Property of
Flood Control District of MC Library
Please Return to
2801 W. Durango
Phoenix, AZ 85009

ENGINEERING REPORT

FOR THE PRICE ROAD DRAINAGE TUNNEL

RAM-600-1-507

ENGINEERING REPORT

FOR

THE PRICE ROAD DRAIN TUNNEL

TEMPE, ARIZONA

BY

CRS SIRRINE, INC

UNDERGROUND ENGINEERING DEPARTMENT

216 SIXTEENTH STREET MALL

SUITE 1700

DENVER, COLORADO 80202

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	1
1.1	General	1
1.2	Scope of Work	1
1.3	Report Organization	2
2.0	SUBSURFACE CONDITIONS	3
2.1	Subsurface Exploration Program	3
2.2	Summary of Soil Conditions	4
2.3	Summary of Water Conditions	6
3.0	GEOTECHNICAL CONSIDERATIONS	8
3.1	Project Description	8
3.2	Previous Tunneling Experience in Phoenix	9
3.3	Ground Characteristics	12
3.4	Temporary Support	14
3.5	Other Facilities	15
3.6	Additional Investigations	15
3.7	Report Limitations	16
4.0	CONSTRUCTION CONSIDERATIONS	17
4.1	General	17
4.2	Excavation and Face Control	17
4.3	Ground Control	18
4.4	Construction Dewatering	20
4.5	Construction Scheduling	20
4.6	Construction Monitoring	21
SELECTED REFERENCES		22
LIST OF FIGURES		
LIST OF TABLES		

LIST OF FIGURES

1.1 Project Locus

2.1 Price Road Drain Tunnel, Sta. 127+00 to 204+28.17
Boring Location Diagram

2.2 Price Road Drain Tunnel, Sta. 33+80 to 127+00
Boring Location Diagram

2.3 Price Road Drain Tunnel, Sta. 10+00 to 33+80
Boring Location Diagram

4.1 Width of Zone of Influence at Ground Surface

4.2 Recommended Instrumentation Program for Test Section

LIST OF TABLES

2.1 Price Road Drain Tunnel Summary of Test Borings

1.0 INTRODUCTION

1.1 General

In accordance with an authorization from Mr. Burton A. Lewis, P.E. of DeLeuw, Cather & Company (DCCO), the Underground Engineering Department of CRS Sirrine, Inc. (CRSS) performed a subsurface exploration program for the proposed Price Road Drain Tunnel in Tempe, Arizona. Work on the project was performed in accordance with a letter proposal from CRSS to DCCO dated December 18, 1986 in which CRSS agreed to accomplish three primary objectives.

1. Describe subsurface soil and water conditions at the site as revealed by subsurface investigations and laboratory tests.

2. Comment on tunnel construction issues based on observed subsurface conditions.

3. Comment on construction scheduling issues specifically with respect to alternatives for timing construction of the tunnel in relation to construction of adjacent proposed highways and bridge structures.

The first objective listed above (subsurface description) is the topic of the report entitled, "Site Conditions Report for the Price Road Drain Tunnel, Tempe, Arizona" that was published under separate cover in August, 1987. The purpose of that report was to present the results of the subsurface exploration performed along the proposed tunnel alignment. The purpose of this report is to describe the tunneling project and to set forth our comments, suggestions, and recommendations for the tunnel based on our knowledge of ground conditions.

The proposed Price Road Drain Tunnel is located as shown on the Project Locus, Figure 1.1. In general, the tunnel is oriented almost due north-south, is approximately 18,000 ft long, and is designed for a finished inside diameter of 18.0 ft. The purpose of the tunnel is to provide storm water drainage for part of the proposed Outer Loop Highway, which is part of a larger freeway and expressway project currently under construction in metropolitan Phoenix.

All discussion herein is based on a description of the tunnel provided by Howard Needles Tammen & Bergendoff (HNTB), that was characterized as the "30 percent" design submittal. Various changes in the location and configuration of the tunnel and of various inlet, outlet and intermediate access facilities should be anticipated prior to final release of contract documents.

1.2 Scope of Work

As described in our proposal dated December 18, 1986, CRSS agreed to accomplish the following scope of work:

6

1. Accumulate and evaluate available information about subsurface conditions and tunneling projects in the Phoenix area and visit the site of the proposed project.

2. Perform a program of subsurface explorations consisting of large diameter borings, Becker drill holes, observation wells, and selected laboratory tests.

3. Provide survey control and obtain required permits and clearances for the field work.

4. Provide full-time technical monitoring of all field activities.

5. Classify all soil samples obtained during the field work on the basis of visual classification and the results of laboratory tests.

6. Meet with DCCO to discuss the work after completion of the first phase of the subsurface exploration program.

7. Provide written description of subsurface soil and water conditions as soon as possible after completion of field and laboratory work.

8. Make preliminary analyses relating to tunnel construction and meet with DCCO to discuss various construction alternatives.

9. Finalize engineering analyses and prepare a final engineering report.

As mentioned above, Work Items 1 through 7 resulted in the preparation of the "Site Conditions Report for Price Road Drain Tunnel, Tempe, Arizona". The work associated with Work Items 8 and 9 is summarized herein.

1.3 Report Organization

This report is divided into three chapters following the introduction:

Chapter 2.0 Subsurface Conditions - This chapter provides a summary of subsurface conditions paraphrased from the detailed description given in the Price Road Drain Tunnel "Site Conditions Report". The purpose of this chapter is to provide a concise description of the ground in which the tunnel would be excavated and to set the stage for discussions of both the geotechnical and construction considerations.

Chapter 3.0 Geotechnical Considerations - This chapter provides a brief description of the project and relates important project elements to observed ground conditions. Recommendations are provided for important support, fact control, shaft excavation, and additional investigations.

Chapter 4.0 Construction Considerations - Based on CRSS's understanding of the ground and the project, comments are made in chapter 4.0 about important construction considerations such as excavation, ground control, third party impacts, and construction dewatering, scheduling, and monitoring.

2.0 SUBSURFACE CONDITIONS

2.1 Subsurface Exploration Program

In order to fulfill project objectives, a total of 59 exploratory borings were completed from January 20 to April 4, 1987 along the proposed tunnel alignment as summarized in Table 2.1, Summary of Test Borings, and as shown in Figures 2.1 through 2.3, Boring Location Diagrams. Of this total, thirteen borings consisted of 36-inch-diameter caisson type excavations and 46 borings were made with reverse circulation hammer drilling equipment. Each caisson excavation was temporarily supported with a steel lining equipped with twelve large and three small observation windows for direct visual inspection of subsurface conditions. Measurements and observations made at these windows consisted of the degree of overbreak, the ease of sampling, the moisture content, and a visual soil classification. In addition, a 50 to 60 pound bulk sample of soil was obtained from each of the large windows for the purpose of additional classification work and laboratory testing.

The 46 hammer borings were 6-5/8 in. diameter and drilled at approximately 500 ft center to center spacing along the tunnel. In addition, a hammer boring was drilled adjacent to each large diameter boring to provide for a correlation of available information. Although no direct visual observation of the ground is possible during hammer drilling, Standard Penetration Tests were performed at appropriate sampling intervals. In addition, careful notes were kept of the character of drill cuttings, blow counts per foot, water content, relative density, degree of cementation, and overall drill rig performance.

The primary objectives of the laboratory testing program were to determine soil classification and to measure water content. Soil classification tests were performed on samples from which all particles in excess of 2-1/2 in. diameter had been removed and consisted exclusively of sieve tests. When applicable, Atterberg limit tests were performed on the soil fraction passing the No. 40 sieve.

Data profiles were prepared for all large diameter boring explorations. Information such as caving during drilling, the rate of auger penetrations, sidewall overbreak, ease of sampling, moisture content, and the laboratory test results are shown on these profiles.

All of the field work described above was performed during full-time supervision by CRSS' field representatives. These representatives observed drilling operations and logged sampling activities. A single field geologist was tasked with logging the large diameter borings and a supervising project geologist checked each log for consistency and accuracy. All field sampling and laboratory testing was done in accordance with applicable ASTM standards.

2.2 Summary of Soil Conditions

The project is located along Price Road near the eastern edge of the City of Tempe, Arizona. The project area is bounded on the north by the Salt River, on the east by the cleared Outer Loop Highway right of way, on the west by the western limit of Price Road, and to the south by a residential subdivision. The topography of the area is nearly flat with a gentle slope northward towards the Salt River and south to the South Shaft from Broadway Road. Surface drainage in the project area is poor and muddy conditions develop quickly during rainfall.

Regionally, the project is located in the Salt River Valley portion of the Phoenix Basin, which is situated in the desert region of the Basin and Range physiographic province. The proposed site location is considered to be the active floodplain of the Salt River. Within the project area, two alluvial terraces were distinguished; the Lehi Terrace and the Mesa Terrace. These terraces are composed of variably consolidated, well graded mixtures of sand, gravel and cobbles with small amounts of boulders, silt, clay and carbonate cementation and are known to extend to depths of 800 to 1200 ft below ground surface. Local scour and redeposition of material within the terraces causes wide soil compositional variations over short distances. As the river abandoned a floodplain level, the terrace was covered by a relatively thin veneer of fine grained alluvium composed of fine sand, silt and clay. Within the project area the fine grained alluvium varies from loose unconsolidated material to extremely hard, rock-like, calichified material.

The site specific soil profile consists of two primary layers of soil: Unit A, fine-grained alluvium; and Unit B, coarse-grained alluvium, known locally as the SAND-GRAVEL-COBBLE (SGC) unit. No proposed facilities except the tops of proposed shafts penetrate the overlying fine-grained alluvium therefore, it will not be discussed further in this section of the report. Additional information and graphic representations of the soil profile are contained in the above referenced Site Conditions Report that is published under a separate cover.

Unit B soil comprises all of the SGC materials in the Phoenix area. For the purpose of this report, the top of the SGC soil is defined as that level where cobbles and boulders were first encountered in the subsurface explorations. Material within the SGC varies from poorly graded to well graded, medium dense to very dense and includes SAND lenses with no gravel or cobbles, lenses and layers of gravelly COBBLES with very little sand, and some gap-graded material composed of sandy COBBLES with virtually no gravel. The coarser cobble and gravel fraction tends to be relatively tabular with the length of the long axis several times that of the short axis. These tabular pieces commonly lay with the long axis horizontal and often overlap and interlock with each other.
Caliche in the project area is confined primarily to the fine grained alluvium and to the upper portion of the terrace gravels, particularly the older Mesa Terrace. Lateral continuity of the caliche is not present and caliche intensity varies from poorly developed to fully cemented. Cementation of the SGC consists of coatings of calcium carbonate on gravel and cobbles and, less frequently, slight cementation of the sand matrix.

In addition to calcium carbonate cementation, it was discovered during the subsurface exploration program that small amounts of clay within the SGC also provide a form of cementation. Clay within the SGC occurs as thin coatings on gravel and cobble-sized particles, as "halos" on sand grains, and as void in-fillings. The clay frequently "cements" sand grains onto gravel and cobble-sized particles, provides "cementation" to deposits of sand, and frequently fills intergranular voids. It was determined during the large diameter down-hole inspections that approximately 2 to 3 percent by weight of clay was sufficient to add a binding effect to the SGC material.

Based on observations of the SGC stratum in subsurface explorations it was decided that clay content provided the best method of in-situ classification. Hence, a conscious effort was made during field mapping to observe and to quantify clay content at various horizons within the SGC and to characterize the unit on that basis. Unit B_1 is the uppermost subunit with the least amount of clay. It is classified as clean to slightly clayey, dry to damp, and loose to dense. Most of the clay appears as thin coatings on gravel and cobble-sand particles. Locally, moderately to poorly developed calcium carbonate cementation and crusts of calcium carbonate on the gravel and cobble-sized particles were observed. When augering to advance 3-ft diameter borings, Unit B_1 SGC material often would not stand in the borehole walls and slight to severe caving was observed.

Along the tunnel alignment, Unit B_1 first begins at depths from 8 ft to 28 ft below ground surface, varies in thickness from 15 ft to 40 ft, and occurs at greater depth below ground surface toward the southern end of the project. For approximately the southernmost 1300 ft of tunnel, Unit B_1 is near or below the crown of the proposed tunnel excavation and is classified as relatively loose, but containing enough clay to provide a slight binding effect to the soil.

Unit B_2 occurs as a continuous layer beneath Unit B_1 and is classified as slightly clayey, damp and of medium to high density. The amount of clay in this unit is sufficient to partially fill intergranular voids. During augering some slight caving was observed in cobbly zones and frequent chunks of "cemented" sand material were removed from the exploration that were difficult to crush with finger pressure.

Unit B_2 varies in thickness from 10 ft to 30 ft and occurs anywhere from 30 ft to 60 ft below ground surface. Except for a few zones where the bottom of the unit is near the proposed tunnel crown in the northern half of the project, Unit B_2 dips below and remains almost entirely below the crown for the entire southern half of the project. At no place does Unit B_2 dip below the proposed invert based on the results of subsurface explorations.

Unit B_3 is the lowest subunit identified at the site and represents the majority of material that will be excavated by the tunnel. In the northern half of the tunnel Unit B_3 comprises the entire face. Near the midpoint of the tunnel, the top of the unit dips below the proposed

10

crown and from there to the end of the project becomes generally a lesser percentage of excavation. Near the southern end of the tunnel, Unit B_3 comprises less than 5 ft of material at the invert.

In accordance with trends discussed above, Unit B_3 contains the highest amount of clay of the three subunits. In general, Unit B_3 is classified as trace clay, damp to moist, and medium to very dense. Wet zones were occasionally encountered. Because of a higher moisture content, the clay in Unit B_3 is described as "cohesive" rather than "cementatious." Clay occurrence is such that intergranular voids are nearly completely filled with clay.

Unit B_3 was consistently stable during augering until the auger penetrated below the water table. When this happened, the soil would not stand vertically and the borehole walls sloughed repeatedly. In addition, wet material would not hold the auger and was difficult to remove from the hole. As a result of sidewall sloughing and difficulty of removal, it was not possible to advance the auger in SGC material significantly below the water table.

Another important characteristic of Unit B_3 was the discovery of several layers of clay-rich material in the vicinity of the proposed tunnel invert from Sta. 82+00 to Sta. 55+00. These layers ranged from clay-rich deposits of gravel to layers of clayey material up to two foot thick. Although it is difficult to determine the lateral extent of soil layers from the results of test borings alone, the nature and thickness of these deposits suggests that they are continuous for a distance of approximately 2,000 ft.

2.3 Summary of Water Conditions

Groundwater conditions in the site vicinity are influenced by regional groundwater levels within the SGC soils and by periodic flows that occur in the Salt River. Regional groundwater levels observed during recent subsurface investigations are at or below El. 1100 ft. Flow in the Salt River produces a temporary groundwater mound in the vicinity of the river. The height and lateral extent of this mound appears to be a function of the duration and magnitude of river flow. Flows actually occurred in Salt River during this study beginning about February 24, 1987 and continuing until about April 19, 1987. Releases from the Salt River Project varied from 250 cubic feet per second (cfs) on March 16, 1987, to 2600 cfs on March 22, 1987, 300 cfs on March 31, 1987, and at lower levels until April 19, 1987. The recent subsurface investigations performed between January and April 1987 and data from groundwater observation wells installed in February 1987 illustrate both regional and temporary groundwater conditions along the proposed tunnel alignment. Data obtained from borings and wells indicate that regional groundwater levels during January and early February, 1987 along the proposed tunnel alignment were at approximately El. 1110 to El. 1085 for the northern portion of the tunnel alignment between the north shaft (Sta. 190+82) and Victory Drive (Sta. 137+00). This groundwater level is from approximately 10 ft above to 15 ft below the proposed tunnel invert.

South of Victory Drive, groundwater was not encountered in any test boring. Data obtained from borings and wells after March 16, 1987 indicate a significant rise in groundwater levels in the northern section of the proposed tunnel alignment. These higher groundwater levels are interpreted as temporary groundwater levels associated with recharge from flows in Salt River. Based on the data obtained, the highest temporary groundwater level occurred at the north shaft location (Sta. 190+82) where groundwater was encountered at El. 1133, approximately 33 ft above the proposed invert. From there, groundwater levels dropped steeply to approximately El. 1105 at about Sta. 185+00, then less steeply to approximately El. 1100 at about Sta. 165+00. South of Sta. 165+00 temporary groundwater levels were at or below El. 1100 which is below tunnel invert.

No data regarding groundwater quality were available at the time of this report. It is our understanding, however, that some potential for groundwater contamination exists in the general site vicinity. Tests for groundwater quality in the tunnel vicinity are recommended particularly should dewatering be necessary during project construction.

12

3.0 GEOTECHNICAL CONSIDERATIONS

3.1 Project Description

As was pointed out in the Introduction, all work on this project was performed on the basis of a set of undated design drawings provided by HNTB that was characterized as the "30 percent" submittal. Based on those drawings, the tunnel begins at the north outlet shaft at Sta. 191+/- and extends approximately 18,000 ft to the south inlet shaft at Sta. 10+/-. As currently designed, the tunnel will have a finished inside diameter of 18.0 ft and a very slight upward gradient from north to south. Invert elevation at the outlet is El. 1100 (80 ft below ground surface) and at the inlet is El 1120 (70 ft below ground surface). Layout of the tunnel is as shown on Figures 2.1 through 2.3, Boring Location Diagrams.

The majority of the proposed tunnel alignment falls within a cleared ADOT right-of-way for the proposed Outer Loop Highway, which is part of a large expressway project currently under construction in metropolitan Phoenix. In addition to inlet and outlet structures, the project includes five storm sewer connections and six street crossings. At the southern end of the alignment the tunnel passes beneath the Tempe Canal and the Superstition Freeway. At the northern end, the tunnel passes beneath FAA property and a large gravel quarry operation.

Although the project stationing extends from south to north it is most likely that the tunnel will be built from north to south. Building tunnels up-gradient greatly facilitates the removal of both water and tunnel spoil. In addition, it appears that both staging of the project and disposal of tunnel spoil will be easier near the north end of the project. Hence, on the basis of this assumption, the remainder of discussion herein will be provided from the outlet to the inlet even though this is from high to low stationing.

The proposed outlet structure is located at Sta. 191+/- within a proposed new interchange and in an existing gravel pit operation. Thirty percent design drawings show a fairly steep up gradient at the extreme northern end of the tunnel followed by a gently sloping canal into the Salt River. It is our understanding that layout of the outlet and, in fact, of the entire northern portion of the tunnel is undergoing further study because of land access problems.

Going south from the outlet, the first major facility encountered by the tunnel is First Street at Sta. 177+/-, which is shown crossing beneath the proposed highway. Other major street crossings include University Drive at Sta. 151+/-, Victory Drive at Sta. 138+/-, Apache Boulevard at Sta. 124+/-, Broadway Road at Sta. 98+/-, and Southern Avenue at Sta. 45+/-. New bridges are proposed at each of these street crossings; two of which, Victory Drive and Apache Boulevard, are currently under construction. Utility line crossings at the above named streets seem to be fairly typical with 2 to 4 in. diameter gas lines, 4 to 12 in. diameter water mains, and 8 to 36 in. diameter sewers.

Given below are brief descriptions of other existing facilities that will be crossed by the proposed tunnel.

- Sta. 111+/- Southern Pacific Railroad - It is reported that the railroad will also be supported by a new bridge.

- Sta. 21+/- Tempe Canal - The Tempe Canal is a concrete lined facility that is used for water supply. Reportedly it was rebuilt in the late 1970's and has operated without difficulty since that time. At the proposed tunnel crossing, the bottom of the canal is at El. 1195 or about 55 ft above the crown of the tunnel which is located at El. 1140. It is reported that the canal always contains water except during the October-November time frame when it is dry for about one month.

- Sta. 18+/- Superstiton Freeway - The Superstition Freeway is a major, operating highway that was constructed in cut at the proposed tunnel alignment. Pavement elevation at the tunnel is El. 1173 or about 33 ft above the proposed tunnel crown. It is reported that part of the proposed new highway will pass beneath the Superstition Freeway at the proposed tunnel alignment so that highway construction activities will take place within 5 ft of the proposed crown of the tunnel.

3.2 Previous Tunneling Experience in Phoenix

The Papago Freeway Drainage Tunnel project Papago Project was recently completed in Phoenix and the purpose of this section of the report is to describe that project and to indicate where additional information about that tunnel can be obtained. One of the primary goals of work associated with this project was to compare and to contrast subsurface conditions as encountered on the Papago Project with those anticipated at Price Road Tunnel. Because the Papago Project is so recent and constructed for ADOT, there is a tendency to assume that tunneling work for Price Road Tunnel will be similar to the Papago Project. This may or may not be true.

In order to facilitate the transfer of information from the Papago Project, ADOT requested that subsurface investigations for Price Road Tunnel be performed by the same persons who worked on the Papago Project. In particular, a fairly extensive subsurface investigation was completed along the West Tunnel of the Papago Project just prior to construction of that tunnel. As requested by ADOT, those same persons who performed the subsurface study along the West Tunnel worked on the Price Road Tunnel subsurface investigations.

On the basis of work completed to date, the Papago Tunnels were constructed in SGC and the Price Road Tunnel will also be constructed in the SGC stratum. However, the two projects are located approximately 10 miles apart and the SGC material at Price Road has a higher clay content than it did at Papago. In addition, ground water

14

conditions have a significant effect on SGC behavior and the water situation at Price Road must be carefully evaluated independently of Papago.

With the above statements in mind, it is the intention of the writers of this report to be objective in their description of subsurface conditions at Price Road. The Papago Project will be treated as a significant, but not conclusive case history with respect to Price Road Tunnel. Where possible, it will be pointed out what is believed to be similar to the Papago Project and what is believed to be different.

Prior to the Papago Project almost no tunneling activity took place in Phoenix. In general, tunneling activity was limited to five utility tunnel crossings of large streets and highways and performed exclusively by hand mining techniques. The largest of these crossings was reportedly the 12th Street crossing of the I-10 Freeway, which was approximately 11 ft in diameter, about 300 ft in length, and excavated very near the top of the SGC stratum.

The Papago Project consisted of three tunnels: the East, the North, and the West. Both the East and West Tunnels had finished inside diameters of 21.0 ft, and were 13,550 ft and 13,970 ft in length, respectively. The North Tunnel had a finished inside diameter of 14.0 ft and was 6544 ft long. All three tunnels were located from 35 to 45 ft below ground surface to the crown and were excavated within the SGC stratum with digger shields.

Construction activities on the Papago Project began with the East and North Tunnels and difficulty with ground control was encountered almost immediately. In general, lenses and layers of loose material near the tunnel crown resulted in running ground conditions that caused a loss of soil above and behind the leading edge of the shield. On the East Tunnel some sinkholes developed to the ground surface and on the North Tunnel voids developed below a fairly continuous layer of caliche. Because both the East and North tunnels were located primarily within previously cleared ADOT rights-of-way, the damage caused by lost ground was minimal and did not result in severe disruption of tunneling operations. On the basis of machine modifications, some chemical grouting, and a change order to fill underground voids along the North Tunnel, both the East and North Tunnels were completed without major problems.

The biggest difference between the East and North Tunnels and the West Tunnel was that the West Tunnel extended directly below downtown Phoenix. Sinkhole and/or void formation along the West Tunnel was not acceptable. Based on evaluation of several methods of approach, it was decided to utilize a continuous program of compaction grouting along the West Tunnel to facilitate tunneling and to help control adverse ground behavior. In general, a grout hole was drilled every 10 ft along the entire West Tunnel alignment and a low slump mixture

of soil or weak mortar-like material was pumped into the ground continuously as the tunnel advanced. By replacing ground lost during tunneling, the compaction grouting program effectively isolated overlying and adjacent facilities from adverse ground behavior. Chemical grouting was used at a few locations for extra protection and ground runs were allowed to occur near the north end of the West Tunnel because repair work in that vicinity was less expensive than either chemical grouting or delayed tunneling.

In addition to a fairly comprehensive subsurface exploration program along the West Tunnel, a detailed risk assessment was performed in that area. The risk assessment included data accumulated from major utility and structure owners for the purpose of deciding which facilities would be at risk during tunneling. Simultaneously, a careful review of the results of instrumentation readings showed that the zone of unstable soil extended upward from the tunnel springline at an angle of about 20 degrees to vertical. Based on this work, it was decided to purchase several homes located directly above the tunnel and to take special care while crossing beneath a large diameter sewer and two other major utilities. These mitigating measures allowed the construction of the West Tunnel to proceed quite smoothly.

The above paragraphs represent the briefest possible description of tunneling activities on the Papago Project. Given below is a listing of reports that were prepared as part of the Papago Project and which will reportedly be made available to prospective bidders for Price Road Tunnel. It is also pointed out that various additional articles about the Papago Project have been published in magazines and journals.

- "Site Conditions Report for the North Tunnel, East Tunnel and West Tunnel from Sta. 9+00 to Sta. 58+14," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, March 1986.

- "Engineering Report for the West Tunnel from Sta. 9+00 to Sta. 58+14," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, May 1986.

- "Site Conditions Report for the West Tunnel from Sta. 58+14 to Sta. 146+20," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, April 1986.

- "Engineering Report for the West Tunnel from Sta. 58+14 to Sta. 146+20," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, May 1986.

- "Report on East Tunnel Instrumentation Sites 12, 13 and 14," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, March 1986.

- "Report on North Tunnel Instrumentation through December 1985," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, April 1986.

- "Report on East Tunnel Instrumentation Sites 1 through 11 through December 1985," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, June 1986, Vol. I and II.

- "Report on West Tunnel Instrumentation Sites 1 throughout 14," Phoenix-Casa Grande Highway Inner Loop Drain Tunnels, Arizona Department of Transportation, October 1986, Vol. I and II.

Four additional reports are currently being prepared and are expected to be issued in August, 1987. These reports are listed below:

- "Arizona Department of Transportation, Final Report of Construction, for North Tunnel Contract I-ID-10-3(187)."

- "Arizona Deparment of Transportation, Final Report of Construction, for East Tunnel Contract I-ID-10-3(188)."

- "Arizona Department of Transportation, Final Report of Construction, for West Tunnel Contract I-ID-10-3(189)."

- "Final Report on North, East, and West Tunnel Instrumentation."

3.3 Ground Characteristics

One of the most important aspects of successful tunneling is an accurate characterization of ground behavior at the face on the basis of the results of subsurface explorations. Face behavior is a function of ground characteristics; the size, shape, depth, and orientation of the opening; and construction methods employed by the contractor. All of these variables combined cause the ground to exhibit a certain "stand-up-time" which will determine to a large degree how fast the tunnel can be advanced, and consequently, how much it will cost. On the basis of an evaluation of stand-up-time, a contractor will select his equipment and method of construction and prepare a cost estimate. If the ground behaves as he assumed or better, then the work should proceed more or less as planned.

Although the above approach sounds fairly straight-forward, it is not easy to implement. Most obviously, the ground may not be as described, it may behave differently than the Contractor anticipated, or it can be subject to such variation either across the face or along the tunnel that no single piece of equipment or method of construction would be suitable for an entire project.

The purpose of this section of the report, will be to attempt to describe the ground along the proposed Price Road Drain Tunnel so as to assist each prospective Contractor in evaluating behavior of the

ground during tunneling and to select appropriate methods for excavating, control and temporary support. Nothing stated herein is intended to relieve the contractor of his responsibility to carefully review available information on his own and to form his own opinions relative to excavation, control, and support of the ground, based on his own background, experience, and knowledge of tunneling in similar environments. The selection of construction methods that are compatible with anticipated ground conditions along the proposed tunnel is, in fact, the contractor's primary responsibility.

It is anticipated that the entire proposed tunnel will be excavated in a single geologic deposit: the SGC stratum. Although this deposit is heterogeneous, it is still only one deposit. No mixed face soil/rock tunneling or tunneling into the overlying fine-grained alluvium is anticipated. However, almost all other types of soil can be anticipated including layers of cobbles and boulders, lenses of sand or clay, occasional boulders and other deposits as shown on the subsurface profiles and as described on the test boring logs contained in the previously mentioned Site Conditions Report. No large deposits of strongly cemented caliche are anticipated in the tunnel, although the ground itself can be densely interlocked, "cemented" with clay or manganese oxide, and difficult to excavate.

Beginning at the north end, excavation will commence in Unit B_3 and proceed upward through Unit B_2 and into Unit B_1. Based on information obtained from subsurface explorations, approximately one half of the tunnel will be entirely within Unit B_3, and almost all of the rest will be in Unit B_3 and Unit B_2 combined. The final 1300 ft or so of tunnel (at the south end) will have as much as one half of the face in Unit B_1, but generally less. As stated earlier in this report and in the Site Conditions Report, the primary variable for differentiating between the various Unit B soils was clay content with the amount of clay decreasing from a trace in Unit B_3 to hardly any in Unit B_1.

In general, it is anticipated that the SGC soil at Price Road will have good stand-up ground. Units B_3 and B_2 have sufficient clay content to provide a binding or cementing effect to the soil and Unit B_1 is exposed for only a small percentage of tunnel. Both Units B_3 and B_2 demonstrated good stand-up characteristics in the large diameter borings and although Unit B_1 showed some caving, it was not a severe problem except at specific locations. By good stand-up ground, it is meant that the face of the tunnel will be generally stable under the action of currently envisioned methods of excavation. It is anticipated that this condition will exist for as much as 95 percent of the tunnel.

Even though the amount of potential running ground on Price Road Drain Tunnel is anticipated to occur for no more than 5 percent of the tunnel, such small amounts of running ground can have a significant impact on job progress. On the Papago Project, unstable soil

conditions began with pockets of loose soil near the crown running away from and above the top edge of the shield. As the void developed, it propagated above and behind the shield and enlarged as a void toward the ground surface. Depending on the size of the zone of loose soil and other factors, the run could be of sufficient quantity to clog the machine's excavation chamber and to result in considerable additional spoil material. The delay associated with hand-excavating the excavation chamber and with running additional muck trains can be significant.

Initially on the Papago Project, this problem was addressed by installing poling plates that could be extended rapidly to bring the shield back into contact with the ground and to stop or at least greatly diminish a run. Later, compaction grouting was used to fill the void above the shield and to interrupt the propogation of runs up through the ground. Similar techniques would be possible at Price Road.

To summarize, it is anticipated that the majority of ground on the Price Road project will be good stand-up ground with no more than five percent of the tunnel exposed to running ground conditions. Running ground conditions are not expected to extend in front of the face to any great distance, but rather to be concentrated above and behind the shield. The tendency for running ground will increase somewhat from Unit B_3 to Unit B_1, but pockets of loose soil can be expected to occur almost anywhere on the project.

Two other ground behavior variables are the water table and cementation above the tunnel. The SGC material was shown to be entirely unstable when excavated below the water table during the large diameter boring program. It is strongly recommended that the water table be drawn down to below the proposed tunnel invert prior to tunnel excavation. Additional discussion of this topic is given in Section 4.4 Construction Dewatering.

Subsurface explorations suggest that a nearly continuous layer of poorly to heavily cemented caliche exists above the tunnel, especially in the southern part of the tunnel. This material has a beneficial effect on soil lost at the tunnel in that it bridges sinkholes and prevents or at least delays sinkholes from extending all the way to the ground surface and damaging surface facilities. Additional discussion about this topic is given herein in Section 4.3, Ground Control.

3.4 Temporary Support

Because of the nature of SGC soil, it will be necessary to continuously support all soil surfaces as excavation progresses. The specific design of support elements should be left to the contractor with criteria established by the designer. More often than not, the controlling design factor for concrete segments is the handling stress

imposed on the lining by the tunneling machine. In addition, the specifications must require good contact between the temporary lining and the ground. Experience on the Papago Project suggests that the best way to do this may be to place pea gravel behind the lining rather than to try to expand the lining.

Either precast concrete panels or ribs and solid wood lagging appear to be acceptable for temporary lining. If lagging is used it is suggested that fabric be placed above and behind the lining to minimize the intrusion of sand into the tunnel.

3.5 Other Facilities

Facilities for this project in addition to the tunnel include inlet and outlet structures and five proposed drop structures for storm drains. Very little is known about the detailed layout of these facilities at this time (August 1987). It is noted that both large diameter borings and hammer drill holes were conducted near all shaft and drop structures for use in evaluating ground conditions at those locations.

In general, some sloughing and caving ground can be anticipated at shafts and drop structures with this behavior being most prevalent in Unit B_1 soils and decreasing in intensity in the Unit A, B_2 and B_3 materials. At other locations, it may be necessary to penetrate almost concrete-like deposits of caliche. In general, shaft excavations are fairly straightforward in the Phoenix area and no unusual problems for these shafts are suggested by the results of test borings for this project.

As currently situated, the proposed bottom portion of the outlet structure may extend below the ground water table in which case excavation would become very difficult. It is assumed that complete dewatering of the SGC would be necessary prior to construction of this structure both to facilitate the work and to maintain a dry working condition. It is our understanding, however, that the northern outlet structure may be moved to the south, shortening the tunnel, and getting the bottom of the shaft up out of the water.

3.6 Additional Investigations

It is recommended that two or three additional large diameter borings be excavated during the bidding period at selected locations so that representatives of prospective contractors can personally observe the character and behavior of SGC material during drilling. This work should also be logged, sampled, and tested similarly to all of the other holes and the results distributed to all concerned parties in an addendum to the contract.

It is our understanding that plans are being made to move the north end of the tunnel up out of the water table prior to construction. If that is not done, then it is strongly recommended that observation

wells be installed and that a large-scale pumping test be conducted near the north end of the tunnel prior to bidding.

3.7 Report Limitations

Nobody can determine with certainty what ground conditions exist between test borings. For design purposes, the limits of various strata between the borings are represented as straight line interpolations of findings at the borings. In addition, the contacts between various strata are generally gradational rather than abrupt. Persons using the results of subsurface explorations for reasons other than design are cautioned to keep the above limitations in mind.

In addition, it must be noted that groundwater level readings are applicable only to the time and place of reading and are subject to flucuation on the basis of precipitation, runoff, withdrawal, and other conditions. This is especially true in the vicinity of the Salt River where flow conditions in the river have a significant impact on heavy water levels.

Preparation of this report was performed on the basis of limited information about proposed structures. It is recommended that CRSS be given an opportunity to review final plans and specifications for all project elements prior to bidding to check that they are compatible with our interpretation of subsurface conditions.

4.0 CONSTRUCTION CONSIDERATIONS

4.1 General

The purpose of this section of the report is to discuss various construction issues as they relate to observed subsurface conditions. It is written for the engineer responsible for preparing final plans and specifications for the project. As stated in Chapter 3.0, each prospective Contractor for the work must carefully review available information about the project and form his own opinions about ground behavior based on his own background, experience, and knowledge of tunneling in similar environments taking into account his own proposed construction methods, schedules and equipment.

4.2 Excavation and Face Control

As stated in Chapter 3.0, approximately 95 percent of the tunnel is expected to be excavated in good stand-up ground where the face of excavation will be generally stable under the action of the anticipated excavation techniques. No large-scale instability of the face and no significant movement of material into the face from in front of the excavation are anticipated. In general, it is anticipated that either a digger shield or a closed face rotary shield would be used for excavation. Either shield would have to be designed to negotiate curves in the tunnel.

Although 95 percent of the ground is anticipated to be stable, it is noted that the ground is highly variable in terms of composition, density, and degree of "cementation". The difficulty of ground excavation can be expected to vary from running to almost rock-like. In addition, large numbers of cobbles and boulders both individually and nested can be anticipated. Some "cemented" chunks of sand are possible and, depending on water content, the silt and clay constituents could be either dusty or sticky. Moist clay may cause some difficulty with maintenance of the spoil removal system.

Some difficulty with excavation is anticipated when the tunnel encounters loose, unstable soil near the crown. When this happens, the soil has a tendency to run away from and above the top edge of the shield. In order to help control this behavior, it is possible to install poling plates and breasting surfaces near the top of the shield. In addition, a breasting table could be used to minimize the amount of soil loss and to help prevent clogging of the excavation chamber.

It is believed that excavation of SGC material below the water table would be difficult and would require substantially different methods of excavation, face control and support. Dewatering of SGC to below the proposed invert is recommended.

4.3 Ground Control

Ground loss is defined as the difference between the volume of material actually removed from the excavation and the volume enclosed by the excavated dimensions of the tunnel. The three major sources of ground loss during tunneling are:

- Face loss
- Shield loss
- Tail loss

Face losses occur when ground ahead of the tunnel face displaces into the tunnel. Face losses can result from deformation of soil into the tunnel or from runs or flows of soil into the face.

Shield losses occur between the leading edge and the tail of the shield. Shield losses are the result of overexcavation by projections outside the shield, such as poling plates or overcutters, or from plowing of the shield which occurs when the shield passes through the ground inclined at an angle to the tunnel axis.

Tail losses occur when the lining emerges from the tail of the shield. Tail losses result from collapse of overlying soil onto the lining or from the incomplete filling of the annular space between the excavated soil surface and the temporary lining.

A certain amount of ground loss is inevitable during soft ground tunneling. Ground loss can result in movements throughout the overlying soil mass and at the ground surface. The magnitude of these movements depends on the amount of loss and on characteristics of the soil mass. Depending on what is located above or adjacent to the tunnel, these movements can be of no concern or can result in great hardship.

Shown in Figure 4.1, Width of Zone of Influence at Ground Surface, is a schematic representation of the zone of influence as anticipated for the Price Road Drain Tunnel. Although the exact dimensions of this zone cannot be known with certainty until tunneling is underway, it is fair to assume that almost all significant soil movement will take place within a zone bounded by a line starting at the springline and extending upwards at an angle of 20 degrees to the vertical. Any foundation or utility located outside this zone of movement should be safe against deformation unless the structure or utility itself is already at or near a state of distress.

When careful excavation techniques are used by the contractor, it should be possible to limit soil movements to within 6.0 in. at 5 ft above the crown and to within 1.0 in. at the ground surface. As ground loss at the machine increases, soil movement will also increase until sinkholes form at the ground surface. Specifications should require the contractor to do what is necessary to minimize ground loss at the face of excavation.

There are three aspects of the soil at Price Road that are beneficial with respect to ground control. These are: clay content, bulking, and caliche layers. Clay content provides a binding effect to the soil and helps to prevent running conditions. Based on the results of subsurface investigations it appears that the majority of proposed Price Road Tunnel will have a clay content higher than the Papago Tunnels.

Bulking of the soil takes place as material is lost from below and soil falling into the resulting void increases in volume. Sometimes, the bulked soil will completely fill a void and stop the progression of a sinkhole. Although this phenomenon is real and of significant value for small losses, it does not take place forever. Once the soil has bulked, all subsequent soil losses at the tunnel are transmitted directly to the surface and result in surface settlement.

Caliche layers are capable of bridging over some sinkholes and stopping or greatly slowing the progression of sinkholes to the ground surface. Although this behavior is beneficial, it is difficult to predict, and can result in the formation of voids underground. It is best not to depend on caliche layers for the protection of surface facilities. In addition, it is necessary to fill voids below with the caliche to prevent long-term problems associated with collapse and settlement of the caliche layer.

As at the Papago Project, it appears that there are two possible methods to assist with ground stabilization at Price Road Tunnel. The first would be compaction grouting or the intentional filling of voids at or near the face of excavation. In essence, a low slump soil or weak mortar is pumped into the ground for the purpose of replacing soil lost during excavation. This method is effective at insulating overlying and adjacent facilities from the potential surface settlement due to tunneling, as long as the losses are not too great and the soil has enough stability so that there is time to do the grouting.

For very important facilities or highly unstable ground, it may be necessary to stabilize the ground by grouting prior to tunneling. At Price Road, some form of chemical grouting would be needed for this purpose and selection of the type of grout and the technique of grouting must be the object of a specific evaluation. After design of the grouting system, it is recommended that a field test section be implemented.

Two areas where chemical grouting might be considered would be the Tempe Canal and the Supersition Freeway. The canal appears to be underlain by strong caliche and is probably safe, but loss of the canal would have severe consequences for both the canal and the tunnel. At the Superstition Freeway, the proposed tunnel is located within 35 ft of the existing pavement, and could cause settlement of the highway. Other potential problem areas may also need to be investigated.

24

4.4 Construction Dewatering

Not much is known about the characteristics of the ground that needs to be dewatered at the north end of the tunnel. It is our understanding that the tunnel in that area is being redesigned so that it will not be below the groundwater level. If this does not happen, then it is recommended that a large scale pumping test be performed to provide input for design of dewatering components. In addition, it is recommended that the Contractor be required to retain the services of an outside, independent consultant to assist him with design of his dewatering system. Tunnel dewatering should take place only after the water table has been drawn down to below tunnel invert.

4.5 Construction Scheduling

Tunneling is expensive and any specification requirement that interferes with a tunneling contractor's ability to advance the face is costly. Hence, it is strongly recommended that potential scheduling conflicts be decided in favor of the uninterrupted advance of the tunnel. The optimum scheduling considerations that would minimize potential interference between tunneling and surface structures and activities are discussed below.

- Bridges - Proposed new bridge structures whose foundations fall within the potential zone of influence of the tunnel should be constructed after the tunnel has been excavated below each structure. If that is not possible, foundations should be located outside the zone of influence from tunneling or instrumentation should be installed to monitor ground movements during tunnel excavation and remedial action, such as compaction grounting, should be readied during mining below each structure.

- Outer Loop Highway - The excavation for the depressed highway should be made after excavation of the tunnel past the highway location is complete. If the highway excavation is completed prior to tunnel excavation, the reduction in overburden stress may result in some increase in the tendency for instability of the tunnel face during excavation.

- Utility Relocations - Any utility relocations requiring temporary support required for surface construction activities should require support to be left in place until tunnel excavation past the utility. This will reduce the likelihood for possible near surface settlements resulting from tunnel excavation causing distress to utilities. Additionally, all utility relocations which will place utilities outside the zone of influence from tunneling should be completed prior to tunnel excavation. Utility relocations which will remain in the tunnel zone of influence should be relocated after tunnel excavation below the utility.

- Tempe Canal - The Tempe Canal is dry for about one month during the October-November time frame each year. Tunnel excavation below the canal during the dry period would reduce the risk of settlement and resulting distress and flood from the canal to the tunnel.

- Superstition Freeway - Proposed highway interchange construction at the Outer Loop Highway and Superstition Freeway includes a possible sub-level interchange ramp below the existing Superstition Freeway grade. This could result in open-cut or tunneled construction to within five feet of the crown of the drain tunnel. Excavation and placement of the final concrete lining of the drain tunnel should preceed construction of sub-level interchange ramps.

- Groundwater - At the northern end of the proposed tunnel, temporary groundwater levels associated with flows in the Salt River are above the tunnel invert. These flows typically occur between December and March each year. Therefore, excavation of the northern-most portion of the proposed tunnel and proposed north shaft would be best accomplished during April through November in order to minimize dewatering requirements.

4.6 Construction Monitoring

It is recommended that a "due diligence" type of subsurface instrumentation program be implemented for Price Road Tunnel. Such a program would include at least one test section as shown in Figure 4.2 near the beginning of the tunnel for the purpose of checking assumptions about ground behavior. The test section would include an array of subsurface settlement points and one line of surface settlement points. Elsewhere, about ten additional deep settlement points to within 5.0 ft of the proposed crown should be used.

In addition to subsurface instrumentation, it is recommended that a "defensive" instrumentation program be used for the specific purpose of showing that no settlement took place at the location of major structures. This work should be done in combination with videotape documentation of existing conditions along the entire tunnel. Finally, interviews should be conducted with all affected utility owners so that pre-existing knowledge about the age, type, and maintenance history of all utilities is known prior to tunneling and emergency procedures can be established for each utility.

SELECTED REFERENCES

Peck, Ralph B., "Tunneling in Soft Ground - Geotechnical Considerations", Vail, Colorado, August 9, 1976.

MacPherson, H. H., J. W. Critchfield, S. W. Wong and E. J. Cording, "Settlements Around Tunnels in Soil: Three Case Histories," U.S. Department of Transportation, UMTA Report IL-06-0043, 78-1, March, 1978.

Bickel, J. O. and T. R. Kuesel, Tunnel Engineering Handbook, Van Nostgrand Reinhold Company, New York, 1982.

Proctor, R. V. and T. L. White, Earth Tunneling With Steel Supports, Commercial Shearing, Inc., Youngstown, Ohio, 19i77.

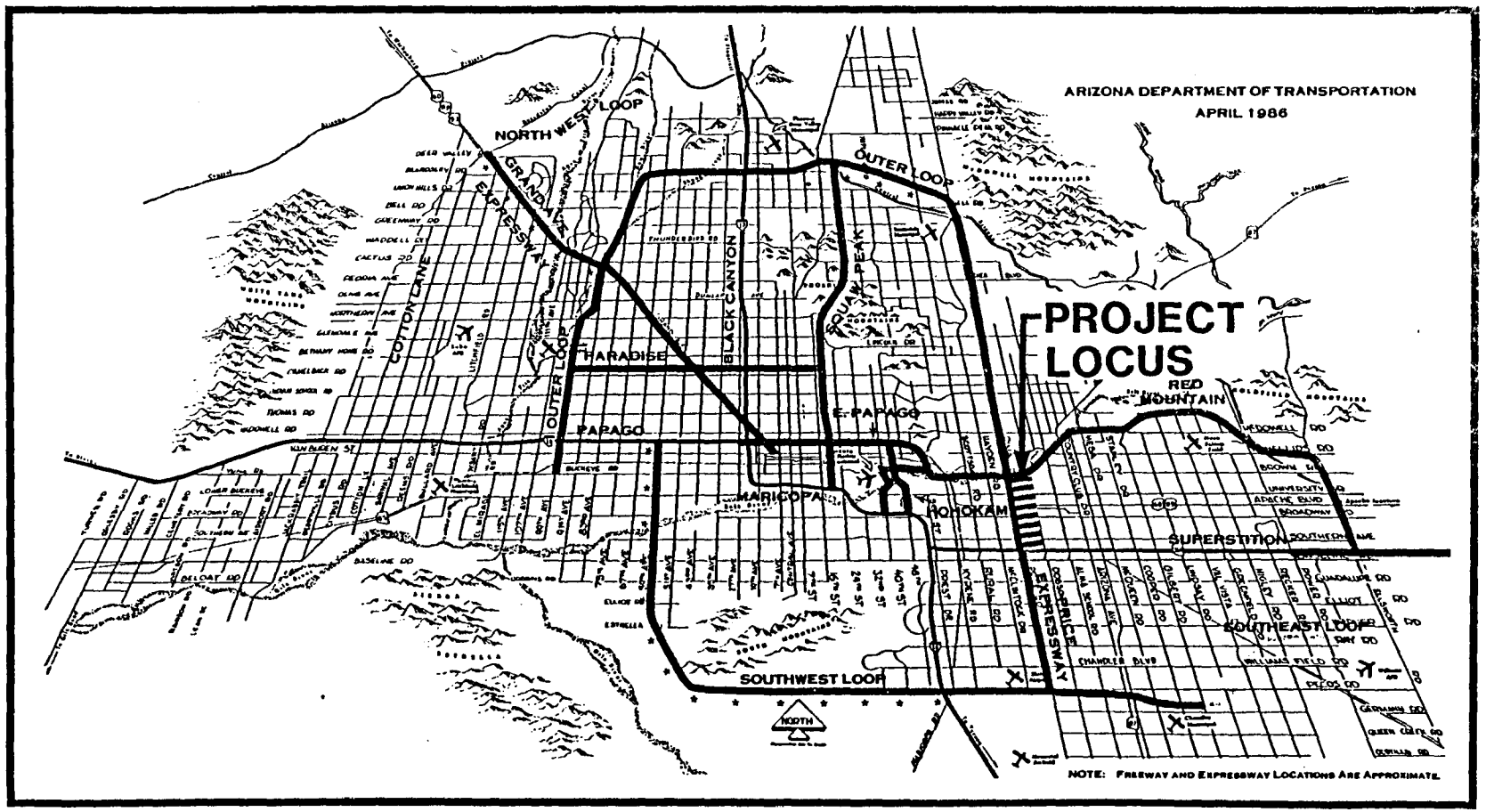
Terzaghi, Karl, "Geologic Aspects of Soft-Ground Tunneling," Applied Sedimentation, Ch. 11, John Wiley and Sons, New York, 1950.

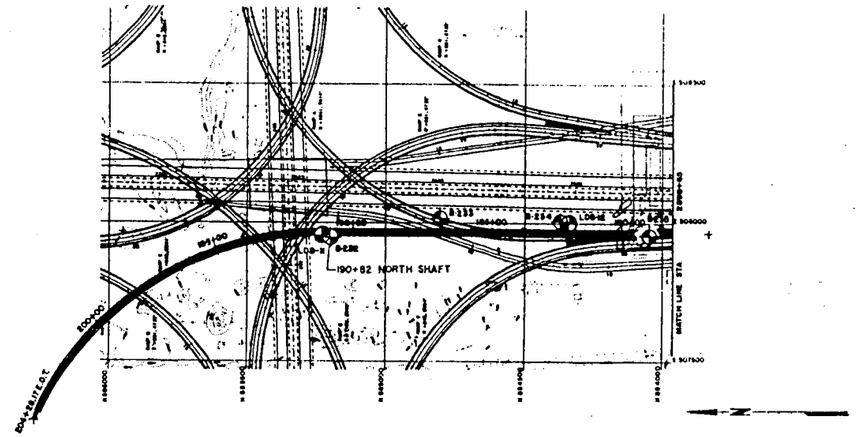
0230W

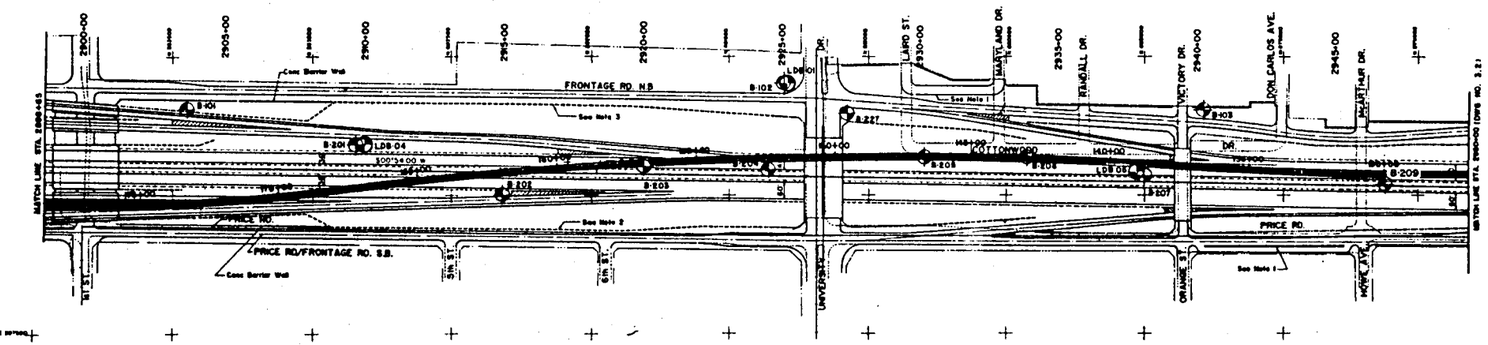
27

CRSS

FIGURE 1.1
PROJECT LOCUS





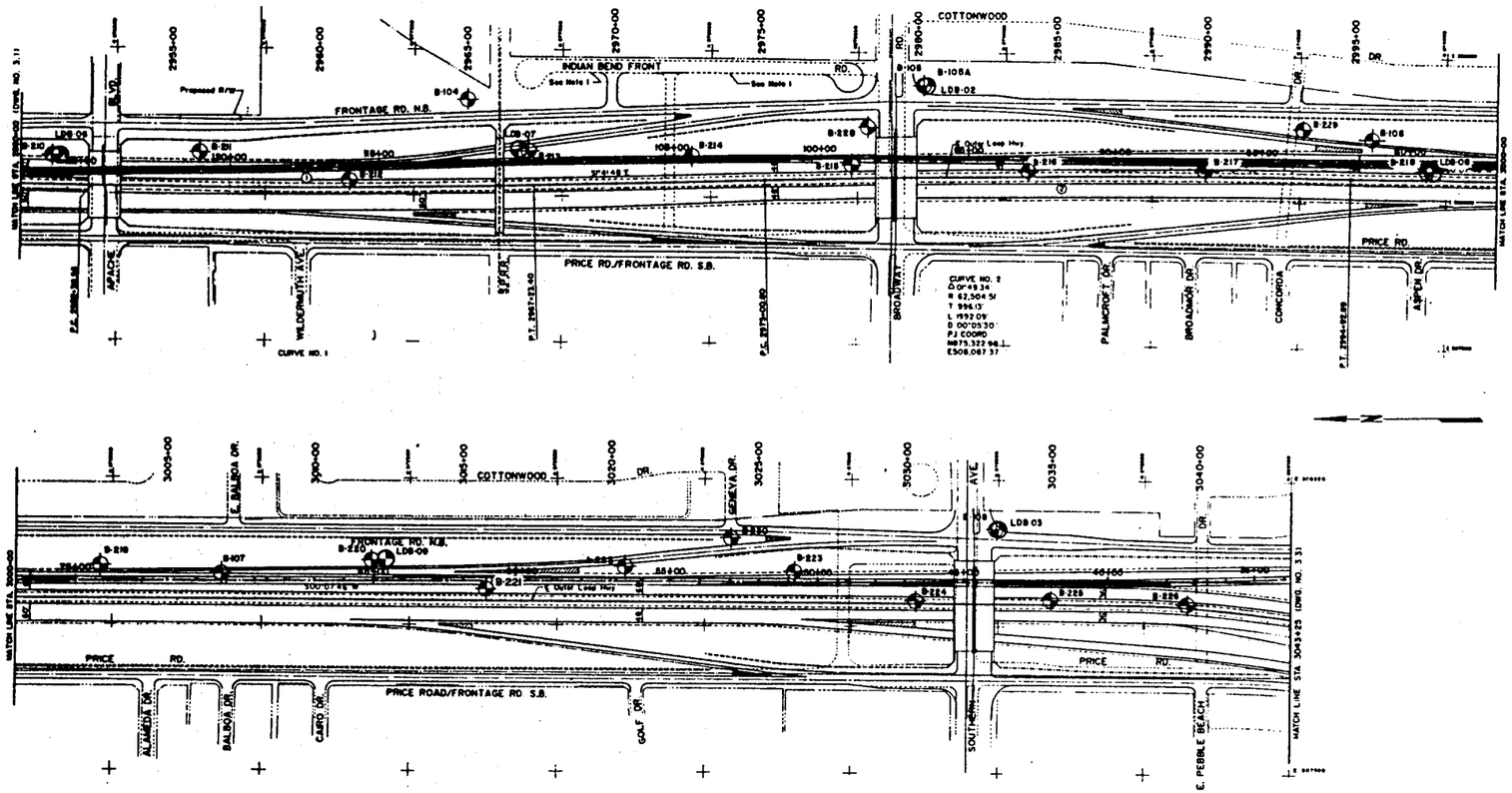


FOR NOTES & LEGEND, SEE DWG NO. 2.3

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 127+00 TO 204+28.17
DWG. TITLE	BORING LOCATION DIAGRAM
DESIGNED BY: DSH DRAWN BY: ACB CHECKED BY: DSH PROJECT NO. 110600 DATE MAY 1987	CRSS, INC. 216 16TH STREET, SUITE 1700 DENVER, COLORADO 80202 303-595-3240 DWG. NO. 2.1
SCALE	1"=400'



FOR NOTES & LEGEND, SEE DWG. NO. 2.3

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 33+80 TO 127+00
DWG. TITLE	BORING LOCATION DIAGRAM
DESIGNED BY DBH DRAWN BY ACB CHECKED BY DBH PROJECT NO. 11108.00 DATE MAY 1987	SCALE 1"=400'
DWG. NO.	2.2

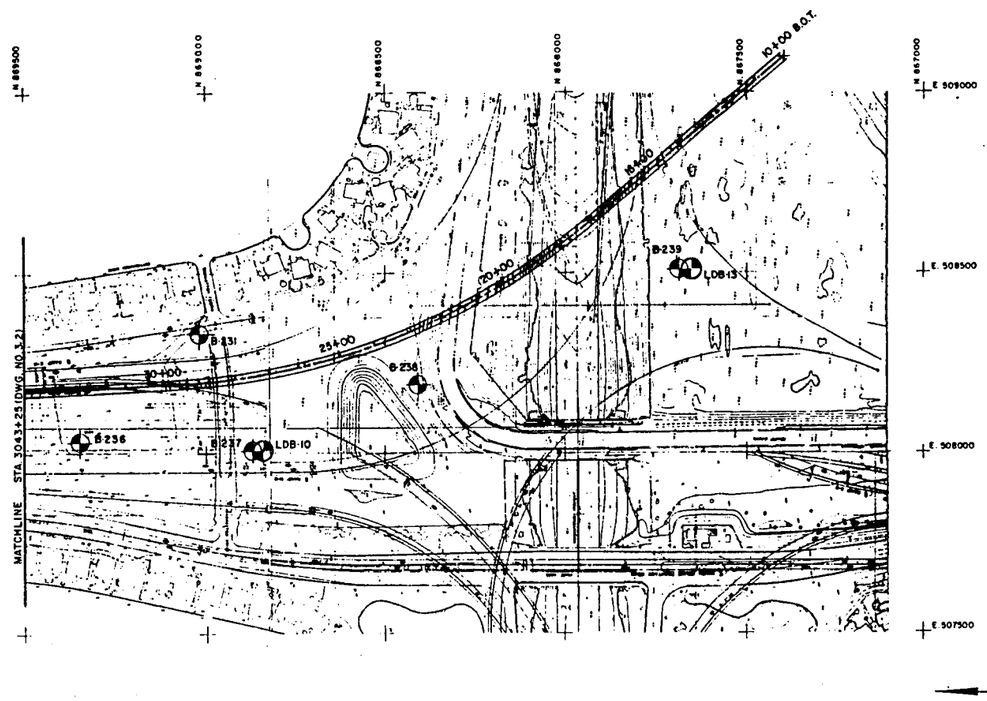
36

NOTES

1. SEE DWGS. 4.2 THROUGH 4.5 FOR GEOLOGIC CROSS-SECTIONS ALONG TUNNEL ALIGNMENT.
2. BASE MAP FROM 30% SUBMITTAL PRELIMINARY PLAN, PROVIDED BY TAMS CONSULTANTS, DECEMBER 10, 1986.
3. THREE COORDINATES SHOWN; STATE PLANE COORDINATES, OUTER LOOP HIGHWAY STATIONS AND TUNNEL STATIONS NOTED ON LEGEND.

LEGEND

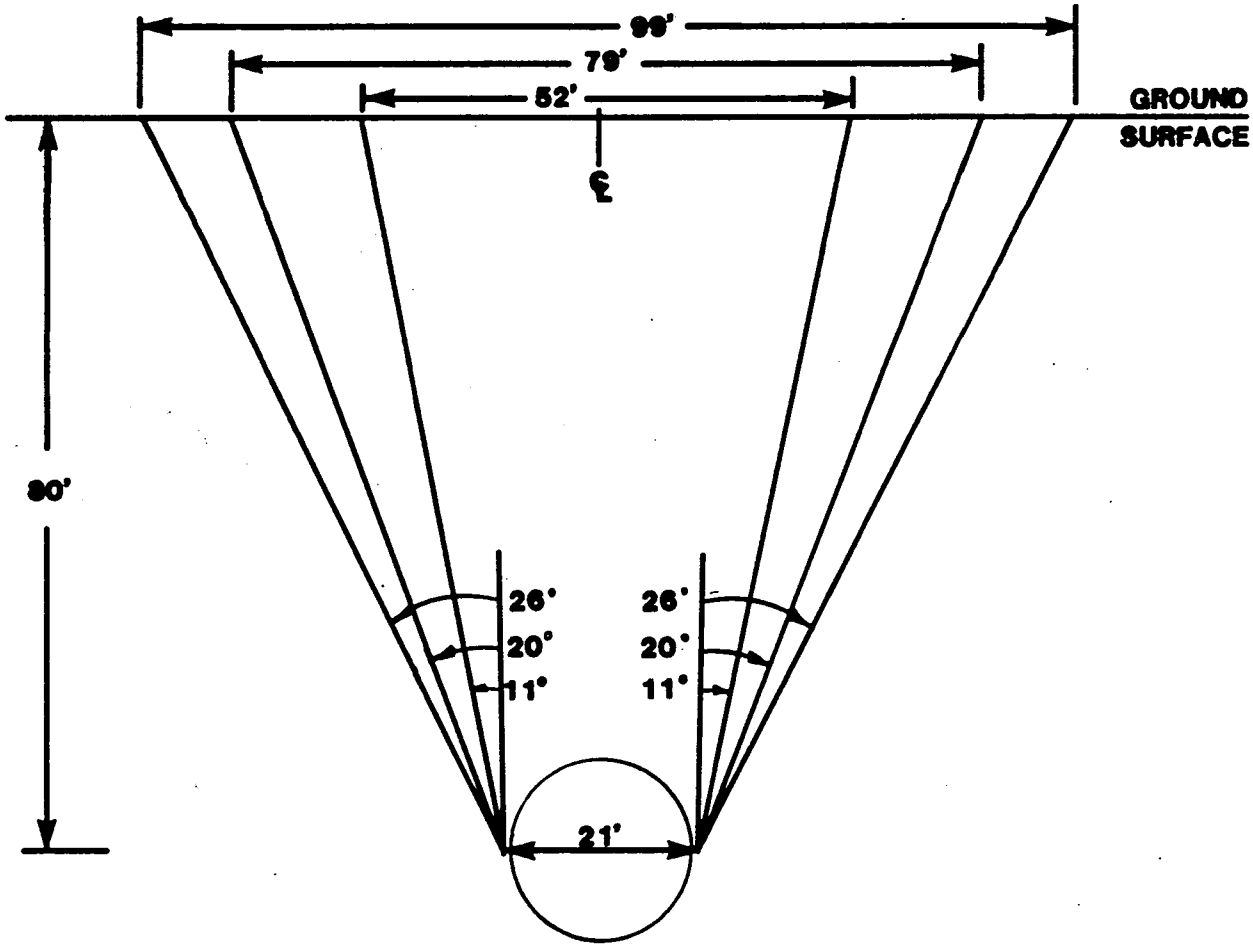
- B-101 REVERSE CIRCULATION HAMMER DRILL BORING
- LDB-01 LARGE DIAMETER BORING.
- E507500 STATE PLANE COORDINATES
- 2905+00 OUTER LOOP HIGHWAY STATIONS
- 165+00 TUNNEL STATIONS



CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 10+00 TO 33+80
DWG. TITLE	BORING LOCATION DIAGRAM
DESIGNED BY DSH DRAWN BY ACB CHECKED BY DSH	SCALE 1"= 400'
PROJECT NO. 11106.00 DATE MAY 1987	DWG. NO. 2.3



ANGLE OF INFLUENCE	WIDTH OF ZONE OF INFLUENCE AT GROUND SURFACE	
11°	52'	
20°	79'	MOST PROBABLE CONDITION
26°	99'	

FIGURE 4.1
WIDTH OF ZONE OF INFLUENCE AT GROUND SURFACE

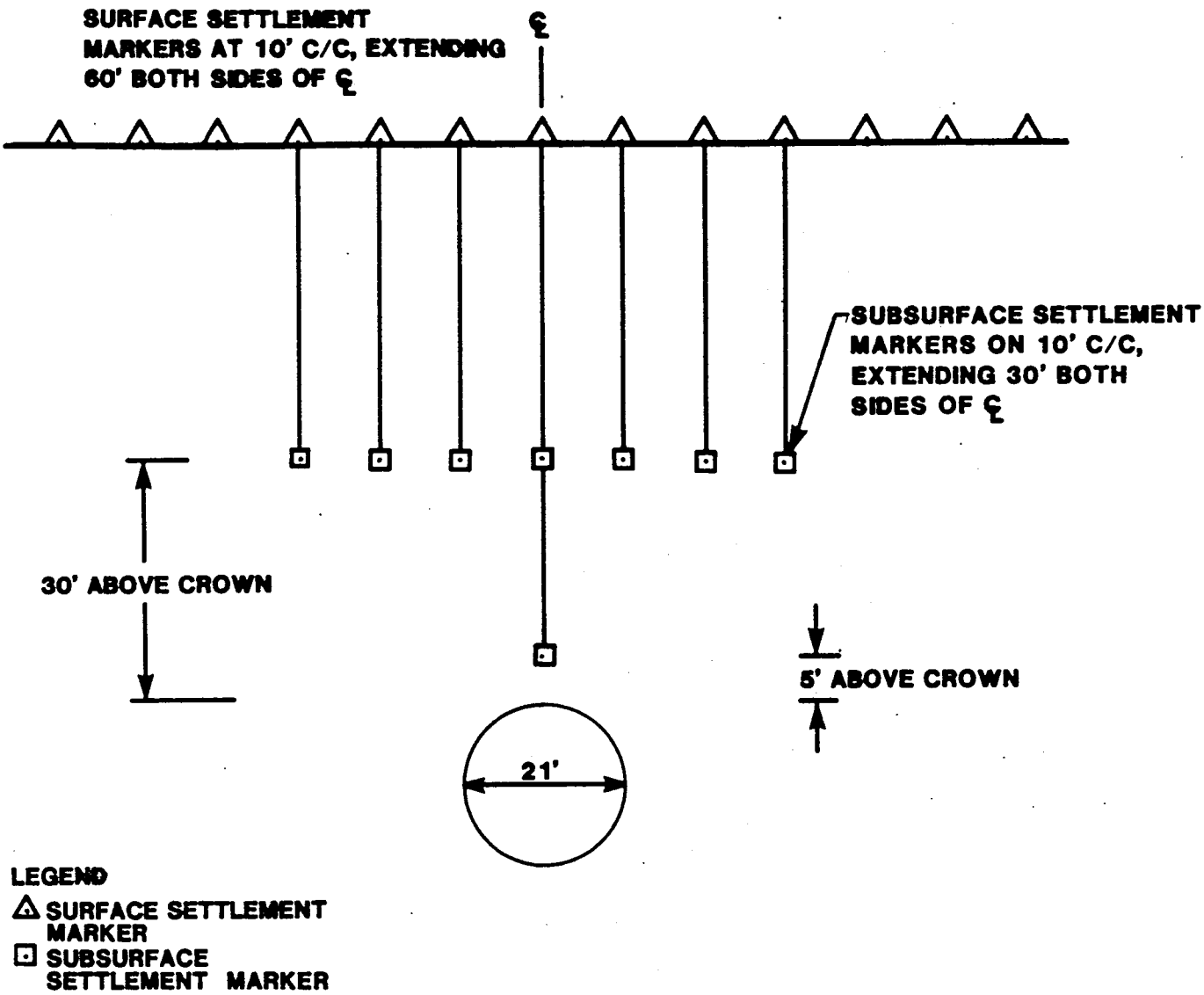


FIGURE 4.2
RECOMMENDED INSTRUMENTATION PROGRAM
FOR TEST SECTION

TABLE 2.1

PRICE ROAD DRAIN TUNNEL
SUMMARY OF TEST BORINGS

Boring Number	Station Number	Offset* (ft)	Collar Elevation (ft)	Depth of Boring (ft)	BOE Elevation (ft)	Tunnel Crown Elevation** (ft)
LDB-01	151+65	270 E	1186.0	87.0	1099.0	1125.2
LDB-02	96+46	250 E	1196.3	93.0	1103.3	1131.1
LDB-03	43+70	185 E	1191.7	94.0	1097.7	1137.2
LDB-04	166+75	155 E	1181.7	87.0	1094.7	1123.3
LDB-05	139+00	38 W	1188.2	94.0	1094.2	1126.4
LDB-06	125+70	55 E	1190.0	94.0	1096.0	1128.0
LDB-07	110+20	45 E	1195.7	92.0	1103.7	1129.8
LDB-08	79+20	32 W	1194.6	95.0	1099.6	1132.9
LDB-09	64+60	75 E	1192.7	87.0	1105.7	1134.4
LDB-10	27+50	208 W	1191.0	81.0	1110.0	1139.9
LDB-11	191+05	16 W	1181.6	56.0	1125.6	1120.9
LDB-12	182+25	38 E	1181.9	73.0	1108.9	1121.8
LDB-13	15+72	285 W	1192.0	76.0	1116.0	1142.2
B-101	173+10	340 E	1180.5	95.0	1085.5	1122.5
B-102	151+75	270 E	1185.8	100.0	1085.8	1125.1
B-103	136+78	207 E	1187.6	100.0	1087.6	1126.9
B-104	111+90	218 E	1195.2	99.0	1096.2	1129.7
B-105	96+54	245 E	1196.1	38.0	1158.1	1130.9
B-105A	96+54	250 E	1196.1	100.0	1096.1	1130.9
B-106	81+28	85 E	1193.1	100.0	1093.1	1132.7
B-107	70+18	25 E	1193.0	100.0	1093.0	1133.9
B-108	43+88	185 E	1191.0	100.0	1091.0	1137.1
B-201	167+00	155 E	1181.7	86.0	1095.7	1123.0
B-202	162+05	82 W	1181.8	89.0	1092.8	1123.7
B-203	156+92	10 W	1182.2	89.0	1093.2	1124.3
B-204	152+40	40 W	1185.0	89.0	1096.0	1125.0
B-205	146+70	5 W	1186.3	90.0	1096.3	1125.8
B-206	143+00	5 E	1187.3	90.0	1097.3	1126.2
B-207	138+72	55 W	1186.3	90.0	1096.3	1126.8
B-208	NOT DRILLED					
B-209	129+95	38 W	1188.4	90.0	1098.4	1127.4
B-210	125+95	55 E	1190.0	90.0	1100.0	1127.9

TABLE 2.1

PRICE ROAD DRAIN TUNNEL
SUMMARY OF TEST BORINGS

Boring Number	Station Number	Offset* (ft)	Collar Elevation (ft)	Depth of Boring (ft)	BOE Elevation (ft)	Tunnel Crown Elevation** (ft)
B-211	120+98	62 E	1190.7	90.0	1100.7	1128.5
B-212	116+00	45 W	1192.9	90.0	1102.9	1129.0
B-213	109+90	38 E	1196.0	89.0	1107.0	1129.9
B-214	104+40	12 E	1196.8	89.0	1107.8	1130.7
B-215	98+95	20 W	1198.0	89.0	1109.0	1130.8
B-216	92+95	40 W	1195.3	89.0	1106.3	1131.2
B-217	86+92	32 W	1194.4	88.0	1106.4	1132.3
B-218	79+45	30 W	1193.9	89.0	1104.9	1132.8
B-219	74+20	55 E	1192.8	89.0	1103.8	1133.2
B-220	65+08	70 E	1192.4	89.0	1103.4	1134.3
B-221	61+20	30 W	1191.7	89.0	1102.7	1134.8
B-222	56+52	50 E	1191.4	89.0	1102.4	1135.7
B-223	50+80	35 E	1189.2	89.0	1100.2	1136.1
B-224	46+60	65 W	1191.4	89.0	1102.4	1136.7
B-225	41+92	58 W	1190.8	84.0	1106.8	1137.7
B-226	37+30	80 W	1192.2	89.0	1103.2	1138.3
B-227	149+52	158 E	1186.4	79.0	1107.4	1126.1
B-228	98+42	105 E	1196.8	89.0	1107.8	1130.8
B-229	83+59	116 W	1195.7	79.0	1116.7	1132.4
B-230	52+98	150 E	1190.1	79.0	1111.1	1136.1
B-231	28+80	135 E	1192.1	79.0	1113.1	1139.7
B-232	190+78	20 W	1181.7	83.0	1098.7	1121.0
B-233	186+90	50 E	1181.3	89.0	1092.3	1121.3
B-234	182+55	42 E	1181.7	83.0	1098.7	1121.7
B-235	179+35	10 W	1181.3	89.0	1092.3	1121.8
B-236	32+38	148 W	1186.9	79.0	1107.9	1139.0
B-237	27+72	205 W	1190.9	79.0	1111.9	1139.8
B-238	23+22	145 W	1191.8	79.0	1112.8	1140.9
B-239	15+98	265 W	1191.4	79.0	1112.4	1142.0

*FROM PROPOSED TUNNEL CENTERLINE
**BASED ON 30 PERCENT DESIGN DRAWINGS SUBMITTED BY HNTB.

CRSS

August 6, 1987

Mr. J. Mike Patterson
DeLeuw, Cather & Company
One Gateway Center
426 North 44th Street, Suite 252
Phoenix, AZ 85008

RE: Site Conditions Report
Price Road Drain Tunnel

Dear Mike:

The purpose of this letter is to transmit to you six bound copies and one unbound original copy of the Site Conditions Report for the Price Road Drain Tunnel. The purpose of the Site Conditions Report is to present the results of the subsurface exploration program performed by CRSS along the proposed tunnel alignment. This report presents the data obtained from the program and our interpretation of subsurface conditions along the proposed alignment.

Since the Site Conditions Report contains factual information obtained from along the tunnel alignment, it should be included as part of the contract documents. The results of our engineering analysis of the subsurface information is presented in a separate report entitled "Engineering Report for the Price Road Drain Tunnel, Tempe, Arizona".

The work performed during the subsurface exploration program and the preparation of this report was performed by CRSS with assistance from our subcontractor, Brierley and Lyman, Inc., Denver, Colorado.

It has been our pleasure to assist DCCO with this challenging project. Please call us if you have any comments, questions, or if you need any additional information.

With best regards,

Michael J. Robison, P.E.
Project Engineer

Gregory P. Sherry, P.E.
Manager, Underground Engineering Department
Infrastructure Division

0228W

CRS Sirrine, Inc.
Suite 1700
216 Sixteenth Street Mall
Denver, Colorado 80202
303 820-5210

SITE CONDITIONS REPORT

FOR

THE PRICE ROAD DRAIN TUNNEL

TEMPE, ARIZONA

BY

CRS SIRRINE, INC

UNDERGROUND ENGINEERING DEPARTMENT

216 SIXTEENTH STREET MALL

SUITE 1700

DENVER, COLORADO 80202

57

TABLE OF CONTENTS

		Page
1.0	INTRODUCTION	
	1.1 Purpose	1
	1.2 Objectives	1
	1.3 Summary of Work Performed	1
	1.4 Report Organization	2
2.0	PROJECT INFORMATION	3
3.0	SUBSURFACE EXPLORATION PROGRAM	
	3.1 General	4
	3.2 Large Diameter Drilling Program	6
	3.3 Reverse Circulation Hammer Drill Borings	7
	3.4 Laboratory Testing Program	10
	3.5 Data Profiles	11
4.0	SUMMARY OF SITE CONDITIONS	
	4.1 General	13
	4.2 Regional Geology	13
	4.3 Subsurface Conditions	15
	4.3.1 Soil Conditions	15
	4.3.2 Groundwater Conditions	19

SELECTED REFERENCES

FIGURES

TABLES

PHOTOGRAPHS

APPENDIX A TEST BORING REPORTS
-Large Diameter Boring Logs
-Hammer Drill Boring Logs
-Hammer Drill Bounce Chamber Pressure Logs

APPENDIX B SUMMARY OF LABORATORY TEST RESULTS AND GRAIN SIZE ANALYSIS CURVES

APPENDIX C DAMES & MOORE WATER LEVEL DATA

LIST OF FIGURES

Figure 1.1	Project Locus
Figure 2.1	Project Location Diagram
Figure 3.1 - 3.3	Boring Location Diagrams
Figure 3.4 - 3.16	Data Profiles
Figure 3.17	Reverse Circulation Hammer Drill Process
Figure 3.18	Hammer Drill Blow Count Correction Curves
Figure 4.1 - 4.5	Subsurface Profiles
Figure 4.6	Arizona Department of Water Resources, Depth to Water and Altitude of Water Level, 1983
Figure 4.7	Arizona State University, Groundwater, Tempe Quadrangle, Maricopa County, Arizona, 1979-1980
Figure 4.8	Arizona State University, Groundwater Profiles

LIST OF TABLES

Table 3.1 Price Road Drain Tunnel Summary of Test Borings

Table 4.1 Price Road Drain Tunnel SGC Cobble and Gravel Content

LIST OF PHOTOGRAPHS

Photograph 1 36 inch Auger in LDB-12
Photograph 2 View Down LDB-12
Photograph 3 Boulder Removed from LDB-04
Photograph 4 LDB-05, Muck from Below Groundwater Table on Auger
Photograph 5 LDB-05, Window #5
Photograph 6 LDB-06, Window #7
Photograph 7 LDB-10, Window #13
Photograph 8 LDB-10, Window #6

1.0 INTRODUCTION

1.1 Purpose

On the basis of an authorization by Mr. Burton A. Lewis, P.E. of DeLeuw, Cather & Company (DCCO), CRS Sirrine, Inc. (CRSS) performed a Subsurface Exploration Program for the proposed Price Road Drain Tunnel located in Tempe, Arizona. The Price Road Drain Tunnel is part of the drainage system being constructed in conjunction with the Outer Loop Highway Project, which is part of a larger freeway and expressway project currently under construction in metropolitan Phoenix (Figure 1.1, Project Locus). The purpose of the subsurface exploration program was to define subsurface conditions along the proposed alignment of the tunnel. This report presents the data obtained from the program and our interpretation of the subsurface conditions along the proposed alignment. The results of our engineering analyses of the subsurface information, and of considerations for tunnel construction, construction scheduling, and geotechnical recommendations are contained in a separate report entitled, "Engineering Report for the Price Road Drain Tunnel, Tempe Arizona."

1.2 Objectives

The objectives of work performed by CRSS on this project are listed as follows:

1. To describe subsurface soil and water conditions at the site as revealed by subsurface investigations and laboratory tests.

2. To comment on tunnel construction issues based on observed subsurface conditions.

3. To comment on construction scheduling specifically with respect to alternatives for timing construction of the tunnel in relation to construction of adjacent highway and bridge structures.

1.3 Summary of Work Performed

In order to meet the proposed objectives a total of 59 exploratory borings were conducted along the proposed tunnel alignment. Two types of borings were used to provide the necessary data for evaluation of the alluvium in the Phoenix Valley -- large diameter inspection borings (LDB's) and small diameter hammer drill borings. The LDB's consisted of 36-in. diameter borings drilled with a caisson drill rig (auger), which were then lined with a steel inspection casing for down-hole inspection and sampling. The smaller diameter borings (6-5/8 in. diameter) were drilled with a reverse circulation hammer drill rig. Laboratory testing consisting of moisture contents, grain size distributions, and where applicable, Atterberg limits was conducted on samples obtained during down-hole inspections of the LDB's.

42

1.4 Report Organization

This Site Conditions Report is divided into four major sections, as follows:

Section 1 - Introduction - Summarizes the purpose, objectives and summary of work performed for this project.

Section 2 - Project Information - Describes the general characteristics of the tunnel and overlying surface features.

Section 3 - Subsurface Exploration Program - Describes what was done in the field, the equipment used, the observation made, and how the data was analyzed.

Section 4 - Summary of Site Conditions - Describes subsurface soil and water conditions as revealed by the subsurface exploration program.

2.0 PROJECT INFORMATION

The Price Road Drain Tunnel Project consists of an approximately 18,000-foot-long by 18-ft finished diameter drainage tunnel extending from a point immediately south of the future Outer Loop/Superstition Freeway interchange to the Salt River. The proposed tunnel, based on 30% design drawings prepared by Howard Needles Tammen and Bergendoff (HNTB), will be oriented south to north and will be constructed beneath the proposed Outer Loop Highway northbound carriageway, adjacent to the existing Price Road. Current plans are for construction of the tunnel to be completed prior to construction of the highway. The tunnel layout relative to Tempe city streets and the Salt River is shown in Figure 2.1, Project Location Diagram.

The majority of the tunnel alignment falls within the cleared ADOT right-of-way for the Outer Loop Freeway and crosses six streets, Southern Avenue, Broadway Road, Apache Boulevard, Victory Drive, University Drive, and First Street. The alignment is also crossed by the Southern Pacific Railroad. A bridge is planned at each of these locations. At the southern end of the alignment, the tunnel passes beneath the Tempe Canal and the Superstition Freeway. At the northern end of the alignment, the tunnel passes nearby a City of Tempe Animal Control Shelter, and beneath Federal Aviation Administration property and a large asphalt plant quarry operation. On-going construction activities at this date along the alignment include construction of two bridges that cross the Outer Loop Highway at Apache Boulevard and Victory Drive.

At the onset of the boring program, the proposed tunnel alignment followed the Outer Loop Freeway's northbound frontage road at a depth of 90 ft below ground surface and the first borings were located accordingly. Later during the program and as shown in the 30 percent design drawings, the alignment was shifted westward to its present location beneath the northbound freeway lanes south of University Drive and beneath the southbound freeway lanes north of University Drive. The tunnel invert was also raised to approximately 70 ft below ground surface at the South Shaft (El. 1120) and to approximately 80 ft below ground surface at the North Shaft (El. 1100). The slope of the tunnel from south to north is constant.

In addition to the tunnel, the project will consist of an inlet shaft and outlet structure and five drop structures located along the tunnel alignment.

3.0 SUBSURFACE EXPLORATION PROGRAM

3.1 General

Subsurface explorations conducted for this study included 59 exploratory borings including 13 large diameter inspection borings and 46 reverse circulation hammer drill borings. The subsurface explorations were begun on January 29, 1987 and completed on April 4, 1987. Photographs illustrating the LDB's and several materials encountered are included as Photographs 1 through 8. Large diameter inspection borings were drilled at approximate 1500 ft spacings and reverse circulation hammer drill borings were drilled at approximate 500 ft spacings along the tunnel alignment. In addition, hammer drill borings B-227, B-228, B-229, B-230, and B-231 were drilled at the proposed locations of five drop shafts.

During the subsurface exploration program, the proposed tunnel alignment was changed both horizontally and vertically. Horizontally, the tunnel was shifted westward from the proposed northbound frontage road to the alignment shown on the 30 percent design drawings submitted by HNTB. Vertically, the proposed depth to the tunnel invert was raised from approximately 90 to 100 ft to approximately 70 to 80 ft below ground surface as shown on the 30 percent design drawings submitted by HNTB.

The alignment shown in the 30 percent design drawings is used exclusively as the basis of this report. An objective of the subsurface investigation program was to locate each boring approximately 50 ft east or west from the proposed tunnel centerline to avoid disturbance to the ground within the proposed tunnel horizon from drilling activities. Because of the horizontal change in the proposed tunnel alignment, four hammer drill borings, B-203, B-205, B-206 and B-235 penetrated the proposed tunnel horizon. Several other hammer drill holes were drilled at offsets less than 50 ft from the proposed tunnel centerline, and other hammer drill holes were drilled at offsets greater than 50 ft from the proposed tunnel centerline. The greatest offset to a hammer drill boring from the proposed tunnel centerline is 340 ft. The offsets of each hammer drill boring are summarized in Table 3.1, Price Road Drain Tunnel, Summary of Test Borings. Because of the horizontal change in the proposed tunnel alignment, several LDB's were drilled at offsets other than 50 ft from tunnel centerline. The closest LDB, LDB-11, was drilled at an offset of 16 ft west of tunnel centerline, or six feet west of tunnel springline. Several other LDB's were drilled at offsets less than 50 ft from tunnel centerline and other LDB's were drilled at offsets greater than 50 ft from tunnel centerline. The greatest offset to a LDB from tunnel centerline is 285 ft. The offsets of each LDB are summarized in Table 3.1.

Three LDB's, LDB-03, LDB-06, and LDB-09 were drilled before the proposed tunnel alignment was raised from an average invert depth of 90 to 100 ft to an average invert depth of 70 to 80 ft. As illustrated on the data profile for each of these borings, Figures 3.6, 3.9 and 3.12, the crown of the proposed tunnel is located closer to the uppermost inspection window then for the rest of the LDB's.

45

Each LDB was drilled and logged from the ground surface, a 3-ft diameter steel inspection casing was inserted to full depth, and each hole was inspected from within the casing. Down-hole inspections were conducted from the bottom of each hole to a point approximately 15 to 20 ft above the proposed tunnel crown.

Each hammer drill boring was drilled and continuously logged as the boring was advanced. Logging included recording the hammer blows required to advance the borings each foot, visual classification of recovered drill cuttings, and observation of soil moisture conditions.

Survey control was established for each boring location and the as-built location of each boring was surveyed and reported using tunnel stations and offsets east or west from the proposed tunnel centerline. Borehole collar elevations were determined based on feet above mean sea level. All boring locations, collar elevations, depths, bottom of hole elevations, and approximate proposed tunnel crown elevations are given in Table 3.1.

Laboratory testing was conducted on samples obtained during down-hole inspection of each LDB. Bulk samples were taken to the laboratory for sieve analyses, determination of Atterberg limits, and water content determination.

Groundwater observations during these subsurface investigations were limited to observations of groundwater conditions during the drilling and logging of each borehole. Except for five LDB's, each borehole was backfilled with excavated material following completion of logging. Five LDB's, LDB-03, LDB-05, LDB-09, LDB-10, and LDB-13 were left open with inspection casings installed to full depth to allow prospective tunnel contractors to inspect ground conditions at these locations. Groundwater observations included description of sample moisture during advance of hammer drill borings, and description of sample moisture and borehole behavior during LDB drilling. These observations allowed for a determination of groundwater levels within each boring at the time of drilling only.

No groundwater observation wells were installed or pump tests conducted as part of this subsurface investigation program. Three observation wells were installed to monitor water quality and groundwater levels along the proposed tunnel alignment under a separate contract issued to Dames & Moore by HNTB. The data from this work is presented in Appendix C, Dames & Moore Water Level Data.

46

3.2 Large Diameter Drilling Program

Eleven, 36-inch-diameter borings were drilled and inspected between January 29, 1987 and April 1, 1987. In addition, two borings were attempted that could not be completed due to caving soil conditions. The locations of all thirteen borings, labeled LDB-01 through LDB-13, are shown in Figures 3.1 through 3.3, Boring Location Diagrams. The logs of the large diameter borings (LDB's) are presented in Appendix A, Test Boring Reports. The location, depth and elevation of each LDB is presented in Table 3.1.

Drilling difficulties arose where loose, unstable ground was encountered and borehole walls caved repeatedly, and where the sand-gravel-cobble stratum (SGC) contained many large cobbles or boulders which were difficult to pick up on the auger flights. Two of the borings, LDB-11 and LDB-12 had to be abandoned due to severe caving and sloughing of the borehole walls and no downhole inspections were conducted. The 11 borings drilled to completion were advanced to an average depth of approximately 85 ft below ground surface. This was generally accomplished within eight to ten working hours.

