

SUBSURFACE INVESTIGATION

PELICAN SHORES  
NORTHWEST CORNER OF CR 13 AND CR26  
WELD COUNTY, COLORADO

PREPARED FOR:

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PROJECT 2002-89

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TABLE OF CONTENTS  
PROJECT 2002-89

	PAGE
PURPOSE	1
INVESTIGATION DETAILS	1
PROPOSED DEVELOPMENT	2
SOIL CONDITIONS	2
GROUNDWATER CONDITIONS	2
FOUNDATION RECOMMENDATIONS	3
SLABS-ON-GRADE RECOMMENDATIONS	3
SITE DRAINAGE RECOMMENDATIONS	4
LIMITATIONS	5
FIGURES AND TABLES	
FIGURE 1	BORING LOCATION MAP - NORTH PELICAN SHORES
FIGURE 2	BORING LOCATION MAP - SOUTH PELICAN SHORES
FIGURE 3	BORING LOGS
TABLE 1	LABORATORY TEST RESULTS

## SUBSURFACE INVESTIGATION

### PELICAN SHORES NORTHWEST CORNER OF CR 13 AND CR 26 WELD COUNTY, COLORADO

#### PURPOSE

The subsurface investigation has been completed for the proposed North and South Pelican Shores residential subdivision located at the northwest corner of CR13 and CR26 in Weld County, Colorado. This investigation was accomplished in order to provide preliminary recommendations for the foundation systems of the proposed residences to be constructed at the site and other pertinent geotechnical engineering recommendations. As part of our field investigation, 4 borings were drilled throughout the lots 1 through 14, Block 2 of North Pelican Shores and 6 borings were drilled throughout lots 1 through 26, Block 1 of South Pelican Shores. The locations of the borings are indicated on Figures 1 and 2.

Factual data gathered during the field and laboratory work is summarized in Figure 3 and Table 1 attached. The results of this investigation and our opinions that are based on this investigation and our experience in the general area are summarized in this report.

#### INVESTIGATION DETAILS

The test borings were completed with 4-inch diameter, continuous flight power augers using a truck-mounted drill rig. The augers are utilized to bore and clean the hole to the desired sampling depth. The augers are then removed and a 2-inch I.D. California spoon sampler is inserted to the desired testing depth. The sampler is then driven with blows of a standard 140-pound hammer falling a distance of 30 inches.

The sampler is driven a total of 12 inches or a maximum of 50 blows. The number of blows required to drive the sampler 12 inches, or a fraction thereof, constitutes the penetration test. The test is similar to the Standard Penetration Test described in ASTM D1586-78 (Reapproved 1974). This test, when properly evaluated, is a measure of the soil strength and density. The results of these tests are shown on the Boring Logs (Figure 3). Samples obtained from the borings were returned to our lab for testing. The test results are indicated on Table 1.

## PROPOSED RESIDENTIAL DEVELOPMENT

It is our understanding that the plan is to develop 14 single-family lots on North Pelican Shores and 26 lots on South Pelican Shores. We were informed that the residences on North Pelican Shores will be constructed over walk-out basements facing the lake. The excavation plans for South Pelican Shores was undecided at the time of this report. We anticipate that the buildings will be constructed using conventional wood framing techniques and will be supported by poured in place reinforced concrete foundation walls. The loadings are anticipated to be light to moderate, typical of residential construction.

If actual plans differ from the above description we should be notified so that our recommendations can be reviewed and revised, if necessary.

## SOIL CONDITIONS

A relatively thick layer of overlot fill was encountered on lots 1 through 14, Block 2 of North Pelican Shores. The depth of the fill appeared to vary from 23 to 31 feet in depth. The fill was underlain by the native soils which consisted of sandy clays, silts and sand and gravel soils. The overburden soils were underlain by sandstone and claystone bedrock at approximately 28 to 31 feet.

A layer of overlot fill varying from approximately 2 ½ to 4 feet thick was encountered on lots 1 through 26, Block 1 of South Pelican Shores. The fill was underlain by topsoil material, which in turn was underlain by a deposit of slightly clayey to clayey, silty sand. The sand deposit was underlain by sand and gravel soils at approximately 7 to 10 feet. This material continued down to approximately 24 to 29 feet. At these depths bedrock was encountered in all but one of the borings.

A more complete description of the subsurface soil conditions can be found on the Boring Logs, Figure 3.

