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Re: Feasibility Geotech Investigation

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1 November 1984
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Gloren Development, Inc.
111 Central Avenue
Lawrence, New York 11559

Attention: Mr. Leonard Dobbs
President

Re: Feasibility Geotechnical Investigation
Bedminster Center
Somerset County, New Jersey

Gentlemen:

This letter report summarizes the results of a feasibility geotechnical investigation performed by Woodward-Clyde Consultants (WCC) for the proposed Bedminster Center in Somerset County, New Jersey. Authorization to proceed with the subject study was based on a signed contract between Mr. Dobbs and WCC, dated 4 October 1984. The scope of the investigation was as described in WCC proposal dated 4 October 1984.

PROJECT LOCATION AND DESCRIPTION

The proposed Bedminster Center will be located south of the Town of Bedminster in Somerset County, New Jersey. The site is bordered by the North Branch Raritan River and Route 202 along its southeastern and eastern edges, respectively. River Road passes through the southeastern portion of the site.

Our understanding of the project is based on discussions with Dr. R. Hordon during a meeting held on 27 September 1984 at the offices of WCC in Wayne, New Jersey. The project consists of a multi-family house development including on-site sewage treatment with subsurface disposal of the tertiary effluent. The proposed disposal area is located in the eastern portion of the site covered by the Birdsboro soil series with 2 to 6 percent slopes (BdB).

FIELD INVESTIGATION

Test Boring

One 4-inch-diameter test boring (B-1) was drilled within the site area on 19 October 1984 and was inspected on a full time basis by our Mr. W. Stewart. A CME-35 truck-mounted drilling rig was used to advance the test boring. Casing was used to support the sides of the boring.

The boring was located in the middle of the area covered by the Birdsboro soil series (BdB) as shown in Figure 1. The boring log is presented in Appendix A. The boring was terminated at a total depth of 28 feet.

During the drilling operations, soil samples were obtained with a standard split-spoon sampler. A NX double core barrel (2-1/8 inch-diameter core) was used for rock coring. Water level observations were made in the test boring.

Seismic Refraction Survey

A total of approximately 2,900 lineal feet of the site north and south of boring B-1 were surveyed by the seismic refraction method on 20 October 1984. The survey was performed in the field by our Messrs. K. Seborowski and W. McGuinness. Locations of the seismic traverses are shown in Figure 1.

The seismic survey was made with a Geometrics multi-trace signal enhancement seismograph (model ES-1210). The seismic pulse was generated by striking a 12-inch square metal plate on the ground surface with a 20-pound sledge hammer. The seismic waves were detected by several high output geophone receivers. The seismic velocities, thicknesses of the soils and depth to bedrock beneath seismic points were determined by plotting the travel time of the seismic pulses versus their travel distances. The seismic velocities and inferred thicknesses of strata are shown in Figure 2.

Field Permeability Testing

Two falling head permeability tests were performed in the test boring. The first test was performed in soil at a depth of 5 feet below ground surface, while the second test was performed near the top of bedrock, at a depth of 26 feet. The test consisted of (1) driving the casing to the top of the test zone; (2) taking a soil sample (or rock core); (3) cleaning with drill bit to a depth of 2 feet below the tip of the casing to create a cylindrical cavity (in soil); (4) filling the cavity with pea gravel to prevent collapse of the cavity walls; and (5) filling the casing with water and recording the drop in water level at several time periods.

LABORATORY TESTING

Grain size analyses were made on selected representative split-spoon samples for identification and classification purposes. The laboratory test results are presented in Appendix B.

GEOTECHNICAL EVALUATIONS

Surficial Geology

A review of the geology of the Raritan Quadrangle where the site is located indicates that the site is underlain by interglacial deposits (i.e., soils deposited in the period between the Jerseyan and Wisconsin glacial stages). These deposits consist of old alluvium which is described as clayey gravel with pebble sizes having a maximum diameter of 6 to 8 inches. The underlying bedrock is the Brunswick red shale.