All borings were drilled using a Watson 5000 auger drill rig mounted on an American 65 ton crane, which is commonly used for caisson drilling. The Watson 5000 advances the borehole by turning a 4.5-ft-long, continuous flight auger attached to a rotating Kelly bar. Auger drilling consisted of rotary advancement of the auger drill bit to its full 4.5 ft length into the soil. The auger was then stopped, raised out of the hole, and the spoils spun off of the auger into a "muck" pile. This procedure constituted one auger penetration, and was designated as one "AP" on the Test Boring Report. The auger was then lowered back into the borehole and the procedure was repeated until the desired depth of open hole was obtained.

A geologist was assigned to the drill rig to sample soils during drilling and to prepare a log of soil classification and remarks concerning water content, caving problems, cementation, and drilling difficulty. The soils were logged in general accordance with ASTM Specification D-2488, Description and Identification of Soils (Visual-Manual Procedure), and ASTM Specification D-2487, Classification of Soils for Engineering Purposes (Unified Soil Classification System, USCS). Specific procedures and terminology used for describing soil samples are presented on the first page of Appendix A. The first four pages of each Test Boring Report present the logs developed during the auger drilling.

Upon completion of auger drilling, the drill rig was mobilized to the next location and a 36-in-diameter steel inspection casing was placed in the drilled hole utilizing a second American 75 ton capacity crane. A total of five inspection casings were fabricated for the project, which contained a series of twelve, 10-in.-wide x 24-in.-high windows for inspection and sampling of soil strata from the bottom to a point 38 ft above the bottom of the hole. Three smaller 10-in.-wide x 12-in.-high windows allowed additional soils inspection to approximately nine ft above the uppermost sampling window or 47 ft above the bottom of the

47

hole. All 15 windows were covered with removable steel doors which were secured by a steel latch. The doors were opened from inside the casing in order to perform the downhole inspection of each boring.

After installation of the inspection casing, a field geologist was lowered to the bottom of the casing in an inspection cage to perform the initial downhole logging and sampling of each boring. The inspection cage consisted of two 30-in.-diameter, 1/4-in.-thick steel plates connected by three 6.5-ft-long sections of 2-1/2-in.-diameter steel pipe. Expanded metal was used for both the floor and the roof of the cage to provide better lighting and to facilitate lowering the cage to the bottom of the casing with a minimum of hang-ups on the window hardware. Pages five and six of each Test Boring Report present the log developed during the downhole inspection.

At the lowest twelve inspection windows (numbered 1 through 12 on the log), the logging procedure consisted of first measuring the distance from the outside of the casing wall to the borehole wall, noted as "Caliper" on the Downhole Inspection Report. A 50 to 60 pound bulk sample of the soil component with less than 2.5-in. nominal diameter was then taken at each window. The soils were logged in a manner similar to that described for the auger drilling log. Remarks concerning the water content of the soil and the ease of sampling were also made in conjunction with logging soil descriptions and soil strata changes. At the upper three 10-in.-wide x 12-in.-high windows, soil descriptions were made, soil strata changes were noted, and observations concerning water content and sampling ease were made. No bulk soil samples were taken at these upper windows.

Comments about ease of sampling, recorded in the "Remarks" column of the Downhole Inspection Report, differentiate between samples that were picked out with difficulty with a geologist's pick (P*), picked out with a geologist's pick (P), scooped out by shovel (S), or dug out by hand (H). The moisture content remarks for various samples were designated either dry, damp, moist or wet, based on visual inspection, and are noted in the "Moisture" column.

The initial downhole inspection generally took six to eight hours. A review inspection of each boring was then performed by the supervising project geologist to provide consistency and quality control. This review inspection took approximately 1.5 hours.

3.3 Reverse Circulation Hammer Drill Borings

Forty-six, 6-5/8 in.-diameter reverse circulation hammer drill borings were drilled and logged between January 20, 1987 and April 4, 1987. All borings were drilled approximately 79 to 100 ft below ground surface (El. 1086 to El. 1117 ft). The locations of the borings, labeled B-101 through B-108, B-201 through B-207, and B-209 through B-239, are shown in Figures 3.1 through 3.3, Boring Location Diagrams. The location, depth and elevation of each of these borings is presented in Table 3.1.

The 6-5/8 in.-diameter borings were conducted at approximately 500 ft centers along the tunnel alignment including borings within 25 to 30 ft from each large diameter boring. Borings were conducted near the LDB's to supplement data for the soils encountered in the LDB's and to correlate data obtained from the smaller borings to observations made about the soils during the LDB downhole inspections.

All 6-5/8 in.-diameter borings were drilled using a reverse circulation hammer drill. This type of rig advances a double walled drive casing with an International Construction Equipment (ICE) Model 180 diesel pile hammer which delivers 95 blows per minute at a rated energy of 8100 ft-lbs per blow. The energy can be increased to 12,000 ft-lbs per blow through the use of a supercharger. Cuttings are removed by air delivered at 125 psi from a 750 cfm compressor mounted on the rig. The air is forced down the annular space between the casing walls where it removes the cuttings from the bit and returns them to a discharge cyclone (Figure 3.17). The inner sleeve has an inside diameter of 4-1/4-in. and material very nearly this large can be brought up intact.

A hammer type of drill rig was selected for this work because of the nature of the alluvium in the project area. Advancing a borehole through the coarse, granular, sand-gravel-cobble alluvium is extremely difficult utilizing conventional rotary methods. The hammer drill offered advantages over other types of percussion drilling, such as the provision of continuous blow count penetration resistance data, the soil material was removed in large pieces, and soil identification and standard penetration tests (SPT) could be conducted without removing the drive casing from the boring. SPT's were conducted in accordance with ASTM Specification D-1586.

A geologist was assigned to the hammer drill rig to observe the soils encountered and to prepare a log consisting of soil classification similar to that used for the LDB's, a log of blow counts, and comments about water content, cementation, relative density and the results of SPT. The soils were logged in general accordance with ASTM Specification D-2488, Description and Identification of Soils (Visual-Manual Procedure), and ASTM Specification D-2487, Classification of Soils for Engineering Purposes (Unified Soil Classification System, USCS). Specific procedures and terminology used for describing soil samples are presented on the first page of Appendix A, Test Boring Reports.

To interpret hammer drill data the following was considered:

1) Type of Material - Sand rich or poor, gap grading, loose sand pockets between cobbles, amount of clay, etc. Sand rich material is penetrated much easier than cobble or boulder rich material. Loose sand pockets between cobbles are not readily identifiable from penetration data alone. Clay content typically is also not identifiable from blow count data.

2) Number of hammer blows required to drive the casing one foot, (blow counts/ft). Typically the blow count data for the materials encountered were as follows:

Clayey or sandy SILT alluvium - zero to 15 blows/ft
(the casing could be pushed down with hydraulics alone for zero blows/ft)

SILT alluvium with carbonate cementation -
Weak cementation - 15 to 25 blows/ft
Moderate cementation - 25 to 40 blows/ft
Strong cementation - 40 to greater than 100 blows/ft

Clean, loose SAND - 10 to 20 blows/ft
Dense or clayey SAND - 20 to 30 blows/ft
Clean, loose sandy GRAVEL or gravelly SAND -
- 20 to 35 blows/ft
Dense or clayey sand and gravel mixtures -
- 30 to 45 blows/ft

Material containing cobbles rarely exhibits blow counts of less than 45 per foot and frequently exhibits blow counts of greater than 200 per foot. To evaluate layers that contained cobbles, the blow counts and penetration characteristics of the "matrix" material between individual cobbles was carefully observed.

3) Presence of any fines, silt or clay, especially cementitious clay coatings on gravels and cobbles or within sand matrix material. It was determined during the LDB inspections that the presence of 2 to 3 percent clay, by weight, had an effect in binding the material together and provided additional strength.

4) Moisture. The air circulation used to remove cuttings from the borehole drys the material to some extent. Therefore, any wetness observed in soil samples from the cyclone was interpreted as indicating fairly damp material in the borehole.

5) Combustion energy of the diesel hammer. The impact energy delivered by the hammer to the casing is a function of the combustion occurring in the hammer cylinder. When the hammer is firing well, the impact energy is higher and the blow counts are decreased. The bounce chamber pressure (air pressure in the top of the hammer cylinder immediately prior to firing) was recorded for each boring in one foot increments. This data is included in Appendix A, Hammer Drill Bounce Chamber Pressure Logs. This information is included based on recommendations from research conducted into penetration resistance for coarse grained soils (Harder and Seed). This research recognized the need to standardize the blow counts recorded using the reverse circulation hammer drill to account for variations in the operating efficiency of the hammer. The calculations required for this standardization were not made for this report because the geologists interpreting the penetration data and soil logs have considerable experience

with interpreting these data without correction. A summary of bounce chamber pressures for each boring is included in Appendix A, and correction curves are presented as Figure 3.18, Hammer Drill Blow Count Correction Curves. The bounce pressure data presented in Appendix A and the correction curves presented as Figure 3.18 have been included to allow this correction to be made by others should that be desired.

3.4 Laboratory Testing Program

The purpose of the laboratory testing program was to provide data for soil classifications and the development of water content profiles. Prior to testing, all particles in excess of approximately 2-1/2-in. in diameter were excluded from the sample. Laboratory data and gradation curves are included in Appendix B.

Soil samples obtained from the drilling program were delivered to the soil testing laboratory by field personnel. Each bulk sample delivered to the laboratory contained a smaller double-wrapped zip-lock bag sample. The zip-lock bag sample was removed for immediate water content testing. The bulk sample was then either tested for soil classification or stored.

The soil classification tests consisted of sieve analysis and if applicable, Atterberg limit tests. Laboratory tests were assigned by field personnel. The following procedure was used in performing the soil classification tests:

1. The bulk sample was weighed, oven dried and then re-weighed for bulk sample moisture content. The sample was then split in accordance with ASTM procedures. The samples contained in the double zip-lock bags were tested for water content in accordance with ASTM D-2216 procedures. The results of the water content determinations on samples in the double zip-lock bags are presented as "Separate Water Content" in the Laboratory Test Summary Sheets in Appendix B.

2. The sample was passed through a series of sieves, with 2-1/2-in. being the largest. All material retained in the 2-1/2-in. sieve was discarded. The sieve analysis on the material passing the17-1/2-in. sieve was performed in accordance with ASTM C-136 and D-422.

3. On samples designated for Atterberg limit tests, liquid limit and plastic limit tests were performed in accordance with ASTM D-4318 procedures. Using this procedure, the plasticity tests are performed on all material passing the #40 sieve.

All laboratory data relating to soil classification and water content testing is tabulated on the four sheets which appear at the front of Appendix B, Summary of Laboratory Test Results and Grain Size Analysis Curves. In addition, a Grain Size Analysis Curve was generated for each sieve test. Since all particles greater than 2-1/2-in. were discarded, each grain size curve begins with the fraction finer than the 2-1/2-in. sieve. A second grain size analysis curve is plotted on the same graph, which represents the grain size distribution for the fraction of the material passing the No. 4 sieve.

3.5 Data Profiles

To assist in analyzing the condition of the ground at each boring, the geotechnical data obtained from auger logging, downhole inspection and laboratory testing was combined into a "Data Profile". The Data Profiles for each Large Diameter Boring reported in this Site Conditions Report are presented as Figures 3.4 through 3.16, Data Profiles.

The center column of the Data Profile illustrates the inspection casing, which was placed into each boring. The lower 12 large windows are numbered 1 through 12. The upper three small windows are also shown, numbered 13 through 15. The End of Boring elevation (E.O.B.), Ground Surface elevation (G.S.), and proposed Crown of Tunnel elevation are shown on each data profile.

Geotechnical data obtained during logging of the borehole is presented to the left of the Boring column. The columns designated "Caving" and "Auger Penetration, AP/FT" present data obtained during logging of the auger drilling operation. The data presented in these two columns comes directly from Pages 1 through 4 of the Test Boring Reports.

The "Caliper", "Sampling" and moisture content "MC" columns present data obtained during the downhole inspection operation. The "Caliper" column is scaled from 0 to 3 ft, and indicates the distance measured from the wall of the inspection casing to the wall of the large diameter boring. The "Sampling" column provides an indication of the ease of sampling, as follows:

P* - sample obtained using a geologist's pick, white marks left in soil.

P - sample obtained using a geologist's pick

S - sample obtained using a shovel

H - sample obtained by hand

The "MC" column indicates whether the sample was Wet, Moist, Damp or Dry. The data presented in these three columns comes directly from pages 5 and 6 of the Test Boring Reports.

Laboratory Test Data is presented to the right of the Boring column. The Water Content is plotted graphically from 0 to 20 percent in the "W(%)" column. The "Percent Passing the No. 200 Sieve, Based on 100 Percent Passing the No. 4 Sieve" is plotted graphically form 0 to 40 percent in the middle column. The "Percent Passing the No. 4 Sieve, Based on 100 Percent Passing the 2-1/2-in. Sieve" is plotted graphically from 0 to 100 percent in the far right column.

4.0 SUMMARY OF SITE CONDITIONS

4.1 General

The project is located along Price Road near the eastern edge of the City of Tempe, Arizona. The project area is bounded to the north by the Salt River, to the east by the cleared ADOT right-of-way for the Outer Loop Freeway, and to the west by Price Road. To the south, the tunnel passes under the Tempe Canal and the Superstition Freeway to a point approximately 500 ft south of the freeway centerline.

The topography of the area is very nearly flat with a very gentle slope north towards the Salt River and south to the South Shaft from Broadway Road. Natural ground surface elevations range from El. 1181 ft near the river to El. 1197 ft near Broadway Road near the midpoint of the alignment to El. 1191 ft at the South Shaft. Vegetation in the project area is sparse due to on-going construction activities and right-of-way clearing. Vegetation consists primarily of grasses and low lying plants with occasional Palm or Cottonwood trees and bushes. Surface drainage in the project area is very poor with muddy conditions developing quickly during rainfall.

As previously stated in Chapter 2.0, the majority of the proposed tunnel alignment falls within the cleared ADOT right-of-way for the Outer Loop Freeway and crosses six major streets and a railroad. At the southern end of the alignment the tunnel passes beneath the Tempe Canal and the Superstition Freeway. At the northern end of the alignment, the tunnel passes in front of a City of Tempe Animal Control Shelter and beneath Federal Aviation Administration property and a large asphalt plant quarry operation. On-going construction activities along the alignment include construction of two bridges which will cross the future freeway.

4.2 Regional Geology

The project is located in the Salt River Valley portion of the "Phoenix Basin", which is situated in the desert region of the Basin and Range physiographic province. Regional geologic structures of the Basin and Range province result primarily from major deformation during early Mesozoic to mid-Cenozoic geologic time. Precambrian to Mesozoic rock units were subject to folding, faulting and intrusion throughout the Mesozoic and continuing into the early Cenozoic, during the Nevadan and Laramide mountain-building periods. Further deformation continued by block faulting through the late Tertiary that resulted in the formation of uplifted fault block mountain ranges and narrow intermontane valleys (Wilson, 1962, Pewe, 1978).

The desert region of the Basin and Range province is characterized by numerous fault-block mountain ranges separated by relatively broad graben-like basins which have been filled with thick deposits of alluvium through extensive erosion of the adjacent ranges (Wilson 1962).

The Salt River has contributed to the Phoenix Basin-fill deposits by transporting alluvium from the Supersition-Goldfield-Mazatzal Mountains in the east. As the basin was filled, the river meandered across the valley in a complex system of braided channels depositing alluvium in old channels and diverting flow into new ones.

With each episode of uplifting of the mountains to the north and east, rejuvenation of the river caused downcutting through the river's existing floodplain and the formation of a new floodplain. Remnants of the older dissected floodplains were left intact as alluvial terraces. Within the project area, along with the present Salt River floodplain, two alluvial terraces can be distinguished, the Lehi Terrace and the Mesa Terrace.

The present Salt River bed is considered the active geologic floodplain. The present river bed and the Lehi Terrace are considered the modern geologic floodplain. Direct age relationships between the Lehi and Mesa Terraces are difficult to discern but evidence suggests that the Mesa Terrace is between 2 and 5 million years old and that the Lehi Terrace is between 2 million and 10,000 years old.

These terraces are composed of variably consolidated, poorly sorted mixtures of sand, gravel and cobbles which contain small amounts of boulders, silt, clay and carbonate cementation. These deposits are known locally as the SGC (sand-gravel-cobble), and extend to depths of 800 to 1200 ft below ground surface. Local scour and redeposition of the material within the terraces make for wide compositional variations over short distances.

As the river abandoned each former floodplain level the terraces were covered by a relatively thin veneer of fine grained alluvium composed of fine sand, silt and clay. This fine grained alluvium was deposited as overbank deposits during flood events and as windblown dust which has been reworked and redeposited by wind and sheet wash. Within the project area the fine grained alluvium varies from loose unconsolidated material to extremely hard, rock-like, calichified material.

Caliche in the project area is primarily confined to the fine grained alluvium and the upper gravels of the terraces, particularly the older Mesa Terrace. In the project area, lateral continuity of the caliche is quite varied. The caliche distribution varies between 1) non-calichified material and poorly to moderately cemented caliche, and 2) poorly to moderately developed and well developed caliche.

Formation of caliche results from in-situ evaporation of near surface meteoric water. As the water is evaporated, calcium carbonate dissolved in the water is precipitated in soil voids. The thickness, lateral continuity and depth of the caliche profile is dependent on the depth of penetration of soil water, thus its formation is influenced by the amount of rainfall and the permeability of the soil. Hot dry climates are most favorable to caliche development where rainfall occurs in periodic thunder showers followed by renewed sunlight and low humidity promoting evaporation (Pewe, et. al., 1986).

Caliche layers exhibit a sequence of progressive development over time. In coarse grained alluvium, caliche first develops as slight coatings on the underside of individual grains, then begins to fill the voids between individual grains as the coatings coalesce and merge, and eventually all voids become completely filled and the material is cemented into a concrete-like mass. In fine grained alluvium the calcium carbonate first forms as discrete nodules, then as thin laminations, and with time these laminations form throughout the soil mass and eventually cement the material into an extremely hard or rock-like mass.

4.3 Subsurface Conditions

4.3.1 Soil Conditions

Based on information obtained from available geologic literature, borings for wells and bridge foundations in the project area, and the recent test boring program, a generalized profile of subsurface soil conditions was developed and is presented herein. The strata are discussed from the ground surface downward with each discussion including information about the thickness, lateral variation and typical composition. The soil strata have been divided into two main units on the basis of soil composition and depositional characteristics. Subsurface information developed from the recent test boring program is presented graphically in Figures 4.2 to 4.5, Subsurface Profiles. The legend and notes accompanying these Figures is presented as Figure 4.1, Subsurface Profile Legend.

Unit A, Alluvium - This material is a thin surficial layer of windblown, sheet wash and overbank deposits of fine-grained soils which cover the entire project area. This unit consists of clayey to sandy SILT and clean to silty SAND overlying transitional components of Unit A which consists of reworked and redeposited sand and gravel mixtures with varying small amounts of clay and silt. Unit A extends to a depth of from 8 ft to 28 ft below ground surface within the project area. The Unit A soils are generally dry to slightly damp and non-plastic to moderately plastic. The Unit A soils have been further subdivided into two sub-groups based on the degree of cementation present:

Unit A_1 - Material possessing no to very weak calcium carbonate laminations or nodules. (See Photographs 1 and 2)

Unit A_2 - Material possessing moderate to extremely hard, occasionally rock-like, calcium carbonate cementation (Caliche).

Unit B, Sand, Gravel and Cobbles (SGC) - This material was deposited by the Salt River in widespread alluvial terraces as the river meandered back and forth across the Phoenix Basin. This unit consists of variably consolidated, poorly-sorted mixtures of sand, gravel and cobbles with small amounts of boulders, silt, clay and occasional carbonate cementation. The SGC deposits as referred to in this report encompass all SAND, GRAVEL and COBBLE layers below the depth at which cobbles are first encountered within the coarse grained alluvial deposits. Within

the project area these deposits extend to the full depth of all borings and are estimated to continue to depths of 800 to 1200 ft below ground surface.

Material within the SGC varies from poorly graded to well graded in composition, and from medium dense to very dense in compactness, and includes SAND lenses with no gravel or cobbles, lenses/layers of gravelly COBBLES with very little sand, and gap graded material composed of sandy COBBLES with virtually no gravel. The cobble and gravel fractions are generally subrounded while the sand fraction is subrounded to subangular. The coarser cobble and gravel fraction tends to be relatively tabular in that the long axis is several times the short axis. These tabular pieces commonly lay with the long axis horizontal and often overlap and interlock with each other. (See photograph 3)

An attempt was made to determine the relative percentages of cobble and coarse gravel in the SGC for samples collected during the large diameter boring down-hole inspections. This was done by isolating auger "loads" of material into separate piles where the cobbles and gravel were then counted. This data is presented in Table 4.1, SGC Cobble and Gravel Content.

Cementation of the SGC varies from uncemented to moderately cemented with calcium carbonate. The carbonate cementation is limited to the upper portions of the SGC and was not encountered in any boring below a depth of approximately 35 ft below ground surface. Most cemented SGC zones were encountered in southern portions of the project area. Cementation of the SGC consists of coatings of calicum carbonate on gravel and cobbles and less frequently, slight cementation of the sand "matrix" material.

In addition to calcium carbonate, small amounts of clay within the SGC provide a form of cementation. Clay within the SGC occurs as slight coatings on the gravel and cobbles, as slight "halos" on sand grains and as void in-fillings. The clay frequently "cements" sand grains onto the gravel and cobbles, provides "cementation" to sand bodies, and frequently fills intergranular voids and thus lowers the permeability. It was determined in the large diameter downhole inspections that a relatively small amount of clay (approximately 2 to 3 percent by weight relative to 100 percent passing a 2-1/2 in. sieve) appeared to add a binding effect to the material.

Clay within the SGC stratum also occurs as occasional lenses, layers or pockets up to 2 ft thick but typically 6 to 12 in. thick. Occasional cobbles or gravel within the SGC, particularly those of volcanic origin, have been completely altered to silt or clay with others showing various stages of weathering. It is possible that some of the clay within the SGC has resulted from in-situ weathering followed by redeposition due to groundwater action. The clay content of the SGC generally increases with depth, where the material has been more continuously inundated by groundwater and is older and more highly weathered.

Groundwater movement through the SGC has resulted in deposition of a precipitate of black Manganese oxide (MnO_2) on much of the material. This precipitate occurs primarily on lenses, layers, or pockets of high permeability material, particularly gravelly COBBLE layers that often contain voids as large as several inches in diameter beneath individual cobbles. These layers appear to act as conduits for groundwater flow.

Although wide changes in the grain size, composition, and distribution of the SGC occur over short distances, it was determined that the clay content exhibited trends with depth that could be traced horizontally along the entire tunnel alignment. On this basis the SGC unit (Unit B) was subdivided into three groups based on clay content.

Unit B_1 - Unit B_1 varies from clean to containing slight traces of clay as coatings on gravel and cobbles. This material ranges in density from loose to dense and is generally dry to damp.

Permeability of this material although not measured directly is interpreted to be relatively high due to the lack of clay in-filling the voids between soil particles, locally extreme variations in permeability exist where the soil is unusually silty or where lenses of gravelly COBBLES exist.

When augering to advance the 3-ft diameter borings through this B_1 Unit, SGC material often would not stand in the borehole walls and slight to severe caving and sloughing occurred. Locally, poor to moderate calcium carbonate cementation or crusts of calcium carbonate on the gravel and cobble components was observed. (See photographs 2 and 7)

Along the subsurface profile, this unit varies in thickness from approximately 15 ft to 40 ft and except for one zone at the south end of the tunnel alignment, the unit occurs entirely above the crown of the tunnel.

Unit B_2 - Unit B_2 occurs below Unit B_1 and contains small amounts of clay as persistent, well developed coatings on gravel and cobbles. This clay provides a binding effect to the SGC and frequently acts as a form of cementation. Excavation of Unit B_2 using the LDB auger resulted in cemented chunks of soil that were often difficult to disintegrate with finger pressure. (See Photographs 2 and 8)

Unit B_2 is medium dense to very dense and is generally damp based on visual classification of moisture content. Moisture content of the clay generally is at or below its plastic limit based on visual observation of soil samples. Within this unit, intergranular voids are partially filled with clay and it has therefore been

interpreted to have a generally lower permeability than the overlying B_1 layer. Many layers or lenses of high permeability, manganese-stained, gravelly COBBLES exist within this unit. These layers, containing little sand, frequently caved slightly while augering the LDB's. The lateral extent of the high permeability manganese stained material is difficult to discern from the available information.

The B_2 unit of the SGC varies in thickness from 10 ft to 25 ft. The base of the unit extends to depths below ground surface of between approximately 50 ft to 60 ft in the northern half of the alignment (El. 1125 ft to El. 1140 ft), and to depths below ground surface of between approximately 60 ft to 70 ft in the southern half of the alignment (El. 1120 ft to El. 1135 ft).

Unit B_3 - Unit B_3 occurs below Unit B_2 and is the lowest unit of the SGC encountered in borings along the proposed tunnel alignment. This unit is relatively clay-rich and was logged as "trace clay" or "with traces of clay", with occasional zones of clay-rich material. This unit is generally medium dense to very dense and is damp to moist with wet material encountered occasionally. Moisture content of the clay within the B_3 unit is above its plastic limit and is frequently near its liquid limit based on visual observation of soil samples. The clay therefore tends to impart some cohesion to the SGC rather than a form of cementation as in the B_2 unit. Permeability of Unit B_3 is interpreted to be relatively low due to the clay content. Intergranular voids are nearly completely filled with clay. (See Photographs 5 and 6)

When encountered below the water table, the clay appears to be too wet to impart any strength to the SGC material. When attempting to auger a large diameter boring below the water table, the SGC would not stand vertically and the borehole walls sloughed repeatedly. This wet material would also not hold on the auger and was difficult to remove from the boring (see Photograph 4). An open hole could not be advanced and maintained below the groundwater although the auger was able to penetrate the ground easily.

Unit B_3 extended to the full depth of all borings and was first encountered at a depth of 50 ft to 60 ft below ground surface (El. 1125 ft to El. 1140 ft) in the northern half of the alignment. In the southern half of the alignment, the B_3 unit was first encountered at depths of 60 ft to 70 ft below ground surface (El. 1120 to El. 1135 ft).

4.3.2 Groundwater Conditions

General

Groundwater conditions in the site vicinity are influenced by the regional groundwater levels within the SGC soils and by the periodic flows that occur in the Salt River. Regional groundwater levels have a very low gradient and have exhibited fluctuations of between 150 ft and 200 ft between 1902 and the present time. Generally, regional groundwater levels dropped consistently in the site vicinity from approximately El. 1200 ft in 1902, to El. 1025 ft in 1976. Since 1976, groundwater levels have risen to between El. 1050 and El. 1100 in the vicinity of the site. Recent regional groundwater levels observed during recent subsurface investigations and observation wells are at or below El. 1100 ft, except for the northern most observation well located immediately south of the Salt River, in which regional groundwater levels were at approximately El. 1110 ft. This regional groundwater trend has resulted from the combined effects of groundwater withdrawals in the area, precipitation patterns, and water management programs in the Salt River Project.

Temporary groundwater conditions occur at the northern end of the proposed tunnel alignment and are associated with recharge from periodic water flows in the Salt River. These Salt River flows result from precipitation and from releases of water managed by the Salt River Project. Flows in the Salt River produce a temporary groundwater mound in the vicinity of the river. The height and lateral extent of this mound above the regional groundwater level is a function of the duration and magnitude of the Salt River flows.

Groundwater Data

Groundwater conditions along the alignment of the Price Road Drain Tunnel have been analyzed on the basis of the following:

- Arizona Department of Water Resources (ADWR) - Depth to Water and Altitude of the Water Table, 1983.
- Arizona State University (ASU), Department of Geology, J.T. Bales, C.S. Wellendorf and T.L. Pewe, 1986 - Ground Water, Tempe Quadrangle, Maricopa County, Arizona.
- Sergent, Hauskins & Beckwith (SHB) - Predrilling Survey of Subsurface Conditions, Outer Loop Highway Project, Phoenix, Arizona, January 1986, Sheets 6B and 7B.
- CRSS - Observations during recent subsurface investigations.
- Dames & Moore - Informal memoranda and profiles depicting groundwater levels in observation wells at the site.

- o Dames & Moore - Preliminary Water Level Report for Price Road Drainage Tunnel, June 15, 1987.

Regional groundwater conditions presented in the map from ADWR, the map from the ASU Department of Geology, and from SHB are discussed and summarized in the following paragraphs.

The ADWR map presents groundwater conditions for the West Salt River, East Salt River, Lake Pleasant, Carefree and Fountain Hills subdivisions of the Phoenix Active Management Area. The data used to develop the map were well readings obtained in 1982. The section of the ADWR map surrounding the Price Road Drain Tunnel is presented in Figure 4.6, Arizona Department of Water Resources, Depth to Water and Altitude of Water Level, 1983. The wells marked by solid circles indicate normal water level readings; whereas, the wells marked by open circles indicate anomalously shallow water level readings.

On the basis of this data, the regional groundwater gradient in the vicinity of the site slopes gently to the north and east. The tunnel alignment is intersected by the El. 1050 groundwater contour at two locations, dividing the tunnel into nearly equal thirds. To the north and the south of the center third of the proposed tunnel, the groundwater elevation is below El. 1050. In the center third of the tunnel, the groundwater elevation is at or above El. 1050. It is our understanding that these contours represent the regional groundwater conditions in the site vicinity. On the basis of ground surface elevations along the tunnel alignment, which range from El. 1181 to El. 1197, the minimum depth to the regional groundwater level is approximately 120 ft below ground surface.

Two anomalously high water level readings were obtained near the proposed North shaft location at the Salt River. The elevation of groundwater at these wells was El. 1092 and El. 1112. The ADWR map does not present a discussion of the cause of the anomalously high water level readings. With the invert at the North shaft set at El. 1100, the highest of these two readings would be 12 ft above the proposed tunnel invert.

The ASU Department of Geology map presents contours of depth to groundwater below land surface for the USGS Tempe Quadrangle. The data used to develop this map were the Salt River Project well records and water level records, USGS water level records, and Arizona State Land Department well and water level data obtained from 1979 to 1980. The section of the ASU map surrounding the Price Road Drain Tunnel is presented in Figure 4.7, Arizone State University, Groundwater, Tempe Quadrangle, Maricopa County, Arizona, 1979-1980.

On the basis of this data, the tunnel alignment is crossed only by the 200 ft depth to groundwater contour. It is not crossed by the 100 ft contour, although, the 100 ft contour is located just north of the North shaft. Since the maximum depth to the proposed tunnel invert is 88 ft below ground surface, the groundwater levels indicated by the ASU map are well below tunnel invert at all locations.

The ASU map also includes a Ground Water Profile showing changes in the water table at selected wells located along a north-south line near Scottsdale Road. This profile illustrates groundwater levels for the years 1902, 1947, 1955, 1957, 1976 and 1979. The Ground Water Profile and the profile of the Price Road Drain Tunnel are presented in Figure 4.8, Arizona State University, Groundwater Profiles.

Figure 4.8 illustrates the progressive drawdown of the groundwater from 1902 to 1976. The 1955, 1957, 1976 and 1979 groundwater profile lines are all located below the proposed tunnel invert. The response of the water table to the wet years of 1978 and 1979 are illustrated by the 1979 groundwater levels. By 1979, groundwater levels between McDowell Road and Broadway Road had risen to near their 1957 levels. The groundwater mound in 1979 extended north and south from the Salt River for several miles. This recharge of the groundwater tab south of the Salt River is attributed to flood flows in the Salt River channel. North of the Salt River, the recharge may be attributed to flows in both the Salt River and Indian Bend Wash.

The data presented in Sergent, Hauskins & Beckwith's predrilling Survey appears to be ADWR data, based on the local number assigned to the individual wells. Since this date was contained in the ADWR Study, it was not analyzed further.

The groundwater data obtained from the subsurface investigations performed by CRSS between January and April 1987 are summarized on the subsurface profiles in Figures 4.2 through 4.5. The dates of each groundwater level are noted on these subsurface profiles.

Groundwater profiles based on data from observation wells installed by Dames & Moore during February 1987 are presented in an informal memorandum for February 9, March 9, and April 6, 1987. Additional data is presented in the "Preliminary Water Level Report for Price Road Drainage Tunnel" dated June 15, 1987. Both the profiles and the preliminary report are contained in Appendix C, Dames & Moore Water Level Data.

River Flow Data

Flows or standing water which occurred in the Salt River began about February 24, 1987 and continued until about April 19, 1987. Releases from the Salt River Project began with 250 cubic feet per second (cfs) on March 16, 1987, increased to 2600 cfs on March 22, 1987, were reduced to 300 cfs until March 31, 1987, then continued at lower levels until April 19, 1987.

Summary and Conclusions

Several CRSS borings and all of the Dames & Moore observation wells were completed prior to the start of flows in the Salt River. Data obtained from these borings and wells show the regional groundwater levels that existed during January and early February, 1987. Between the north shaft

(Sta. 190+82) and Victory Drive (Sta. 137+00), the regional groundwater level varied from approximately El. 1100 to El. 1085. At approximately 4500 ft north of the proposed north shaft, at an observation well located immediately south of the Salt River, the regional groundwater level was at El. 1110. South of Victory Drive, groundwater was not encountered in any borings and was therefore below El. 1090 southward to the South Shaft location (Sta. 10+00). Groundwater levels from the CRSS borings are indicated on Figures 4.2, 4.3, 4.4. and 4.5. Regional groundwater levels are indicated by dates preceding February 24, 1987.

Groundwater observations made in borings drilled after March 16, 1987 and groundwater level readings from observation wells taken after that date indicate a significant rise in groundwater levels at the northern section of the proposed tunnel alignment. These higher groundwater levels are interpreted as temporary groundwater levels associated with recharge from flows in the Salt River. Based on the data obtained, the highest temporary groundwater level along the tunnel alignment occurred at the north shaft location (Sta. 190+82) where groundwater was encountered at El. 1133. Temporary groundwater levels reached El. 1148 at the observation well located north of the proposed tunnel and immediately south of the Salt River. As illustrated on Figure 4.2, temporary groundwater levels during Salt River flows dropped steeply from the north shaft to approximately El. 1105 at about Sta. 185+00, then dropped less steeply to approximately El. 1100 at about Sta. 165+00. South of Sta. 165+00 temporary groundwater levels were at or below El. 1100 and, therefore coincided approximately with regional groundwater levels.

In conclusion, the temporary groundwater levels associated with flows in the Salt River occur very quickly after flows in the Salt River commence. Groundwater in the vicinity of the proposed tunnel alignment occurs in two modes: regional groundwater levels occurring at or below El. 1100 ft, and temporary groundwater levels associated with flows in the Salt River occurring at approximately El. 1133 at the north shaft location and at El. 1100 at approximately Sta. 165+00.

Specific information was not available regarding groundwater quality along the proposed tunnel alignment at the time of this report. It is understood that some potential sources of groundwater contamination may exist in the general vicinity of the project. It is recommended that groundwater quality samples be taken from observation wells to determine water quality. Aquifer characteristics were not determined as part of this study. For dewatering purposes, aquifer characteristics should be determined.

SELECTED REFERENCES

Harder, L. F. Jr. and Seed, H. B.; Determination of Penetration Resistance for Coarse-Grained Soils Using the Becker Hammer Drill. University of California, Berkeley, Earthquake Engineering Research Center. Report No. UCB/EERC-86/06, May 1986.

Pewe, T.L.; Bales, J. T. and Wellendorf, C. S.; Environmental Geology of the Tempe Quadrangle, Maricopa County, Arizona (Ground Water, Caliche, Landforms, Depth to River Gravel, Flooding, and Geologic Maps). Arizona Bureau of Geology and Mineral Technology, Geologic Investigation Services, Folio Series No. 2, Maps GI-2-A to H, 1986.

Pewe, T. L. and Burt, D. M. (ed.); Guidebook to the Geology of Central Arizona. Arizona Bureau of Geology and Mineral Technology, Special Paper No. 2, 1978.

Predrilling Survey of Subsurface Conditions, Outer Loop Highway Project, Phoenix, Arizona. Prepared by Sergent, Hauskins and Beckwith, January 1986, SHB Job No.E85-281.

Reeter, R. W. and Remick, W. H.; Depth to Water and Altitude of the Water Level, 1983. Maps Showing Groundwater Conditions in the West Salt River, East Salt River, Lake Pleasant, Carefree and Fountain Hills Sub-Basins of the Phoenix Active Management Area, Maricopa, Pinal and Yavapia Counties, Arizona, 1983. Arizona Department of Water Resources Hydrologic Map services Report NO. 12.

Arizona Department of Transportation Highway Division, Outer Loop Highway, 30% Submittal Preliminary Plan. Prepared by TAMS Consultants Inc., December 10, 1986.

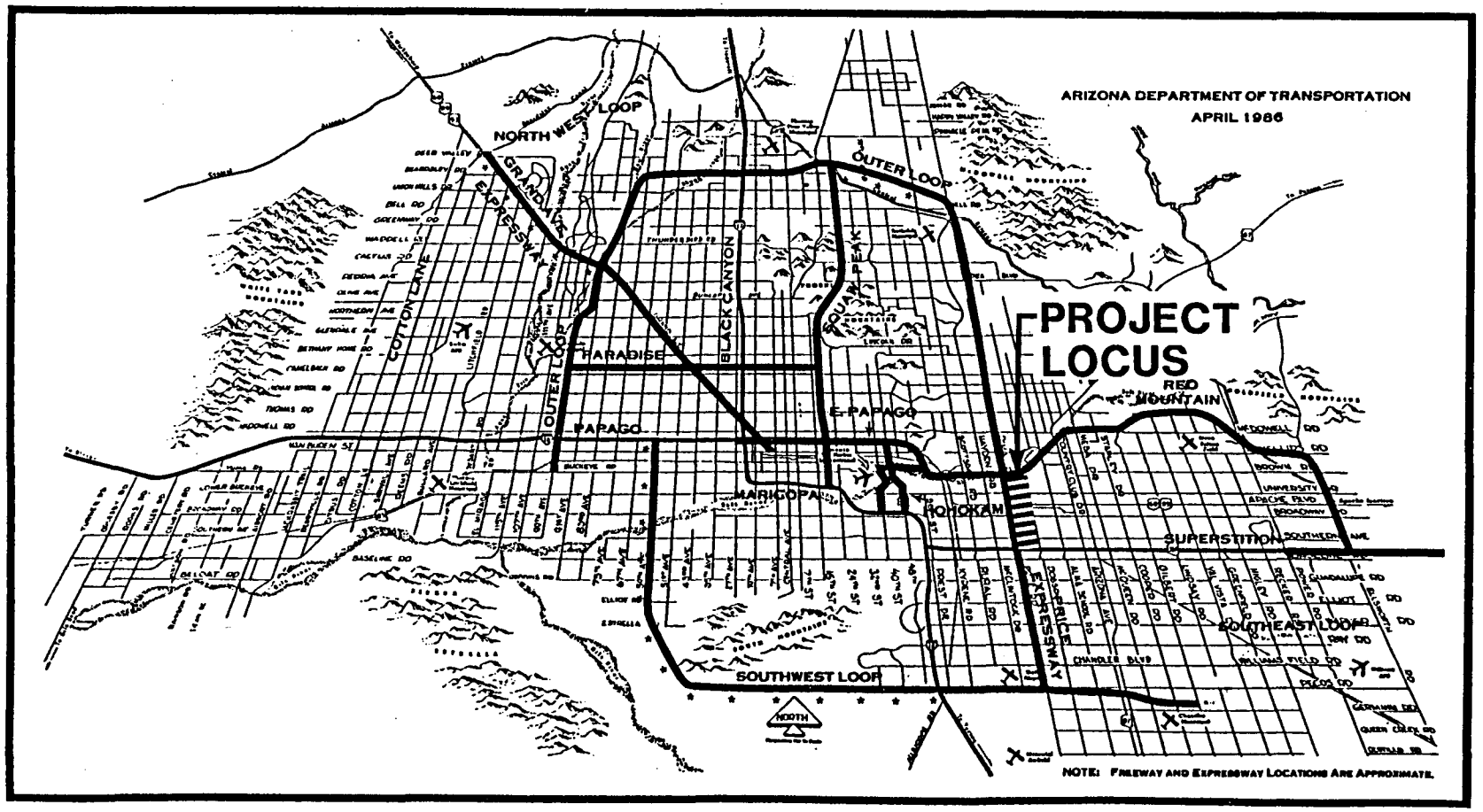
Wilson, Eldred D., 1962, A Resume of the Geology of Arizona: The Arizona Bureau of Mines, Bulletin 171.

0031W

64

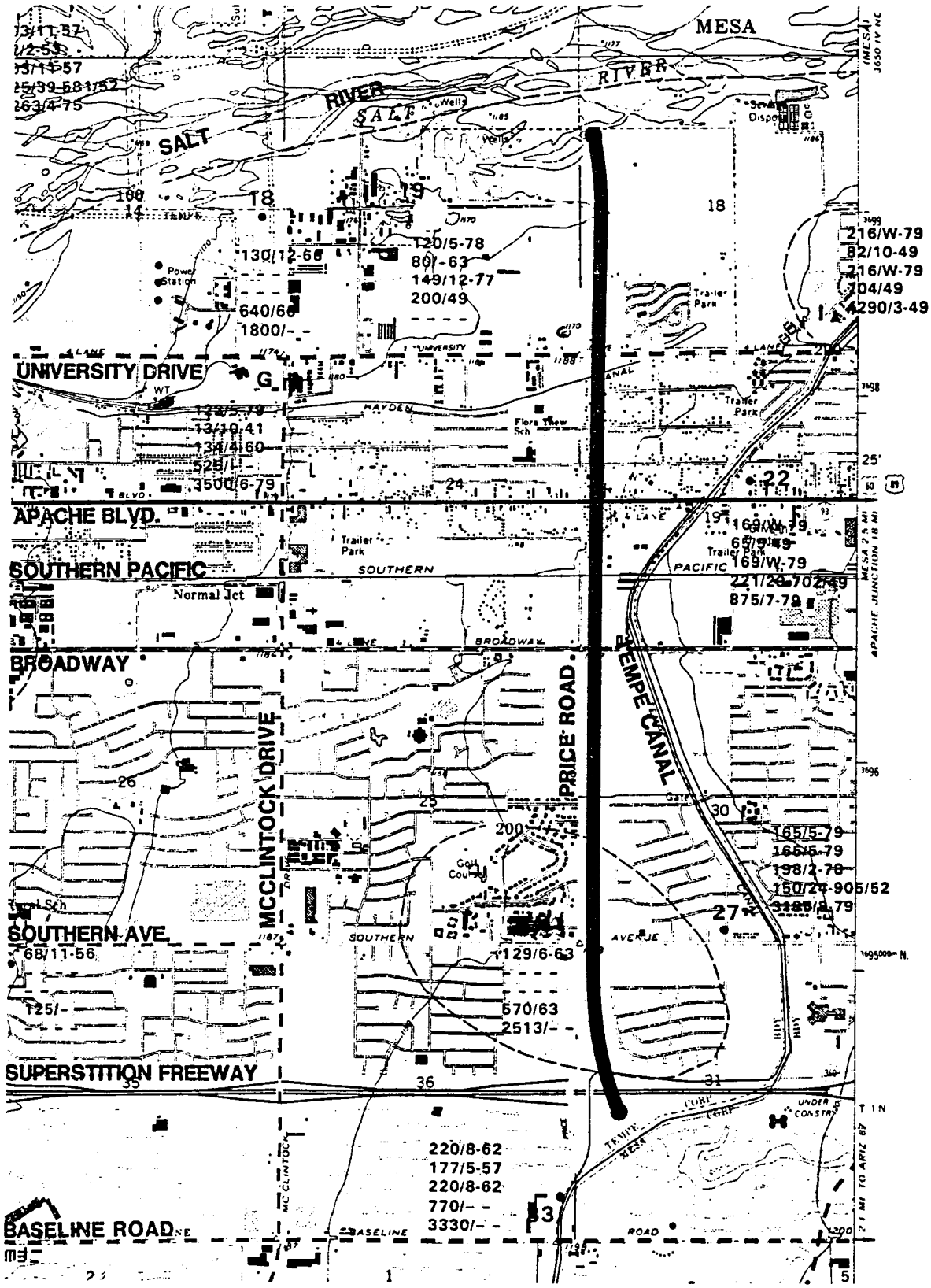
CRSS

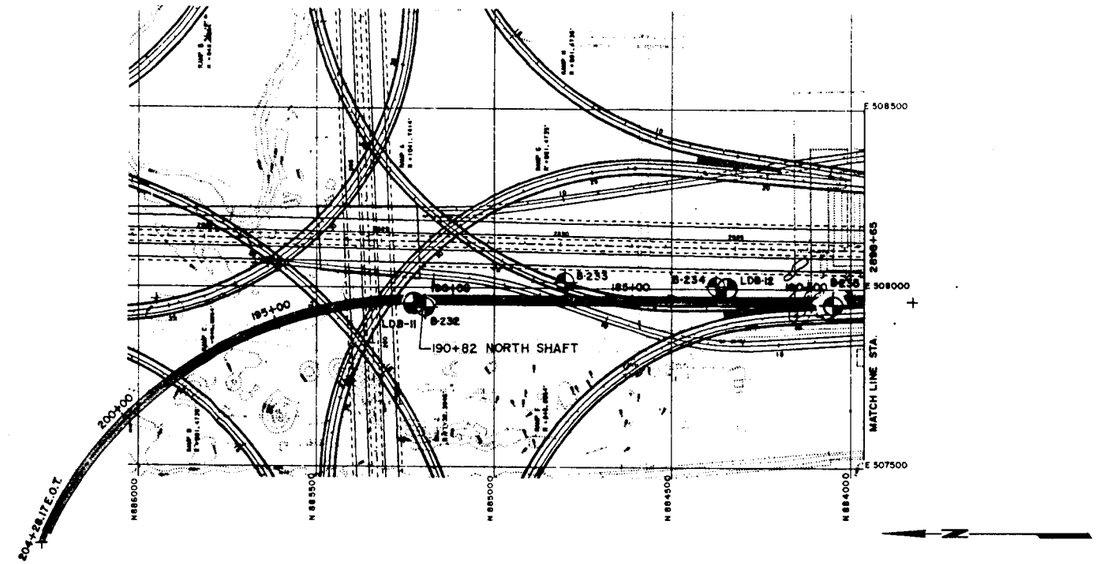
FIGURE 1.1
PROJECT LOCUS

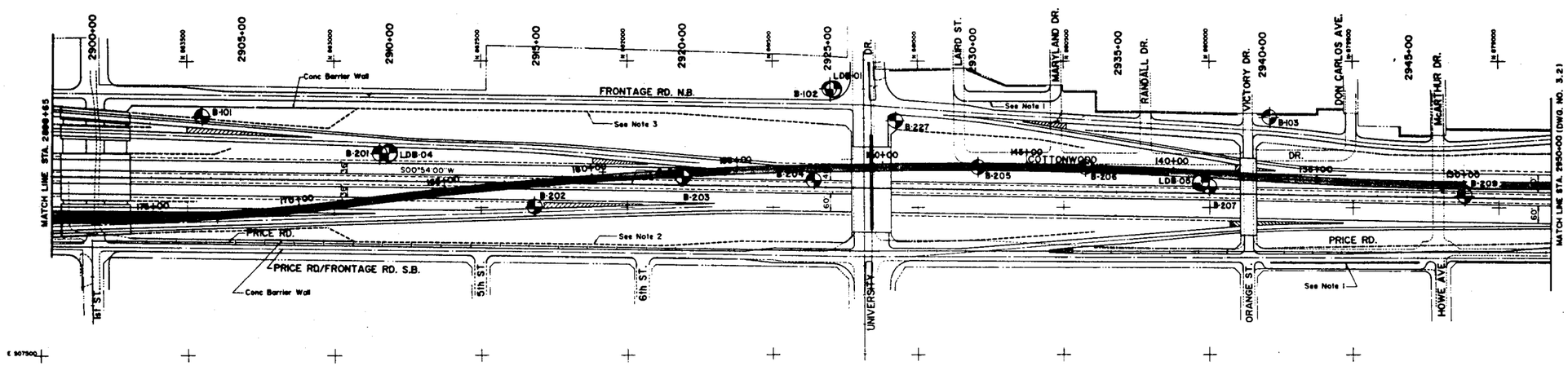


CRSS

FIGURE 2.1
PROJECT LOCATION DIAGRAM





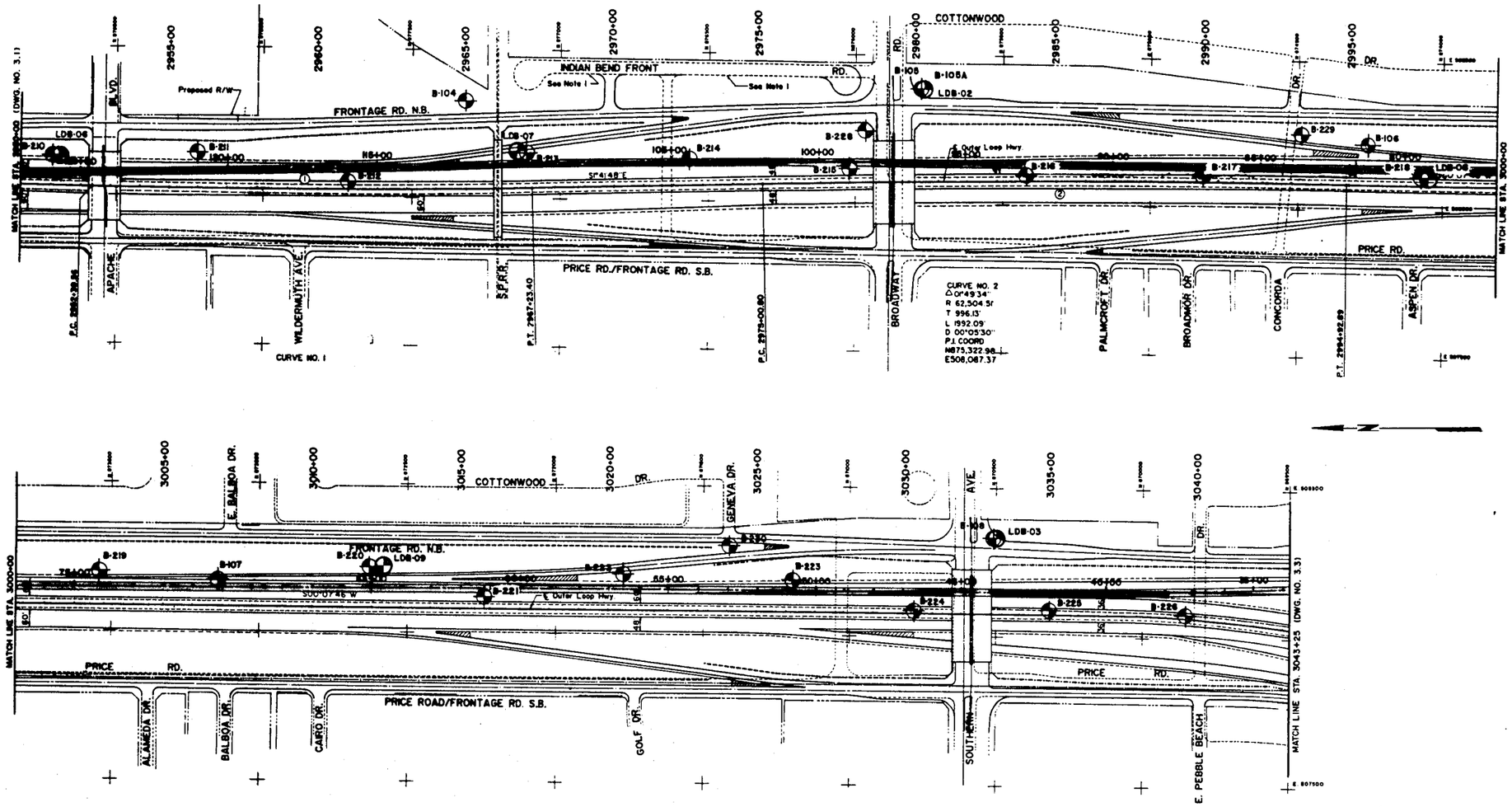


FOR NOTES & LEGEND, SEE DWG. NO. 3.3

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 127+00 TO 204+28.17
DWG. TITLE	BORING LOCATION DIAGRAM
DESIGNED BY: DSH DRAWN BY: ACB CHECKED BY: DSH PROJECT NO. 11106.00 DATE MAY 1987	CRSS INC 216 16TH STREET SUITE 1700 DENVER COLORADO 80202 (303) 620 5240 DWG. NO. 3.1
SCALE	1"=400'



FOR NOTES & LEGEND, SEE DWG. NO. 3.3

CRSS

CRS SIRRINE

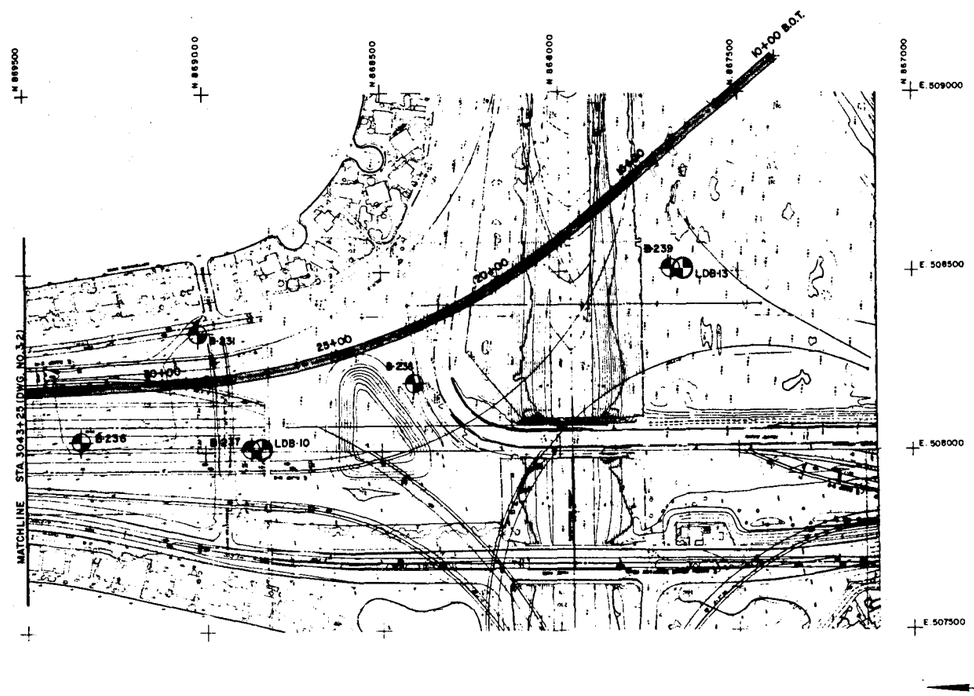
CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 33+80 TO 127+00
DWG. TITLE	BORING LOCATION DIAGRAM
DESIGNED BY DSH	CRSS, INC. 7979 E. TUFTS AVENUE PKWY. DENVER, COLORADO 80237 (303) 820-5240
DRAWN BY ACB	SCALE 1"=400'
CHECKED BY DSH	
PROJECT NO. 11106.00	DWG. NO. 3.2
DATE MAY 1987	

NOTES

1. SEE DWGS. 4.2 THROUGH 4.5 FOR GEOLOGIC CROSS-SECTIONS ALONG TUNNEL ALIGNMENT.
2. BASE MAP FROM 30% SUBMITTAL PRELIMINARY PLAN, PROVIDED BY TAMS CONSULTANTS, DECEMBER 10, 1986.
3. THREE COORDINATES SHOWN; STATE PLANE COORDINATES, OUTER LOOP HIGHWAY STATIONS AND TUNNEL STATIONS NOTED ON LEGEND.

LEGEND

- B-101 REVERSE CIRCULATION HAMMER DRILL BORING
- LDB-01 LARGE DIAMETER BORING.
- E507500 STATE PLANE COORDINATES
- 2905+00 OUTER LOOP HIGHWAY STATIONS
- 165+00 TUNNEL STATIONS



CRSS

CRS SIRRINE

DELEUW CATHER AND COMPANY

PRICE ROAD DRAIN TUNNEL

STA. 10+00 TO 33+80

BORING LOCATION DIAGRAM

DSH
ACB
DSH
11106.00
MAY 1987

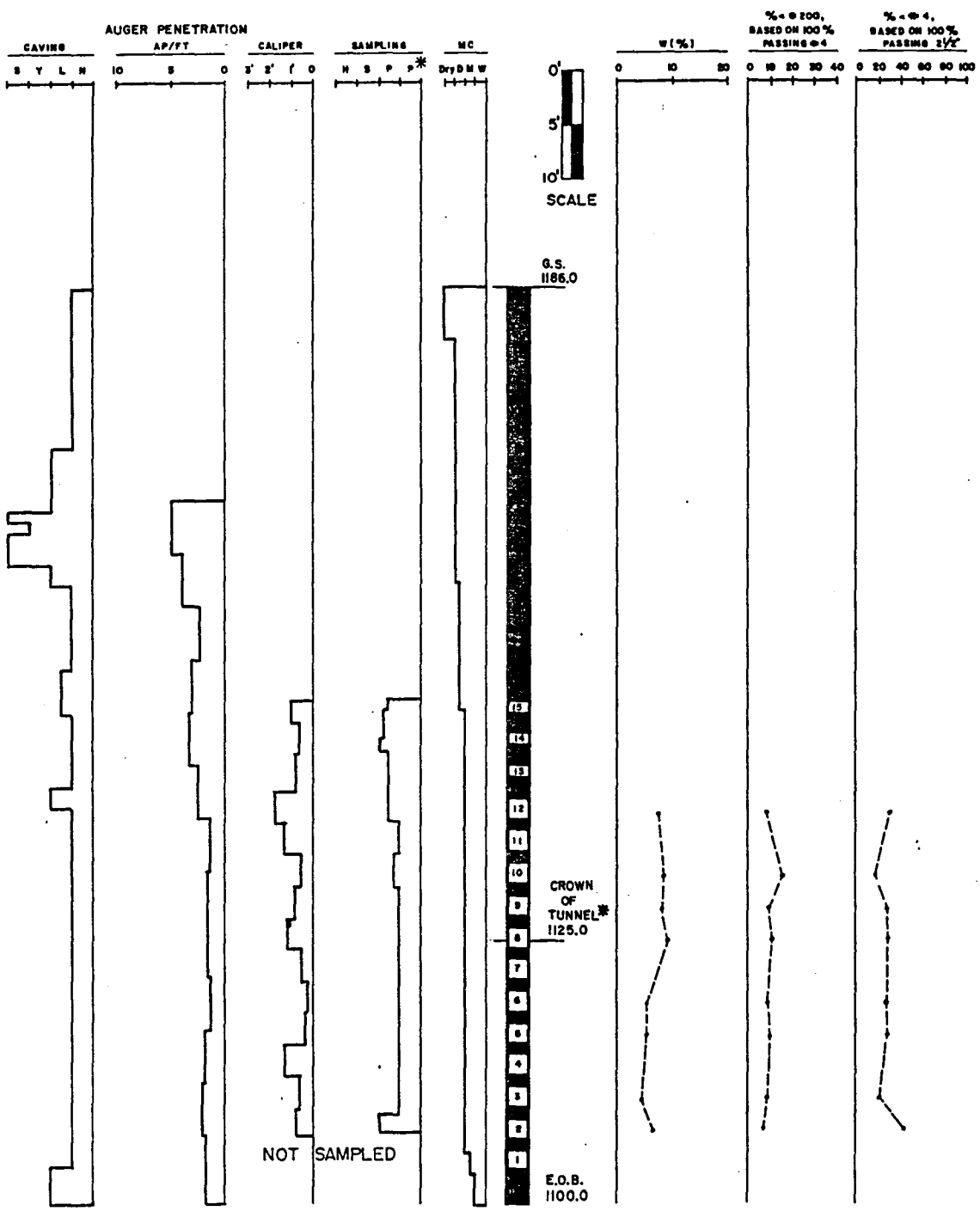
1" = 400'

33

FIGURE 3.4

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-01

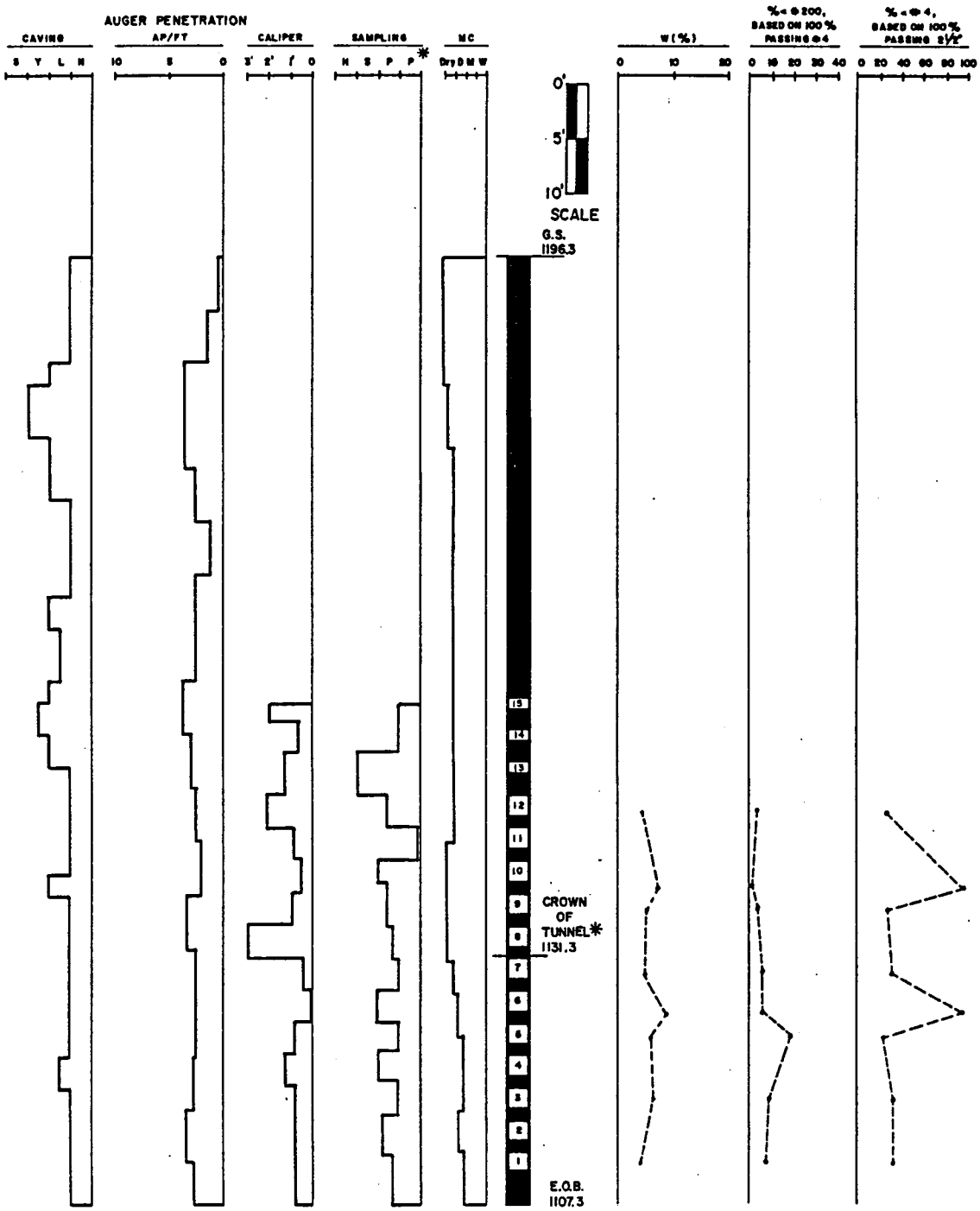


* BASED ON 30% DESIGN SUBMITTAL FROM [illegible]

