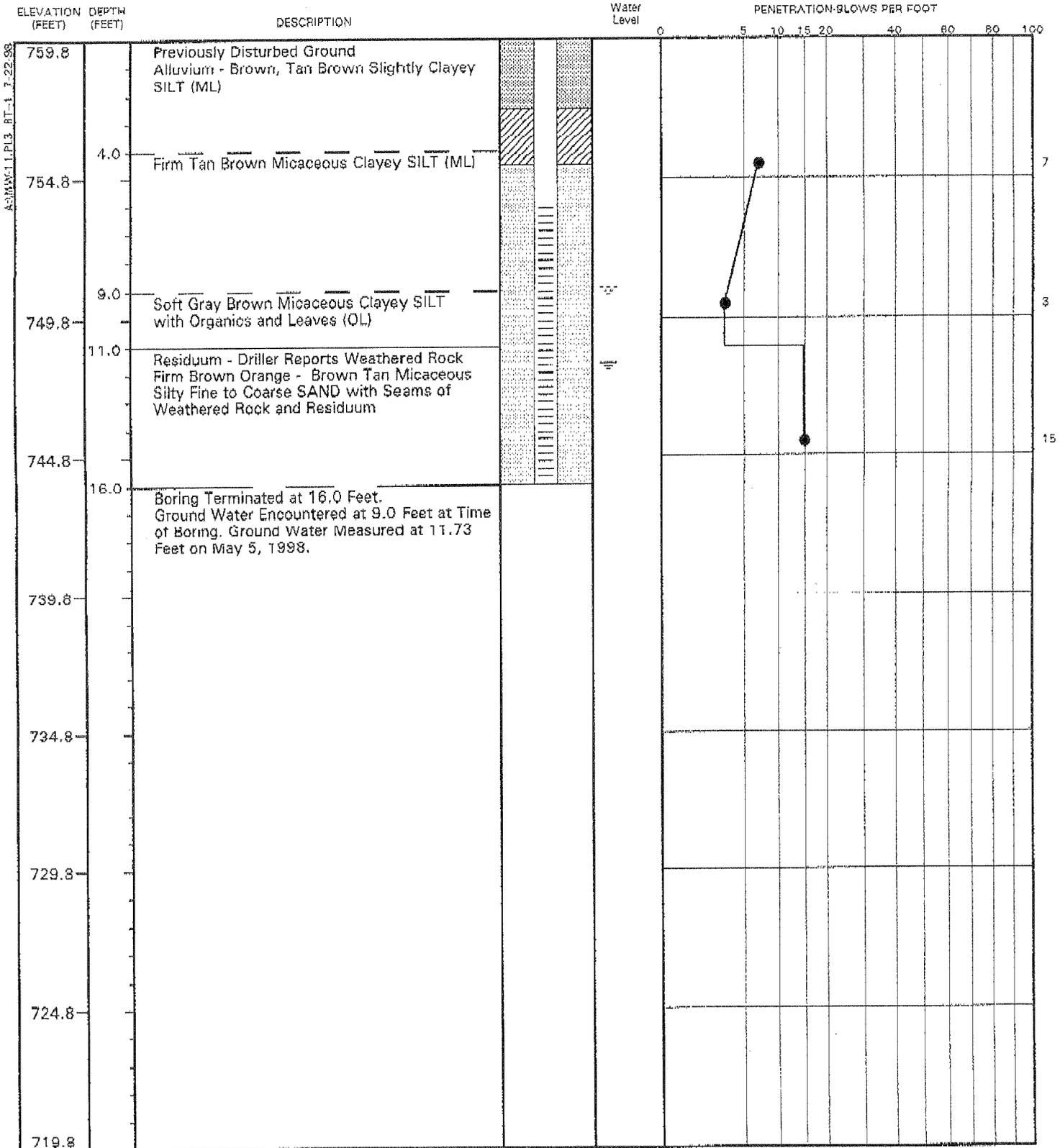
DRILLED BY LAW
LOGGED BY RT
CHECKED BY KJM

BORING NUMBER MW-10
DATE DRILLED 4/29/98
JOB NAME Clev. Co. LF
JOB NUMBER 56-453208



TEST BORING RECORD

DATUM ELEVATION: 759.77



REMARKS:

Drilled with 8-inch Hollow-Stem Augers. Set 2-inch Schedule 40 PVC with 10 Feet of 0.070-inch Slotted Screen to 16.0 Feet. Sand to 4.5 Feet, Bentonite Seal to 2.5 Feet, Grout to Ground Surface. Set Lockable Steel Cover.