## GROUNDWATER CONDITIONS

Groundwater was not encountered in the borings on lots 1 through 14, Block 2 of North Pelican Shores at the time of drilling. Upon returning to the site several days after drilling groundwater was encountered in Boring 3 at approximately 33 feet. No water was noted in the other holes on this site. Groundwater was

encountered at approximately 9 to 11 feet in the borings on lots 1 through 26, Block 1 at South Pelican Shores at the time of drilling. The groundwater level will fluctuate throughout the year depending upon the amount of precipitation, surface runoff, the application of irrigation water and the water level maintained in the lakes.

#### FOUNDATION RECOMMENDATIONS

Due to the amount of fill present on lots 1 through 14, Block 2 at the North Pelican Shore site, we recommend that the residences be supported by a drilled pier foundation system. Using this approach, the piers are drilled through the overburden fill and native soils and well into the underlying bedrock for support. The piers are typically drilled 8 to 10 feet into the bedrock. If groundwater seepage or caving soils are encountered, casing will be required for the pier drilling operation.

On lots 1 through 26, Block 1 at South Pelican Shores, we anticipate that a spread footing foundation system can be used for support of the residences. The footings must be placed below the overlot fill and topsoil should bear on the native sands or sand and gravel soils.

Site specific investigations should be accomplished for each site within both developments in order to provide final foundation recommendations and design parameters.

#### SLABS-ON-GRADE RECOMMENDATIONS

The fill present on lots 1 through 26, Block 1 at South Pelican Shores was predominately a granular fill which appeared relatively well compacted. The underlying native soils consisted of slightly clayey to clayey sands and sand and gravel soils. These soils are non expansive to low expansive potential and are generally considered acceptable soils for conventional slab-on-grade construction.

Due to the depth, varying densities and nature of the fill present on lots 1 through 14, Block 2 at North Pelican Shores, there is some risk involved in using standard slab-on-grade construction. Slabs constructed on these soils could be subject to long term settlement. As with the foundation systems constructed on these lots, the most positive approach would be to use a structural floor system.

supported by the foundation walls and interior piers also drilled well into the underlying bedrock for support.

#### SITE DRAINAGE RECOMMENDATIONS

It is essential that proper site drainage be provided to divert all surface water runoff and water from the roof well away from the foundation walls. Satisfactory long-term performance of any foundation system depends on prevention of infiltration of water into the soils supporting the foundation. The following methods of preventing this infiltration are recommended:

1. Mechanically compact all fill around the building, including the backfill. Compaction by ponding or saturation must not be permitted. The backfill should be compacted to not less than 90% of maximum density as determined by the standard moisture/density relationship ASTM D698-78. Backfill which is to support slabs or pavement should be compacted to 95% of maximum dry density. Note, that some moisture will have to be added to the soils in order to obtain the proper compaction.
2. Provide an adequate grade for rapid runoff of surface water away from the structure (a minimum of 10 percent for the first 10 feet away from the structure is essential for unpaved areas).
3. A well constructed, leak-resistant series of gutters, or other roof drainage system, is essential.
4. Discharge roof downspouts and all other water collection systems well beyond the limits of the backfill, a minimum of 5 feet away from the foundation walls. We recommend against landscaping which requires any watering within 5 feet of the foundation walls.

It is our opinion that all of the residences should have the protection of a perimeter drainage system. The perforate drainage pipe should be placed at least one foot below the bottom of the slab or the structural floor and should drain to a gravity outfall, if possible, or to a sump pit equipped with a pump. Depending upon the depth of the excavation and the proximity to the groundwater level, it may also be necessary to install an interior drainage system under the basement floor. These drainage lines should be channeled to the same outfall as the

perimeter drainage system. Final details for the drainage systems can be provided as part of the site specific investigation for each lot.

Special considerations should be given to the depth of any basement excavations on lots 1 through 26, Block 1 at South Pelican Shores due to the groundwater conditions throughout this area of development. For preliminary considerations, garden level or raised basements with 4 to 5 feet cuts below the existing grades would be more suitable than full depth basements with typically 8 foot cuts below grade.

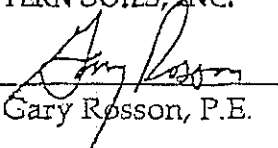
#### LIMITATIONS

The borings in this investigation present a reasonably accurate knowledge of the existing subsoils. Variations of the soil and bedrock conditions are always possible. Site specific investigations should be accomplished for each lot in order to provide final design criteria for the foundations, floor systems and drainage systems.