FIGURE 3.5

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-02

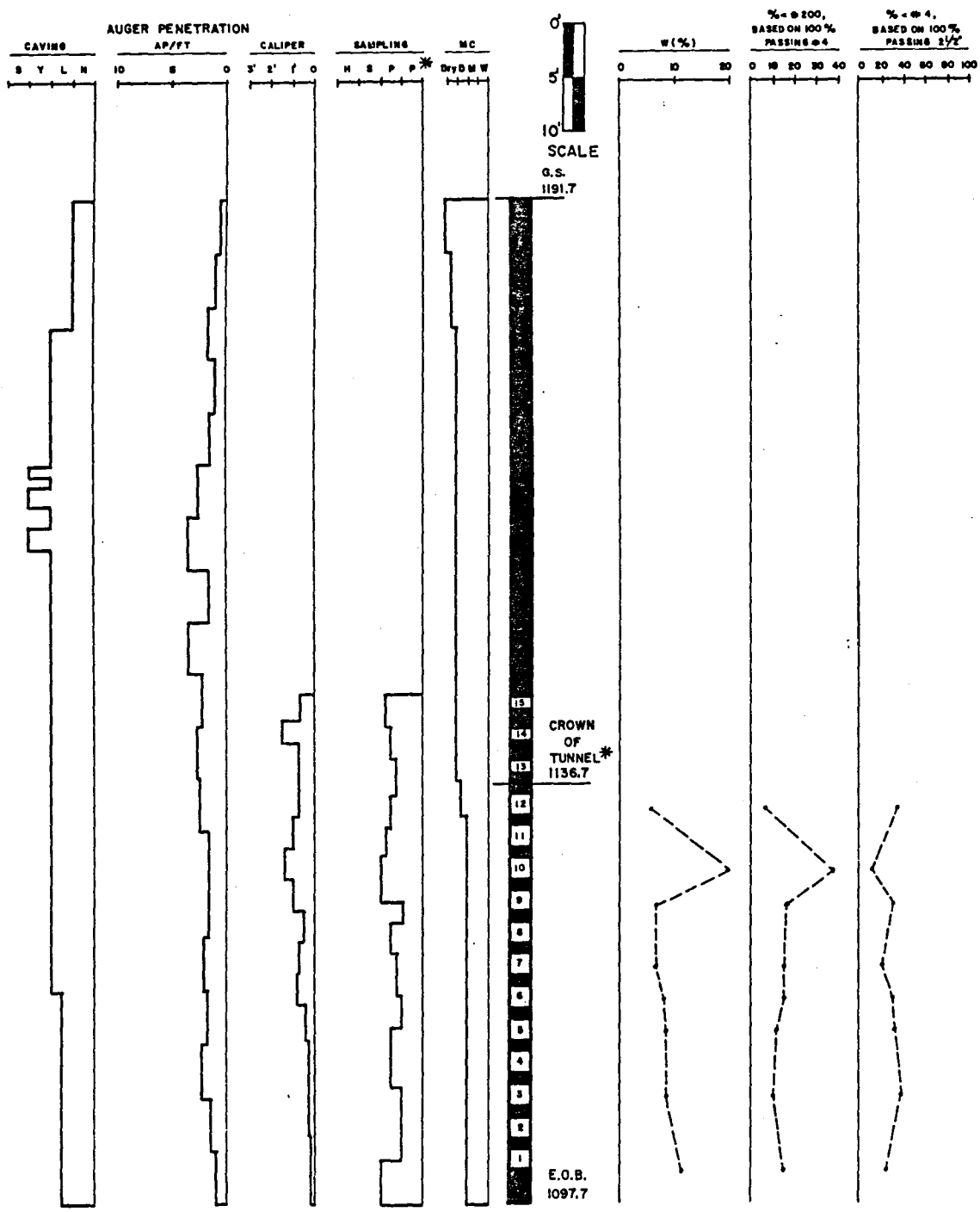


* BASED ON 30 % DESIGN SUBMITTAL FROM HNTB

FIGURE 3.6

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-03

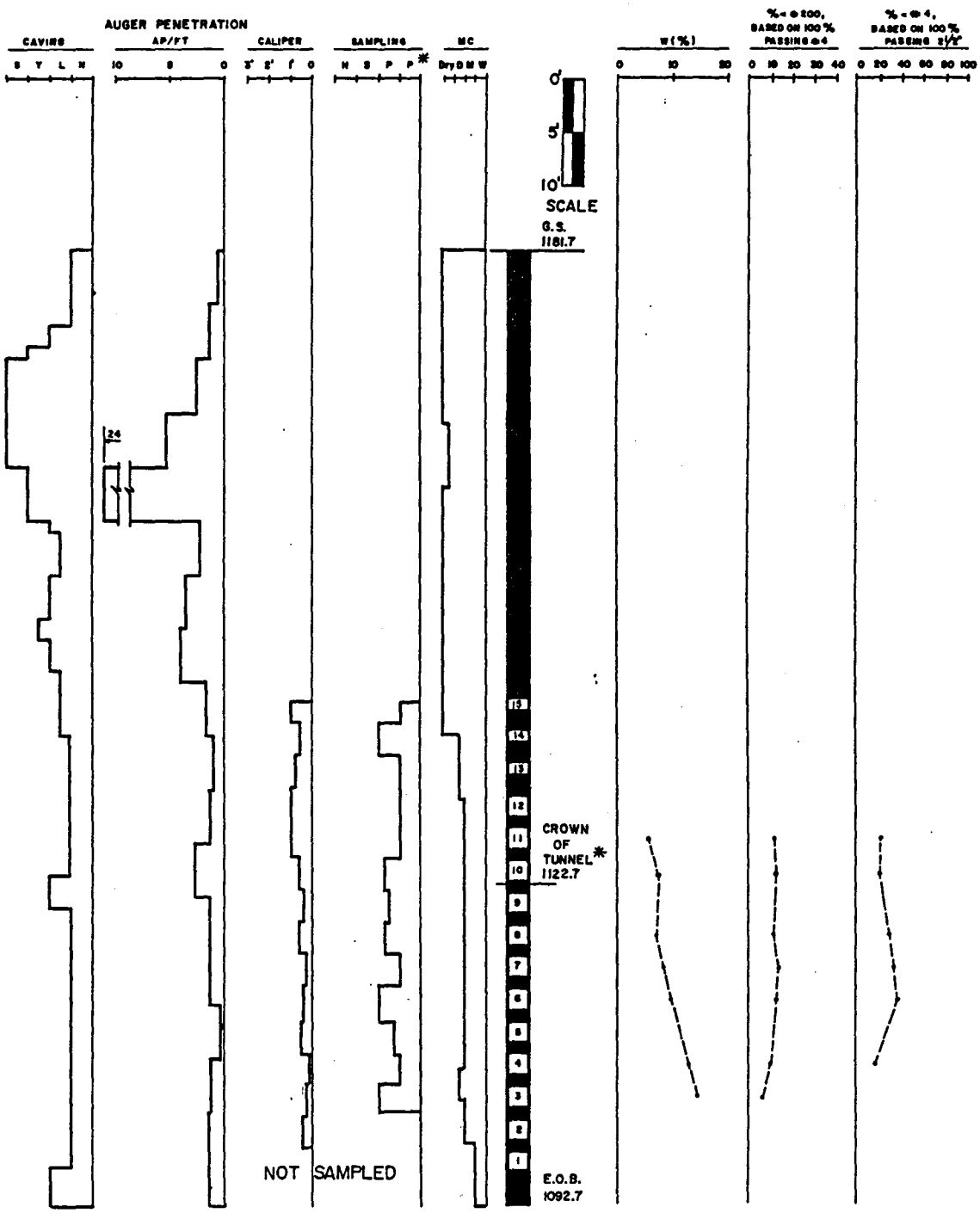


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.7

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-04

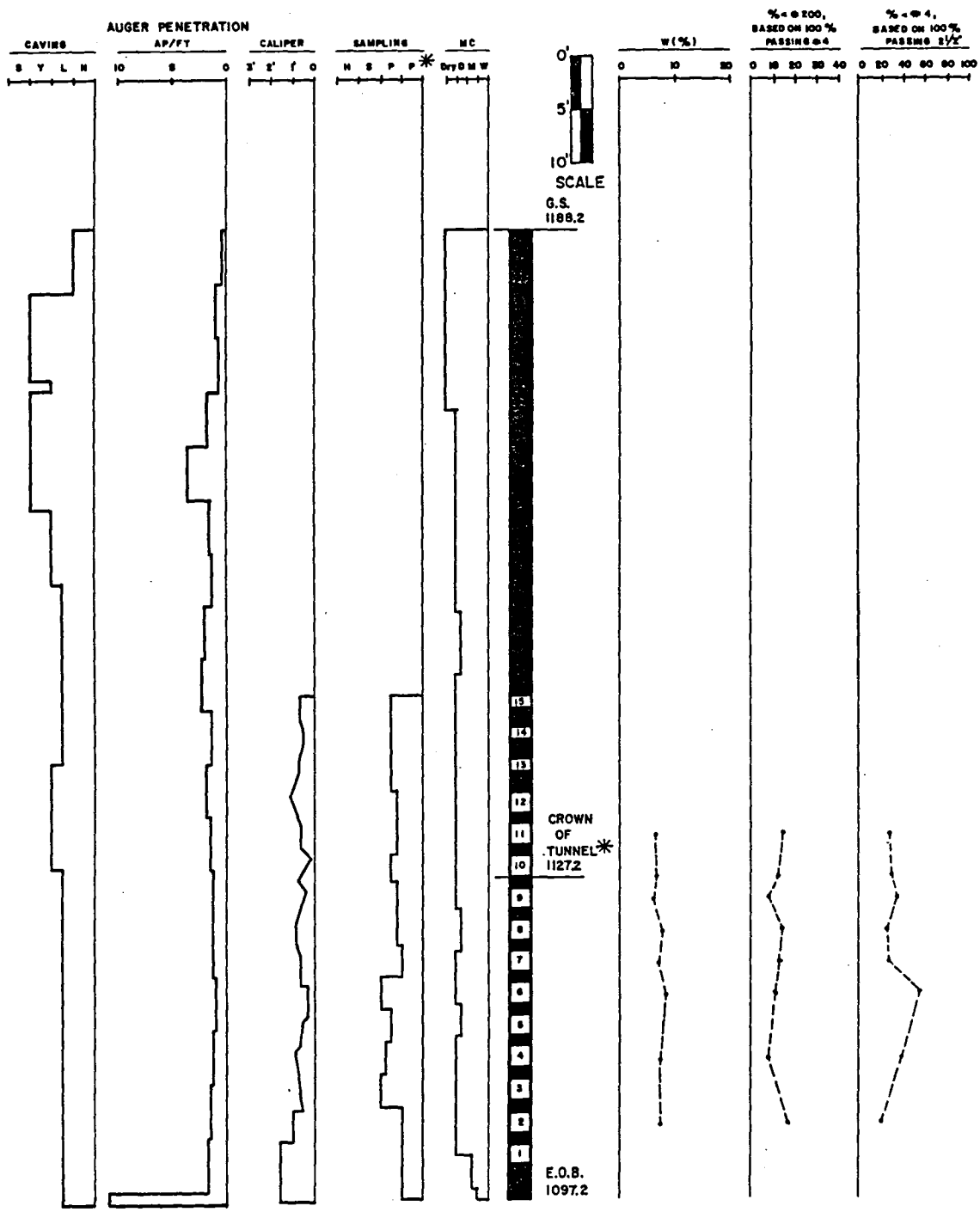


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.8

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-05

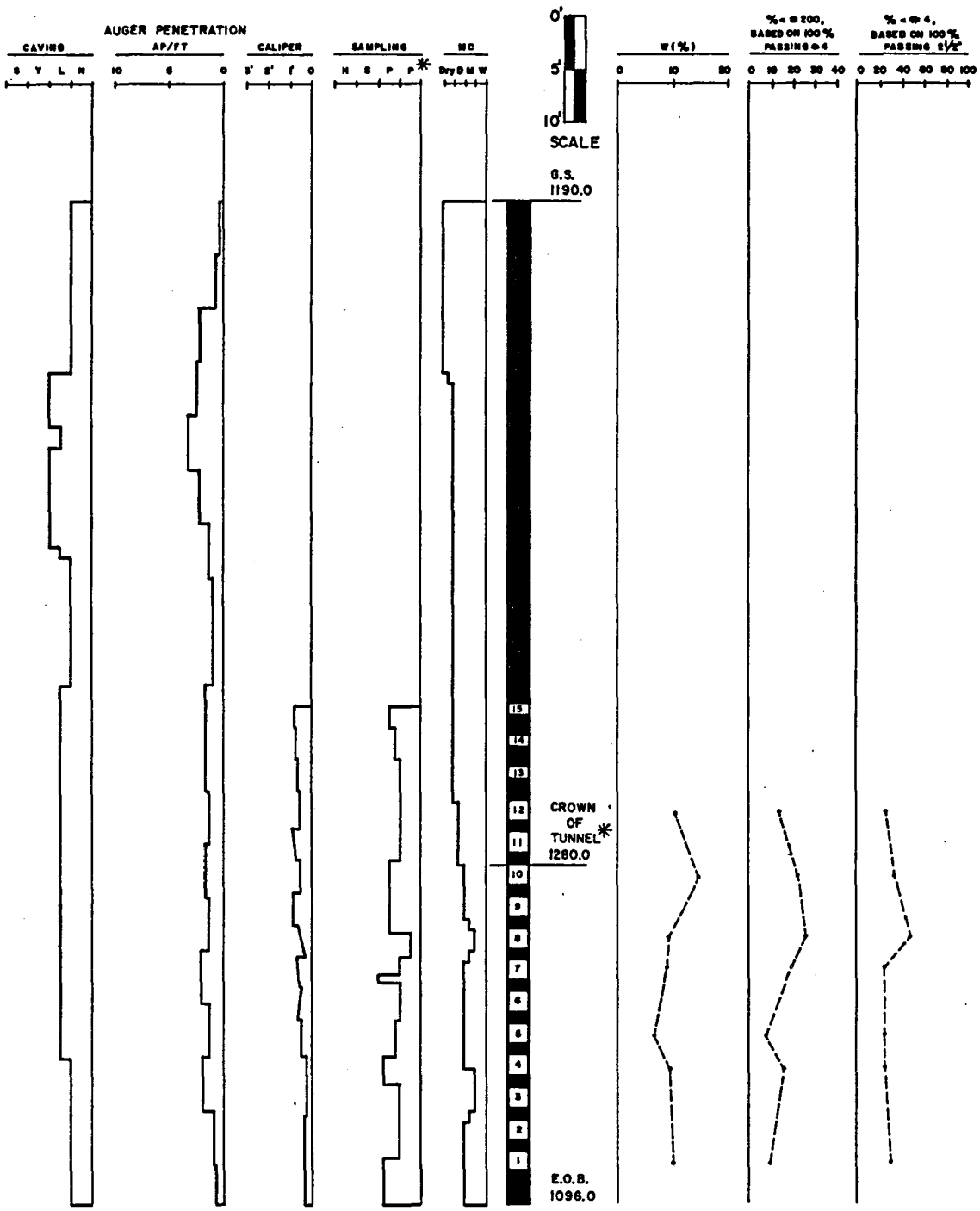


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.9

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-06

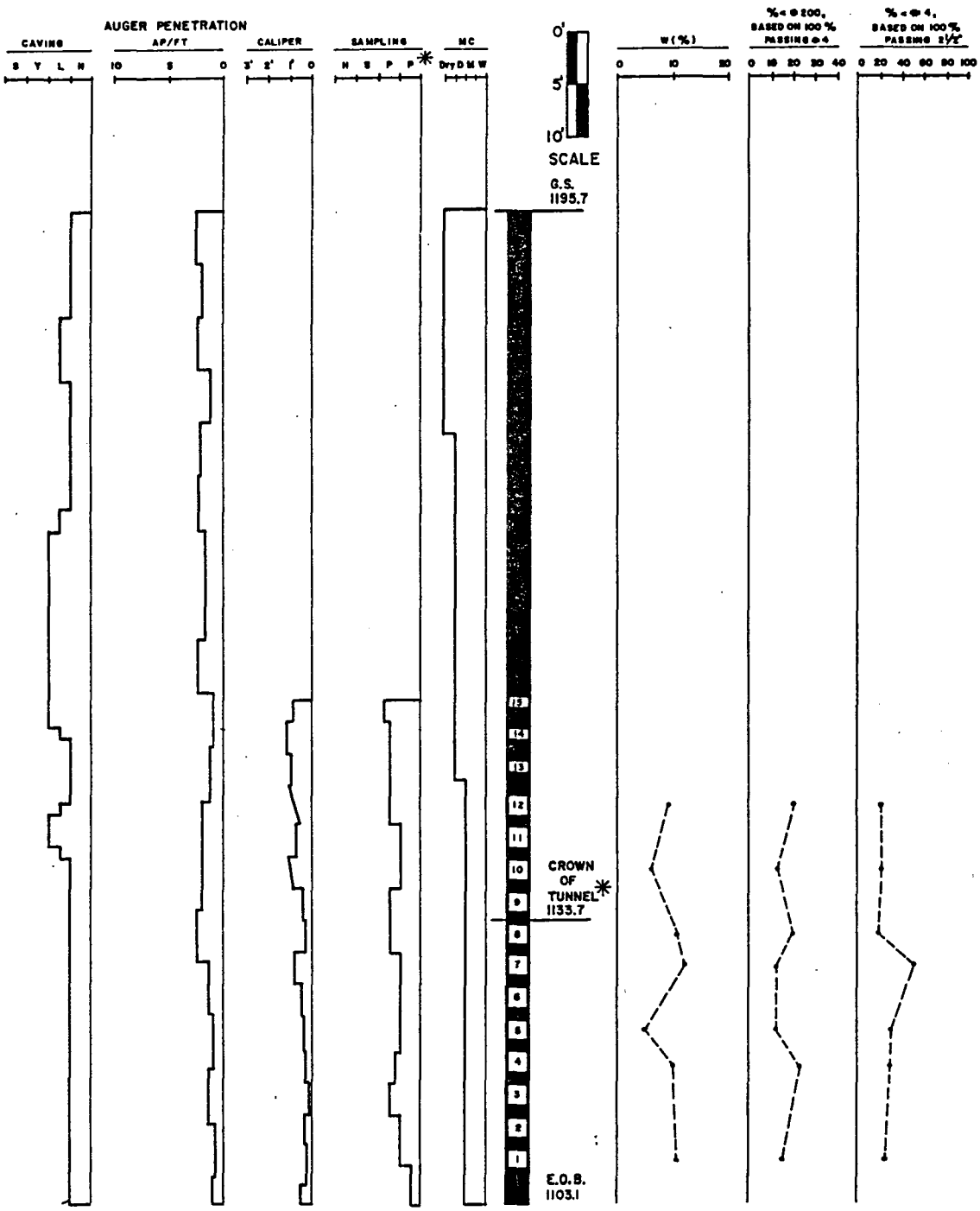


* BASED ON 30% DESIGN SUBMITTAL BY HNTB

FIGURE 3.10

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-07

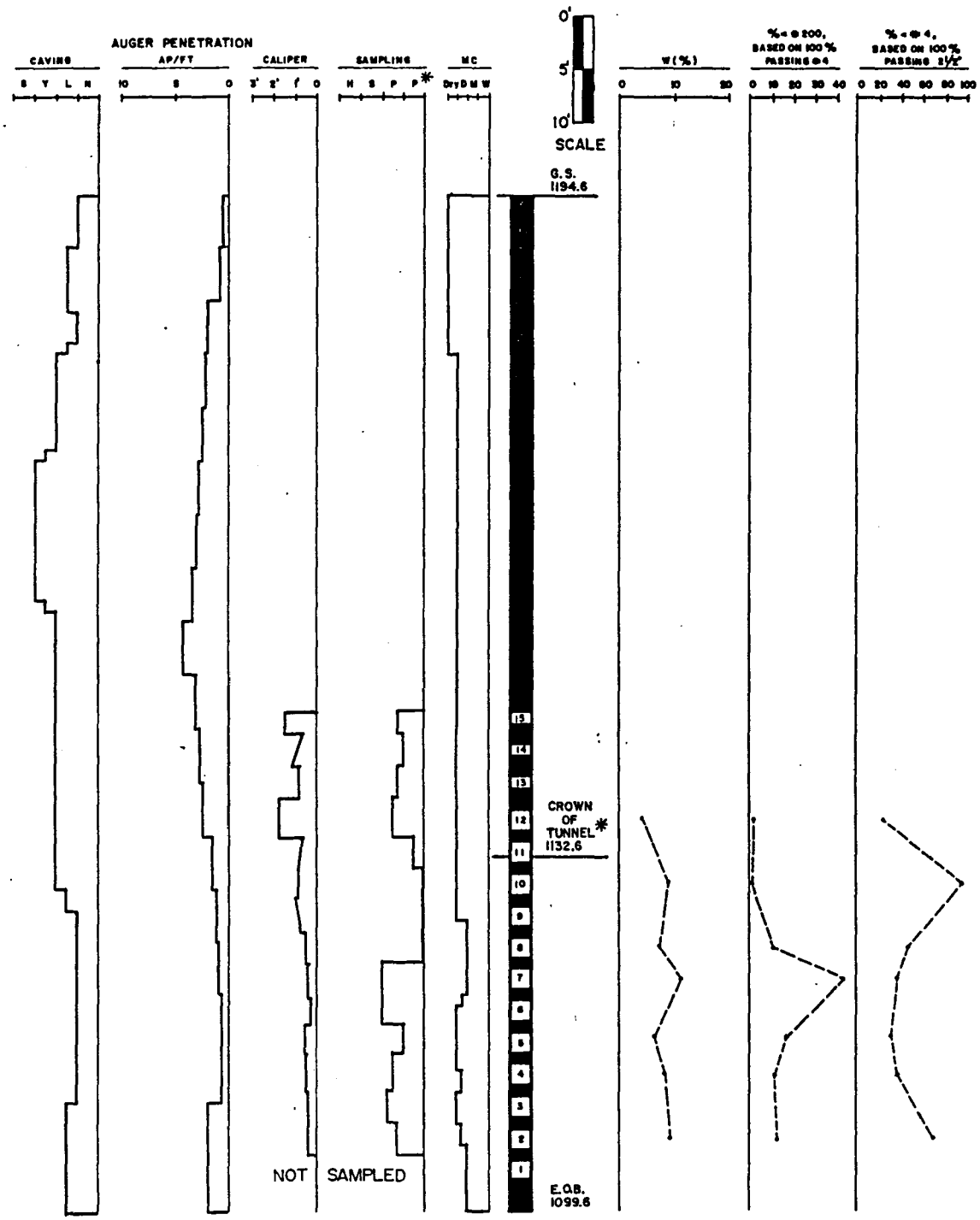


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.11

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-08

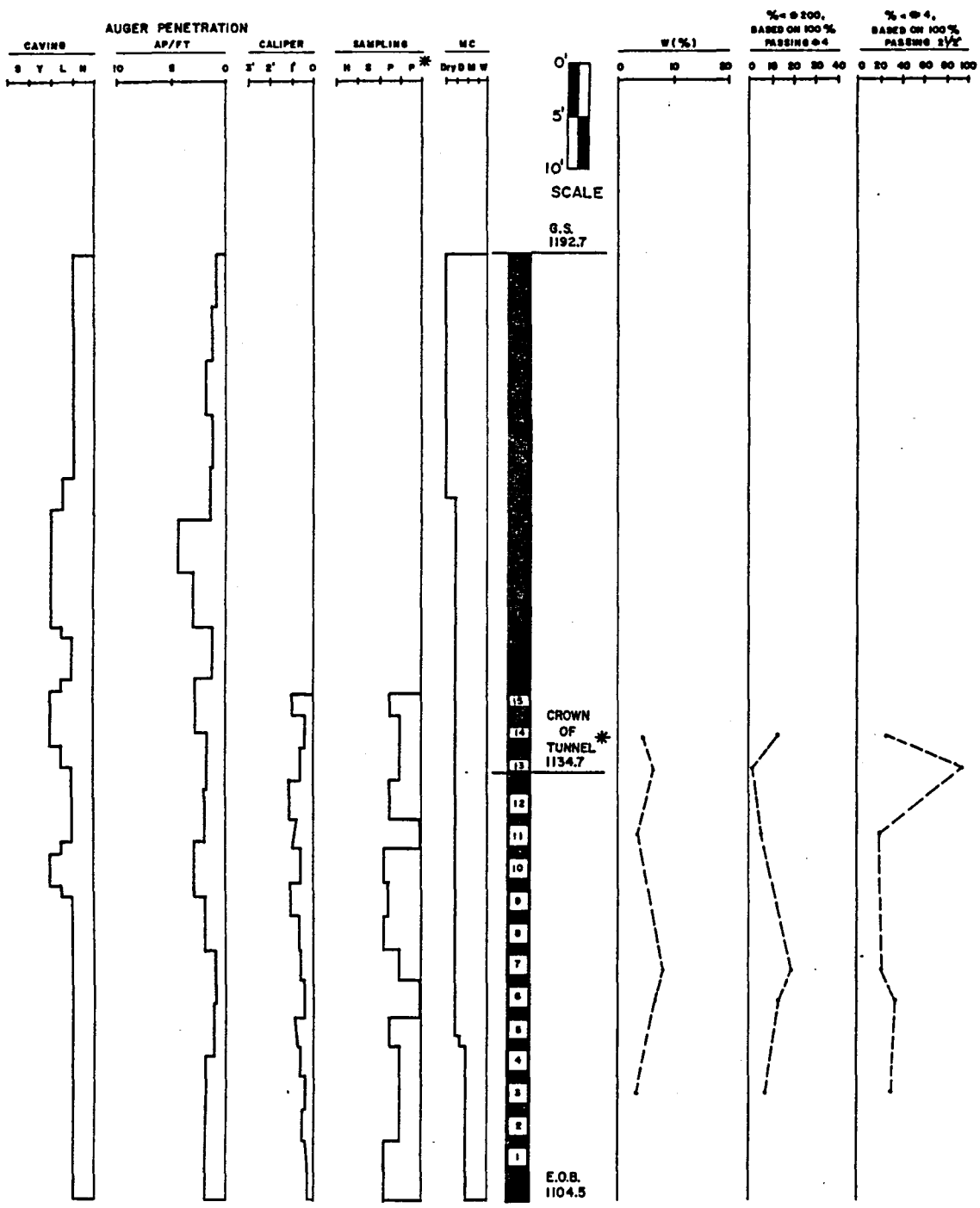


* BASED ON 30% DESIGN SUBMITTAL BY HNTB

FIGURE 3.12

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-09

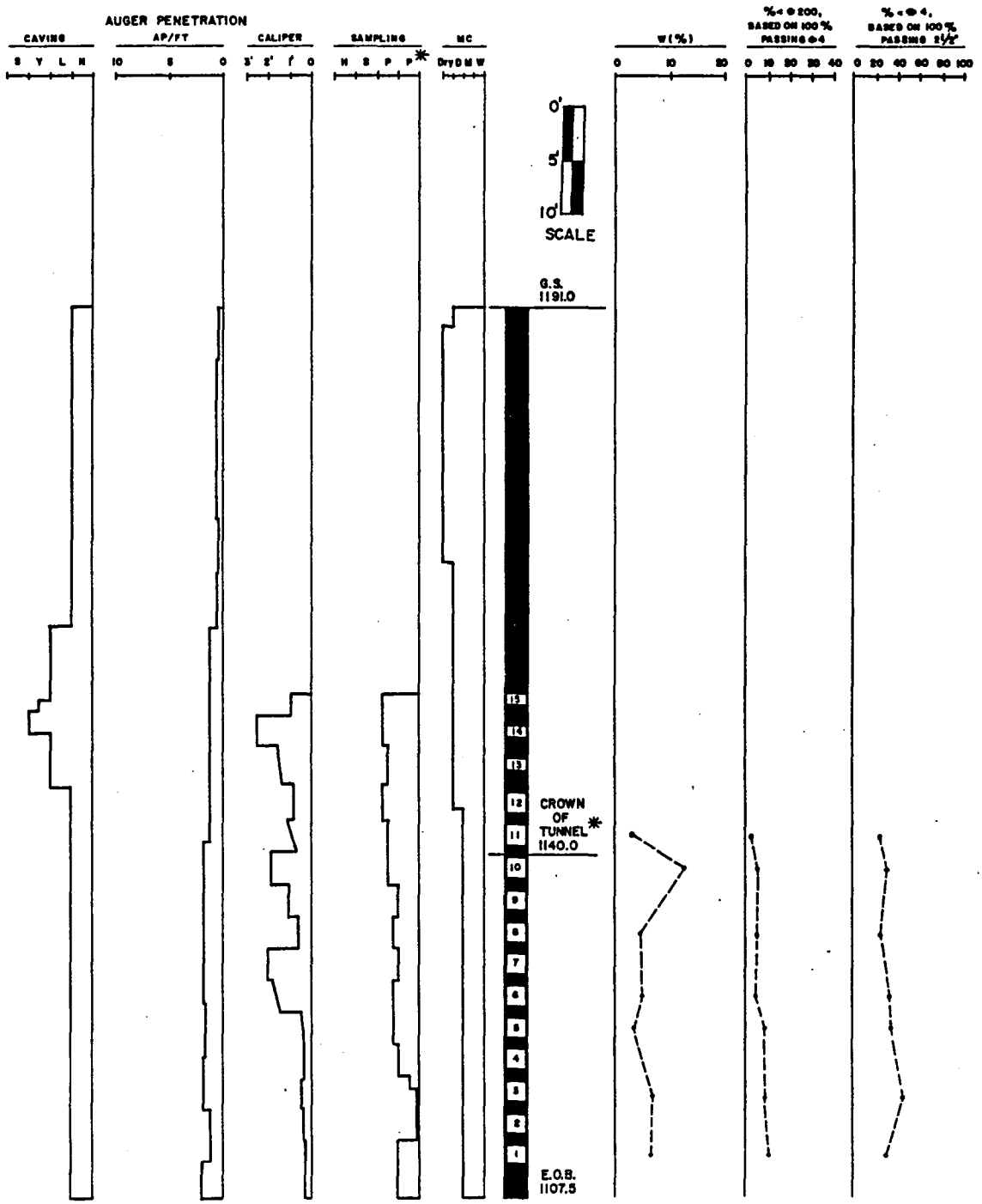


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.13

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-10

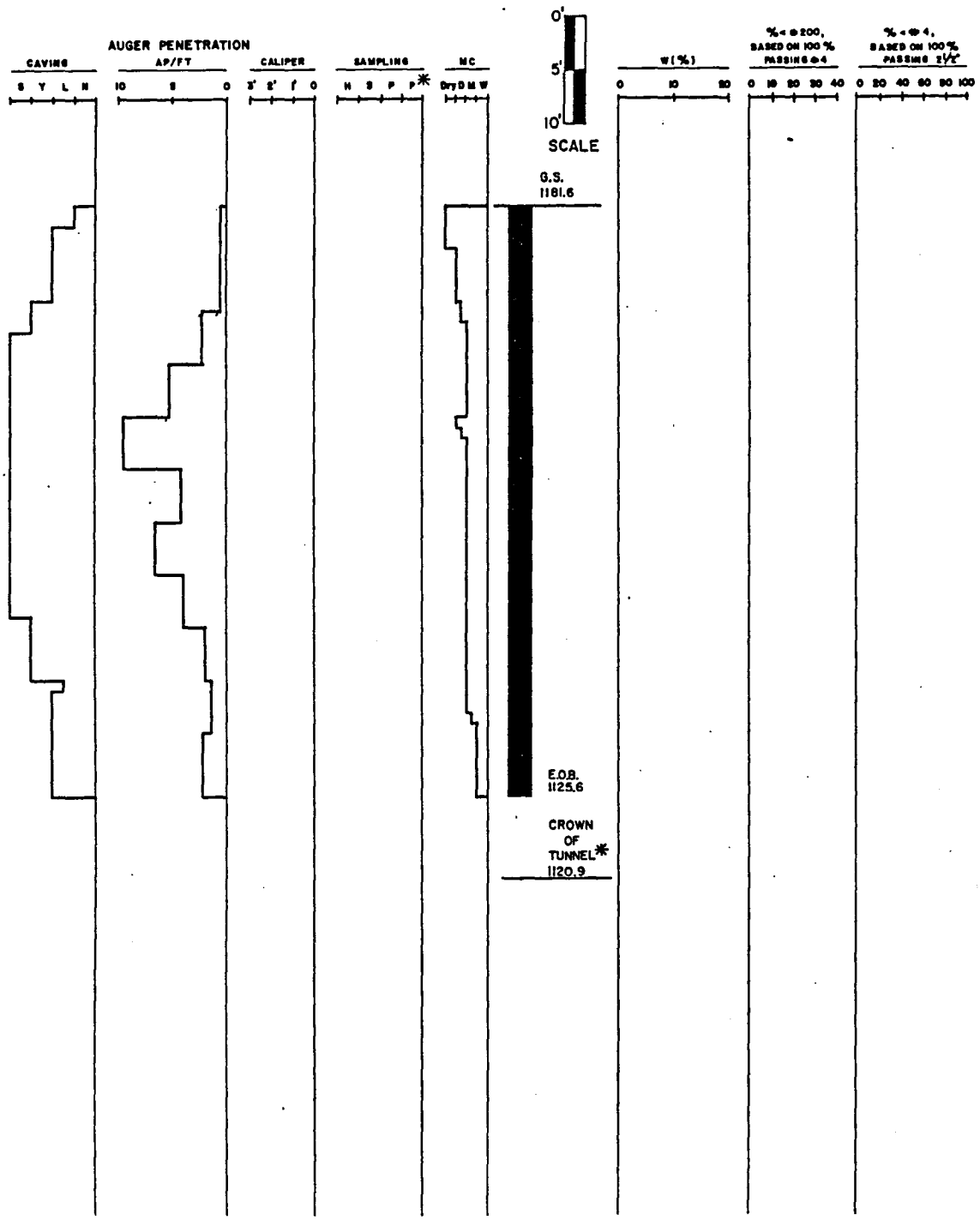


* BASED ON 30% DESIGN SUBMITTAL FROM HNTB

FIGURE 3.14

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-11



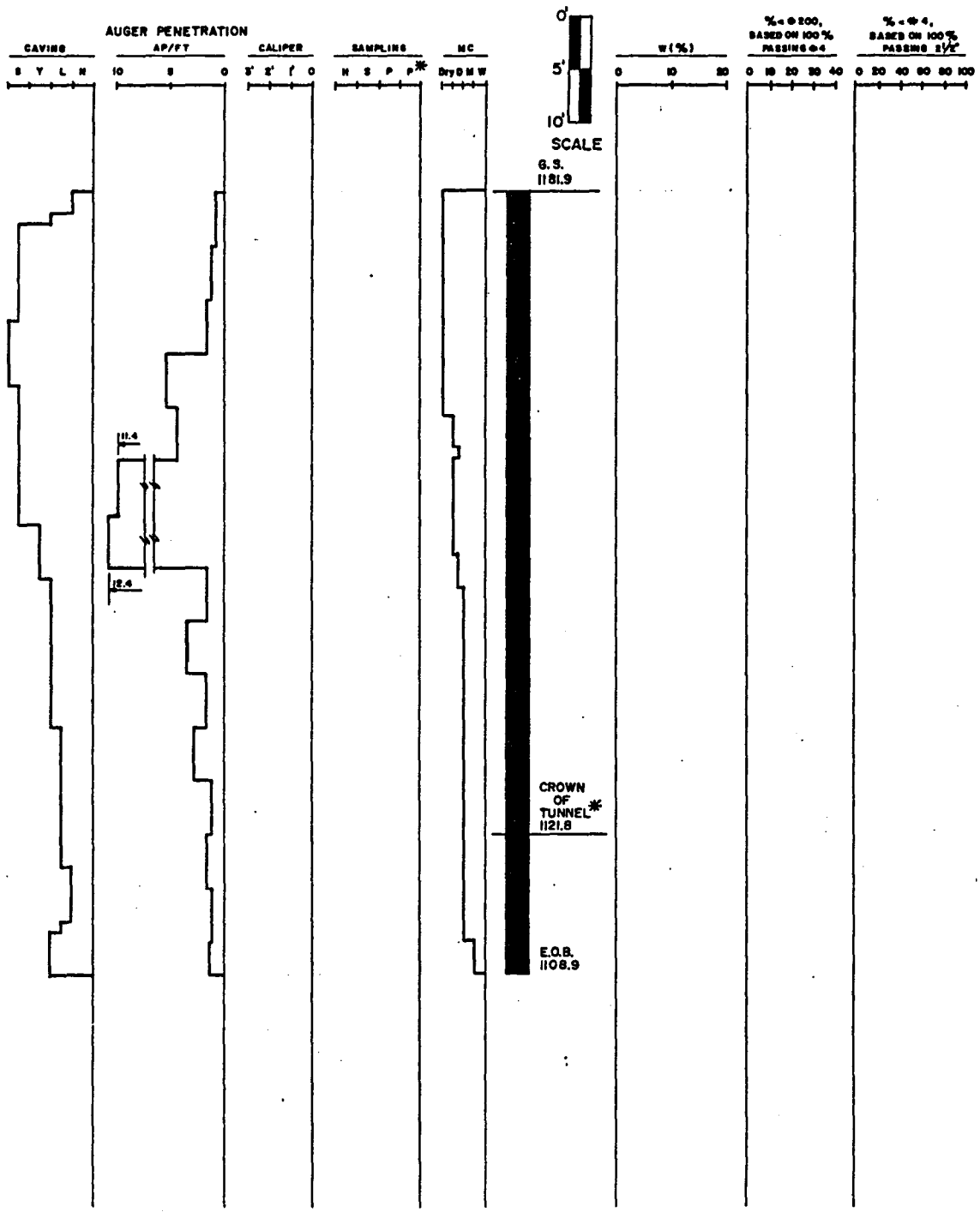
NOTE: BORING ABANDONED @ 56.0' - NO SAMPLES TAKEN.

* BASED ON 30% DESIGN SUBMITTAL BY HNTB

FIGURE 3.15

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-12



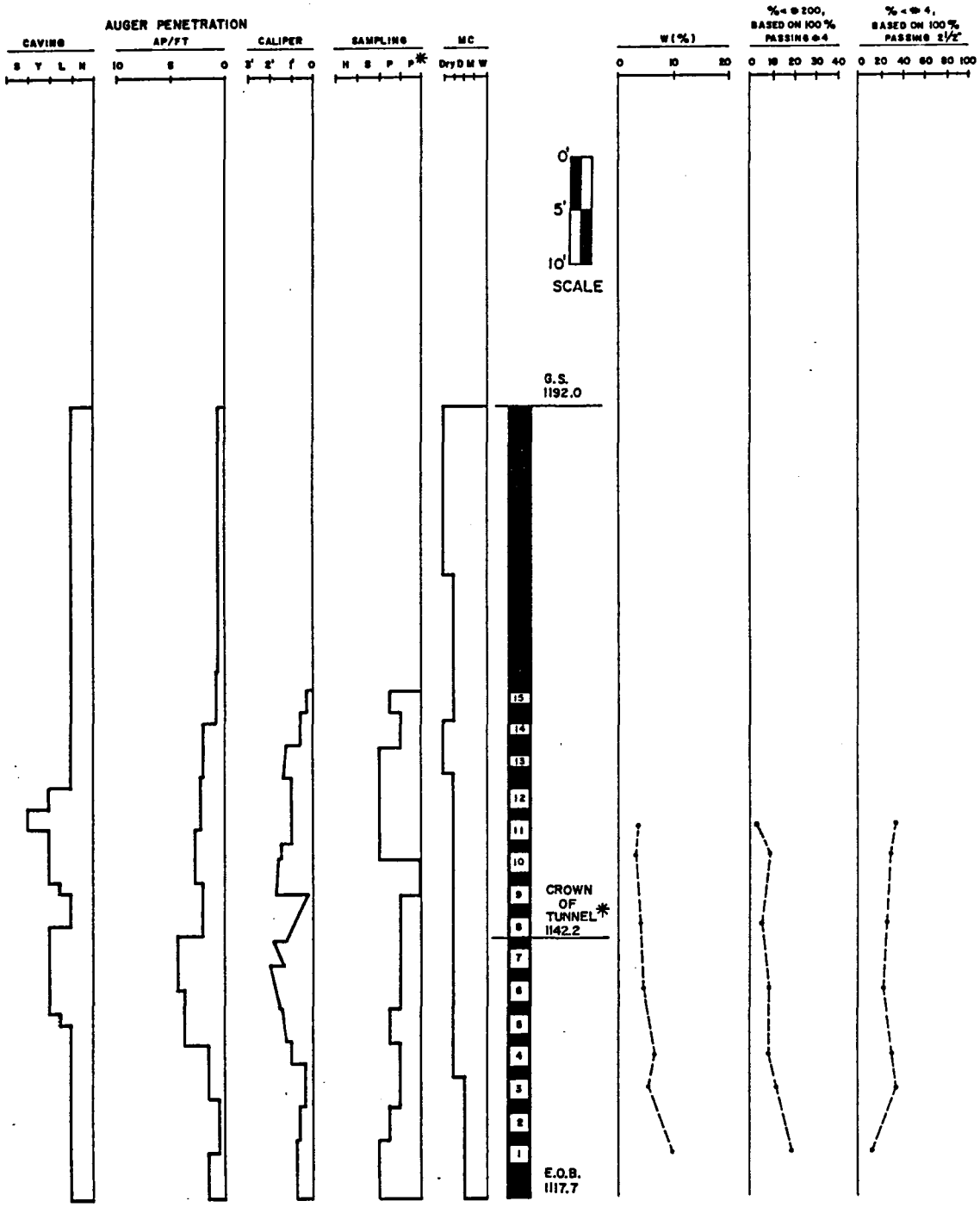
NOTE: BORING ABANDONED @ 73.0' – NO SAMPLES TAKEN.

* BASED ON 30% DESIGN SUBMITTAL BY HNTB

FIGURE 3.16

PRICE ROAD DRAIN TUNNEL

DATA PROFILE-BORING LDB-13



* BASED ON 30% DESIGN SUBMITTAL BY HNTB

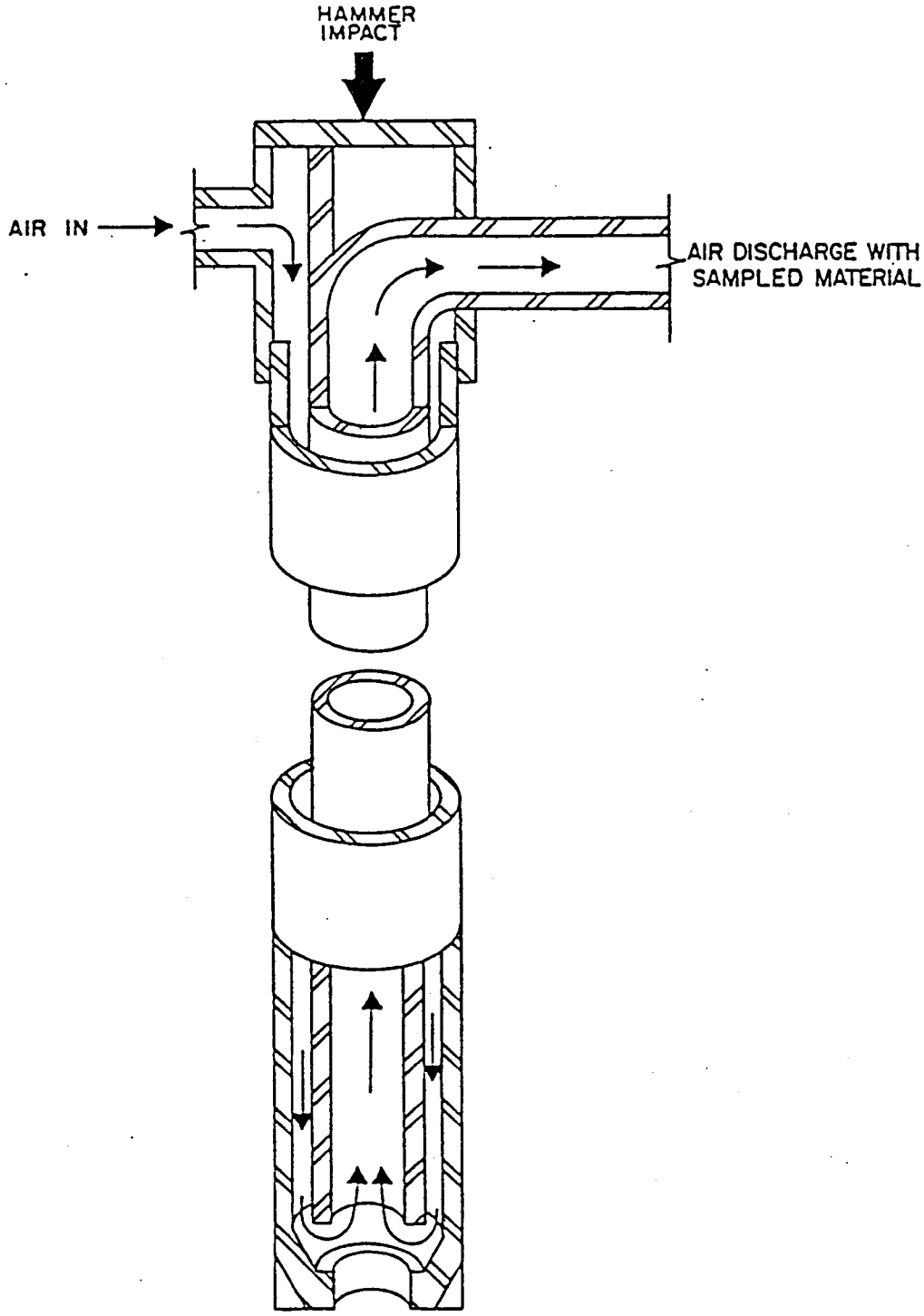


FIGURE 3.17
REVERSE CIRCULATION HAMMER DRILL PROCESS

Source: Harder, L.F. Jr. and Seed, H.B.; Determination of Penetration Resistance for Coarse Grained Soils Using the Becker Hammer Drill, University of California, Berkeley, Earthquake Engineering Research Center, Report No. UCB/EERC-86/06, May 1986.

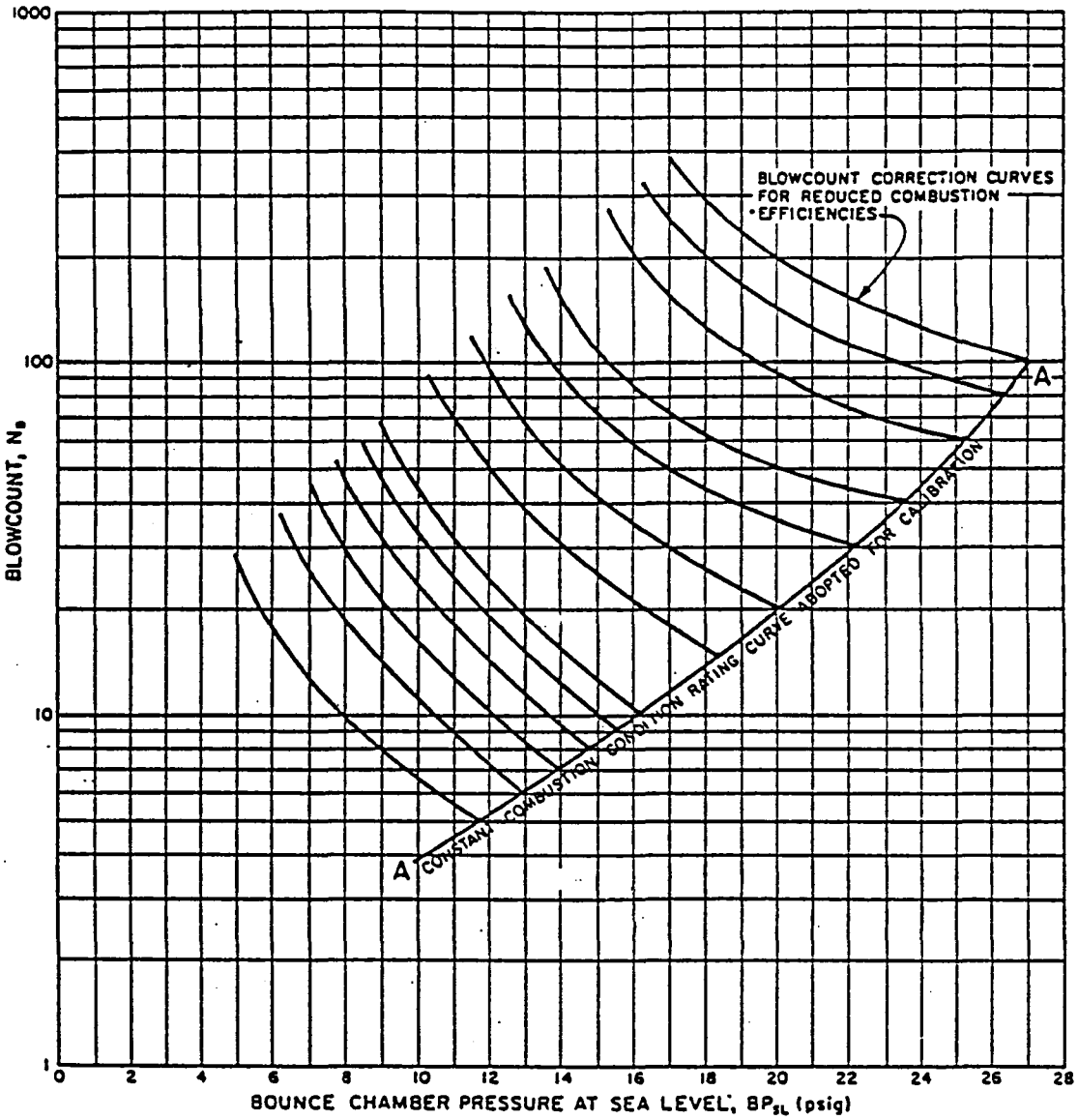


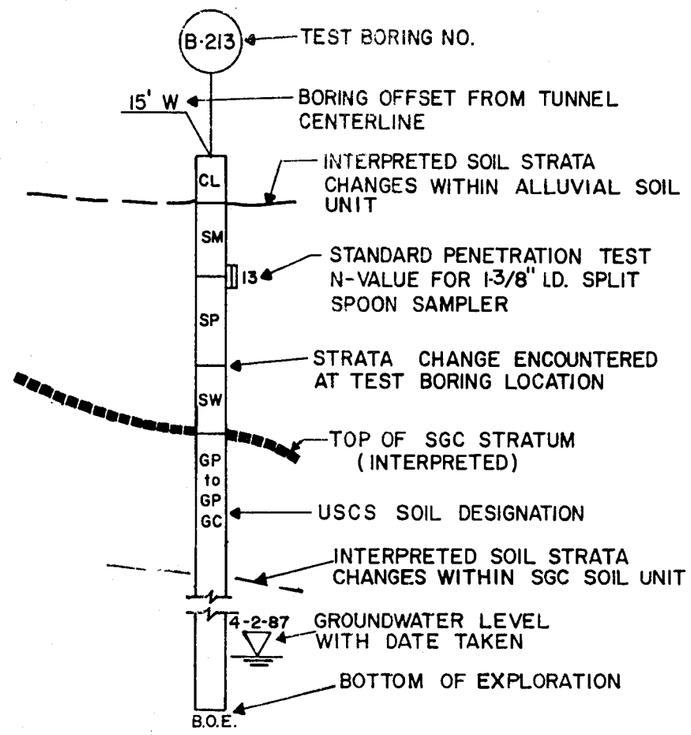
FIGURE 3.18
HAMMER DRILL BLOW COUNT CORRECTION CURVES

Source: Harder, L.F. Jr. and Seed, H.B.; Determination of Penetration Resistance for Coarse Grained Soils Using the Becker Hammer Drill, University of California, Berkeley, Earthquake Engineering Research Center, Report No. UCB/EERC-86/06, May 1986.

SOIL UNIT LEGEND

- A_1 NON-CEMENTED, SURFICIAL ALLUVIUM
- A_2 CALCIUM CARBONATE CEMENTED, SURFICAL ALLUVIUM
- B_1 SAND-GRAVEL-COBBLE (SGC) WITH NO CLAY
- B_2 SAND-GRAVEL-COBBLE (SGC) WITH SMALL AMOUNTS OF CLAY
- B_3 SAND-GRAVEL-COBBLE (SGC) WITH SOME CLAY
- INTERPRETED EXTENT OF MODERATELY DEVELOPED CALCIUM CARBONATE CEMENTATION
- INTERPRETED EXTENT OF WELL DEVELOPED CALCIUM CARBONATE CEMENTATION

LEGEND



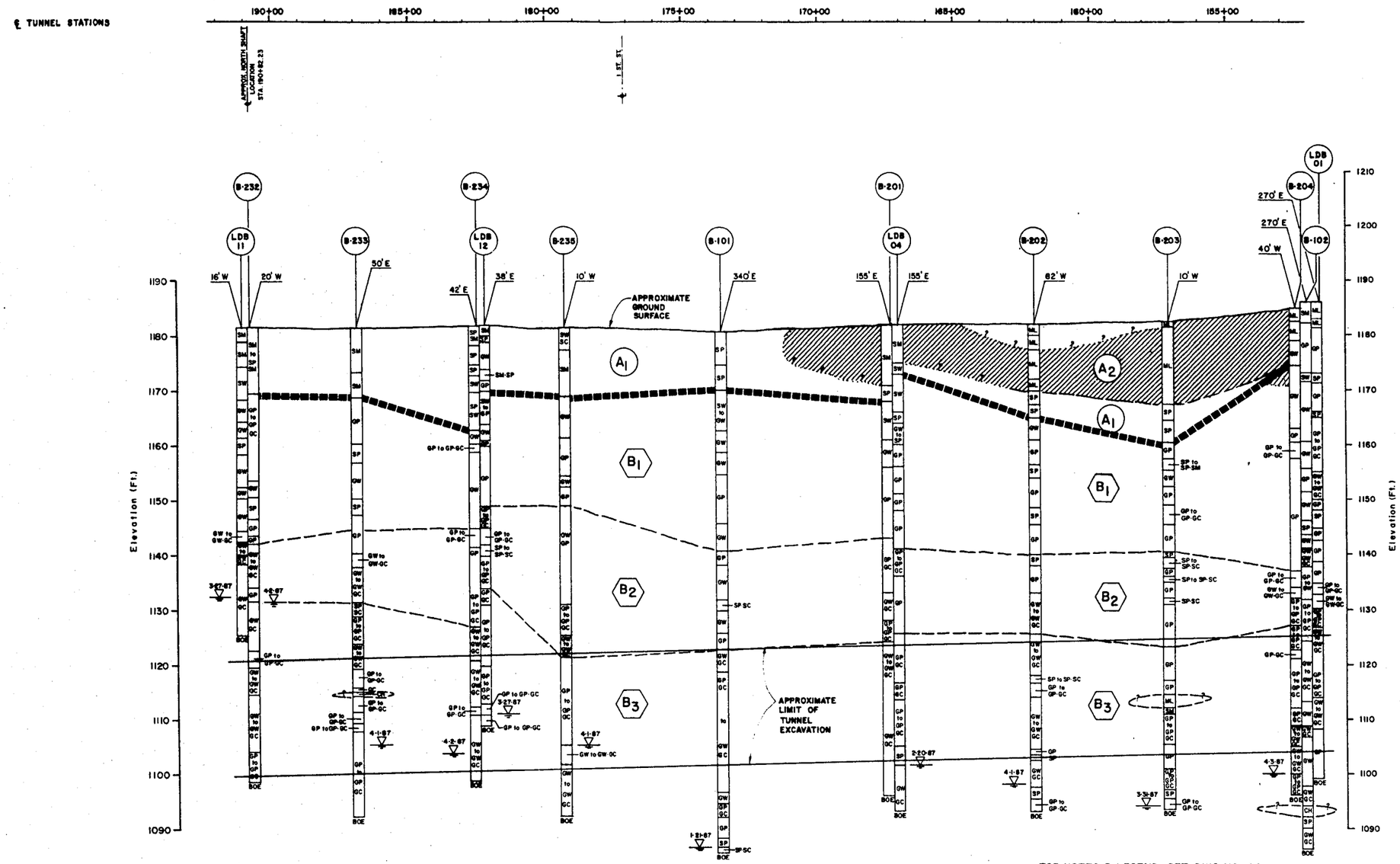
NOTES

1. SEE FIGURES 3.1 THROUGH 3.3 FOR BORING LOCATIONS.
2. APPROXIMATE TUNNEL ALIGNMENT AND TUNNEL ELEVATIONS ARE TAKEN FROM 30 PERCENT DESIGN DRAWINGS BY HNTB.
3. STRATIFICATION LINES SHOWN BETWEEN SOIL LAYERS ARE BASED ON INTERPRETATION OF SOIL CONDITIONS LOGGED AT EACH BORING. ALL STRATIFICATION LINES INDICATED REPRESENT TRANSITIONAL CHANGES IN SUBSURFACE SOIL CONDITIONS.
4. FOR MORE DETAILED INFORMATION ABOUT SOIL UNITS SHOWN ON SUBSURFACE PROFILES REFER TO SITE CONDITIONS REPORT, FOR THE PRICE ROAD DRAIN TUNNEL, TEMPE, ARIZONA.
5. VERTICAL TO HORIZONTAL EXAGGERATION 20 TO 1.
6. FOR BORING LOCATIONS, OFFSET FROM TUNNEL CENTERLINE AND ELEVATIONS OF BORING COLLAR, BOTTOM OF EXCAVATION, AND TUNNEL CROWN REFER TO TABLE 3.1.
7. B-213 REFERS TO THE LOCATION OF HAMMER DRILL BORINGS, LDB-03 REFERS TO THE LOCATION OF 3FT. DIAMETER, LARGE DIAMETER BORINGS.

CRSS

CRS SIRRINE

CLIENT	DELEUTH CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL
DWG TITLE	SUBSURFACE PROFILE LEGEND
DESIGNED BY DSH	CRSS INC 216 16TH STREET SUITE 1100 DENVER COLORADO 80202 (303) 820 5240
DRAWN BY ACB	SCALE NONE HORIZ VERT
CHECKED BY DSH	
PROJECT NO 11106.00	DWG NO 4.1
DATE MAY 1987	

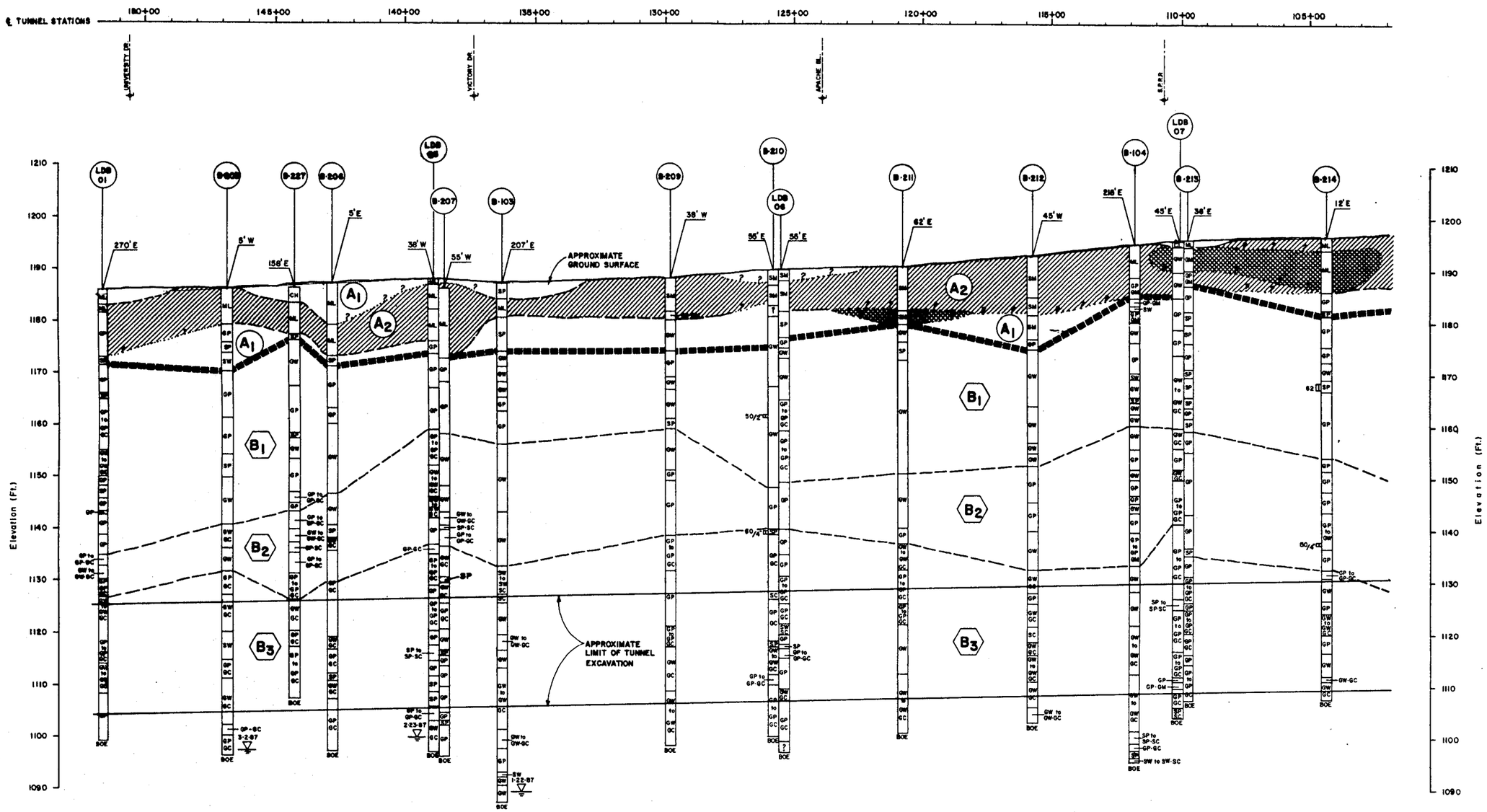


FOR NOTES & LEGEND, SEE DWG. NO. 4.1

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 151+65 TO 191+05
DWG TITLE	SUBSURFACE PROFILE
DESIGNED BY DSH	CRSS INC 216 16TH STREET SUITE 1700 DENVER, COLORADO 80202 (303) 820-5240
DRAWN BY ACB	SCALE: AS NOTED
CHECKED BY DSH	
PROJECT NO 11106.00	DWG NO 4.2
DATE MAY 1987	

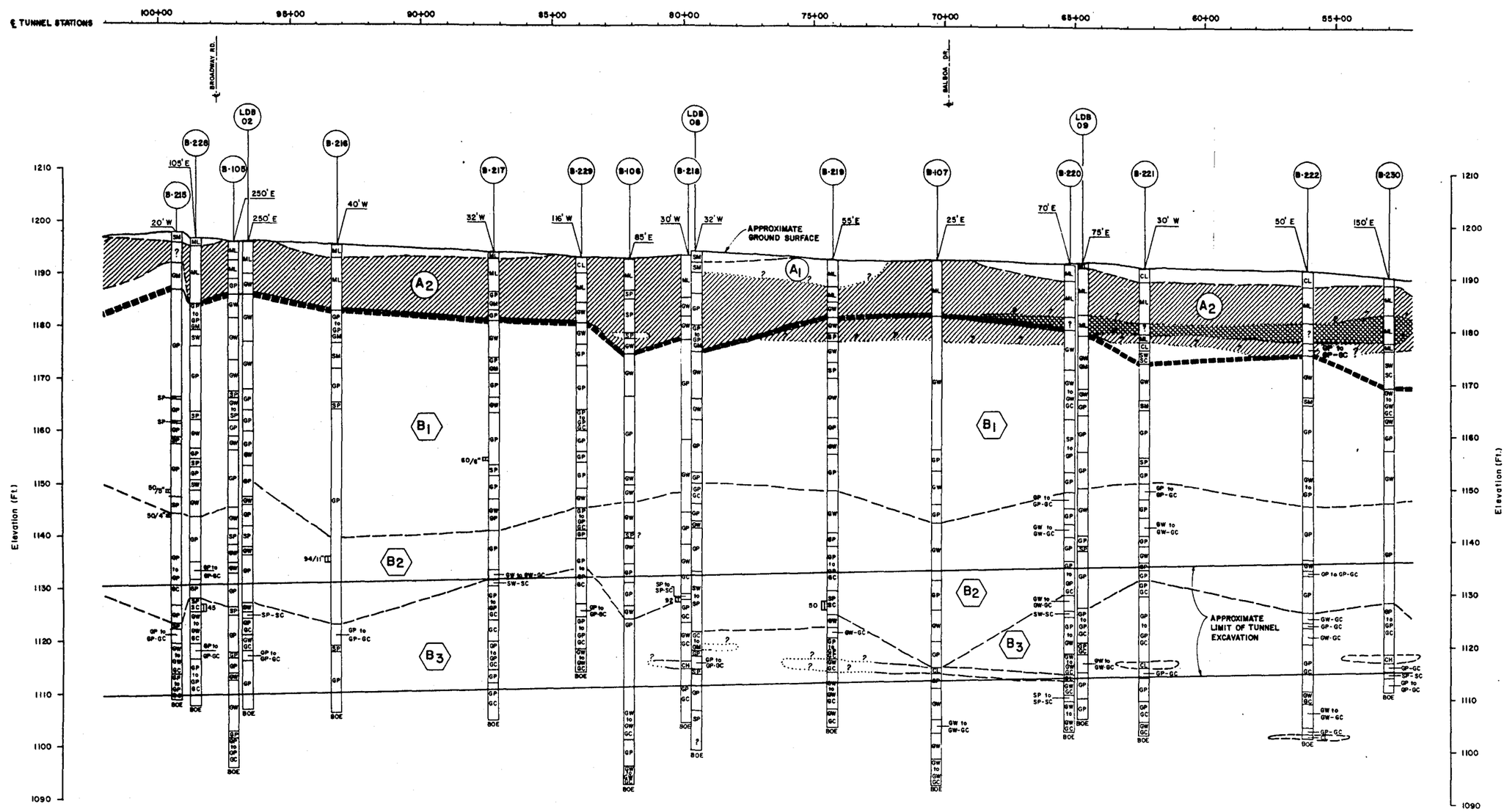


FOR NOTES & LEGEND, SEE DWG. NO. 4.1

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 101+65 TO 151+65
DWG. TITLE	SUBSURFACE PROFILE
DESIGNED BY DSH DRAWN BY ACB CHECKED BY DSH PROJECT NO. 11106.00 DATE MAY 1987	CRSS, INC 216 16TH STREET SUITE 1700 DENVER, COLORADO 80202 (303) 820-5240 DWG. NO. 4.3
SCALE	AS NOTED

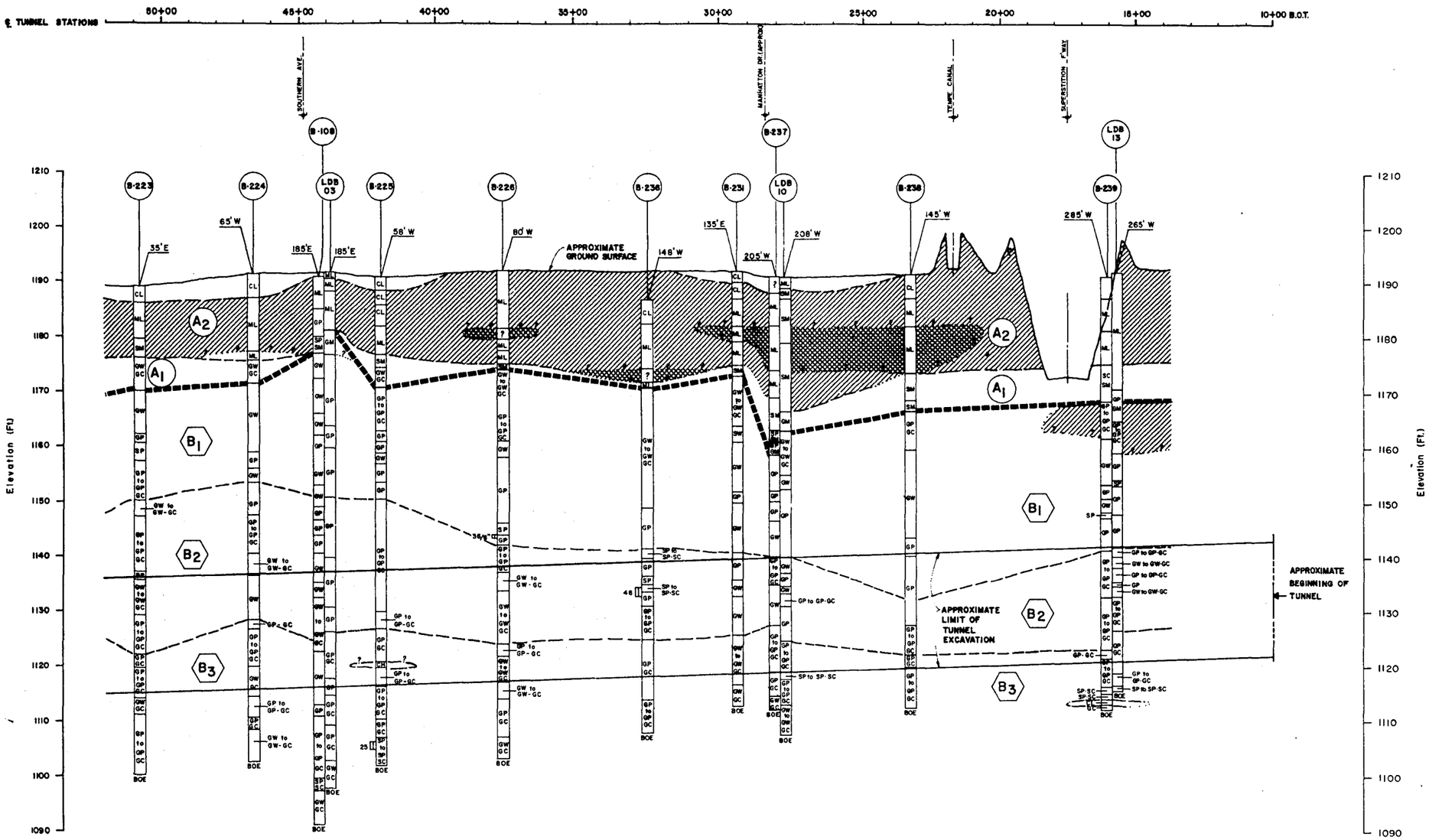


FOR NOTES & LEGEND, SEE DWG NO. 4.1

CRSS

CRSS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 52+03 TO 102+03
DWG TITLE	SUBSURFACE PROFILE
DESIGNED BY DBH	CRSS INC 216 16TH STREET SUITE 1700 DENVER COLORADO 80202 (303) 820 5240
DRAWN BY ACB	SCALE AS NOTED
CHECKED BY DBH	
PROJECT NO 11106.00	DWG NO 4.4
DATE MAY 1987	



FOR NOTES & LEGEND, SEE DWG NO 41

CRSS

CRS SIRRINE

CLIENT	DELEUW CATHER AND COMPANY
PROJECT	PRICE ROAD DRAIN TUNNEL STA. 10+00 TO 53+80
DWG. TITLE	SUBSURFACE PROFILE
DESIGNED BY DSH	CRSS INC 216 16TH STREET SUITE 1100 DENVER COLORADO 80202 303-820-5240
DRAWN BY ACB	SCALE AS NOTED
CHECKED BY DSH	
PROJECT NO 11106.00	DWG NO 4.5
DATE MAY 1987	

CRSS

FIGURE 4.6
ARIZONA DEPARTMENT OF WATER RESOURCES, DEPTH TO WATER AND ALTITUDE OF WATER LEVEL, 1983

LEGEND & NOTES

NORMAL GROUNDWATER READINGS

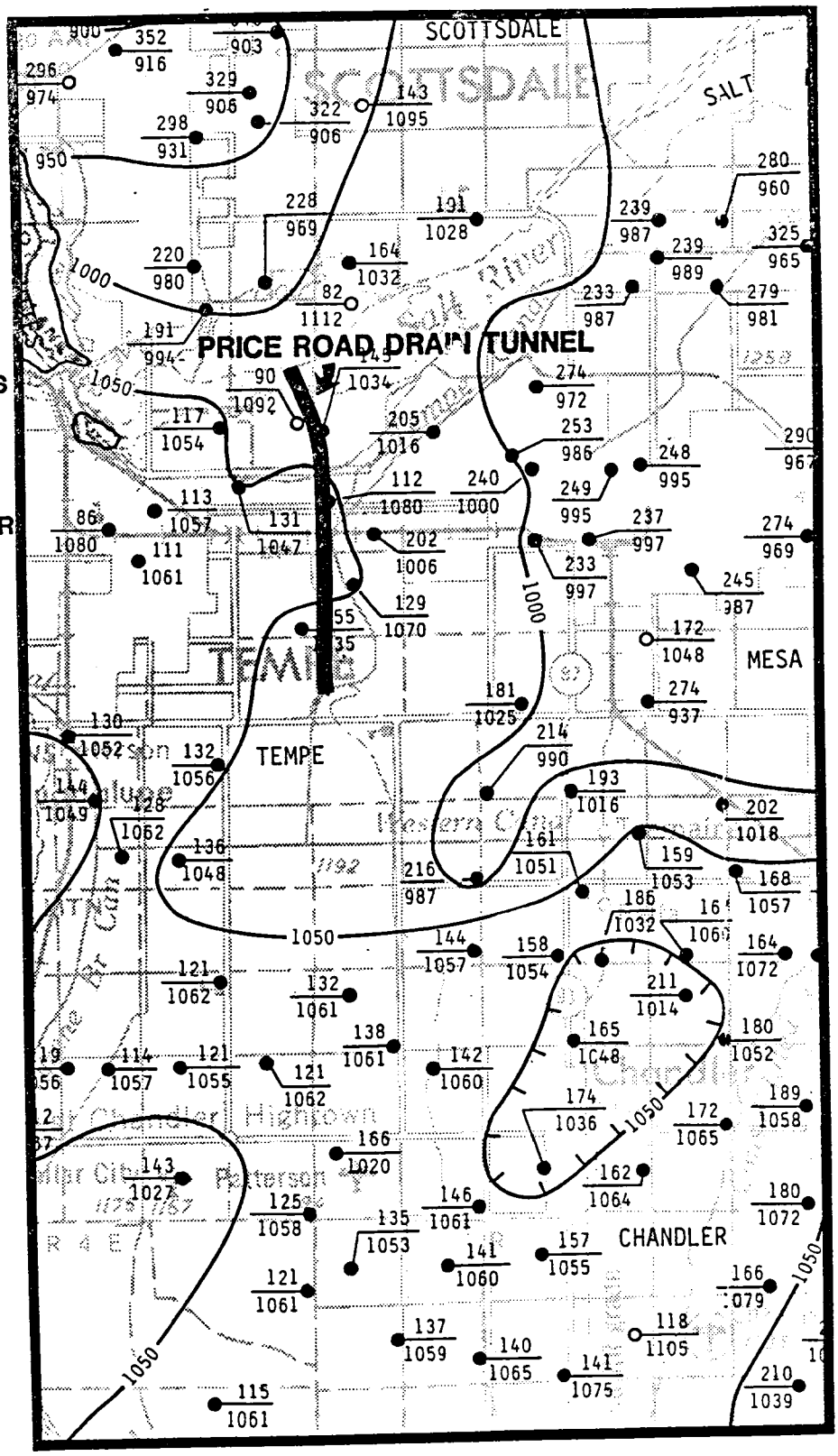
205 / 1080 — Depth to Groundwater / Groundwater Elevation

ANOMALOUSLY HIGH GROUNDWATER READINGS

132 / 1056 — Depth to Groundwater / Groundwater Elevation

1050 — GROUNDWATER CONTOUR WITH GROUNDWATER ELEVATION

Note:
Based on Well Readings Obtained in 1982.



NORTH
SCALE: 1:125,000

Source:
Arizona Department of Water Resources,
Depth to Water and Attitude of Water Level, 1983.

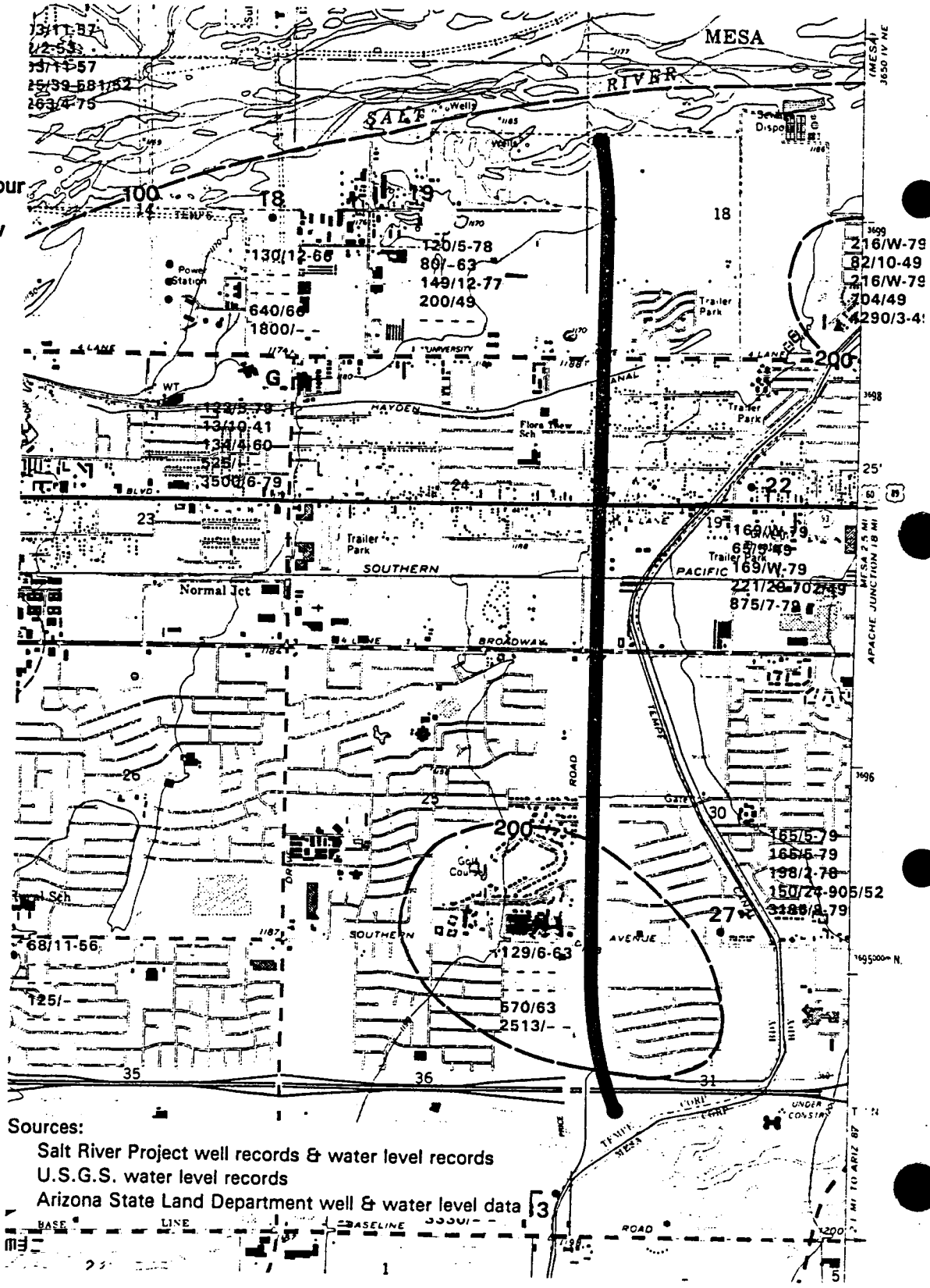
CRSS

FIGURE 4.7
ARIZONA STATE UNIVERSITY, GROUNDWATER, TEMPE QUADRANGE, MARICOPA COUNTY, ARIZONA, 1979–1980

LEGEND

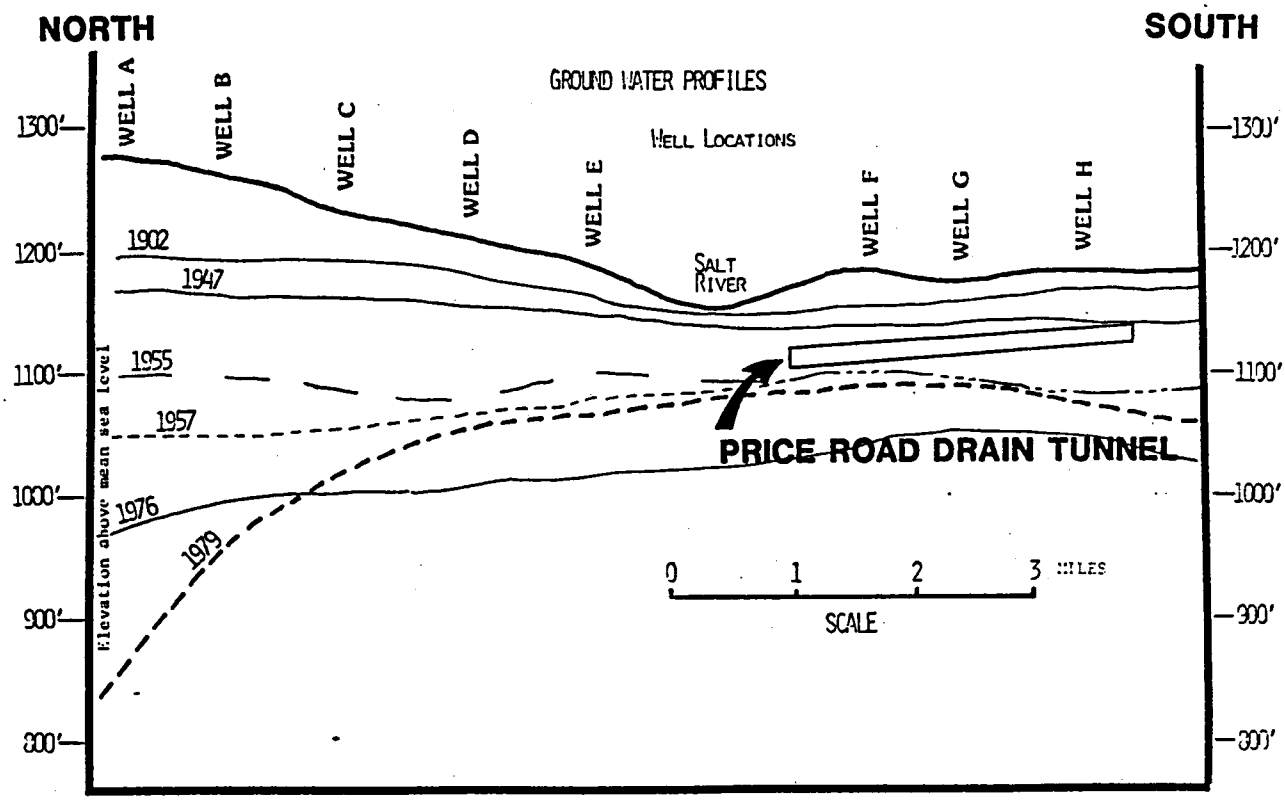
200

Groundwater Contour
Depth to
Groundwater Below
Ground Surface



NORTH
Not to Scale

FIGURE 4.8
ARIZONA STATE UNIVERSITY, GROUNDWATER PROFILES



Source: Arizona State University, Groundwater, Tempe Quadrange, Maricopa County, Arizona, 1979–1980

TABLE 3.1

PRICE ROAD DRAIN TUNNEL
SUMMARY OF TEST BORINGS

Boring Number	Station Number	Offset* (ft)	Collar Elevation (ft)	Depth of Boring (ft)	BOE Elevation (ft)	Tunnel Crown Elevation** (ft)
LDB-01	151+65	270 E	1186.0	87.0	1099.0	1125.2
LDB-02	96+46	250 E	1196.3	93.0	1103.3	1131.1
LDB-03	43+70	185 E	1191.7	94.0	1097.7	1137.2
LDB-04	166+75	155 E	1181.7	87.0	1094.7	1123.3
LDB-05	139+00	38 W	1188.2	94.0	1094.2	1126.4
LDB-06	125+70	55 E	1190.0	94.0	1096.0	1128.0
LDB-07	110+20	45 E	1195.7	92.0	1103.7	1129.8
LDB-08	79+20	32 W	1194.6	95.0	1099.6	1132.9
LDB-09	64+60	75 E	1192.7	87.0	1105.7	1134.4
LDB-10	27+50	208 W	1191.0	81.0	1110.0	1139.9
LDB-11	191+05	16 W	1181.6	56.0	1125.6	1120.9
LDB-12	182+25	38 E	1181.9	73.0	1108.9	1121.8
LDB-13	15+72	285 W	1192.0	76.0	1116.0	1142.2
B-101	173+10	340 E	1180.5	95.0	1085.5	1122.5
B-102	151+75	270 E	1185.8	100.0	1085.8	1125.1
B-103	136+78	207 E	1187.6	100.0	1087.6	1126.9
B-104	111+90	218 E	1195.2	99.0	1096.2	1129.7
B-105	96+54	245 E	1196.1	38.0	1158.1	1130.9
B-105A	96+54	250 E	1196.1	100.0	1096.1	1130.9
B-106	81+28	85 E	1193.1	100.0	1093.1	1132.7
B-107	70+18	25 E	1193.0	100.0	1093.0	1133.9
B-108	43+88	185 E	1191.0	100.0	1091.0	1137.1
B-201	167+00	155 E	1181.7	86.0	1095.7	1123.0
B-202	162+05	82 W	1181.8	89.0	1092.8	1123.7
B-203	156+92	10 W	1182.2	89.0	1093.2	1124.3
B-204	152+40	40 W	1185.0	89.0	1096.0	1125.0
B-205	146+70	5 W	1186.3	90.0	1096.3	1125.8
B-206	143+00	5 E	1187.3	90.0	1097.3	1126.2
B-207	138+72	55 W	1186.3	90.0	1096.3	1126.8
B-208	NOT DRILLED					
B-209	129+95	38 W	1188.4	90.0	1098.4	1127.4
B-210	125+95	55 E	1190.0	90.0	1100.0	1127.9

TABLE 3.1

PRICE ROAD DRAIN TUNNEL
SUMMARY OF TEST BORINGS

Boring Number	Station Number	Offset* (ft)	Collar Elevation (ft)	Depth of Boring (ft)	BOE Elevation (ft)	Tunnel Crown Elevation** (ft)
B-211	120+98	62 E	1190.7	90.0	1100.7	1128.5
B-212	116+00	45 W	1192.9	90.0	1102.9	1129.0
B-213	109+90	38 E	1196.0	89.0	1107.0	1129.9
B-214	104+40	12 E	1196.8	89.0	1107.8	1130.7
B-215	98+95	20 W	1198.0	89.0	1109.0	1130.8
B-216	92+95	40 W	1195.3	89.0	1106.3	1131.2
B-217	86+92	32 W	1194.4	88.0	1106.4	1132.3
B-218	79+45	30 W	1193.9	89.0	1104.9	1132.8
B-219	74+20	55 E	1192.8	89.0	1103.8	1133.2
B-220	65+08	70 E	1192.4	89.0	1103.4	1134.3
B-221	61+20	30 W	1191.7	89.0	1102.7	1134.8
B-222	56+52	50 E	1191.4	89.0	1102.4	1135.7
B-223	50+80	35 E	1189.2	89.0	1100.2	1136.1
B-224	46+60	65 W	1191.4	89.0	1102.4	1136.7
B-225	41+92	58 W	1190.8	84.0	1106.8	1137.7
B-226	37+30	80 W	1192.2	89.0	1103.2	1138.3
B-227	149+52	158 E	1186.4	79.0	1107.4	1126.1
B-228	98+42	105 E	1196.8	89.0	1107.8	1130.8
B-229	83+59	116 W	1195.7	79.0	1116.7	1132.4
B-230	52+98	150 E	1190.1	79.0	1111.1	1136.1
B-231	28+80	135 E	1192.1	79.0	1113.1	1139.7
B-232	190+78	20 W	1181.7	83.0	1098.7	1121.0
B-233	186+90	50 E	1181.3	89.0	1092.3	1121.3
B-234	182+55	42 E	1181.7	83.0	1098.7	1121.7
B-235	179+35	10 W	1181.3	89.0	1092.3	1121.8
B-236	32+38	148 W	1186.9	79.0	1107.9	1139.0
B-237	27+72	205 W	1190.9	79.0	1111.9	1139.8
B-238	23+22	145 W	1191.8	79.0	1112.8	1140.9
B-239	15+98	265 W	1191.4	79.0	1112.4	1142.0

*FROM PROPOSED TUNNEL CENTERLINE
**BASED ON 30 PERCENT DESIGN DRAWINGS SUBMITTED BY HNTB.

TABLE 4.1

PRICE ROAD DRAIN TUNNEL
SGC COBBLE and GRAVEL CONTENT

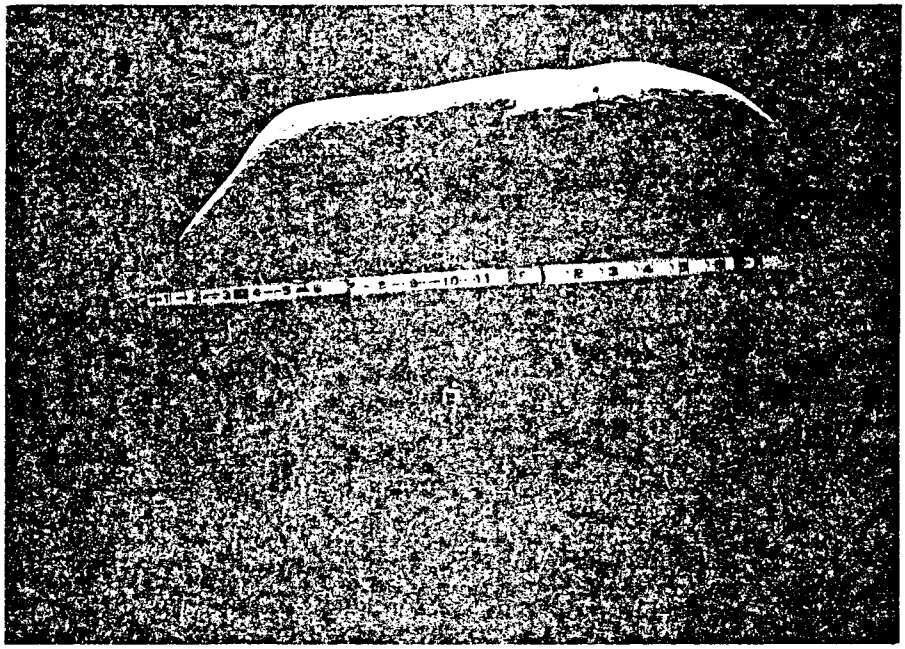
LDB hole number	Sample depth (ft)	Auger loads (*)	Large Gravel (approx. 3")	Small Cobbles (3" to 6")	Large Cobbles (6" to 12")	Boulders (12")
LDB-08	55	2	44	163	13	0
LDB-08	65	2	278	127	28	1(17" x 12" x 10")
LDB-08	75	2	270	157	27	0
LDB-08	80	1	500+	112	40	1(14" x 6" x 7")
LDB-09	55	2	176	79	15	0
LDB-09	65	2.5	307	220	3	0
LDB-09	75	2	232	206	13	0
LDB-10	55	2	367	343	9	0
LDB-10	65	2	252	185	6	0
LDB-10	75	2	218	106	15	0
LDB-12	65	2	155	219	2	0
LDB-12	70	2	119	165	6	0
LDB-13	45	2	164	167	5	0
LDB-13	65	2	215	108	7	0
LDB-13	75	2	132	145	5	0

(*) approximately 4.5 auger loads per cubic yard

CRSS

Photograph 1- 36 inch auger in LDB-12, sloughing A_1 material,14 ft. diameter hole at ground surface.

Photograph 2- View down LDB-12, 1) sloughing B_1 SGC material. 2) cobbly BOULDER layer at 18 ft. below ground surface. 3) B_2 SGC material.



Photograph 3- Boulder removed from LDB-04 at 26 ft.

Photograph 4 - LDB-05, muck from below groundwater table on auger.

Photograph 7- LDB-10, window # 13 , sandy GRAVEL within B_1 SGC unit. NOTE: contains small amounts of clay at this location. 1) MnO_2 staining on gravel and cobbles. 2) clay rich zone- cast where cobble was removed . 3) Pocket of SAND. 4) edge of casing window.

Photograph 8- LDB-10, window# 6 , COBBLE layer within B_2 SGC unit. 1) MnO_2 stained cobble.

CRSS

Photograph 5- LDB-05, window #5, sandy GRAVEL within B_3 SGC unit.

Photograph 6- LDB-06, window #7. Cobbly GRAVEL within B_3 SGC unit showing clay "cementation".

PROCEDURES AND TERMINOLOGY FOR DESCRIBING SOIL SAMPLES

Material	Definition	Fractions	Sieve Limit Upper	Sieve Limit Lower
Boulders	Material too large to pass through an opening 12 in. square.			
Cobbles	Material passing through a 12 in. square opening and retained on the 3 in. sieve.			
Gravel	Material passing the 3 in. sieve and retained on the No. 4 sieve.	Coarse Fine	3 in. 3/4 in.	3/4 in. No. 4
Sand	Material passing the No. 4 sieve and retained on the No. 200 sieve.	Coarse Medium Fine	No. 4 No. 10 No. 40	No. 10 No. 40 No. 200
Silt	Material passing the No. 200 sieve which is also non-plastic in character and exhibits little or no strength when dried.		No. 200	
Clay	Material passing the No. 200 sieve which can also be made to exhibit plasticity within a certain range of moisture contents which exhibits considerable strength when air dried.		No. 200	

VISUAL SOIL CLASSIFICATION

Major soil component	=	Upper case letters
Secondary component	=	Adjective used (if 25 - 50% of total)
Third component	=	"some" used (if third component comprises 20 - 35% of total)
Other components	=	"little" used (if 12 - 25% of total) "trace" used (5 - 12% of total) "clean" used (less than 5% of total)
Example	=	Gravelly, coarse to fine SAND, little silt, trace clay.

0176W

Large Diameter Boring Logs

CRSS SIRRINE

TEST BORING REPORT

BORING NO. LDB-01

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 7
LOCATION: Sta. 151+65
ELEVATION: 1186.0
DATE START: 1/28/87
DATE FINISH: 2/2/87
DRILLER: Richard Scott
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger
1/28/87	WD	89(?)	-	87	SIZE ID	-	36"
	see	notes	below		HAMMER WT		-
					HAMMER FALL		-

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			NOTE: Location = N 881,291.99, E 508,405.56	
	Dry	N			Brown, dry, SILT, trace fine sand and clay, with $CaCO_3$ and roots present. (ML)	
	Dry	N			3.0 -TOPSOIL-	
	Dry	N			Hard, brown, dry, fine sandy, SILT, cemented	
	Dry	N			4.5 with $CaCO_3$. -CALICHE- (ML)	
5						
	D	N				
	D	N			Tan, damp, fine sandy, coarse to fine GRAVEL, trace medium sand, trace to occasional cobbles,	
	D	N			with traces of silt. $CaCO_3$ coatings present with	
	D	N			pockets of clean and lightly cemented material.	
	D	N			-ALLUVIUM- (GP)	
10						
	D	N				
	D	N			NOTE: Bottom of Excavation/Begin Drilling at 12.0 ft.	
	D	N			13	
	D	N			Brown, damp, clean, fine SAND. (SP)	
	D	N			14.5 -ALLUVIUM-	
15						
	D	L			Brown, damp, fine sandy, COBBLES, some coarse to fine gravel, little medium sand, trace coarse	
	D	L			sand, with occasional boulders. (GP)	
	D	L			-SGC-	
	D	L			NOTE: Same as above, but medium to fine sandy	
	D	L			at approximately 18.5 ft.	
20					20	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			Brown, damp, clean, medium to fine SAND. (SP)	25 A.P. from 20 to 25 ft.
					21	
	D	Y			Brown, damp, coarse to fine gravelly, COBBLES, some to little medium to fine sand. (GP)	
	D	Y				
	D	Y			NOTE: Black manganese (MnO_2) staining from approximately 23 to 24 ft.	
	D	Y				
	D	Y				Approximately 20 A.P. from 25 to 30 ft.
25						
	D	Y			NOTE: Traces of clay beginning at approximately 26 ft. Drilling more difficult at approximately 28 ft.	
	D	L				
	D	L				
	D-M	N			Brown, damp to moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay, with occasional boulders. (GP) to (GP-GC)	
	D-M	N				12 A.P. from 30 to 35 ft.
30						
	D-M	N			31	
	D-M	N			Rust-brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW) to (GW-GC)	
	D-M	N				
	D-M	N				
	D-M	N				16 A.P. from 35 to 40 ft.
35						
	D-M	N			36	
	D-M	N-L			Brown, damp to moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. (GW) to (GW-GC)	
	D-M	N-L				
	D-M	N-L				
	D-M	N-L			40	17 A.P. from 40 to 45 ft.
40						
	M	N			Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	
	M	N			42	
	M	N			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay, with occasional boulders. (GW-GC)	
	M	N				
	M	N			45	
45						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-01
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			Brown, moist, coarse to fine sandy, COBBLES, little coarse to fine gravel, trace clay, with occasional boulders. (GP-GC)	12 A.P. from 45 to 50 ft.
	M	N			47	
	M	L			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)	
	M	L				
	M	N				7 A.P. from 50 to 55 ft.
50	M	N				
	M	N				
	M	N				
	M	N			54	
	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	8 A.P. from 55 to 60 ft.
55	M	N				
	M	N				
	M	N				
	M	N			59	
	M	N			Black to brown, moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GW)	8 A.P. from 60 to 65 ft.
60	M	N			61 NOTE: Changed augers at 61 ft.	
	M	N				
	M	N			Brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay with occasional boulders. (GW-GC)	
	M	N				
	M	N			65	7 A.P. from 65 to 70 ft.
65	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay.	(GW-GC)
	M	N			NOTE: Clay has high plasticity.	
	M	N				
	M	N			69	
70						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			Dark brown, moist, coarse to fine gravelly, COBBLES, some to little coarse to fine sand, trace clay, with occasional boulders. (GW-GC)	9 AP from 70 to 75 ft.
	M	N	X1	71/72		
	M	N				
	M	N			74	
75	M	N			Grayish-brown, moist, coarse to fine gravelly, COBBLES, some medium sand, trace clay. (GP-GC)	10 A.P. from 75 to 80 ft.
	M	N				
	M	N			77	
	M	N			Brown, moist, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace clay, with occasional boulders. (GP-GC)	
	M	N			79	
80	M	N			Tan, moist, clean, medium to fine SAND (lens, approximately 1 to 2 ft. thick. (SP)	9 A.P. from 80 to 85 ft.
	M	N			80.5	
	M	N			Brown, moist, coarse to fine sandy, COBBLES, little coarse to fine gravel, trace clay. (GP-GC)	
	M	N			82	
	M	N			Tan, moist, clean, medium to fine SAND. (SP)	
	M-W	N			83.5	
85	M-W	L			Brown, moist to wet, medium to fine sandy, COBBLES, little coarse to fine gravel, trace clay, with occasional boulders. (GP-GC)	
	W	L	X1	±86		
	W	L			Brown, wet, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)	
					Bottom of Exploration at 87.0 ft.	
90					NOTE: Encountered groundwater at approximately 85-87 ft. Material sloughing into borehole. Terminated exploration at 87 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-01
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection performed by D. Hallman on 1/30/87.	
					NOTES: 1. Sample designation "NS" = not sampled 2. Ease of sampling: (P*) = picked, left white marks (P) = picked (S) = shoveled (H) = hand sampled 3. Unless otherwise noted, soil held in overhang above sample excavation.	
25						
30						
35					Brown, damp, medium to fine sandy, COBBLES, some coarse to fine gravel. (GP)	Clay (?) - over-break appears consistent with windows below.
					38.0	
40	D	0.8 to 1.1	NS15	39 / 40	Brown to rust-brown, damp, fine gravelly, medium to fine SAND, little coarse sand, trace coarse gravel, with traces of clay. Contains frequent layers (up to 6") of damp, medium to fine SAND, with traces of clay. (SP)	(P) medium - quite dense, has clay also. (SE
	D	0.4 to 0.8	NS14	41.5 / 42.5	41.5 Rust-brown, damp, coarse to fine GRAVEL, little medium to fine sand, trace cobbles and coarse sand, with traces of silt and clay. (GP)	(P) medium to easily. (SW
					43.0	
	Dry				43.5 Black, dry, cobbly, coarse to fine GRAVEL, with traces of coarse to fine sand and frequent voids (up to 2"). (GP)	(P) easily - won't hold in an overhang.
45					See next page.	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-01
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	D to M	0.7 to 0.9	NS13	45/46	Brown to rust-brown, damp to moist, fine sandy COBBLES, little coarse to fine gravel, trace medium sand, with traces of silt and clay. (GP)	(P) medium - cobbles interlocked.	(NW
					47.5		
	D to M	1.4 to 2.1	G12	48/50	Brown, damp to moist, coarse to fine gravelly, COBBLES, some medium to fine sand, with traces of clay. (GP) NOTE: Higher caliper for #11 & #12 seems to be drilling induced overbreak.	(P) medium - interlocking is great. Quite a bit of clay still.	(E)
50					51.3		
	M	1.0 to 1.7	G11	51/53	Brown and black, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay, with frequent black (MnO_2) staining (coarse sand in pockets). (GP) to (GP-GC)	(P) Hard-interlocked. Frequent small voids between gravels.	(S)
					53.5		
55	M	0.6	G10	54/56	Brown, tan and black, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay, with frequent black and tan colored clay pockets (up to 1"). (GW) to (GW-GC)	(P) Medium to hard - slight interlocking; quite a bit of clay.	(W)
					56.0		
	M	0.7 to 0.8	G9	57/59	Brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace cobbles (in layers), coarse sand, with traces of clay, with traces of silt, and frequent tan clay pockets. (GP) to (GP-GC)	(P) Hard - clay and interlocking, holds together well.	(N)
					59.6		
60	M	1.0 to 1.3	G8	60/62	Brown and gray, moist, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay, with frequent small black (MnO_2) stained layers in-filled with clay. (GW) to (GW-GC) NOTE: Cobbles predominantly composed of quartzite, sandstone, granitics, schist and weathered volcanics.	(P) Hard.	(SE
65	M	0.4 to 0.6	G7	63/65	Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay, with occasional black (MnO_2) staining and medium to fine SAND, trace clay in lenses. (GW) to (GW-GC) NOTE: Gradational change from G5 to G8.	(P) Very hard - clay "cementing" material together.	(SW
	M	0.1 to 0.2	G6	66/68	Same as G5, with frequent pockets with more coarse sand. (GP) to (GP-GC)	(P) Hard.	(NW
70	M	0.3 to 0.4	G5	69/71	Brown and black, moist, medium to fine sandy, GRAVEL, some cobbles, trace coarse sand, with traces of clay, with frequent black (MnO_2) staining. (GP) to (GP-GC)	(P) Hard-clay and tight interlocking, holds together well.	(NE

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-01

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	M	0.3 to 0.4	G5	69/71	Brown and black, moist, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand, with traces of clay, with frequent black (MnO_2) staining. (GP) to (GP-GC)	(P) hard - tightly interlocked and significant clay as binder.	(NE
72.2							
	M	1.1 to 1.4	NS4	72/74	NOTE: Medium to fine SAND lens, trace cobbles, gravel and clay from approximately 71.1 to 72.4 ft. NOTE: NS4 is the same as G3, with coarse to medium sand pockets (beneath cobbles). Clay is buff to white in color.	(P) hard -tightly interlocked grains.	(S)
75							
	M	0.5 to 0.7	G3	75/77	Tan, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay, with occasional coarse sandy, gravel lenses and pockets of clay. (GW) to (GW-GC)	(P) hard- well graded, good interlocking, and clay also helps hold together.	(W)
78.0							
	M	0.7	G2	78/80	Tan, moist medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with traces of clay. (GP)	(P) easily - Material holds up well. Moisture too high for clay to add much strength (W.C. near L.L?)	(N)
80							
			NS1	81/83	NOTE: Sample G2 material appears to continue to bottom of hole. NOTE: Bottom window blocked with soil.		(E)
85							
					Bottom of casing 86.0 ft. below ground surface.		
90							
95							

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-01
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-02

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 7
LOCATION: Sta. 96+46
ELEVATION: 1196.3
DATE START: 2/2/87
DATE FINISH: 2/2/87
DRILLER: Richard Scott
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
2/2/87	0	NE	-	93	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N				2 A.P. from 0 to 5 ft.
	Dry	N			Tan, dry, SILT, little to trace fine sand, with slight $CaCO_3$ cementation. (ML)	
	Dry	N			-ALLUVIUM-	
	Dry	N				
	Dry	N			NOTE: Location = N 875,773.08, E 508,389.40	7 A.P. from 5 to 10 ft.
5	Dry	N			6	
	Dry	N			Tan, dry, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of silt and strong $CaCO_3$ cementation. (GW)	
	Dry	N			-CALICHE-	
	Dry	N			10	18 A.P. from 10 to 15 ft.
10	Dry	L			Tan, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with some $CaCO_3$ present. (GW)	
	Dry	L			-SGC-	
	Dry-D	Y				
	Dry-D	Y				
	Dry-D	Y				18 A.P. from 15 to 20 ft.
15	Dry-D	Y				
	Dry-D	Y				
	Dry-D	L				
	D	L			19	
	D	L			Brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GW)	
20						

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. LDB-02

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			Brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay and occasional boulders. (GW)	12 A.P. from 20 to 25 ft.
	D	L				
	D	L				
	D	N				
25	D	N				6 A.P. from 25 to 30 ft.
	D	N				
	D	N				
	D	N			28	
	D	N			Brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with traces of clay. (GP)	
30	D	N				12 A.P. from 30 to 35 ft.
	D	N				
	D	N			32	
	D	L			Brown, damp, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, trace coarse sand. (GP)	
	D	L				
35	D	L				12 A.P. from 35 to 40 ft.
	D	N-L			36	
	D	N-L			Brown, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with slight traces of clay and occasional boulders (up to 15"). (GP)	
	D	N-L				
	D	N-L				
40	D	N-L				19 A.P. from 40 to 45 ft.
	D	L			NOTE: encountered black (MnO_2) stained cobbles and gravel at approximately 42-44 ft.	
	D	L				
	D	L-Y				
	D	L-Y				
45	D	L-Y				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-02
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			46	15 A.P. from 45 to 50 ft.
	D	L			Brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay. (GP)	
	D	L			48	
	D	N-L			Tan to brown, damp, medium to fine SAND, trace fine gravel, "cemented" with traces of clay (lens?). (SP) 49	
50	D	N-L			Brown, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay. (GP)	12 A.P. from 50 to 55 ft.
	D	N-L				
	D	N-L				
	D	N-L				
	D	N-L				
55	D	N-L			55	10 A.P. from 55 to 60 ft.
	D-M	N-L			Brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay and occasional boulders. (GW)	
	D-M	N-L				
	D-M	N-L			NOTE: Encountered black (MnO_2) stained gravels at approximately 59 ft.	
	D-M	L				
60	D-M	L				16 A.P. from 60 to 65 ft.
	D-M	N-L			61	
	D-M	N-L			Brown, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of coarse sand and clay. (GP)	
	D-M	N-L				
	D-M	N-L				
65	D-M	N-L				12 A.P. from 65 to 70 ft.
	D-M	N-L				
	D	N-L			67	
	D	N-L			Brown to tan, damp, fine sandy COBBLES, little coarse to fine gravel, with slight traces of clay. (GP)	
	D	N-L				
					NOTE: material seems to be quite dense.	
70	D-M	N-L			70	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-02
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D-M	N-L			Brown, damp to moist, coarse to fine gravelly, COBBLES, little medium to fine sand, with traces of coarse sand and clay. (GP)	12 A.P. from 70 to 75 ft.
	D-M	N-L				
	D-M	N-L			73	
	M	N-L			Brown to gray, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, trace clay. (GW-GC)	
75	M	N-L				13 A.P. from 75 to 80 ft.
	M	N-L				
	M	N-L				
	M	N-L				
	M	N-L				
80	M	N-L			80	16 A.P. from 80 to 85 ft.
	M	N-L			Brown to gray, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of coarse sand and clay. (GP)	
	D-M	N-L				
	D-M	N-L				
	D-M	N-L				
85	D-M	N-L				14 A.P. from 85 to 90 ft.
	M	N-L				
	M	N-L			87 NOTE: Encountered a small (6-12"?) lens or layer of: Gray, damp to moist, coarse to fine SAND, trace fine gravel and clay at approximately 87 ft.	
	M	N-L			88 Sand was "cemented" into chunks with clay. (SW-SC)	
	M	N-L			89	
90	M	N-L			Gray to brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GP-GC)	12 A.P. from 90 to 93 ft.
	M	N-L				
	M	N-L				
	M	N-L				
					Bottom of exploration at 93 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-02
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection performed by D. Hallman on 2/3/87.	
25					NOTES: 1. Sample designation "NS" = not sampled	
					2. Ease of sampling: (P*) = picked, left white marks (P) = picked (S) = shoveled (H) = hand sampled	
					3. Unless otherwise noted, soil held in overhang above sample excavation.	
30					4. (*) indicates overbreak believed to be caused by drilling operation rather than unusual ground instability (excessive borehole reaming along N side of borehole).	
35						
40					Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of silt and clay in pockets, and frequent voids between gravel and cobbles. (GW)	(P) hard - tightly interlocked. (E)
	Dry-D	1.6 * to 2.4*	NS15	42 / 43	42.5	
45			NS14	45/46	See next page.	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-02
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	Dry-D	0.4 to 0.8	NS14	45/46	Tan and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GP)	(P) hard - tightly interlocked. Clay binder- will hold <1.5 ft. overhang over material below.	(S)
	D	1.2 to 1.4	NS13	48/49	48.5 Black and brown, cobbly, coarse to fine GRAVEL, trace coarse to fine sand, with pockets with traces of clay and black (MnO_2) staining. (GW)	(S) easily - loose (porous) gravel layer, lying at angle of repose on material below.	(W)
50					50.0		
	D	1.8 * to 2.4 *	G12	51/53	Brown, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with slight traces of clay. (GP)	(P) moderate - slight "cemented" clay coatings.	(NE
					54.0		
55	D	0.4 * to 1.4 *	NS11	54/56	(Dense) tan, damp, clean fine gravelly, medium to fine SAND, (SP) INTERLAYERED WITH	(P*) very hard - excavated in chunks.	(SE
	D	0.4 to 0.5	G10	57/58	(Dense) tan, damp, clean, medium to fine SAND, with pockets containing traces of clay. (SP) 58.0	(P) easy-excavated in chunks. Very slight clay halos on sand grains.	(SW
					Tan, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay. (GW) 59.5		
60	D-M	0.8 to 1.0	G9	60/62	Black, tan and brown, damp to moist, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay and frequent thin layers with black (MnO_2) staining. (GP)	(P) moderate - cobbles interlocked and has clay binder, although some pockets are "clean".	(NW
65	D	3.1 * to 3.8 *	G8	63/65	Black and tan, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, with traces of clay and frequent (4" to 12") layers of "clean" black (MnO_2) stained gravel with frequent small voids. (GP) 65.7	(P) hard to moderate - gravels interlocked and clay binder present.	(E)
	D	0.0 to 0.8	G7	66/68	Tan, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with traces of silt and clay and occasional gravel layers with trace coarse to medium sand and black (MnO_2) staining. (GP) 68.5	(P) Very hard - cobbles interlocked. Clay acts as binder- sand excavated in chunks.	(S)
70			G6	70/71	Tan, moist to damp, coarse to fine gravelly, coarse to fine SAND, with traces of clay and pockets of clayey fine sand. (SW) 70.3		