Subsurface Conditions

The following summarizes the subsurface information obtained from the one boring and seismic refraction survey performed at the site. Three generalized layers were found to underly the explored site area (i.e., area covered by BdB soils). The description of the soil and rock are based on our interpretation of the test boring and the laboratory test data. Refer to Figure 2 for subsurface profiles based on the seismic velocity data.

Layer 1. This layer consists mainly of the solum (i.e., the upper part of the soil profile), including topsoil and cultivated soils which have root matter, and of mainly dry soils above the ground-water table. In boring B-3, these soils were found to consist of dark brown CLAY with some sand, grading into sandy and silty GRAVEL. The Unified Soil Classification Symbols for these soils are CL and GP-GM. These soils were encountered to a depth of 3 feet to 4 feet. Their corresponding seismic velocities were found to be less than 2,000 feet/second. The thickness of layer 1 appears to increase north of Boring B-1.

Layer 2. This layer underlies layer 1 and consists mainly of brown dense to very dense coarse to fine sandy GRAVEL with trace to some silty clay to gravelly-clayey coarse to fine SAND. The Unified Soil Classification Symbols for these soils are GM, GW-GM, GP-GC, and SC-GC. Layer 2 appears to be at least 10 feet thick with an average thickness in excess of 15 feet. The seismic velocities of layer 2 were found to be in the range of 1,800 feet/second to 6,400 feet/second. The higher velocities are indicative of the gravelly nature of this layer, while the lower velocities are associated with probably the fine-grained zones in layer 2.

Laboratory grain size analyses performed on two samples from this layer indicated fines contents (soil material passing the no. 200 sieve) of 8 and 22 percent of the dry weight of the sample. Refer to Appendix B.

Layer 3. This layer consists mainly of deeply to slightly weathered shale bedrock. In boring B-3, the top of rock was encountered at approximately 25.5 ft depth.

Examination of the core recovered from boring B-1 indicates that the top of shale bedrock is fragmented along horizontal bedding planes. Highly weathered shale, consisting of one to 2 feet of reddish brown plastic CLAY (CL) was found overlying the top of sound bedrock. The seismic velocities of layer 3 were found to be in excess of 7,400 feet/second.

Ground-Water Conditions

Observations of water level in boring B-1 indicate that the ground-water table is below a depth of 5 feet from the ground surface and is probably located somewhere between a depth of 6 feet and 7 feet. It should be indicated, however, that ground-water observations made in boreholes are not very reliable unless the boring is left open for several days to allow stabilization of the ground-water level.

Permeability of Soil and Rock

The field permeability test performed at the top of layer 2 (i.e., depth of 5 feet to 7 feet) indicates that the sandy gravel with trace to some silt encountered at that depth has a permeability in the range of 1×10^{-3} cm/second to 1×10^{-4} cm/second. Based on crude correlations developed between permeability and percolation rate, the corresponding percolation rate at a 5 foot depth is believed to be in the range of 10 minutes/inch to 40 minutes/inch. We believe that field percolation tests will show this rate to be closer to the lower end of the range (i.e., 10 minutes/inch).

The field permeability test performed at the top of shale bedrock (i.e, depth of 26 feet to 28 feet) indicates that the permeability of the top of shale bedrock is less than about 1×10^{-5} cm/second. The corresponding percolation rate is likely to be significantly over 60 minutes/inch.

It should be mentioned, however, that actual percolation rates can be obtained only from field percolation tests performed at the design depth. The percolation rates given herein represent general expected ranges for the materail tested.

CONCLUSIONS

The limited field investigations performed within the site area covered by the Birdsboro Soil Series (BdB) revealed the following:

1. The top of shale bedrock is expected to be encountered at a depth greater than 15 feet from the ground surface. Generally, the average depth to bedrock is in excess of 20 feet.

2. The main layer in the overburden soils beneath the solum and above bedrock consists of sandy GRAVEL to gravelly clayey SAND. This layer is normally more than 10 feet thick with an average thickness in excess of 15 feet.