If there are any questions concerning this report or when we can be of further assistance, please call.

Sincerely,

WESTERN SOILS, INC.

By:   
Gary Rosson, P.E.



Laboratory Test Results

Table 1

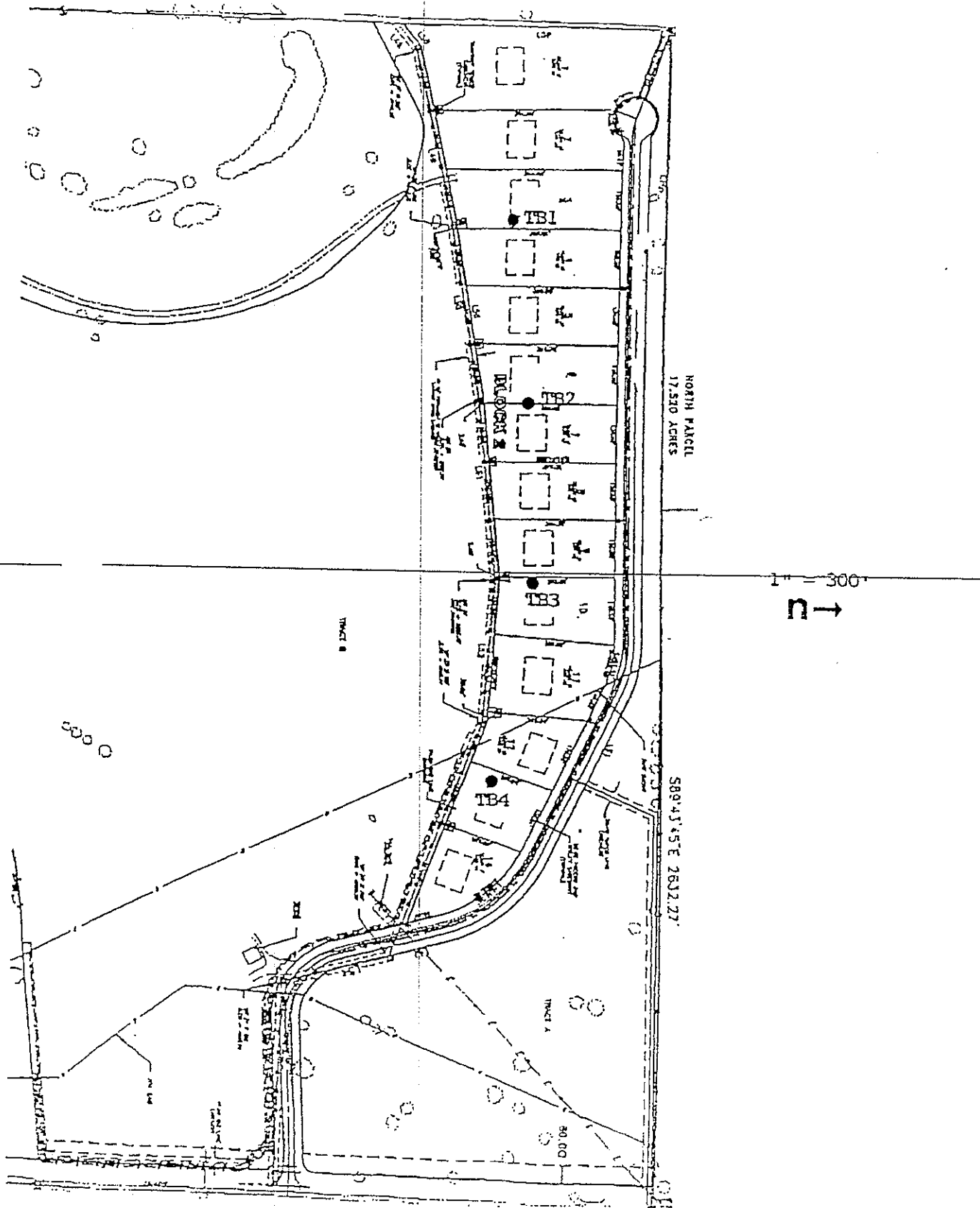
Project #2002-89

PROPERTIES AT NATURAL MOISTURE CONTENT			CONSOLIDATION/SWELL				DESCRIPTION
Natural Moisture (%)	Natural Dry Density (PCF)	Unconfined Compression (PSF)	Loading (PSF)	Settlement (DRY) (%)	Settlement (Saturated) (%)	Swell (%)	
Test Boring 1 @ 3'							
5.0	106.3	5000	100 1000 3000	0.4	0.2 2.1 4.1		<u>Fill</u> , slightly clayey, silty to very silty sand, brown.
0.2% Swell upon the addition of water							
Test Boring 1 @ 9'							
10.1	121.1	>9000	100 1000 3000	0.4	0.6 0.8 2.2		<u>Fill</u> , very silty, sandy, gravelly clay, dark brown to grey.
1.0% Swell upon the addition of water							
Test Boring 2 @ 9'							