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-02

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	D	0.0 to 0.1	G6	70.3 / 71	70.3 (Dense) tan, damp, fine SAND, trace medium sand, 71.5 trace clay. (SP-SC)	(S) hard - clay acts as binder, excavated in chunks.	(W)
	M	0.6 to 1.1	G5	72 / 74	Gray and tan, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay, with occasional pockets of black (MnO_2) stained gravel, porous coarse sand and fine gravel, and 74.5 silty clay. (GP-GC)	(P) hard - interlocked and clay acts as binder.	(N)
75	M	1.1 to 1.4	G4	75 / 77	Black and tan, moist, coarse to fine GRAVEL, little cobbles and coarse to fine sand, trace clay, with frequent small (up to 4" thick) layers and pockets of black (MnO_2) stained gravel 77.5 (with voids up to 2"). (GW-GC)	(P) easy - poorly interlocked but clay acts as binder.	(SE
	M	0.6 to 0.8	G3	78 / 79.5	Tan, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand with 79.5 traces of clay. (GP) to (GP-GC)	(P) hard - clay cementing material together, sand excavated in chunks.	(SW
80	D	0.7 to 0.9	G2	81 / 83	Tan, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace coarse sand, trace cobbles, with traces of clay and occasional small lenses (2" thick) of black (MnO_2) stained gravel. (GP)	(P) easy to moderate - gravels interlocked clay coatings cementing finer materials onto gravels.	(NW
85	D	0.6 to 0.8	G1	84 / 86	Tan and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay (sand is predominantly medium sand). (GP)	(P) moderate to hard. Frequent small pockets (2"-3") of "cemented" sand.	(NE
					NOTE: No groundwater encountered.		
90					Bottom of casing at 89.0 ft. below ground surface.		
95							

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-02
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-03

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta. 43+70
ELEVATION: 1191.7
DATE START: 2/3/87
DATE FINISH: 2/4/87
DRILLER: Richard Scott
PREPARED BY: Alan Howard, Dave Hallman

GROUNDWATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
2/4/87	WD	NE	-	94'	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			1.0 Dark brown, dry, fine sandy SILT, trace coarse to fine gravel, coarse to medium sand and clay. (ML) -TOPSOIL-	3 A.P. from 0 to 5 ft.
	Dry	N			Rust-brown, dry, fine sandy SILT, little clay, trace coarse to fine gravel and coarse to medium sand, with frequent white nodules of $CaCO_3$ (up to 1"). -ALLUVIUM- (ML)	
	Dry	N			3.5	
	Dry	N				
5	Dry	N			Brown to rust-brown, dry, cemented, fine sandy SILT, little clay, trace coarse to fine gravel and coarse to medium sand. (ML) -CALICHE-	5 A.P. from 5 to 10 ft.
	Dry-D	N			NOTE: frequent cemented nodules up to 3".	
	Dry-D	N				
	Dry-D	N			NOTE: Location = N 870,500.05, E 508,334.32	
	Dry-D	N				
10	Dry-D	N			10.5	8 A.P. from 10 to 15 ft.
	Dry-D	N			Light-brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace silt, trace cobbles (positive reaction for $CaCO_3$ with HCl). -SGC- (GM)	
	Dry-D	N				
	D	L				
	D	L				
15	D	L			15.0	5 A.P. from 15 to 20 ft.
	D	L			Brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with traces of clay and minor black (MnO_2) staining. (GP)	
	D	L				
	D	L			NOTE: Occasional boulders up to 18".	
20	D	L				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-03

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			20.5 Brown and gray, damp, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, little to trace coarse sand, with traces of clay and occasional boulders (up to 15"). (GP)	8 A.P. from 20 to 25 ft.
	D	L				
	D	L				
	D	L				
25	D	L				14 A.P. from 25 to 30 ft.
	D	L			26.0 NOTE: boulders or nested cobbles from approximately 26 to 28 ft.	
	D	Y				
	D	L			28.0	
	D	Y			Brown to rust-brown and gray, damp, clean, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand. (GP)	
30	D	Y				17 A.P. from 30 to 35 ft.
	D	L				
	D	L			32.0	
	D	Y			Dark brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of silt and clay (slight positive reaction for $CaCO_3$). (GP)	
	D	Y				
35	D	L				9 A.P. from 35 to 40 ft.
	D	L			NOTE: occasional calcareous nodules (up to 1") at approximately 36 ft.	
	D	L				
	D	L				
	D	L				
40	D	L				17 A.P. from 40 to 45 ft.
	D	L			41.0	
	D	L			Brown, damp, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand, with slight traces of clay and slight, black (MnO_2) staining. (GP)	
	D	L				
	D	L				
45	D	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-03
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-03

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L				11 A.P. from 45 to 50 ft.
	D	L			46.5	
	D	L			Dark brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of silt and clay. (GP)	
	D	L				
50	D	L				12 A.P. from 50 to 55 ft.
	D	L				
	D	L			52	
	D	L			Dark brown, damp, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand, with traces of clay (soil holds together in a ball when squeezed). (GP)	
	D	L			NOTE: Frequent pockets (?) of clean sandy GRAVEL and occasional boulders (up to 18").	
55	D	L				12 A.P. from 55 to 60 ft.
	D	L				
	D	L				
	D	L				
	D	L				
	D	L			NOTE: Fewer cobbles ("little") at approximately 60 ft. - varies. Increased black (MnO_2) staining of gravel and cobbles and slight clay increase also at approximately 60 ft.	
60	D	L				9 A.P. from 60 to 65 ft.
	D	L				
	D	L				
	D	L			63	
	M	L			64 Black and brown, cobbly, coarse to fine GRAVEL, trace coarse to fine sand and clay (black and tan clays). (GW-GC)	
65	M	L				9 A.P. from 65 to 70 ft.
	M	L			Brown, coarse to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace to traces of clay. (GW) to (GW-GC)	
	M	L				
	M	L			68	
	M	L				
70	M	L			See next page.	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-03
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-03

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	L			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, trace clay (GW-GC)	10 AP from 70 to 75 ft.
	M	L			TO	
	M	L			Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GW-GC)	
	M	L				
75	M	L				9 A.P. from 75 to 80 ft.
	M	L				
	M	L				
	M	L			78	
	M	L			Gray, brown and black, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand and clay (behaves like a clayey GRAVEL). (GP-GC)	
80	M	L				11 A.P. from 80 to 85 ft.
	M	L			INTERLAYERED WITH	
	M	L			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)	
	M	L				
	M	L				
85	M	L				7 A.P. from 85 to 90 ft.
	M	L				
	M	L			NOTE: possible higher clay content ("little?") from 88 to 89 ft.	
	M	L				
	M	L				
90	M	L				5 A.P. from 90 to 94 ft.
	M	L			91	
	M	L			Tan and gray, moist, medium to fine sandy, COBBLES, little coarse to fine gravel, trace clay (cream-colored clay, not as plastic as above clays). (GP-GC)	
	M	L				
	M	L			Bottom of exploration at 94 ft.	
95	M	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-03
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-03

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
					Downhole inspection by D. Hallman on 2/4-5/87. NOTE: See explanatory notes on p 5/7 on LDB-01 boring log.		
	D	0.6 to 0.7	NS15	47/48	Rust to tan, damp, fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse to medium sand, with traces of silt and clay and occasional black coarse sandy gravel pockets. (GP)	(P) moderate to easy - less clay than at windows 11 to 14.	(SE
50	D	1.4 to 1.5	NS14	50/51	Tan to rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay. (GP)	(P) moderate - slightly interlocked.	(SW
52							
55	D	0.7 to 0.9	NS13	53/55	Tan to brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles and coarse sand, with traces of clay (binding material together). (GP)	(P) hard to moderate - interlocked and clay "cementation".	(NW
	D-M	0.7 to 0.9	G12	56/58	Rust-brown to tan, damp to moist, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay (decreasing upwards). (GP)	(P) moderate - interlocking and has slight clay "cementation".	(E)
60	M	0.7 to 1.2	G11	59/60	Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay and occasional lenses or layers (up to 6") of MnO_2 stained coarse to fine gravelly COBBLES (with voids up to 2" to 3"). (GP)	(P) moderate to easy - interlocked slightly and slight clay "cementation".	(S)
61							
65	M	1.1 to 1.8	G10	62/64	Black and rust-brown, moist, coarse to fine gravelly COBBLES, trace coarse sand, with traces of clay and black (MnO_2) staining. Frequent layers contain little to trace coarse to fine sand. Open voids (up to 2") occur between gravel and cobbles. (GP)	(P) easy - slight interlocking but poor gradation. Clay is sticky but W.C. near L.L. (?)	(W)
65.5							
	M	0.9 to 1.1	G9	65.5/67	Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace to traces of clay, with occasional small pockets of black (MnO_2) stained material. (GP) to (GP-GC)	(P) hard - interlocked and has clay "cementation".	(N)
70	M	0.3 to 0.6	G8	68/70	Light rust-brown, gray, and black, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand and clay, with frequent pockets of black (MnO_2) stained coarse sandy gravel. (GP-GC)	(P) moderate - poorly interlocked clay "cementing" sand into chunks.	(SE

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-03
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-03

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
					NOTE: Gray clay within black layers, rust-brown clay otherwise.		
	M	0.5 to 0.8	G7	71/73	Black, brown and rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand and clay, with frequent layers (up to 4") stained black with MnO_2. (GP-GC)	(P) hard to moderate - poorly interlocked, clay acts as binder.	(SW
74.0							
75	M	0.6 to 0.9	G6	74/76	Tan and gray, moist, medium to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay and frequent pockets of fine gravel and clay. (GP)	(P) very hard - interlocked and clay "cementing" material together (sand excavated in chunks).	(NW
77.0							
	M	0.3 to 0.5	G5	77/79	Tan and gray, moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace clay, with occasional MnO_2 stained layers /pockets (sand is in coarser and finer pockets). (GP-GC)	(P) moderate - slight interlocking. Clay acts as binder.	(NE
80							
	M	0.2 to 0.3	G4	80/82	Tan, gray, and black, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay, with frequent pockets of tan clay and black (MnO_2) staining on gravel. (GP-GC)	(P) moderate - poorly interlocked but clay acts as binder.	(S)
82.5							
	M	0.2 to 0.4	G3	83/85	Tan to gray, moist, coarse to fine gravelly, COBBLES, some to little coarse to fine sand, trace clay. (GP-GC)	(P) hard - tightly interlocked.	(W)
85							
	M	0.2 to 0.3	G2	86/88	Tan to gray, moist, coarse to fine gravelly, COBBLES, some medium to fine sand, trace coarse sand and clay. (GP-GC) NOTE: Some cobbles are completely weathered but retain their shape.	(P) very hard - tightly interlocked, clay acts as binder.	(N)
89.0							
90	M	0.0 to 0.3	G1	89/91	Brown, tan and black, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay, with frequent layers of black (MnO_2) stained coarse sandy GRAVEL, trace medium to fine sand and clay. (GW-GC)	(P) easy - not interlocked well. Clay possibly has W.C. near L.L., but is still quite sticky and soil holds up well.	(E)
95					Bottom of casing at 94.0 ft. below ground surface.		

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO LDB-03
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-04

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 7
LOCATION: Sta. 166+75
ELEVATION: 1181.7
DATE START: 2/18/87
DATE FINISH: 2/19/87
DRILLER: Richard Scott
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
2/19/87	WD	82'	89'	87'	SIZE ID	-	36"	
2/20/87	2	81.8'	-	82.5'	HAMMER WT		-	
2/20/87	28	80.5'	-	82.5'	HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Light brown, dry, silty fine SAND, trace clay. $CaCO_3$ present, with frequent cemented nodules (up to 1/2"). -ALLUVIUM- (SM)	3 A.P. from 0 to 5 ft.
	Dry	N				
	Dry	N			NOTE: Location = N 882,814.33, E 508,190.44	
	Dry	N				
5	Dry	N				7 A.P. from 5 to 10 ft.
	Dry	N				
	Dry	N			7	
	Dry	L			Tan, dry, clean, coarse to fine SAND, little fine gravel. -ALLUVIUM- (SW)	
	Dry	L			9	
10	Dry	Y			Tan and gray, dry, clean, coarse to fine gravelly, coarse to fine SAND, little cobbles. -SGC- (SW)	13 A.P. from 10 to 15 ft.
	Dry	S				
	Dry	S				
	Dry	S				
	Dry	S				
15	Dry	S				27 A.P. from 15 to 20 ft.
	Dry	S			16	
	Dry-D	S			Tan, dry to damp, clean, medium to fine SAND. (SP)	
	Dry-D	S			18	
	Dry-D	S			Tan, dry to damp, clean, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with occasional boulders (up to 18") (GW)	
20	Dry-D	S			-TO- (See next page.)	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry-D	Y			Tan, dry to damp, clean, coarse to fine gravelly, coarse to fine SAND, little cobbles. (SP)	120 A.P. from 20 to 25 ft. Sand is predominately medium to fine.
	Dry-D	Y			22	
	D	Y			Tan to brown, damp, clean, medium to fine sandy, COBBLES, some coarse to fine gravel, with occasional boulders (up to 16"). (GP)	
	D	Y				
25	D	Y				11 A.P. from 25 to 30 ft.
	D	L			26	
	D	N-L			NOTE: Encountered boulder at 26 ft. (20" x 12" x 12").	
	D	N-L			Tan to brown, damp, clean, coarse to fine gravelly, COBBLES, some medium to fine sand, trace coarse sand, with occasional boulders. (GP)	
	D	N-L				
30	D	N-L				18 A.P. from 30 to 35 ft.
	D	L			31	
	D	L			Tan to brown, damp, coarse to fine gravelly, COBBLES, little coarse to medium sand. (GP)	
	D	L			NOTE: Encountered boulder at 34 ft. (24" x 14" x 12").	
	D	L			34	
35	D	L-Y			Brown to light brown, damp, coarse gravelly, COBBLES, some coarse to fine sand, with occasional boulders. (GP)	20 A.P. from 35 to 40 ft.
	D	L-Y				
	D	L			NOTE: Encountered black (MnO_2) stained gravel and cobbles, and slight clay coatings, from approximately 34 to 36 ft.	
	D	L				
	D	L				
40	D	N-L				8 A.P. from 40 to 45 ft.
	D	N-L			41	
	D	N-L			Brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight traces of clay as coatings. (GW)	
	D	N-L				
	D	N-L				
45	D	N-L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-04
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D-M	N			46	5 A.P. from 45 to 50 ft.
	D-M	N			Brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW)	
	D-M	N				
	D-M	N				
	M	N				6 A.P. from 50 to 55 ft.
50	M	N			51	
	M	N			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)	
	M	N			NOTE: Soil is moldable when pressed into a ball.	
	M	N				
	M	N			NOTE: Clay changed to cream colored from 54 to 57 ft. This clay is not as plastic as brown clay above.	13 A.P. from 55 to 60 ft.
55	M	N				
	M	N				
	M	N				
	M	L			58.5	
	M	L			Black and brown, moist, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, trace clay (much of the material is stained black with MnO_2). (GW-GC)	6 A.P. from 60 to 65 ft.
60	M	L			61	
	M	N			Tan to brown, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of clay. (GP) to (GP-GC)	
	M	N				
	M	N			NOTE: Clay is cream colored.	
	M	N			65	6 A.P. from 65 to 70 ft.
65	M	N			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay, with occasional boulders. (GW-GC)	
	M	N				
	M	N				
	M	N				
	M	N				
70					NOTE: Increased clay content below 70 ft.	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-04
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay, with occasional boulders. (GW-GC)	2 AP from 70 to 75 ft.
	M	N				
	M	N				
	M	N				
75	M	N				6 A.P. from 75 to 80 ft.
	M	N			76	
	D-M	N			Tan, damp to moist, clean, fine SAND.	
	D-M	N				
	D-M	N			79	
80	M	N			Brown, moist, medium to fine sandy, COBBLES, little to trace coarse to fine gravel, with traces of clay. (GP)	10 A.P. from 80 to 87 ft.
	M	N				
	M	N			NOTE: Encountered groundwater at approximately 82 ft.	
	M	N				
	W	N			84	
85	W	L			Brown, wet, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)	
	W	L				
	W	L				
					Bottom of Exploration at 87.0 ft.	
90						
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-04 124
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection performed by D. Hallman on 2/19/87.	
					NOTES: 1. Sample designation "NS" = not sampled	
25					2. Ease of sampling: (P*) = picked, left white marks (P) = picked (S) = shoveled (H) = hand sampled	
					3. Unless otherwise noted, soil held in overhang above sample excavation.	
30						
35						
40						
	D	0.9 to 1.1	NS15	42/43	Same as NS14, but cobbly, coarse to fine GRAVEL, and with traces of rust colored clay. (GP) to (GP-GC)	(P) Hard. (NW
45					See next page.	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-04
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	D	0.4 to 0.8	NS14	45/46	Black and rust-brown, damp, coarse to fine gravelly, COBBLES, trace coarse sand and clay. Partially stained black with MnO_2 and partially infilled with rust colored clay. Frequent open voids and medium to fine sand pockets. (GP-GC)	(P) Easy - little sand to help hold material together.	(NE
	D	0.1 to 0.6	NS13	48/49	Rust-brown, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of tan clay. (GP)	(P) Hard - tightly interlocked, clay binder.	(SE
50							
	D-M	0.8 to 1.1	G12	51/53	Tan to rust-brown, damp to moist, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, trace coarse sand, with traces of clay. (GP)	(P) Hard - tightly interlocked, clay binder. Sand frequently "cemented" into chunks. Clay providing more strength than below.	(W)
55	M	0.8 to 1.1	G11	54/56	Tan, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay and occasional small layers (up to 4") of MnO_2 stained material. (GP)	(P) Hard - tightly interlocked - clay binder.	(N)
	M	0.4 to 0.8	G10	57/59	Tan, rust-brown and black, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay, with frequent layers (up to 6" thick) of dry, black (MnO_2) stained, cobbly, coarse to fine GRAVEL with voids (up to 2"). (GP-GC)	(P) Moderate to easy - gravel layers are loose, clay binder in rest of material.	(E)
60							
	M	0.3 to 0.5	G9	60/62	Tan to brown, moist, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace clay, with occasional pockets of well sorted gravel with black (MnO_2) staining, voids and cream colored clay pockets. (GP-GC)	(P) Moderate - slight interlocking. Clay acts as binder.	(S)
65	M	0.5 to 0.7	G8	63/65	Brown to tan, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and frequent coarse sandy gravel lenses. (GP-GC)	(P) Moderate to easy - not interlocked, but has clay binder.	(NW
	M	0.2 to 0.4	G7	66/68	Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay, with frequent pockets of cream colored clay. (GP-GC)	(P) Hard - clay binder and interlocked.	(NE
70	M	0.4 to 0.5	G6	69/71	Brown to tan, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay and occasional black (MnO_2) stained lenses. (GP) to (GP-GC)	(P) Easy - non-interlocked, but clay acts as binder.	(SE

46

56.5

65.5

68.5

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

BORING NO. LDB-04 126

CPSS FORM # 10 11-15-85

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-04

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	M	0.4 to 0.5	G6	69 / 71	Brown to tan, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay and occasional small lenses of black (MnO_2) stained gravel. (GP) to (GP-GC) NOTE: Many cobbles are fractured and weathered.	(P) Easy - material is not interlocked but clay acts as binder.	(SE
	M	0.4 to 0.6	G5	72.5 / 74.5	Brown and tan, moist, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay and frequent small lenses of black (MnO_2) stained gravels (up to 2" thick) containing small voids. (GP) to (GP-GC)	(P) Moderate to hard - clay binder and slight interlocking.	(SW
75							
	M	0.1 to 0.3	G4	75 / 77	Brown to tan, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles and coarse sand, trace clay, with frequent small pockets of clay and black (MnO_2) stained material with occasional voids (up to 3/4"). (GP) to (GP-GC)	(P) Hard - clay binder and interlocked.	(N)
					77.0		
	M	0.2 to 0.4	G3	78 / 80	(Very dense) brown, moist, fine SAND, with occasional gravel and coarse sand pieces. (SP)	(P) Easily to (S) hard.	(E)
80							
					80.5		
	W	0.4 to 0.6	NS2	81 / 83	Brown, moist to wet, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC) NOTE: Standing groundwater inside casing at 81.8 ft. below ground surface during downhole inspection.		(S)
85			NS1	84 / 86			(W)
90					Bottom of casing at 89 ft. below ground surface.		
95							

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-04
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-05

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 7
LOCATION: Sta. 139+00
ELEVATION: 1188.2
DATE START: 2/19/87
DATE FINISH: 2/20/87
DRILLER: Richard Scott
PREPARED BY: Bruce Robinson, Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE			
2/20/87	WD	91'	-	91'	TYPE	-	Auger
2/20/87	2.5	89'	-	91'	SIZE ID	-	36"
2/23/87	64	88'	-	91'	HAMMER WT		-
					HAMMER FALL		-

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			1.0 Brown, dry, clayey SILT, trace fine sand and roots. -TOPSOIL- (ML)	2 A.P. from 0 to 5 ft.
	Dry	N			NOTE: Location = N 880,024.32, E 508,083.85	
	Dry	N				
	Dry	N			Brown, dry, clayey SILT, little to trace fine sand, with frequent calcareous nodules (up to 3") and occasional gravel. (ML) -ALLUVIUM-	
5	Dry	N				
	Dry	N			6.0	5 A.P. from 5 to 10 ft.
	Dry	N			NOTE: Same as above, but highly cemented from approximately 6 to 12 ft. -CALICHE-	
	Dry	N				
	Dry	N				
10	Dry	N				
	Dry	N				4 A.P. from 10 to 15 ft.
	Dry	N			12.0	
	Dry	N			NOTE: Same as above, but not cemented. (ML) -ALLUVIUM-	
	Dry	N				
					14.5	
15	Dry	L			Brown, dry, clean, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP) -SGC-	
	Dry	Y				9 A.P. from 15 to 20 ft.
	Dry	Y				
	D	Y			NOTE: "Some" cobbles at approximately 18 or 19 ft.	
	D	Y				
20	D	Y				

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

BORING NO. LDB-05 128

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	Y			21	18 A.P. from 20 to 25 ft.
	D	Y			Rust-brown, damp, medium to fine sandy, COBBLES, some coarse to fine gravel, trace coarse sand, with traces of clay and frequent black (MnO_2) staining on cobbles and gravel. (GP)	
	D	Y				
	D	Y			NOTE: Varies to sandy GRAVEL with occasional boulders at approximately 22 ft.; traces of silt at approximately 24 ft.	
25	D	Y				8 A.P. from 25 to 30 ft.
	D	Y				
	D	L				
	D	L				
	D	L			29	
30	D	L			Dark brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of silt and clay and frequent boulders. (GP) to (GP-GC)	7 A.P. from 30 to 35 ft.
	D	L				
	D	L				
	D	L				
	D	N-L				
35	D	N-L				10 A.P. from 35 to 40 ft.
	D	N-L			36	
	D-M	N-L			Tan and black, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of tan clay and frequent black (MnO_2) staining. (GW) to (GW-GC)	
	D-M	N-L				
	D-M	N-L				
40	D-M	N-L				11 A.P. from 40 to 45 ft.
	D-M	N-L				
	D-M	N-L			42	
	D	N-L			Dark brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay and black (MnO_2) staining. (GW) to (GW-GC)	
	D	N-L				
	D	N-L			NOTE: Soil moldable when squeezed in hand.	
45						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-05
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N-L			46	7 A.P. from 45 to 50 ft.
	D	N-L			Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)	
	D	N-L				
	D	N-L			NOTE: Gravels have cream colored clay coatings, and black (MnO_2) staining. Frequent chunks of "clay-cemented" sand.	
50	D	N-L				9 A.P. from 50 to 55 ft.
	D	L				
	D	L			52	
	D	L			Brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay (soil holds together in a ball when squeezed). (GP) to (GP-GC)	
	D	L				
55	D	L				7 A.P. from 55 to 60 ft.
	D	L			NOTE: Bulge on north side of borehole between 47 and 58 ft. below ground surface is kicking auger to the south.	
	D	L				
	D	L			58	
	D	L			Light brown, damp, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay (very little MnO_2 staining). (GW)	
60	D	L				6 A.P. from 60 to 65 ft.
	D	N-L			61.5	
	D	N-L			NOTE: Medium to fine sandy, cleaner, and little cobbles at approximately 61.5 ft. (GP)	
	D	N-L				
	D	N-L			64	
65	D-M	N-L			Brown, damp to moist, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand with traces of clay (soil holds together in a ball when squeezed). (GP) to (GP-GC)	6 A.P. from 65 to 70 ft.
	D-M	N-L				
	D-M	N-L				
	D-M	N-L				
	D	N-L				
70	D	N-L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-05
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N-L			71 See previous page.	5 AP from 70 to 75 ft.
	D	N-L			Light brown, damp, clean, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace	
	D	N-L			73 coarse sand. (GP)	
	D-M	N-L			Dark brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace	
75	D-M	N-L			coarse sand, with traces of clay and frequent pockets of rust-brown medium to fine sand. (GP)	6 A.P. from 75 to 80 ft.
	D-M	N-L			76	
	D	N-L			Tan, damp, clean, medium to fine sandy, coarse GRAVEL, little cobbles, trace fine gravel and	
	D	N-L			coarse sand. (GP)	
	D	N-L			78.5	
80	D	N-L			Tan to brown, damp, coarse to medium sandy, coarse gravel, little cobbles, trace fine gravel	7 A.P. from 80 to 87 ft.
	D	N-L			and fine sand, with traces of clay. (GP) to (GP-GC)	
	D	N-L			NOTE: Soil forms a ball when squeezed in hand.	
	D	N-L				
	D	N-L				
85	D	L-L			85	8 A.P. from 85 to 90 ft.
	D	N-L			Tan, damp, coarse to medium sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand,	
	D	N-L			with traces of clay as coatings on gravel, and frequent black (MnO_2) staining on gravel.	
	M-W	N-L			(GP) to (GP-GC)	
	M-W	N-L			89	
90	M-W	N-L			Black and rust-brown, moist to wet, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, trace clay. (GW-GC)	11 A.P. below 90 ft. (penetrated to 94 ft ±; hole stayed open to 91 ft.)
	W	N-L			91 NOTE: Black (MnO_2) staining with rust-brown clay between gravels.	
	W	Y				
	W	Y			Brown, wet, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GW)	
	W	Y			NOTE: Groundwater table at approximately 91 ft.	
					Bottom of Exploration at approximately 94 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-05 137
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection performed by D. Hallman and A. Howard on 2/20/87 and 2/23/87.	
					NOTES: 1. Sample designation "NS" = not sampled	
25					2. Ease of sampling: (P*) = picked, left white marks (P) = picked (S) = shoveled (H) = hand sampled	
					3. Unless otherwise noted, soil held in overhang above sample excavation.	
30						
35						
40						
		0.3-1.0	NS15	44.0	Rust-brown, damp, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand, with occasional boulders (to 18"), traces of clay throughout and occasional clayey sand pockets. (GP) to (GP-GC)	(P) Moderate to easy-sand breaks loose (N) without clay as binder, some interlocking of cobbles and gravel.
45		0.5-0.8		45.0		

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-05
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CPSS FORM # 102 11-15-85

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					46.0	
	D	0.3-0.7	NS14	47.0 / 48.0	Same as NS13, but with little cobbles and coarse to fine sandy pockets. (GP)	(P) Moderate to easy- gravel lenses are loose. (E
50	D	0.5-0.9	NS13	50.0 / 51.0	Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with traces of clay and frequent black (MnO_2) gravel lenses with voids (up to 2") and clay pockets within. (GP)	(P) Moderate - clay acts as binder. (S
					51.2 Brown and gray, damp, medium to fine sandy, COBBLES, some coarse gravel, trace silt and clay, with occasional fine gravel and coarse sand. (GP-GC)	
55	D	1.0-1.3 / 0.7-0.9	NS12	53.0 / 55.0	Brown to rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with traces of silt and clay, occasional clayey fine sand pockets and frequent rust-colored clay pockets. (GP) to (GP-GC)	(P) Hard to moderate cobbles and gravel interlocked. Clay acts as binder. (N
	D	0.5-0.7	G11	56.0 / 58.0	Grayish-brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with traces of silt(?) and clay, frequent black (MnO_2) staining and occasional clay pockets. (GP)	(P) Moderate to hard- gravel and cobbles interlocked. Holds an overhang well. (NE
					59.0	
60	D	0.1-0.2 / 0.1-0.5	G10	59.0 / 61.0	Tan and gray, damp, fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse to medium sand, with traces of clay, occasional black (MnO_2) staining of cobbles and gravel and coarse to medium sand pockets. (GP)	(P) Moderate - gravels interlocked. Clay present, but not binder as below. (SE
					61.5	
65	D	0.4 / 0.1-0.7	G9	62.0 / 64.0	Gray to brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles (varies), trace coarse sand, with traces of clay, occasional black (MnO_2) staining on cobbles and occasional rust-brown clayey fine sand pockets. (GP) to (GP-GC)	(P) Hard to moderate- cobbles somewhat interlocked. (SW
	D-M	0.7-1.0	G8	65.0 / 67.0	Grayish-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand, with traces of clay and occasional black (MnO_2) stained coarse sandy gravel lenses. (GP) to (GP-GC)	Hard to moderate- gravel and cobbles slightly interlocked. Clay helps bind sand together. (N)
					67.7 NOTE: Clay pockets associated with coarser fraction.	
70	D-M	0.7 / 0.5-0.7	G7	68.0 / 70.0	Brown and gray, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay, frequent clay pockets and occasional fine gravel lenses. (GP)	(P) Hard - gravels are well interlocked. Clay helps as binder. (E)

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-05
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-05

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					70.6	
	M	0.2 to 0.4	G6	71 / 73	Tan, moist, fine gravelly, coarse to medium SAND, trace coarse gravel, with traces of clay and occasional layers/pockets (up to 4" thick) of fine sandy, fine GRAVEL, trace silt. (SP) to (SP-SC)	(P) Easily - clay binder makes sand moldable and holds it into chunks.
					73.5 Gradational Change	
75	D-M	0.4-0.5	G5	74.5 / 76.5	Tan, damp to moist, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay as coatings on undersides of gravels. (GP)	(P) Moderate - gravels are interlocked.
		0.5-0.8			76.5	
	D-M	0.8-1.0 / 0.6-0.9	G4	77 / 79	Tan, damp to moist, coarse to fine gravelly, medium to fine SAND, with occasional cobbles and slight traces of clay on sand and as coatings on coarser material. (SP)	(P) Moderate to easy-sand frequently in weakly "cemented" chunks. Slight interlocking of gravels.
					79.5	
80	D-M	0.5-0.8 / 0.5	G3	80.6 / 82.0	Tan, damp to moist, medium SAND, trace fine gravel and coarse and fine sand, with occasional cobbles and coarse gravel, and traces of clay. (SP)	(P) Easy to (S) hard - frequently excavated in weakly "cemented" chunks.
					82.3	
85	M	0.9 / 1.1	G2	83 / 85	Gray to brown, moist, coarse to fine gravelly, COBBLES, little fine sand, trace coarse to medium sand, with traces of cream-colored clay. Has frequent layers (up to 6") of black (MnO_2) stained gravel containing some coarse to medium sand, partially infilled with black and rust-brown clays. (GP) to (GP-GC)	(P) Hard-tightly interlocked. Sand excavates frequently as "clay-cemented" chunks.
	M	1.4 / 1.8	NS1	86 / 88	NOTE: NS1 = same as G2.	
90	W / W				Bottom of casing at 91 ft. below ground surface.	
95						

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-05 134
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CPSS FORM # 10 11-15-85

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-06

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta 2951+25
ELEVATION: 1190.0
DATE START: 2/23/87
DATE FINISH: 3/2/87
DRILLER: Richard Scott
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE			
2/23/87	WD	NE	-	93'	TYPE -	Auger	
					SIZE ID -	36"	
					HAMMER WT	-	
					HAMMER FALL	-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Reddish-brown, dry, silty fine SAND, trace cobbles, with roots and $CaCO_3$ present. (SM)	2 A.P. from 0 to 5 ft.
	Dry	N			2+ -TOPSOIL-	
	Dry	N			NOTE: From 2-8 ft. showed strong $CaCO_3$ cementation. -CALICHE-	
	Dry	N				
5	Dry	N				4 A.P. from 5 to 10 ft.
	Dry	N			NOTES: 1. Approximate Location = N 878,692.00, E 508,130.00. 2. Boring was obstructed by construction activities prior to survey.	
	Dry	N				
	Dry	N			8.0	
	Dry	N			Reddish-brown, dry, silty, medium to fine SAND, little coarse to fine GRAVEL. (SP) -ALLUVIUM-	11 A.P. from 10 to 15 ft.
10	Dry	N				
	Dry	N				
	Dry	N				
	Dry	N			13	
	Dry	N			Brown, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles. (GP) -SGC-	
15	Dry	N			15	12 A.P. from 15 to 20 ft.
	Dry	N			Tan, dry, clean, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GW)	
	Dry-D	L			17	
	D	L			Brown, dry to damp, clean, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW)	
	D	L				
20	D	L			NOTE: Soil will clump together in hand with pressure, but has less than 2% clay present. One or two boulders noted also.	

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-06

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					See previous page.	16 A.P. from 20 to 25 ft.
	D	L				
	D	N-L				
	D	N-L				
	D	L				
25	D	L			25	11 A.P. from 25 to 30 ft.
	D	L			Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay. (GP) to (GP-GC)	
	D	L			NOTE: Encountered black (MnO_2) staining and slight traces of clay as coatings on gravel.	
	D	L				
	D	L			NOTE: Encountered a zone of coarse to fine sandy, COBBLES, with less clay and mostly coarse to medium sand from approximately 28-30 ft.	
30	D	L				7 A.P. from 30 to 35 ft.
	D	L			31	
	D	L			Reddish-brown, damp, medium sandy, coarse to fine GRAVEL, little cobbles and fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)	
	D	N-L				
	D	N				
35	D	N			NOTE: Black (MnO_2) staining at approximately 35 ft.	5 A.P. from 35 to 40 ft.
	D	N				
	D	N				
	D	N				
	D	N				
40	D	N				5 A.P. from 40 to 45 ft.
	D	N			41	
	D	N			Brown, damp, medium sandy, coarse to fine GRAVEL, little cobbles and fine sand, trace clay. (GP-GC)	
	D	N			NOTE: This material is darker in color, and clay makes soil more moldable than above 41 ft.	
	D	N				
45	D	N				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-06
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-06

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N-L			See previous page.	8 A.P. from 45 to 50 ft.
	D	N-L				
	D	N-L				
	D	N-L				
50	D	N-L				8 A.P. from 50 to 55 ft.
	D	N-L				
	D	N-L				
	D	N-L			53	
	D	N-L			Brown to tan, damp, coarse to medium sandy, coarse to fine GRAVEL, trace fine sand, with occasional cobbles and traces of clay. (GP) to (GP-GC)	7 A.P. from 55 to 60 ft.
55	D	N-L				
	D	N-L				
	D-M	N-L				
	D-M	N-L				
	D-M	N-L			NOTE: GRAVELS have coatings of cream colored clay as cementation.	
60	D-M	N-L				8 A.P. from 60 to 65 ft.
	D-M	N-L				
	D-M	N-L				
	M	N-L				
	M	N-L			64	Sand grains are mostly medium to fine.
65	M	N-L			Dark brown, moist, coarse to medium sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GP-GC)	
	M	N-L			NOTE: Black (MnO_2) staining, and gray clay cemented to gravels. Possible perched groundwater at approximately 68 ft. in gravel-rich layer. Heavy rainfall during 2/24-26/87.	7 A.P. from 65 to 70 ft.
	M	N-L				
	M-W	N-L			68	
	W	N-L			Reddish-brown, wet, coarse to medium sandy, coarse to fine GRAVEL, trace clay. (GP-GC) NOTE: Clay coatings on all gravel and clayey sand in pockets, lumps together in balls.	
70	W	N-L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-06
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-06

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					See previous page.	
	M-W	N-L			71	10 AP from 70 to 75 ft.
	M	N-L			Tan to brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW) to (GW-GC)	
	M	N-L			NOTE: Clay occurs as coatings on all gravel grains and makes soil moldable.	
	M	N-L				
75	M	N-L				7 A.P. from 75 to 80 ft.
	M	N-L				
	M	N-L			77	
	M	N-L			Light-brown, moist, coarse to medium sandy, coarse to fine GRAVEL, little cobbles and fine sand, with traces of clay . (GP)	
	M	N-L			NOTE: Lower percentage of clay, more poorly graded sand.	
80	M	N-L				9 A.P. from 80 to 85 ft.
	M	N				
	W	N				
	W	N			83	
	W	N			Tan to grayish-brown, moist, coarse to medium sandy, coarse to fine GRAVEL, little cobbles, trace fine sand and clay. (GP) to (GP-GC)	
85	W	N			NOTE: Creamy clay, very moldable, adhered to gravel grains and black (MnO_2) staining on gravel.	4 A.P. from 85 to 90 ft.
	M-W	N				
	M	N			NOTE: Stopped drilling at 83 ft. on 2/24/87. Resumed drilling at 81.5 ft. on 3/2/87 (minor caving). Soil is wet from recent heavy rainfall.	
	M	N				
	M	N				
90	M	N				3 A.P. from 90 to 94 ft.
	M	N			91	
	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GP) to (GP-GC)	
	M	N			NOTE: Cobble-sized blocks of clay-cemented coarse sandy, coarse to fine gravel with black (MnO_2) coatings on some gravel in isolated pockets.	
	M	N			93	
					Gray to brown, moist to wet, clean, medium to fine SAND. (SP)	
95	M-W	N				
					Bottom of Exploration at 94.0 ft.	

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-06
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CPSS FORM # 102 11-15-85

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-06

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
					NOTES: 1. Downhole Inspection performed by David Hallman on 3/2/87 and 3/3/87. 2. See page 5 of 7 of boring log LDB-01 for additional explanatory notes.		
	D	0.6 to 1.0	NS15	47/48	Rust-brown and black, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand, with traces of clay and frequent layers/pockets (up to 6") of black (MnO_2) stained gravel containing open voids (up to 1"). (GP)	(P) Moderate - interlocked, and clay acts as binder.	(N)
50					50.0		
	D	0.7 to 0.8	NS14	50/51	Rust-brown to tan, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay. (GP)	(P) Hard to moderate - interlocked and clay acts as binder.	(W)
	D	0.5 to 0.7	NS13	53/54	Rust-brown to tan, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional boulders. (GP)	(P) Hard - interlocked and clay acts as binder.	(S)
55					55.0		
	D	0.5 to 0.6	G12	56/58	Tan and gray, damp, coarse to fine gravelly, COBBLES, some to little medium to fine sand, trace coarse sand, with traces of clay and occasional layers (up to 6" thick) of black (MnO_2) stained, cobbly, coarse to fine GRAVEL, with traces of coarse to fine sand, clay and open voids (up to 2"). (GP)	(P) Hard - tightly interlocked. Slight clay binder.	(E)
					59.2		
60	D-M	0.8-1.0 / 0.7-0.8	G11	59.2/61	Tan to gray, damp to moist, coarse to fine gravelly, COBBLES, some medium to fine sand, trace coarse sand, with traces of clay. (GP)	(P) Hard - interlocking and clay acts as binder.	(NW
	M	0.4 to 0.7	G10	62/64	Tan and gray, moist, medium to fine sandy, COBBLES, some coarse gravel, little fine gravel, trace coarse sand, with traces of clay in pockets and frequent small voids (up to 1/2"). (GP) to (GP-GC)	(P) Moderate - cobbles interlocked. Clay binder - extreme gap grading made sampling easier.	(SW
					64.5		
65	Dry-W	0.6 to 1.1	G9	65/67	Black, tan and rust-brown, dry to wet, coarse to fine gravelly, COBBLES, trace coarse sand and clay, with voids (up to 1"x2"x1"). (GP-GC) - INTERLAYERED WITH (12" layers) - Brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, trace clay. (GP-GC) NOTE: Porous areas are dry, visible water present in frequent pockets containing high amounts of clay.	(P) Hard to easy - cobbles and gravel are tightly interlocked with occasional looser pockets. Clay not providing much strength.	(N)
					68.3		
	D	0.4-0.8 / 0.2-0.4	G8	68.3/70	Brown to rust-brown, damp, coarse to fine gravelly, coarse to medium SAND, trace fine sand and clay, with occasional cobbles and pockets of clay. (SW-SC)	(P*) Clay acts as "cement". Sand excavated in "cemented" chunks.	(SE
70							

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-06
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-06

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					70.5	
	D	0.6-0.7	G7	71.0 / 72.3	Tan, damp, cobbly, coarse to fine GRAVEL, little fine sand, trace coarse to medium sand, with traces of silt and clay in pockets. (GP)	(P) Very hard - interlocked with clay "cementation". (S) Hard. (NI
		0.5-0.6			72.3 Tan, damp, medium to fine SAND, trace coarse to fine gravel, with traces of clay. (SP) 73.0	
					Tan, damp to moist, medium to fine sandy, COBBLES, some coarse gravel, trace fine gravel, with traces of clay. (GP) to (GP-GC)	(P) Hard.
75					74.8	
	D-M	0.4-0.6 / 0.6-0.7	G6	74.8 / 76.0	Tan to rust-brown, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP)	(P) Very hard - interlocked with clay "cementation". Sand excavated in cemented chunks. (SI
	D-M	0.4 to 0.5	G5	77 / 79	Tan to gray, damp to moist, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand, with traces of clay and occasional layers/pockets (up to 3" thick) of black (MnO_2) stained coarse sandy, coarse to fine GRAVEL, with voids (up to 1/2"). (GP) NOTE: Coarse sand and fine gravel are relatively missing.	(P) Hard to moderate - interlocked with clay as binder. Sand frequently excavated in small "cemented" chunks. (NE
80					80.8	
	M	0.1(*) to 0.3	G4	80.8 / 82	Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay, with occasional layers/pockets (up to 12") of black (MnO_2) stained, cobbly, coarse to fine GRAVEL, trace coarse to fine sand and clay with voids between gravel and cobbles. (GW-GC)	(P) Moderate to easy - poorly interlocked clay, too moist to act as "cement" WC near LL(?) (N)
	M	0.1(*) to 0.4	G3	83 / 85	83.0 Tan to rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay, with trace coarse sand in pockets and frequent pockets of buff colored clay. (GP-GC)	(P) Hard-interlocked with clay as binder. Soil molds well due to clay and frequently excavated in chunks. (W)
85						
	M	0.0(*) to 0.1	G2	86 / 88	Tan to rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace (?) clay, with occasional layers containing traces of rust-brown silt. (GP) to (GP-GC)	(P) Hard - tightly interlocked with clay as binder. Sand frequently excavated in "cemented" chunks. (S)
	M-W	0.0(*) to 0.1	G1	89 / 91	Tan, moist to wet, coarse to fine sandy, coarse to fine GRAVEL, trace clay, with occasional cobbles. (GP-GC)	(P) Moderate to easy - slight interlocking, but too moist for clay to act as "cement". Clay provides considerable cohesion even though W.C. near L.L. (E)
90					90.9	
					NOTE: Black (MnO_2) stained material, with trace black clay, below 90.9 ft.	
					NOTES: 1. (*) Indicates false caliper-material from above has filled casing annulus. 2. Groundwater at 93.5 ft.	
					Bottom of casing at 94 ft. below ground surface.	
95						

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-06
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-07

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta. 110+20
ELEVATION: 1195.7
DATE START: 3/5/87
DATE FINISH: 3/6/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/6/87	WD	NE	-	92'	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Light brown, dry, silty CLAY, little fine sand, with traces of roots. (CL)	13 A.P. from 0 to 5 ft.
	Dry	N			1 -TOPSOIL-	
	Dry	N			NOTE: Location = N 877,144.18, E 508,159.45	
	Dry	N			Extremely hard, cemented ($CaCO_3$), tan, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GW)	
5	Dry	N			NOTE: Very hard, highly cemented. Required core barrel on auger to penetrate.	10 A.P. from 5 to 10 ft.
	Dry	N			6 -CALICHE-	
	Dry	N			Light tan, dry, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles. (GW)	
	Dry	N			NOTE: Boulder encountered at 5-1/2 to 6 ft.	
	Dry	N			-CALICHE-	
10	Dry	N				12 A.P. from 10 to 15 ft.
	Dry	N-L			11	
	Dry	N-L			Light brown, dry, coarse to fine gravelly COBBLE, little medium to fine sand, trace coarse sand. (GP)	
	Dry	N-L			-SGC-	
	Dry	N-L				
15	Dry	N-L				6 A.P. from 15 to 20 ft.
	Dry	N-L				
	Dry	N			17	
	Dry	N			Light brown, dry, medium to fine sandy, coarse to fine GRAVEL, little cobble, trace coarse sand. (GP)	
	Dry	N				
20	Dry	N				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-07

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N				11 A.P. from 20 to 25 ft.
	D	N			22	
	D	N			Reddish-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobble, with traces of clay. (GW) to (GW-GC)	
	D	N			NOTES: 1. Gravel coated by thin rusty clay.	
	D	N			2. Black (MnO_2) staining on gravel and cobbles.	
25	D	N			3. Cobbles get larger and more frequent with depth.	12 A.P. from 25 to 30 ft.
	D	N				
	D	N				
	D	N				
	D	N-L				
30	D	N-L				9 A.P. from 30 to 35 ft.
	D	L				
	D	L				
	D	L				
	D	L				
35	D	L				9 A.P. from 35 to 40 ft.
	D	L			36	
	D	L			Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobble, trace clay. (GW-GC)	
	D	L			NOTE: Frequent black (MnO_2) staining on gravel and cobbles.	
	D	L				
40	D	L			40	12 A.P. from 40 to 45 ft.
	D	L			Tan-brown, damp, coarse to fine gravelly, COBBLE, little coarse to fine sand, with traces of clay.	
	D	L			NOTE; Black (MnO_2) staining present in small quantities. (GP)	
	D	L				
	D	L			44 Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobble, trace clay.	
45	D	L			NOTE: Much greater percentage of clay and black (MnO_2) staining. (GW-GC)	

CPSS FORM # 102 4-4-86

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S—— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T—— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U—— UNDISTURBED PISTON	UR – NOT READ
31-50	DENSE	9-15	STIFF	G—— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X—— OTHER	BORING NO. LDB-07
		31+	HARD	NR—— NO RECOVERY	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-07

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			46	5 A.P. from 45 to 50 ft.
	D	L			Brown, damp, coarse to fine sandy, COBBLES, some gravel, trace clay. NOTE: Black (MnO_2) staining present. (GW) to (GW-GC)	
	D	L				
	D	L-N			49	
50	D	N			Dark brown, damp, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. NOTE: Black (MnO_2) staining present. (GW) to (GW-GC)	6 A.P. from 50 to 55 ft.
	D	N				
	D	N				
	D	N			53	
	M	N			Dark brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay with occasional boulders. (GW) to (GW-GC)	
55	M	N				10 A.P. from 55 to 60 ft.
	M	N-L				
	M	L			57	
	M	L			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, trace clay with occasional boulders. (GW) to (GW-GC)	
	M	L				
60	M	N-L			60	10 A.P. from 60 to 65 ft.
	M	N			Dark brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. (GW) to (GW-GC)	
	M	N				
	M	N			63	
	M	N			Tan brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	
65	M	N			65	12 A.P. from 65 to 70 ft.
	M	N			Dark brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. (GW) to (GW-GC)	
	M	N			67	
	M	N			Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	
	M	N				
70	M	N				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-07
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-07

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			71	8 AP from 70 to 75 ft.
	M	N			Dark brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	
	M	N			73	
	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GP) to (GP-GC)	
75	M	N				5 A.P. from 75 to 80 ft.
	M	N			76	
	M	N			Dark brown, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. NOTE: Encountered boulder 16" x 15" x 9". (GW-GC)	
	M	N				
	M	N			79	
80	M	N			Tan to brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. (GW) to (GW-GC)	7 A.P. from 80 to 85 ft.
	M	N				
	M	N			82	
	M	N			Dark brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay. NOTE: Material molds well. (GW-GC)	
	M	N			84	
85	M	N			Gray to brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW) to (GW-GC)	4 A.P. from 85 to 90 ft.
	M	N				
	M	N				
	M	N			88	
	M	N			Gray to brown, medium to fine SAND, little to trace, coarse to fine gravel, trace clay. (SP-SC)	
90	M	N			NOTE: Clay providing cementation to sand.	2 A.P. below 90 ft.
	M	N				
	M	N				
					Bottom of Exploration at 92.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-07
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-07

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
					NOTE: Downhole inspection performed by D. Hallman on 3-6 and 3-9-87.		
	D	0.8 to 1.0	NS15	45.8 / 46.8	Rust-brown and black, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. Frequent small pockets of black (MnO_2) stained material with numerous small voids.	(P) Moderate to easy - poor interlocking clay binder to clay "cementation" with with occasional chunks of sand.	(S)
50	D	1.0 to 1.3	NS14	48.8 / 49.8	Light brown to rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay. Contains occasional small layer of slightly black (MnO_2) stained material with voids up to (1" x 1" x 3").	(P) Moderate - slight interlocking, clay binder.	(E)
	D	0.9 to 1.1	NS13	51.8 / 52.8	Light brown, coarse to fine gravelly, COBBLES, little medium to fine sand, with slight traces of clay. (GP)	(P) Moderate - slight interlocking, slight clay "cementation".	(N)
55	Dry-M	1.0-1.2 / 0.5-0.7	G12	54.8 / 56.8	54.5 Black and rust-tan, (MnO_2) stained), dry to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, trace clay. Frequent voids between gravels and cobbles (up to 1/2" x 1" x 2"), areas with voids are dry. (GW-GC)	(P) Hard to easy - Interlocked in clumps. Clay W.C. approaching L.L. High permeability in Zones.	(W)
60	M	0.6 to 0.8	G11	57.8 / 59.8	Rust-brown and black, moist, coarse to fine gravelly, COBBLES, little medium to fine sand, with traces of clay and frequent small pockets of black (MnO_2) stained gravels and cobbles. (GP) to (GP-GC)	(P) Hard - interlocked and clay "cementation."	(SE
	M	1.0-1.2 / 0.9	G10	60.8 / 62.8	Rust-brown, moist, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay and frequent black (MnO_2) staining on gravels and cobbles (isolated, not layers). (GP) to (GP-GC)	(P) Hard - interlocked clay binder. Sand frequently excavated in "cemented" chunks.	(NE
65	Dry-M	0.3 to 0.6	G9	63.8 / 65.8	-INTERLAYERED- Black, dry, cobbly, coarse to fine GRAVEL, with traces of coarse to fine sand and black, orangish, and gray clays. Very porous, large (1"x1"x2") voids -WITH- Brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobble, trace coarse sand with traces of clay. (GP) to (GP-GC)	(P) Easy to hard.	(S)
70	M	0.2 to 0.5	G8	66.8 / 68.8	69 Light brown, orangish and black, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, trace clay. Frequent small (up to 4" thick) layers of black (MnO_2) stained coarse sandy, coarse to fine GRAVEL which have been infilled with orangish clay. (GP) to (GW-GC)	(P) Easy to hard- Gravel interlocks in clusters. Material molds easily.	(NW

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-07
	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-07

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	M-W	0.7 to 1.0	G7	69.8 / 71.8	Tan, moist, cobbly, coarse to fine SAND, little coarse to fine gravel, with traces of clay. (SP) to (SP-SC)	(P) Hard, interlocked clay binder.	(SF
71.0					Rust-brown, moist to wet, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with traces of clay and occasional cobbles. (GP) to (GP-GC)		
	M-W	0.4 to 0.6	G6	72.8 / 74.8	(Relatively dense), brown, moist to wet, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay. NOTE: Frequent small pockets containing visible water on material. (GP)	(P) Very hard - interlocked and clay binder. Sand frequently in chunks. Material is not moldable.	(NE
75							
	D-M	0.3 to 0.4	G5	75.8 / 77.8	Light brown, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of clay. (GP)	(P) Very hard - tightly interlocked in clusters, clay "cementation." Sand matrix frequently excavated in chunks.	(SW
79.4							
80	M	0.2 to 0.4	G4	79.4 / 80.8	Brown, moist, cobbly, coarse to fine GRAVEL, little fine sand, trace silt. (GP-GM)	(P) Moderate to hard - interlocked cobbles and gravel.	(S)
	M	0.1 to 0.2	G3	81.8 / 83.8	Dark brown, moist, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand, with traces of silt and clay, and occasional small layers/pockets (up to 2") of black (MnO_2) stained material. (GP) to (GP-GC)	(P) moderate-slight interlocking, clay not providing "cementation". Material molds easily.	(E)
84.0					Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GP)		
84.8							
85	M	0.2 to 0.4	G2	84.8 / 86.3	Brown, moist, COBBLES, little coarse to fine gravel, little to trace fine sand, with traces of silt and clay. Contains frequent pockets of visible water behind cobbles. (GP-GM)	(P) Very hard-nested cobbles, matrix not providing strength. Material above does not hold up well.	(N)
86.3							
	M	0.2 to 0.3	G1	87.8 / 89.8	Tan, moist, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand and clay. (GP-GC)	(P) Hard - interlocked clay binder.	(W)
90							
	M	0.5-0.6			Tan, moist, medium to fine SAND, trace fine gravel and clay. (SP-SC)	(P*) clay binder.	
					Bottom of casing at 92.6 ft.		
95							

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-08

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta. 79+20
ELEVATION: 1194.6
DATE START: 3/3/87
DATE FINISH: 3/4/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/4/87	WD	NE	-	95'	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Dark brown, dry, silty fine SAND, little clay. -TOPSOIL- (SM)	3 A.P. from 0 to 5 ft.
	Dry	N			2.0	
	Dry	N			Light brown, dry, silty, fine SAND, little clay, trace fine gravel and roots. (SM) -ALLUVIUM-	
	Dry	N			4.0	
5	Dry	N			NOTES: 1. $CaCO_3$ cementation below 4.0 ft. 2. Location = N874,047.95, E 508,110.51 -CALICHE-	4 A.P. from 5 to 10 ft.
	Dry	N-L				
	Dry	N-L				
	Dry	N-L			8.0	
	Dry	N-L			Light brown, dry, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand. -ALLUVIUM- (GP)	
10	Dry	N-L				10 A.P. from 10 to 15 ft.
	Dry	N-L			NOTE: $CaCO_3$ occurs in gravel size silty clumps and as coatings on gravel.	
	Dry	N				
	Dry	N				
	Dry	N			14	
15	Dry	N-L			Tan to brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand and silt. -SGC- (GP) to (GP-GM)	11 A.P. from 15 to 20 ft.
	D	L				
	D	L			NOTE: $CaCO_3$ occurs only as coatings on gravel.	
	D	L				
	D	L			19	
20	D	L			Reddish-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay. (GW)	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-08

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			NOTES: 1. $CaCO_3$ occurs as coatings on gravel and cobbles. 2. Large boulder encountered at 19 ft. 3. Reddish-brown clay sticking to gravel.	12 A.P. from 20 to 25 ft.
	D	L				
	D	L				
	D	L			NOTE: 20" x 12" x 9" boulder brought out at 24 ft.	
25	D	L-Y				14 A.P. from 25 to 30 ft.
	D	Y				
	D	Y				
	D	Y			28	
	D	Y			Dark brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW)	
30	D	Y				15 A.P. from 30 to 35 ft.
	D	Y			NOTE: Black (MnO_2) staining and dark reddish-brown clay on gravel.	
	D	Y			32	
	D	Y			Dark reddish-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with black (MnO_2) staining. (GP)	
	D	Y				
35	D	Y			NOTE: Coarse to fine sand/clay matrix holding gravels together (no reaction for $CaCO_3$).	17 A.P. from 35 to 40 ft.
	D	Y			GRADING TO	
	D	Y				
	D	Y			Dark brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with black (MnO_2) staining as coatings. (GP)	
	D	L-Y				
40	D	L				21 A.P. from 40 to 45 ft.
	D	L				
	D	L			42	
	D	L			Brown and creamy-white, damp, medium to fine sandy, COBBLES, little coarse to fine gravel. (GP) NOTE: Hard, dry, creamy clay coatings on cobbles.	
	D	L			44	
45	D	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-08
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-08

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			Dark brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, trace coarse sand and clay. (GP-GC)	15 A.P. from 45 to 50 ft.
	D	L				
	D	L		48	NOTE: Clay also occurs as coatings on gravel and cobbles.	
	D	L			Brown and creamy white, damp, coarse to fine sandy, COBBLES, little coarse to fine gravel, trace coarse sand and clay, with creamy clay coatings on gravel and cobbles and some black (MnO_2) staining. (GP-GC)	
50	D	L				13 A.P. from 50 to 55 ft.
	D	L				
	D	L				
	D	L		53		
	D	L			Reddish-brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, trace coarse sand and clay, with creamy clay coatings on gravel and very little black (MnO_2) staining. (GP-GC)	
55	D	L		55		11 A.P. from 55 to 60 ft.
	D	L			Dark brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, trace coarse sand. (GP)	
	D	L				
	D	L			NOTE: Increased black (MnO_2) staining.	
	D	L		59		
	D	L			Light brown, damp, clean, fine SAND, trace coarse to fine gravel. (SP)	
60	D	L				7 A.P. from 60 to 65 ft.
	D	L		61		
	D	L			Rust-brown, damp, coarse to fine gravelly, medium to fine SAND, little cobbles. (SP)	
	D	L		63	NOTE: Sand grains cemented to gravel with clay (slight clay traces).	
	D	L			Rust-brown, damp, coarse to fine gravelly, coarse to fine SAND, little cobbles (SW)	
65	D	L			GRADING TO	5 A.P. from 65 to 70 ft.
	D	N-L			Brown, damp, coarse to fine gravelly, medium to fine SAND, little cobbles, trace coarse sand. (SP)	
	D	N-L			NOTE: Occasional cobble-size chunks of gravel cemented by compact, dry, medium to fine sand, with traces of clay.	
	D	N				
	M	N		69	Brown, moist, coarse to fine gravelly, medium to fine SAND, trace cobbles and clay. (SP-SC)	
70	M	N			NOTE: Molds easily in hand, reddish clay coatings on gravel.	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-08
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-08

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			71	4 AP from 70 to 75 ft.
	M	N			Dark brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GP-GC)	
	M	N			NOTE: Very clay rich and all gravel and cobbles coated with sticky clay.	
	M	N				
75	M	N				3 A.P. from 75 to 80 ft.
	D-M	N				
	D	N			77	
	D	N			Creamy white to brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand and clay. (GP-GC)	
	D	N				
80	D	N			80	3 A.P. from 80 to 85 ft.
	D	N			Light brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GP) to (GP-GC)	
	D	N			82 NOTE: Black (MnO_2) staining and creamy clay coatings.	
	D-M	N			Dark brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and clay. (GP-GC)	
	D-M	N			GRADING TO	
85	D	N			Light brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay and black (MnO_2) staining. (GP)	8 A.P. from 85 to 90 ft.
	D	N-L				
	D	N-L				
	D-M	N-L			88	
	D-M	N-L			Light brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles. (GP)	
90	M	N-L				
	M	N-L			91	? A.P. below 90 ft.
	M	N-L			Dark brown to black, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GP-GC)	
	M	N-L				
	M	N-L			94 Tan to grayish-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of creamy clay and black (MnO_2) staining. (GP)	
95	M	N-L			Bottom of Exploration at 95.0 ft.	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-08 150
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-08

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					NOTES: 1. Downhole inspection performed by D. Hallman on 3/4 - 3/6/87. 2. See page 5/7 of LDB-01 boring log for explanatory notes.	
	Dry-D	1.2 to 1.7	NS15	48.5 / 49.5	Gray and tan, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay (predominantly as coating on gravels and cobbles) and occasional boulders. (GP) NOTE: Many large cobbles.	(P) Hard to moderate - Interlocking cobbles and gravel, slight clay binder. (NE
50						
	Dry-D	0.6-0.7	NS14	51.5	51.5 Gray and tan, dry to damp, coarse to fine gravelly, COBBLES, trace coarse sand, with traces of medium to fine sand (in pockets) and slight traces of clay. Open voids (up to 2"-3") occur between gravels and cobbles (very high permeability). (GW)	(P) Hard - tightly interlocked, clay "cement" in sand greatly contributes to stability. (N
		1.1-1.2		52.5	52.7	
55	D	0.7 to 1.0	NS13	54.5 / 55.5	Rust-tan, gray and black, damp, medium to fine sandy, coarse to fine GRAVEL, some cobbles, little to trace coarse sand, with slight traces of clay, frequent small pockets of black (MnO_2) stained material and occasional boulders. (GP)	(P) Hard to moderate-Interlocked. Clay "cementation." (S
		1.6(*)	G12	57.5	Rust-tan and gray, damp, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, trace coarse sand with slight traces of clay and occasional layers of black (MnO_2) stained material. (GP)	(P) Moderate - Interlocked and has slight clay "cementation." (E
	D	to 1.9		59.5		
60					(*) NOTE: Material on this side of casing has caved slightly and increases upwards to approximately 4 ft. 25 ft. up.	
		0.8-0.9			61.0	
	D	0.5-0.7	G11	61.0 / 62.5	Tan, damp, medium to fine SAND, with slight traces of clay (as "cementation") and occasional cobbles. (SP)	(P*) Moderate - Clay cementation. Sand finer than G10, Sampled slightly easier. (N)
		0.8-0.9			- INTERLAYERED WITH - Tan, damp, coarse to fine gravelly, coarse to fine SAND with slight traces of clay (as cementation), occasional cobbles, and frequent pockets/lenses of fine SAND (clean to trace silt) and of coarse to fine SAND, both with slight traces of clay.	
		0.7-1.0				
	D		G10	63.9 / 65.1		(P*) Hard- with clay cementation. Chunks of sand are moderately to very difficult to crumble with finger pressure. (W)
65		0.8-0.9				
		0.9-1.0			(Relatively dense) tan to rust-brown, damp, coarse to fine gravelly, coarse to fine SAND, little to trace cobbles (small), with slight traces of clay. Sand is in coarser and finer zones and in frequent lenses (up to 8") of medium to fine SAND, little coarse sand, trace fine gravel with traces of clay. (SW)/(SP)	
	D		G9	66.5 / 68.5		(P*) Hard - very dense with clay "cementation". Excavated in large "cemented" chunks. (S
		0.7-0.8				(NE
70	D	0.4 to 0.6	G8	69.5 / 71.5		

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-08 151
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-08

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
	D	0.4 to 0.6	G8	69.5 / 71.5	(Relatively dense) tan to rust-brown, damp, coarse to fine gravelly, coarse to fine SAND, with traces of clay and occasional cobbles and pockets of fine gravel. (SW)	(P*) Hard-very dense. Clay acts as binder.	(N
					72.5 Rust-brown and black, damp, coarse to fine GRAVEL, little cobbles and clay, little to trace medium to fine sand, with traces of silt and frequent black (MnO_2) staining on gravels. (GC)	(P) Easy - noninterlocking, clay holding material together. Clay is moderately plastic.	(N
	D	0.3 to 0.4	G7	72.5 / 74.5	GRADES TO		
75					Rust-brown, damp, silty, coarse to fine GRAVEL, trace medium sand and clay, with lenses/pockets		
					76.0 of CLAY, little silt (up to 8" thick). (GM)	(P) Easy-poorly interlocked with wide gap in grain size.	(S
	D	0.2 to 0.4	G6	76.0 / 77.1	Tan, damp, fine sandy, coarse to fine GRAVEL, little cobbles (small), with slight traces of clay. (GP) 77.1		
					Tan, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles (small, under 6" diameter) with strong traces of clay. (GP) to (GP-GC)	(P) Very hard-tightly interlocked, clay acting as "cementation". Sand excavates in chunks.	(N
	D-M	0.4 to 0.6	G5	78.5 / 79.5	79.5 Tan, damp, medium to fine SAND, trace coarse to fine gravel and coarse sand. (SP)		
80					80.5		
	D-M	0.3 to 0.6	G4	81.5 / 83.5	Tan, damp to moist, medium to fine sandy, fine GRAVEL, little coarse gravel, little to trace cobbles (in nested clusters), trace coarse sand, with traces of clay and occasional lenses (up to 4" thick) of relatively dense, medium to fine	(P) Moderate - Poor interlocking, clay binder, sand frequently excavated in "cemented" chunks.	(N
					84.0 SAND, with traces of clay and cross bedding. (GP)		
85	D	0.3 to 0.5	G3	84.5 / 86.5	Tan and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles (predominantly small), trace coarse sand, with slight traces of clay in pockets and occasional pockets of black (MnO_2) stained fine GRAVEL. (GP)	(P) Moderate to easy - slight interlocking, little clay binder, holds an overhang well.	(W
					87.5		
	D	0.3 to 0.5	G2	87.5 / 89.5	(Relatively dense) tan, damp, medium to fine SAND, little fine gravel, trace coarse gravel and coarse sand, with slight traces of clay, one 8" lens of clean medium to fine SAND, and occasional cobbles. (SP)	(P) Hard to moderate-very dense, clay acts as binder.	(S
90					NOTE: Black sand partings exhibit cross-bedding.		
			NS1	90.5 / 92.5	Sandy GRAVEL (?)		
					NOTE: Casing settled into soil at bottom of borehole -- could not open window #1.		
95					Bottom of casing at 95.5 ft. below ground surface.		

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-08 152
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CPSS FORM # 10 11-15-85

CRSS
CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-09

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta. 64+60
ELEVATION: 1192.7
DATE START: 3/9/87
DATE FINISH: 3/10/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/10/87	WD	NE	-	87'	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			1 Brown, dry, clayey SILT, trace fine sand and roots. -TOPSOIL- (ML)	2 A.P. from 0 to 5 ft.
	Dry	N			Brown, dry, clayey SILT, little to trace fine sand, with frequent calcareous nodules and occasional gravels. (ML) -ALLUVIUM-	
	Dry	N				
	Dry	N				
5	Dry	N				6 A.P. from 5 to 10 ft.
	Dry	N			NOTE: Location = N872,583.00, E 508,224.05	
	Dry	N				
	Dry	N				
	Dry	N				
10	Dry	N			10	9 A.P. from 10 to 15 ft.
	Dry	N			Same as above but contains little gravel and $CaCO_3$ cementation. (ML) -ALLUVIUM-	
	Dry	N				
	Dry	N				
	Dry	N			14	
15	Dry	N			Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace silt. (GW-GM) -SGC-	6 A.P. from 15 to 20 ft.
	Dry	N				
	Dry	N				
	Dry	N				
	Dry	N				
20	Dry	N				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-09

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			(See previous page)	7 A.P. from 20 to 25 ft.
	Dry	N-L				
	Dry	N-L				
	D	N-L			24	
25	D	L			Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GW)	22 A.P. from 25 to 30 ft.
	D	L			26	
	D	L			Same as above, but is medium to fine sandy and trace coarse sand. (GP)	
	D	L				
	D	L			29	
30	D	L			Brown, damp, coarse to fine gravelly, COBBLES, some medium to fine sand, trace coarse sand. (GP)	15 A.P. from 30 to 35 ft.
	D	L			NOTES: 1. Bulge on north side of borehole between 29 and 33 ft. kicking auger south.	
	D	L			2. Black (MnO_2) stained at approximately 33 ft.	
	D	L				
	D	L				
35	D	L				6 A.P. from 35 to 40 ft.
	D	N-L			36	
	D	N			Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay and black (MnO_2) staining. (GP) to (GP-GC)	
	D	N				
	D	N				
40	D	N				14 A.P. from 40 to 45 ft.
	D	N-L				
	D	L			42	
	D	L			Rust-brown, damp, coarse to fine sandy, COBBLES, some coarse to fine gravel, with traces of clay. (GW) to (GW-GC)	
	D	L				
	D	L			NOTE: Frequent large cobbles.	
45	D	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-09
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-09

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L			45 Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and black (MnO_2) staining. (GW) to (GW-GC)	8 A.P. from 45 to 50 ft.
	D	N-L				
	D	N-L			48 Light brown, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay. (GP) to (GP-GC)	
	D	N				
50	D	N				9 A.P. from 50 to 55 ft.
	D	N				
	D	N			52 Light brown, damp, medium to fine SAND, with traces of clay. (SW) to (SW-SC)	
	D	N				
	D	N			54 Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles and clay with black (MnO_2) staining on gravel. (GW-GC)	
55	D	N				14 A.P. from 55 to 60 ft.
	D	N-L				
	D	L				
	D	L				
	D	L				
60	D	N-L				9 A.P. from 60 to 65 ft.
	D	N				
	D	N			62 Light brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay and frequent black (MnO_2) staining on gravels. (GW) to (GW-GC)	
	D	N				
	D	N				
65	D	N			65 Light brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles and trace to traces of clay. (GW) to (GW-GC)	4 A.P. from 65 to 70 ft.
	D	N				
	D	N				
	D	N				
	D	N				
70	D	N			70 (See next page)	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-09
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-09

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N			Light brown and black, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay, with frequent black (MnO_2) staining on gravel and cobbles. (GW) to (GW-GC)	5 A.P. from 70 to 75 ft.
	D	N				
	D	N				
	D-M	N			74	
75	M	N				9 A.P. from 75 to 80 ft.
	M	N				
	M	N				
	M	N				
	M	N			Light brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles and clay. (GW-GC)	
80	M	N				
	M	N				
	M	N				
	M	N			83	
	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles. (GW)	
85	M	N			- GRADING TO -	
	M	N				
	M	N			Light brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace to traces of clay. (GW-GC)	
					Bottom of Exploration at 87.0 ft.	
90						
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-09
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-09

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection by D. Hallman on 3/11/87.	
	D	0.8 to 1.2	NS15	41.4 / 42.4	Rust-colored, damp, coarse to fine GRAVEL, little medium to fine sand, little to trace cobbles, trace coarse sand with slight traces of clay. (GP)	(P) Moderate- slight interlocking, slight clay "cementation." (N
43.0						
45	D	0.5 to 0.4	NS14	44.4 / 45.4	Tan to rust-brown, damp, coarse to fine GRAVEL, little (small) cobbles and coarse to fine sand, with traces of clay. (GW)	(P) Hard - interlocked, clay "cementation." (S
	D	0.5 to 0.8	NS13	47.4 / 48.4	Tan, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay. (GW)	(P) Hard - tightly interlocked, slight clay "cementation." (S
50					50.0	
	D	0.9 to 1.3	G12	50.4 / 52.4	Rust-brown and black, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay and frequent black (MnO_2) staining in poorly developed layers up to 6" thick. (GP)	(P) Moderate - slight interlocking, slight clay "cementation." (E
		0.7-0.9			53.9	
	D	0.6-0.7	G11	53.9 / 54.9	Tan, damp, medium to fine SAND (very uniform). NOTE: Very slight clay coatings on sand grains "cementing" into a hard mass, slight cross-bedding visible. (SP)	(P*) Hard- clay "cement". Sand chunks are hard to disintegrate by finger pressure. (N
55		0.9-1.0				
	D	0.5 to 0.7	G10	56.4 / 58.4	Rust-brown and black, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand, with slight traces of clay and frequent black (MnO_2) staining of gravels and cobbles (not in layers). (GP)	(P) Moderate to easy- poorly interlocked, slight clay "cementation." (S
60	D	0.9 to 1.2	G9	59.4 / 61.4	Tan and black, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace (small) cobbles, trace coarse sand, with slight traces of clay and frequent lenses/layers of black (MnO_2) stained material containing voids. (GP)	(P) Moderate - slight interlocking, low clay content. (N
	D	0.5 to 0.8	G8	62.4 / 64.4	Light brown and black, damp (small) cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand with slight traces of clay and frequent layers (up to 6" thick) of black (MnO_2) stained coarse to fine gravelly COBBLES, trace coarse to fine sand. (GP)	(P) Moderate to easy- poor interlocking, low clay content. Voids present - high permeability. (SE
65						

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-09 157
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-09

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS	
					65.8 (See previous page)		
	D-M	0.5 to 0.6	G7	65.8 / 67.4	Rust-brown, damp to moist, coarse to fine gravelly, COBBLES, some medium to fine sand, trace coarse sand with traces of clay. (GP) to (GP-GC)	(P) Very hard-interlocked, clay "cementation."	(W
70	D-M	0.3 to 0.5	G6	68.4 / 70.4	Light brown to tan, damp to moist, medium to fine sandy, COBBLES (predominantly less than 8") little coarse to fine gravel with traces of clay. (GP) to (GP-GC)	(P*) Very hard - clay "cementation," slight interlocking. Sand excavated in "cemented" chunks.	(S
		0.7-1.0					
	M	0.7-0.8	G5	72.4 / 73.4	72.4 Brown, moist, coarse sandy, fine GRAVEL, some coarse gravel, little (small) cobbles, and medium to fine sand, trace clay, with frequent black (MnO_2) staining of material. (GP-GC) 74.7 NOTE: Frequent gravels and cobbles completely altered to clay.	(P) Moderate - interlocked but clay W.C. approaching L.L.	(N
75	M	0.5 to 0.7	G4	74.7 / 76.4	Light brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay (frequent zones of trace clay) and one 6" lens/layer of coarse sandy, coarse to fine GRAVEL, trace medium to fine sand with traces of clay and small voids between gravels. (GW) to (GW-GC)	(P) Very hard-interlocked, clay "cementation". Sandy pockets excavated in chunks.	(N
	M	0.3 to 0.5	G3	78.1 / 79.4	78.1 Tan, moist, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with traces of clay. (GP)	(P) Hard - interlocked, clay binder.	(S
80	D to M	0.4 to 0.6	G2	80.4 / 82.4	Tan, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with slight traces of clay. Sand is in coarser and finer zones/pockets. (GP) 83.1	(P) Hard - interlocked, clay binder.	(S
		0.4-0.5					
85	D	0.2-0.4	G1	83.4 / 85.4	Tan, damp, coarse to fine GRAVEL, little medium to fine sand, little to trace (small) cobbles, trace coarse sand, with frequent poorly developed clay coatings "cementing" sand onto gravel and occasional large cobbles (up to 12"). (GP)	(P) Moderate to easy - slight interlocking, no clay binder. Does not hold an overhang well.	(NE
90					Bottom of casing at 88.2 ft.		