3. The permeability of the top of the gravelly layer is expected to be in the moderate range of 1×10^{-3} cm/second to 1×10^{-4} cm/second. The permeability of the top of the shale bedrock is expected to be very low, less than 1×10^{-5} cm/second.

LIMITATIONS

The conclusions presented in this report are based on interpretations of data obtained from a very limited field investigation. Therefore, these conclusions are very preliminary in nature. Additional field investigations, testing, and evaluations would be required for specific design purposes.

We appreciate the opportunity of serving you on this phase of the project.

Very truly yours,

Majed A. Khoury, P.E.
Project Engineer

Melvin I. Esrig, P.E.
Principal and Vice President

MAK:jc
attachment
D1029/165
cc: R. Hordon
D. Klein (WBR&B) ✓

APPENDIX A

TEST BORING LOG

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

LOG OF BORING B-1 **SHEET** 1 **OF** 2

PROJECT AND LOCATION: BEDMINSTER RESIDENTIAL DEVELOPMENT		ELEVATION AND DATUM: ~ 117 ft	PROJECT NO: 84C4204
DRILLING AGENCY: JERSEY BORING & DRILLING Co.	FOREMAN: JERRY KLAUS	DATE STARTED: 26 OCT. 1984	DATE FINISHED: 26 OCT. 84
DRILLING EQUIPMENT: CME-35 TRUCK MOUNTED DRILLING RIG		COMPLETION DEPTH: 28.0 FT.	ROCK DEPTH: 25.75 FT.
SIZE AND TYPE OF BIT: 3 7/8 INCH O.D. ROLLER	SIZE AND TYPE CORE BARREL: 2 INCH - NX CORE BARREL	NO. SAMPLES: DIST 8	UNDIST 0; CORE 2.0 FT
CASING: 4 INCH I.D. H.W		WATER LEVEL: FIRST	COMPL; 24 HR
CASING HAMMER	WEIGHT 300 LB	DROP 24 INCHES	BORING ANGLE AND DIRECTION: VERTICAL
SAMPLER: 2 INCH O.D. SPLIT BARREL			
SAMPLER HAMMER	WEIGHT 140 LB.	DROP 30 INCHES	INSPECTOR: WINSTON L. STEWART

CASING BLOWS	DESCRIPTION	PIEZOMETER	DEPTH, FT	SAMPLES: TYPE NO LOC	SAMPLES: RECOV FT	SAMPLES: PENETR RESIST BL/6IN	POCKET PENETROMETER TSF	ROCK CORE: RECOVERY %	ROCK CORE: CRACK SKETCH	ROCK CORE: CRACK COND	ROCK CORE: RQD	ROCK CORE: CORE TIME	REMARKS
11	CL; Hard dark brown slightly plastic CLAY, some m-f sand, trace c-sand and gravel; freq. roots, moist		0–1	S-1	1.2	1, 11							* Interpolated from Figure 1
45			1–2			21, 37							
110	GP-GM; Very dense c-f brown c-f sandy GRAVEL, trace silt, occ. roots dry to moist		2–3	S-2	1.0	30, 29							Difficult drilling ↓
338			3–4			60, 100							
274	GM; Very dense brown c-f GRAVEL, some c-f sand and silt, dry		4–5	S-3	0.6	30, 61							Recovery was restricted to 0.6 ft due to large gravel pieces in split-barrel
5			5–6			40, 61							
25			6–7										
60	GW-GM; Dense brown c-f sandy c-f GRAVEL, trace silt, moist		7–8	S-4	1.2	5, 11							Wash color is brown
76			8–9			39, 80							
106	GP-GC; Very dense brown c-f sandy GRAVEL, trace to some reddish brown silty clay, moist.		9–10	S-5	1.0	59, 84							
2			10–11			99, 135							* Washing ahead of casing; starting from 10 ft.
3			11–12										
13			12–13										
33			13–14										
28			14–15										
10	GP-GC; Very dense brown c-f sandy GRAVEL, trace reddish brown silty clay, moist.		15–16	S-6	1.0	37, 78							
24			16–17			81, 79							
27			17–18										CL; indicates soil symbol based on the Unified Soil Classification system
48			18–19										
33			19–20										