28.8	88.1	1000	500 1500 3500	5.5	5.5 9.0 14.0		<u>Fill</u> , clayey, slightly sandy silt, grey to black.
0.0% Swell upon the addition of water							
Test Boring 2 @ 29'							
16.5	113.6	>9000	500 1500 3500 8500	0.3	0.3 0.9 1.9 3.3		<u>Sandstone</u> , slightly clayey, silty, olive brown to brown.
0.0% Swell upon the addition of water							
Test Boring 4 @ 9'							
12.0	112.8	8000	100 1000 3000	1.0	0.5 2.7 4.3		<u>Fill</u> , silty, sandy to very sandy clay, brown.
0.5% Swell upon the addition of water							
Test Boring 6 @ 9'							
8.3	117.8	N/A	100 1000 3000	0.9	0.9 2.8 4.6		<u>Sand</u> , very silty, slightly clayey, dark brown.
0.0% Swell upon the addition of water							
Test Boring 10 @ 4'							
6.3	108.3	N/A	500 1500 3500	0.7	0.7 2.0 3.6		<u>Sand</u> , very silty, slightly clayey, dark brown.
0.0% Swell upon the addition of water							



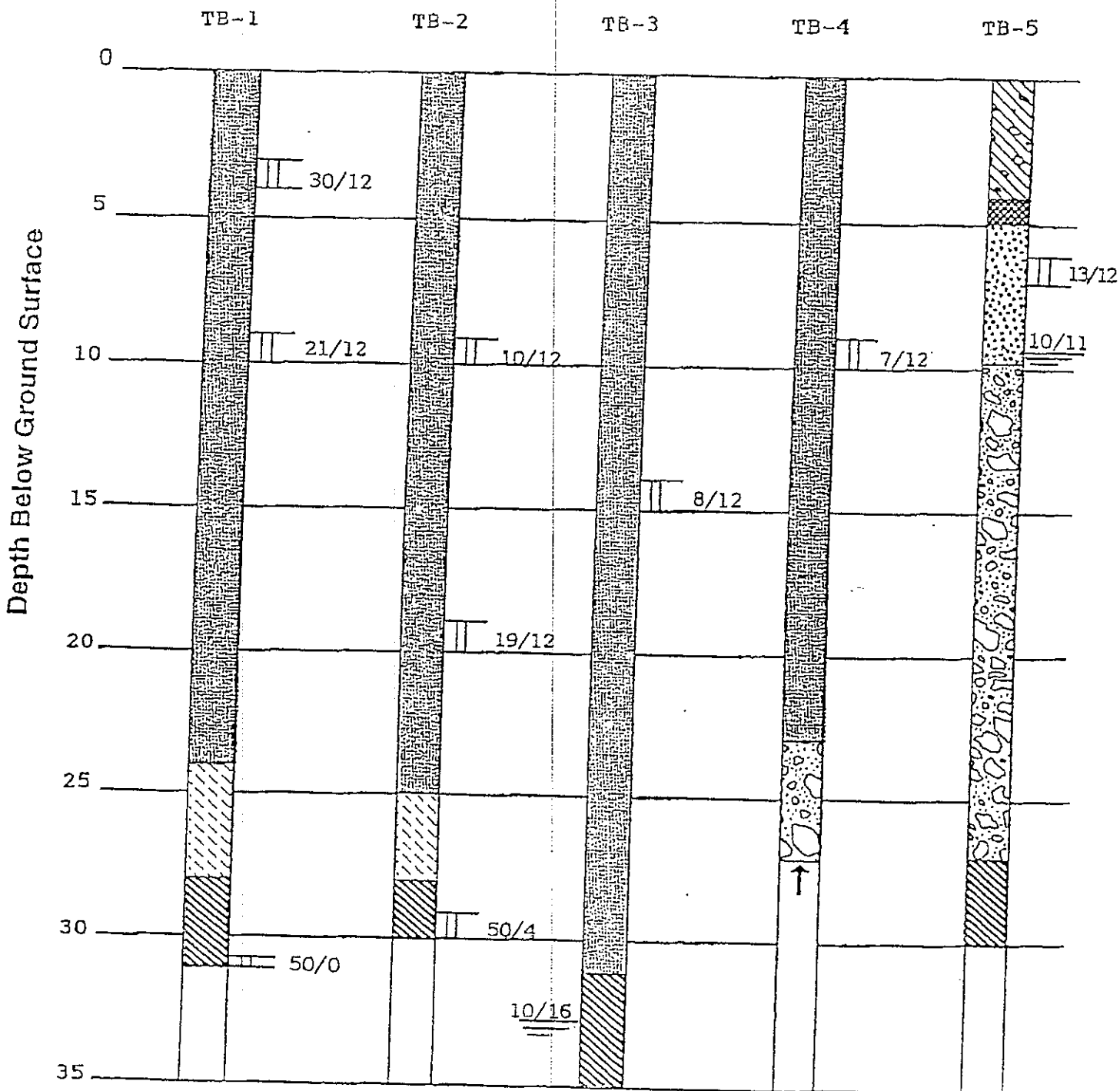
BORING LOCATION MAP-NORTH PELICAN SHORES