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-09 158
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-10

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta 27+50
ELEVATION: 1191.0
DATE START: 3/11/87
DATE FINISH: 3/11/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/11/87	WD	NE	-	81'	SIZE ID	-	36"	
					HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N			Dark brown, damp, clayey SILT, trace roots. -TOPSOIL- (ML)	2 A.P. from 0 to 5 ft.
	D	N			2	
	Dry	N			Light brown, dry, silty, fine SAND, with traces of roots and small (1/16 - 1/8") $CaCO_3$ nodules. -ALLUVIUM- (SM)	
	Dry	N			4	
5	Dry	N			Light brown, dry, silty, fine SAND, with $CaCO_3$ nodules and laminations. (SM) -CALICHE-	3 A.P. from 5 to 10 ft.
	Dry	N				
	Dry	N				
	Dry	N				
	Dry	N			NOTE: Location = N 868,841.13,E 508,007.84	
10	Dry	N				3 A.P. from 10 to 15 ft.
	Dry	N				
	Dry	N			12	
	Dry	N			Light brown, dry, silty, fine SAND, with traces of clay. (SM) -ALLUVIUM-	
	Dry	N				
15	Dry	N				3 A.P. from 15 to 20 ft.
	Dry	N				
	Dry	N				
	Dry	N				
	Dry	N				
20	Dry	N				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-10

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			(See previous page.)	2 A.P. from 20 to 25 ft.
	Dry	N				
	Dry	N				
	Dry	N				
					24.5	
25	D	N			Light brown, damp, fine sandy, coarse to fine GRAVEL, little silt, with traces of clay. (GM) -ALLUVIUM-	3 A.P. from 25 to 30 ft.
	D	N				
	D	N				
	D	N			28	
	D	N			Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC) -SGC-	
30	D	N				6 A.P. from 30 to 35 ft.
	D	L				
	D	L				
	D	L				
	D	L				
35	D	L				6 A.P. from 35 to 40 ft.
	D	L				
	D	L			37	
	D	L-Y			Same as above with black (MnO_2) staining on gravels and cobbles. (GW) to (GW-GC)	
	D	Y				
40	D	Y				? A.P. from 40 to 45 ft.
	D	L			41	
	D	L			Rust-brown, damp, clean, medium to fine SAND, trace gravel, with traces of coarse sand. (SP) GRADING TO Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles. (GW)	
	D	L				
	D	L				
45	D	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-10
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-10

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N			(See previous page.)	6 A.P. from 45 to 50 ft.
	D	N			47	
	M	N			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay and frequent black (MnO_2) staining on gravel. (GW) to (GW-GC)	
	M	N				
50	M	N			50	9 A.P. from 50 to 55 ft.
	M	N			Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)	
	M	N				
	M	N			53	
	M	N			Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay and frequent black (MnO_2) staining on gravel. (GW) to (GW-GC)	
55	M	N				9 A.P. from 55 to 60 ft.
	M	N				
	M	N			57	
	M	N			Same as above but contains little cobbles and no black (MnO_2) staining. (GW) to (GW-GC)	
	M	N			59	
60	M	N			Light brown, moist, medium to fine SAND, trace coarse to fine gravel. (SP)	9 A.P. from 60 to 65 ft.
	M	N			60.5	
	M	N			Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)	
	M	N				
	M	N				
65	M	N				8 A.P. from 65 to 70 ft.
	M	N				
	M	N				
	M	N			68	
	M	N			Light brown, damp, medium to fine SAND, trace coarse to fine gravel and coarse sand. (SP)	
70	M	N				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-10
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-10

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			71 (See previous page.)	9 AP from 70 to 75 ft.
	M	N			Light brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay. (GW-GC)	
	M	N				
	M	N				
75	M	N			75 Same as above but contains frequent black (MnO_2) staining on gravel and cobbles. (GW-GC)	6 A.P. from 75 to 80 ft.
	M	N				
	M	N				
	M	N				
	M	N				
80	M	N				2 A.P. below 80 ft.
	M	N				
					Bottom of Exploration at 81.0 ft.	
85						
90						
95						

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-10
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CPSS FORM # 102 11-15-85

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-10

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection by D. Hallman on 3/12/ and 3/13/87.	
					36.0 NOTE: $CaCO_3$ present-strong show, but not "cement."	
	Dry to D	0.3 to 0.6	NS15	36.5 / 37.5	Tan, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with pockets containing traces of clay and pockets of clean material.	(P) Moderate to easy slight interlocking. Clean material was easy to sample. (S
					38.7	
40	Dry to D	2.3 to 2.8(*)	NS14	39.5 / 40.5	Black, gray and rust-brown, dry to damp, coarse to gravelly, COBBLES, little to trace coarse to fine sand with slight traces of clay, black (MnO_2) staining and voids (up to 2"x3"x1"). (GP)	(P) Moderate to very easy-slight interlocking, slight clay "cementation" (in zones). Very high permeability. (N
					42.3 NOTE: This layer has actual overbreak of approximately 1 ft. from material above.	
	D	1.5-1.8 / 1.3-1.6	NS13	42 / 44	Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay. (GP)	(P) Moderate - poor interlocking, slight clay "cementation." (N
45					44.7	
	D	0.8 to 0.9	G12	45.5 / 47.5	Black and tan to rust-brown, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand (in coarser and finer zones) with slight traces of clay. (GP)	(P) Moderate to easy- poorly interlocked, very slight clay "cementation." Holds overhang well. (SE
50	D	1.0-1.3 / 0.5-0.9	G11	48.5 / 50.5	Tan, gray and brown, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of coarse sand and clay (slight). (GP)	(P) Moderate-interlocked, slight clay "cementation." (S
					51.2	
	Dry to D	1.8 to 2.0 (*)	G10	51.5 / 53.5	Rust-brown and black, dry to damp, coarse sandy, fine GRAVEL, little coarse gravel, trace medium to fine sand, with traces of clay and frequent black (MnO_2) staining. (GW) NOTE: Same material as 56.6 to 57.7 ft.	(P) Moderate -poorly interlocked, clay cementation. Occasionally excavated in small "cemented" chunks. (N
					54.0	
55	D	0.9 to 1.2	G9	54.5 / 56.5	Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and frequent layers (up to 6") of black (MnO_2) stained, dry, coarse to fine gravelly, COBBLES, contains voids up to 1"x 2"x 1/2". (GP)	(P) Hard-interlocked, clay "cementation." Excavated in occasional large chunks. Voids, high permeability. (NE
					56.6 Brown and black, dry to damp, coarse sandy, fine GRAVEL, with traces of coarse gravel, medium to fine sand and clay, black (MnO_2) staining. (GW)	
	D	0.5 to 0.8	G8	57.7 / 59.5	57.7 Black and rust-brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand with traces of clay and frequent layers (up to 8") of black (MnO_2) stained material containing many small voids. (GP) to (GP-GW)	(P) Hard to moderate-interlocked, clay "cementation." Cobbles are in zones/ layers, pockets of clay rich moldable material. (S)
60					60.0 (See next page.)	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-10

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	1.6 to 2.5	G7	60.5 / 62.5	Rust-brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand (in coarser and finer zones/layers), with traces of clay and occasional boulders. (GP)	(P) Hard-interlocked, clay "cementation." Sand matrix excavated in "cemented" chunks. Voids half filled with clay.
65	D	1.5-2.2 (*) 1.0-2.0	G6	63.5 / 65.5	Rust-brown and gray, damp, COBBLES, little coarse to fine gravel, trace medium to fine sand with traces of coarse sand, slight traces of clay and occasional boulders. (GP) NOTES: 1. Many large cobbles. 2.(*) Overbreak as great as 2.5 ft. to the NW. Hole is "egg shaped" at this elevation.	(P) Moderate to hard-interlocking, clay cementation-sand matrix material excavated in chunks. Difficult to crumble in fingers.
	D	0.5-0.6 0.3-0.4	G5	66.5 / 68.5	66.5 Rust-brown and gray, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand (in coarser and finer zones/pockets) with traces of clay and occasional weakly developed black (MnO_2) staining. (GP) to (GP-GC)	(P) Moderate to hard-interlocked in groups Clay binder to cementation-sand frequently excavated in small "chunks."
70	M	0.2 to 0.5	G4	69.5 / 71.5	Rust-brown, gray and black, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand (in coarser and finer pockets), with traces of clay and occasional thin zone containing black (MnO_2) staining. (GP) to (GP-GC) 72.0 NOTE: Possible boulder at 69 ft.	(P) Very hard-tightly interlocked, clay binder.
		0.5-0.6			73.3 Light brown, damp, medium to fine SAND, with traces of clay. (SP) to (SP-SC)	(P*) Moderate to hard- clay binder, very slightly moldable.
75	D to M	0.4 to 0.5	G3	73.3 / 74.5	Light brown, damp to moist, coarse to fine sandy, fine GRAVEL, with traces of clay and occasional coarse gravel. Sand is in coarser and finer zones. (GP) to (GP-GC)	(P*) Very hard - interlocked, clay binder.
	D to M	0.3 to 0.5	G2	75.5 / 77.5	GRADES TO Brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, trace (small) cobbles and coarse sand, with traces of clay. (GP) to (GP-GC) 78.0	(P*) Very hard - tightly interlocked, clay binder. Material is not moldable.
80	M	0.3 to 0.4	G1	78.5 / 80.5	Brown to gray, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with strong traces of clay. (GW) to (GW-GC) NOTE: Cobbles are predominately under 8 in. diameter.	(P) Very hard - tightly interlocked and has clay binder. Material is slightly moldable.
85					Bottom of casing at 83.5 ft. NOTE: Casing sink into the disturbed soil at the bottom of the hole.	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-10
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-11

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 3
LOCATION: Sta. 191+05
ELEVATION: 1181.6
DATE START: 3/23/87
DATE FINISH: 3/24/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/24/87	WD	56'	-	56.6'	SIZE ID	-	36"	
3/25/87	29.5	52.5'	-	56.2'	HAMMER WT		-	
3/27/87	69.5	49.1'	-	55.6'	HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Brown, dry, silty fine SAND, trace clay, with roots. -TOPSOIL- (SM)	3 A.P. from 0 to 5 ft.
	Dry	N				
	Dry	L			2.5	
	Dry	L			Brown, dry, silty fine SAND, trace clay. -ALLUVIUM- (SM)	
5	D	L				3 A.P. from 5 to 10 ft.
	D	L			NOTE: Location = N885,222.00,E 507,947.00	
	D	L			7	
	D	L			Brown, damp, clean, coarse to fine gravelly, coarse to fine SAND, trace cobbles. (SW) -ALLUVIUM-	
	D	L				
10	D-M	Y			NOTE: Becomes moist at approximately 11 ft.	11 A.P. from 10 to 15 ft.
	D-M	Y				
	M	Y				
	M	S			13	
	M	S			Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, (GW) -SGC-	
15	M	S			INTERBEDDED WITH	26 A.P. from 15 to 20 ft.
	M	S			Brown, moist, clean, coarse to fine sandy, coarse to fine GRAVEL, with traces of cobbles. (GW)	
	M	S			17	
	M	S			Brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand. (GW)	
	M	S				
20	M	S			NOTE: Slight but noticeable silt content in layers. (See next page)	
					20	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-11

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	S			20 Light brown, damp, clean, fine SAND. (SP)	48 A.P. from 20 to 25 ft.
	D-M	S				
	M	S			23	
	M	S			Brown, moist, coarse to fine sandy, BOULDERS, some cobbles and coarse to fine gravel. (GW)	
25	M	S			GRADATIONAL TO	21 A.P. from 25 to 30 ft.
	M	S			Same as above, but with little coarse to fine gravel, clay coatings on gravel, and black (MnO_2) staining.	NOTE: Zone from 26' to 33' exhibited continued caving throughout drilling of this boring.
	M	S			GRADATIONAL TO	
	M	S			Brown, moist, coarse to fine sandy, COBBLES, little coarse to fine gravel, with frequent boulders. (GW)	
	M	S			29	
30	M	S			Dark brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with occasional boulders, clay coatings and black (MnO_2)	33 A.P. from 30 to 35 ft.
	M	S			31 staining on gravel. (GW)	
	M	S			Brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, with frequent boulders (up to 20"). (GW)	
	M	S				
	M	S				
35	M	S				20 A.P. from 35 to 40 ft.
	M	S				
	M	S			37	
	M	S			NOTE: Same as above, but with layers containing cream-colored clay as coatings on gravel. (GW) to (GW-GC)	
	M	S			39	
40	M	Y			Dark brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and black (MnO_2) staining on gravels. (GW) to (GW-GC)	10 A.P. from 40 to 45 ft.
	M	L				
	M	L				
	M	L			43	
	M	L			NOTE: Same as above, but with trace clay. (GW-GC)	
45	M	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-11
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-11

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N-L			(See previous page.) (GW-GC)	7 A.P. from 45 to 50 ft.
	M	L				
	M	L				
	M-W	L			NOTE: Wet soil at approximately 49 ft.	
50	W	L				11 A.P. from 50 to 55 ft.
	W	L				
	W	L			NOTES: 1. Continued caving from zone 26 to 33 ft. below ground surface - some boulders, many large cobbles and black (MnO_2) staining in this zone.	
	W	L				
	W	L			2. Groundwater free-standing at 53 ft. at 9:50 a.m.	
55	W	L			3. Groundwater free-standing at 56 ft. at 11:00 a.m.	
	W	L				
					Borehole abandoned at 56 ft.	
60						
65						
70						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. LDB-11
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-12

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 182+25
ELEVATION: 1181.9
DATE START: 3/24/87
DATE FINISH: 3/26/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	-	Auger	
3/26/87	WD	72.5'	-	73.0'	SIZE ID	-	36"	
3/27/87	24	70.4'	-	71.9'	HAMMER WT		-	
					HAMMER FALL		-	

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Light brown, dry, fine SAND, little silt, with roots. -TOPSOIL- (SM)	4 A.P. from 0 to 5 ft.
	Dry	N			2	
	Dry	L			3 Tan to brown and black, dry, crossbedded, fine SAND. -ALLUVIUM- (SP)	
	Dry	Y-S			Brown, dry, crossbedded, coarse to fine sandy, coarse to fine GRAVEL, with some black (MnO_2) staining at approximately 7 ft. (GW) -ALLUVIUM-	
5	Dry	Y-S				6 A.P. from 5 to 10 ft.
	Dry	Y-S				
	Dry	Y-S			NOTE: Location = N884, 338.00, E 508,003.00 (approximate)	
	Dry	Y-S			8	
	Dry	Y-S			Reddish-brown, damp, silty fine SAND, interbedded with light brown, clean, dry, fine SAND. (SM/SP) -ALLUVIUM-	
10	Dry	Y-S			10	8 A.P. from 10 to 15 ft.
	Dry	Y-S			Brown, dry, coarse to fine sandy, coarse to fine GRAVEL. -ALLUVIUM- (GP)	
	Dry	Y-S			12	
	Dry	S			Brown, dry, clean, coarse to fine SAND, little coarse to fine gravel. (SW)	
	Dry	S			INTERLAYERED WITH	
15	Dry	S			Brown, dry, medium to fine sandy, coarse to fine GRAVEL, some cobbles. (GP) -SGC-	32 A.P. from 15 to 20 ft.
	Dry	S			NOTE: Predominant zone for caving problems from approximately 12 to 18 ft.	
	Dry	S				
	Dry	S			18	
	Dry	Y-S			Brown and gray, dry, cobbly, BOULDERS, little coarse to fine gravel, trace coarse to fine sand. (GW)	
20	Dry	Y-S				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-12

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					(See previous page.)	22 A.P. from 20 to 25 ft.
	Dry	Y-S			21	
	D	Y-S			22 Brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with occasional boulders. (GP)	
	D	Y-S			NOTE: Same as above, but with little medium to fine sand and frequent large cobbles and boulders. (GP)	
	D	Y-S				
25	D	Y-S				57 A.P. from 25 to 30 ft.
	D	Y-S			NOTE: Difficult to describe the composition of the material between 24 and 32 ft. due to caving from 0 to 12 ft. from ground surface.	
	D	Y-S				
	D	Y-S				
	D	Y-S				
30	D	Y-S				67 A.P. from 30 to 35 ft.
	D	Y-S				
	D	L-Y				
	D	L-Y			33	
	D	L-Y			NOTE: Same as above, with cream-colored clay coatings on gravel. (GP) to (GP-GC)	
35	D-M	L-Y				8 A.P. from 35 to 40 ft.
	D-M	L-Y				
	D-M	L			37	
	M	L			Cream-colored and brown, moist, coarse to fine gravelly, COBBLES, some medium to fine sand, with traces of clay. (GP) to (GP-GC)	
	M	L				
40	M	L			40	17 A.P. from 40 to 45 ft.
	M	L			Light brown, moist, medium to fine SAND, with traces of clay (acting as cement). (SP) to (SP-SC)	
	M	L			42	
	M	L			Light brown, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)	
	M	L				
45	M	L			NOTE: Black (MnO_2) staining at approximately 45 ft.	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-12
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-12

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	L			(See previous page.)	8 A.P. from 45 to 50 ft.
	M	L				
	M	L			48	
	M	L			NOTE: Same as above, but is moist to wet with lenses containing trace cream-colored clay. (GP-GC)	
50	M	L				14 A.P. from 50 to 55 ft.
	M	N-L			51	
	M	N-L			NOTE: Same as above 48 ft. (GP) to (GP-GC)	
	M	N-L				
	M	N-L				
55	M	N-L				6 A.P. from 55 to 60 ft.
	M	N-L				
	M	N-L				
	M	N-L				
	M	N-L				
60	M	N-L				8 A.P. from 60 to 65 ft.
	M	N-L			NOTE: Grading to medium to fine sandy, GRAVEL at approximately 62 ft.	
	M	N-L			62	
	M	N-L			Light brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of cream-colored clay, and black (MnO_2) staining on gravel. (GP) to (GP-GC)	
	M	N				
65	M	N				11 A.P. from 65 to 70 ft.
	M	N				
	M	N				
	M	N				
	M	N-L			69	
70	M	L			Brown, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of cream-colored clay. (GP) to (GP-GC)	

CPSS FORM # 102 4-4-86

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	UR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. LDB-12
		31+	HARD	NR — NO RECOVERY	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-12

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	W	L			71 (See previous page.)	4 A.P. below 70 ft.
	W	L			Light brown, moist to wet, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of cream-colored clay.	
	W	L			73 NOTE: Clay water content is near liquid limit and is providing very little cohesion. (GP) to (GP-GC)	
75					Dark brown, wet, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)	
					NOTE: Bottom of Exploration at approximately 73 ft. Auger penetrated to approximately 76 ft. Borehole remained open to 73 ft., just below the groundwater table.	
80						
85						
90						
95						

CPSS FORM # 102 4-4-86

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	UR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. LDB-12
		31+	HARD	NR — NO RECOVERY	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-13

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Ed Logan Contracting Co., Inc.
EQUIPMENT USED: Watson 5000/75T American

JOB NO. 11106.00
PAGE NO. 1 of 6
LOCATION: Sta. 15+72
ELEVATION: 1192.0
DATE START: 3/27/87
DATE FINISH: 3/30/87
DRILLER: Willy Bridge
PREPARED BY: Bruce Robinson

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE			
3/20/87	WD	NE	-	76.0'	TYPE	-	Auger
			-		SIZE ID	-	36"
			-		HAMMER WT		-
			-		HAMMER FALL		-

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	Dry	N			Light brown, dry, clayey SILT, with traces of fine sand and moderate to well-developed laminar $CaCO_3$ cementation. (ML) -CALICHE-	3 A.P. from 0 to 5 ft.
	Dry	N				
	Dry	N				
	Dry	N			NOTE: Location = N 867,656.12, E 508,510.10	
5	Dry	N				3 A.P. from 5 to 10 ft.
	Dry	N				
	Dry	N				
	Dry	N				
	Dry	N				
10	Dry	N				3 A.P. from 10 to 15 ft.
	Dry	N				
	Dry	N				
	Dry	N			GRADES TO	
	Dry	N				
15	Dry	N				3 A.P. from 15 to 20 ft.
	Dry	N				
	D	N			Brown, damp, clayey SILT, little fine sand, with moderately developed laminar $CaCO_3$ cementation. (ML) -CALICHE-	
	D	N				
	D	N				
20	D	N				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-13

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	N			21 (See previous page.)	3 A.P. from 20 to 25 ft.
	D	N			Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace silt, with traces of clay and slight $CaCO_3$ cementation and crusts on gravel. (GP-GM) -CALICHE-	
	D	N				
	D	N				
25	D	N				4 A.P. from 25 to 30 ft.
	D	N				
	D	N			27 Gray to brown, damp, coarse to fine gravelly, COBBLE, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC) -SGC-	
	D	N				
	D	N				
30	D	N				10 A.P. from 30 to 35 ft.
	Dry	N			31 Same as above but little coarse to fine sand. (GW) to (GW-GC)	
	Dry	N				
	Dry	N			Same as above but dry and no clay. (GW)	
	Dry	N				
35	D	N			35 Same as above with slight traces of clay. (GW)	11 A.P. from 35 to 40 ft.
	D	N				
	D	L			37 Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with black (MnO_2) staining on gravels. (GW)	
	D	L				
	D	Y			39 GRADES TO Rust-brown, damp, medium to fine SAND, trace coarse sand, with streaks of black (MnO_2) staining. (GP)	
40	D	Y				14 A.P. from 40 to 45 ft.
	D	L				
	D	L			42 Rust-brown, damp, coarse to fine gravelly, COBBLE, some coarse to fine sand. (GW)	
	D	L				
	D	L			Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with black (MnO_2) staining on gravels. (GW)	
45	D	L				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-13
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-13

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	D	L-N			45 Rust-brown, damp, coarse to fine sandy, COBBLES, little coarse to fine gravels, with slight traces of clay and black (MnO_2) staining. (GP) 47	10 A.P. from 45 to 50 ft.
	D	N				
	D	N			Dark brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay, and frequent black (MnO_2) staining on gravels and cobbles. (GW) (GW-GC)	
	D	N				
50	D	L			50 Same as above with no clay. (GW)	22 A.P. from 50 to 55 ft.
	D	L				
	D	L			52 Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with slight traces of clay and black (MnO_2) staining. (GW) to (GW-GC)	
	D	L				
	D	L				
55	D	L				19 A.P. from 55 to 60 ft.
	D	L				
	D	L			57 Rust-brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay. (GW) to (GW-GC)	
	D	L-N				
	D	N				
60	D	N				8 A.P. from 60 to 65 ft.
	D	N			61 Same as above but no clay coatings. (GW)	
	D	N				
	D	N			63 Dark brown to black, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace black clay, with black (MnO_2) staining. (GW-GC) INTERBEDDED WITH Dark brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)	
	M	N				
65	M	N				3 A.P. from 65 to 70 ft.
	M	N				
	M	N				
	M	N				
	M	N				
70	M	N				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-13
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. LDB-13

DEPTH IN FEET	MOISTURE	CAVING	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
	M	N			(See previous page)	8 A.P. from 70 to 75 ft.
	M	N			72	
	M	N			Light brown, moist, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay. . (GP) to (GP-GC)	
	M	N				
75	M	N			75	
					Light brown, moist, medium to fine SAND, with traces of clay acting as cement. (SP) to (SP-SC)	
					76	
					Bottom of Exploration at 76 ft.	
80						
85						
90						
95						

CPSS FORM # 102 4-4-86

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	UR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. LDB-13 175
		31+	HARD	NR — NO RECOVERY	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-13

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
					Downhole inspection performed by Dave Hallman on 3/31/87.	
	Dry to D	0.2 to 0.4	NS15	27.0 / 28.0	Gray, dry to damp, (small) cobbly coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay and slight $CaCO_3$ coatings on gravel and cobbles. (GP) to (GP-GC)	(P) Moderate - slight interlocking. Clay "cementation." (S
30	D	0.4 to 0.8	NS14	30.3 / 31.3	Rust-brown and gray, damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with strong traces of clay, slight $CaCO_3$ coatings on gravel and $CaCO_3$ nodules in sand (small 1/4" diameter maximum). (GP) to (GP-GC) NOTE: Cobbles under 6" in diameter. -CALICHE (SGC)- 33.0	(P) Hard - interlocking, and clay cementation. (W
	Dry to D	1.1-1.4 / 1.3-1.5	NS13	33.3 / 34.3	Tan to rust-brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GP) NOTE: Sand is lacking somewhat in the upper "medium" range.	(P) Easily - slight interlocking, nearly "clean". (N
35	Dry to D	0.9 to 1.1	G12	36.3 / 38.3	Rust-brown, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand (zoned coarser and finer) with slight traces of clay. (GP) 38.0	(P) Very easily to moderate - interlocked in clumps, pockets with clay "cementation." (E
					8 to 12 inch lens(?) of medium to fine SAND, with 38.9 slight traces of clay. (SP)	
40	D	0.9 to 1.1	G11	39.1 / 41.1	Tan to light brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with slight presence of clay and occasional lens (up to 8") of medium to fine SAND. (GP) GRADES TO	(P) Very easily - poorly interlocked, slight clay "cementation" in zones. Holds an overhang (weakly though). (S
	D	1.4 to 1.6 (*)	G10	42.0 / 44.0	Rust-colored, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay, frequent voids under and between gravel/cobbles (up to 3/4" x 2" x 3") and occasional black (MnO_2) staining. (GP) 44.5	(P) Easy - poorly interlocked, slight clay "cementation." (W
45	D	1.5-1.7 (*) 1.6-1.7	G9	45.3 / 47.3	NOTE: Stratigraphic change at 44.5 ft. based on density (ease of sampling) and slight color change. Rust-brown, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with slight traces of clay and occasional slight black (MnO_2) staining on cobbles. (GP) (*) NOTE: Overbreak seems to be due to drilling process, not material instability.	(P*) Very hard-tightly interlocked, clay "cementation." Sand frequently excavated in small "cemented" chunks. (N
50	D	0.1-0.2 / 1.1-1.3	G8	48.5 / 50.1	Tan to rust-brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces 50.1 of clay and occasional black (MnO_2) staining. (GP) (See next page)	(P) Very hard - tightly interlocked, clay "cementation. (SE

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-13
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

DOWNHOLE INSPECTION REPORT

BORING NO. LDB-13

DEPTH IN FEET	MOISTURE	CALIPER	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION	REMARKS
		1.6-2.0			Black and tan, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay and MnO_2 staining. (GP) to (GP-GC)	(P) Easy to moderate. NOTE: Frequent voids-high permeability.
52.0						
	D	1.3-1.5	G7	52.0 / 53.3	Black and brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay and frequent black (MnO_2) staining. (GW) to (GW-GC)	(P) Hard-interlocked, clay "cementation." Sand frequently excavated in small "cemented" chunks.
54.0						
55	D to M	1.9-2.1 (*) 1.3-1.8	G6	54.3 / 56.3	Rust-brown, damp to moist, cobbly, coarse to fine GRAVEL, some to little medium to fine sand with traces of coarse sand and clay and with occasional black (MnO_2) staining. (GP) to (GP-GC) (*) NOTE: Overbreak seems to be due to drilling, not material instability.	(P) Very hard-interlocked and clay "cementation."
56.9						
57.7	D	1.2-1.8 (*)	NS5	57.3 / 59.3	Black (MnO_2 stained) dry, coarse to fine gravelly, COBBLES, trace coarse sand with traces of medium to fine sand. (GP) NOTE: Voids up to 2" x 3" x 1".	(P) Hard to easy - Due to difference in clay content and interlocking. NOTE: High permeability for 56.9-57.7 layer.
59.3		0.9-1.6			Rust-brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with intermittent traces of clay. (GW) to (GW-GC)	
60	D to M	0.9 to 1.1	G4	60.3 / 62.3	Rust-brown, damp to moist, medium to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay. (GP) to (GP-GC)	(P) Hard - interlocked, clay "cementation." Sand frequently excavated in small (2" dia. max.) "cemented" chunks.
	M	0.1 to 0.5	G3	63.3 / 65.3	Rust-brown to rust colored, moist, (small) cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay, traces of silt in pockets and occasional black (MnO_2) staining. (GP) to (GP-GC)	(P) Hard - interlocked, clay binder.
65						
65.5						
	Dry to M	0.4 to 0.8	G2	66.3 / 68.3	Black and rust-brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand with traces of clay and frequent layers (up to 10" thick) of black (MnO_2) stained, dry to moist, coarse to fine gravelly, COBBLES, trace coarse sand and clay, with traces of medium to fine sand. See notes below. (GP-GC)	(P) Hard to easy - interlocked in zones, sand rich areas were hard.
70	Dry to M	0.5 to 0.9	G1	69.3 / 71.3	Black and light brown, dry to moist, coarse to fine gravelly, COBBLES, trace clay with trace to traces of coarse to fine sand (in layers) and MnO_2 staining. (GP-GC) NOTES: 1. Material excavated as clayey masses. 2. Occasional layers with large voids (up to 2" x 3" x 1/2") that are dry.	(P) Easy - poorly interlocked. Clay W.C. approaching L.L.
73.3						
					Tan to rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)	
75					Bottom of casing at 74.3 ft.	

CPSS FORM # 10 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. LDB-13
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

Hammer Drill Boring Logs

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B101

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 173+10
ELEVATION: 1180.5
DATE START: 1/21/87
DATE FINISH: 1/21/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/21/87	WD	94'	95'	95'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				NOTE: Location = N883,447.78, E508,313.05
	0				Tan, dry, clean, fine SAND, $CaCO_3$ present but not acting as cement (SP)
	0				-ALLUVIUM-
	1				
5	0				
	0				6.0
	0				Tan, dry, clean, fine SAND, trace coarse to fine gravel and coarse-medium sand, $CaCO_3$ present but not acting as cement (SP)
	3				-ALLUVIUM-
	14				NOTE: possible slight cementation from 10 to 12 ft.
10	24				10.5
	35				Tan, dry to damp, coarse to fine gravelly, coarse to fine SAND, trace cobbles, with traces of $CaCO_3$ (SW)
	29				TO
	19				Coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of $CaCO_3$ (not cemented) (GW)
	14				-SGC-
15	9				
	11				
	19				
	29				18.0
	42				See next page
20	43				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 172 B101

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B101

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	21				Gray to brown, dry, coarse to fine GRAVEL, little to trace cobbles and coarse to medium sand (no $CaCo_3$) (GW)
	25				22.0
	90				Gray to brown, dry, coarse to fine gravelly, COBBLES, with traces of sand. (GW)
	88				
25	52				
	68				26.0
	37				Tan, dry, coarse to fine sandy, COBBLES, trace coarse to fine gravel (GP)
	32				
	44				
30	30				
	29				
	30				
	70				NOTE: Large cobble at approximately 32 ft. NOTE: Circulation clogged - blow counts misleading from approximately 33 to 35 ft.
	144				35.0
35	119				
	39				Tan, dry, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles and very slight $CaCO_3$ coatings (GW)
	41				
	49				
	40				
40	44				40.0
	24				Brown to black, moist, MnO_2 stained, coarse to fine GRAVEL, trace coarse sand, with traces of clay (GP)
	27				42.5
	25				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay (GW)
	45				
45	43				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 179 B101
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B101

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	47				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay (GW)
	42				
	54				
	41				49.0
50	32				Brown, moist, medium SAND, trace clay, (soil holds together in a ball) (SP-SC)
	35				51.0
	62				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay (GW)
	43				
	66				
55	42				55.0
	72				Tan, damp, medium to fine sandy, COBBLES, little to trace gravel, with traces of clay (GP)
	71				
	60				58.0
	50				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles and clay (GW-GC)
60	44				
	32				
	47				62.0
	56				Brown, damp, coarse to fine sandy, COBBLES, some coarse to fine gravel, trace clay (GP-GC)
	54				
65	63				
	74				
	53				
	48				
	46				
70	59				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 180 B101
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B101

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					Brown to rust-brown, moist, coarse to fine GRAVEL, trace cobbles and clay (GW-GC)
	29				
	52				
	49				
	52				NOTE: Little to trace cobbles at approximately 74 ft
75	52				
	45				
	36				NOTE: Large cobble at approximately 77.5 ft.
	61				
	52				
80	43				
	57				
	46				
	44				
	47				84.0
85	36				Black to brown, moist, MnO_2 stained, coarse to fine GRAVEL, little cobbles, trace coarse to fine sand, with traces of clay. (GW)
	36				86.0
	44				Brown, wet, coarse to medium sandy, coarse to fine GRAVEL, little cobbles, trace fine sand and clay (GP-GC)
	65				
	68				88.5
90	72				Brown, moist, coarse to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay (GP)
	96				
	66				NOTE: Hole caved to 8 ft. after casing was pulled.
	48				92.5 Brown, wet, clean, medium to fine SAND, trace coarse to fine gravel. (SP)
	93				94.0 NOTE: Groundwater at approxmately 94.0 ft.
95					Brown, wet, medium to fine SAND, trace fine gravel and clay. (SP-SC)
					Bottom of Exploration at 95 ft.

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 181 B101
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B102

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 151+75+
ELEVATION: 1185.8
DATE START: 1/21/87
DATE FINISH: 1/21/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/21/87	WD	NE	100'	100'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				NOTES: 1. Pushed casing first 1.5 ft. 2. Survey coordinates could not be obtained due to construction activity. Approximate Location = N 881,317, E 508,405; which is 25 ft north of LDB-01.
	1				Brown, moist, silty, medium to fine SAND, trace clay (SM)
	3				-ALLUVIUM-
	4				4.0
5	12				Tan, dry, medium to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ coatings on gravel (GP)
	29				-CALICHE-
	25				
	23				
	25				
10	48				
	35				
	24				
	35				13.0
	14				Brown, dry, fine gravelly, coarse to fine SAND, with $CaCO_3$ coatings (SW)
					14.5 -ALLUVIUM-
15	32				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles (no reaction for $CaCO_3$ with HCL) (GW)
	29				-SGC-
	40				
	30				
	31				
20	30				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

BORING NO. 182 B102

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B102

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	22				Rust-brown, dry, coarse to fine sandy,coarse to fine GRAVEL, trace cobbles (very slight reaction for $CaCO_3$ with HCL) (GW)
	19				
	21				
	50				
25	32				
	42				25.5 Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay coating coarser material (no reaction for $CaCO_3$ with HCl) (GW)
	27				
	54				
	47				
30	44				
	48				30.5 Tan, dry, medium to fine sandy, COBBLES, little coarse to fine gravel (GP)
	57				
	53				
	66				
35	53				34.7 Brown to rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL,little cobbles, with traces of clay as frequent coatings (GW)
	27				
	45				
	44				
	54				
40	32				40.0 Brown, moist, clean, fine SAND, little medium sand will hold together in a ball when squeezed. (SP)
	16				
	13				42.5 Brown, damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay as coatings (GW)
	41				
	43				
45	42				45.0

See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 183 B102
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B102

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	43				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay as coatings and throughout sand, with occasional cobbles (GW) to (GW-GC)
	40				
	44				
					48.5
	49				Tan to brown, dry, coarse to fine sandy, COBBLES, little to trace coarse to fine gravel, with traces of clay. (GP)
50	80				
	64				
	68				
					NOTE: Gradational change downward.
	49				
	56				Brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand (GW)
					54.5
55	68				Rust-brown, moist coarse to medium sandy, COBBLES, little coarse to fine gravel, trace fine sand and clay (clay will bind sand together in a ball) (GP) to (GP-GC)
	33				
	29				
	51				
	38				
60	64				
	45				NOTE: Coarse to fine sandy and less clay at approximately 60 ft. (GP)
	54				62.0
	68				
	66				Dark brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay (GW) to (GW-GC)
65	89				
	46				
	60				
	79				
	53				
70	71				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 184 B102
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B102

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	48				Dark brown, moist, coarse to fine sandy, COBBLES, some coarse to fine gravel, trace clay (GP-GC)
	34				
	62				73.0
	100				Tan, dry, COBBLES, little coarse to fine gravel and coarse to fine sand, with very slight clay coatings (GW)
75	116				
	93				
	113				77.5
	64				Dark brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW-GC)
	64				79.5
80	96				
	99				Brown, damp, COBBLES, little coarse to fine gravel and coarse to fine sand, with traces of clay and frequent pockets (?) of moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW)
	67				
	89				
	66				
85	81				
	68				NOTE: Frequency of sandy GRAVEL pockets increases downward, perhaps becomes interlayered.
	76				
	86				88.5
	70				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW-GC)
90	?				
	?				
	44				92.0
	27				Gray-brown, moist, CLAY, little silt (high plasticity) (CH)
	35				94.0
95	17				Brown, moist,medium to fine SAND, with traces of clay (SP)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 185 B102
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B102

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	89				96.0 Brown, moist, medium to fine SAND, with traces of clay (SP)
	88				Brown, moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, trace clay (GW-GC)
	79				
	107				
100	57				Bottom of Exploration at 100 ft.
105					
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 186 B102
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B103

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 136+78
ELEVATION: 1187.6
DATE START: 1/22/87
DATE FINISH: 1/22/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/22/87	WD	98'-99'	100'	100'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					NOTE: Survey coordinates could not be obtained due to construction activity.
	8				Brown, moist, medium to fine SAND, trace silt and clay (SP-SM)
	15				-ALLUVIUM-
	16				3.0 NOTE: Approximate Location = N 881,812, E 508,105
	19				
5	29				Hard, tan to brown, dry, SILT, trace fine sand and clay, strongly cemented with $CaCO_3$ (ML)
	28				-CALICHE-
	30				6.5
	35				Brown, moist, coarse to fine gravelly, medium to fine SAND, with traces of clay (no $CaCO_3$) (SP)
	27				-ALLUVIUM-
10	27				NOTE: Pockets contain trace clay
	20				
	28				
	18				13.0
	30				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles (GW)
15	36				-SGC-
	59				16.0
	22				Brown, dry, coarse to fine GRAVEL, little cobbles, trace coarse to fine sand (GW)
	43				
	25				19.0
20	67				Gray to brown, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand (GW)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 187 B103

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B103

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	42				
	?				22.0
	22				Gray to brown, dry, coarse to fine sandy, fine GRAVEL, little coarse gravel (GP)
	19				24.5
25	27				Brown, dry, medium to fine sandy, COBBLES, trace coarse to fine gravel. (GP)
	86				
	47				
	75				
	60				
30	68				
	74				31.0
	42				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with slight traces of clay as coatings and occasional pockets (up to 6") of loose gravel (GW)
	111				
	58				
35	39				
	43				
	73				
	78				(Very dense) brown, damp, coarse to fine sandy, COBBLES, little coarse to fine gravel, wilth slight traces of clay as coatings (GW)
	78				
40	135				
	110				
	63				
	75				
	72				44.0
45	41				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight traces of clay as coatings (GW)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 188 B103
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B103

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	46				
	68				NOTE: Traces of clay occur as well developed coatings at approximately 48 ft.
	63				
	44				
50	52				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay. (GW)
	49				
	58				NOTE: "Clean" pocket at approximately 52.5 ft.
	41				
	53				
					54.5
55	58				Brown, damp, coarse to fine gravelly, coarse to fine SAND, trace clay with occasional cobbles. (SW) to (SW-SC)
	30				
	37				
	42				
	54				
60	30				60.0
					Rust-brown, damp, clayey, medium to fine SAND (SC)
	20				
					61.5
	72				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay throughout (GW)
	50				
	60				
65	62				
	69				
	90				
					67.5
	72				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW) to (GW-GC)
	45				
70	67				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 189 B103
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B103

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					70.5
	60				Brown to gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay (GW)
	83				
	152				
					74.0
	96				Brown, moist to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay (GW) to (GW-GC)
75	54				
	77				
	67				NOTE: Black (MnO_2) staining from approximately 76.0 to 77.5 ft.
	87				
	73				
80	62				
	77				
	71				
	70				
	72				
85	73				
					85.8
	63				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW) to (GW-GC)
	42				
	59				
	52				
					89.5
90	53				Brown, damp, coarse to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay. (GP)
	96				
	95				
	100				
					94.0
	73				Brown, moist, coarse to fine SAND, with traces of clay (SW)
95	27				95.0

See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 190 B103
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B103

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	48				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay (GW)
96.5					
	80				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay (GW)
	84				
	83				
100	88				
					Bottom of Exploration at 100 ft.
					NOTE: Groundwater at approximately 99 ft.
105					
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 191 B103
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B104

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 111+90
ELEVATION: 1195.2
DATE START: 1/20/87
DATE FINISH: 1/21/87
DRILLER: Mike Mottet
PREPARED BY: Tom Manton and Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/21/87	WD	99'	99.0'	100.0'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	140#	--	--
--	--	--	--	--	HAMMER FALL	30"	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	10				NOTE: Location = N877,320.51, E508,329.66
	10				Brown, dry, SILT (ML)
	15				-ALLUVIUM-
	22				
5	32				
	24				
					6.5
	34				
	34				Dry, fine sandy, coarse to fine GRAVEL, trace silt (GP-GM)
	24				-ALLULVIUM-
10	22				
					10.5
	34				Dry, fine sandy, coarse to fine GRAVEL, some cobbles, trace silt -SGC- (GP-GM)
	25				12.0
					12.5 Dry, coarse to fine SAND (SW)
	21				
	23				NOTE: Increased cobbles at approximately 15 ft. (GP-GM)
15	24				15.0
	54				
	48				Light brown, dry, cobbly, coarse to fine GRAVEL, trace coarse to fine sand (GW)
	48				
	25				19.0
20	24				See next page

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 192 B104

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B104

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	28				Brown, dry, medium to fine sandy, coarse to fine GRAVEL, with occasional cobbles (GP)
	28				
	39				
	53				
					24.8
25	38				Brown to tan, dry to damp, coarse to fine SAND, trace fine gravel, with traces of silt. (SW)
	10				26.0
	53				Gray to brown, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand (GW)
	84				
	40				
					29.5
30	23				Tan, damp, fine gravelly, medium fine SAND (SP)
					30.5
	34				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL (GW)
	44				
					32.7
	43				Brown to gray, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GW
	79				
35	56				35.0
	37				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles (GW)
	60				
	45				
	74				
					39.5
40	45				Brown, damp, medium to fine sandy, coarse to fine GRAVEL (GP)
	44				
	46				
	32				
					43.5
	76				Brown to gray, damp to dry, coarse to fine gravelly, COBBLES, trace sand (GW)
45	90				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 193 B104
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B104

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	45				45.5 Brown, moist, coarse to fine sandy, fine GRAVEL, little to trace coarse gravel, with traces of silt (no reaction for $CaCO_3$ with HCl) (GP)
	37				
	26				
	57				48.5 Brown to gray, dry to damp, coarse to fine gravelly, COBBLES, (GP)
50	72				49.8 Brown, moist, coarse to fine sandy, coarse to fine GRAVEL (GW)
	34				
	57				51.7 Brown to gray, dry, medium to fine sandy, COBBLES (GP)
	63				
	50				
55	57				55.5 Brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL (GP)
	40				
	39				
	37				NOTE: Hit a small pocket of very dense, damp, silty fine SAND (no reaction for $CaCO_3$ with HCl)
	44				
60	36				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and silt (GP-GM)
	43				NOTE: Circulation blocked off at approximately 61.5 ft
	33/6"				62.0
	61				
	57				
65	37				Brown, moist, coarse to fine GRAVEL, with traces of clay "cementing" sand onto gravel. (No reaction for $CaCO_3$ with HCl) (GW)
	33				
	47				67.0
	63				Brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay as coatings and cementing sand to coarser material. (GW)
	65				
70	53				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 194 B104
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B104

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with slight traces of clay as coatings (GW)
	62				
	49				
	39				
					73.5
	68				Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay throughout and as coatings, and occasional "clean" pockets (GW) to (GW-GC)
75	50				
	47				
	57				NOTE: Circulation clogged briefly at approximately 77 ft.
	?				
	46				
80	60				
	53				
	52				
	50				83.0
	?				NOTE: Hydraulic fitting broke on drill rig motor. End of drilling for 1-20-87, pulled casing back to 79 ft. NOTE: Large cobbles at approximate 84.5 ft
85	156				(Very dense) brown, moist, coarse to fine GRAVEL, little cobbles, and coarse to fine sand, trace clay (GW) to (GW-GC)
	69				
	99				
	124				
	159				
90	117				(Dense) brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay as coatings (GW)
	66				
	146				
	84				
	81				94.0
95	51				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 195 B104
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B104

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	45				Brown, moist, fine gravelly, coarse to medium SAND, trace clay	(SP) to (SP-SC)
					96.5	
	85				-SGC-	(GP-GC)
					97.7	
	39				Brown, moist, clean, medium to fine SAND, subangular to subrounded (80% quartz)	(SP)
	14					
		34		99.2	99.5	
100		50/4"	S1	100.0	(Very dense) brown, wet, fine gravelly, coarse to fine SAND, trace clay	(SW) to (SW-SC)
					Bottom of Exploration at 100 ft.	
					NOTE: Ground water encountered at approximately 99 ft.	
105						
110						
115						
120						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 126 B104
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 2
LOCATION: Sta. 96+54
ELEVATION: 1196.1
DATE START: 1/22/87
DATE FINISH: 1/22/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/22/87	WD	NE	38'	38'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	26				NOTE: Location = N875,781.30, E508,384.40 Light brown, dry to damp, fine sandy SILT, trace clay, with $CaCO_3$ present (ML) -ALLUVIUM-
	?				
	?				
5	?				
	?				
	21				
					7.5
	70				Brown to gray, dry, coarse to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ coatings on gravel (GW) -ALLUVIUM-
	53				
10	52				
	48				
	40				NOTE: less $CaCO_3$ present at approximately 12.5 ft.
	32				
	25				
15	26				15.0
	77				Brown to gray, dry, coarse to fine sandy, COBBLES, trace coarse to fine gravel, with $CaCO_3$ coatings (GP) -SGC-
	49				
	60				
	75				18.5
20	68				See next page

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 196 B105

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	60				Brown to gray, dry, coarse to fine gravelly, COBBLES, some coarse to fine sand, with occasional $CaCO_3$ coatings (GW)
	69				
	57				NOTE: No more $CaCO_3$ below 28.5 feet.
	44				
25	48				
	60				
	55				
	54				
	52				NOTE: No returns from approximately 28 to 38 ft: drill bit clogged (?)
30	72				
	66				
	80				
	125				
	146				
35	156				
	180				
	197				NOTE: Drill bit definitely clogged - pulling casing.
	230				
					Bottom of Exploration at 38 ft.
40					NOTE: The drill bit broke (piece still in hole). Will redrill hole 5 ft. to the east. (B105A).
45					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 198 B105
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105A

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 96+54
ELEVATION: 1196.1
DATE START: 1/22/87
DATE FINISH: 1/22/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:		
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE
1/22/87	WD	NE	100'	100'
--	--	--	--	--
--	--	--	--	--

	CASING	SAMPLER	CORE BARREL
TYPE	dbl wall	--	--
SIZE ID	4-1/4"	--	--
HAMMER WT	--	--	--
HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					NOTES: 1. Location = N 875,781.30, E 508,389.40
	9				2. B105A is approximately 8 ft north of LDB-02.
	17				
	17				Tan, dry, SILT, little fine sand, trace clay, with $CaCO_3$ present (ML)
	27				3.5 -ALLUVIUM-
	30				NOTE: With trace fine gravel below 3.5 ft. (ML)
5					
	35				
	31				7.0
	69				Brown, dry, medium to fine sandy, fine GRAVEL, little coarse gravel, with $CaCO_3$ as coatings (GP)
	48				-ALLUVIUM-
	43				10.0
10					
	62				Tan, dry, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with $CaCO_3$ as coatings (GW)
	80				-SCG-
	40				
	37				14.5
	61				Tan, dry, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with slight $CaCO_3$ as coatings (GW)
15					
	90				
	67				
	72				
	88				
20	43				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B105A 1/2

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105A

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	60				
	63				
	49				22.5 Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with slight clay coatings and no $CaCO_3$ present (GW)
	53				
25	59				
	70				
	54				
	45				
	40				28.5 Brown, damp, clean, medium to fine SAND (SP)
					29.5
30	43				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles (GW)
	44				TO
	35				Coarse to fine gravelly, medium to fine SAND (Interlayered?) (SP)
	61				
	44				34.0 Brown to gray, dry, coarse to fine sandy, COBBLES, little coarse to fine gravel (GP)
35	90				
	60				
	126				37.0 Loose, brown, damp, coarse to fine sandy, coarse to fine GRAVEL (GW)
	30				
	29				39.5
40	?				Brown, dry, coarse to fine sandy, COBBLES, little to trace coarse to fine gravel (GP)
	83				
	~~121~~				
	104				
45	78				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 200 B105A
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105A

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	47				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles (cobbles concentrated in layers) (GP)
	85				
	68				
	44				NOTE: Slight clay coatings on gravel at approximately 53.5 ft.
50	52				
	80				50.5 Brown to gray, dry, coarse to fine gravelly, COBBLES, trace coarse to fine sand (GW)
	244				
	123				
	96				54.5
55	54				Brown, damp, clean, medium to fine SAND, with little to trace coarse to fine gravel in layers (SP)
	33				
	31				57.5
	99				Brown to gray, dry, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with occasional clay coatings (GW)
	134				
60	170				
	139				61.0
	80				Brown to gray, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight clay coatings (GW)
	84				
	120				63.0 Brown and gray, dry, COBBLES, little coarse to fine gravel, trace coarse to fine sand (GP)
65	135				
	192				
	131				
	242				
	167				69.5
70	66				(Dense) brown, damp, clean, fine SAND (SP)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 201 B105A
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105A

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					(Dense) brown, damp, clean, fine SAND (SP)
	65				71.0
					Gray, dry, coarse to fine gravelly, COBBLES, trace coarse to medium sand, with slight clay coatings (GP)
	267				
	238				
	142				
75	141				
	153				NOTE: Same as above, but little to trace coarse to fine sand at approximately 76 ft.
	142				
	239				78.0
					Brown, damp, medium to fine sandy, coarse to fine GRAVEL (GP)
	70				79.0
80	154				Gray, dry, coarse to fine gravelly, COBBLES, trace coarse to fine sand (GP)
	218				
	114				82.0
	35				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight clay coatings (GW)
					83.2
	121				Brown to gray, dry, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with clay coatings and traces of clay throughout (GW)
85	132				
	95				
	184				
	126				
	77				
90	113				
	181				
	231				
	138				93.0
	96				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay (GP)
					94.3
95	153				See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 202 B105A
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B105A

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	178				Brown to gray, dry to damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay as coatings
	326				
	468				
	164				
100	183				
					Bottom of Exploration at 100 ft.
					NOTE: Used a different bit and a slightly damaged bit inner sleeve on this hole. Blow counts may be erroneously high. Hammer isn't firing as well eigher, misses every now and then.
105					
					NOTE: Quite a bit of material caved back into the hole each time the driller pulled the casing up a few feet to check that his bit was clear. The hole caved to 40 ft. after casing was pulled.
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 203 B105A
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B106

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta.81+28
ELEVATION: 1193.1
DATE START: 1/23/87
DATE FINISH: 1/23/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/23/87	WD	NE	100'	100'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
0					NOTES: 1. Usng a new drill bit on this hole 2. Location = N874,254.25, E508,220.53	
	4				Tan, dry, SILT, trace fine sand and clay, cemented with $CaCO_3$	(ML)
	6				-CALICHE-	
	16					
	18					
5	24					
	29				6.0	
	23				Tan, dry, fine SAND, trace medium sand, with $CaCO_3$ present (but not cemented)	(SP)
	18				7.5 -ALLUVIUM-	
	16				Tan, dry, medium to fine SAND, little to trace fine gravel, with $CaCO_3$ present (but not cemented)	(SP)
10	49				-ALLUVIUM-	
	54				NOTE: "Little" coarse to fine gravel with $CaCO_3$ coatings at approximately 10 ft.	
	62					
					14.0	
	43				15.0 Tan, dry, clean, medium to fine SAND (lens)	(SP)
15	28					
	?				Brown to gray, dry, coarse to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ as coatings	(GW)
	63				-ALLUVIUM-	
	50				18.0	
	80				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with slight $CaCO_3$ coatings	(GW)
20	40				-SGC-	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 204 B106

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B106

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	42				Brown to tan, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles (no $CaCO_3$) (GW)
	56				
	50				
	49				
25	50				
	58				26.0 Relatively loose, rust-brown, dry, coarse to fine sandy, COBBLES, little to trace coarse to fine gravel in pockets and lenses, with traces of silt in pockets (GP)
	44				
	39				
	36				
30	40				
	53				
	61				
	61				
	56				
35	49				
	54				
	38				
	73				NOTE: Same as above, but without silt and with slight clay coatings.
	61				
40	55				
	53				40.5 Brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles (GW)
	48				
	47				43.0 Gray to brown, dry, coarse to fine gravelly, COBBLES, little to trace sand in looser pockets (GW)
	83				
45	79				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 205-B106
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B106

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	119				46.3
	55				Relatively loose, tan to gray, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles. (GW)
	32				
	33				
50	89				
	145				
	115				52.0
	62				NOTE: Cobble caught in bit and no cuttings returned from 49.5 to 55 ft. Possible sand lens from approximately 52 to 53 ft. (SP?)
	352				53.0
55	400+				
	143				Brown, dry, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand (GW)
	97				
	86				58.0
	57				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay as coatings (GP)
60	33				
	29				
	61				61.5
	58				Brown to rust-brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay as frequent coatings, and occasional pockets with traces of silt (GP)
	94				
65	113				
	75				66.0
	66				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay (GW)
	65				
	78				68.5
70	120				Brown to gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay as coatings (GP)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B106
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B106

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	68				Brown, damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay (occasional clayey sand balls came up with cuttings.) (GP)
	123				
	112				
	163				
75	179				
	119				
	109				NOTE: 77 ft - not getting enough air to bit. Raised casing up approximately 10 ft (hard to pull up), a lot of material had caved back into hole.
	210				
	75				
80	183				NOTE: No returns from approx. 79 ft to 81 ft: pulled casing - had a damaged inner sleeve and were loosing air. Therefore, blow counts since approx. 71 ft. are probably misleading.
	250+				
	234				
	330				NOTE: High blows and no returns from approximately 82 to 85 ft: missed some counts. Talked to Dave Broerman of Dames and Moore. Pulling all the casing to check bit then re-start from 85 ft.
	?				
85	?				
	125				
	58				Brown, moist, cobbly, coarse to fine GRAVEL, some to little coarse to fine sand, trace clay. Sand coming out in frequent clayey balls (GW) to (GW-GC)
	91				
	65				
90	72				
	66				
					91.5
	82				Brown to gray, damp, COBBLES, little coarse to fine sand, little to trace coarse to fine gravel, with traces of clay (GP)
	101				
	118				
95	151				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 207 B106
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. 2106

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	87				
	97				96.5 (Dense) brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles and clay. (GW) to (GW-GC)
	87				
	74				
100	158				
					Bottom of Exploration at 100 ft.
105					
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 2028106
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS
CRS SIRRINE

TEST BORING REPORT

BORING NO. B107

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 70+18
ELEVATION: 1193.0
DATE START: 1/23/87
DATE FINISH: 1/23/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	--	--
1/23/87	WD	NE	100'	100'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	2				NOTE: Location = N873,138.28, E508,171.83
	8				(Hard) tan, dry, SILT, little fine sand, trace clay, $CaCO_3$ cemented (ML)
	14				-CALICHE-
	18				
5	18				
	34				
	20				
	22				
	26				
10	20				
					10.5
	27				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with $CaCO_3$ as coatings (GW)
	42				-SGC-
	36				
	46				
15	34				
	39				
	47				NOTE: $CaCO_3$ decreasing downwards
	41				
	41				
20	31				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B107

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B107

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	39				
	68				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with occasional slight clay coatings (No $CaCO_3$) (GW)
	43				
25	39				
	37				
	36				NOTE: This material seems fairly loose to "medium dense"
	46				28.0
	65				Brown to gray, dry, coarse to fine gravelly, COBBLES, some coarse to fine sand, with occasional slight clay coatings (GW)
30	75				
	70				
	85				32.5
	?				Brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles (GW)
	29				
35	51				
	51				36.0
	99				Brown to gray, dry, coarse to fine sandy, COBBLES, little coarse to fine gravel, with frequent clay coatings and loose sand and gravel pockets (GP)
	43				
	70				
40	112				40.0
	49				Brown to gray, cobbly, coarse to fine GRAVEL, some coarse to fine sand (GW)
	45				
	61				NOTE: Occasional slight clay coatings (varies).
	66				
45	86				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 2/2 B107
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B107

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	73				
	85				46.5 Gray, dry, COBBLES, little coarse to fine gravel and coarse to fine sand (GP)
	99				
	141				NOTE: Possible boulder at approxmately 48.5 ft.
50	98				50.0 Brown, dry to damp, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with occasional pockets with traces of clay as coatings (GW)
	47				
	96				
	128				
55	70				
	57				
	75				
	98				58.0 Brown to gray, dry, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with occasional clay coatings (GW)
	49				
60	54				
	76				61.0 Gray to brown, dry, coarse to fine gravelly, COBBLES, trace coarse to fine sand (GP)
	122				
	228				NOTE: Quartzite boulder at approximately 62 ft.
	190				
65	105				
	126				
	95				66.5 Brown, damp, coarse to fine sandy, coarse to fine GRAVEL (GW)
	26				
	45				
70	76				NOTE: Trace cobbles at approximately 70 ft.

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 2 / / B107
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B107

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	58				Brown, dry to damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with slight clay coatings (GW)
	39				
	72			72.5	Gray, dry, coarse to fine gravelly, COBBLES, trace coarse to fine sand (GP)
	91				
75	76				
	123				
	117			77.5	
	53				Dark brown, damp, CLAY, little to trace silt (CL)
	53			78.5	Brown, moist to damp, coarse to fine gravelly, medium to fine SAND (SP)
80	66				
	97			81.5	Brown, moist to damp, coarse to fine GRAVEL, little coarse to fine sand, little to trace cobbles, with traces of clay (GW)
	53				
85	55				
	104				
	95			87.5	
	63				Brown, moist to damp, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles and trace clay (GW) to (GW-GC)
	50				
90	61			90.0	
	116				Brown to gray, damp, coarse to fine gravelly, COBBLES, some coarse to fine sand, with traces of clay as coatings (GW)
	84				
	100				
	84				
95	117			95.0	

See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 2 12 B107
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B107

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	77				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, trace clay (GW) to
					INTERLAYERED WITH (GW-GC)
	71				Brown to gray, damp to moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, with traces of clay (GW)
	109				
	81				
100	130				
					Bottom of Exploration at 100 ft.
105					
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B107
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B108

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 5
LOCATION: Sta. 43+88
ELEVATION: 1191.0
DATE START: 1/24/87
DATE FINISH: 1/24/87
DRILLER: Mike Mottet
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
1/24/87	WD	NE	100'	100'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	3*				NOTES: 1. (*) Indicates partial blows (Hammer not fully hitting.)
					2. Location = N870,510.07, E508,334.80
	4*				3. Boring B-108 is approximately 10 ft north of LDB-03.
	4*				
	4*				Brown, damp, SILT, little clay, trace fine sand, $CaCO_3$ cemented (ML)
5	5*				-CALICHE-
	10				6.0
					Tan, damp, medium to fine sandy, fine GRAVEL, with occasional coarse gravel, and traces of silt. Partially cemented with $CaCO_3$ (GP)
	14				-CALICHE-
	16				
	20				
10	30				
	42				11.0
					Tan, damp, medium to fine SAND, little fine gravel, trace silt, with $CaCO_3$ cement (SP-SM)
	25				-CALLICHE-
	23				
	25				14.0
					Brown to gray, dry, cobbly, coarse to fine GRAVEL, some coarse to fine sand (no $CaCO_3$) (GW)
15	81				-SGC-
	49				
	56				
	52				
					18.5
	34				
20	26				See next page

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 2 14 B108

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B108

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	42				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay (GW)
	30				
	23				
	37				
25	31				25.0
	55				Brown to gray, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand (GW)
	52				
	123*				
	158*				29.0
30	34				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of silt and occasional cobbles (GP)
	71				
	37				NOTE: Loose fine gravel pocket at approximatelyl 32.5 ft.
	30				
	56				
35	43				Brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles with frequent 4" to 6" layers or pockets of looser materials (GW)
	41				
	76				
	47				38.0
	82				Brown to gray, dry to damp, cobbly, coarse to fine GRAVEL, some to little coarse to fine sand (GW)
40	40				
	71				
	66				42.0
	37				Relatively loose, brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL. (GP)
	36				44.5
45	59				See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 2/5 B108
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B108

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	81				Brown to gray, dry, medium to fine sandy, COBBLES, trace coarse to fine gravel (GP)
	100				47.2
	58				(Relatively dense) brown, damp, medium to fine sandy, coarse to fine GRAVEL, with slight clay coatings (GP)
	51				
50	37				50.5
	56				Brown to gray, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with small pockets of looser material
	88				
	43				
	93				
55	121				
	82				55.8 Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight clay coatings (GW)
	31				
	27				58.5
	60				NOTE: Interlayered with gray-brown, dry, cobbly, coarse to fine GRAVEL, trace coarse to fine sand (coarser layers slightly less frequent) below 58.5 ft. (GW)
60	56				
	35				
	63				NOTE: traces of clay at approximately 63.5 ft.
	50				
	52				
65	50				
	47				NOTES: Trace clay, sand is coarse to medium at 66 ft (GW-GC)
	48				
	84				68.2
	50				
70	57				See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 2 16 B108
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B108

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	68				Brown and brownish-gray, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles with traces of clay in pockets (GW)
	50				
	58				
	52				
75	48				
	47				
	54				
	56				78.0
	73				Brown to gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand (GP)
80	83				80.0
	46				Brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little coarse sand, trace clay (GP) to (GP-GC)
	54				
	43				
	42				
85	49				
	43				NOTE: Coarse to fine sandy below approximately 85 ft.
	45				
	55				
	54				NOTE: On cobble at approximately 89 ft.
90	83				
	53				91.5
	34				Brown, moist, fine gravelly, medium to fine SAND, trace coarse gravel and clay (SP-SC)
	26				93.5
	43				
95	57				See next page

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 217 B108
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B108

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	63				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay (GW-GC)
	44				
	63				NOTE: Little cobbles approximately 98 to 100 ft.
100	82				
					Bottom of Exploration at 100 ft.
105					
110					
115					
120					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B108
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-201

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 167+00
ELEVATION: 1181.7
DATE START: 2/24/87
DATE FINISH: 2/24/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
2/24/87	WD	NE	86'	86'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				NOTES: 1. Approximate location = N 882,839, E 508,190
	0				2. Boring B-201 is approximately 25 ft north of LDB-04.
	12				3. Boring was obscured by construction activities prior to survey.
	12				
5	21				
	22				
	14				
	18				Brown, dry, silty fine SAND, little coarse gravel, trace clay, with frequent nodules of cemented silty sand ($CaCO_3$) (SM-SC) -ALLUVIUM-
	11				
10	11				
	10				11.0
	0				Tan to gray, dry, clean, medium to fine SAND, trace coarse to fine gravel. (SP)
	1				
	10				14.0
15	21				Tan to gray, dry, clean, coarse to fine gravelly, coarse to fine SAND, trace cobbles. (SW) -SGC-
	19				
	17				
	12				18.0
	13				NOTE: More medium to fine SAND at approximately 18 ft. (SP)
20	9				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE — NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR — NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-201

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-201

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	14				21.0
					NOTE: More gravel at approximately 21 ft.
	19				
	350				
					NOTE: Rock fragments coming up drill pipe at approximately 23 ft: on cobble or boulder
	294				
25	73				Medium to fine sandy, coarse to fine GRAVEL, little cobbles (GW)
	68				26.0
	59				
	55				Dry, clean, cobbly, coarse to fine GRAVEL, little coarse to fine sand (GP)
	43				
30	51				NOTE: Looser pockets of coarse sand and fine gravel between cobbles
	71				
	43				
	91				
35	68				
	58				
	54				
	78				
	126				39.0
40	96				NOTE: Slight clay coatings on gravels at approximately 39 ft.
	88				
	58				Brown, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace clay (GP-GC)
	61				
	41				
45	105				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-201
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-201

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	66				
	60				NOTE: Encountered black (MnO_2) stained gravels at approximately 47 ft
	59				
	73				49.0
50	59				Damp, brown, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay (GW-GC)
	62				
	154				NOTE: Encountered boulder at 54 ft. Hammer energy staying consistent.
					54.0
55	196				
	174				Damp, brown to rust-brown, coarse to fine gravelly, COBBLES, little to trace medium to fine sand, with traces of clay (GP) to (GP-GC)
	124				
	146				58.0
	64				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)
60	87				
	70				TO
	99				Cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay (GW) to (GW-GC)
	91				
	143				
65	402				NOTE: Drill bit plugged at 63.5 ft. Blow counts are misleading from approximately 63 to 73 ft.
	276				
	245				NOTE: No cuttings returned from 65 to 73 ft
	182				
	76				
70	134				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 221 B-201
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-201

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	110				
	163				NOTE: No cuttings returned from 65 ft to 73 ft.
	~~212~~				
					Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay (GW-GC)
75	62				
	55				
	100				NOTE: Drill bit clogged from 76 to 79 ft: No cuttings returned; blow counts are misleading
	127				
	171				
80	250+				NOTE: Hammer energy low, very few cuttings returned - gravelly COBBLES (?)
	226				
	165				
	250+				
	471				
85	294				
	273				
					Bottom of Exploration at 86.0 ft.
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 222 B-201
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-202

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 162+05
ELEVATION: 1181.8
DATE START: 3/31/87
DATE FINISH: 4/1/87
DRILLER: Terry Leither
PREPARED BY: Alan Howard & Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/1/87	WD	84'(?)	89'	89'	SIZE ID	4-1/4"	--	--
-See note at bottom of page 4/4				--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				Dark reddish-brown, damp, clayey SILT, trace fine sand, with roots. (ML)
	1				2.0 -TOPSOIL-
	7				Reddish-brown, dry to damp, clayey SILT, trace fine sand. (ML) -ALLUVIUM-
	12				NOTE: Location = N 882,316.96, E 508,001.73
5	13				4.5
	11				NOTE: Same as above, but with moderate to weak, laminar, $CaCO_3$ cementation. (ML) -CALICHE-
	13				
	17				
	18				
10	19				10.0
	17				NOTE: Little fine sand below 10.0 ft. (ML)
	16				12.0
	16				Tan, dry, clean, fine SAND, trace fine gravel and coarse sand. (SP) -ALLUVIUM-
	12				14.5
15	22				NOTE: Little coarse to fine gravel below 14.5 ft. (SP) -ALLUVIUM-
	30				
	25				17.0
	19				(Relatively loose) gray and brown, dry, clean, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles. (GW) -SGC-
	27				
20	41				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 223 B-202

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-202

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					(See previous page)
	50				21
	24				(Relatively loose) brown and gray, dry, clean, coarse to medium sandy,coarse to fine GRAVEL, trace cobbles and fine sand. (GP)
	39				
25	21				25.5
	20				NOTE: Possible coarse to medium SAND layer, with some amount of gravel, from 25.5 to 28 ft. (SP)
	15				
	16				28
	50				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand. (GP)
30	40				
	71				
	47				
	51				33.5
	37				(Relatively loose) light rust-brown, damp, medium SAND, trace fine gravel and coarse and fine sand, with traces of clay in pockets (?) (SP)
35	23				
					36.5
	16				Brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with slight traces of clay as coatings. (GP)
	57				
	76				
40	64				
	149				42
	24				Brown, damp, coarse to medium SAND, trace fine gravel and fine sand, with traces of clay. (SP) NOTE: Sand forms a ball when squeezed together.
	39				44
45	41				(see next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-202
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-202

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	88				Light brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace coarse sand, with slight traces of clay. (GP)
	91				
	123				
	71				49
50	106				Brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	98				
	106				
	110				TO
	129				Coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
55	128				
	164				NOTE: Frequent balls of clayey sand (up to 1.5") in returns.
					56.5
	89				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with strong traces of clay. (GW) to (GW-GC)
	88				
	72				
60	54				
	60				
	66				NOTE: Returns are intermittently moldable.
	73				
	47				64
65	29				Brown, damp, medium to fine SAND, with traces of clay. (SP) to (SP-SC) NOTE: Returns are slightly moldable.
					65.5
	82				Brown, damp, medium to fine sandy, COBBLES, little to trace coarse to fine gravel, with traces of clay. (GP) to (GP-GC)
	80				
	110				68
	68				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with traces of clay. (GW) to (GW-GC)
70	65				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-202
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-202

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	71				
	105				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with strong traces of clay. (GW) to (GW-GC)
	94				
	74				NOTES: 1. Returns are almost moldable. 2. No cobbles from 74 to 76 ft.
75	65				
	56				
	74				
					77.5
	50				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GP)
					78.5
	26				Brown, moist, clean, fine SAND, little medium sand. (SP)
					79.3
80	59				
	97				Brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace clay. (GW-GC)
	46				
	57				NOTE: Returns are moldable.
	57				
					84.5
85	36				Brown, moist to wet, coarse to fine gravelly, medium to fine SAND, with slight traces of clay. (SP)
	28				
					86.7
	38				Brown moist to wet, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)
	56				
	47				
90					Bottom of Exploration at 89.0 ft.
					NOTE: Sounded casing when it was pulled back to 79 ft - soil caved to 80 ft. No water noted to 80 ft. Water was possibly encountered at 84 ft while drilling.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-202
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

226

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-203

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 156+92
ELEVATION: 1182.2
DATE START: 3/31/87
DATE FINISH: 3/31/87
DRILLER: Terry Leither
PREPARED BY: Alan Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/31/87	WD	88-89'	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	7				Dark brown, damp, SILT, little clay, trace fine sand, with roots. -TOPSOIL- (ML)
1.0					
	14				NOTE: Location = N 881,810.65, E 508,105.29
	15				Brown, dry, fine sandy, SILT, little to trace clay, trace coarse to fine gravel, with laminar, weak, $CaCO_3$ cementation. (ML)
	18				-ALLUVIUM-
5	15				
	19				
	19				
	22				NOTE: No returns from approximately 2 to 7.5 ft - pulled casing back to unclog drill bit, but still no returns to 13.5 ft.
	15				
10	30				
	20				
	17				NOTE: Same as above (?)
	18				
	17				
15	17				15
	11				Brown to rust-brown, dry, clean, medium to fine SAND, trace fine gravel and coarse sand. (SP)
	9				-ALLUVIUM-
	13				18
	19				Light brown, dry, clean, coarse to fine gravelly, medium to fine SAND. (SP)
20	10				-ALLUVIUM-

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 227 B-203

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-203

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	11				(See previous page)
	14				22.0
	51				Gray and brown, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP)
	52				-SGC-
25	90				25
	21 (?)				Tan, dry, clean, medium to fine SAND, trace coarse to fine gravel and coarse sand, with traces of silt. (SP) to (SP-SM)
	25				27
	62				Gray and brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GW)
	96				
30	149				30
	105				Gray and brown, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles and coarse sand. (GP)
	118				
	85				33.5
	71				Dark to light brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and pockets of dark brown, clayey, medium to fine sand. (GP) to (GP-GC)
35	57				
	63				
	51				37
	53				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with occasional rust-colored damp, clayey sand coatings on cobbles and gravel. (GP)
	56				
40	45				
	44				
	32				42
	47				43 Light rust-brown, damp, medium to fine SAND, trace fine gravel with slight traces of clay. (SP)
45	20				45 Light rust-brown, damp, medium SAND, trace coarse to fine gravel and coarse and fine sand, with traces of clay. (SP) to (SP-SC)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-203

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	43				Gray and brown, dry, medium to fine sandy, coarse to fine
				46.5	GRAVEL, trace cobbles and coarse sand. (GP)
	24				Rust-brown, damp, medium to fine SAND, trace coarse to fine
				47.5	gravel, with traces of clay. (SP) to (SP-SC)
	52				Brown and gray, dry to damp, medium to fine sandy, coarse
	54				to fine GRAVEL, little to trace cobbles, with clayey sand
					coatings on gravel and cobbles. (GP)
50	35				
				50.5	
	40				Rust-brown, damp, coarse to medium SAND, trace fine gravel,
				51.5	coarse sand and clay. (SP-SC)
	66				
	57				
	56				Brown and gray, dry to damp, medium to fine sandy, coarse to fine
					GRAVEL, trace cobbles and coarse sand, with traces of rust-brown
55	59				clay as clayey sand coatings. (GP)
	45				
	40				
	54				NOTE: "Little" cobbles and dark brown clayey coatings at
					approximately 52.5.
	?				
				59.5	
60	66				
	54				Rust-brown and gray, damp, coarse to medium sandy, coarse
					to fine GRAVEL, little cobbles, trace fine sand, with traces
	64				of clay. (GP)
	60				
	57				NOTE: Varies to dark brown, medium sandy and trace cobbles.
65	63				
				65.5	
	112				Gray, dry, coarse to fine gravelly, COBBLES, trace medium
	108				to fine sand. (GP)
	91				
				68	
	28				Rust-brown, damp to moist, clayey, SILT, trace fine gravel. (ML)
70	26				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-203 229
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-203

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
					70.5 (See previous page)	
	41				Brown to rust-brown, damp to moist, medium to fine SAND,	
					71.5 little silt, trace fine gravel, coarse sand and clay.	(SM)
	46					
	67					
	70				Brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace coarse sand, trace cobbles, with traces of clay as coatings and in pockets.	(GP) to (GP-GC)
75	87					
	70				77	
	115					
	95				Gray and brown, dry to damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand.	(GP)
80	183				NOTE: Checked for groundwater at 79 ft while drilling - borehole was dry to 79 ft.	
	133				81.5	
	95					
	90				Rust-brown to brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
	86					
85	82				85.5	
	58				Tan, damp, clean, medium to fine SAND, trace fine gravel and coarse sand.	(SP)
	40				87.0	
	76				Brown to rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with traces of clay.	(GP) to (GP-GC)
	85					
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-203
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-204

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 152+40
ELEVATION: 1185.0
DATE START: 4/2/87
DATE FINISH: 4/2/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/2/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
4/2/87	1/2	85'	79'	89'	HAMMER WT	--	--	--
4/3/87	12-1/2	85'	79'	89'	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	5*				Tan, dry, SILT, little clay, with weak, laminar $CaCO_3$ cementation. (ML)
	10*				
	14*				2.5 -CALICHE-
	21*				Tan, dry, SILT, trace fine sand and clay, with moderately developed, laminar, $CaCO_3$ cementation. (ML)
5	21*				-CALICHE-
	19*				NOTE: Location = N 881,358.00, E 508,090.10
	27*				6.0 Tan and gray, dry, coarse to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ present as coatings on gravel and as light cementation. (GW)
	40*				-CALICHE-
	25				
10	28				NOTE: * Indicates weak blows - turbo charger not turned on.
	42				10.5
	31				Brown and gray, dry, coarse to fine gravelly, COBBLES, little coarse to fine sand, with frequent slight, $CaCO_3$ coatings on gravel and cobbles. (GW)
	48				-SGC-
	71				
15	70				
	102				NOTES: 1. Possible boulder at 13 ft.
	78				2. Pockets of relatively loose material between cobbles.
	45				3. Boulder at 19 ft.
	36				
20	153				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 231 B-204

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-204

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	355				(See previous page)
	108				22
	32				Brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand. (GP)
	40				24.5
25	46				Dark brown and black, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay and black (MnO_2) staining. (GP) to (GP-GC)
	32				
	59				27.5
	56				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight traces of clay. (GP)
	49				
30	63				
	59				
	50				
	37				
	62				
35	76				NOTES: 1. Pocket richer in fine gravel at approximately 32.5 ft. 2. Possible boulder at 36 ft. 3. Sand is concentrated in pockets.
	70				
	132				
	98				
	81				
40	89				
	126				
	103				
	59				
	79				
45	73				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-204
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-204

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	134				(See previous page)	
	149					
	77			48		
	54				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
50	43					
	53			51		
	67				Rust-brown, damp to moist, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	72			53		
	110					
55	104				Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	135					
	90					
	102			58		
	51					
60	58				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little to trace (small) cobbles, with strong traces of clay.	(GP) to (GP-GC)
	53					
	44				NOTE: Returns are barely moldable.	
				62.5		
	46				Black, moist, cobbly, coarse to fine GRAVEL, trace clay, with traces of coarse to fine sand.	(GP-GC)
	34			64		
65	86					
	76				Rust-brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	63					
	76				NOTE: Occasional balls of clayey sand in returns.	
	83					
70	90					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-204
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-204

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	98				(See previous page)
	115				
	97				73
	60				Rust-brown, moist, coarse sandy, fine GRAVEL, little coarse gravel, trace medium to fine sand and clay. (GP-GC)
75	52				
	47				76.5
	60				Rust-brown, moist, coarse to medium sandy, coarse to fine GRAVEL, little (small) cobbles, trace fine sand, with traces of clay. (GW) to (GW-GC)
	74				
	62				
80	63				80
	106				Rust-brown to brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	78				
	75				
	80				
85	123				85
	76				Rust-brown, moist, coarse to fine GRAVEL, little (small) cobbles, little to trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	66				
	135				
	79				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-204 234
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-205

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 146+70
ELEVATION: 1186.3
DATE START: 3/2/87
DATE FINISH: 3/2/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/2/87	WD	89'	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					NOTE: Location = N 880,792.38, E 508,136.83
	4				
	21				NOTE: Dry, fine sandy SILT, trace clay, was observed at the very beginning of the boring. Strong $CaCO_3$ cementation was noted almost immediately. (ML) -CALICHE-
	21				
5	36				
	58				
	65			7.0	
	78				Tan to brown, dry, coarse gravelly, COBBLES, trace coarse to fine sand. (GP) -ALLUVIUM-
	92				
10	43			10.5	
	41				Pinkish-tan, dry, coarse to fine SAND, little fine gravel. (SP) -ALLUVIUM-
	20			12.5	
	16				Tan to light gray, dry, coarse to fine gravelly, coarse to fine SAND. (SW) -ALLUVIUM-
	22				
15	28				
	18			16.0	
	53				Brown to tan, dry, coarse to fine GRAVEL, trace cobbles and coarse to fine sand. (GP) -SGC-
	34				
	65				
20	34				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 235 B-205

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-205

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	44				
	42				See previous page
	44				
	43				
25	49				25.0
	77				Tan to gray, dry, cobbly, coarse to fine GRAVEL, trace medium to fine sand. (Difficult to tell if cobbly GRAVEL, or gravelly COBBLES). (GP)
	81				
	111				NOTE: Abundant rock fragments and rock "flour" in ruturns. Drill bit breaking cobbles into gravel sized pieces. Sand returns are sporadic.
	150				
30	104				
	138				32.0
	31				Tan to gray, damp, medium to fine SAND, little fine gravel (SP)
	36				
35	27				
	35				36.5
	82				Tan to brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW)
	58				
	55				
40	50				NOTE: Black clay as coatings on gravel.
	69				
	115				
	204				NOTE: Occasional SAND "nodules" - sand is well compacted, no visible clay binding grains (damp, no $CaCO_3$).
	172				
45	73				NOTE: Driller stopped drilling at 44+ ft and pulled casing back. Hose plugged at hammer.

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	BORING NO. 236 B-205

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-205

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	54				45.5
	38				Rust-brown to brown, moist, coarse to fine GRAVEL, little coarse to fine sand, trace clay (clay appears in nodules of fine sand and clay and as coatings on gravel), with frequent black (MnO_2) staining on gravel. (GW-GC) NOTE: Very "sticky" clay.
	40				
	62				
50	45				50.0
	48				Tan to light rust-brown, damp, coarse to fine sandy, COBBLES, little coarse to fine gravel. (No black gravels or clay nodules). (GW)
	62				
	66				
	88				
					54.5
55	49				Brown, moist, coarse to fine GRAVEL, little coarse to fine sand, trace clay (clay as nodules mixed with sand and as thick coatings on gravel). (GP-GC)
	77				
	75				NOTE: Mostly coarse gravel.
	67				
	89				59.0
60	108				Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
	72				
	58				
	50				
	55				NOTE: Clay is very moist and sticky and occurs as coatings on gravel and sand.
65	69				
	56				66.0
	37				Rust-brown, moist, coarse to fine SAND, trace coarse to fine gravel. (SW)
	39				
	25				
70	26				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 237 B-205
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-205

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	32				
	76				71.5 Dark brown, moist, coarse GRAVEL, little medium to fine sand, trace clay, with occasional black (MnO_2) staining. (GP-GC)
	63				
	70				
75	64				75.0 Dark brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand and clay, with frequent black (MnO_2) staining on gravel and cobbles. (GW-GC)
	164				
	90				
	88				
	83				
80	108				NOTE: This sequence of SGC has progressively fewer cobbles in returns down to approximately 84.0 ft where a definite change to gravel occurs (although most of it was coarse gravel).
	134				
	154				
	143				
	119				84.0 Dark brown, moist, coarse to fine GRAVEL, little medium to fine sand, trace clay. (GP-GC) NOTE: Some gravels may be cobble-sized (broken during drilling).
85	85				
	100				86.0 Dark brown to rust-brown, moist, coarse to fine sandy, coarse GRAVEL, trace clay, with occasional black (MnO_2) staining. (GP-GC)
	72				
	50				
	54				
90	68				Bottom of Exploration at 90.0 ft. NOTE: Water was encountered at approximately 89 ft. No indication of groundwater was determined from cuttings during drilling.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. 238 B-205
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-206

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 143+00
ELEVATION: 1187.3
DATE START: 3/2/87
DATE FINISH: 3/2/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/2/87	WD	NE	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	--				NOTES: 1. Driller pushed casing into soil to 2 ft before hammer started. 2. Location = N 880,424.92, E 508,137.68
	--				
	8				Tan to brown, dry to damp, medium to fine sandy, SILT, trace clay (ML)
	13				-ALLUVIUM-
5	15				
	16				
	22				
	28				8.0
	42				NOTE: Same as above, but strongly developed, laminar, white $CaCO_3$ cementation. (ML)
10	43				-CALICHE-
	34				
	28				
	19				
	22				14.0
15	32				Tan to rust-brown, dry to damp, medium to fine SAND, little coarse to fine gravel (SP) -ALLUVIUM-
	33				16.0
	92				Light tan to gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand (GP) -SGC-
	128				
	41				
20	68				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 239 B-206

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-206

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	53				
	70				(See prevoius page)
	78				
	85				24.0
25	48				Gray to light tan, dry to damp, coarse to fine sandy, coarse to fine GRAVEL. NOTE: Mostly coarse gravel fraction. (GP)
	44				
	36				27.0
	96				Gray to light tan, dry to damp, coarse to fine gravelly COBBLES, little coarse to fine sand. (GW)
	66				
30	145				NOTE: Occasional hard clay coatings on cobbles and gravel.
	138				
	206				
	131				
	81				
35	88				NOTE: Drilling was stopped at 34.5 ft to unclog hose at at sample discharge funnel.
	89				
	87				
	108				
	71				
40	122				
					40.5
	91				NOTE: Frequent clay coatings on gravel and cobbles below 40.5 ft.
	70				
	80				
	53				Rust-brown to tan, damp, coarse to fine gravelly, COBBLES, some coarse to fine sand, with traces of black clay. (GW)
45	123				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 240 B-206
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-206

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					NOTE: Black clay in small pockets and on cobbles as coatings.
	61				
					46.5
	48				Rust-brown, damp, medium to fine SAND, little coarse to fine gravel. (SP)
	24				
	25				49.0
					Rust-brown to gray, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
50	63				
	68				
					51.5
	79				Rust- brown to tan, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay (coarse sand appeared intermittently in returns). (GP-GC)
	88				
	92				
					NOTE: 1. Limonite staining on some gravel 2. Driller stopped to repair hose at 55.5 ft.
55	71				
	153				
	66				NOTE: Moist, black clay at 57 ft.
	84				NOTE: Observed frequent clayey nodules brought up with cuttings. They were rust-brown, medium to fine SAND, little clay.
	122				
60	156				
	186				
	103				
					NOTE: Boulders at 60.5 ft and 63 ft.
	118				
	80				
65	93				
					NOTE: Boulder at 67.0 ft. NOTE: Driller pulled back casing at 67.0 ft. Re-drilled to 67.0 ft with few returns.
	150				
	344				
	109				68.0
					Tan to light rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace brown clay, with frequent coatings of white clay found with brown clay on cobbles and gravel. (GW-GC)
	50				
70	82				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 241 B-206
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-206

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	96				
	136				70.5 Brown to rust-brown, moist, COBBLES, little coarse to fine gravel, trace coarse to fine sand and clay. (GP-GC)
	149				
	71				
75	98				75.0
	70				Rust-brown, moist, medium to fine SAND, little coarse to fine gravel. (SP) 76.5
	136				
	?				Tan to rust-brown, moist, COBBLES, little coarse to fine gravel and coarse to fine sand, trace clay (NOTE: Clay fraction approaching high end of "trace" - large and numerous nodules of clay in returns.) (GW-GC)
	87				
80	126				80.0
	80				
	74				
	104				Tan to rust-brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand and clay. (GP-GC)
	82				
85	121				
	197				NOTE: Boulders at approximately 85 ft and 86 ft (with black clay traces in returns).
	274				
	166				
	333				
90	45				
					Bottom of Exploration at 90.0 ft.
					NOTE: Waited 5-10 minutes to check for possible groundwater flow into bottom of borehole - groundwater not encountered.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. 242 B-206
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-207

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 138+72
ELEVATION: 1186.3
DATE START: 2/24/87
DATE FINISH: 2/24/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
2/24/87	WD	NE	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0*				NOTE: * Indicates weak blow counts - low hammer energy.
	0*				Brown to tan, dry, SILT, little clay, trace fine sand, moderately well cemented with $CaCO_3$ (frequent nodules of $CaCO_3$). (ML)
	5*				-ALLUVIUM-
	10*				
5	12*				
	16*				NOTES: 1. Location = N 880,000.32, E 508,068.85 2. B-207 is approximately 25 ft southwest of LDB-05.
	18*				
	22				
	22				
10	41				NOTE: Small lens of coarser material at 10.5 ft: coarse to fine sandy, fine GRAVEL.
	49				
	45				NOTE: strong cementation on gravels.
	35				
					13.5
	92				
15	134				
	90				Tan to rust-brown, coarse to fine sandy, fine GRAVEL, with pockets of tan, dry, clean, medium to fine sand. (GP)
	43				-ALLUVIUM-
	127				18.0
	40				NOTE: Cobbles encountered at approximately 18.0 ft.
20	34				(See next page)

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 243 B-207

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-207

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	128				Tan to gray, dry, clean, coarse to fine gravelly, COBBLES, little coarse to fine sand (GP) -SGC-
	227				
	110				
	213				
25	264				
	150+				NOTE: Slight clay coatings on gravels at approximately 26 ft.
	301				
	134				28.0
	78				Tan to rust-brown, damp, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with frequent clay coatings on gravel and cobbles. (GW)
30	121				
	108				
	62				
	48				NOTE: Same as above, but with traces of clay (black clay on all gravels).
	107				
35	210				
	96				
	152				
	205				38.0
	81				
40	85				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and frequent black (MnO_2) staining on gravel and cobbles. (GW)
	45				
	232				NOTE: Encountered boulder at 41 ft.
	311				43.0
	112				Rust-brown, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)
45	97				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-207 2 of 4
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-207

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					45.5
	76				Rust-brown, damp to moist, medium to fine SAND, trace
					46.2 coarse sand and clay. (SP-SC)
	48				NOTE: Sand is moldable due to clay content.
					Rust-brown, damp, cobbly, coarse to fine GRAVEL, little
	103				medium to fine sand, with traces of clay and frequent
					black (MnO_2) staining. (GP) to
	113				(GP-GC)
					49.5
50	89				Rust-brown, moist, coarse to fine sandy, coarse to fine
					GRAVEL, little cobbles, trace clay. (GW-GC)
	131				
	86				
	80				
	71				
55	91				
					55.5
	65				Rust-brown, moist, medium to fine SAND, little coarse to fine
					56.5 gravel, with traces of clay. (SP)
	149				Tan to rust-brown, moist, coarse to fine sandy, coarse to fine
					GRAVEL, little cobbles, trace clay (GW-GC)
	122				
	78				
60	111				
					60.5
	58				
					Light tan to gray, damp, coarse to fine sandy, coarse to fine
	50				GRAVEL, trace clay. (GP-GC)
	68				NOTE: Balls of clay appearing in cuttings muck pile, clay
					coatings around gravels and some gravels have black (MnO_2)
	57				staining.
65	72				
					65.5
	100				Tan to light brown, damp, coarse to fine gravelly, COBBLES,
					some coarse to fine sand, with traces of clay. (GW)
	76				
	127				
	77				
					69.5
70	52				Rust-brown, moist, medium to fine SAND, little coarse to fine
					gravel, with traces of clay. (SP)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-207
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	2 of 5

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-207

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					70.5
	79				Light tan to rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay (clay as coatings and mixed in sand). (GP)
	85				
					72.5
	98				Light tan to brown, moist, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with traces of clay. (GP)
	141				
75	176				NOTE: Boulder at 75.5 ft.
	239				
					76.5
	115				Tan to light rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP)
	62				
	92				NOTE: Clay occurs as coatings on gravel. Some clay is creamy-white, other is rust-brown in color.
80	104				
	99				
					81.5
	153				Tan to brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay on gravel. (GP)
	139				83.0
	44				Tan to rust-brown, moist, medium to fine SAND, little coarse to fine gravel. (SP)
85	82				84.0
	133				Light brown to rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP)
	78				
	113				NOTE: Frequent black (MnO_2) staining on gravels.
	97				
90	79				
					Bottom of Exploration at 90.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-207
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	246

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-209

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 129+95
ELEVATION: approx. 1188.4
DATE START: 3/2/87
DATE FINISH: 3/3/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/3/87	WD	NE	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					NOTE: Location and elevation are approximate. Borehole was obscured by construction activities prior to survey. Approximate location = N 879,117, E 508,046
	30				Tan to brown, dry, silty, fine SAND, little fine gravel, trace clay. (SM)
					-ALLUVIUM-
	34				NOTE: Weakly developed $CaCO_3$ cementation in silty material. Occasional $CaCO_3$ coatings on gravel down to depth of approximately 8.0 ft.
5	21				
	38				
				6.5	
	45				Tan to gray, dry, fine GRAVEL, little medium to fine sand, trace silt. (GP-GM)
	52			8.0	-ALLUVIUM-
	58				
10	43				Rust-brown to tan, damp, coarse to fine sandy, coarse to fine GRAVEL. (GW)
	38				-ALLUVIUM-
	60				
	54			14.0	
15	85				Tan to light brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GP)
	58				-SGC-
	80				NOTE: Sand has more of coarse fraction.
	80				
	76			19.0	
20	58				Reddish-brown, damp, coarse to fine sandy, coarse to fine GRAVEL. (GW)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 2&17 B-209

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-209

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	66				
	117				21.5
	178				Tan to gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand. (GW)
	90				
25	110				NOTE: Occasional clay coatings on gravel.
	76				
	57				27.0
	16				Tan to rust-brown, dry to damp, coarse to fine gravelly, medium to fine SAND. (SP)
	32				29.0
30	156				
	92				Gray to tan, dry to damp, COBBLES, little coarse to fine gravel, trace coarse to fine sand, with traces of clay. (GW)
	83				NOTE: Clay coatings on most gravels.
	96				
	60				NOTE: Same as above, but little coarse to fine sand.
35	64				
	96				NOTE: Occasional black $(Mn)_2$) staining and back to trace sand.
	97				37.0
	64				Brown to reddish-tan, damp, coarse sandy, COBBLES, little coarse to fine gravel, trace medium to fine sand (GP)
	59				39.0
40	734				NOTE: Frequent black (MnO_2) staining and black clay as coatings on gravel at approximately 39.0 ft.
	503				NOTE: Driller pulled back casing and blew cuttings out of hole at 41 ft.
	182				
	150				
	165				Tan to light gray, damp to moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay as frequent coatings on gravels. (GP)
45	162				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-209 2 of 4
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-209

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	100				NOTE: Clay occurs in spots on gravel, not coating entire gravel grains.
	94				Tan to light gray, damp to moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay as frequent coatings on gravels. (GP)
	128				
	126				
	88				49.5
50					Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GP) to (GP-GC)
	123				
	138				NOTE: Clay coating entire gravel grains; frequent black (MnO_2) staining on gravel; and clay/sand nodules in returns.
	130				
	147				
55	165				
	208				56.5
	159				Tan to brown, damp to moist, cobbly, coarse to fine GRAVEL, trace coarse to fine sand, with traces of clay (GP)
	107				
	112				
60	116				NOTE: Clay not completely coating gravel, occasional black (MnO_2) staining.
	201				
	136				NOTE: Driller hammered casing up and down in hole. Clog in cuttings return pipe, so 63 ft and 64 ft blow counts were incomplete.
	?				
	?				
65	149				
	104				
	143				67.0
	165				Tan to brown, damp to moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay. (GW)
	98				NOTE: Gradational change at approximately 67 ft. Some pockets of coarse to fine gravel, thickly coated with clay, noted from 68-69 ft.
70	206				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-209
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-209

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					NOTE: Driller stopped again, returns hose clogged.
	184				71.0
	151				Dark brown, moist, coarse to fine GRAVEL, trace coarse to fine sand and clay. (GW-GC)
	88				
	?				NOTE: Frequent small clay/sand nodules; thick dark coatings and abundant black (MnO_2) staining on gravel.
75	140				
	117				
	108				
	109				
	84				
					79.5
80	177				Tan to light gray, moist to damp, coarse to fine grvelly, COBBLES, little coarse to fine sand, with traces of clay (GW) to (GW-GC)
	121				
	208				
	103				NOTE: Clay on most gravels, some on cobbles. Sporadic black (MnO_2) staining.
	119				
85	180				
	100				
	101				
	137				
	289				
					89.5
90	267				Dark brown, moist, coarse to fine GRAVEL, trace medium to fine sand and clay. (GP-GC) NOTE: Clay completely coating gravel: Black (MnO_2) staining on almost all gravel.
					Bottom of Exploration at 90 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-209
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-210

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 125+95
ELEVATION: Approx. 1190
DATE START: 3/4/87
DATE FINISH: 3/4/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	
3/4/87	WD	NE	90'	90'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	25				Tan to brown, silty, fine SAND, trace coarse to fine gravel and clay. (SM) -ALLUVIUM-
				3.0	
	22				NOTE: Weakly developed $CaCO_3$ cementation from 3 to 6 ft then very strongly developed (laminar) from 6 to 7 ft. -CALICHE-
5	34				
	27				
	49			7.0	
	31				-ALLUVIUM- (SM)
	28			9.0	
10	44				Gray, dry, coarse to fine GRAVEL, trace coarse to fine sand, with traces of silt. (GW) -ALLUVIUM- NOTE: Blotchy $CaCO_3$ coatings.
	62				
	56				TO Tan, dry, coarse to fine sandy, coarse to fine GRAVEL. (GW) -ALLUVIUM- NOTE: Drilled through intermittent (6") pockets of SAND.
	49				
	33				
15	40				
	45				
	75				NOTES: 1. Location and elevation are approximate. Borehole was obscured by construction activities prior to survey. Approximate location = N 878,717, E 508,130 2. Boring B-210 is approximately 25 ft north of LDB-06.
	70				
	42				
20	71				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 257 B-210

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-210

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	50				(See previous page)
	41				
					22.5
	86				Tan to gray, dry to damp, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, with $CaCO_3$ cementation in spots on gravel. (GW)
	81				-SGC-
25	46				NOTE: Most cobbles at or near coarse gravel size. Amount of rock chips in returns indicates cobbles, but not enough to give description a COBBLE designation.
	71				
	97				
	75				
		50/2"	NR	28 / 28.2	
	97				NOTE: No Recovery - Drove SPT 50 blows for 2" on cobble or gravel.
30	76				
	53				
	85				
	101				
	59				
35	80				NOTE: Continued intermittent pockets of SAND.
	90				
	90				
	74				
	98				
40	84				
	72				
	79				42.0
					Dark brown, damp to moist, coarse to fine GRAVEL, little medium to fine sand, with traces of clay and occasional cobbles. (GP)
	55				
	58				
45	62				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-210 252
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-210

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	101				
	68				NOTE: Clay occurs as coatings on gravel, and black (MnO_2) staining occurs on most gravel.
	57				
	56				
50	47				50.0
	46	60/4"	S1	50.5 / 50.8	51.0 Very dense, tan to rust-brown, damp to moist, medium to fine SAND, little coarse to fine gravel, trace coarse sand (SP)
	123				
	62				Dark brown, moist, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GP-GC)
	49				
55	41				
	92				NOTE: Occasional cobbles caused increased blow counts.
	122				
	104				NOTE: Black (MnO_2) staining on all gravels.
	171				
60	96				
	64				
	57				62.0
	32				Light brown, moist, coarse to fine SAND, little fine gravel, silt and clay. (SC)
	22				63.5 NOTE: Large round clayey sand balls came out of sample discharge cyclone.
65	45				
	54				NOTE: Same as above 62 feet, with occasional cobbles (small, just exceeding coarse gravel size.) (GP-GC)
	68				
	49				
	71				
70	33				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-210
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-210