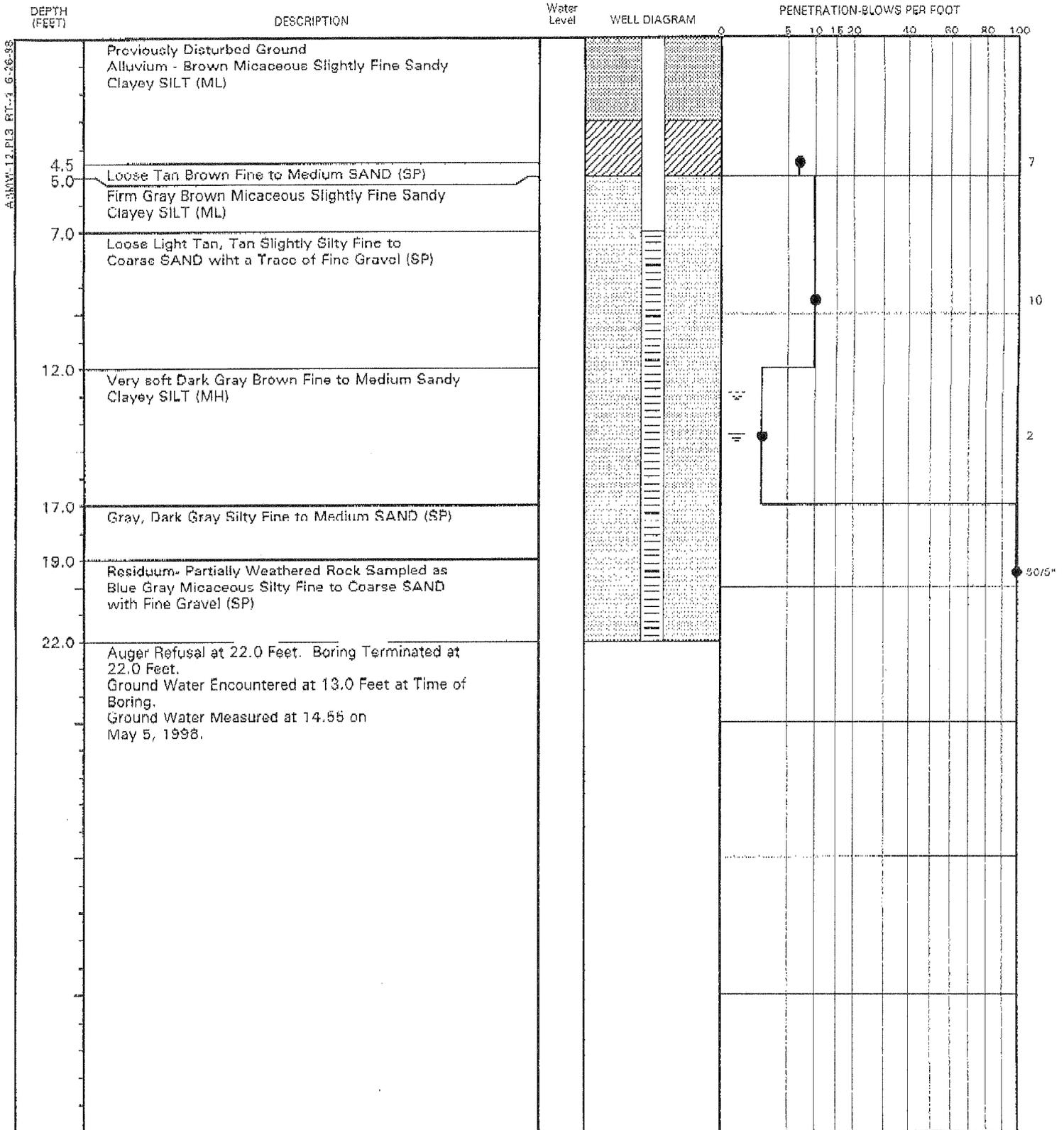
DRILLED BY LAW
 LOGGED BY RT
 CHECKED BY KJM

BORING NUMBER MW-11
 DATE DRILLED 5/1/98
 JOB NAME Clev. Co. LF
 JOB NUMBER 56-453208



BORING LOG

DATUM ELEVATION 759.84



REMARKS:

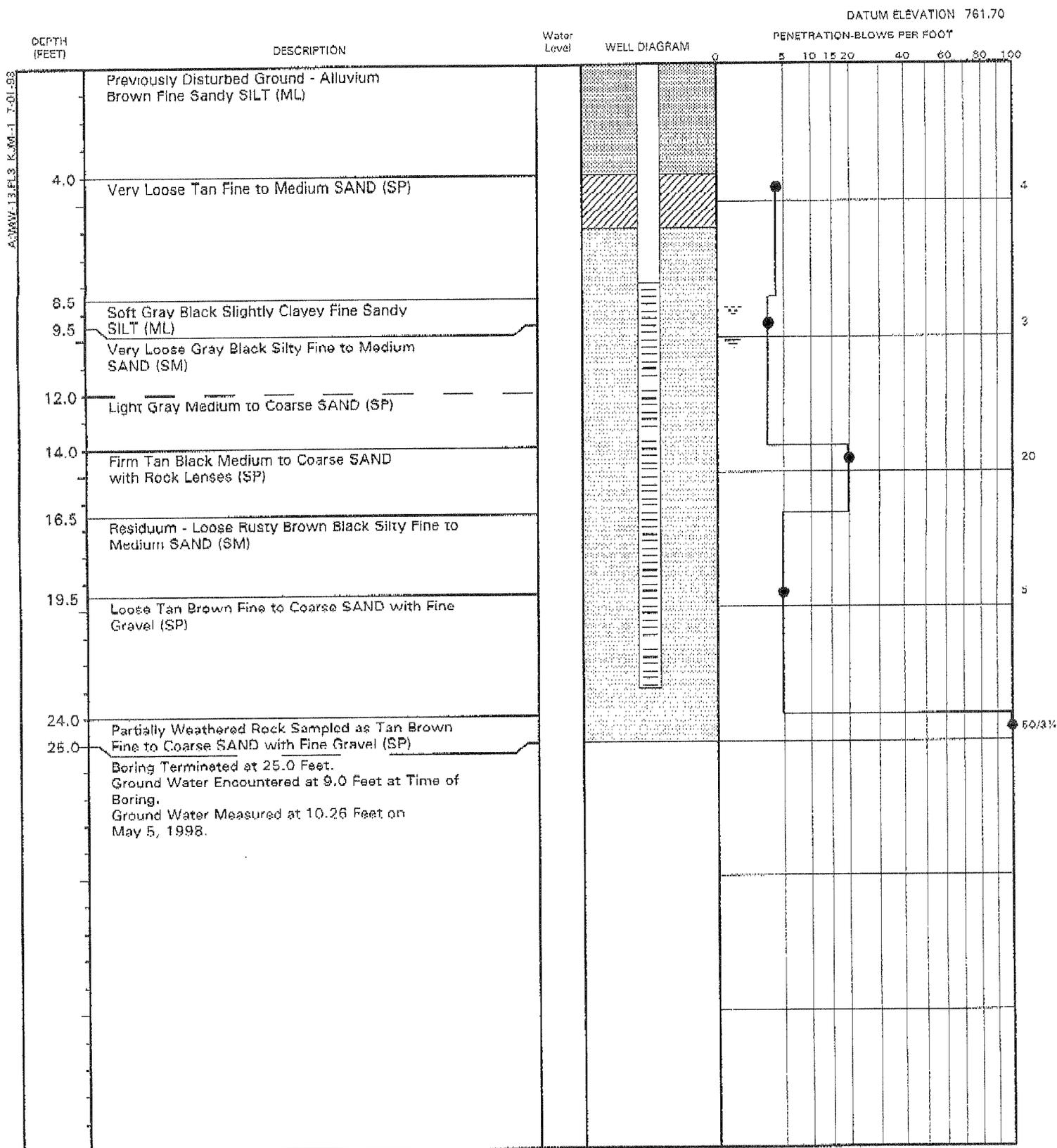
Drilled with 8-inch Hollow-Stem Augers. Set 2-Inch Schedule 40 PVC to 22.0 Feet with 15 Feet of 0.010-inch Slotted Screen. Sand to 5.0 Feet, Bentonite Seal to 3.0 Feet, Grout to Ground Surface. Set Lockable Steel Cover.

DRILLED BY LAW
 LOGGED BY RT
 CHECKED BY KJM

BORING NUMBER MW-12
 DATE DRILLED 5/1/98
 JOB NAME Clev. Co. LF
 JOB NUMBER 56-453208



BORING LOG



AS-MW-13-F1-S KJM-1 7-01-98

REMARKS:

Drilled with 8-inch Hollow-Stem Augers. Set 2-inch Schedule 40 PVC with 15 Feet of 0.010-inch Slotted Screen to 23.0 Feet. Sand to 6.0 Feet, Bentonite Seal to 4.0 Feet. Grout to Ground Surface. Set Lockable Steel Cover.

DRILLED BY LAW
 LOGGED BY RT
 CHECKED BY KJM

BORING NUMBER MW-13
 DATE DRILLED 5/2/98
 JOB NAME Clev. Co. LF
 JOB NUMBER 56-453208