WOODWARD-CLYDE CONSULTANTS

CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS

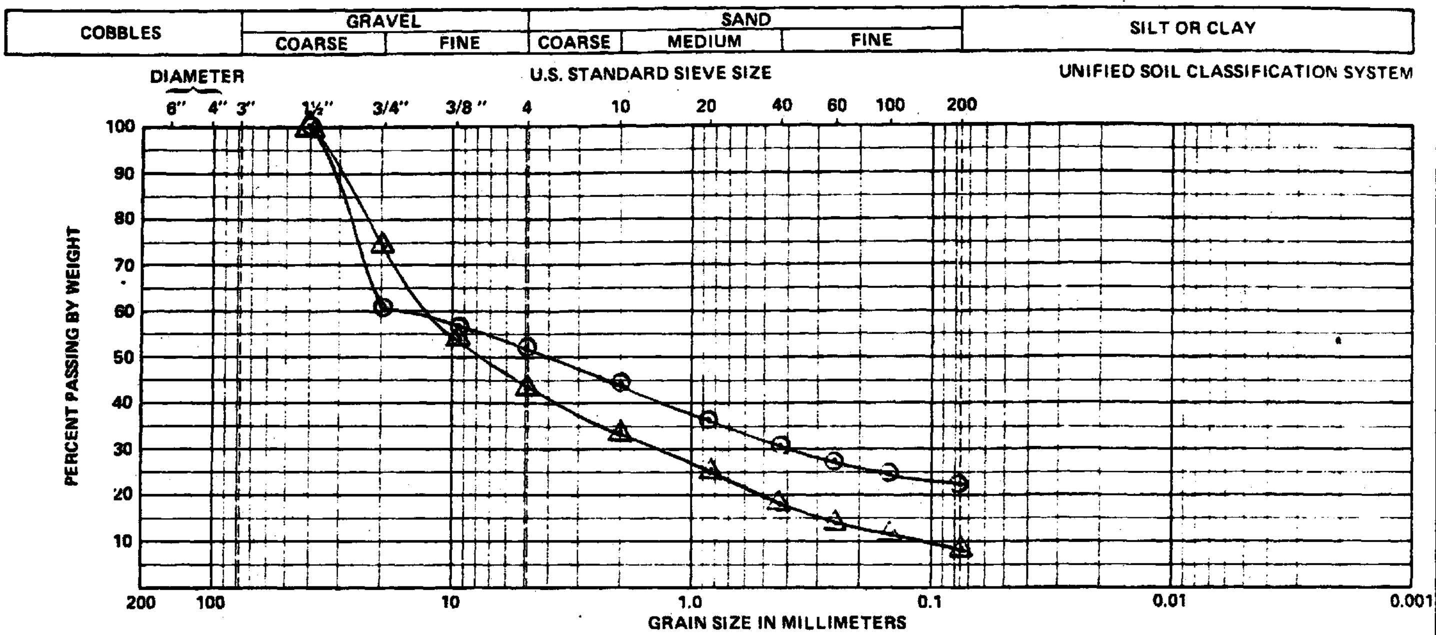
LOG OF BORING B-1 SHEET 2 OF 2

DESCRIPTION	PIEZOMETER	DEPTH, FT	SAMPLES: TYPE NO. LOC	SAMPLES: RECOV. FT	SAMPLES: PENETR. RESIST. BL/6 IN.	POCKET PENETROMETER TSF	ROCK CORE: RECOVERY %	ROCK CORE: CRACK SKETCH	ROCK CORE: CRACK COND	ROCK CORE: RQD	ROCK CORE: CORE TIME FT	REMARKS
SC-GC; Very dense reddish brown gravelly clayey c-f SAND, moist.		21, 22	S-7	1.0	4[illegible] 81 62 82							Grav[illegible] tip of sampler prevented full recovery
- - - - ? - - - ? - - - -		23, 24										Color of wash changed from brown to reddish brown at about 21 ft.
CH - Hard reddish brown plastic CLAY, trace of gravel, moist (Weathered SHALE)		25, 26	S-8	0.4	11 100/3"							Sample has horizontal bedding planes.
Red brown Brunswick SHALE		27, 28					80		FRAGMENTED		15 min.	Cored from 26 ft to 28 ft.
BOTTOM OF BORING 28.0 FT		29–44										