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	69				
	47				71.5
	71				Brown to dark brown, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay and black (MnO_2) staining. (GP) to (GP-GC)
	76				72.5 NOTE: Plastic but less than 5% clay
75	116				Tan to brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay.
	89				(GW) to (GW-GC)
	162				NOTE: Frequent black staining.
	103				78.0
	61				Tan to gray, damp to moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)
80	48				80.0
	106				NOTE: Occasional cobbles.
	51				Dark brown, moist, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	123				
	78				NOTE: Frequent black staining on gravels.
85	56				
	60				
	68				
	148				NOTE: Clay coatings less frequent near bottom of hole.
	67				
90	77				Bottom of Exploration at 90.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-210
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-211

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 120+98
ELEVATION: 1190.7
DATE START: 3/3/87
DATE FINISH: 3/4/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/4/87	WD	NE	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					NOTE: Location = N 878,218.59, E 508,143.26
					Tan to rust-brown, damp, silty, fine SAND, trace clay. (SM) -ALLUVIUM-
	10				NOTE: Weakly developed $CaCO_3$ cementation - forms small nodules.
5					
	12				
	8				
	10				
	13			8.5	NOTE: Strongly developed CALICHE layer ($CaCO_3$) at 8.5 ft.
10	20				
	35			11.0	Gray to brown, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GW) -SGC-
	26				
	27				
	22			14.5	Brown, dry to damp, coarse to fine gravelly, medium to fine sand. (SP)
15	11				
	22				
	36				
	46			18.0	Gray to tan, dry, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GW)
	60				
20	38				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-211

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-211

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	64				NOTE: Frequent small white clay/sand nodules (coarse sand sized) in cuttings returns. Intermittently occurring with rust clay/sand nodules. Occasional coatings occur on cobbles, also.
	88				
	90				
	114				NOTE: Upon re-examination, "white clay" turned out to be damp $CaCO_3$ cementation (weak).
25	120				
	193				
	77				
	144				NOTE: COBBLES are small, many are at or close to coarse gravel in size.
	195				
30	165				
	77				
	104				
	81				
	166				NOTE: Below 36 ft, occasional chunks of "clayey sand" (medium to fine SAND, trace clay) were observed.
35	80				
	129				
	107				
	153				NOTE: Returns indicate intermittent sandy GRAVEL layers within SGC.
	90				
40	82			40.0	
	78				Dark brown, damp to moist, cobbly, coarse to fine GRAVEL, trace coarse to fine sand, with traces of clay. (GW)
	114				
	83				NOTE: Clay coatings on all gravels, black (MnO_2) staining prevalent.
	126				TO
45	148				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-211
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-211

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	45				Tan to brown, damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with occasional clay coatings, clay mixed with sand and black (MnO_2) staining. (GW)
	69				
	124				
	78				
50	66				
	52				50.5 Gray to tan, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with frequent clay coatings and black (MnO_2) staining. (GP)
	113				
	80				
	85				53.5 Dark brown, damp to moist, coarse to fine GRAVEL, little cobbles, trace coarse to fine sand, with traces of clay. (GW) to (GW-GC)
55	92				
	162				NOTE: clay occurs as thick coatings on gravel; abundant black (MnO_2) staining.
	79				
	134				
	92				58.5 Brown, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay (no black staining). (GP) to (GP-GC)
60	44				
	53				NOTE: Thin coatings of white (cream colored) clay underneath darker clay and sand coatings.
	49				
	77				
	105				
65	106				65.0 Tan to gray, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)
	61				
	40				
	109				
	78				69.0
70	127+				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-211
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-211

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	88				Tan to gray, damp to moist, COBBLES, little coarse to fine gravel, trace coarse to fine sand, with occasional clay coatings on gravel. (GW)
	160				
	153				
	187				
75	134				
	115				
	131				
	87				
	93				78.5 Dark brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
80	102				
	191				
	?				
	164				
	200				
85	203				NOTE: Hammer has been hitting weakly since 80 ft. Blow counts are spuriously high.
	344				
	237				
	137				
	104				
90	147				
					Bottom of Exploration at 90.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-211
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-212

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 116+00
ELEVATION: 1192.9
DATE START: 3/3/87
DATE FINISH: 3/3/87
DRILLER: Terry Leither
PREPARED BY: C. Budinger

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/3/87	WD	NE	90'	90'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	19				NOTE: Location = N 877,712.42, E 508,051.43
	13				Tan to reddish-brown, silty, fine SAND, little fine gravel, trace clay. (SM) (Soil has weakly to strongly developed $CaCO_3$ cementation). -CALICHE-
5	17				
	25				
	27				
	26				8.0
	25				NOTE: Nodules of $CaCO_3$ below 8 ft, laminar cementation above 8 ft. -CALICHE-
10	20				
	19				
	27				11.5
	29				Brown to reddish-brown, damp, silty, medium to fine SAND, little coarse to fine gravel, with traces of clay. (SM) -ALLUVIUM- NOTE: Weakly developed $CaCO_3$.
	37				
15	20				
	42				16.0
	28				Tan to gray, dry, clean, medium to fine sandy, coarse to fine GRAVEL. -ALLUVIUM- (GP) NOTE: Small patches of $CaCO_3$ on gravel
	23				18.0
	52				-SGC-
20	42				(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 259 B-212

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-212

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	59				Tan to gray, dry to damp, COBBLES, little coarse to fine gravel, trace coarse to fine sand. (GW) -SGC-
	80				NOTE: Abundance of rock fragments and rock flour in cuttings returns.
	97				
	66				NOTE: Sandier layer from 23 to 24 ft.
25	83				
	38				
	48				NOTE: More gravelly layer from 25 to 27 ft.
	80				
	84				29.0
30	71				Tan to reddish-brown, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW)
	111				
	106				NOTE: Frequent clay coatings on gravel. No black (MnO_2) staining.
	132				
	98				
35	110				
	142				36.0
	38				Gray, dry to damp, coarse to fine GRAVEL, little coarse to fine sand. (GW)
	58				38.0
	42				Tan to rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL. (GW)
40	47				
	54				40.5
	78				Gray to tan, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GP)
	125				
	188				NOTE: Sand in cuttings returns in intermittent and is usually damp. Frequent clay coatings and frequent black (MnO_2) staining occur on gravel.
45	133				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-212
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-212

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	108				
	115				
	118				47.5 Reddish-brown to tan, coarse to fine gravelly, COBBLES, some medium to fine sand. (GP) NOTE: Frequent clay coatings on gravels, no black staining.
	79				
50	74				
	66				
	64				NOTE: Sandier pocket from 52 to 53 ft.
	44				53.0 Tan to gray, damp, COBBLES, little coarse to fine gravel and coarse to fine sand, with occasional clay coatings on gravel. (GW)
	101				
55	163				
	92				
	178				
	182				
	83				
60	146				
	82				60.5 Dark brown, moist to wet, coarse to fine GRAVEL, trace coarse to fine sand and clay. (GW-GC)
	59				NOTE: Clay content approaching "little" classification (clay on all gravel as thick coatings). Black (MnO_2) staining on all gravels, also.
	72				
	66				
65	75				65 NOTE: From 65 to 67 ft contained cobbles with no clay, trace sand and gravel. (GP)
	98				
	140				67 NOTE: "Coarse to fine" chunks of sandy clay in cuttings returns (Same as above 65 ft). (GW-GC)
	94				
	59				
70	79				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-212
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-212

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	79				(See previous page)
					71.5
	47				Rust-brown (with streaks of black), moist to wet, fine SAND, little clay, trace coarse to medium sand, with occasional fine gravel. (SC)
	59				
	?				
					74.5
75	67				Dark brown, moist to wet, coarse to fine GRAVEL, trace coarse to fine sand and clay. (GW-GC)
	52				
	44				77.0
	117				Gray, damp, COBBLES, little coarse to fine gravel, and coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	83				
80	68				
	83				
	98				82.0
	231				Tan to rust-brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay. (GW-GC)
	120				NOTES: 1. Occasional clay/sand balls in cuttings returns.
85	123				2. Black staining frequent.
					3. White clay as thin coatings frequent.
	200				
	148				87.0
	84				Tan to brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	118				
					NOTE: Lots of rock flour, (not many big chips) in cuttings returns.
90	93				
					Bottom of Exploration at 90.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-212
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-213

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 109+90
ELEVATION: 1196.0
DATE START: 3/11/87
DATE FINISH: 3/11/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/11/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Light brown, dry, fine sandy SILT, little cobbles and coarse to fine gravel, trace coarse to medium sand and clay. (ML)
	5*				-FILL-
				1.5	NOTES: 1. Re-worked ground surface from 0 to 1.5 ft due to regrading after completion of LDB-07.
	50				2. * Indicates partial hammer blows.
	88				3. Location = N 877,114.81, E 508,156.61
	125				Tan and gray, dry, silty fine GRAVEL, some fine sand, little coarse gravel and coarse sand, trace cobbles and medium sand, with frequent cemented ($CaCO_3$) nodules (up to 1"). (GM)
5	142				-CALICHE-
	226			6.0	
					Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and silt, with occasional cemented ($CaCO_3$) nodules (up to 1") and frequent ($CaCO_3$) coatings. (GP-GM)
	100				-CALICHE-
	89				
	94			9.0	
10	55				
	57				NOTE: Cleaner and "little" cobbles below 9.0 ft (no $CaCO_3$ cemented nodules). (GP)
	61				-SGC-
	102				
	70			14.0	
15	43				Light rust-brown, dry, medium to fine SAND, trace coarse to fine gravel and coarse sand, with traces of silt. (SP)
	37			16.5	
	58				Light brown and gray, dry, coarse to fine gravelly, medium to fine SAND, little cobbles. (SP)
	80				
	59				
20	97			20.0	(See next page)

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 263 B-213

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-213

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	68				Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles. (GP)
	86				
	70				
	78				
25	70				25.0
	48				Light brown, dry, clean, medium to fine SAND, trace coarse to fine gravel and coarse sand. (SP)
	74				26.5
	96				Light brown to rust brown, dry to damp, coarse to fine gravelly, medium to fine SAND, little to trace cobbles. (SP)
	60				
30	103				30.5
	53				Light rust-brown, dry to damp, clean, medium to fine SAND, trace fine gravel and coarse sand. (SP)
	24				32.5
	104				Light brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand. (GP)
					34.5
35	38				NOTE: Possible medium to fine SAND layer from 34.5 to 37.0 ft. (SP)
	33				
	48				37.0
	78				Light brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles (cobble content varies). (GP)
	70				
40	67				
	81				41.0
	106				Light brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand. (GP)
	80				
	66				
45	75				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-213
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-213

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	147				Light brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand. (GP)
	153				
	228				NOTE: Drilling through cobble(s) from 45 to 48 ft. -- reduced returns and increased blow counts.
	90				
50	108				
	86				
	127				NOTE: Same as above, with little to trace coarse sand and occasional rust-brown clay coatings from 52 ft to 53 ft.
	100				53.0
	89				Grayish-brown and gray, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of silt (more medium to fine than coarse sand). (GP)
55	82				
	141				
	159				
	91				NOTE: Pulled back casing at 59 ft to unclog drill bit.
	115				59.5
60	72				Light rust-brown, damp, coarse to fine gravelly, medium to fine SAND, trace cobbles, with traces of clay. (SP)
	63				61.0
	114				NOTE: Drill bit clogged from 61 to 63 ft.
	131				Brown, gray and rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with frequent pockets of rust-brown, medium to fine sand, trace clay. (GP)
	123				
65	113				65.0
	89				
	97				Light brown to rust-brown, damp, coarse to medium sandy, coarse to fine GRAVEL, little cobbles, trace fine sand, with traces of clay and frequent clayey sand coatings on gravel and cobbles. (GP) to (GP-GC)
	99				
	70				
70	148				70.0
					(See next page)

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-213
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CPSS FORM # 102 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-213

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	149				Grayish-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, some to little cobbles, with slight traces of clay
					71.5 as coatings. (GP)
	189				NOTE: Pulled casing back at 73 ft to unclog bit.
	360				
	175				Brown and gray, damp, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
75	96				
	59				76.0
	226				Brown to rust-brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay and silt (clay occurs in sandy/silty clay pockets -- occurs in returns as clumps up to 5"). (GP-GC)
	113				
80	104				80.0
	92				Light brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with slight traces of clay. (GP)
	99				82.0
	135				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay (frequently as coatings on gravel and cobbles). (GP) to (GP-GC)
	214				
85	138				
	156				
	181				
	176				
	235				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-213
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-214

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 104+40
ELEVATION: 1196.8
DATE START: 3/11/87
DATE FINISH: 3/11/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/11/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Reddish-brown, dry to damp, clayey SILT, little fine sand, trace fine gravel and coarse sand, with frequent laminae of $CaCO_3$ cementation (weak) and roots. (ML)
	5*				
	18				
					2.5
	39				NOTES: 1. * Indicates partial hammer blows. 2. Location = N 876,580.73, E 508,141.19
	49				
5	32				Light reddish-brown, dry, fine sandy SILT, little coarse to medium sand, trace fine gravel, strongly cemented with $CaCO_3$ (nodules up to 2" in cuttings returns). (ML) -CALICHE-
	30				
	23				
	22				
	25				
10	58				
					10.5
					Light rust-brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of silt. (GP) -ALLUVIUM-
	85				
	55				
	52				14.0
					Tan, dry, medium to fine SAND (lens?) (SP)
15	47				15.0 -ALLUVIUM-
	115				Light brown, gray and reddish-brown, dry, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace coarse sand. (GP) -SGC-
	83				
	105				
	66				
20	72				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 269 B-214

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-214

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	70				21.0
	103				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay, occasional $CaCO_3$ coatings on gravel, and occasional clayey sand pockets. (GP)
	118				
	134				24.0
25	87				
	114				Light brown to gray, dry, clean, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GW)
	96				
	70				27.5
		47		28.0	Very dense, light rust-brown and gray, dry to damp, medium to fine SAND, little coarse to fine gravel, trace coarse sand. (SP)
	33	27	S1	—	
		35		29.5	29.5
30	56				NOTE: Mostly medium sand, trace cobbles observed in cuttings returns, 100% recovery on SPT.
	140				
	223				Light brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, trace coarse sand. (GP)
	148				
35	77				NOTE: Sandy pockets at approximately 34 and 38 ft; occasional clayey silt pockets between 33 and 36 ft.
	105				
	122				
	76				
	150				
40	79				
	96				
	88				42.5
	78				Brown to rust-brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with occasional clayey sand pockets (up to 3"). (GP)
	79				
45	37				45.0

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-214
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-214

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	119				Light brown and gray, dry, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand.	(GP)
	138					
	162					
	168				49.0	
50	98				Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand.	(GP)
	106					
	202					
	140				53.0	
	234				Grayish-brown and gray, dry, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand (mostly medium to fine sand).	(GP)
55	112				TO	
	118				Gray and brown, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand.	(GW)
	132					
	127					
	92					
		50/4"	NR	59.0	NOTE: Attempt SPT at 59.0 ft - No Recovery.	
60	104			59.3	60.0	
	315				NOTE: Mostly COBBLES from approximately 60 to 64 ft.	(GP)
	273					
	249					
	304				64.0	
65	168				Reddish-brown, damp to moist, medium to fine sandy, GRAVEL, little cobbles, with traces of clay and pockets	(GP) to
					65.5 of clayey sand.	(GP-GC)
	332				Grayish-brown and gray, dry, coarse to fine sandy, coarse to fine GRAVEL, some to little cobbles, with occasional dry clayey coatings on gravel and cobbles.	(GW)
	135					
	201					
	200					
70	187				70.0	
					(See next page)	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-214
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-214

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	146				Grayish-brown to brown, dry, cobbly, coarse to fine GRAVEL, some medium to fine sand, little to trace coarse sand, with dry clayey coatings on gravel and cobbles.	(GP)
	159					
					72.5	
	144					
	147				Brown, gray and rust-brown, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay and frequent sandy clay pockets and coatings.	(GW) to (GW-GC)
75	132					
	145*					
					76.5	
	394*				NOTE: Poor hammer combustion from 75.5 to 79 ft. Hammer blows should be approximately 2/3 x recorded blow counts. Drill bit clogged somewhat, also in this interval.	
	249*					
	206*				Brown, dry, clean, coarse to medium sandy, coarse to fine GRAVEL, some to little cobbles and fine sand, with occasional dry clayey coatings on cobbles and gravel.	(GP)
80	204*				80.0	
	374*					
	450*				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight traces of clay.	(GW)
	400*					
	368*					
					84.5	
85	137*				Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, trace clay (occasional balls of fine sandy clay came up in returns).	(GW-GC)
	294*				85.5	
	538*				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, trace clay.	(GW-GC)
	646*					
	251*				NOTE: Occasional small clayey sand balls in returns.	
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-214
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-215

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 98+95
ELEVATION: 1198.0
DATE START: 3/12/87
DATE FINISH: 3/12/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/12/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Reddish-brown, dry to damp, silty fine SAND, little to trace clay, trace fine gravel and concrete fragments, with frequent clumps of clayey silt. (SM)
	10*				
	10				2.0 -FILL-
	9				NOTES: 1. Advanced casing to 9.0 ft with only a handfull of cuttings returned (pushing concrete fragment). 2. -CALICHE- from 2 to 6 ft (?) - difficult to judge, very few returns. 3. Location = N 876,019.54, E 508,115.60
	11				
5	9				
	11				6.0+
	17				Tan and gray, dry, sandy GRAVEL, little silt. (GM) -ALLUVIUM-
	19				
	21				
10	28				
	39				11.0
	64				NOTES: 1. Top of SGC at 11.0 ft based on blow counts. Minimal, intermittent, returns made it impossible to see soil strata changes at discharge funnel. 2. * Indicates weak hammer blows - fuel injector clogged.
	77				
	206*				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with occasional $CaCO_3$ coatings. (GP)
15	165*				
	156*				TO
	327*				Cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with occasional $CaCO_3$ coatings. (GP)
	412*				
	253*				NOTE: Stopped drilling at 18 ft to work on diesel hammer fuel injector.
20	273*				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 271 B-215

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-215

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	?				NOTE: Diesel hammer firing better after approximately 23 ft.
	140*				
	151*				NOTE: Same as above to approximately 29 ft (added casing at 29 ft). Returns still seem low in volume. Hammer energy is low, also. Pulled casing back at 29 ft then readvanced to clear hole.
	85				
25	143				
	160				
	126				
	157				NOTE: No $CaCO_3$ coatings below 29 ft.
	79				
30	145				
	170				
	79				31.5 32.0 SAND layer or lens. (SP)
	194				
	231				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand. (GP)
35	171				
	168				36.0 36.5 SAND layer or lens (SP)
	151				
	135				Brown and gray, dry, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand. (GP)
	137				39.0
40	40				Rust-brown, dry, medium to fine SAND, trace coarse to fine gravel and coarse sand. (SP) 40.5
	116				NOTE: Hammer energy increased after 39.0 ft.
	124				
	112				Brown to rust-brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of silt and clay (intermittently). (GP)
	290				
45	115				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-215 272
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-215

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	226				NOTE: Occasional rust-brown, medium to fine SAND pockets and variable cobble content.
	192				
	87				
		50/5"	NR	49.0	NOTE: Attempted SPT at 59.0 ft - No Recovery.
50	67			49.5	
					50.5
	70				Dark brown to rust-brown, damp, coarse to fine gravelly, medium to fine SAND, trace cobbles and coarse sand, with traces of clay. (SP)
	45				
	62				
					53.5
	69				
		50/4"	S1	54.0	Very dense, brown, rust-brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little (?) cobbles, trace sand, with traces of clay. (GP)
55	97			54.3	
	96				TO
	81				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with slight traces of clay and frequent clumps (pockets?) of rust-brown, medium to fine sand, trace clay. (GP) to (GP-GC)
	83				
	132				
60	69				
	40				
	56				62.0
	68				Light brown, dry to damp, medium to fine sandy, fine GRAVEL, little cobbles and coarse gravel, trace coarse sand, with traces of silt and clay. (GP) to (GP-GC)
	62				
65	81				
	85				
	58				67.5
	136				Dark brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles and coarse sand, with traces of clay and frequent, clayey, medium to fine sand pockets and coatings. (GP) to (GP-GC)
	74				
70	135				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-215
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-215

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	96				71.0	
	114				Light grayish-brown, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of silt (and clay?)	(GP)
	123					
	99				74.5	
75	63				Light brown, dry to damp, medium to fine SAND, trace	
	104				75.5 coarse to fine gravel.	(SP)
	80				Light brown and gray, dry, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, with traces of clay as coatings (clay and medium to fine sand occur as	(GP) to
	78				78.0 coatings partially covering cobbles and gravel).	(GP-GC)
	~~70~~					
80					Brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay.	(GW) to (GW-GC)
	~~66~~					
	36					
	65				84.0	
85	61				Dark brown, damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with traces of clay and frequent, thick, clayey coatings on gravel and cobbles.	(GP) to (GP-GC)
	91					
	59					
	73					
	69					
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-215
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-216

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 92+95
ELEVATION: 1195.3
DATE START: 3/13/87
DATE FINISH: 3/13/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/13/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Dark reddish-brown and brown, dry and damp, clayey SILT, little fine sand, trace coarse to fine gravel and coarse sand, with roots and organics. (ML) -TOPSOIL-
	2*				
	13				
	17				
	31				
5	31				
	28				
	35				
	39				
	41				
10	39				
	45				
	59				
	203				
	303				
15	216				
	183				
	156				
	214				
	48				
20	29				

2.5

NOTES: 1. * Indicates partial hammer blows.
2. Location = N 875,420.88, E 508,098.86

Tan to light reddish-brown, dry, SILT, little fine sand and clay, trace fine gravel and coarse sand, with frequent $CaCO_3$ cemented nodules (up to 1.5"). Moderately cemented. (ML)
-CALICHE-

10.5

NOTE: Same as above, but fine sandy SILT, little coarse to fine gravel and coarse sand, with occasional roots. (ML)
-CALICHE-

12.5

Light brown and gray, dry, medium to fine sandy, fine GRAVEL, little coarse gravel and coarse sand, trace cobbles and silt (?). (GP) to (GP-GM)
-SGC-

NOTE: Pushed cobble from approximately 12.5 to 15 ft. Silt returns may be mixed in materials from CALICHE above.

Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with occasional, partial, $CaCO_3$ coatings on coarser fraction. (GP)

18.5

(See next page)

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 275 B-216

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-216

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	25				Light brown, dry, silty, medium to fine SAND, little to trace coarse to fine gravel, trace cobbles and coarse sand. (SM)
	31				
	36				
					23.5
	85				Light brown and gray, dry, cobbly, coarse to fine GRAVEL, some medium to fine sand, trace coarse sand. (GP)
25	53				
					TO
	79				Medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP)
	96				
	101				
	77				NOTE: Missed blow counts from 29 to 33 ft due to site visitor interruptions.
30	?				30(?)
					NOTE: Possible sand layer or lens at approxmately 30 ft. (SP)?
	?				31(?)
	?				
	?				
	123				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with occasional, damp, clayey coatings on cobbles. (GP)
35	126				
	139				
	95				
	120				
	?				39.0
40	152				Brown and gray, dry, clean, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with occasional, damp, clayey coatings on cobbles and gravel. (GP)
	138				
					42.5
	59				NOTE: Becomes sandier at approximately 42 or 43 ft.
	188				
45	194				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-216 276
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-216

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	107				
	128				
	129				
	73				Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand, with slight traces of clay (and silt?) (GP)
50	74				
	136				
	121				
	124				
	119				NOTE: Occasional medium to fine SAND pockets from approximately 54 to 56 ft.
55	116				
	114			56.0	
	159				NOTE: Same as above but dry to damp below approximately 56.0 ft. Hard to distinguish any stratification from 42.5 to 62 ft.
	143				
	73				
	100	4 / 44 / 50/5"	S1	59.0 - 60.4	Very dense, brown and gray, dry to damp, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay in sandier pockets. (GP)
60					
	109				
	123			62.0	
	66				Brown and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with slight traces of clay as coatings and throughout sandy matrix. (GP)
	65				
65	100				
	87				NOTE: Gap graded sand - varies to medium to fine sandy, GRAVEL, little to trace coarse sand.
	96				
	111				
	84				
70	86				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-216
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-216

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					NOTE: Increased cobbles ("some").
	83				
	97				72.0
	92				Rust-brown and gray, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand, with traces of clay and frequent coatings of fine sand, trace clay, on coarser fraction. (GP) to (GP-GC)
	101				
75	127				
	92				76.0
	67				Rust-brown, damp, medium to fine SAND (SP) 77.0
	181				
	119				
80	123				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, trace coarse sand (less clay than above the sand lens). (GP)
	161				
	150				
	156				
	364				NOTE: Pulled casing back at 85 ft to clear drill bit.
85	320				85.0+
	79				Brown and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, some cobbles, with traces of clay and frequent fine sandy clay coatings. (GP)
	65				
	116				
	136				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-216
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-217

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 86+92
ELEVATION: 1194.4
DATE START: 3/13/87
DATE FINISH: 3/13/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/13/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Dark brown, dry and damp, clayey SILT, little fine sand, trace coarse to fine gravel, with roots and grass. (ML)
	1*				
	5*				1.5 -TOPSOIL-
	13*				NOTE: Location = N 874,820.30, E 508,107.78
	22*				Tan to light reddish-brown, dry, SILT, little fine sand, trace coarse to fine gravel and clay, moderately cemented with $CaCO_3$ (frequent nodules up to 1"). (ML)
5	38*				-CALICHE-
	21*				NOTE: Hammer blows at approximately one-half energy from 0 to 6 ft.
	33				
	33				7.5
	?				Tan and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little coarse sand, trace silt, cemented with $CaCO_3$. (GP-GM)
10	49				-CALICHE-
					11.0
	43				Tan and gray, dry, clean, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with $CaCO_3$ coatings on gravel. (GP)
	43				13.0 -SGC-
	79				Brown and gray, dry, clean, coarse to fine sandy, coarse to fine GRAVEL, little cobbles. (GW)
15	56				-SGC-
	57				
	51				
	74				
	43				
20	45				20.0+

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 279 B-217

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-217

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	72				Brownish-gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace silt. (GP-GM)
	63				
	49				23.0
	52				
25	47				Tan and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP)
	52				
	35				27.5
	58				
	43				Brown and gray, dry, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles. (GW)
30	44				30.5
	50				Rust-brown, tan and gray, dry, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP)
	94				
	51				TO
	76				Gray, dry, cobbly, coarse to fine GRAVEL, little medium to fine sand, little to trace coarse sand. (GP)
35	116				
	79				
	76				NOTE: Slight clay coatings at approximately 38 ft.
	77				
	55				
		60/6"	NR	39.0 / 39.5	NOTE: Attempted SPT from 39.0 to 39.5 ft. - No Recovery.
40	61				40.5
	48				Tan, dry, clean, medium to fine SAND, little coarse to fine gravel, trace coarse sand. (SP)
	32				42.5
	38				Light rust-brown and gray, dry, clean, medium sandy, coarse to fine GRAVEL, little cobbles, trace coarse and fine sand. (GP)
	61				
45	51				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-217 280
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-217

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	69				(See previous page)	
	103				47.0	
	180				Gray, dry, clean, coarse to fine gravelly, COBBLES, trace coarse to fine sand.	(GW)
	154				TO	
50	166				NOTE: Same as above, but trace medium to fine sand.	(GP)
	132					
	121					
	166				53.0	
	268					
55						
	83				Light brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, some to little cobbles, with traces of clay as coatings (with fine sand) on cobbles and gravel.	(GP)
	94					
	93					
	?					
60	62				60.5	
	42				Rust-brown and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay (coatings and throughout.)	(GW) to (GW-GC)
	50				62.5	
	90				Rust-brown, damp, coarse to fine SAND, trace clay.	(SW-SC)
					63.5	
65	94					
	81				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay throughout and as thick clayey fine sand coatings.	(GP) to (GP-GC)
	118					
	96					
	77					
70	75				70.0	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-217 281
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-217

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	61				Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little clay, trace cobbles. (GC)
	51				
	60				
	70				74.0
75	59				
	71				Brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay (as coatings, primarily). (GP) to (GP-GC)
	104				
	172				
	91				79.5
80	90				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with occasional dry clay coatings.
	129				
	153				82.0
	109				
	121				
85	117				Brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	92				
	44				NOTE: Same as above, with pockets of rust-brown, moist, clayey, medium to fine sand. (GP-GC)
	46				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-217
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-218

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 79+45
ELEVATION: 1193.9
DATE START: 3/16/87
DATE FINISH: 3/16/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	S	
3/16/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	
--	--	--	--	--	HAMMER WT		140#	
--	--	--	--	--	HAMMER FALL		30"	

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					NOTES: 1. * Denotes weak hammer blows. 2. Location = N 874,071.51, E 508,113.02 3. Boring B-228 is approximately 25 ft south of LDB-08.
	3*				
	9*				
	10*				
	11*				
5	26*				Light brown, dry, SILT, trace clay, with moderate to well developed $CaCO_3$ cementation. (ML) -CALICHE-
	17*				
	12				
	13				
10	15				
	15				
	20			11.5	Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ coatings on gravel. (GW) -ALLUVIUM-
	49				
	30				
15	39				
	38			16	Brown, dry, medium to fine sandy, coarse to fine GRAVEL, with occasional, slight, $CaCO_3$ coatings on gravel. (GP) -ALLUVIUM-
	31				
	37				
	38			19	-SGC-
20	50				(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 283 B-218

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-218

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	65				Rust-brown to brown, dry to damp, coarse to fine gravelly, COBBLES, little medium to fine sand. (GP) -SGC-
	85				
	94				
	50				
25	82				NOTES: 1. Slight black (MnO_2) staining from 25 to 29 ft. (drilling through stained layers?) 2. Encountered a large cobble or boulder at approximately 27.5 ft.
	48				
	62				
	136				
	91				
30	131				
	87			30.5	
	26				(Relatively loose) rust-brown and black, damp, coarse to fine GRAVEL, trace coarse sand, with slight traces of clay as coatings and black (MnO_2) staining on gravel. (GP)
	30				
	63				
35				35	
	24				(Relatively loose) tan, dry, coarse to fine sandy, coarse to fine GRAVEL, with occasional (small) cobbles. (GW)
	37				NOTE: Relatively loose material also encountered at boring LDB-08 (25 ft south) from approximately 30 to 36 ft below ground surface.
	29				
	37			39	
40	83				Rust-brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GW)
	43				
	110				NOTE: Pockets of looser material between cobbles.
	41				
	90				
45	128			45	

(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-218 284
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-218

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	109				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay as coatings. (GW)
	84				
	109				
	110				49
50	40				Brown, damp, coarse to fine sandy, coarse to fine GRVEL, with slight clay coatings. (GP)
	35				
	32				NOTE: Same as above with little cobbles at approximately 53 ft.
	38				
	53				
55	62				55
	35				
	40				
	45				
	74				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional cobbles. (GW) to (GW-GC)
60	43				
	37				
	78				
	65				
	59				NOTE: Occasional clayey sand balls in returns at 63 ft.
					64.5
65	36				Brown, damp, medium to fine SAND, with traces of clay. (SP) to (SP-SC)
		24	S1	65	65.5
	25	68		66	
	123				Rust-brown, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, with traces of clay. (GP) to (GP-GC)
	176				
	66				
70	84				70

(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-218
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-218

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	39				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
	37				NOTE: Occasional balls of clayey sand in returns.
	39				
	43				74
75	158				Rust-brown and gray, damp to moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GW) to (GW-GC)
	75				
	72				77.3
	47				Rust colored, damp, CLAY. (CH)
	47				78.8
80	95				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GP) to (GP-GC)
	55				
	79				82
	59				Grayish-brown, damp to moist, coarse to medium sandy, coarse to fine GRAVEL, little cobbles (in layers), trace fine sand and clay. (GP-GC)
	41				NOTE: Returns are moldable due to clay content.
85	78				
	79				
	54				87
	112				Brown and gray, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, with traces of clay. (GP) to (GP-GC)
	131				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-218 286
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-219

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 74+20
ELEVATION: 1192.8
DATE START: 3/16/87
DATE FINISH: 3/16/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	S	
3/16/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	
--	--	--	--	--	HAMMER WT		140#	
--	--	--	--	--	HAMMER FALL		30"	

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	2				NOTE: Location = N 873,540.18, E 508,199.62
	7				
	10				Brown, damp, clayey SILT. (ML)
	13				-ALLUVIUM-
5	14				5
	22				Brown, dry, SILT, little to trace clay, with well developed $CaCO_3$ cementation. (ML)
	26				-CALICHE-
	36				8
	41				Tan, dry, coarse to fine sandy, coarse to fine GRAVEL, with $CaCO_3$ cementation. (GW)
10	30				-CALICHE-
	36				11
	54				Brown and gray, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight coatings of $CaCO_3$ cementation. -SGC- (GW)
	68				
	85				14
15	35				Brown, dry to damp, medium to fine SAND, with some $CaCO_3$ cementation. (SP)
	59				15.5
	59				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles. (GW)
	46				
	32				19.5
20	26				(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 287 B-219

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-219

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	17				Brown, damp, coarse to fine gravelly, medium to fine SAND. (SP)
	22				
	34				22.5
	40				
25	36				
	35				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with occasional (small) cobbles, occasional black (MnO_2) staining and very slight clay coatings on gravel. (GW)
	42				
	46				
	48				
30	36				30
	63				
	47				Brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand. (GP)
	63				
	51				34
35	29				(Relatively loose) brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles and slight clay coatings. (GW)
	46				
	34				37
	65				Brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with slight clay coatings. (GP)
	96				NOTE: Pockets of relatively loose material between cobbles.
40	80				
	108				
	72				
	131				44
					(See next page)
45	62				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-219
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-219

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	65				Rust-brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight traces of clay. (GW)
	91				
	47				
	59				49
50	34				(Relatively loose) brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight clay coatings. (GW)
	26				
	41				52
	200				NOTE: Possible boulder at 52 ft. Black, dry, coarse to fine gravelly, COBBLES, with black (MnO_2) staining. (GP)
	95				
					54.5
55	50				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace coarse sand, with traces of clay. (GP) to (GP-GC)
	55				
	52				
	53				
	41				
60	93				NOTE: Blow counts for 59 to 60 ft are misleading - circulation air not turned on.
	31				
	48				
	30				63
	22				
65	21				Dense, brown, damp, medium to fine SAND, trace clay. (SP-SC)
	20	15 / 28 / 22	S1	65 / 66.5	NOTE: Returns will mold into a ball when squeezed.
	16				
					67.5
	63				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight traces of clay. (GW)
	123				
70	146				70

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-219
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-219

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	30				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay.	(GW-GC)
	58				72.0	
	86					
	92				Brown, damp, medium to fine sandy, COBBLES, little to trace coarse to fine GRAVEL, with traces of clay.	(GP) to (GP-GC)
75	65					
	112				76.0	
					Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay, with occasional cobbles.	(GW-GC)
	50					
	68				78.5	
80	80					
	67				Rust-brown, damp, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	63					
	62					
	58					
85	50					
					85.5	
	53					
	38				Rust-brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay.	(GW-GC)
	37					
	72					
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-219
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-220

PROJECT: Price Road Drain Tunnel
CLIENT: Deleuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 65+08
ELEVATION: 1192.4
DATE START: 3/16/87
DATE FINISH: 3/17/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	--	--
3/17/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0	3				NOTES: 1. Location = N 872,630.79, E 508,221.67 2. Boring B-220 is approximately 50 ft north of LDB-09. Brown, damp, clayey SILT. (ML) 3.0 -TOPSOIL-
	9				
	17				
	22				Tan to white, dry, SILT, little clay, with well developed $CaCO_3$ cementation. (ML) -CALICHE-
5	22				
	23				
	19				
	29				
	36				
10	23				10
	64				Very hard, gray, dry, cemented SILT (and medium to fine sand?) - Rock-like Caliche. -CALICHE- 12.0
	51				
	40				Brown, dry, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with slight $CaCO_3$ coatings on gravel. (GW) -SGC-
	67				
15	170				
	66				
	66				
	85				
20	66				20

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 291 B-220

CRSS FORM # 101 11-15-85

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-220

PAGE 2 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	53				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional cobbles. (GW) to (GW-GC)
	47				NOTE: Frequent balls of clayey sand in cuttings returns.
	55				
	57				NOTE: At 24 ft clay occurred only as coatings not "traces."
25	43				
	47				
	51				
	52				
	42				29.5
30	36				
	18				
	30				Rust-brown, damp, coarse to fine gravelly, medium to fine SAND, with slight clay coatings. (SP)
	27				
	33				TO
35	31				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with slight clay coatings. (GP)
	33				
	44				
	34				
	21				39.5
40	43				
	43				Brown and gray, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, with slight clay coatings. (GP)
	45				43.5
	39				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)
	42				
45	35				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-220 292
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-220

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	39				(See previous page)	
					46.5	
	90				Brown and gray, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, with clay coatings on gravel and cobbles.	(GP)
	71					
	?					
					49.5	
50	33				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay.	(GW) to (GW-GC)
	35					
	30				52	
	66				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with clay coatings on coarser material.	(GP)
	89					
55	95					
	93					
					56.5	
	64				Rust-brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with traces of clay (sand is in coarser and finer pockets).	(GP) to (GP-GC)
	37					
	64					
					TO	
60	52				Brown, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional lenses (up to 8") of medium to fine SAND, trace clay.	(GP) to (GP-GC)
	63					
	25					
	58				63	
	230				Brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
65	108				NOTE: Frequent balls of clayey sand in returns.	
	110				66	
	30				Brown, moist, fine gravelly, coarse to fine SAND, trace clay. 67	(SW-SC)
	94				Brown and gray, damp, fine gravelly, COBBLES, little coarse gravel and coarse to fine sand, with slight traces of clay.	(GP)
	121					
70	95				TO	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-220
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-220

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	93				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay and occasional black (MnO_2) staining. (GW)
	87				
	89				
	80				74
75	67				
	72				Brown, damp to moist, cobbly, coarse to fine GRAVEL, some coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	75				
	72				78
	36				Brown to rust-brown, damp, CLAY, little to trace silt. (CL) 79
80	36				Rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
	41				NOTE: Returns are slightly moldable. 81.8
	41				Brown, moist, coarse to fine gravelly, medium to fine SAND, with traces of clay. (SP) to (SP-SC) 82.7
	85				
	78				
85	91				
	91				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	100				
	144				
	108				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-220 2 of 4
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-221

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 61+20
ELEVATION: 1191.7
DATE START: 3/17/87
DATE FINISH: 3/17/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	--	--
3/17/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					Dark brown, damp, silty CLAY, with organic material. (CL) -TOPSOIL-
	2				
	18				2.5
					NOTE: Location = N 872,241.32, E 508,122.46
	14				
5	20				
	34				Hard, tan, dry, clayey SILT, with moderately to strongly developed $CaCO_3$ cementation. (ML)
	23				-CALICHE-
	25				
	25				
10	34				10.3
	74		G1	10.5 12.0	Very hard, gray, dry, cemented SILT (and medium to fine sand?). NOTE: Returns were rock-like fragments.
	230				12.5 -CALICHE-
	73				NOTE: Same as from 2.5 to 10.3 ft. (ML) -CALICHE-
	52				14.0
15	44				Rust-brown, damp, CLAY, little silt (no $CaCO_3$ present). (CL) -ALLUVIUM-
					15.5
	60				Brown, damp, fine gravelly, coarse to fine SAND, trace clay (no $CaCO_3$ present). (SW-SC)
	77				
	60				18.0
	46				-SGC-
20	43				(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-221

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-221

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	38				Brown and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with clay coatings on gravel and cobbles. -SGC-
	35				
	47				
	38				
25	29				25
	25				Rust-brown, dry to damp, fine SAND, little silt. (SM)
	21				27
	42				Brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles, with clay coatings on gravel. (GP)
	61				
30	34				
	36				
	35				NOTE: Large cobble at approximately 32.5 ft.
	85				
	35				
35	50				
	54				36
	20				Rust-brown, dry to damp, medium to fine SAND, with traces of silt. (SP)
					37.5
	66				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand. (GP)
	69				
40	93				
					40.8
	86				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace coarse sand, with traces of clay. (GP) to (GP-GC)
	41				
	30				
	39				44
					NOTE: Same as from 37.5 to 40.8 ft, but with clay coatings. (GP)
45	67				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-221
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-221

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					(See previous page)
	28				46.0
	14				(Relatively loose) black (MnO_2) stained, dry, coarse sandy, fine GRAVEL, little coarse gravel, with slight traces of clay. (GP)
	58				47.5
	63				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay. (GW) to (GW-GC)
50	?				
	48				51
	30				Brown, damp, medium to fine sandy, coarse to fine GRAVEL. (GP)
	32				53
	53				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with clay coatings on gravel. (GW)
55	55				
	46				56
	29				Rust-brown, damp, coarse to fine gravelly, medium to fine SAND, with slight traces of clay. (SP)
	38				57.5
	81				Black, brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight clay coatings. (GP)
60	42				59.5
	39				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand and clay. (GP-GC)
	26				NOTE: Returns are slightly moldable.
	54				62.5
	51				Black and brown, damp, cobbly, coarse to fine GRAVEL, some to little coarse to fine sand (in pockets), with traces of clay. (GP) to (GP-GC)
65	39				
	46				NOTE: Black (MnO_2) stained gravel encountered from 65 to 68 ft.
	50				
	63				68
	107				
70	71				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-221
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-221

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	81				Brown and gray, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
	80					
	76					
	79					
75	45			74.8	Rust-brown, moist, CLAY, little silt. NOTE: W.C. approaching L.L.	(CL)
	22			76	Rust-brown, moist, coarse to fine GRAVEL, little coarse to fine sand, trace clay, with occasional cobbles.	(GP-GC)
	68					
	69			78	Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight traces of clay. NOTE: Sand occurs in pockets (gap graded).	(GP)
	93					
80	85					
	175					
	133			82.2	Black and brown, damp to moist, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, trace clay. NOTE: Much of the soil is stained black (MnO_2).	(GP-GC)
	73					
	82					
85	108					
	91			86.5	Brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, trace clay. NOTE: Frequent balls of clayey sand in returns.	(GW-GC)
	61					
	86					
	69					
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-221
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-222

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 56+52
ELEVATION: 1191.4
DATE START: 3/17/87
DATE FINISH: 2/24/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/17/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
0						
	0				NOTE: Location = N 871,772.34, E 508,203.71	
	9				Brown, damp, silty CLAY, containing organic material. -TOPSOIL-	(CL)
	15				3.0	
	22					
5	29					
	33				Tan to white, dry, clayey SILT, with moderate to strongly developed $CaCO_3$ cementation. -CALICHE-	(ML)
	45					
	32					
	62					
10	46				10.0	
	80			10.0		
	183		G1	—	Very hard, gray to white, dry, cemented SILT (rock-like). -CALICHE- NOTE: Cannot break fragments by hand.	(ML)
	198					
	106			13.7	13.7	
15	85				Rust-brown, dry, coarse to fine sandy, fine GRAVEL, with traces of clay and slight $CaCO_3$ cementation. -ALLUVIUM-	(GP) to (GP-GC)
	83				16.0	
	66					
	67				Brown and gray, dry, coarse to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with slight clay coatings and some $CaCO_3$ cementation. -SGC-	(GW)
	39					
20	55					

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 299 B-222

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-222

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	61				(See previous page)
	54				
	44				
	33				24
					Rust-brown, damp, fine SAND, little silt. (SM)
25	30				25.2
	37				
	47				
	58				
	68				Brown and gray, dry, medium to fine sandy, COBBLES (small), little coarse to fine gravel. (GP)
30	56				
	61				
	59				
	48				33
	41				Tan, dry, clean, medium to fine sandy, COBBLES. (GP)
35	40				
	49				36
	74				
	102				Brown and gray, dry, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight clay coatings on cobbles and gravel. (GW)
	80				
40	80				TO
	77				Coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with clay coatings. (GP)
	94				
	82				
	87				44.7
45	62				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-222
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

300

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-222

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	39					
	70				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight traces of clay and occasional cobbles.	(GP)
	41					
	63				NOTE: Sand is in coarser and finer layers and/or pockets.	
50	31					
	74					
	52				NOTE: Black (MnO_2) stained gravels at approximately 53 ft.	
	55					
	47					
55	60			55		
	89				Brown and gray, damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with slight clay coatings.	(GW)
	82			57		
	35			58	Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little coarse sand, with slight traces of clay.	(GP) to (GP-GC)
	96					
60	41					
	82				NOTE: Black (MnO_2) stained gravels at approximately 58.5 ft.	
	65				Brown and gray, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with slight clay coatings.	(GP)
	99					
	108					
65	103			65		
	55				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay.	(GW-GC)
	49			67		
	71			68	Black (MnO_2) stained, moist, coarse to fine GRAVEL, trace clay.	(GP-GC)
	91				Black and brown, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, trace clay, with frequent black (MnO_2) staining.	(GW-GC)
70	125					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-222 301
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-222

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					NOTE: Frequent clayey sand balls in cuttings returns.
	100				71
	121				
	99				Rust-brown, damp to moist, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand (in pockets) and clay. (GP-GC)
	110				
75	82				
	124				NOTE: Sand is gap-graded and occurs in medium to fine and coarse to medium layers and/or pockets.
	?				
	132				
	97				
80	89				80 (Gradational Change)
	85				Brown, damp to moist, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
	52				82.5
	?				NOTE: Possible boulder at 82.5 ft.
	168				
85	106				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	100				
	93				87
	64				Brown and black (MnO_2 stained), damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, trace clay. (GP-GC)
					88.5
	37		G2	88.5	Rust-brown, damp, silty CLAY. (CL)
				89.0	
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-222
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-223

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 50+80
ELEVATION: 1189.2
DATE START: 3/18/87
DATE FINISH: 3/18/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/18/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
0	0				Location = N 871,199.90, E 508,185.92	
	0				Dark brown, damp, silty CLAY, with organic material. -TOPSOIL-	(CL)
	0				3.0	
	9					
5	19					
	25				Tan, dry to damp, SILT, little clay, trace fine sand, with moderate to strongly developed $CaCO_3$ cementation. -CALICHE-	(ML)
	47					
	78					
	56				9.5	
10	28					
	27				Dark brown, damp, silty, fine SAND, trace medium sand and clay, with occasional to frequent $CaCO_3$ nodules and laminations (decrease with depth). -ALLUVIUM-	(SM)
	26					
	28				13	
	82					
15	90				Rust-brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay (as cementation). -ALLUVIUM-	(GW-GC)
	75					
	82				17	
	56				NOTE: At 17 ft clay content decreases to "traces of" (approximately 2 - 5%).	
	60				19	
20	93				-SGC-	

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE — NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR — NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 303 B-223

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-223

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	70				
	86				
	78				Rust-brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with traces of clay. (GW) -SGC-
	105				
					24.5
25	74				Brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GW)
	56				
	45				27.0
	20				Rust-brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GP)
					28.5
	31				Rust-brown, dry to damp, medium to fine SAND, with slight traces of clay. (SP)
30	25				
	26				31.0
					31.8 NOTE: Same as above, but with little coarse to fine gravel. (SP)
	32				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight clay coatings on gravel and cobbles. (GP)
	104				
	70				NOTES: 1. 8" lens of medium to fine SAND with slight traces of clay encountered from 33.3 to 34 ft.
35	158				2. Encountered large cobble or boulder at 34.5 ft.
	71				3. From 35 to 38 ft, encountered frequent thin (4 - 6") layers of black (MnO_2) stained, damp, coarse to fine GRAVEL, little cobbles and coarse sand, with traces of clay. (GP) to (GP-GC)
	63				
	87				
	93				39
40	53				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GW) to (GP-GC)
	49				
	41				42
	92				Brown and gray, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight traces of clay
	67				INTERLAYERED WITH
45	69				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-223
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-223

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	83					
					(See previous page)	
	65				47	
	28					
	83				Rust-brown, damp, coarse to fine GRAVEL, little cobbles (small) and medium to fine sand, with traces of clay.	(GP) to (GP-GC)
50	51					
	43					
	65				52	
	24				Rust-brown, damp, coarse to fine gravelly, medium to fine SAND, with traces of clay.	(SP)
	54				53.5	
55	79					
	40				Black and rust-brown, damp, coarse to fine GRAVEL, little cobbles (small, in layers/pockets) and coarse to fine sand, with traces of clay and frequent black (MnO_2) staining on gravel.	(GW) to (GW-GC)
	68					
	54					
	71					
60	65				60	
	95					
	58					
	94				Rust-brown and gray, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
	79					
65	100					
	108				NOTE: Cobbles are predominantly large.	
	49				67	
	38				Black and rust-brown, damp, coarse to fine GRAVEL, trace coarse to fine sand and clay, with occasional cobbles and black (MnO_2) staining.	(GP-GC)
	65				NOTE: Occasional balls of clayey sand in returns.	
					69.5	
70	119				(See next page)	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-223
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-223

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	68				
	70				Black and brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay and black (MnO_2) staining. (GP) to (GP-GC)
	92				
	82				NOTE: Frequent balls of clayey sand in returns.
75	90			75	
	57				Dark brown and black, moist, coarse sandy, coarse to fine GRAVEL, little medium to fine sand, trace (small) cobbles and clay, with blackc (MnO_2) staining. (GW-GC)
	62				
	53			78	
	73				NOTES: 1. Balls of clayey sand (up to 3") in returns. 2. Returns are easily moldable.
80	86				
	92				
	90				Brown, gray and black, damp to moist, coarse to fine gravelly, COBBLES, trace medium to fine sand, with traces of clay and frequent black (MnO_2) staining. (GP) to (GP-GC)
	104				
	157				
85	115				
	70				
	149				NOTES: 1. Frequent large cobbles. 2. Pocket of clean gravel from approximately 85 to 86 ft.
	76				
	116				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-223
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-224

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 46+60
ELEVATION: 1191.4
DATE START: 3/18/87
DATE FINISH: 3/18/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/18/87	WD	NE	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0	0				Location = N 870,783.05, E 508,090.68
	2				Dark brown, damp, silty CLAY, trace coarse to medium sand, with organic material. (CL) -TOPSOIL-
	5				
	10				
5	19				4.5
	47				Tan to brown, dry to damp, SILT, little to trace fine sand and clay, with moderately developed $CaCO_3$ cementation and frequent $CaCO_3$ nodules. (ML) -CALICHE-
	35				
	19				
	28				
10	45				NOTE: Varies to well developed $CaCO_3$ cementation (difficult to break chunks of this material by hand).
	30				
	32				
	31				
	35				14.2 Rust-brown, damp, SILT, little fine sand, trace clay (without $CaCO_3$). (ML) -ALLUVIUM-
15	28				15.7
	46				Brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC)
	36				
	70				NOTES: 1. Frequent small balls of clayey sand in returns and sand stuck to gravel with clay.
	78				2. Fine GRAVEL, little to trace coarse gravel, from 15.7 to 17 ft. (GP-GC)
20	76				20+ -SGC-

(see next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-224

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-224

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	55				
	52				
	55				NOTE: Gradational change downward into SGC, difficult to define top of SGC exactly.
	63				
25	60				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES (small, less than 6"), little coarse to fine sand, with slight traces of clay. (GW) -SGC-
	50				
	53				
	120				NOTE: Larger COBBLES at approximately 28 ft.
30	98				
	73				
	81				32.5
	41				Rust-brown, dry to damp, medium to fine sandy, coarse GRAVEL, little (small) cobbles, trace fine gravel, with slight clay coatngs. (GP)
	45				
35	42				35.5
	57				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with clay coatings on gravel, coarse sand and cobbles. (GW)
	59				
	76				38
	43				
40	48				Black, brown and gray, damp, coarse sandy, coarse to fine GRAVEL, little to trace medium to fine sand, with slight traces of clay, frequent black (MnO_2) staining and occasional small cobbles. (GP)
	50				
	48				
	47				
	44				44
45	35				

(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-224 308
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-224

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	43				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with strong traces of clay, slight traces of silt and occasional small cobbles.	(GP) to (GP-GC)
	59					
	42				NOTES: 1. Occasional balls of clayey sand in returns (up to 3").	
	33				2. Encountered approximately 6" seam/pocket of rust-colored damp, silty CLAY at 49.5 ft.	
50	28				3. Returns are slightly moldable.	
	34				51	
	47				Rust-brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with traces of clay.	(GW) to (GW-GC)
	39					
	64					
55	47				55	
	98					
	200+				NOTE: Drill bit plugged at approximately 56 ft.	
	69					
	65				Brown, damp, cobbly, coarse to fine GRAVEL, some to little coarse to fine sand, with slight traces of clay.	(GW)
60	62					
	48					
	64					
	60				63	
	42				Dark brown and black, damp, coarse to fine GRAVEL, little cobbles, trace coarse to fine sand and clay,	
65	62				64.7 with black (MnO_2) staining.	(GP-GC)
	97				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	74					
	88				NOTE: Occasonal balls of SAND, little clay in returns.	
	101					
70	81					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-224
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-224

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	95				(See previous page)
	61				71.5 Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GW-GC)
	56				
	53				NOTES: 1. Frequent balls of clayey sand in returns (up to 1.5").
75	67				2. Returns are slightly moldable.
	42				
	59				77.0
	95				Brown and gray, damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	80				
80	108				
	80				80.8 Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand and clay. (GP-GC)
	64				NOTE: Returns are moldable.
	55				83
	88				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand with traces of clay and occasional black (MnO_2) staining on gravel and cobbles. (GW) to (GW-GC)
85	95				
	90				
	70				
	64				87.6 Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with traces of clay. (GW) to (GW-GC)
	49				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-224
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-225

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 41+92
ELEVATION: 1190.8
DATE START: 3/23/87
DATE FINISH: 3/23/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/23/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0	0				Dark brown, damp, CLAY, little silt, with organic material. (CL) -TOPSOIL-
	0				
	1				2.5+
	0/3				NOTES: 1. Same as above but without organic material. (CL) 2. Location = N 870,320.38, E 508,095.80 -ALLUVIUM-
5	5				5
	13				Tan to brown, damp, silty CLAY, with moderately developed $CaCO_3$ cementation. (CL) -CALICHE-
	16				
	20				
	24				9
10	46				(Relatively hard) gray to brown, dry, fine sandy, SILT, little clay, with well developed $CaCO_3$ cementation. (ML) -CALICHE-
	42				
	33				
	33				
	32				14
15	26				Rust-brown, dry to damp, silty fine SAND, with traces of clay. (SM) -ALLUVIUM- NOTE: No $CaCO_3$ present.
	23				16.5
	74				Brown and gray, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, trace clay. (GW-GC) -ALLUVIUM-
	91				
	68				
20	66				20.0

(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-225

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-225

PAGE 2 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	94				
	90				
	91				Brown and gray, damp, coarse to fine gravelly, COBBLES, (small), little coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	112				-SGC-
25	97				
	81				NOTE: Occasional small balls (1/2") of clayey sand in returns. Lacks somewhat the coarse gravel fraction; cobbles are predominantly smaller than 8".
	71				
	78				28
	59				Brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little to trace coarse sand, with slight traces of clay and occasional cobbles. (GP)
30	62				30
	149				NOTE: Possible boulder at 30.5 ft. Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand. (GP)
	99				32
	48				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles (small, less than 6"), with slight traces of clay. (GW)
	40				34
35	90				
	81				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand. (GP)
	141				
	105				37.5
	55				Black and gray, dry, coarse sandy, coarse to fine GRAVEL, little to trace medium to fine sand (in layers), with frequent black (MnO_2) staining. (GP)
40	36				40.5
	32				
	25				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional small cobbles. (GP) to (GP-GC)
	30				
	31				NOTE: Clay is concentrated in layers.
45	24				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-225
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-225

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	43					
	52					
	41					
	67				Rust-brown and gray, damp, coarse to fine GRAVEL, little (small) cobbles and coarse to fine sand, with slight traces of clay.	(GP)
50	45					
	72					
	65				NOTE: Sand occurs in medium to fine and coarse to medium pockets/layers.	
	67					
	74					
55	74				55	
	44					
	42				Rust-brown, damp, coarse to fine GRAVEL, little medium to fine sand, trace (small) cobbles, with traces of clay.	(GP) to (GP-GC)
	65					
	71					
60	61					
	55				61	
	33				Black, damp, coarse to fine GRAVEL, trace medium to fine sand, with traces of clay and black (MnO_2) staining.	(GP) to (GP-GC)
	44					
	33				64	
65	52				Dark brown and black, moist, coarse sandy, coarse to fine GRAVEL, trace medium to fine sand and clay, with frequent black (MnO_2) staining.	(GP-GC)
	33					
	22				NOTES: 1. Returns are slightly moldable (hold in a ball when squeezed).	
	22				2. Frequent balls of clayey sand in returns (up to 2").	
	63					
70	33				70	

(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-225
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-225

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	18				(Relatively stiff) reddish-brown, damp, CLAY.	(CH)
					71	
	74				Brown and gray, damp, cobbly, coarse to fine GRAVEL, little to trace medium to fine sand, with traces of clay.	(GP) to (GP-GC)
	71					
					73.5	
	54					
75	53				Brown and black, damp to moist, coarse sandy, coarse to fine GRAVEL, little medium to fine sand, little to trace (small) cobbles, with traces of clay and frequent black (MnO_2) staining.	(GP) to (GP-GC)
	50					
	44					
	46				NOTES: 1. Occasional balls of clayey sand in returns. 2. Large cobble at approximately 79.5 ft.	
	42					
80	71					
					80.5	
	46				Black, damp, coarse sandy, coarse to fine GRAVEL, with traces of medium to fine sand and clay.	(GP-GC)
	36					
	41				NOTE: Material is stained black with MnO_2.	
	31					
					83.8	
	14 / 10	11			Medium dense, tan to brown, damp to moist, medium to fine SAND, trace fine gravel (in layers), with slight traces of clay.	(SP) to (SP-SC)
85		14	S1	84.5		
	30	11		86		
	26					
	27				NOTE: Returns are slightly moldable (due as much to moisture as to clay content).	
	32					
90					Bottom of Exploration at 89.0 ft.	
95						

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-225
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-226

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 37+30
ELEVATION: 1192.2
DATE START: 3/23/87
DATE FINISH: 3/27/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/27/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	4				
	14				NOTES: 1. Location = N 869,852.94, E 508,079.61
					2. No returns from 0 to 3 ft.
	13				
	13				
5	15				Brown to tan, dry, SILT, trace clay, with moderate to well developed $CaCO_3$ cementation. (ML)
	16				-CALICHE-
	27				
	36				NOTE: Some chunks of this material are difficult to break by hand.
	31				
10	27				
	35				10.5 Very hard, gray to tan, dry, strongly cemented, (rock-like) fine sandy SILT.
	55				-CALICHE-
					NOTE: Difficult to tell composition due to hardness;
	24				12.5 cannot break chunks of this material by hand.
	18				NOTE: Same as from 3 to 10.5 ft. but poorly to moderately developed laminar $CaCO_3$. (ML)
					14.5 -ALLUVIUM-
15	27				
	34				NOTE: Same as from 3 to 10.5 ft. (ML)
					-CALICHE-
	34				17 Rust-brown, damp, silty fine SAND, with traces of clay. (SM)
					NOTE: No $CaCO_3$ present.
	33				18
	27				Brown and gray, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay and occasional cobbles. (GW) to
20	24				-SGC- (GW-GC)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 3/5 B-226

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-226

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	37				GRADATIONAL TO
	53				
	62				
	67				Brown and gray, damp, cobbly, coarse to fine GRAVEL, little to trace medium to fine sand, with traces of coarse sand and clay. (GP) to (GP-GC)
25	75				
	60				
	62				NOTES: 1. Frequent small (1/4" to 1/2") balls of clayey sand in returns. 2. Clay content decreases downward.
	69				
	68				
30	58				
	66			31	
	110				Brown and gray, dry, coarse to fine gravelly, COBBLES, trace coarse to fine sand. (GW)
	100				
	75			34	
35	45				
	76				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, trace coarse to fine sand. (GP)
	51				INTERLAYERED WITH
	75				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with slight clay coatings. (GP)
	68				
40	66				
	63				NOTE: Interlayered material occurs in 6 - 12" layers or pockets.
	75				
	39				
	71				
45	58				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-226
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-226

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	65				46	
	19				Brown, damp, clean, fine SAND, little medium sand.	(SP)
	13					
		36	S1	48	48.2	
	22			48.5	Very dense, rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay.	(GP)
50	61				50 NOTE: Split spoon refusal on gravel at 48.5 ft.	
	50				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	78					
	115					
	107					
55	80				55	
	69				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	64					
	65				58.5	
	89				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay.	(GW) to (GW-GC)
60	112					
	101					
	100					
	81					
	82					
65	102				NOTE: When driller pulled back casing at 68 ft, he had to "bump" it with the hammer - could not pull with hydraulics alone. Once freed, the casing suddenly pulled quite easily - casing broke leaving 20 ft section in the ground.	
	98					
	69					
	189				68	
	34				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
70	37					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-226
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-226

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					70.3
	118				NOTE: Drilling resumed on 3/27/87 from 68 ft. Hole was redrilled 11 ft north due to broken casing.
	62				
	51				Brown, damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	56				NOTE: Frequent balls of clayey sand in returns (up to 2").
75	62				75
	110				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	154				
	99				78
	53				
80	60				Brown, damp, coarse to fine GRAVEL, little coarse to fine sand, trace (small) cobbles and clay. (GP-GC)
	60				
	57				NOTES: 1. Frequent balls of clayey sand in returns. 2. Returns are moldable.
	↑ 115 ↓				
85	48				85
	52				
	53				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, trace clay. (GW-GC)
	59				
	78				NOTE: Returns are moldable.
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-226
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-227

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 149+52
ELEVATION: 1186.4
DATE START: 4/3/87
DATE FINISH: 4/3/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/3/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	4				Dark brown, dry to damp, CLAY, trace silt, with $CaCO_3$ present. (CL)
	12				-TOPSOIL-
	12			3	
					NOTE: Location = N 881,075.62, E 508,294.69
	16				
5	19				Tan to brown, dry to damp, SILT, trace fine sand and clay, with moderately to well developed $CaCO_3$ cementation and laminations. (ML)
	22				-CALICHE-
	26				
	32				
	46			9	
					Tan , dry, medium to fine SAND, little fine gravel. (SP)
10	18			10	-ALLUVIUM-
	41				
	51				(Relatively loose) brown and gray, dry to damp, clean, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, with minor traces of $CaCO_3$. (GW)
	49				-SGC-
	35				
15	41				
	39				NOTE: $CaCO_3$ does not seem to be imparting any strength. No sand grains cemented onto gravel or cobbles. No $CaCO_3$ observed below 15 ft.
	37				
	54				
	57			19	
					NOTE: Boulder at 20 ft. (See next page)
20	109				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-227

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-227

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	200				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand. (GP)
	56				
	65				
	74				NOTES: 1. Frequent black (MnO_2) staining from 21 to 23 ft. 2. Slight clay coatings on gravel and cobbles begin to appear at 23 ft.
25	82				
	92				
	89				
	127				28 Rust-brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, with clay coatings present on gravel. (GP)
	48				29
30	77				Rust-brown and gray, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GW)
	88				
	88				
	72				33
	115				Brown and gray, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GP)
35	113				
	97				
	144				
	164				
	?				39.5
40	33				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, with strong traces of clay. (GP) to (GP-GC) NOTE: Returns are moldable.
	40				41.5
	71				Brown and gray, damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay. (GP)
	75				43
	46				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, with strong traces of clay. (GP) to (GP-GC)
45	43				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-227
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-227

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	30				(See previous page)	
					46.5	
	56				Brown and gray, damp to moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	82					
	63				49	
50	35				Rust-brown, moist, medium to fine SAND, little coarse to fine gravel, trace clay.	(SP-SC)
	39				51	
	105				Rust-brown and gray, damp to moist, medium to fine sandy, COBBLES, some coarse to fine gravel, with traces of clay.	(GP) to (GP-GC)
	58					
	73					
55	60				55	
	46				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with traces of clay.	(GP) to (GP-GC)
	41					
	55					
	34					
60	46				60	
	56				Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay.	(GW-GC)
	66					
	40					
	68					
65	79					
	53				66	
	31				Brown, moist, coarse to medium sandy, coarse to fine GRAVEL, trace clay.	(GP-GC)
	34				NOTE: Returns mold well.	
	44				69	
70	89				(See next page)	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-227
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-227

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	74				
	65				Brown to rust-brown, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	50				
	131				
75	108				
	80				NOTE: Bit plugged from 73 to 79 ft, blow counts misleading.
	77				
	71				
	124				
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-227 322
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-228

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 98+42
ELEVATION: 1196.8
DATE START: 3/12/87
DATE FINISH: 3/12/87
DRILLER: T. Leither
PREPARED BY: A. Howard

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl. wall	S	--
3/12/87	WD	NE	89'	89'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0	1				Dark brown, dry, fine sandy SILT, little clay, trace coarse to fine gravel and coarse to medium sand, with roots. (ML)
	9				
1.5					NOTE: Location = N 875,963.48, E 508,242.86
	5				
	9				Tan to light reddish-brown, dry to damp, moderately cemented, clayey SILT, little fine sand, trace coarse sand. (ML)
5	13				-CALICHE-
	14				
	12				NOTE: Caliche drilled easily; but silt returns were cemented nodules.
	17				
	19				
10	22				
	33				
	44				
12.5					
	40				Light brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and silt (hard to tell if silt is mixed in from above). (GP) to (GP-GM)
	109				
15	78				-SGC-
	101				
	318				NOTE: Pushed cobble or boulder at 16.5 ft (no returns, high blow counts).
17.5					
	94				
	42				Tan and gray, dry, clean, coarse to fine gravelly, coarse to fine SAND, little cobbles. (SW)
20	52				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 323 B-228

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-228

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					20.5
	72				Light brown and gray, dry, coarse to fine GRAVEL, little cobbles and coarse to fine sand (more medium to fine sand). (GP)
	82				
	86				
	75				
25	79				
	112				
	75				NOTE: Occasional pockets of damp, rust-brown, medium to fine SAND, trace clay in cuttings returns at approximately 27 ft.
	61				
	56				
30	53				Light brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand. (GP)
	58				
	55				
	55				33.0
	32				Rust-brown, damp, medium to fine SAND, trace coarse to fine gravel and coarse sand. (SP)
					34.5
35	69				
	98				
	197				Gray, dry, cobbly, coarse to fine GRAVEL TO coarse to fine gravelly, COBBLES, trace coarse to fine sand (returns were mostly rock chips). (GW)
	133				
	64				
40	101				40.0
	94				NOTE: Same as above, but some to little medium to fine sand, trace coarse sand. (GP)
	61				42.0
	47				Light rust-brown, dry to damp, medium to fine SAND, trace coarse sand. (SP)
					43.5
	58				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, some cobbles, trace coarse sand. (GP)
45	63				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-228
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-228

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	61				46.0
	33	41			Very dense, brown and gray, damp, coarse to fine gravelly, coarse to fine SAND, trace cobbles, with traces of clay. (SW)
		60/6"	S1	46.8	
	36			47.8	48.0
	205				
50	58				Brown and gray, dry to damp, coarse to fine GRAVEL, little cobbles and coarse to fine sand. (GW)
	42				
	36				
	37				53.0
	76				
55	76				
	55				
	62				Dark brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, some to little medium to fine sand, trace coarse sand, with slight traces of clay as coatings on gravel and cobbles. (GP)
	70				
	61				
60	62				
	55				61.5
	57				Light rust-brown and gray, damp, coarse to fine GRAVEL, little medium to fine sand, little to trace cobbles and coarse sand, with traces of clay as coatings and throughout sand matrix. (GP) to (GP-GC)
	39				
	67				
65	76				65.0
	126				Brown and gray, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles and coarse sand. (GP)
	79				
	69				
					68.5
	61				NOTE: Attempted SPT with casing at 69 ft. (SAND). Circulation cleaned hole to 69.5 ft ahead of casing.
70	23	13	S2	69.5	(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-228
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-228

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
		14		-	Medium dense to dense, tan, damp to moist, medium SAND,
	27	31	S2	71.0	71.0 trace coarse and fine sand, and clay (cream colored clay). (SP-SC)
	82				
	62				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay and thick clayey sand coatings on cobbles and gravel. (GW) to (GW-GC)
	71				
75	79				
	101				
	86				77.0
	138				NOTE: Same as above, but coarse to medium sandy and trace fine sand. (GP) to (GP-GC)
	74				
80	36				80.0
	72				
	81				Brown and gray, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, trace coarse sand, with traces of clay and thick clayey sand coatings on coarser fraction. (GP) to (GP-GC)
	107				
	88				
85	126				
	144				
	124				87.0
	128				Brown and gray, dry, medium to fine sandy, coarse to fine GRAVEL, some cobbles, with dry clay coatings on cobbles and gravel.
	176				
90					Bottom of Exploration at 89.0 ft.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-228
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-229

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 83+59
ELEVATION: 1195.7
DATE START: 4/3/87
DATE FINISH: 4/3/87
DRILLER: T. Leither
PREPARED BY: D. Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/3/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
0						
	2					
	6				Dark-brown, dry to damp, CLAY, little silt with slight traces of $CaCO_3$ frequently as small (1/16") nodules.	(CL)
	0				3 -ALLUVIUM-	
	10				NOTE: Location = N 874,488.3, E 508,256.0	
5					Tan, dry to damp, clayey SILT, with poorly developed $CaCO_3$ cementatiton and thin $CaCO_3$ laminations (1/16"). -CALICHE (weak)-	(ML)
	9					
	9					
	9				8.5	
	21					
10	43				Tan and gray, dry, coarse to fine sandy, coarse to fine GRAVEL, with moderately developed $CaCO_3$ cementation. -CALICHE-	(GW)
	29					
	38				12.2	
	81					
	39				(Relatively loose) brown and gray, dry, cobbly, coarse to fine GRAVEL, some to little coarse to fine sand, with slight $CaCO_3$ coatings on gravel and cobbles. -SGC-	(GW)
15	58					
	51				16.5	
	39					
	29				(Relatively loose) brown, damp, medium to fine sandy, COBBLES, little to trace coarse gravel.	(GP)
	19					
20	25					

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE — NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR — NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-229

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-229

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					20.5 (See previous page)
	96				
	40				Gray, brown and black, dry, cobbly, coarse to fine GRAVEL, trace coarse to fine sand, with black (MnO_2) staining. (GP)
	50				
25	38				INTERLAYERED WITH
	33				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace (small) cobbles and coarse sand, with slight traces of clay. (GP)
	45				
	53				
	47				29
30	32				(Relatively loose) rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GP) to (GP-GC)
	22				
	17				
	23				33
	53				(Relatively loose) brown, gray and black, dry to damp, coarse to fine gravelly, COBBLES, trace to "with traces of" coarse to fine sand and with frequent black (MnO_2) staining. (GP)
35	58				
	51				
	38				37
	33				Gray and black, dry to damp, coarse sandy, fine GRAVEL, little coarse gravel, trace medium to fine sand, with black (MnO_2) staining. (GP)
	29				39
40	59				Gray, brown and black, dry to damp, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, with frequent black (MnO_2) staining and occasional slight clay coatings. (GP)
	54				
	59				
	37				NOTE: Sand is concentrated in pockets or layers.
	62				44
45	95				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-229
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-229

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	72				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES (few large), little coarse to fine sand, with slight clay coatings on gravel and cobbles. (GW)
	67				
	64			47.7	
	46				Rust-brown, damp, coarse to fine GRAVEL, little medium to fine sand, trace cobbles and coarse sand, with slight traces of clay. (GP) to (GP-GC)
50	57				
	93				NOTE: Large cobble or small boulder at 50 ft.
	57			52	
	71				Brown and gray, damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with clay coatings. (GP)
	80			53.5	
55	56				
	61				Rust-brown, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	40				
	56				
	65				
60	82				
	60				
	45				NOTE: Clay content increased at approximately 60 ft (but not to "trace" clay). Occasional balls of clayey sand in returns up to 3/4").
	58				
	100				
65	84				
	73			66	
	54				Dark brown to black, moist, cobbly, coarse to fine GRAVEL, little coarse sand, with traces of medium to fine sand and clay, and with black (MnO_2) staining. (GP) to (GP-GC)
	57			68.5	
	54				
70	67				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-229
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-229

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	78				
	72				Rust-brown, moist, medium to fine sandy, COBBLES, some coarse to fine gravel, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	75				
	70				74.5
75	59				
	43				Brown and rust-brown, moist, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)
	72				
	56				
	97				
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-229
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-230

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 52+98
ELEVATION: 1190.1
DATE START: 3/17/87
DATE FINISH: 4/4/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/17/87	WD	NE	58'	58'	SIZE ID	4-1/4"	--	--
4/4/87	WD	NE	79'	79'	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	5				-TOPSOIL-
					1.5
	27				NOTE: Location = N 871,413.13, E 508,302.02
	22				
	26				Tan, dry, SILT, little to trace clay, with moderate to well developed $CaCO_3$ cementation. (ML)
5	31				-CALICHE-
	25				
	38				7.0
	55				
	45				Tan, dry, cemented SILT (rock like). (ML)
10	40				-CALICHE-
	38				
	68				12.5
	91				Brown, dry to damp, medium to fine sandy, SILT, little clay, with small (1/8") $CaCO_3$ nodules. (ML)
	83				14.0 -ALLUVIUM-
15	125				
	144				Brown, dry to damp, fine gravelly, coarse to fine SAND, little to trace clay. (SW-SC)
	79				
	68				NOTES: 1. Driller pulled casing back at 16 ft, could not pull with hydraulics alone, had to "bump" casing back with hammer to loosen.
	59				2. Coarse to fine gravelly at approximately 17 ft.
20	43				3. Frequent balls of clayey SAND in returns.

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-230

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-230

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	56				21± NOTE: Gradational change to SGC at approximately 21 ft.
	67				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay. (GW) to (GW-GC)
	74				
	80				-SGC-
25	86				
	148				
	35				26.5 Rust-brown, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of silt (?) (GW)
	22				28
	78				Gray and brown, dry to damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight clay coatings. (GP)
30	85				
	60				
	100				
	98				33
	61				Brown and gray, dry to damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with frequent clay coatings on gravel and cobbles. (GW)
35	56				
	69				
	49				
	63				NOTE: Sandier pocket at approximately 41.5 ft.
	61				
40	40				
	40				
	28				
	47				43 Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little medium to fine sand, with slight traces of clay. (GP)
	87				
45	?				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-230
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-230

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	84				
	108				
	100				(See previous page)
	114				
50	107				
	96				51
	60				
	55				Rust-brown, damp, medium to fine sandy, coarse GRAVEL, trace fine gravel and cobbles, with slight traces of silt and clay. (GP)
	55				
55	34				
	39				56
	66				Rust-brown and gray, damp, coarse to fine GRAVEL, little cobbles and medium to fine sand, with slight traces of clay. (GP)
	70				NOTE: Bit plugged at 58 - 60 ft.
	103				NOTE: Air returning up borehole annulus starting at 49 ft, blow counts from 49 - 58 ft may be slightly affected by slightly diminished cuttings returns. Casing pulled at 58 ft. Casing broken off 30 ft down hole allowing air to escape. Boring was re-drilled 5 ft east where logging was resumed at 58 ft.
60	179				
	95				
	115				62
	57				
	67				
65	68				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	45				
	53				NOTE: Returns are slightly moldable and contain occasional balls of clayey SAND up to 3/4".
	58				
	74				68.5
70	110				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-230
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-230

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	84				Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	60			71.8	
					Rust-brown, damp to moist CLAY. (CH)
	26			73.6	Rust-brown, moist, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GP-GC)
75	49			75	Brown, moist, medium to fine SAND, trace clay. (SP-SC)
	27			76.2	
	110				Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	94				
	77				
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-230
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-231

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 28+80
ELEVATION: 1192.1
DATE START: 3/30/87
DATE FINISH: 3/30/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/30/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	3				Dark brown, dry to damp, CLAY, little silt, with CaC_{03} laminations and organic material. (CL)
	?			2±	-TOPSOIL-
	8				NOTE: Same as above, without organics. -ALLUVIUM-
	8				
	9			5	NOTE: Locataion = N 869,016.08, E 508,333.70
5					
	15				Tan to brown, dry, SILT, little to trace fine sand and clay, with poorly to moderately developed $CaCO_3$ laminations and cementation. (ML) -ALLUVIUM/CALICHE-
	24				
	27				
	24				
	38			10	
10					
	74				Extremely hard, tan to gray, dry, strongly cemented, (rock-like) SILT, little fine sand. (ML) -CALICHE-
	60				NOTE: Pieces of this material cannot be broken by hand.
	52			12.8	
	35				Tan to brown, dry, SILT, trace fine sand and clay, with moderate to well developed $CaCO_3$ cementation. (ML) -CALICHE-
	51				
15					
	73				
	58			17	
	48				Rust-brown to brown, dry to damp, silty fine SAND. (SM) -ALLUVIUM- NOTE: No $CaCO_3$ present.
	45			19	
	126				(See next page)
20					

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 335 B-231

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-231

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	108					
	75				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with strong traces of clay. -SGC-	(GW) to (GW-GC)
	99					
	102					
25	53					
	40				NOTE: Frequent balls (up to 2") of clayey SAND in returns.	
	75					
	93				28	
	90				NOTE: Clay content decreases to slight clay coatings (not "with traces of") at 28 ft.	(GW)
30	98					
	92				31	
	58					
	59				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand.	(GW)
	62					
35	50					
	73					
	61				NOTE: Running off compressor on drill rig only from 0 to 39 ft - blow counts may be slightly high.	
	56					
	49					
40	54				40	
	34				Rust-brown to brown, damp, medium to fine sandy, coarse to fine GRAVEL.	(GP)
	30				42	
	91					
	136				(See next page)	
45	168					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-231
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-231

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	120				NOTE: No returns from 43 to 48 ft - return hose clogged.
	102				
	124				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GW)
	61				
50	87				
	84			51	
	55				Rust-brown to brown, dry to damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles (small, less than 6"), trace coarse sand, with slight traces of clay. (GP)
	63				
	45				
55	150				NOTE: Large cobble or boulder at approximately 54.7 ft.
	70			56	
	43				Brown, gray and black, dry to damp, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, with clay coatings and black (MnO_2) staining on gravel and cobbles. (GW)
	37				
	40			59	
60	161				
	109				
	80				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay and occasional black (MnO_2) staining. (GW)
	97				
	158				NOTE: Large cobble or boulder at approximately 63.5 ft.
65	100				
	112			66	
	54				Rust-brown to brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little to trace (small) cobbles, with traces of clay. (GW) to (GW-GC)
	59				
	64				NOTE: Encountered a 6" thick lens/layer of medium to fine SAND, trace clay at approximately 69.5 ft.
70	30				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-231
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-231

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	41				
	58				NOTE: Returns are slightly moldable at 70 ft.
	51				
	57				
75	53				75
	49				
	68				NOTE: Same as above, but at 75 to 79 ft frequent balls (up to 2") of clayey SAND in returns. (GW-GC)
	72				
	53				
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-231
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-232

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 190+78
ELEVATION: 1181.7
DATE START: 4/2/87
DATE FINISH: 4/2/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/2/87	WD	50'	83'	83'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				
	15				
	2				NOTES: 1. Location = N 885,193.67, E 507,942.53
	0				2. Boring B-232 is approximately 20 ft south of LDB-11.
5	0				3. Pushed casing from 0 to 1 ft and 3 to 8 ft (no hammer blows).
	0				
	0				Light brown, dry to damp, fine SAND, little to trace silt, with weak, laminar, $CaCO_3$ (not acting as cement). (SM) to (SP-SM)
	0				-ALLUVIUM-
	11				
10	8				
	11				
	9			12	
	23				
	24				
15	29				(Relatively loose) brown and gray, dry to damp, coarse to fine gravelly, (small) COBBLES, some coarse to fine sand, with occasional slight clay coatings on gravel and cobbles.
	46				-SGC-
	48				
	25				
	33				
20	37				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 339 B-232

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-232

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	35				
	41				
	43				Brown, damp, coarse to fine gravelly, (small) COBBLES, some to little coarse to fine sand, trace clay. (GP-GC)
	36				
25	36				NOTE: Returns were moldable and contained frequent balls of clayey sand.
	43				
	54				
	48				28
	33				Black and brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with slight traces of clay, occasional cobbles and black (MnO_2) staining. (GW)
30	35				
	40				31
	23				(Relatively loose) light brown, damp, coarse to fine gravelly, medium to fine SAND. (SP)
	16				
	16				
35	16				35
	46				Brown, damp, coarse to fine sandy, (small) COBBLES, little coarse to fine gravel, with slight clay coatings. (GP)
	33				
	49				38
	26				Brown, damp, coarse sandy, coarse to fine GRAVEL, little to trace medium to fine sand, with slight traces of clay. (GP)
					39.5
40	40				
	82				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) (GW-GC)
	60				
	75				NOTE: Possible boulder at 44 ft.
	70				
45	124				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-232
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-232

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	72				(See previous page)
	85				
	61				47.5 Dark brown and black, damp, coarse to fine gravelly, COBBLES, trace medium to fine sand, with traces of clay and black (MnO_2) staining. (GP)
	39				
50	52				50
	55				Dark brown, moist to wet, cobbly, coarse to fine GRAVEL, little coarse to fine sand, trace clay. (GW-GC)
	51				
	55				
	40				NOTES: 1. Returns are very moldable. 2. Visible water on a few gravels at 50 ft. 3. 6" - 8" lens (?) of medium to fine SAND, trace clay at approximately 54 ft. 4. Frequent balls of clayey sand, (up to 1.5") in returns.
55	24				
	55				
	65				
	48				
	62				59
60	71				Brown, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	113				
	80				62
	68				(Relatively dense) brown, moist, coarse to fine sandy, coarse to fine GRAVEL, trace cobbles, with traces of clay. (GW) to (GW-GC)
	78				
65	78				
	61				NOTE: Returns are slightly moldable.
	70				67
	48				(See next page)
	57				
70	75				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-232
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-232

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	80				
	83				
	44				Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	79				
75	80				NOTE: Encountered a 8" lens (?) of coarse to fine sandy, fine GRAVEL, with traces of clay at 73 ft.
	64				
	61				
	41				77.5
	44				Brown, damp to moist, medium to fine sandy, COBBLES, little coarse to fine gravel, trace coarse sand, with traces of clay. (GP) to (GP-GC)
80	80				
	118				
	97				
	113				Bottom of Exploration at 83.0 ft.
85					
					NOTE: Encountered wet soil at approximately 50 ft. No other signs of groundwater were encountered to the bottom of the borehole.
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-332 343
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS SIRRINE

TEST BORING REPORT

BORING NO. B-233

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 186+90
ELEVATION: 1181.3
DATE START: 4/1/87
DATE FINISH: 4/1/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/1/87	WD	76'	89'	89'	SIZE ID	4-1/4"	--	--
See notes pg. 4		of 4	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	1				
	2				NOTE: Location = N 884,805.36, E 508,017.78
	0				
	0				Brown, dry, silty, fine SAND, with traces of minor $CaCO_3$ laminations. (SM)
					-ALLUVIUM-
5	5				
	10				
	10				
	10				8
	9				Rust-brown, damp, silty, fine SAND, with slight traces of clay and slight $CaCO_3$ laminations. (SM)
10	6				
					-ALLUVIUM-
	7				
	8				12.5
	11				
	26				
15	38				(Relatively loose) rust-brown and gray, dry to damp, coarse to fine sandy, COBBLES (small), little coarse to fine gravel. (GP)
	32				
	62				-SGC-
	25				
20	34				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 3/3 B-233

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-233

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					~~(See previous page)~~
	30				21.0
	17				(Relatively loose) brown, damp, fine gravelly, medium to fine SAND. (SP)
	15				
	16				24.5
25	14				
	11				(Relatively loose), brown, damp, coarse to fine sandy, coarse to fine GRAVEL. (GW)
	18				
	31				NOTE: With little to trace cobbles below 27 ft.
	30				
30	33				
	31				31
	16				(Relatively loose) tan, dry to damp, clean, coarse to fine SAND. (SP)
	15				
	14				34
35	32				Brown, damp, medium to fine sandy, coarse to fine GRAVEL, little cobbles, trace coarse sand, with slight clay coatings on gravel and cobbles. (GP)
	28				36.5
	51				Brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with slight traces of clay. (GP)
	61				
	69				NOTE: Occasional balls of clayey SAND (up to 1").
40	71				
	65				41
	49				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, with traces of clay. (GW) to (GW-GC)
	31				NOTE: Returns are moldable.
	47				43.5
45	52				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-233
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-233

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	53				Brown and black, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay and frequent black (MnO_2) staining.	(GW) to (GW-GC)
	54					
	57				NOTES: 1. Cobbles are under 6" in diameter. 2. Returns are slightly moldable.	
	52					
50	53				50	
	31				Brown, damp, coarse to fine gravelly, medium to fine SAND, with strong traces of clay.	(SP-SC)
	36				NOTE: Returns are very moldable.	
	38				52.5	
	64				Brown, damp to moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
55	75					
	68				NOTE: Balls of clayey sand in returns.	
	100				57.5	
	88					
	67				Brown, moist, coarse to fine GRAVEL, little cobbles and coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
60	58					
	55					
	63				62	
	91				Brown, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	75					
65	68				65.5	
	27				66.2 Rust-brown, moist, coarse to fine GRAVEL, little clay.	(GC)
	16				67.0 Rust-brown, damp to moist, CLAY.	(CH)
	54				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay.	(GP) to (GP-GC)
	43					
70	47				70	
					(See next page)	

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-233
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-233

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	78				Brown, moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, with traces of clay. (GP) to (GP-GC)
	67			72	Black, moist to wet, coarse to fine GRAVEL, trace cobbles and medium to fine sand, with traces of clay. (GP) to (GP-GC)
	43			73.5	Brown, moist to wet, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with slight traces of clay. (GP) to (GP-GC)
	62				
75	79				
	62				
	47				
	73				
	42				NOTES: 1. Material is wet below 76 ft. Strong source of water. 2. Sand concentrated in pockets. 3. Probable boulders at 80, 83 and 84 ft. 4. Groundwater encountered from 76 to 80 ft. Material below 80 appeared to be only moist. Possible perched water or channel for water flow was encountered.
80	88				
	134				
	93				
	75				
	153				
85	146				
	63				
	75				
	89				
	103				
90					Bottom of Exploration at 89.0 ft.
					NOTE: When casing was pulled back to 79 ft, tried to sound casing for water depth with tape -- stopped 1 ft short of tip of drill bit (plugged?). Tape came out dry.
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-233
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

346

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-234

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 182+55
ELEVATION: 1181.7
DATE START: 4/2/87
DATE FINISH: 4/2/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
2/24/87	WD	78'	83'	83'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	0				NOTES: 1. Location = N 884,370.78, E 508,006.93 2. Boring B-234 is located approximately 25 ft north of LDB-12.
	0				Tan, dry, fine SAND, trace silt, with minor $CaCO_3$ laminations. (SP-SM)
	0				3.5 -ALLULVIUM-
	1				(Relatively loose) tan and gray, dry, coarse to fine gravelly, medium to fine SAND, trace coarse sand, with frequent slight $CaCO_3$ coatings on gravel. (SP)
5	8				-ALLUVIUM-
	12				
	12				7
	9				(Relatively loose) light brown, dry to damp, medium to fine SAND, trace coarse sand. (SP)
	9				-ALLUVIUM-
					9
10	11				(Relatively loose) light brown, damp, coarse to fine SAND, little coarse to fine gravel. (SW)
	12				
	8				-ALLUVIUM-
					12
	16				INTERLAYERED
	20				(Relatively loose) light brown, damp, medium to fine SAND. (SP)
15	13				WITH
	15				(Relatively loose) light brown, dry to damp, coarse to fine gravelly, coarse to fine SAND. (SW)
	11				-ALLUVIUM-
	16				
	23				19
20	41				(See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

BORING NO. 347 B-234

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-234

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	54				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand. (GW)
					21.5 -SGC-
	36				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with traces of clay. (GP) to (GP-GC)
	24				23
	73				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with frequent clay coatings on gravel and cobbles. (GW)
25	56				
	40				
	71				
	47				
	79				
30	73				
	65				
	57				NOTE: Pockets of relatively loose material between cobbles.
	40				
	61				
35	66				
	53				
	68				37
	60				Brown, damp to moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	60				
40	56				40.5
	74				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay. (GP)
	95				
	130				
	109				
45	98				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-234
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	348

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-234

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
	99					
	85					
	69				NOTE: Black (MnO_2) staining on gravel and cobbles from 47 to 50 ft. Richer in clay content also.	
	60					
50	62					
	80				Brown, damp to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay.	(GP) to (GP-GC)
	87					
	112					
	102					
55	104			55		
	57				Brown, moist, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with strong traces of clay.	(GW) to (GW-GC)
	62					
	62				NOTE: Frequent small balls of clayey sand in returns.	
	62					
60	71					
	68			61		
	93				Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, some coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	108					
	88				TO	
65	74				Brown, moist, (small) cobbly, coarse to fine GRAVEL, some coarse to fine sand, with traces of clay.	(GW) to (GW-GC)
	58					
	77				NOTE: Approximately 6" lens(?) of medium to fine SAND, trace clay at 65.5 ft.	
	86					
	66			69.5		
70	85				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, with traces of clay.	(GP) to (GP-GC)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-234
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-234

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
					71 (See previous page)
	93				
	106				Brown and gray, moist, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	94				
75	77				
	88				
	109				
	135				
	95				
80	109				NOTE: Encountered groundwater at approximately 78 ft.
	94				
	139				NOTE: Probable boulder at 81 ft.
	174				
					Bottom of Exploration at 83.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-234
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

350

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-235

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 179+35
ELEVATION: 1181.3
DATE START: 4/1/87
DATE FINISH: 4/1/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/1/87	WD	76'	89'	89'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	5				NOTE: Location = N 884,047.77, E 507,953.09
	10				
	11				Brown, damp to moist, coarse to fine SAND, little coarse to fine gravel, trace clay. (SW-SC) -FILL-
	11				4
5	9				
	10				
	10				
	11				Rust-brown, dry to damp, silty fine SAND, with minor traces of $CaCO_3$ (not as cementation). (SM) -ALLUVIUM-
	11				
10	12				
	12				
	12				12.5
	13				
	17				
15	22				(Relatively loose) tan to light brown and gray, dry, clean, coarse to fine sandy, coarse to fine GRAVEL, with occasional cobbles. (GW) -SGC-
	31				
	26				
	19				
	47				
20	50				20 (See next page)

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE — NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR — NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 351 B-235

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-235

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	17				
	16				
	41				(Relatively loose) tan, dry, clean, medium to fine sandy, coarse to fine GRAVEL, with occasional cobbles. (GP)
	17				
25	21				
	40				
	33				27 Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight clay coatings on gravel. (GW)
	41				
	50				29
30	81				Brown and gray, dry, COBBLES, little coarse to fine gravel, little to trace coarse to fine sand, with occasional boulders. (GP)
	231				
	118				NOTE: Encountered boulder at 30.3 ft.
					32.5
	76				
	74				Brown, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with traces of clay. (GW)
35	69				
					TO
	78				
	81				Brown and gray, damp, coarse to fine gravelly COBBLES, little to trace coarse to fine sand, with traces of clay. (GP)
	101				
	67				NOTE: Sand concentrated in pockets.
40	72				
	51				NOTE: Borehole was logged from 0 to 39 ft approximately 30 ft south and 15 ft west of surveyed location. Logged from 39 to 89 ft at surveyed location. Repeated attempts (3) were made to advance this hole but had to be abandoned due to unacceptable casing deflection. All borings were in the same general vicinity as the 4th (surveyed) boring.
	80				
	77				
	75				
45	88				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-235

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	111				NOTE: Occasional balls of clayey sand (up to 1" dia.).
	69				
	68				
	81				
50	106				50.5
	62				Rust-brown to brown, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace (small) cobbles with traces of clay and occasional lens(?) (up to 6") of medium to fine SAND, with traces of clay. (GP) to (GP-GC)
	35				
	46				
	48				
55	35				
	41				56.0
	54				Dark brown and black, moist to damp, coarse to fine GRAVEL, little cobbles and coarse sand, trace medium to fine sand, with traces of clay and black (MnO_2) staining. (GW) to (GW-GC)
	50				
	56				
60	44				60
	68				Brown and gray, moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	93				
	78				
	106				
65	85				
	83				
	76				NOTE: Frequent small (3/4" - 1" max) balls of clayey SAND in returns.
	103				
	68				
70	78				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-235
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-235

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	97				
	95				Brown and gray, moist, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	115				
	152				
75	124				
	78				76
	39				Brown to dark brown and black, wet to moist, coarse to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with strong traces of clay and occasional black (MnO_2) staining. (GW) to (GW-GC)
	39				
	49				NOTE: Encountered groundwater at approximately 76 ft.
80	?				79.5
	82				
	60				Brown, wet, coarse to fine gravelly, COBBLES, little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	113				
	104				
85	89				
	137				NOTE: Frequent to occasional balls of clayey sand (up to 1" dia.) in returns.
	?				
	100				
	124				
90					Bottom of Exploration at 89.0 ft.
					NOTE: Encountered groundwater above 79 ft. Possibly at 76 ft (could not determine exactly).
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-235 354
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-236

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 32+38
ELEVATION: 1186.9
DATE START: 3/27/87
DATE FINISH: 3/27/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	S	--
3/27/87	WD	NE	79'	79'	SIZE ID	4-1/4"	1-3/8"	--
--	--	--	--	--	HAMMER WT	--	140#	--
--	--	--	--	--	HAMMER FALL	--	30"	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	2				NOTES: 1. Collar of this boring is approximately 5 ft below original ground surface. 2. Location = N 869,347.25, E 508,033.02
	9				
	17				Dark brown, damp, CLAY, little silt, with $CaCO_3$ present. (CL) -ALLUVIUM-
	20				
					4.5
5	26				
	63				
	54				
	46				Tan, dry, fine sandy SILT, trace medium sand, with traces of clay and moderate to well developed $CaCO_3$ cementation. (ML) -CALICHE-
	29				
10	44				
	34				
	27				NOTES: 1. Chunks in returns were moderately to extremely difficult to break by hand. 2. Extremely hard, rock-like, cemented material from 12.5 to 15.0 ft.
	50				
	125				
15	94				15
	62				Rust-brown, damp, fine sandy SILT. (ML) 16 NOTE: No $CaCO_3$ present.
	58				
	52				Brown and gray, damp, coarse to fine sandy, coarse to fine GRAVEL, trace (small) cobbles, with trace of clay. (GW) to (GW-GC) -SGC-
	40				
20	63				NOTE: Frequent small balls (1/2") of clayey SAND in returns.