FIGURE 1



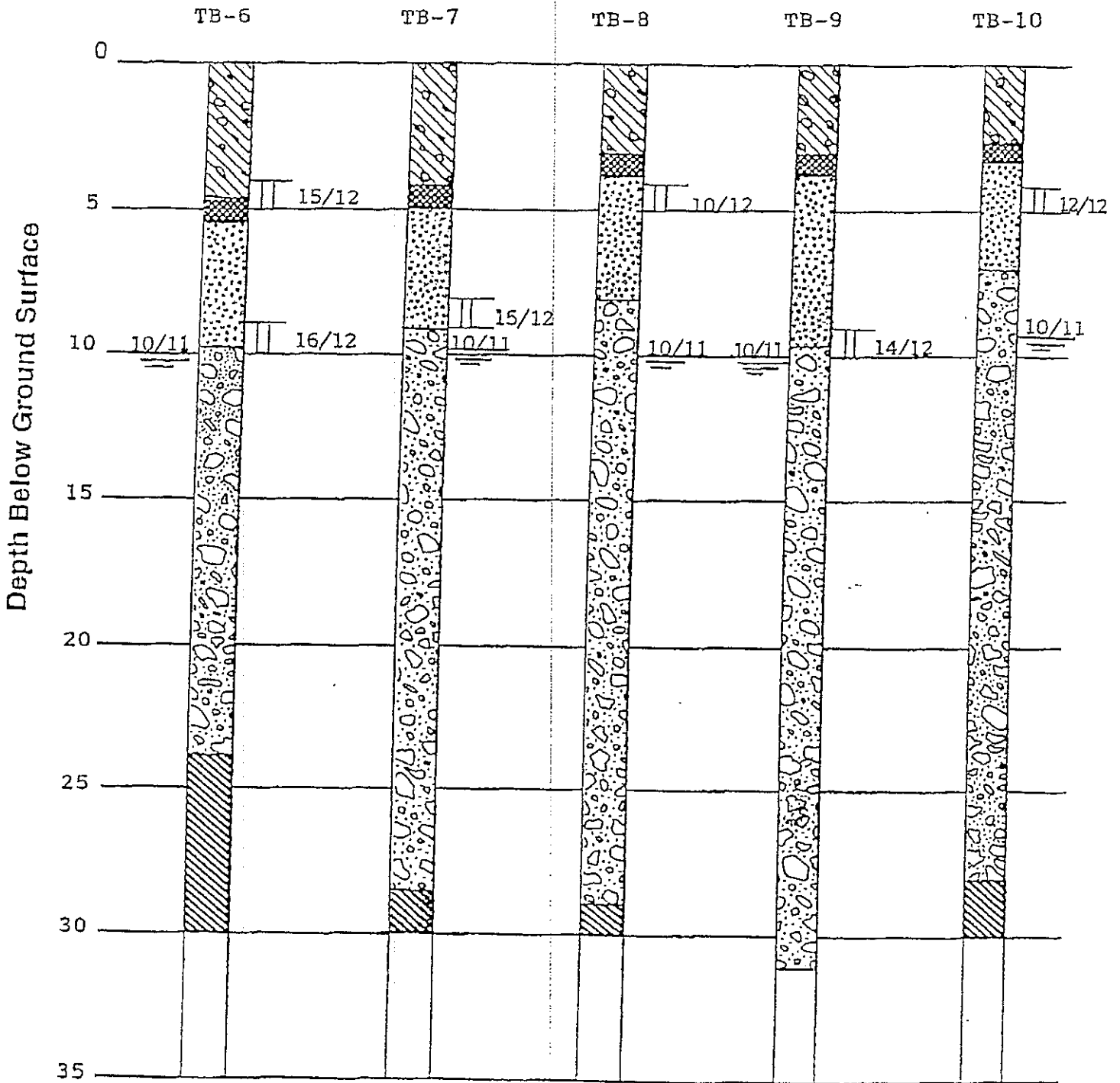


Boring Logs  
FIGURE 3



# Boring Logs

## FIGURE 3



LEGEND AND NOTES



FILL, Mixture of silty, slightly clayey to clayey, sands and clayey, slightly sandy silts, soft to stiff, brown, dark brown to grey



FILL, Predominately slightly clayey, silty sands & gravels with occasional cobbles, brown, medium dense to dense



TOPSOIL, clayey, silty, sandy, dark brown, loose



CLAY, silty, sandy to very sandy, brown to olive brown, medium stiff



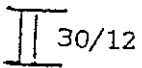
SAND, silty to very silty, with occasional gravel, dark brown to brown, medium dense



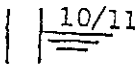
SAND & GRAVEL, silty with scattered cobbles, brown to orange brown, medium dense to dense



SANDSTONE, silty to very silty, slightly clayey, to CLAYSTONE, silty, slightly sandy, olive brown to grey, hard to very hard



Indicates that 30 blows of a 140 pound hammer were required to drive a 2 inch diameter sampler 12 inches.



Indicates groundwater level, if encountered, and date which reading was taken.



Indicates drill rig encountered refusal due to dense cobbles

Laboratory Test Results

Table 1

Project #2002-89

PROPERTIES AT NATURAL MOISTURE CONTENT			CONSOLIDATION/SWELL				DESCRIPTION