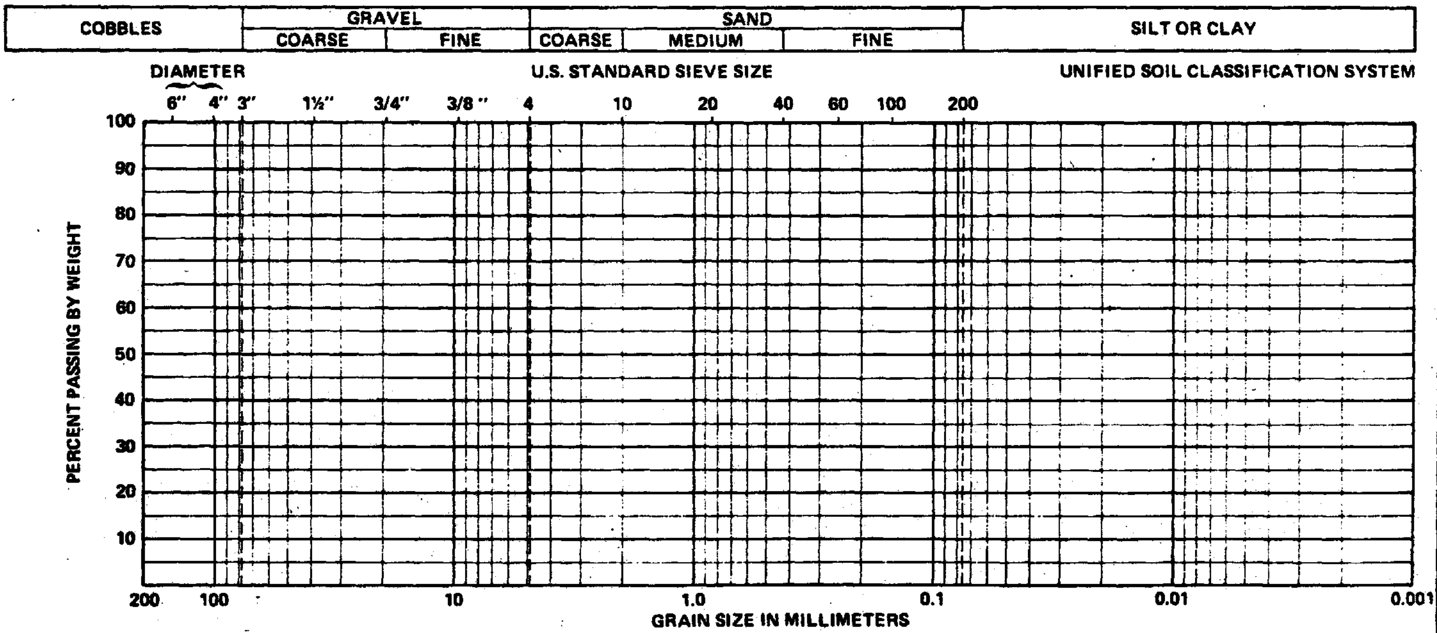
APPENDIX B

LABORATORY TEST RESULTS

PARTICLE-SIZE DISTRIBUTION



BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)
1	3	4-6	⊙	GM, brown c+-f GRAVEL, some c-f Sand and silt			
1	4	7-9	△	GW-GM, brown c-f sandy c-f GRAVEL, trace silt			



BORING	SAMPLE	DEPTH (ft)	SYMBOL	CLASSIFICATION	w (%)	w_L (%)	w_P (%)