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 355 B-236

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-236

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	54				
	48				
	45				NOTE: Clay occurs as slight coatings on gravel and cobbles, below "traces of" in quantity.
	93				
25					
	49				
	30				
	53				
	48				NOTE: Encountered pockets of material (up to 6" thick) that were richer in fine gravel between 23 and 27 ft. Hammer penetrated easily.
30	33				
	24				
	51				
	73				
	36				NOTES: 1. Relatively loose material from 29 to 38 ft. 2. Large cobble at 32.5 ft. 3. Material is the same as noted above (from 16 ft) except as noted.
35	32				
	36				
	32				
	30				38
	26				
40	26				
	35				(Relatively loose) rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles, with slight traces of clay. (GP)
	40				
	38				
	43				
45	32				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-236
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-236

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS	
					45.5	
	35				Rust-brown, damp, coarse to fine gravelly, medium to fine SAND, with strong traces of clay. NOTE: Returns are moldable.	(SP) to (SP-SC)
	20				47.3	
	40				Rust-brown, medium to fine sandy, COBBLES, little coarse to fine gravel, with slight traces of clay.	(GP)
	76					
50	69				50.5	
	27				Brown to tan, moist to damp, clean, medium to fine SAND.	(SP)
	11				52	
		18		52	Dense to very dense, rust-brown, damp, medium to fine SAND, little coarse to fine gravel, with traces of clay. NOTE: Returns are moldable.	(SP) to (SP-SC)
	12	26	S1	53.5		
		20/4"			53.4	
	36				Rust-brown, damp, medium to fine sandy, COBBLES, little coarse to fine gravel, with traces of clay.	(GP) to (GP-GC)
55	88					
	39				56	
	27				Brown and black, damp, coarse to fine GRAVEL, trace medium to fine sand, with strong traces of clay and frequent black (MnO_2) staining.	(GP) to (GP-GC)
	24					
	42					
60	38				NOTE: With "little" cobbles below 58 ft.	
	43					
	42				62	
	28				Rust-brown, damp to moist, coarse to fine GRAVEL, little (small) cobbles and medium to fine sand, trace clay.	(GP-GC)
	50					
65	43					
	33					
	37				NOTES: 1. Returns are very moldable. 2. Frequent balls of clayey SAND (up to 1.5") in returns. 3. Material probably consists of layers or pockets of cobbly GRAVEL and sandy GRAVEL.	
	46					
	50					
70	45					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-236
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-236

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	34				(See previous page)
	30				
	35				73
	50				
75	69				
	65				Black, rust-brown and brown, damp, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, with traces of clay and frequent black (MnO_2) staining on gravel and cobbles. (GP) to (GP-GC)
	59				
	85				
	102				
80					Bottom of Exploration at 79.0 ft.
					NOTE: Much of the ground at this boring was relatively loose.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-236
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-237

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 27+72
ELEVATION: 1190.9
DATE START: 3/30/87
DATE FINISH: 3/30/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/30/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	5*				NOTES: 1. No returns from 0 to 3 ft.
	9*				2. * Indicates weak hammer blows.
	6*				3. Boring B-237 located 25 ft north of boring LDB-10.
	11*				4. Location = N 868,867.95, E 508,008.35
5	15*				
	20*				Tan and brown, dry, SILT, little clay, trace fine sand, with poorly to moderately developed laminar $CaCO_3$ cementation. (ML)
	26				-CALICHE-
	25				
	29				9
10	65				
	39				
	46				Hard, tan to gray, dry, SILT, little fine sand, trace clay, with moderately to well developed $CaCO_3$ cementation. (ML)
	59				-CALICHE-
	58				
15	59				NOTE: Most of this material cannot be broken by hand, some breaks with difficulty.
	57				
	79				17
	55				NOTE: Same as from 3 to 9 ft.
	32				
20	32				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD — WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE — NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR — NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. B-237

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-237

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	57				(See previous page)
					22
	27				
	27				Rust-brown, damp, fine SAND, little silt, trace clay, with slight to no traces of $CaCO_3$. (SM) -ALLUVIUM-
25	33				
	32				NOTE: Returns are moldable.
	29				
	28				28.0
	15				Rust-brown, damp, fine SAND, little to trace silt. (SM) to (SP-SM) -ALLUVIUM-
30	13				
					30.2
	24				Rust-brown, damp, medium to fine sandy, fine GRAVEL, with traces of silt. (GP) to (GP-GM) -ALLUVIUM-
	28				
					32.5
	55				
	47				
35	59				Rust-brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, trace cobbles and coarse sand, with slight traces of clay. (GP) -SGC-
	43				
	62				
	52				
	47				39
40	91				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand. (GP)
	84				41
	35				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, with slight traces of clay. (GP)
	26				
	26				NOTE: Encountered 6" - 12" lens(?) of medium to fine SAND, with traces of clay from approximately 42.5 - 43.5 ft.
					44.5
45	54				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-237
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-237

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	56				(Relatively loose) brown, gray and black, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with frequent black (MnO_2) staining. (GW)
	53				
	46				
	?				NOTE: Pockets of looser material between cobbles.
50	58				
	57				51
	35				Rust-brown, damp, medium to fine sandy, coarse to fine GRAVEL, trace coarse sand, with traces of clay and occasional small cobbles. (GP) to (GP-GC)
	36				
	43				
55	27				
	38				56.3
	67				
	79				Brown and gray, damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with slight traces of clay. (GW)
	99				
60	55				
	87				
	92				
	154				63.5
	74				Rust-brown, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
65	117				
	58				
	68				
	82				
	75				69
70	63				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-237
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-237

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	73				Rust-brown, damp to moist, medium to fine sandy, coarse to fine GRAVEL, little (small) cobbles, with traces of clay. (GP) to (GP-GC)
	62				72 NOTE: Returns are moldable.
	40				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace clay. (GP-GC)
	34				NOTES: 1. Returns are very moldable. 2. Frequent balls of clay in returns - possibly encountered a 6" - 8" lens(?) of CLAY, trace silt at approximately 75 ft.
75	31				
	31				76.5
	68				
	112				Brown and gray, damp to moist, coarse to fine gravelly, COBBLES, some to little coarse to fine sand, with traces of clay. (GW) to (GW-GC)
	98				
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-237 362
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-238

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 23+22
ELEVATION: 1191.8
DATE START: 3/30/87
DATE FINISH: 3/30/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:			CASING	SAMPLER		CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
3/30/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	10*				NOTES: 1. * indicates weak blows. 2. Location = N 868,410.22, E 508,191.21
	15*				
	14*				(Relatively hard) dark brown, dry to damp, CLAY, little to trace silt, with $CaCO_3$ nodules (up to 1/2") and organic material. (CL)
	16*				
					4.5 -TOPSOIL-
5	25*				Tan and brown, dry, SILT, little to trace clay, trace fine sand, with moderately developed $CaCO_3$ cementation. (ML)
	33				
	38				
	38				NOTE: Difficult to break pieces of this material by hand. -CALICHE-
	33				
					9.5
10	42				
	56				
	57				Hard, tan to brown, dry, cemented SILT, little fine sand, trace clay, with strongly developed $CaCO_3$ cementation. (ML) -CALICHE-
	45				
	41				
15	38				
	33				NOTE: Cannot break pieces of this rock-like material by hand.
	27				
	37				18
	15				(See next page)
20	15				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 363 B-238

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-238

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	13				Rust-brown, brown and greenish-gray, damp, silty, fine SAND, little to trace clay. (SM)
	12				-ALLUVIUM-
	15				NOTE: No $CaCO_3$ present, returns are moldable.
				23	
	24				Rust-brown to rust-colored, damp, fine SAND, little silt with traces of clay. (SM)
					-ALLUVIUM-
25	27			25	NOTE: Returns are moldable.
	41				
	49				Brown and gray, damp, coarse to fine sandy, COBBLES (small, less than 6"), little coarse to fine gravel, trace clay (rust and greenish-gray clays). (GP-GC)
	60				-SGC-
	60				GRADATIONAL TO
30	72				
	76				Brown, damp, coarse to fine sandy, coarse to fine GRAVEL, little cobbles, with traces of clay. (GW) to (GW-GC)
	71			32	
	84				
	100				
35	70				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little coarse to fine sand, with clay coatings on gravel and cobbles. (GW)
	77				
	77				
	120				
	91				
40	89				NOTE: Clay occurs as very slight coatings below 37 ft.
	79				
	95				
	95				NOTE: Large cobble or boulder at approximately 44.5 ft and 46 ft.
	91				
45	132				

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-238 364
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-238

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	95				NOTE: Same as above.
	168				
	225				48
	53				Rust-brown and gray, damp, medium to fine sandy, coarse to fine GRAVEL, little to trace cobbles and coarse sand, with slight traces of clay. (GP)
50	56				
	44				51.5
	65				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand. (GP)
	85				
	82				
55	77				
	64				
	215				NOTE: Large cobble or boulder at 56 ft.
	94				
	73				
60	158				NOTE: Encountered pockets containing traces of clay below 60 ft.
	93				
	105				
	109				64
65	73				Rust-brown and gray, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
	49				
	58				
	114				
	2				69.5
70	117				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-238 365
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-238

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	50				Rust-brown, moist, medium to fine sandy, coarse to fine GRAVEL, trace clay. (GP-GC)
	110				71.5 NOTE: Returns are very moldable.
	72				
	89				Rust-brown, damp to moist, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand, with traces of clay. (GP) to (GP-GC)
75	69				
	61				
	70				NOTE: Encountered pockets containing trace clay that were moldable.
	61				
	61				
80					Bottom of Exploration 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-238 366
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-239

PROJECT: Price Road Drain Tunnel
CLIENT: DeLeuw, Cather & Company
CONTRACTOR: Layne Western Co., Inc.
EQUIPMENT USED: Reverse Circulation Hammer Drill Rig

JOB NO. 11106.00
PAGE NO. 1 of 4
LOCATION: Sta. 15+98
ELEVATION: 1191.4
DATE START: 4/4/87
DATE FINISH: 4/4/87
DRILLER: Terry Leither
PREPARED BY: Dave Hallman

GROUNDWATER		DEPTH TO:				CASING	SAMPLER	CORE BARREL
DATE	HRS AFTER COMP	WATER	BOTTOM OF CASING	BOTTOM OF HOLE	TYPE	dbl wall	--	--
4/4/87	WD	NE	79'	79'	SIZE ID	4-1/4"	--	--
--	--	--	--	--	HAMMER WT	--	--	--
--	--	--	--	--	HAMMER FALL	--	--	--

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
0					
	3				Coarse to fine gravel, coarse to fine sand, asphalt,
	9				brick concrete.
	8				-FILL-
	16				NOTES: 1. Location = N 867,685.20, E 508,509.02
					2. Boring is approximately 30 ft north of LDB-13.
					4
5	35				
	56				Tan, dry, SILT, trace fine sand and clay, with moderate
	47				to well developed $CaCO_3$ cementation (laminar to cemented). (ML)
	44				-CALICHE-
	37				
10	43				10
	59				Extremely hard, brown to gray, dry, cemented, fine sandy,
	58				SILT, with well developed $CaCO_3$ cementation.
	63				NOTE: Pieces of this material in returns are rock-like and
	64				extremely difficult to impossible to break by hand.
					-CALICHE-
15	77				
	69				16
	42				(Relatively dense) brown, damp, fine SAND, trace silt
	57				and clay. (SC-SM)
	42				NOTE: No $CaCO_3$ present.
					-ALLUVIUM-
20	37				

CRSS FORM # 101 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD - WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE - NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR - NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	BORING NO. 367 B-239

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-239

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	38				(See previous page)
	40				22.7
	70				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little medium to fine sand, trace coarse sand, with traces of clay and occasional slight coatings of $CaCO_3$ on gravel and cobbles. (GP) to (GP-GC)
	78				
25	83				
	88				-SGC-
	88				NOTE: Encountering frequent small pockets rich in medium to fine sand. Generally sand is coarse to fine.
	135				
	103				29.5
30	84				Black, brown and gray, damp, cobbly, coarse to fine GRAVEL, little coarse to fine sand, with slight traces of clay (in zones) and frequent black (MnO_2) staining. (GW)
	51				
	96				
	69				
	89				
35	115				NOTE: Encountered large cobble or possible boulder at 34 ft.
	72				
	78				
	75				38
	36				Tan and gray, dry to damp, clean, medium to fine sandy, coarse to fine GRAVEL. (GP)
40	41				40.5
	56				Brown and gray, dry to damp, cobbly, coarse to fine GRAVEL, little to trace coarse to fine sand, with slight traces of clay. (GW)
	61				
	67				43
	34				43.8 Tan, damp, medium to fine SAND. (SP)
45	150				(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-239 368
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-239

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	90				Brown and gray, dry to damp, coarse to fine gravelly, COBBLES, little to trace medium to fine sand, trace coarse sand, with slight traces of clay (in layers). (GP)
	74				
	49				NOTE: Encountered occasional layers with black (MnO_2) staining.
	134				
50	178				50
	86				Brown, damp, cobbly, coarse to fine GRAVEL, little medium to fine sand, trace coarse sand with traces of clay.
	111				
	106				
	108				TO
55	88				
	175				Brown, damp, coarse to fine gravelly, COBBLES, trace coarse to fine sand, with traces of clay. (GP) to (GP-GC)
	99				
	79				
	80				58.5
60	64				
	60				Rust-brown and black, damp, coarse to fine GRAVEL, little medium to fine sand, little to trace cobbles, with traces of clay and frequent black (MnO_2) staining.
	47				
	43				
	45				
65	95				NOTE: 6 - 8" lens(?) of medium to fine SAND, trace clay at 62 ft. (GP) to (GP-GC)
	69				
	98				
	80				68
	46				Black, damp, coarse to fine GRAVEL, little (small) cobbles, trace coarse to fine sand and clay. (GP-GC)
70	82				69.5
					(See next page)

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S — SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T — TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U — UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G — GRAB SAMPLE	BORING NO. B-239 369
51+	VERY DENSE	16-30	VERY STIFF	X — OTHER	

CRSS

CRS SIRRINE

TEST BORING REPORT

BORING NO. B-239

PAGE 4 OF 4

DEPTH IN FEET	CASING BLOWS PER FOOT	SAMPLER BLOWS PER 6 INCHES	SAMPLE NUMBER	SAMPLE DEPTH RANGE	FIELD CLASSIFICATION AND REMARKS
	87				
	76				Black and dark brown, damp to moist, coarse to fine gravelly, COBBLES, little to trace coarse to fine sand, trace clay. (GP-GC)
	94				
	50				74.7
75	50				Brown, moist, medium to fine SAND, with traces of clay. (SP-SC)
	25				76.2
	28				Brown, moist, medium to fine SAND, little coarse to fine gravel, with traces of clay. (SP-SC)
					77
					Rust-brown, damp to moist, silty, CLAY. (CL)
	23				78
	54				Rust-brown, damp to moist, clayey, coarse to fine GRAVEL, trace silt. (GC)
80					Bottom of Exploration at 79.0 ft.
85					
90					
95					

CPSS FORM # 102 11-15-85

BLOWS/FT.	DENSITY	BLOWS/FT.	CONSISTENCY	SAMPLE IDENTIFICATION	GROUNDWATER ABBREVIATIONS
0-4	VERY LOOSE	0-2	VERY SOFT	S —— SPLIT SPOON	WD – WHILE DRILLING
5-10	LOOSE	3-4	SOFT	T —— TUBE	NE – NOT ENCOUNTERED
11-30	MEDIUM DENSE	5-8	MEDIUM STIFF	U —— UNDISTURBED PISTON	NR – NOT READ
31-50	DENSE	9-15	STIFF	G —— GRAB SAMPLE	BORING NO. B-239
51+	VERY DENSE	16-30	VERY STIFF	X —— OTHER	

370

Hammer Drill Bounce Chamber Pressure Logs

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-101

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	*	26	26	51	25	76	28
2	*	27	24	52	27	77	29
3	*	28	19	53	24	78	26
4	*	29	21	54	26	79	26
5	*	30	24	55	27	80	26
6	*	31	26	56	29	81	28
7	*	32	26	57	28	82	27
8	21	33	31	58	28	83	25
9	11	34	31	59	29	84	26
10	25	35	32	60	24	85	27
11	24	36	28	61	25	86	25
12	22	37	25	62	28	87	30
13	22	38	28	63	26	88	31
14	11	39	26	64	27	89	29
15	11	40	25	65	28	90	24
16	19	41	21	66	29	91	25
17	22	42	21	67	28	92	23
18	26	43	25	68	30	93	26
19	29	44	27	69	29	94	27
20	24	45	29	70	27	95	27
21	24	46	30	71	27	96	
22	22	47	30	72	27	97	
23	25	48	32	73	25	98	
24	28	49	29	74	26	99	
25	23	50	22	75	28	100	

* CASING PUSHED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-102

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	*	26	23	51	32	76	29
2	*	27	25	52	27	77	29
3	*	28	29	53	27	78	27
4	15	29	25	54	29	79	30
5	15	30	28	55	21	80	27
6	20	31	30	56	22	81	26
7	21	32	30	57	26	82	26
8	21	33	31	58	24	83	28
9	23	34	32	59	26	84	26
10	26	35	29	60	30	85	27
11	26	36	25	61	27	86	29
12	25	37	30	62	26	87	28
13	26	38	27	63	26	88	25
14	20	39	32	64	26	89	29
15	26	40	27	65	29	90	25
16	23	41	19	66	27	91	26
17	26	42	22	67	29	92	23
18	27	43	27	68	30	93	25
19	24	44	29	69	30	94	25
20	25	45	27	70	27	95	27
21	19	46	26	71	24	96	25
22	23	47	25	72	23	97	26
23	22	48	26	73	27	98	26
24	30	49	29	74	27	99	30
25	22	50	30	75	29	100	27

* CASING PUSHED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-103

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	NR	26	28	51	28	76	28
2	NR	27	25	52	31	77	27
3	NR	28	28	53	28	78	28
4	NR	29	29	54	31	79	30
5	NR	30	30	55	30	80	27
6	11	31	29	56	28	81	28
7	19	32	31	57	29	82	26
8	21	33	30	58	29	83	30
9	20	34	29	59	27	84	29
10	21	35	28	60	24	85	28
11	21	36	28	61	25	86	26
12	25	37	30	62	25	87	27
13	26	38	28	63	24	88	24
14	30	39	29	64	26	89	26
15	30	40	28	65	27	90	27
16	25	41	28	66	27	91	28
17	30	42	26	67	26	92	28
18	26	43	26	68	24	93	26
19	26	44	25	69	23	94	26
20	27	45	26	70	25	95	27
21	25	46	25	71	25	96	27
22	21	47	26	72	26	97	30
23	19	48	25	73	26	98	28
24	22	49	27	74	27	99	30
25	26	50	27	75	25	100	30

NR=NOT RECORDED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-104

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	12	26	20	51	21	76	28
2	13	27	28	52	26	77	26
3	16	28	24	53	30	78	26
4	18	29	28	54	28	79	25
5	22	30	21	55	30	80	25
6	21	31	23	56	26	81	24
7	21	32	27	57	26	82	27
8	24	33	29	58	27	83	26
9	25	34	31	59	27	84	26
10	19	35	27	60	25	85	27
11	23	36	21	61	27	86	25
12	21	37	30	62	29	87	24
13	22	38	22	63	28	88	26
14	24	39	27	64	22	89	30
15	20	40	25	65	20	90	27
16	27	41	26	66	22	91	26
17	25	42	27	67	21	92	27
18	25	43	25	68	29	93	25
19	21	44	29	69	28	94	27
20	25	45	30	70	24	95	25
21	26	46	29	71	25	96	26
22	24	47	22	72	26	97	26
23	27	48	24	73	24	98	22
24	26	49	27	74	27	99	25
25	24	50	29	75	27	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-105

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	11	26	31	51	24	76	24
2	13	27	30	52	27	77	24
3	15	28	27	53	31	78	24
4	17	29	30	54	28	79	23
5	20	30	31	55	24	80	24
6	15	31	25	56	22	81	22
7	19	32	25	57	23	82	21
8	24	33	28	58	26	83	20
9	21	34	30	59	27	84	24
10	21	35	29	60	29	85	25
11	23	36	30	61	24	86	26
12	25	37	30	62	24	87	23
13	26	38	31	63	25	88	22
14	25	39	25	64	25	89	29
15	24	40	26	65	26	90	22
16	28	41	26	66	26	91	23
17	25	42	24	67	24	92	25
18	29	43	31	68	25	93	24
19	28	44	30	69	23	94	23
20	26	45	27	70	26	95	20
21	30	46	32	71	19	96	22
22	29	47	30	72	19	97	18
23	28	48	27	73	24	98	19
24	29	49	23	74	26	99	22
25	26	50	23	75	24	100	23

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-106

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	NR	26	28	51	30	76	28
2	NR	27	22	52	28	77	28
3	NR	28	27	53	25	78	27
4	NR	29	26	54	32	79	27
5	16	30	25	55	26	80	23
6	16	31	23	56	30	81	25
7	12	32	25	57	28	82	29
8	14	33	26	58	26	83	24
9	13	34	24	59	28	84	25
10	20	35	25	60	22	85	22
11	21	36	22	61	25	86	24
12	26	37	24	62	27	87	25
13	24	38	30	63	28	88	27
14	25	39	28	64	27	89	26
15	11	40	27	65	27	90	27
16	21	41	28	66	28	91	24
17	22	42	26	67	26	92	24
18	20	43	26	68	26	93	26
19	25	44	29	69	28	94	25
20	26	45	27	70	25	95	28
21	24	46	24	71	24	96	25
22	24	47	28	72	26	97	22
23	24	48	21	73	25	98	24
24	27	49	24	74	27	99	22
25	27	50	24	75	26	100	24

NR=NOT RECORDED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-107

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	*	26	28	51	27	76	30
2	*	27	26	52	29	77	26
3	11	28	28	53	27	78	28
4	15	29	30	54	26	79	28
5	17	30	30	55	28	80	27
6	18	31	30	56	25	81	26
7	19	32	30	57	24	82	24
8	16	33	31	58	27	83	25
9	21	34	27	59	26	84	27
10	22	35	29	60	28	85	25
11	25	36	29	61	26	86	30
12	26	37	26	62	22	87	25
13	26	38	28	63	31	88	22
14	30	39	23	64	28	89	25
15	26	40	30	65	24	90	25
16	29	41	31	66	27	91	26
17	26	42	26	67	24	92	25
18	26	43	26	68	28	93	26
19	25	44	30	69	26	94	26
20	23	45	31	70	24	95	27
21	25	46	32	71	25	96	24
22	24	47	26	72	23	97	30
23	26	48	32	73	26	98	27
24	26	49	31	74	26	99	30
25	27	50	30	75	24	100	31

* CASING PUSHED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-108

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	13	26	25	51	26	76	24
2	14	27	25	52	27	77	25
3	14	28	21	53	27	78	28
4	14	29	24	54	26	79	26
5	14	30	20	55	24	80	25
6	14	31	27	56	22	81	23
7	15	32	22	57	22	82	26
8	17	33	24	58	21	83	23
9	18	34	29	59	27	84	25
10	25	35	22	60	24	85	25
11	25	36	22	61	25	86	24
12	21	37	30	62	25	87	24
13	22	38	25	63	25	88	26
14	22	39	27	64	22	89	26
15	29	40	22	65	26	90	25
16	27	41	25	66	24	91	24
17	27	42	27	67	27	92	21
18	28	43	26	68	19	93	22
19	24	44	25	69	26	94	25
20	25	45	25	70	26	95	22
21	23	46	27	71	25	96	24
22	22	47	25	72	27	97	21
23	22	48	22	73	27	98	23
24	21	49	27	74	24	99	25
25	25	50	25	75	25	100	26

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-201

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	20	51	20	76	26
2	0	27	20	52	21	77	26
3	10	28	21	53	20	78	26
4	10	29	21	54	22	79	26
5	10	30	20	55	23	80	22
6	15	31	20	56	23	81	22
7	15	32	19	57	23	82	20
8	15	33	16	58	23	83	18
9	16	34	20	59	22	84	17
10	17	35	21	60	20	85	17
11	0	36	20	61	21	86	17
12	0	37	21	62	21	87	
13	0	38	22	63	22	88	
14	17	39	22	64	24	89	
15	17	40	21	65	25	90	
16	17	41	21	66	25	91	
17	17	42	21	67	25	92	
18	15	43	21	68	25	93	
19	15	44	21	69	24	94	
20	15	45	22	70	25	95	
21	15	46	21	71	25	96	
22	15	47	21	72	25	97	
23	21	48	20	73	25	98	
24	24	49	21	74	25	99	
25	22	50	20	75	25	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-202

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	20	51	21	76	28
2	0	27	20	52	21	77	27
3	9	28	20	53	22	78	27
4	9	29	20	54	23	79	28
5	9	30	27	55	23	80	27
6	14	31	27	56	23	81	27
7	16	32	28	57	23	82	27
8	17	33	28	58	23	83	26
9	17	34	28	59	22	84	26
10	17	35	29	60	25	85	25
11	17	36	29	61	25	86	25
12	18	37	29	62	26	87	27
13	18	38	29	63	24	88	28
14	20	39	31	64	26	89	27
15	20	40	30	65	26	90	
16	23	41	31	66	26	91	
17	23	42	31	67	26	92	
18	23	43	28	68	24	93	
19	24	44	30	69	26	94	
20	25	45	30	70	28	95	
21	20	46	32	71	28	96	
22	21	47	32	72	28	97	
23	20	48	22	73	29	98	
24	22	49	22	74	28	99	
25	21	50	22	75	28	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-203

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	10	26	24	51	26	76	29
2	10	27	21	52	26	77	28
3	10	28	21	53	26	78	30
4	10	29	23	54	27	79	24
5	10	30	24	55	27	80	24
6	13	31	24	56	27	81	28
7	13	32	26	57	27	82	28
8	13	33	26	58	29	83	28
9	13	34	26	59	28	84	29
10	15	35	26	60	27	85	28
11	15	36	26	61	27	86	27
12	16	37	25	62	27	87	27
13	16	38	25	63	28	88	28
14	19	39	27	64	28	89	29
15	19	40	25	65	28	90	
16	19	41	26	66	27	91	
17	19	42	23	67	28	92	
18	19	43	23	68	28	93	
19	20	44	23	69	27	94	
20	20	45	25	70	24	95	
21	20	46	25	71	27	96	
22	21	47	23	72	28	97	
23	21	48	26	73	28	98	
24	24	49	26	74	29	99	
25	24	50	24	75	29	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-204

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	27	51	30	76	29
2	0	27	28	52	30	77	29
3	0	28	26	53	29	78	28
4	6	29	28	54	31	79	28
5	6	30	30	55	33	80	28
6	6	31	30	56	32	81	28
7	10	32	30	57	33	82	30
8	10	33	31	58	33	83	30
9	10	34	31	59	28	84	31
10	10	35	28	60	28	85	30
11	15	36	33	61	28	86	30
12	21	37	33	62	29	87	31
13	27	38	30	63	28	88	31
14	29	39	24	64	28	89	28
15	29	40	22	65	28	90	
16	28	41	33	66	30	91	
17	28	42	32	67	30	92	
18	28	43	31	68	30	93	
19	29	44	33	69	29	94	
20	33	45	34	70	29	95	
21	30	46	35	71	30	96	
22	33	47	34	72	30	97	
23	33	48	32	73	30	98	
24	26	49	28	74	28	99	
25	27	50	29	75	28	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-205

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	26	51	23	76	25
2	0	27	26	52	23	77	26
3	0	28	26	53	25	78	26
4	15	29	25	54	25	79	26
5	15	30	25	55	25	80	25
6	18	31	25	56	25	81	25
7	18	32	21	57	25	82	25
8	23	33	21	58	26	83	26
9	23	34	21	59	26	84	26
10	21	35	26	60	26	85	26
11	17	36	26	61	26	86	26
12	17	37	26	62	24	87	26
13	17	38	25	63	24	88	26
14	15	39	25	64	24	89	26
15	15	40	25	65	24	90	26
16	21	41	25	66	25	91	
17	21	42	26	67	25	92	
18	21	43	26	68	25	93	
19	21	44	26	69	25	94	
20	23	45	22	70	25	95	
21	23	46	21	71	25	96	
22	21	47	21	72	25	97	
23	25	48	21	73	25	98	
24	25	49	22	74	24	99	
25	26	50	23	75	24	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-206

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	21	51	24	76	25
2	0	27	18	52	24	77	25
3	0	28	21	53	24	78	26
4	0	29	22	54	24	79	25
5	0	30	21	55	24	80	24
6	10	31	23	56	24	81	24
7	10	32	22	57	26	82	24
8	10	33	22	58	26	83	25
9	15	34	23	59	26	84	26
10	15	35	24	60	26	85	26
11	15	36	23	61	26	86	26
12	15	37	23	62	26	87	26
13	19	38	23	63	26	88	26
14	19	39	23	64	26	89	26
15	19	40	24	65	26	90	26
16	18	41	24	66	27	91	
17	18	42	24	67	27	92	
18	19	43	23	68	25	93	
19	20	44	24	69	25	94	
20	20	45	24	70	26	95	
21	21	46	24	71	26	96	
22	21	47	24	72	26	97	
23	21	48	21	73	25	98	
24	19	49	21	74	25	99	
25	19	50	23	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-207

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	21	51	25	76	26
2	0	27	20	52	25	77	26
3	9	28	21	53	24	78	26
4	9	29	21	54	24	79	26
5	9	30	21	55	24	80	25
6	12	31	21	56	26	81	25
7	12	32	23	57	26	82	25
8	14	33	23	58	26	83	24
9	15	34	23	59	26	84	24
10	15	35	23	60	25	85	24
11	15	36	23	61	25	86	24
12	15	37	23	62	25	87	24
13	16	38	24	63	25	88	25
14	14	39	24	64	25	89	25
15	14	40	23	65	26	90	25
16	19	41	23	66	26	91	
17	19	42	24	67	26	92	
18	19	43	25	68	26	93	
19	19	44	25	69	26	94	
20	20	45	24	70	25	95	
21	20	46	24	71	25	96	
22	20	47	24	72	25	97	
23	20	48	24	73	25	98	
24	20	49	24	74	26	99	
25	20	50	25	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-209

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	23	51	28	76	28
2	0	27	21	52	28	77	28
3	15	28	21	53	28	78	28
4	15	29	24	54	28	79	28
5	22	30	19	55	28	80	25
6	22	31	19	56	28	81	25
7	22	32	23	57	28	82	26
8	20	33	23	58	28	83	27
9	19	34	25	59	28	84	27
10	19	35	25	60	28	85	28
11	23	36	26	61	27	86	28
12	23	37	26	62	27	87	28
13	24	38	26	63	27	88	28
14	24	39	26	64	27	89	29
15	24	40	16	65	27	90	29
16	24	41	25	66	27	91	
17	24	42	25	67	27	92	
18	26	43	26	68	28	93	
19	26	44	26	69	28	94	
20	25	45	26	70	28	95	
21	25	46	26	71	28	96	
22	25	47	26	72	28	97	
23	25	48	26	73	28	98	
24	23	49	26	74	28	99	
25	23	50	28	75	28	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-210

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	15	26	26	51	26	76	26
2	15	27	26	52	26	77	26
3	15	28	26	53	26	78	26
4	15	29	26	54	26	79	26
5	19	30	26	55	26	80	26
6	19	31	27	56	26	81	26
7	19	32	27	57	26	82	25
8	17	33	25	58	25	83	25
9	17	34	25	59	25	84	28
10	18	35	25	60	24	85	28
11	19	36	26	61	24	86	28
12	15	37	27	62	24	87	28
13	18	38	27	63	24	88	28
14	18	39	27	64	23	89	28
15	18	40	26	65	23	90	28
16	18	41	26	66	24	91	
17	18	42	26	67	24	92	
18	18	43	26	68	24	93	
19	18	44	26	69	24	94	
20	19	45	26	70	24	95	
21	19	46	26	71	26	96	
22	19	47	25	72	26	97	
23	23	48	25	73	26	98	
24	23	49	25	74	26	99	
25	26	50	26	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-211

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	14	26	20	51	27	76	28
2	14	27	20	52	27	77	28
3	14	28	20	53	27	78	28
4	18	29	20	54	27	79	28
5	18	30	19	55	27	80	21
6	18	31	19	56	27	81	21
7	18	32	15	57	27	82	21
8	18	33	15	58	27	83	21
9	18	34	15	59	27	84	21
10	18	35	15	60	26	85	21
11	18	36	15	61	26	86	21
12	18	37	18	62	26	87	22
13	18	38	18	63	26	88	22
14	18	39	26	64	26	89	22
15	18	40	26	65	27	90	22
16	20	41	26	66	27	91	
17	20	42	26	67	27	92	
18	20	43	26	68	27	93	
19	20	44	26	69	27	94	
20	20	45	26	70	27	95	
21	19	46	26	71	27	96	
22	19	47	25	72	27	97	
23	19	48	25	73	27	98	
24	19	49	26	74	27	99	
25	19	50	27	75	27	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-212

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	10	26	21	51	23	76	26
2	10	27	21	52	23	77	26
3	12	28	23	53	22	78	27
4	12	29	23	54	22	79	27
5	13	30	26	55	22	80	25
6	13	31	29	56	31	81	25
7	13	32	29	57	31	82	26
8	13	33	29	58	27	83	26
9	13	34	29	59	26	84	26
10	13	35	30	60	26	85	26
11	13	36	30	61	26	86	26
12	13	37	30	62	26	87	26
13	13	38	21	63	27	88	26
14	21	39	21	64	27	89	26
15	21	40	28	65	28	90	26
16	21	41	28	66	27	91	
17	21	42	28	67	28	92	
18	19	43	30	68	25	93	
19	19	44	30	69	26	94	
20	19	45	30	70	27	95	
21	19	46	29	71	27	96	
22	19	47	29	72	26	97	
23	19	48	29	73	25	98	
24	21	49	20	74	25	99	
25	21	50	23	75	27	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-213

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	15	26	19	51	25	76	20
2	15	27	19	52	27	77	20
3	16	28	20	53	27	78	22
4	16	29	20	54	27	79	22
5	25	30	25	55	20	80	20
6	25	31	18	56	18	81	21
7	23	32	18	57	18	82	21
8	23	33	23	58	18	83	23
9	23	34	20	59	18	84	20
10	20	35	20	60	16	85	20
11	20	36	18	61	16	86	20
12	22	37	24	62	19	87	20
13	23	38	24	63	19	88	22
14	20	39	24	64	19	89	18
15	18	40	24	65	19	90	
16	16	41	25	66	19	91	
17	20	42	25	67	19	92	
18	21	43	25	68	20	93	
19	21	44	25	69	20	94	
20	22	45	25	70	21	95	
21	22	46	27	71	19	96	
22	22	47	27	72	18	97	
23	22	48	27	73	18	98	
24	22	49	25	74	19	99	
25	22	50	25	75	20	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-214

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	10	26	23	51	21	76	20
2	10	27	23	52	23	77	21
3	10	28	23	53	23	78	19
4	14	29	22	54	24	79	19
5	14	30	21	55	23	80	19
6	14	31	21	56	23	81	21
7	14	32	22	57	24	82	21
8	14	33	19	58	23	83	21
9	14	34	19	59	22	84	21
10	19	35	21	60	21	85	19
11	19	36	21	61	21	86	19
12	20	37	21	62	19	87	24
13	19	38	19	63	19	88	22
14	20	39	23	64	19	89	22
15	21	40	23	65	19	90	
16	24	41	23	66	19	91	
17	23	42	23	67	22	92	
18	23	43	22	68	23	93	
19	23	44	22	69	23	94	
20	23	45	23	70	22	95	
21	19	46	23	71	23	96	
22	21	47	24	72	22	97	
23	21	48	24	73	22	98	
24	21	49	24	74	22	99	
25	21	50	20	75	20	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-215

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	19	51	28	76	25
2	9	27	21	52	28	77	26
3	9	28	19	53	28	78	26
4	9	29	19	54	28	79	26
5	9	30	18	55	28	80	26
6	9	31	18	56	28	81	26
7	11	32	18	57	28	82	27
8	12	33	19	58	28	83	26
9	12	34	18	59	28	84	26
10	15	35	18	60	25	85	27
11	15	36	18	61	25	86	27
12	15	37	19	62	25	87	27
13	17	38	19	63	25	88	27
14	19	39	17	64	24	89	27
15	19	40	19	65	22	90	
16	19	41	19	66	25	91	
17	21	42	23	67	25	92	
18	21	43	27	68	25	93	
19	19	44	29	69	25	94	
20	19	45	25	70	25	95	
21	19	46	25	71	25	96	
22	19	47	27	72	25	97	
23	19	48	27	73	26	98	
24	19	49	27	74	26	99	
25	19	50	28	75	25	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-216

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	25	51	28	76	32
2	9	27	25	52	28	77	32
3	9	28	26	53	29	78	32
4	9	29	25	54	29	79	31
5	12	30	26	55	29	80	32
6	12	31	26	56	29	81	32
7	12	32	26	57	29	82	32
8	12	33	26	58	29	83	31
9	12	34	28	59	27	84	32
10	12	35	26	60	27	85	32
11	20	36	24	61	26	86	32
12	21	37	27	62	28	87	32
13	21	38	27	63	28	88	32
14	21	39	27	64	29	89	32
15	22	40	27	65	29	90	
16	22	41	25	66	29	91	
17	22	42	26	67	31	92	
18	23	43	24	68	31	93	
19	19	44	26	69	31	94	
20	20	45	26	70	29	95	
21	20	46	27	71	30	96	
22	23	47	26	72	31	97	
23	23	48	28	73	31	98	
24	23	49	26	74	31	99	
25	23	50	28	75	30	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-217

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	31	51	32	76	32
2	9	27	31	52	32	77	32
3	9	28	28	53	33	78	32
4	9	29	31	54	33	79	32
5	11	30	30	55	33	80	31
6	11	31	30	56	33	81	31
7	21	32	26	57	33	82	32
8	21	33	26	58	33	83	31
9	23	34	26	59	30	84	32
10	24	35	31	60	31	85	32
11	26	36	31	61	31	86	30
12	26	37	31	62	31	87	31
13	30	38	31	63	30	88	31
14	30	39	28	64	30	89	
15	30	40	24	65	32	90	
16	30	41	24	66	31	91	
17	30	42	26	67	33	92	
18	31	43	26	68	33	93	
19	27	44	26	69	33	94	
20	26	45	26	70	30	95	
21	31	46	28	71	30	96	
22	31	47	31	72	30	97	
23	31	48	32	73	30	98	
24	28	49	32	74	31	99	
25	30	50	32	75	30	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-218

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	20	51	25	76	23
2	9	27	20	52	25	77	21
3	9	28	21	53	25	78	21
4	9	29	21	54	25	79	21
5	9	30	24	55	25	80	26
6	9	31	20	56	22	81	25
7	9	32	20	57	22	82	25
8	9	33	20	58	23	83	25
9	9	34	20	59	23	84	26
10	16	35	20	60	25	85	26
11	16	36	20	61	25	86	26
12	16	37	19	62	23	87	26
13	16	38	19	63	23	88	26
14	15	39	20	64	23	89	27
15	15	40	20	65	23	90	
16	15	41	17	66	26	91	
17	15	42	20	67	26	92	
18	15	43	18	68	26	93	
19	16	44	19	69	26	94	
20	15	45	20	70	21	95	
21	19	46	23	71	20	96	
22	19	47	23	72	20	97	
23	20	48	23	73	23	98	
24	20	49	23	74	23	99	
25	20	50	23	75	23	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-219

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	27	51	27	76	26
2	9	27	27	52	28	77	26
3	9	28	27	53	29	78	26
4	13	29	21	54	28	79	26
5	13	30	24	55	29	80	28
6	13	31	22	56	29	81	27
7	14	32	24	57	26	82	29
8	16	33	24	58	28	83	29
9	16	34	26	59	29	84	29
10	16	35	26	60	30	85	30
11	16	36	26	61	28	86	29
12	21	37	25	62	28	87	27
13	22	38	25	63	27	88	29
14	22	39	25	64	25	89	30
15	22	40	28	65	26	90	
16	20	41	28	66	26	91	
17	20	42	28	67	25	92	
18	20	43	28	68	23	93	
19	18	44	29	69	23	94	
20	20	45	28	70	22	95	
21	20	46	28	71	22	96	
22	20	47	28	72	24	97	
23	23	48	29	73	26	98	
24	23	49	30	74	26	99	
25	23	50	24	75	28	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-220

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	29	51	28	76	29
2	9	27	29	52	27	77	28
3	9	28	29	53	30	78	25
4	9	29	24	54	30	79	24
5	15	30	25	55	30	80	23
6	15	31	26	56	30	81	22
7	15	32	26	57	29	82	22
8	19	33	26	58	29	83	24
9	19	34	26	59	30	84	23
10	22	35	27	60	23	85	25
11	23	36	27	61	23	86	25
12	23	37	25	62	23	87	27
13	28	38	28	63	25	88	27
14	28	39	28	64	27	89	27
15	29	40	26	65	26	90	
16	28	41	26	66	24	91	
17	29	42	27	67	24	92	
18	21	43	28	68	24	93	
19	26	44	27	69	24	94	
20	26	45	27	70	25	95	
21	26	46	29	71	26	96	
22	28	47	29	72	27	97	
23	29	48	29	73	29	98	
24	28	49	29	74	29	99	
25	28	50	27	75	28	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-221

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	8	26	22	51	29	76	24
2	8	27	23	52	27	77	24
3	9	28	28	53	30	78	25
4	9	29	23	54	30	79	28
5	12	30	24	55	30	80	26
6	13	31	26	56	30	81	26
7	16	32	26	57	29	82	26
8	17	33	26	58	31	83	26
9	19	34	27	59	30	84	27
10	21	35	27	60	28	85	29
11	24	36	25	61	28	86	29
12	29	37	25	62	25	87	30
13	27	38	31	63	29	88	28
14	25	39	31	64	28	89	27
15	25	40	28	65	28	90	
16	29	41	26	66	28	91	
17	29	42	24	67	28	92	
18	24	43	24	68	29	93	
19	26	44	26	69	29	94	
20	26	45	26	70	24	95	
21	27	46	23	71	26	96	
22	30	47	30	72	28	97	
23	28	48	30	73	30	98	
24	25	49	30	74	28	99	
25	25	50	29	75	24	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-222

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	24	51	25	76	24
2	9	27	29	52	26	77	22
3	9	28	28	53	24	78	24
4	9	29	28	54	25	79	23
5	12	30	25	55	25	80	23
6	12	31	28	56	25	81	23
7	15	32	27	57	27	82	20
8	17	33	26	58	27	83	24
9	22	34	24	59	24	84	25
10	24	35	24	60	24	85	24
11	27	36	28	61	24	86	23
12	27	37	30	62	24	87	24
13	27	38	31	63	23	88	24
14	25	39	25	64	25	89	23
15	29	40	27	65	24	90	
16	29	41	24	66	25	91	
17	29	42	28	67	25	92	
18	25	43	28	68	27	93	
19	26	44	28	69	27	94	
20	26	45	27	70	25	95	
21	26	46	29	71	25	96	
22	27	47	30	72	25	97	
23	25	48	30	73	26	98	
24	25	49	30	74	26	99	
25	26	50	28	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-223

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	9	26	23	51	20	76	26
2	9	27	13	52	20	77	27
3	9	28	15	53	22	78	26
4	10	29	15	54	24	79	27
5	10	30	15	55	24	80	25
6	10	31	15	56	24	81	25
7	10	32	!9	57	26	82	25
8	10	33	19	58	24	83	25
9	12	34	21	59	27	84	25
10	12	35	27	60	23	85	24
11	12	36	24	61	20	86	28
12	15	37	29	62	20	87	30
13	20	38	25	63	!9	88	30
14	22	39	22	64	21	89	30
15	22	40	25	65	21	90	
16	22	41	23	66	23	91	
17	22	42	28	67	23	92	
18	22	43	28	68	24	93	
19	23	44	25	69	22	94	
20	25	45	25	70	22	95	
21	25	46	27	71	23	96	
22	25	47	27	72	24	97	
23	25	48	21	73	24	98	
24	25	49	27	74	26	99	
25	25	50	24	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-224

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	12	26	25	51	20	76	27
2	12	27	25	52	25	77	28
3	12	28	25	53	25	78	29
4	16	29	23	54	25	79	27
5	16	30	24	55	25	80	29
6	16	31	28	56	28	81	26
7	16	32	30	57	25	82	28
8	16	33	30	58	30	83	28
9	16	34	28	59	27	84	28
10	16	35	28	60	25	85	27
11	18	36	30	61	23	86	27
12	18	37	28	62	23	87	27
13	18	38	28	63	23	88	27
14	19	39	30	64	23	89	27
15	20	40	30	65	23	90	
16	20	41	30	66	25	91	
17	22	42	28	67	25	92	
18	22	43	28	68	25	93	
19	22	44	28	69	25	94	
20	26	45	26	70	28	95	
21	25	46	25	71	28	96	
22	25	47	30	72	28	97	
23	24	48	28	73	27	98	
24	24	49	26	74	27	99	
25	24	50	22	75	27	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-225

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	NR	26	28	51	28	76	29
2	NR	27	27	52	28	77	29
3	NR	28	25	53	28	78	29
4	NR	29	28	54	28	79	29
5	NR	30	28	55	28	80	29
6	NR	31	27	56	28	81	29
7	NR	32	27	57	28	82	28
8	NR	33	26	58	28	83	28
9	NR	34	27	59	28	84	28
10	NR	35	28	60	28	85	
11	22	36	27	61	28	86	
12	24	37	28	62	28	87	
13	24	38	28	63	28	88	
14	24	39	30	64	28	89	
15	22	40	24	65	29	90	
16	23	41	24	66	28	91	
17	25	42	22	67	28	92	
18	25	43	22	68	28	93	
19	25	44	23	69	29	94	
20	27	45	24	70	28	95	
21	27	46	23	71	29	96	
22	28	47	23	72	30	97	
23	27	48	23	73	30	98	
24	28	49	28	74	29	99	
25	30	50	27	75	29	100	

NR=NOT RECORDED

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-226

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	12	26	29	51	28	76	25
2	12	27	29	52	29	77	26
3	12	28	29	53	29	78	26
4	12	29	29	54	29	79	25
5	18	30	29	55	29	80	22
6	18	31	29	56	29	81	22
7	18	32	28	57	30	82	23
8	20	33	28	58	30	83	23
9	20	34	25	59	28	84	23
10	24	35	29	60	25	85	24
11	26	36	29	61	25	86	24
12	26	37	29	62	25	87	23
13	26	38	29	63	25	88	25
14	26	39	28	64	29	89	25
15	26	40	28	65	29	90	
16	26	41	30	66	30	91	
17	26	42	29	67	30	92	
18	26	43	29	68	31	93	
19	25	44	29	69	20	94	
20	25	45	29	70	21	95	
21	26	46	29	71	21	96	
22	28	47	29	72	24	97	
23	28	48	29	73	24	98	
24	28	49	29	74	25	99	
25	28	50	28	75	25	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-227

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	6	26	27	51	28	76	28
2	6	27	28	52	29	77	29
3	6	28	28	53	29	78	29
4	8	29	28	54	30	79	31
5	8	30	28	55	29	80	
6	8	31	29	56	28	81	
7	15	32	28	57	28	82	
8	15	33	29	58	30	83	
9	15	34	29	59	28	84	
10	15	35	30	60	26	85	
11	19	36	30	61	26	86	
12	19	37	30	62	25	87	
13	21	38	31	63	27	88	
14	20	39	30	64	27	89	
15	22	40	30	65	29	90	
16	22	41	31	66	27	91	
17	24	42	31	67	28	92	
18	26	43	29	68	28	93	
19	23	44	29	69	28	94	
20	24	45	32	70	26	95	
21	28	46	32	71	26	96	
22	27	47	32	72	28	97	
23	25	48	31	73	28	98	
24	25	49	28	74	30	99	
25	28	50	27	75	29	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-228

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	13	26	28	51	28	76	33
2	13	27	31	52	28	77	32
3	13	28	31	53	28	78	31
4	13	29	28	54	30	79	31
5	13	30	27	55	30	80	31
6	13	31	27	56	27	81	31
7	13	32	31	57	28	82	33
8	13	33	31	58	28	83	33
9	13	34	23	59	31	84	28
10	15	35	26	60	32	85	28
11	15	36	31	61	32	86	33
12	19	37	31	62	32	87	34
13	23	38	28	63	32	88	34
14	23	39	30	64	32	89	34
15	23	40	29	65	33	90	
16	23	41	31	66	33	91	
17	23	42	30	67	32	92	
18	25	43	30	68	32	93	
19	25	44	31	69	32	94	
20	27	45	31	70	31	95	
21	27	46	31	71	32	96	
22	27	47	21	72	32	97	
23	28	48	21	73	31	98	
24	28	49	22	74	31	99	
25	28	50	28	75	32	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-229

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	21	51	28	76	26
2	0	27	23	52	26	77	26
3	8	28	23	53	28	78	27
4	8	29	23	54	29	79	27
5	8	30	23	55	29	80	
6	8	31	23	56	30	81	
7	10	32	24	57	28	82	
8	16	33	24	58	29	83	
9	16	34	25	59	29	84	
10	24	35	20	60	22	85	
11	24	36	19	61	22	86	
12	28	37	19	62	22	87	
13	29	38	19	63	27	88	
14	29	39	21	64	27	89	
15	29	40	26	65	27	90	
16	25	41	27	66	28	91	
17	24	42	24	67	28	92	
18	22	43	24	68	28	93	
19	22	44	26	69	28	94	
20	22	45	26	70	24	95	
21	23	46	26	71	25	96	
22	21	47	27	72	25	97	
23	21	48	29	73	25	98	
24	21	49	29	74	26	99	
25	21	50	27	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-230

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	16	26	19	51	29	76	24
2	16	27	19	52	30	77	26
3	16	28	28	53	30	78	24
4	16	29	28	54	28	79	25
5	18	30	26	55	28	80	
6	18	31	29	56	30	81	
7	19	32	29	57	30	82	
8	19	33	29	58	30	83	
9	21	34	29	59	25	84	
10	21	35	29	60	23	85	
11	21	36	29	61	27	86	
12	21	37	29	62	27	87	
13	24	38	29	63	26	88	
14	24	39	29	64	26	89	
15	24	40	29	65	24	90	
16	24	41	28	66	24	91	
17	26	42	28	67	26	92	
18	26	43	30	68	26	93	
19	26	44	30	69	26	94	
20	26	45	25	70	25	95	
21	28	46	25	71	26	96	
22	28	47	25	72	26	97	
23	28	48	29	73	20	98	
24	28	49	30	74	20	99	
25	28	50	29	75	25	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-231

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	25	26	28	51	30	76	29
2	25	27	30	52	32	77	30
3	25	28	30	53	32	78	29
4	23	29	30	54	32	79	29
5	23	30	28	55	32	80	
6	25	31	28	56	30	81	
7	23	32	28	57	30	82	
8	25	33	30	58	32	83	
9	25	34	30	59	32	84	
10	25	35	32	60	30	85	
11	25	36	32	61	30	86	
12	25	37	30	62	30	87	
13	23	38	30	63	30	88	
14	23	39	30	64	30	89	
15	27	40	29	65	29	90	
16	27	41	28	66	28	91	
17	27	42	28	67	28	92	
18	27	43	32	68	32	93	
19	25	44	30	69	29	94	
20	30	45	32	70	29	95	
21	30	46	32	71	30	96	
22	30	47	32	72	29	97	
23	30	48	33	73	29	98	
24	30	49	30	74	29	99	
25	28	50	32	75	29	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-232

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	6	26	22	51	25	76	26
2	6	27	22	52	24	77	26
3	0	28	22	53	27	78	25
4	0	29	23	54	27	79	21
5	0	30	23	55	24	80	27
6	0	31	19	56	24	81	29
7	0	32	18	57	27	82	29
8	0	33	18	58	26	83	29
9	7	34	19	59	28	84	
10	7	35	19	60	28	85	
11	7	36	23	61	28	86	
12	7	37	21	62	28	87	
13	12	38	24	63	27	88	
14	12	39	24	64	27	89	
15	16	40	23	65	27	90	
16	19	41	23	66	28	91	
17	16	42	23	67	28	92	
18	15	43	25	68	28	93	
19	15	44	26	69	23	94	
20	19	45	28	70	26	95	
21	19	46	26	71	26	96	
22	19	47	24	72	25	97	
23	19	48	24	73	25	98	
24	20	49	23	74	26	99	
25	20	50	25	75	26	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-233

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	19	51	26	76	28
2	0	27	23	52	27	77	26
3	7	28	24	53	25	78	26
4	7	29	21	54	28	79	28
5	8	30	18	55	30	80	29
6	8	31	18	56	30	81	30
7	6	32	18	57	31	82	30
8	6	33	18	58	31	83	30
9	6	34	24	59	28	84	31
10	9	35	22	60	28	85	29
11	9	36	27	61	28	86	29
12	9	37	27	62	27	87	30
13	16	38	31	63	28	88	30
14	16	39	29	64	28	89	31
15	18	40	27	65	28	90	
16	18	41	27	66	23	91	
17	21	42	25	67	23	92	
18	21	43	26	68	27	93	
19	21	44	29	69	27	94	
20	23	45	28	70	28	95	
21	23	46	30	71	25	96	
22	23	47	29	72	25	97	
23	18	48	28	73	25	98	
24	18	49	25	74	24	99	
25	18	50	25	75	24	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-234

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	6	26	27	51	30	76	33
2	6	27	26	52	30	77	33
3	6	28	30	53	32	78	32
4	7	29	28	54	33	79	31
5	7	30	24	55	33	80	32
6	5	31	27	56	32	81	32
7	5	32	26	57	32	82	32
8	6	33	26	58	29	83	33
9	6	34	26	59	31	84	
10	10	35	26	60	31	85	
11	10	36	30	61	31	86	
12	10	37	31	62	31	87	
13	10	38	31	63	30	88	
14	12	39	28	64	31	89	
15	12	40	30	65	30	90	
16	11	41	30	66	30	91	
17	13	42	32	67	29	92	
18	13	43	32	68	29	93	
19	17	44	32	69	31	94	
20	29	45	32	70	28	95	
21	26	46	32	71	31	96	
22	28	47	31	72	31	97	
23	28	48	31	73	30	98	
24	29	49	28	74	32	99	
25	27	50	29	75	32	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-235

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	0	26	25	51	28	76	28
2	0	27	24	52	28	77	28
3	0	28	24	53	31	78	29
4	7	29	21	54	30	79	29
5	7	30	26	55	29	80	29
6	7	31	26	56	30	81	28
7	8	32	27	57	30	82	29
8	8	33	27	58	29	83	30
9	8	34	28	59	29	84	30
10	9	35	28	60	30	85	31
11	9	36	27	61	30	86	31
12	10	37	29	62	31	87	30
13	12	38	29	63	31	88	31
14	12	39	28	64	32	89	31
15	17	40	28	65	31	90	
16	18	41	29	66	29	91	
17	21	42	29	67	30	92	
18	18	43	30	68	32	93	
19	24	44	31	69	30	94	
20	20	45	34	70	29	95	
21	19	46	33	71	28	96	
22	19	47	33	72	28	97	
23	20	48	32	73	28	98	
24	22	49	30	74	32	99	
25	22	50	31	75	30	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-236

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	15	26	21	51	21	76	24
2	15	27	19	52	21	77	24
3	15	28	22	53	17	78	25
4	15	29	21	54	17	79	25
5	15	30	18	55	18	80	
6	15	31	18	56	25	81	
7	15	32	19	57	25	82	
8	15	33	21	58	25	83	
9	15	34	17	59	27	84	
10	18	35	15	60	27	85	
11	18	36	15	61	28	86	
12	19	37	15	62	28	87	
13	22	38	18	63	27	88	
14	22	39	18	64	28	89	
15	22	40	22	65	28	90	
16	22	41	22	66	28	91	
17	22	42	23	67	29	92	
18	22	43	21	68	29	93	
19	22	44	22	69	28	94	
20	21	45	23	70	24	95	
21	21	46	21	71	24	96	
22	21	47	21	72	24	97	
23	19	48	23	73	24	98	
24	19	49	22	74	24	99	
25	19	50	20	75	25	100	

NOTE: Hose to box was kinked. Energy not accurate above 56 feet.

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-237

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	10	26	28	51	32	76	32
2	10	27	27	52	31	77	30
3	12	28	27	53	31	78	32
4	14	29	24	54	30	79	32
5	16	30	24	55	32	80	
6	16	31	24	56	32	81	
7	17	32	24	57	32	82	
8	18	33	25	58	32	83	
9	18	34	25	59	32	84	
10	20	35	28	60	30	85	
11	23	36	28	61	30	86	
12	25	37	28	62	32	87	
13	25	38	28	63	31	88	
14	25	39	30	64	32	89	
15	26	40	28	65	32	90	
16	28	41	28	66	31	91	
17	28	42	26	67	31	92	
18	25	43	28	68	30	93	
19	25	44	28	69	30	94	
20	23	45	26	70	31	95	
21	23	46	30	71	31	96	
22	25	47	32	72	31	97	
23	25	48	32	73	32	98	
24	25	49	32	74	32	99	
25	28	50	30	75	32	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-238

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	15	26	27	51	32	76	32
2	15	27	28	52	32	77	32
3	15	28	28	53	32	78	32
4	17	29	29	54	31	79	32
5	17	30	26	55	32	80	
6	20	31	26	56	32	81	
7	20	32	30	57	32	82	
8	23	33	30	58	32	83	
9	23	34	30	59	32	84	
10	24	35	31	60	30	85	
11	25	36	31	61	30	86	
12	25	37	31	62	32	87	
13	25	38	31	63	30	88	
14	25	39	30	64	32	89	
15	26	40	32	65	32	90	
16	26	41	29	66	32	91	
17	26	42	29	67	32	92	
18	26	43	32	68	32	93	
19	20	44	32	69	30	94	
20	23	45	29	70	29	95	
21	23	46	29	71	29	96	
22	23	47	31	72	31	97	
23	25	48	31	73	31	98	
24	25	49	31	74	31	99	
25	25	50	31	75	31	100	

PRICE ROAD DRAIN TUNNEL
HAMMER DRILL - BOUNCE CHAMBER PRESSURE vs. DEPTH
BORING NO. B-239

DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)	DEPTH (ft)	BOUNCE CHAMBER PRESSURE (psi)
1	15	26	28	51	26	76	25
2	15	27	26	52	26	77	24
3	15	28	29	53	24	78	26
4	14	29	28	54	29	79	28
5	14	30	26	55	29	80	
6	15	31	26	56	28	81	
7	19	32	27	57	25	82	
8	19	33	26	58	25	83	
9	19	34	28	59	25	84	
10	21	35	27	60	25	85	
11	21	36	27	61	26	86	
12	22	37	26	62	26	87	
13	25	38	26	63	30	88	
14	25	39	28	64	30	89	
15	28	40	25	65	29	90	
16	25	41	25	66	29	91	
17	27	42	23	67	29	92	
18	25	43	25	68	29	93	
19	23	44	20	69	27	94	
20	23	45	28	70	26	95	
21	23	46	27	71	26	96	
22	24	47	28	72	24	97	
23	27	48	28	73	25	98	
24	27	49	28	74	27	99	
25	28	50	25	75	27	100	

LABORATORY TEST DATA SUMMARY
PRICE ROAD DRAIN TUNNEL
TEMPE, ARIZONA
CRSS JOB NO. 11106
PAGE 1

HOLE NO.	TEST NO.	SAMPLE DEPTH TOP	SAMPLE DEPTH BOT.	WATER CONT. (%)	SEPARATE WATER CONT. (%)	LL	PL	PI	GRAIN SIZE, IN MM, BASED ON 100% PASSING 2-1/2" 2-1/2 62.5	2" 50	1-1/2 37.5	1" 25	3/4" 19	1/2" 12.50	3/8" 9.50	1/4" 6.30	#4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075	GRAIN SIZE, BASED ON 100% PASSING #4 SIEVE #4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075
LDB-01	12	85.0	87.0	15.2	15.3				100	100	100	88	78	62	56	50	47	41	39	34	23	18	13	8	6.2	100	87	83	72	49	38	28	17	13
LDB-01	NS1	81.0	83.0																																
LDB-01	62	78.0	80.0	8.1	6.8				100	96	77	65	57	53	50	47	46	44	43	39	15	7	5	4	3.0	100	96	93	85	33	15	11	9	7
LDB-01	63	75.0	77.0	11.0	4.6				100	100	89	75	67	57	52	37	24	20	19	16	10	8	6	3	2.1	100	83	79	67	42	33	25	13	9
LDB-01	NS4	72.0	74.0																																
LDB-01	65	69.0	71.0	6.2	7.6	45	16	29	100	85	67	55	46	40	36	33	31	29	28	26	16	10	7	4	3.2	100	94	90	84	52	32	23	13	10
LDB-01	66	66.0	68.0	8.7	5.7				100	92	78	60	49	41	36	32	30	25	24	21	16	12	9	4	2.8	100	83	80	70	53	40	30	13	9
LDB-01	67	63.0	65.0		7.8																														
LDB-01	68	60.0	62.0	10.8	9.4				100	100	80	64	54	46	40	34	31	26	24	20	17	10	7	5	3.3	100	84	77	65	55	32	23	16	11
LDB-01	69	57.0	59.0	8.7	8.1				100	100	84	62	52	43	37	33	30	26	25	21	14	10	8	5	3.0	100	87	83	70	47	33	27	17	10
LDB-01	610	54.0	56.0	9.2	8.8	54	18	36	100	85	73	52	41	31	26	21	19	14	13	11	9	8	7	5	3.1	100	74	68	58	47	42	37	26	16
LDB-01	611	51.0	53.0		7.7																														
LDB-01	612	48.0	50.0	8.1	7.8				100	91	80	68	54	45	40	35	33	30	29	26	16	10	7	4	2.8	100	91	88	79	48	30	21	12	8
LDB-02	61	84.0	86.0	7.2	4.4				100	92	82	69	58	48	43	37	34	29	27	22	11	7	5	3	2.7	100	85	79	65	32	21	15	9	8
LDB-02	62	81.0	83.0		4.1																														
LDB-02	63	78.0	79.5	11.1	6.5				100	87	77	67	56	46	41	37	35	32	31	28	15	9	6	4	3.1	100	91	89	80	43	26	17	11	9
LDB-02	64	75.0	77.0		4.6																														
LDB-02	65	72.0	74.0	4.9	6.1				100	93	74	56	45	37	33	28	25	21	20	17	13	11	9	7	4.7	100	84	80	68	52	44	36	28	19
LDB-02	66	70.3	71.0	7.7	9.3				100	100	100	100	100	100	100	100	99	99	99	99	90	68	42	13	5.5	100	100	100	100	91	69	42	13	6
LDB-02	67	66.0	68.0	9.1	5.1				100	79	63	48	42	37	36	34	33	31	30	28	21	15	9	4	2.1	100	94	91	85	64	45	27	12	6
LDB-02	68	63.0	65.0		5.5																														
LDB-02	69	60.0	62.0	7.0	5.7				100	98	83	65	56	45	39	33	30	25	24	20	12	8	4	2	1.2	100	83	80	67	40	27	13	7	4
LDB-02	610	57.0	58.0	5.8	7.7				100	100	100	100	100	100	100	100	100	100	100	98	70	29	8	2	0.8	100	100	100	98	70	29	8	2	1
LDB-02	NS11	54.0	56.0																																
LDB-02	612	51.0	53.0	5.7	4.6				100	89	67	52	44	36	32	29	28	26	26	23	14	8	4	2	0.9	100	93	93	82	50	29	14	7	3
LDB-03	61	89.0	91.0	11.5	11.5	61	17	44	100	90	85	63	52	40	34	28	26	22	21	18	13	9	7	5	3.6	100	85	81	69	50	35	27	19	14
LDB-03	62	86.0	88.0		9.5																														
LDB-03	63	83.0	85.0	9.7	8.6				100	93	82	68	61	54	49	44	40	32	30	23	13	10	8	5	3.9	100	80	75	58	33	25	20	13	10
LDB-03	64	80.0	82.0		11.1																														
LDB-03	65	77.0	79.0	3.4	8.4	43	17	26	100	86	71	58	50	44	39	35	33	29	27	23	14	10	7	5	4.1	100	88	82	70	42	30	21	15	12
LDB-03	66	74.0	76.0	12.6	8.0				100	86	61	52	47	41	37	33	32	29	28	26	19	14	10	5	3.3	100	91	88	81	59	44	31	16	10
LDB-03	67	71.0	73.0	6.2	6.5	77	21	56	100	81	68	49	41	31	27	23	21	19	18	14	8	6	5	4	3.1	100	90	86	67	38	29	24	19	15
LDB-03	68	68.0	70.0		9.2																														
LDB-03	69	65.5	67.0	4.7	6.8				100	90	70	57	51	44	39	34	31	27	26	23	16	13	10	7	5.1	100	87	84	74	52	42	32	23	16
LDB-03	610	62.0	64.0	4.3	20.1	104	27	77	100	84	70	51	38	26	19	14	12	10	9	8	7	6	6	5	4.6	100	83	75	67	58	50	50	42	38
LDB-03	611	59.0	60.0		6.6																														
LDB-03	612	56.0	58.0	4.1	5.6				100	97	83	66	58	49	43	38	36	32	31	25	14	9	6	3	2.1	100	89	86	69	39	25	17	8	6

LABORATORY TEST DATA SUMMARY
PRICE ROAD DRAIN TUNNEL
TEMPE, ARIZONA
CRSS JOB NO. 11106
PAGE 2

HOLE NO.	TEST NO.	SAMPLE TOP	SAMPLE BOT.	DEPTH WATER CONT. (%)	SEPARATE WATER CONT. (%)	LL	PL	PI	GRAIN SIZE, IN MM, BASED ON 100% PASSING 2-1/2" 2-1/2 62.5	2" 50	1-1/2 37.5	1" 25	3/4" 19	1/2" 12.50	3/8" 9.50	1/4" 6.30	#4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075	GRAIN SIZE, BASED ON 100% PASSING #4 SIEVE #4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075
LDB-04	NS1	84.0	86.0																																
LDB-04	NS2	81.0	83.0																																
LDB-04	G3	78.0	80.0	15.7	14.7				100	100	100	100	100	100	100	100	100	100	100	100	98	92	72	20	6.5	100	100	100	100	98	92	72	20	7
LDB-04	G4	75.0	77.0	6.4	13.2				100	84	73	58	48	40	28	22	19	17	16	13	10	8	5	3	2.0	100	89	84	68	53	42	24	16	11
LDB-04	G5	72.5	74.5		5.9																														
LDB-04	G6	69.0	71.0	6.1	9.9				100	89	83	66	58	51	47	43	40	34	34	28	17	12	9	6	5.2	100	90	85	70	43	30	23	15	13
LDB-04	G7	66.0	68.0	7.2	8.5	34	19	17	100	95	79	67	60	52	46	40	36	30	28	24	17	14	11	7	5.2	100	83	78	67	47	39	31	19	14
LDB-04	G8	63.0	65.0	5.9	7.3				100	82	74	63	55	46	40	35	32	29	29	26	16	9	6	4	3.8	100	91	91	81	50	28	19	13	12
LDB-04	G9	60.0	62.0		6.6																														
LDB-04	G10	57.0	59.0	4.0	7.4				100	87	75	57	48	38	32	26	24	20	19	16	9	6	5	4	3.2	100	83	79	67	38	25	21	17	13
LDB-04	G11	54.0	56.0	5.7	5.7				100	90	76	58	47	39	33	28	25	22	21	20	17	14	10	5	2.9	100	88	84	80	68	56	40	20	12
LDB-04	G12	51.0	53.0																																
LDB-05	NS1	86.0	88.0																																
LDB-05	G2	83.0	85.0	7.8	7.5	39	19	20	100	79	65	47	37	29	25	22	21	19	19	18	15	12	9	5	3.6	100	90	90	86	71	57	43	24	17
LDB-05	G3	80.6	82.0		9.8																														
LDB-05	G4	77.0	79.0	5.7	7.8				100	95	73	55	50	46	45	43	42	41	40	38	23	13	7	4	3.6	100	98	95	90	55	31	17	10	9
LDB-05	G5	74.5	76.5		4.9																														
LDB-05	G6	71.0	73.0	7.2	8.8				100	100	93	85	79	72	67	62	59	53	51	41	21	15	12	9	6.4	100	90	86	69	36	25	20	15	11
LDB-05	G7	68.0	70.0	5.5	7.6				100	100	79	57	47	41	36	31	29	26	25	23	18	14	10	5	4.1	100	90	86	79	62	48	34	17	14
LDB-05	G8	65.0	67.0	5.8	8.0				100	93	74	55	48	41	35	30	27	24	23	20	14	11	8	5	4.1	100	89	85	74	52	41	30	19	15
LDB-05	G9	62.0	64.0	6.4	6.5				100	100	80	67	53	43	42	38	37	35	34	29	15	9	6	4	3.4	100	95	92	78	41	24	16	11	9
LDB-05	G10	59.0	61.0	3.9	6.9				100	100	78	58	46	39	36	33	32	30	30	29	24	17	10	5	4.3	100	94	94	91	75	53	31	16	13
LDB-05	G11	56.0	58.0	4.7	6.9	NP		NP	100	93	84	65	57	46	40	34	31	27	26	23	17	14	11	7	4.8	100	87	84	74	55	45	35	23	15
LDB-05	NS12	53.0	55.0																																
LDB-06	G1	89.0	91.0	2.6	10.3	57	17	40	100	95	84	70	59	50	43	36	32	26	24	20	13	10	7	4	3.2	100	81	75	63	41	31	22	13	10
LDB-06	G2	86.0	88.0		9.7																														
LDB-06	G3	83.0	85.0		8.9																														
LDB-06	G4	80.8	82.0	3.4	9.9	44	19	25	100	91	77	59	48	40	34	28	26	22	21	19	13	10	8	6	4.1	100	85	81	73	50	38	31	23	16
LDB-06	G5	77.0	79.0	10.7	6.7				100	91	83	69	57	44	37	30	27	22	21	17	10	8	5	3	2.1	100	81	78	63	37	30	19	11	8
LDB-06	G6	74.8	76.0		6.5																														
LDB-06	G7	71.0	72.3	6.3	9.3				100	100	77	59	45	37	32	28	27	24	24	22	21	19	15	8	5.3	100	89	89	81	78	70	56	30	20
LDB-06	G8	68.3	70.0	7.5	9.8	42	13	29	100	100	95	88	82	72	65	56	50	39	36	29	24	23	21	16	13.0	100	78	72	58	48	46	42	32	26
LDB-06	G9	65.0	67.0		10.5																														
LDB-06	G10	62.0	64.0	4.5	15.1				100	81	77	68	59	48	42	38	36	35	35	34	32	29	23	13	8.2	100	97	97	94	89	81	64	36	23
LDB-06	G11	59.2	61.0		6.5																														
LDB-06	G12	56.0	58.0	4.1	10.6				100	88	61	44	39	34	32	30	28	26	25	22	14	9	7	5	4.0	100	93	89	79	50	32	25	18	14

LABORATORY TEST DATA SUMMARY
PRICE ROAD DRAIN TUNNEL
TEMPE, ARIZONA
CRSS JOB NO. 11106
PAGE 3

GRAIN SIZE, IN MM, BASED ON 100% PASSING 2-1/2"

HOLE NO.	TEST NO.	SAMPLE DEPTH TOP	SAMPLE DEPTH BOT.	WATER CONT. (%)	SEPARATE WATER CONT. (%)	LL	PL	PI	2-1/2 62.5	2" 50	1-1/2 37.5	1" 25	3/4" 19	1/2" 12.50	3/8" 9.50	1/4" 6.30	#4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075
LDB-07	G1	87.8	89.8	2.3	11.1				100	78	57	48	41	34	31	28	26	24	23	21	12	8	7	5	3.9
LDB-07	G2	84.8	86.3		11.9																				
LDB-07	G3	81.8	83.8		7.3																				
LDB-07	G4	79.4	80.8	11.8	10.5				100	88	76	51	44	37	34	31	30	29	29	28	27	25	20	11	7.1
LDB-07	G5	75.8	77.8	1.9	5.2				100	95	73	51	45	39	34	33	31	28	27	23	14	10	7	5	3.8
LDB-07	G6	72.8	74.8		9.0																				
LDB-07	G7	69.8	71.8	3.8	12.5				100	95	88	78	72	64	60	55	53	48	46	38	18	11	9	7	5.9
LDB-07	G8	66.8	68.8	2.6	11.2	60	15	45	100	88	78	62	51	38	32	25	20	14	12	10	9	8	7	5	3.9
LDB-07	G9	63.8	65.8		7.8																				
LDB-07	G10	60.8	62.8	5.3	6.2				100	91	68	49	40	33	29	26	23	20	19	16	10	7	6	4	3.1
LDB-07	G11	57.8	59.8		5.7																				
LDB-07	G12	54.8	56.8	2.8	9.7	54	22	32	100	90	73	56	43	34	29	24	21	17	16	13	9	8	7	5	4.2
LDB-08	NS1	90.5	92.5																						
LDB-08	G2	87.5	89.5	4.0	9.5				100	100	90	85	81	78	75	73	72	71	70	68	53	31	18	11	9.0
LDB-08	G3	84.5	86.5		5.8																				
LDB-08	G4	81.5	83.5	6.1	8.5				100	100	97	84	74	59	50	42	39	34	33	30	22	14	9	6	4.8
LDB-08	G5	78.5	79.5	0.0	6.6	34	15	19	100	92	83	61	53	46	41	36	34	31	30	27	19	15	11	7	5.8
LDB-08	G6	76.0	77.1		7.0																				
LDB-08	G7	72.5	74.5	12.2	11.7	51	23	28	100	100	89	67	58	50	46	41	39	35	34	32	28	26	24	20	17.0
LDB-08	G8	69.5	71.5	2.1	7.4				100	97	94	82	76	69	62	55	50	42	40	35	23	16	11	7	5.5
LDB-08	G9	66.5	68.5		6.2																				
LDB-08	G10	63.9	65.1	6.8	9.1	NP		NP	100	100	100	100	100	100	100	100	100	99	99	95	61	29	10	3	1.4
LDB-08	G11	61.0	62.5		9.1																				
LDB-08	G12	57.5	59.5	11.4	4.3				100	91	77	59	47	37	32	28	26	24	23	20	11	5	2	1	0.6
LDB-09	G1	83.4	85.4	3.5	3.8				100	95	78	67	54	44	40	35	33	29	28	24	15	9	5	3	2.6
LDB-09	G2	80.4	82.4		5.6																				
LDB-09	G3	78.1	79.4																						
LDB-09	G4	74.7	76.4	5.3	7.0				100	92	79	64	56	50	46	40	37	33	31	27	17	12	9	6	5.1
LDB-09	G5	72.4	73.4	3.8	8.4				100	98	94	86	67	51	41	30	24	18	17	14	12	10	9	6	4.8
LDB-09	G6	68.4	70.4		13.4																				
LDB-09	G7	65.8	67.4																						
LDB-09	G8	62.4	64.4		5.3																				
LDB-09	G9	59.4	61.4	2.4	3.9				100	92	74	51	41	29	25	23	22	21	21	20	13	7	4	2	1.4
LDB-09	G10	56.4	58.4		4.3																				
LDB-09	G11	53.9	54.9	1.4	6.9				100	100	100	100	100	100	100	100	100	100	100	98	67	29	11	3	2.2
LDB-09	G12	50.4	52.4	4.6	4.8				100	91	71	58	50	41	36	31	28	25	24	21	17	14	10	6	3.7

GRAIN SIZE, BASED ON 100% PASSING #4 SIEVE

HOLE NO.	TEST NO.	#4 4.75	#8 2.36	#10 2.00	#16 1.18	#30 0.60	#40 0.425	#50 0.30	#100 0.15	#200 0.075
LDB-07	G1	100	92	88	81	46	31	27	19	15
LDB-07	G4	100	97	97	93	90	83	67	37	24
LDB-07	G5	100	90	87	74	45	32	23	16	12
LDB-07	G7	100	91	87	72	34	21	17	13	11
LDB-07	G8	100	70	60	50	45	40	35	25	20
LDB-07	G10	100	87	83	70	43	30	26	17	13
LDB-07	G12	100	81	76	62	43	38	33	24	20
LDB-08	G2	100	99	97	94	74	43	25	15	13
LDB-08	G5	100	87	85	77	56	36	23	15	12
LDB-08	G7	100	91	88	79	56	44	32	21	17
LDB-08	G8	100	90	87	82	72	67	62	51	44
LDB-08	G9	100	84	80	70	46	32	22	14	11
LDB-08	G10	100	99	99	95	61	29	10	3	1
LDB-08	G12	100	92	88	77	42	19	8	4	2
LDB-09	G1	100	88	85	73	45	27	15	9	8
LDB-09	G4	100	89	84	73	46	32	24	16	14
LDB-09	G5	100	75	71	58	50	42	38	25	20
LDB-09	G9	100	95	95	91	59	32	18	9	6
LDB-09	G11	100	100	100	98	67	29	11	3	2
LDB-09	G12	100	89	86	75	61	50	36	21	13