Natural Moisture (%)	Natural Dry Density (PCF)	Unconfined Compression (PSF)	Loading (PSF)	Settlement (DRY) (%)	Settlement (Saturated) (%)	Swell (%)	
Test Boring 1 @ 3'							
5.0	106.3	5000	100 1000 3000	0.4	0.2 2.1 4.1		Fill, slightly clayey, silty to very silty sand, brown.
0.2% Swell upon the addition of water							
Test Boring 1 @ 9'							
10.1	121.1	>9000	100 1000 3000	0.4	0.8 2.2	0.5	Fill, very silty, sandy, gravelly clay, dark brown to grey.
1.0% Swell upon the addition of water							
Test Boring 2 @ 9'							
28.8	88.1	1000	500 1500 3500	5.5	5.5 9.0 14.0		Fill, clayey, slightly sandy silt, grey to black.
0.0% Swell upon the addition of water							
Test Boring 2 @ 29'							
16.5	113.6	>9000	500 1500 3500 8500	0.3	0.3 0.9 1.9 3.3		Sandstone, slightly clayey, silty, olive brown to brown.
0.0% Swell upon the addition of water							
Test Boring 4 @ 9'							
12.0	112.8	8000	100 1000 3000	1.0	0.5 2.7 4.3		Fill, silty, sandy to very sandy clay, brown.
0.5% Swell upon the addition of water							
Test Boring 6 @ 9'							
8.3	117.8	N/A	100 1000 3000	0.9	0.9 2.8 4.6		Sand, very silty, slightly clayey, dark brown.
0.0% Swell upon the addition of water							
Test Boring 10 @ 4'							
6.3	108.3	N/A	500 1500 3500	0.7	0.7 2.0 3.6		Sand, very silty, slightly clayey, dark brown.
0.0% Swell upon the addition of water							