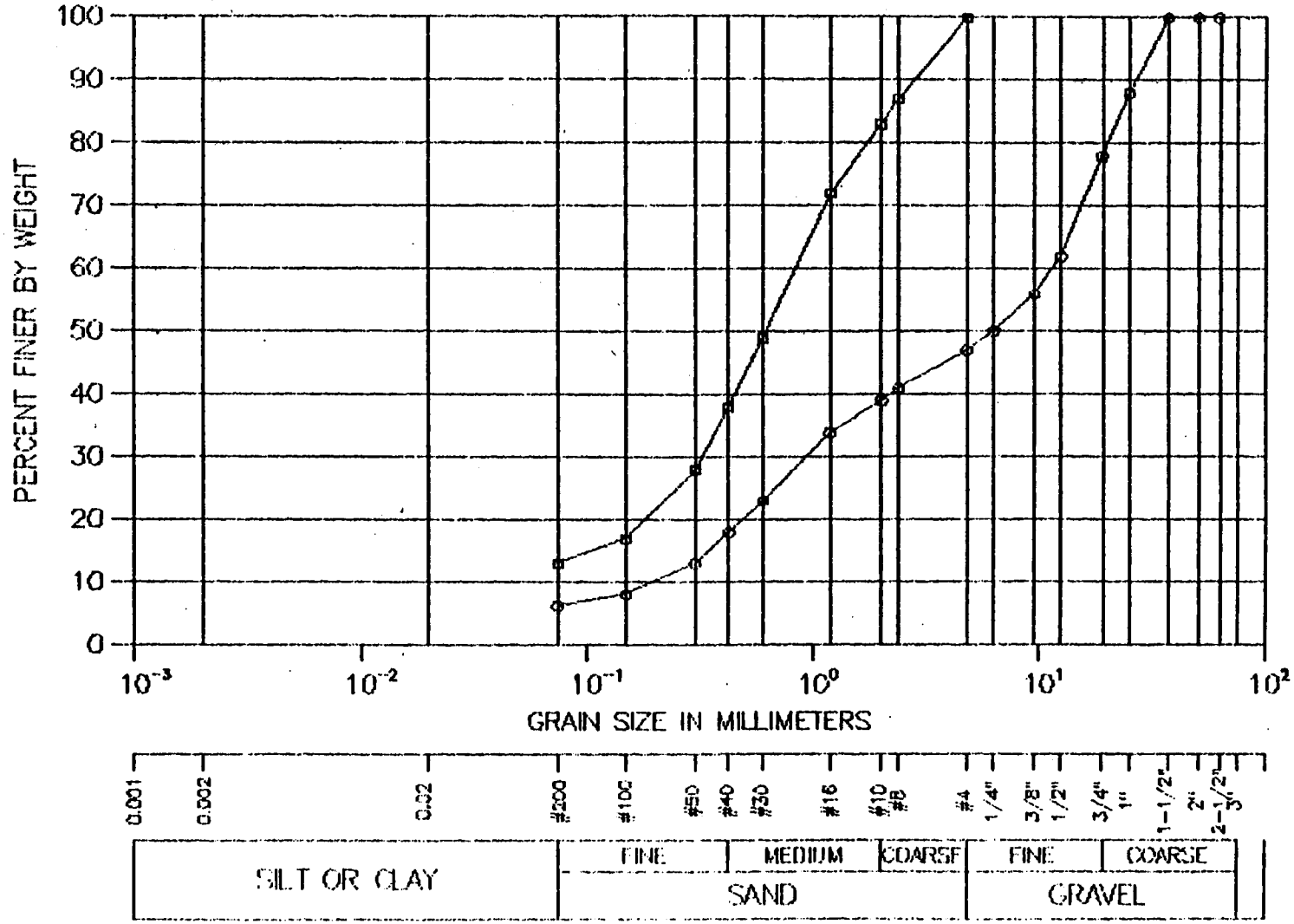
LABORATORY TEST DATA SUMMARY
PRICE ROAD DRAIN TUNNEL
TEMPE, ARIZONA
CRSS JOB NO. 11106
PAGE 4

HOLE NO.	TEST NO.	SAMPLE DEPTH TOP	SAMPLE DEPTH BOT.	WATER CONT. (%)	SEPARATE WATER CONT. (%)	LL	PL	PI	GRAIN SIZE, IN MM, BASED ON 100% PASSING 2-1/2" 2-1/2	2"	1-1/2	1"	3/4"	1/2"	3/8"	1/4"	#4	#8	#10	#16	#30	#40	#50	#100	#200	GRAIN SIZE, BASED ON 100% PASSING #4 SIEVE #4	#8	#10	#16	#30	#40	#50	#100	#200
									62.5	50	37.5	25	19	12.50	9.50	6.30	4.75	2.36	2.00	1.18	0.60	0.425	0.30	0.15	0.075	4.75	2.36	2.00	1.18	0.60	0.425	0.30	0.15	0.075
LDB-10	G1	78.5	80.5	4.1	8.5	38	14	24	100	95	83	70	59	48	42	35	31	28	26	23	16	11	8	5	3.5	100	90	84	74	52	35	26	16	11
LDB-10	G2	75.5	77.5		6.7																														
LDB-10	G3	73.3	74.5	2.2	8.8				100	100	100	96	86	74	65	53	47	39	37	33	24	18	12	6	4.1	100	83	79	70	51	38	26	13	9
LDB-10	G4	69.5	71.5		7.6																														
LDB-10	G5	66.5	68.5	3.4	5.6				100	95	80	67	58	52	43	38	35	31	29	23	15	11	8	5	3.0	100	89	83	66	43	31	23	14	9
LDB-10	G6	63.5	65.5	3.4	6.8				100	96	79	67	60	51	45	38	35	32	31	30	21	12	6	5	1.6	100	91	89	86	60	34	17	14	5
LDB-10	G7	60.5	62.5		13.4																														
LDB-10	G8	57.7	59.5	4.1	6.2				100	94	79	67	57	48	41	32	26	21	19	14	8	6	4	2	1.3	100	81	73	54	31	23	15	8	5
LDB-10	G9	54.5	56.5		5.6																														
LDB-10	G10	51.5	53.5	3.3	14.8				100	100	95	87	75	61	51	39	32	24	21	14	7	5	4	3	1.8	100	75	66	44	22	16	13	9	6
LDB-10	G11	48.5	50.5	1.9	5.0				100	98	82	61	50	40	33	30	27	26	25	23	14	9	5	2	0.9	100	96	93	85	52	33	19	7	3
LDB-10	G12	45.5	47.5		3.4																														
LDB-11 ** NO SAMPLES TAKEN **																																			
LDB-12 ** NO SAMPLES TAKEN **																																			
LDB-13	G1	69.3	71.3	3.1	10.0	92	20	72	100	88	67	46	36	28	24	18	14	10	9	7	6	5	4	3	2.7	100	71	64	50	43	36	29	21	19
LDB-13	G2	66.3	68.3		6.6																														
LDB-13	G3	63.3	65.3	3.8	5.9	NP		NP	100	91	73	61	53	47	43	38	35	30	29	27	22	18	13	7	4.3	100	86	83	77	63	51	37	20	12
LDB-13	G4	60.3	62.3	3.3	6.6				100	87	66	50	44	40	37	35	33	32	32	31	20	11	6	3	2.5	100	97	97	94	61	33	18	9	8
LDB-13	G5	57.3	59.3																																
LDB-13	G6	54.3	56.3	2.4	4.6				100	89	69	50	43	36	31	26	24	22	22	19	13	9	6	3	2.0	100	92	92	79	54	38	25	13	8
LDB-13	G7	52.0	53.3		4.2																														
LDB-13	G8	48.5	50.1	2.3	4.0				100	89	79	61	49	41	36	31	28	24	23	20	12	8	5	2	1.4	100	86	82	71	43	29	18	7	5
LDB-13	G9	45.3	47.3		3.3																														
LDB-13	G10	42.0	44.0	2.8	3.0				100	98	78	67	54	44	39	34	31	28	27	24	17	14	11	6	2.8	100	90	87	77	53	45	35	19	9
LDB-13	G11	39.1	41.1	2.0	3.9				100	96	84	67	55	47	42	37	34	33	32	27	15	8	4	2	1.0	100	92	89	75	42	22	11	6	3
LDB-13	G12	36.3	38.3		3.6																														

420

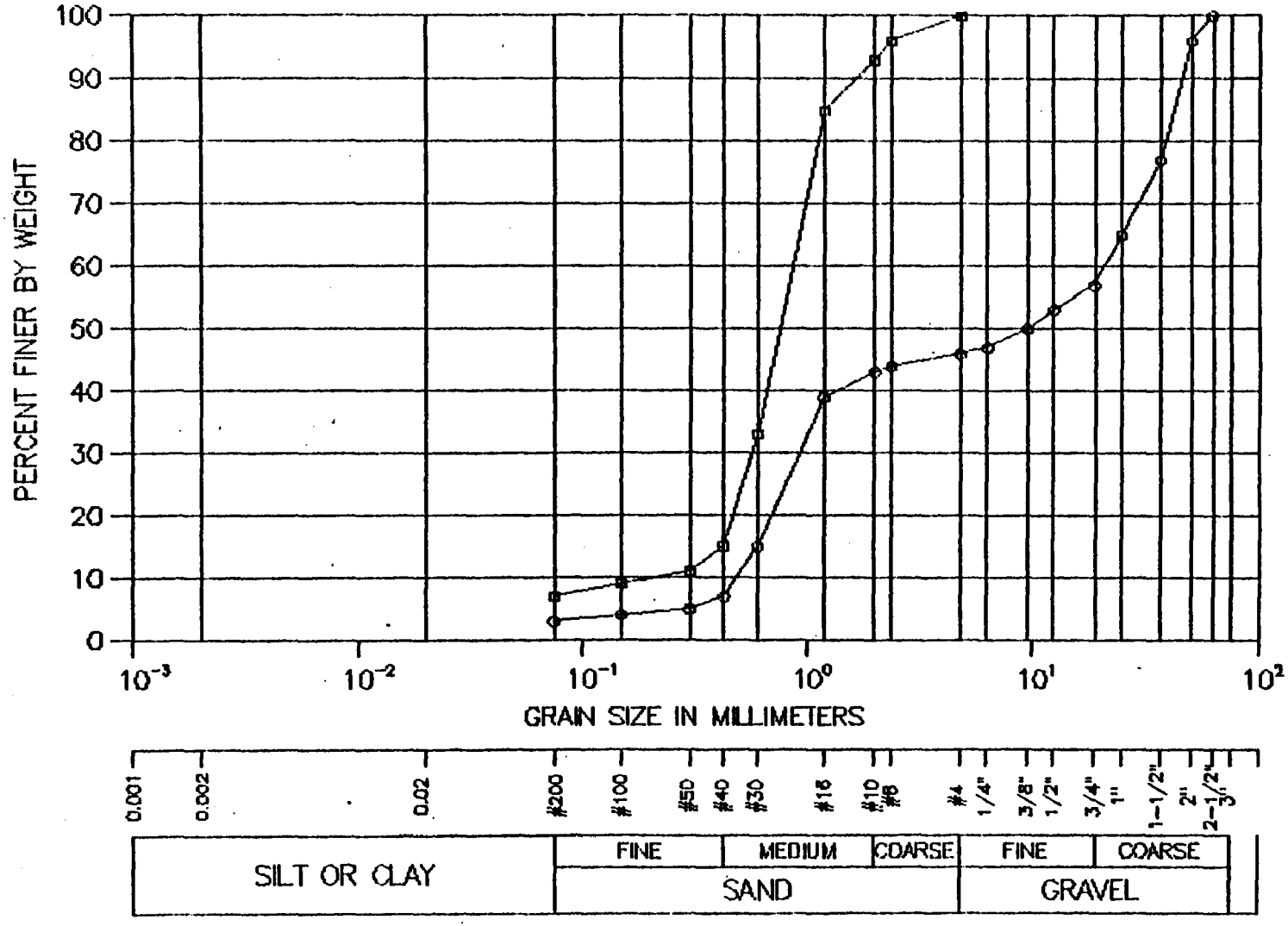
PRICE ROAD TUNNEL - GRAIN SIZE ANALYSIS CURVE

BORING LDB - 01, SAMPLE X2



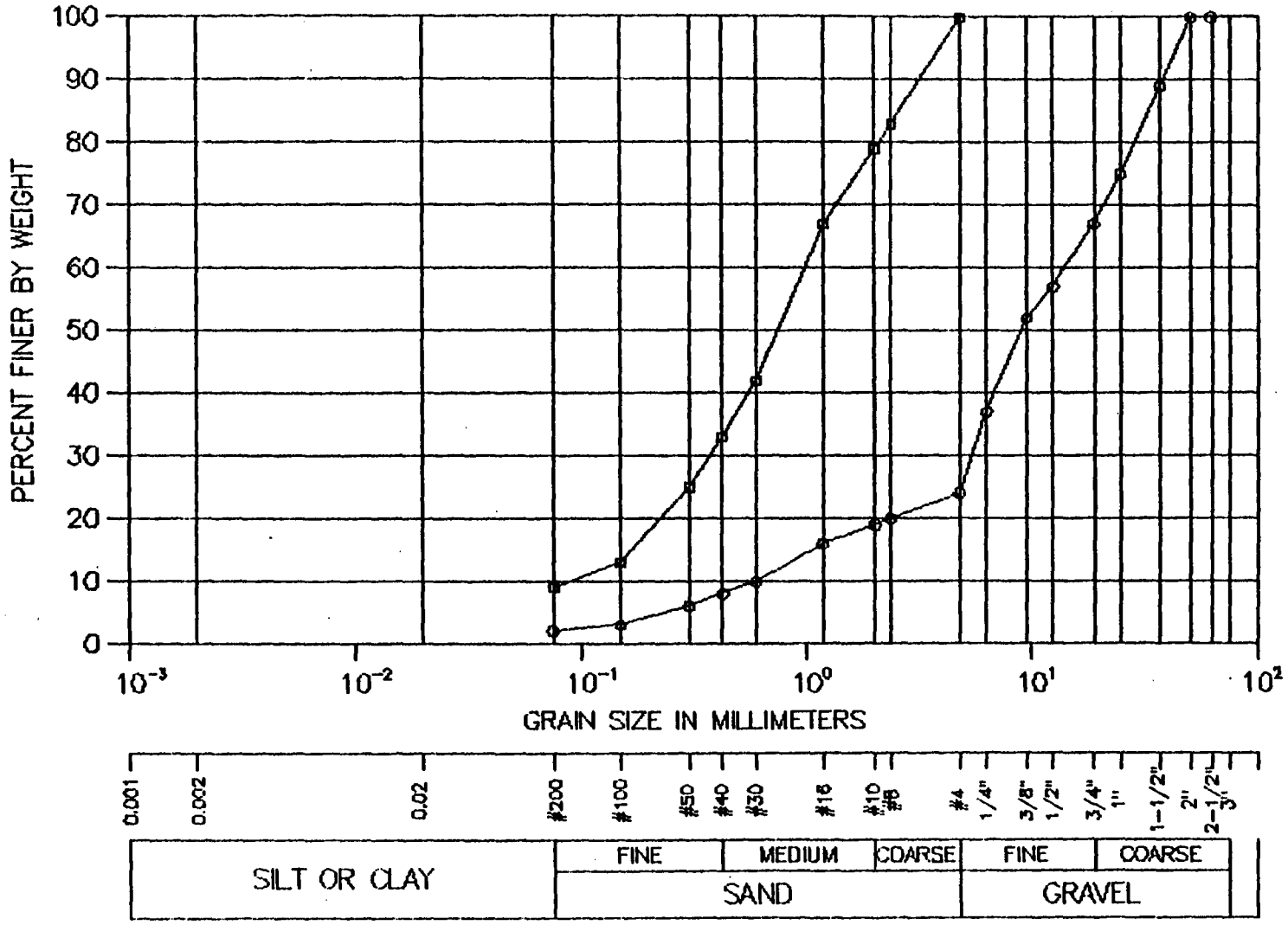
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 01, SAMPLE G2



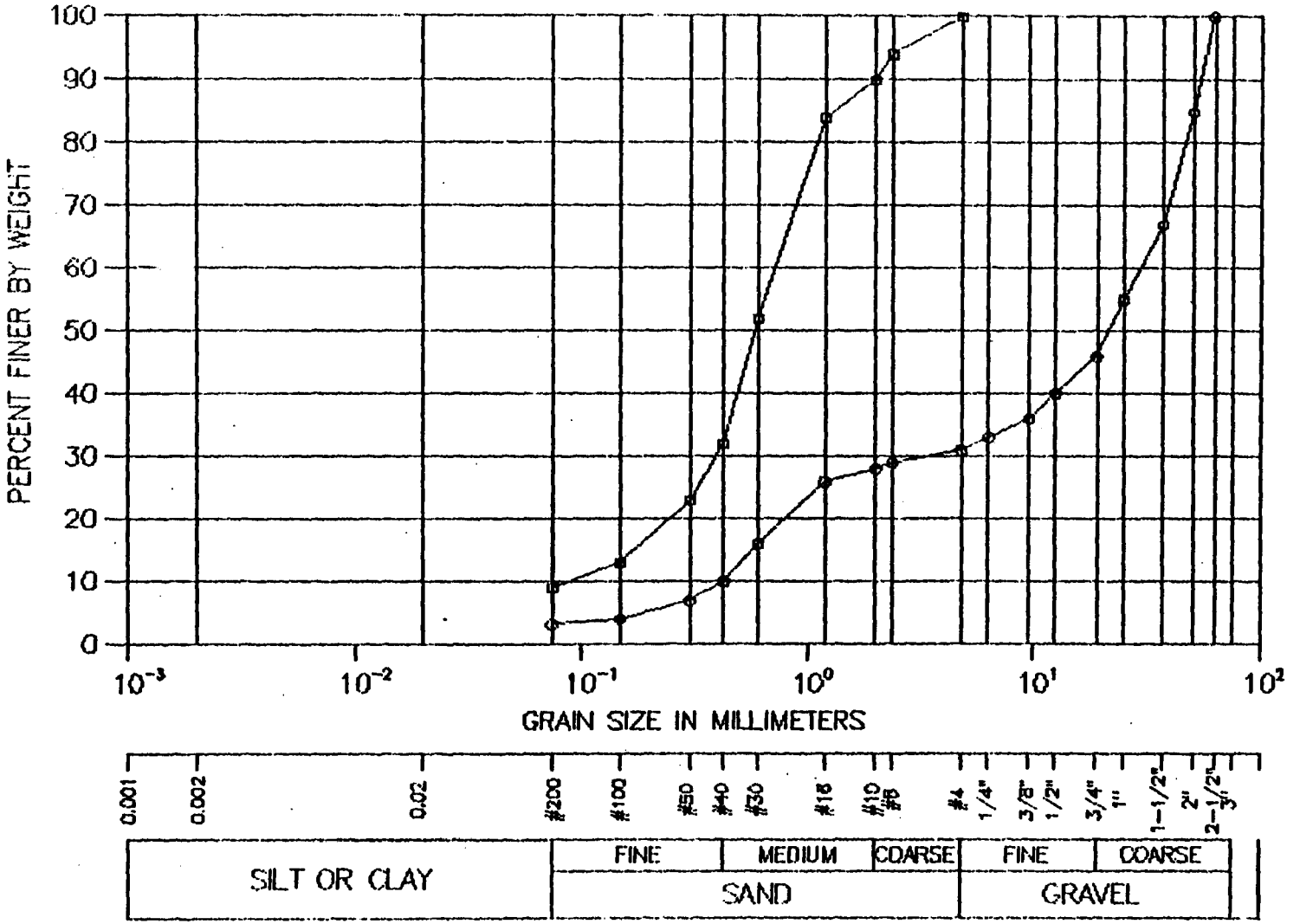
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 01, SAMPLE G3



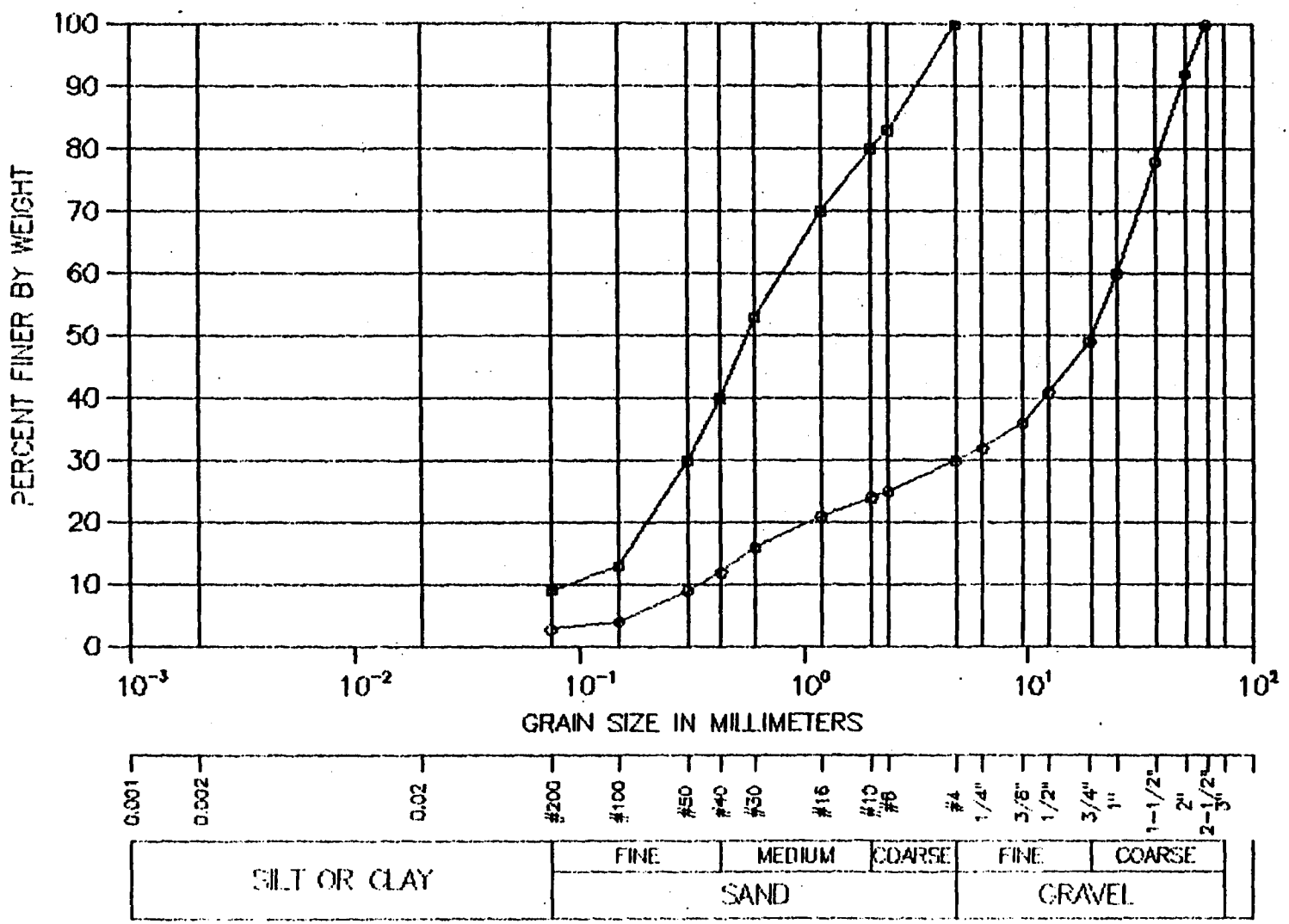
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LOB – 01, SAMPLE G5



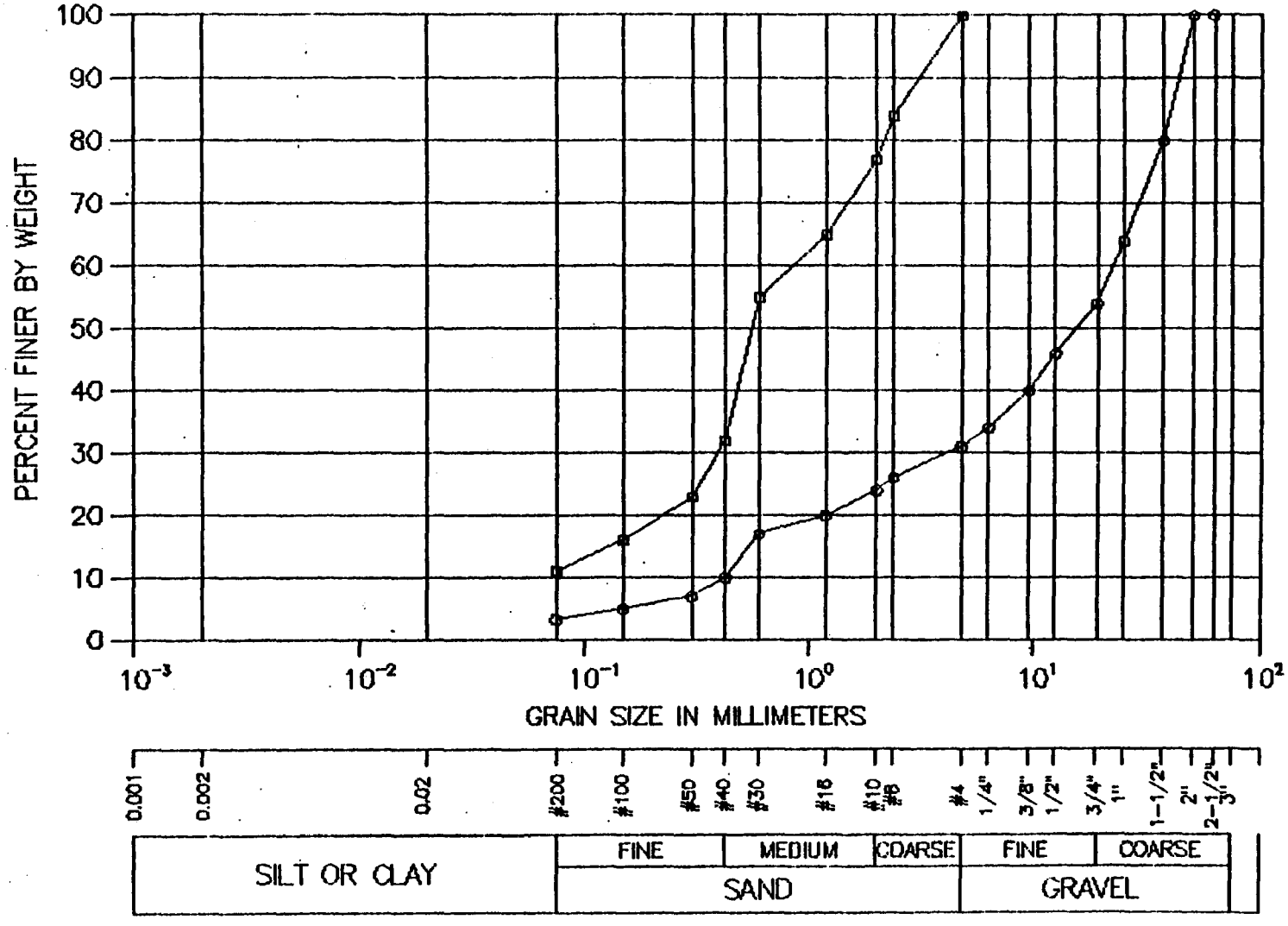
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 01, SAMPLE G6



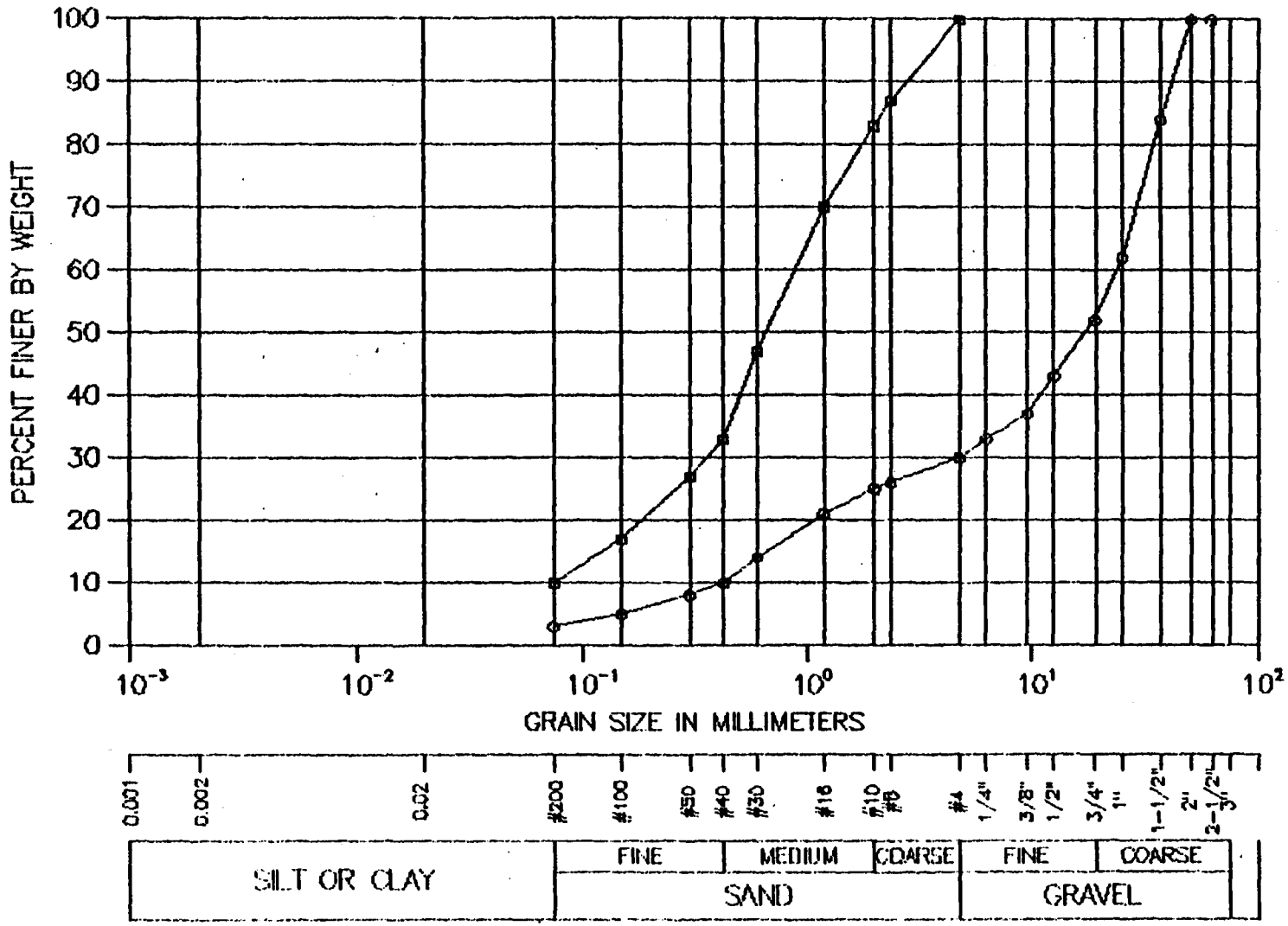
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 01, SAMPLE G8



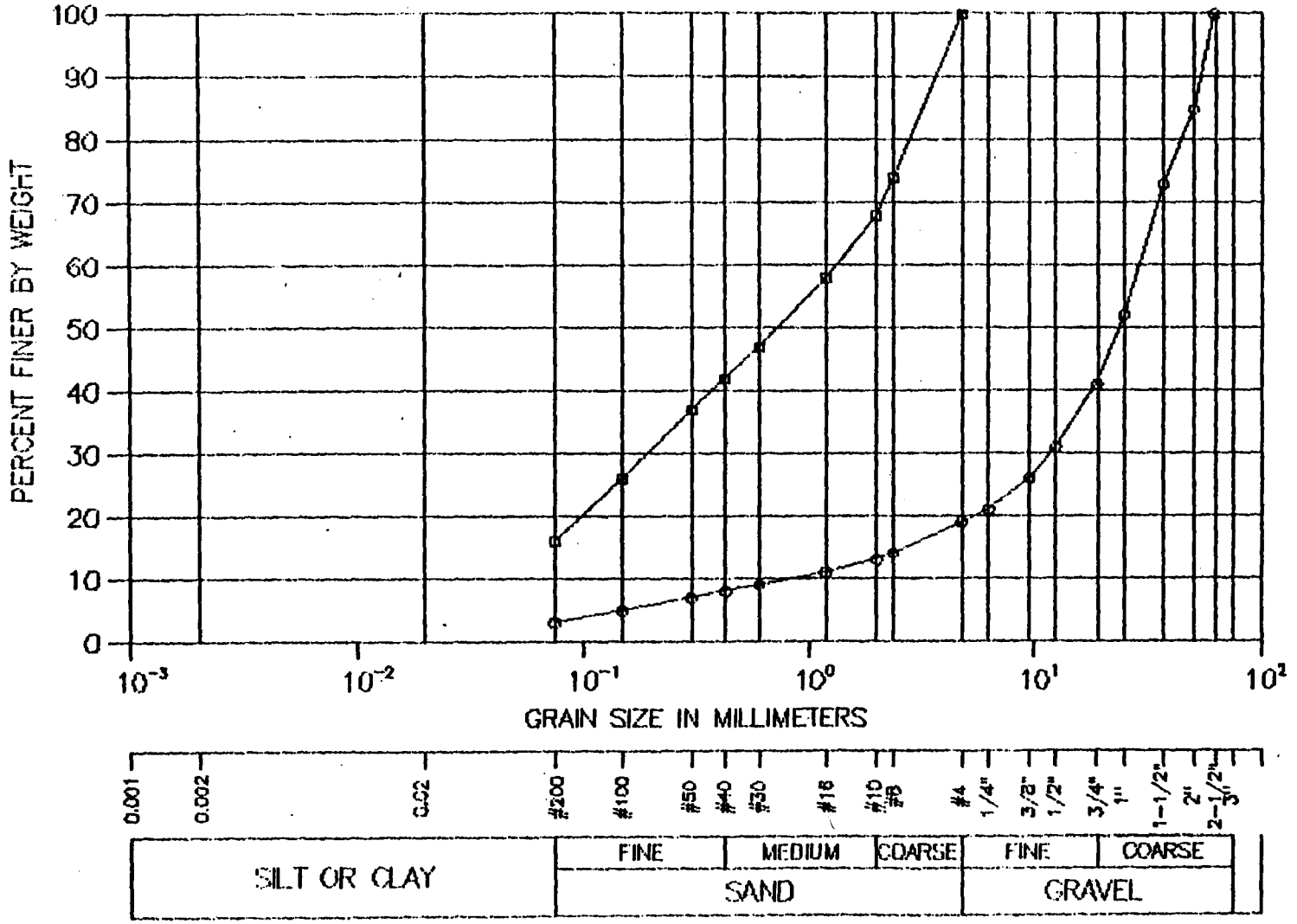
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 01, SAMPLE G9



PRICE ROAD TUNNEL -- GRAIN SIZE ANALYSIS CURVE

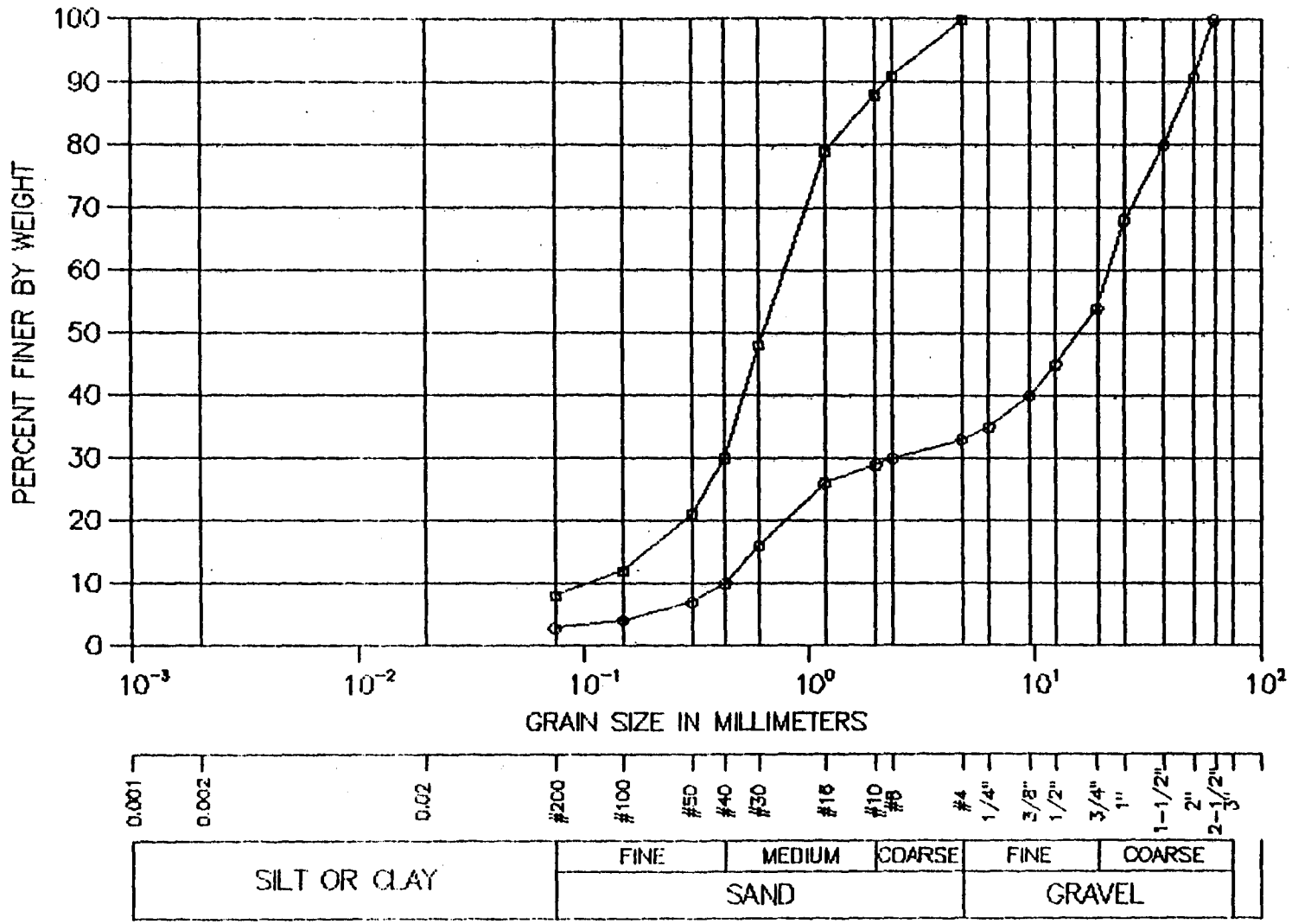
BORING LDB -- 01, SAMPLE G10



428

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

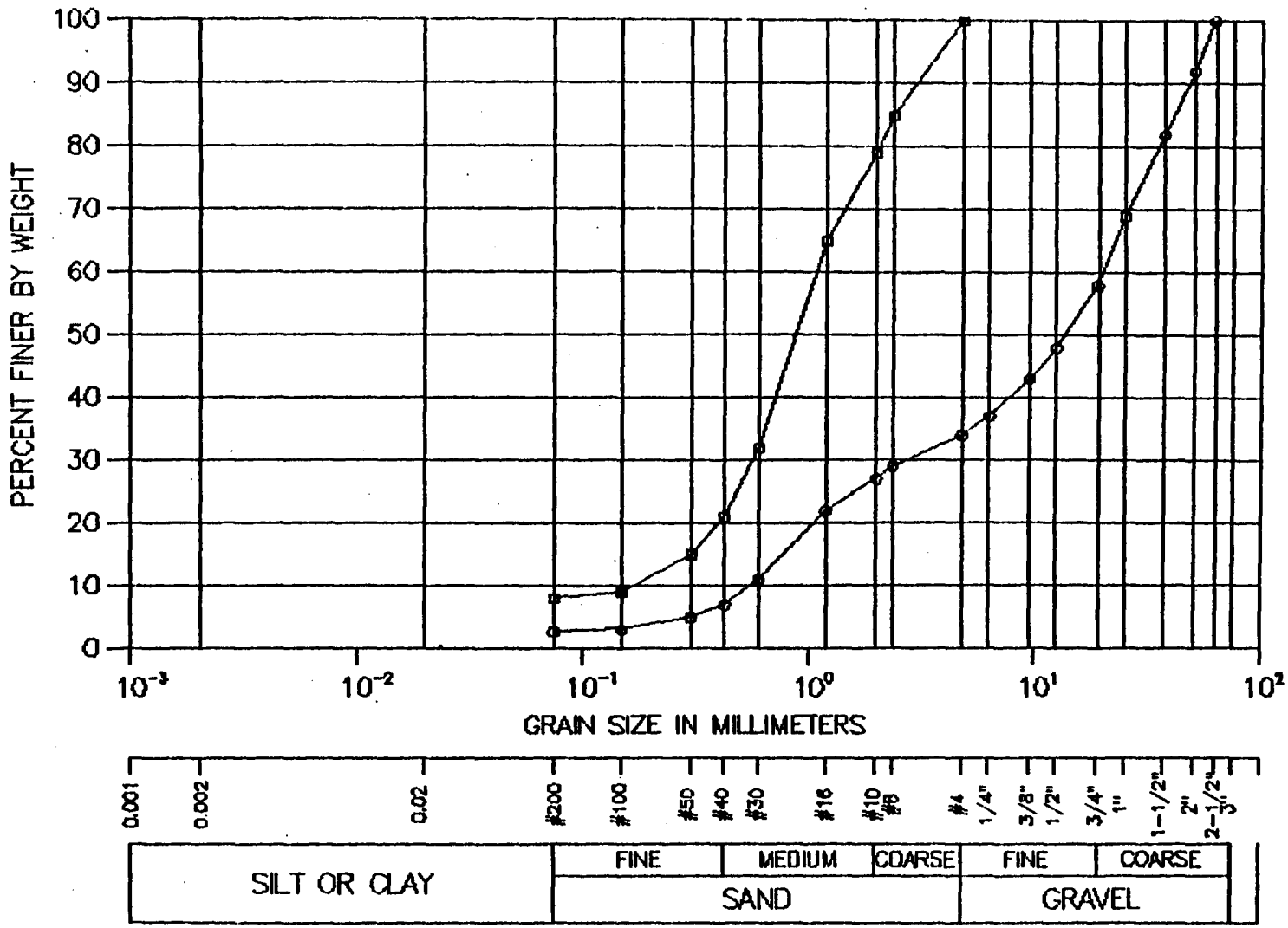
BORING LDB – 01, SAMPLE G12



429

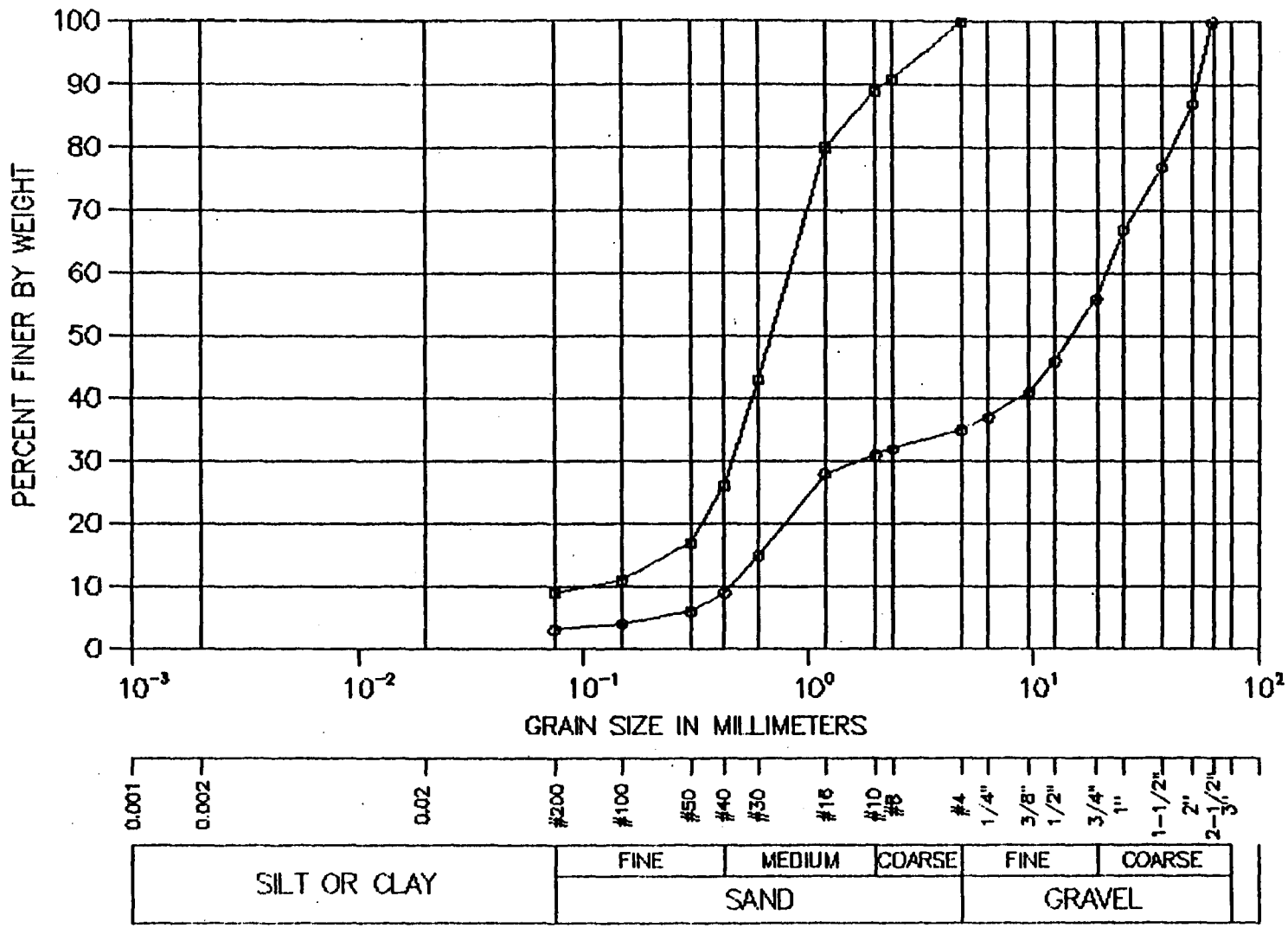
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 02, SAMPLE G1



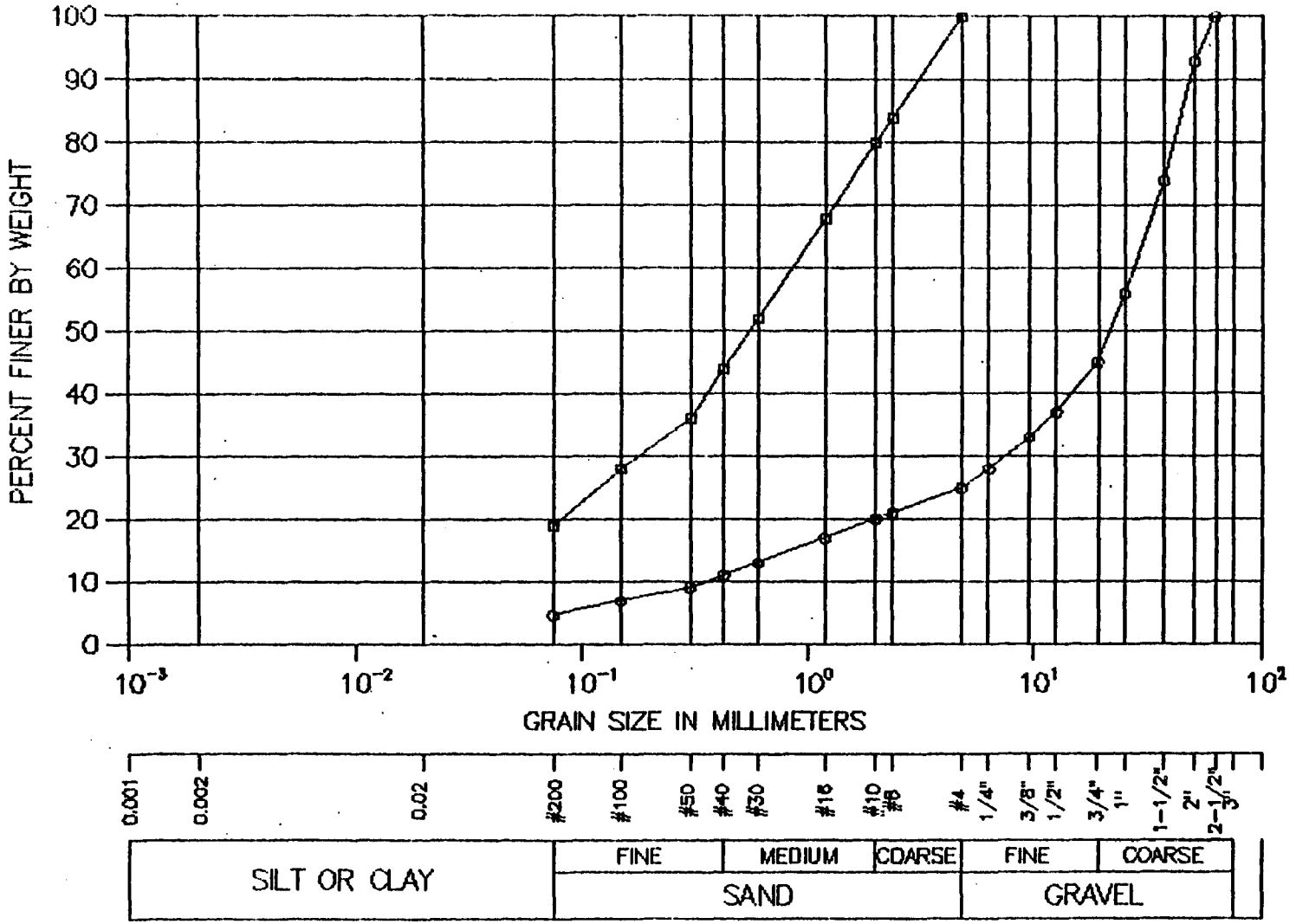
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 02, SAMPLE G3



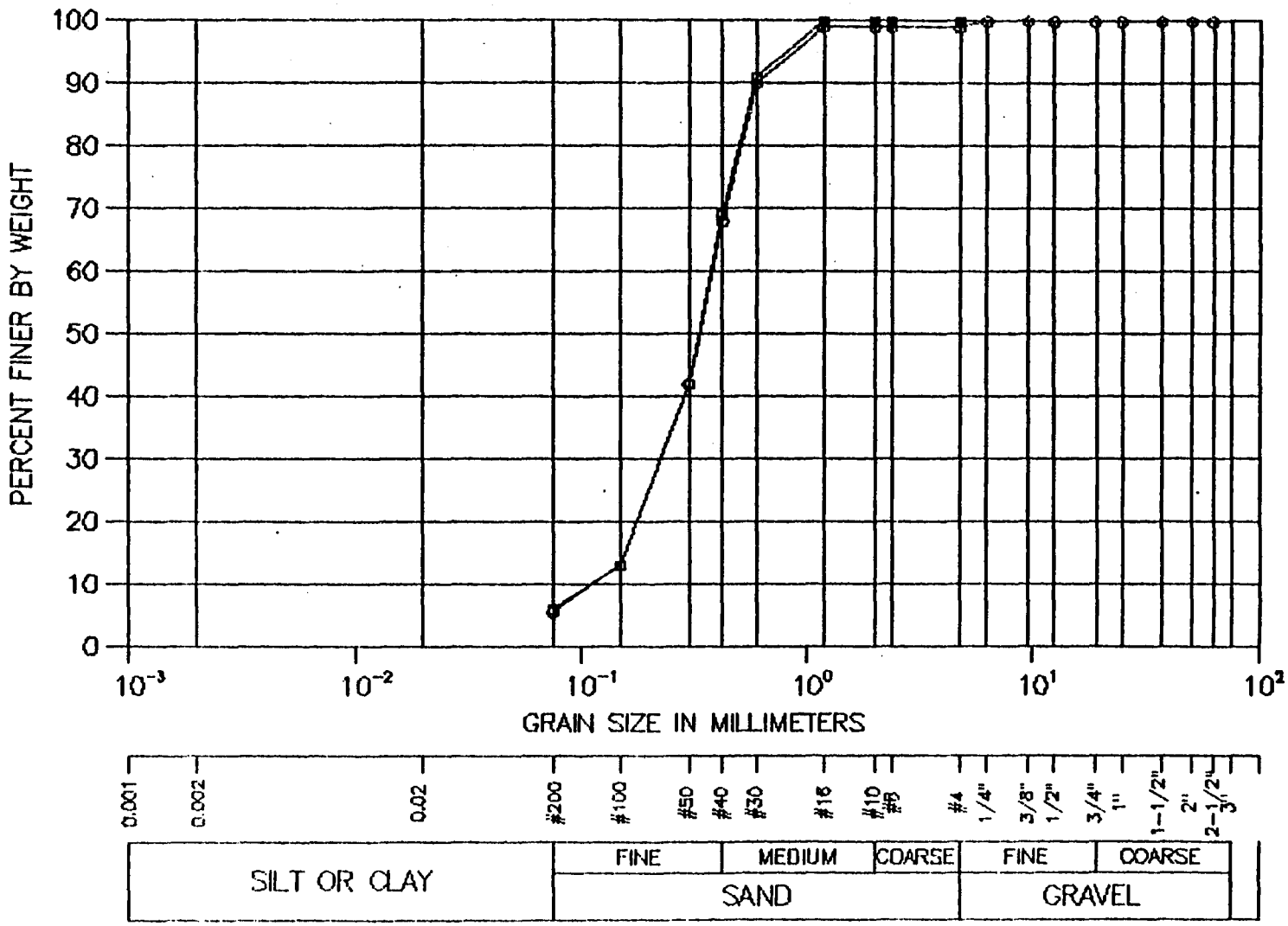
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB -- 02, SAMPLE G5



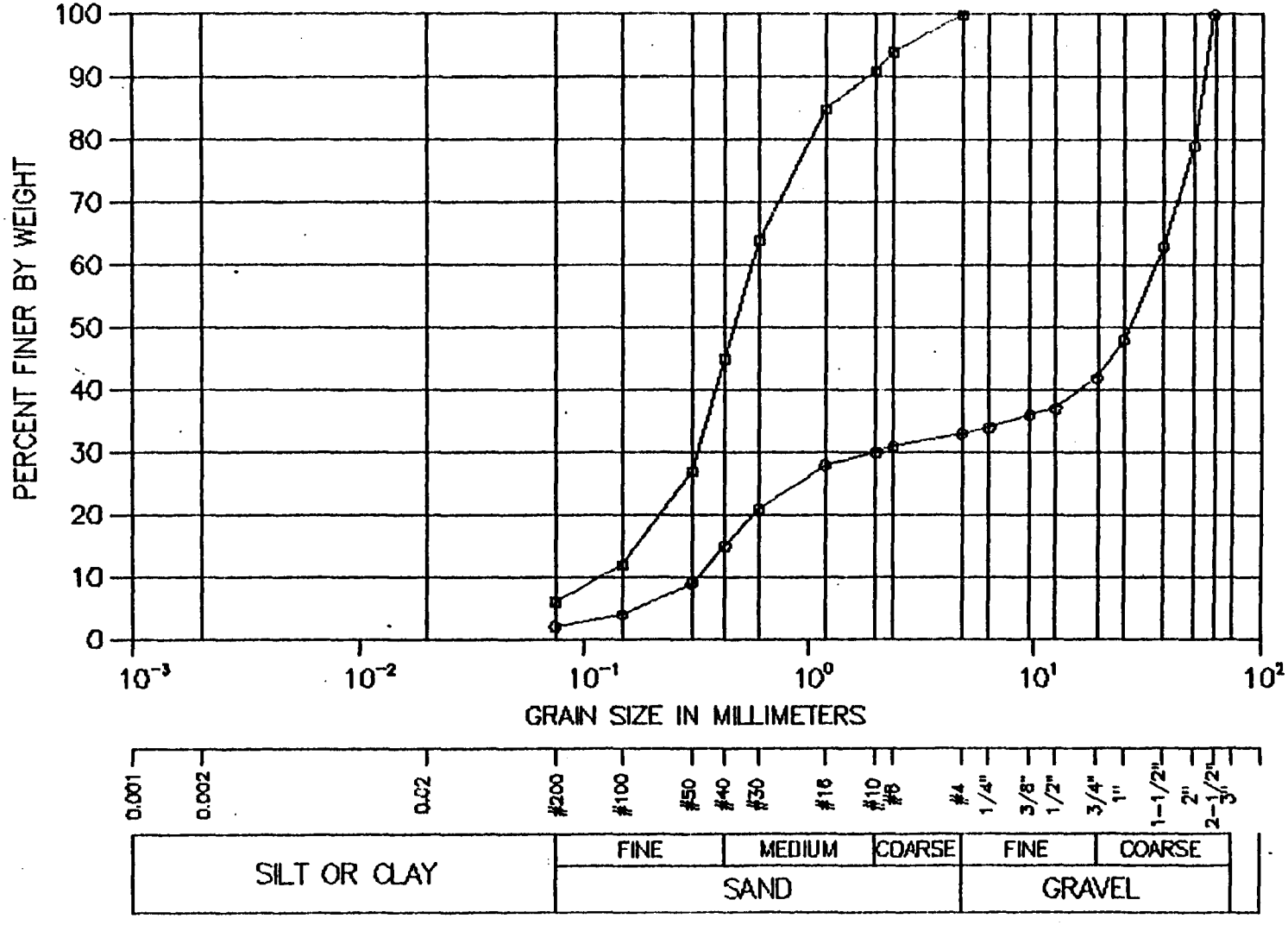
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 02, SAMPLE G6



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

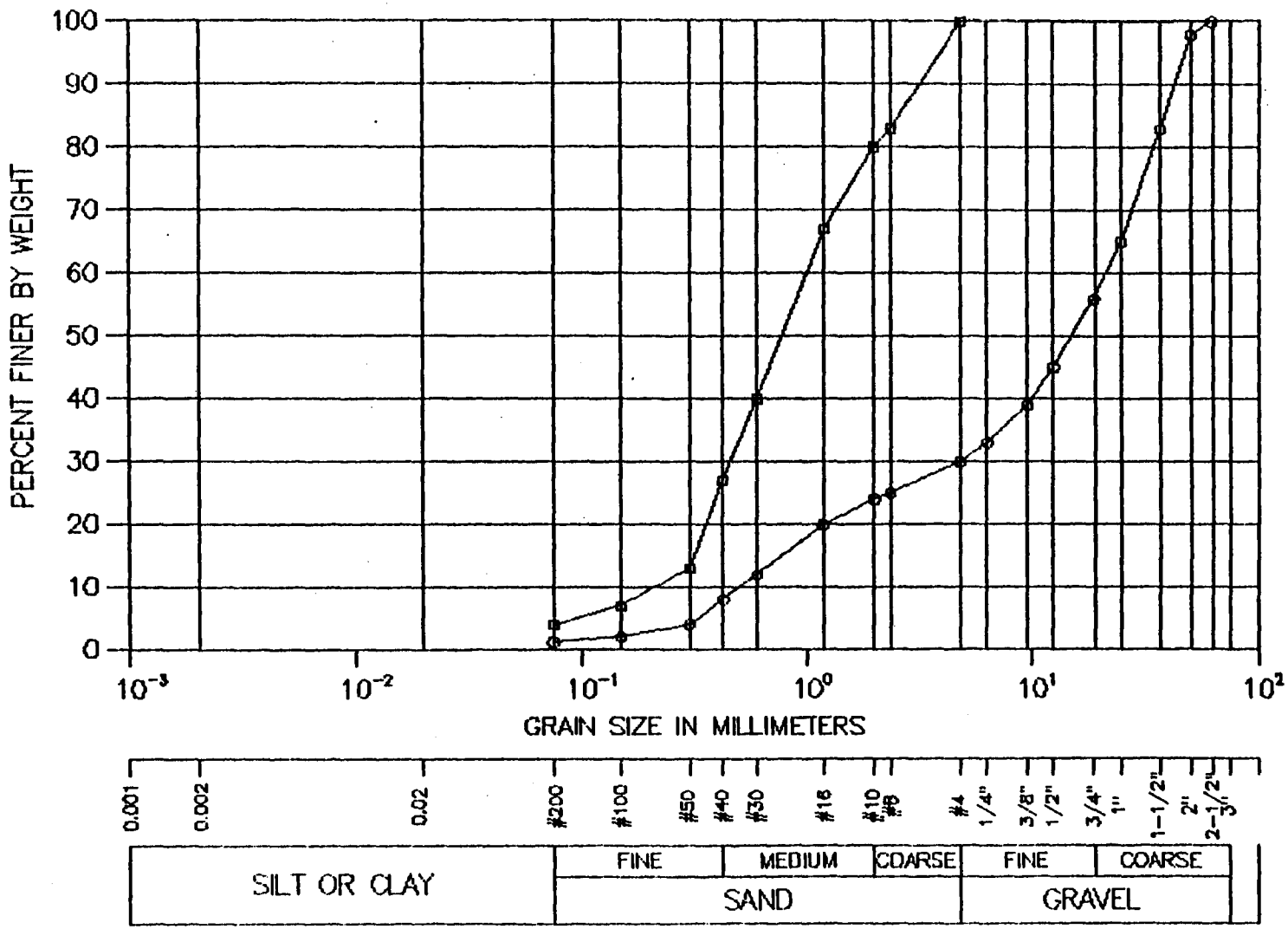
BORING LDB – 02, SAMPLE G7



1/34

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

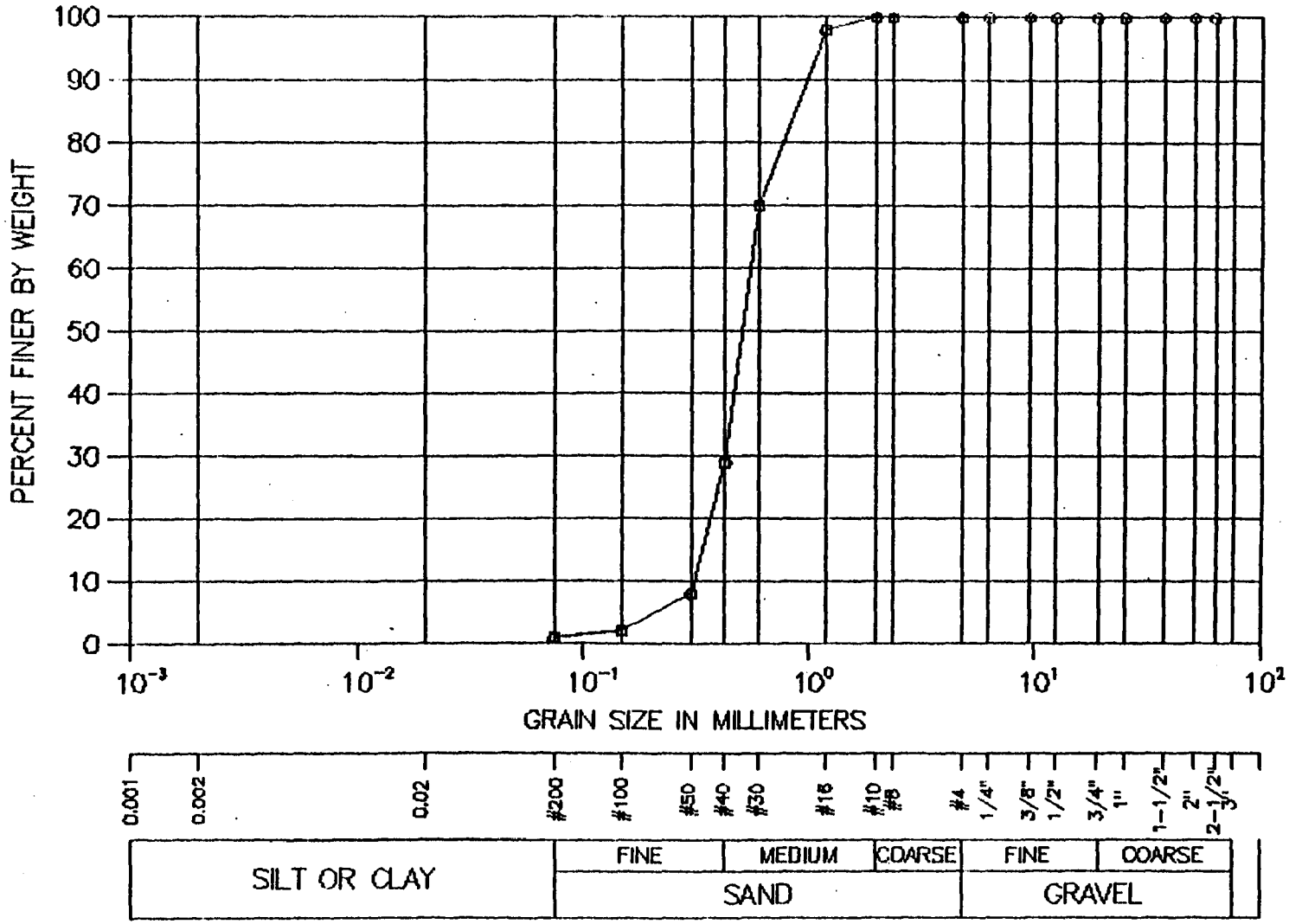
BORING LDB – 02, SAMPLE G9



435

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

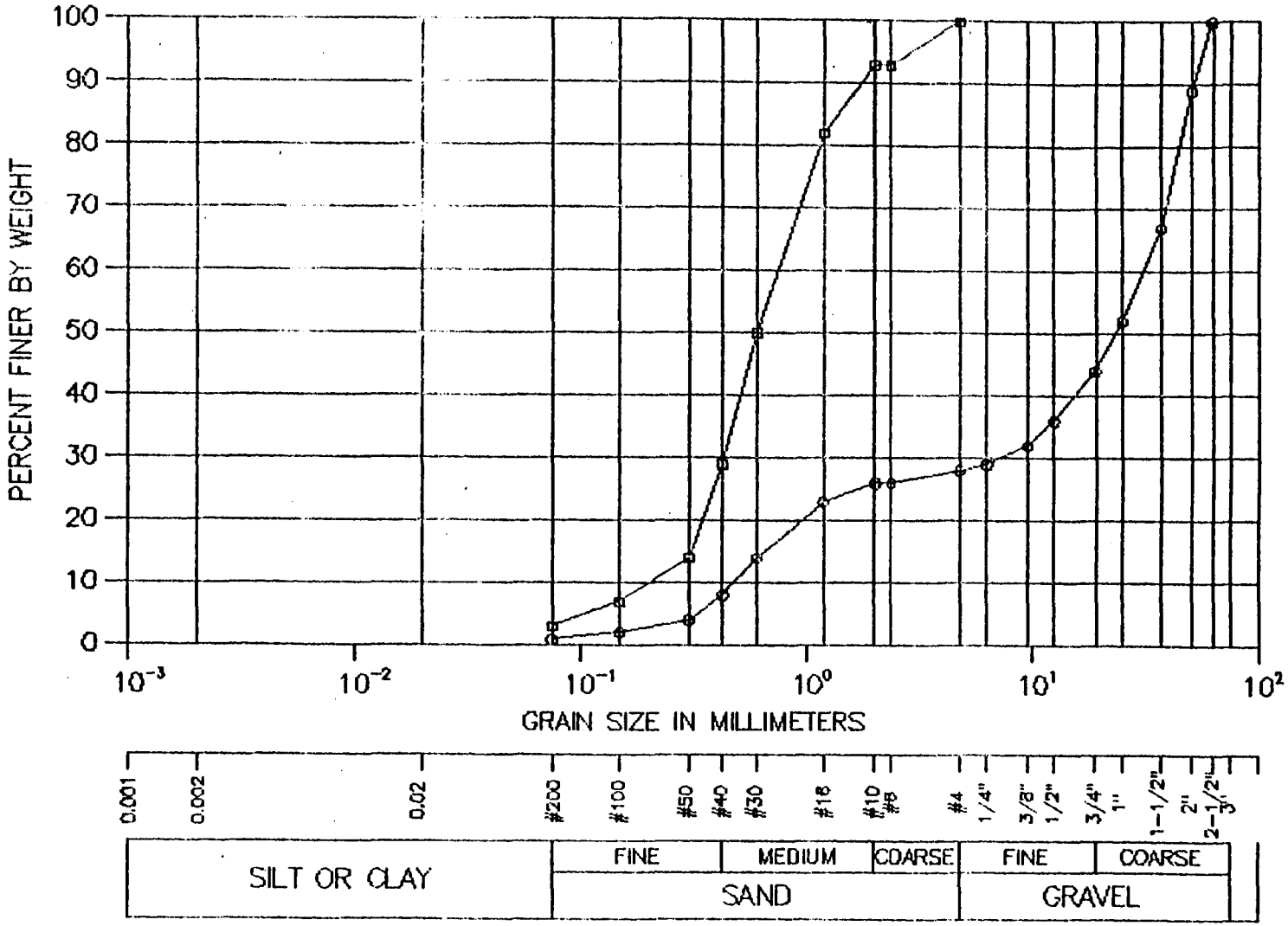
BORING LDB – 02, SAMPLE G10



4/3C

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

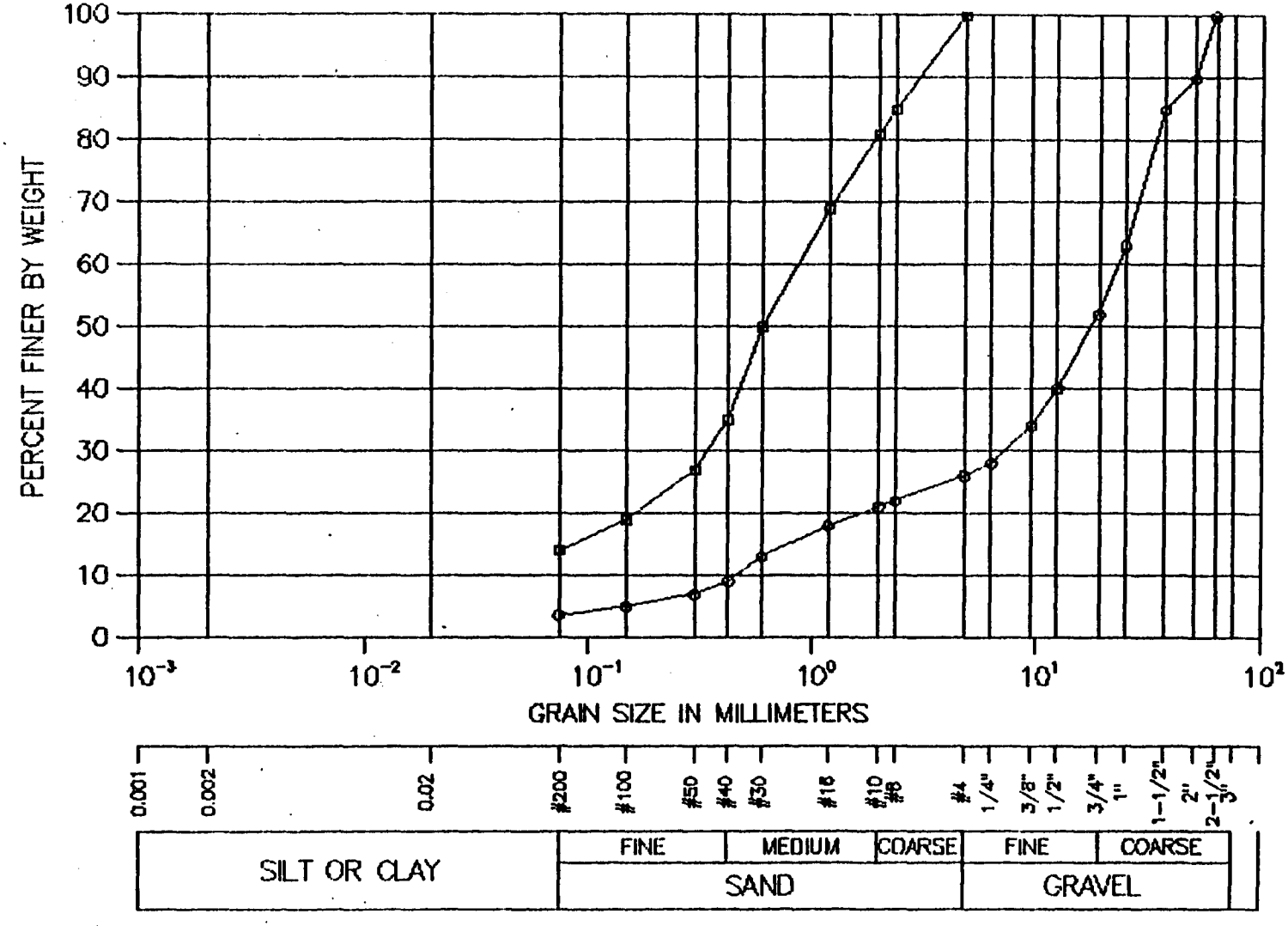
BORING LDB – 02, SAMPLE G12



4.67

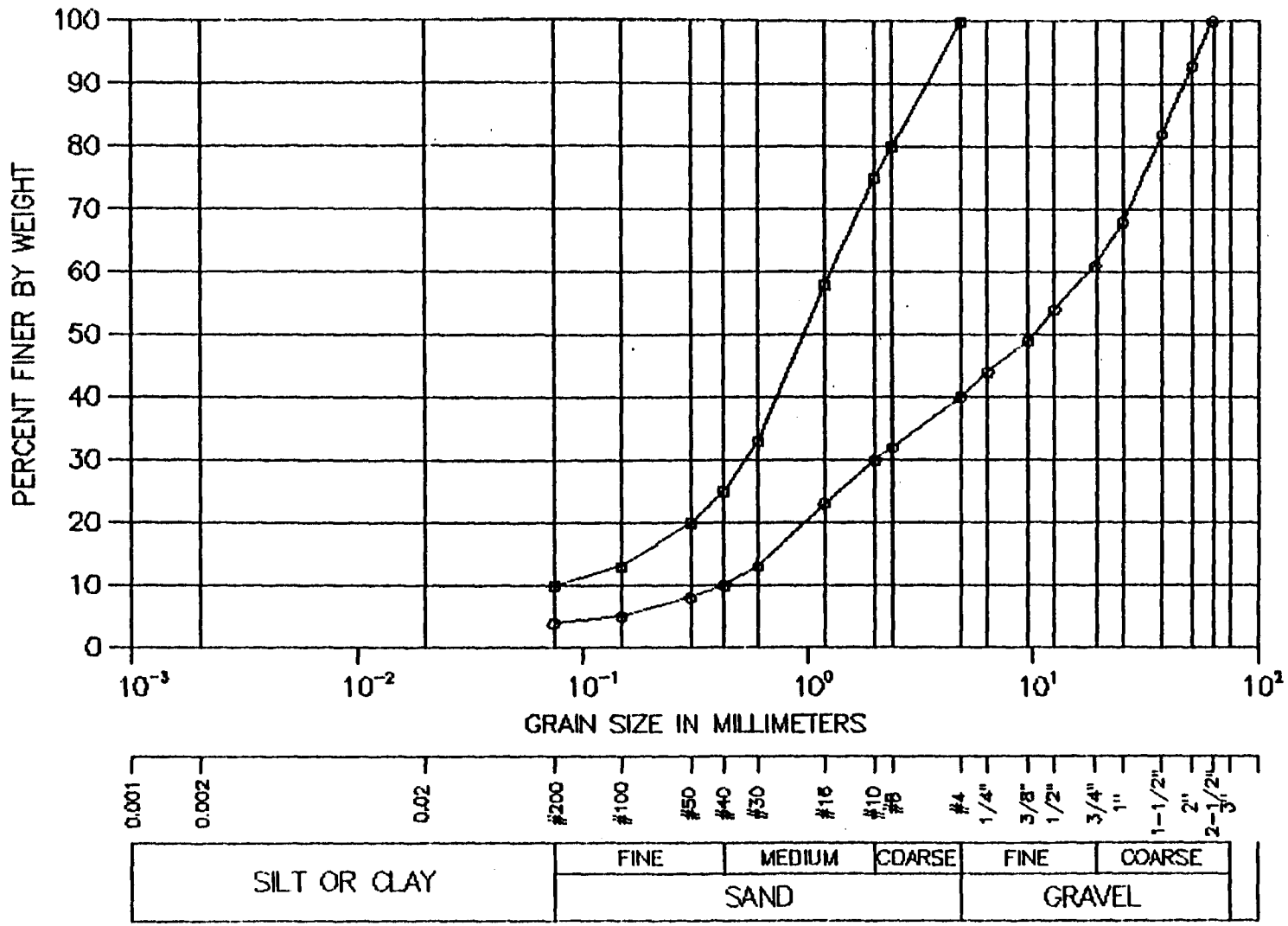
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 03, SAMPLE G1



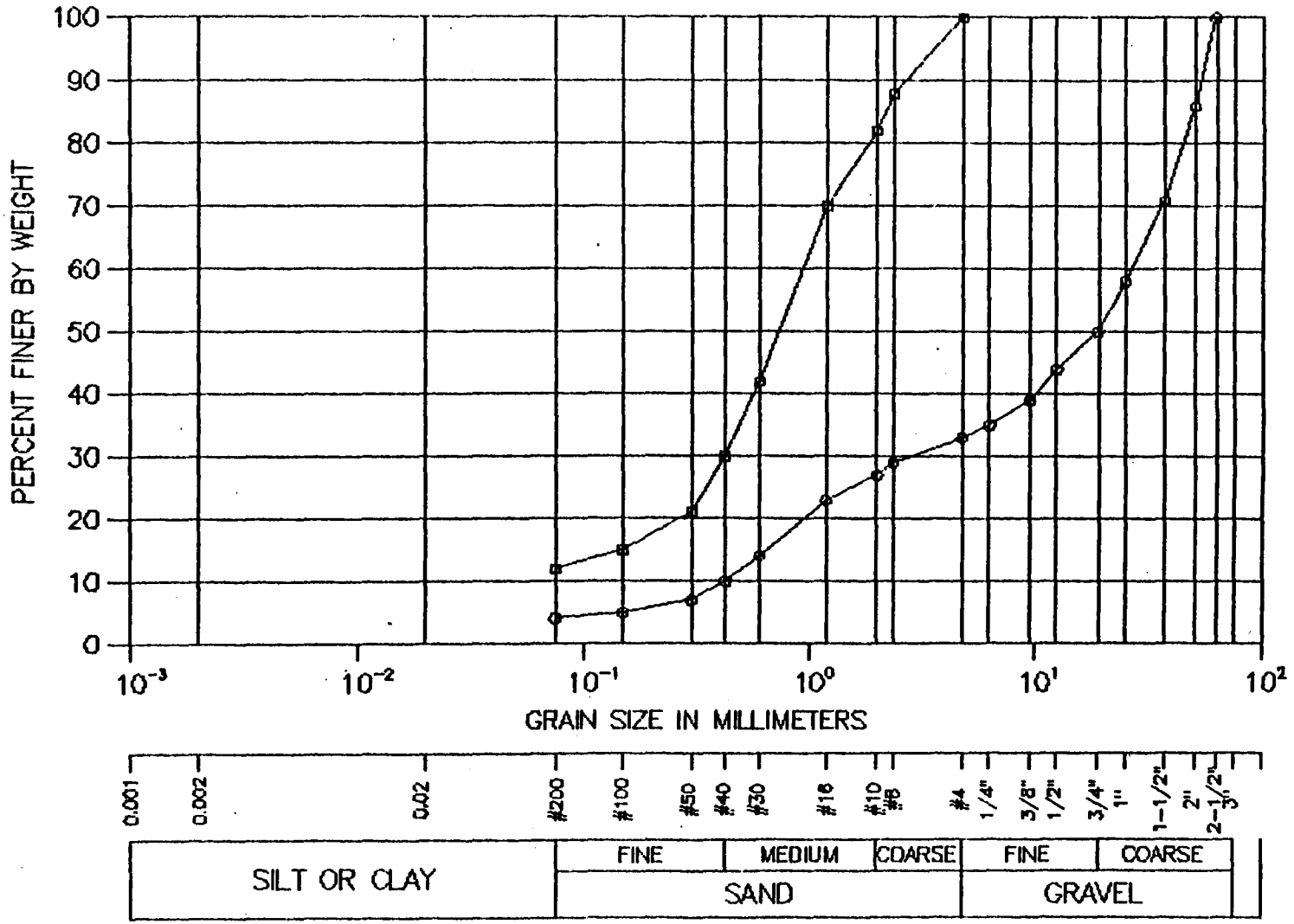
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 03, SAMPLE G3



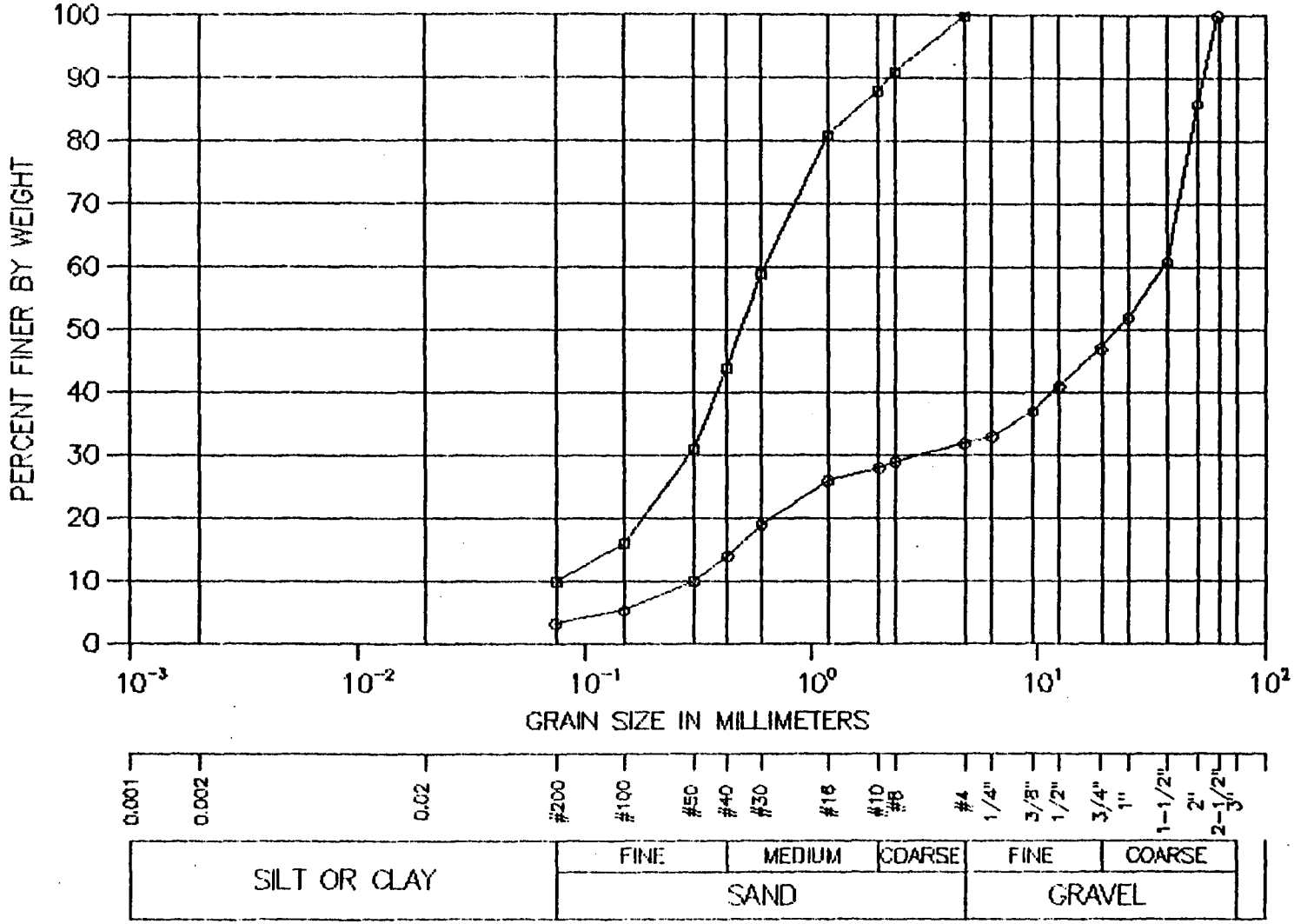
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 03, SAMPLE G5



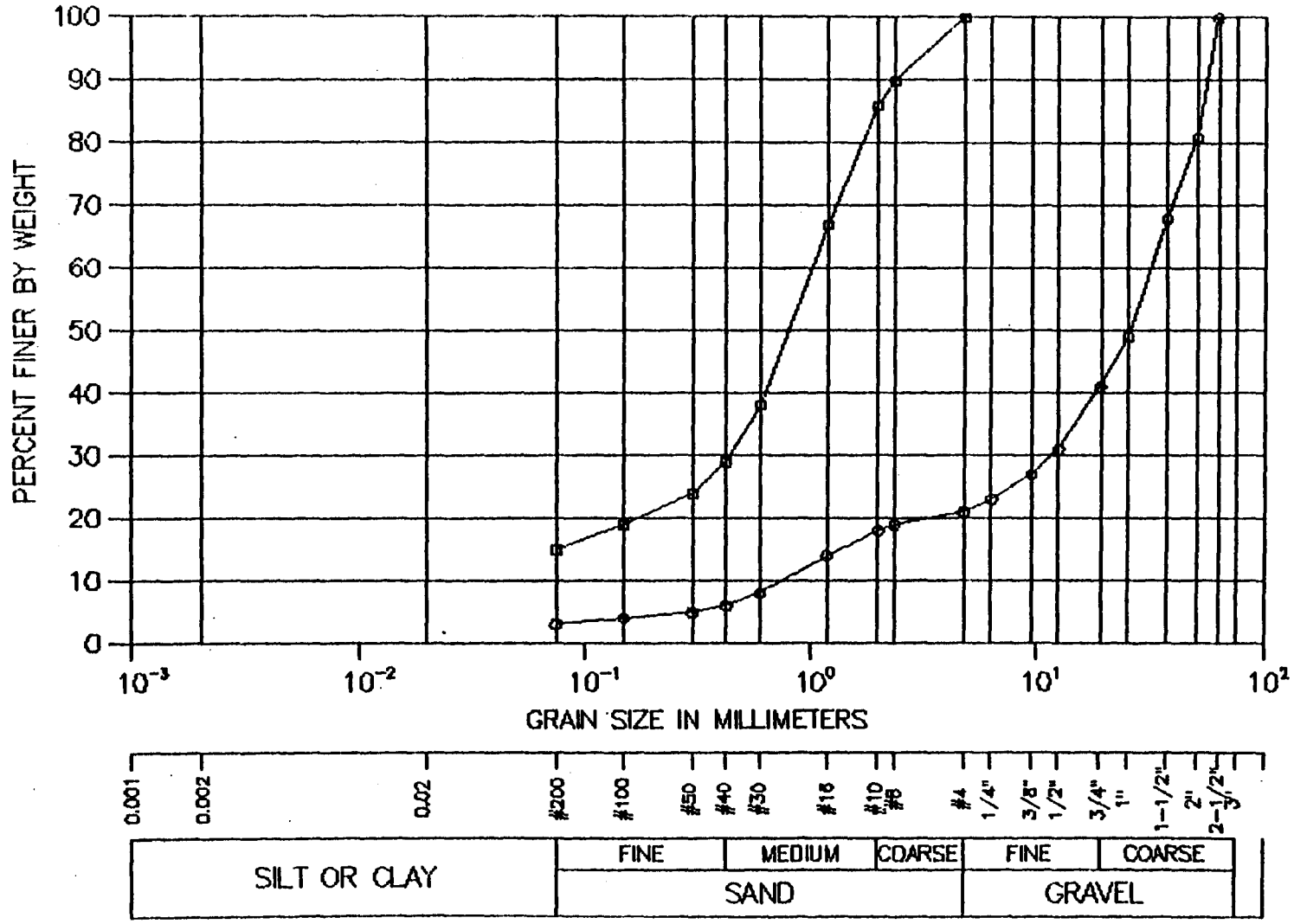
PRICE ROAD TUNNEL - GRAIN SIZE ANALYSIS CURVE

BORING LDB - 03, SAMPLE G6



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

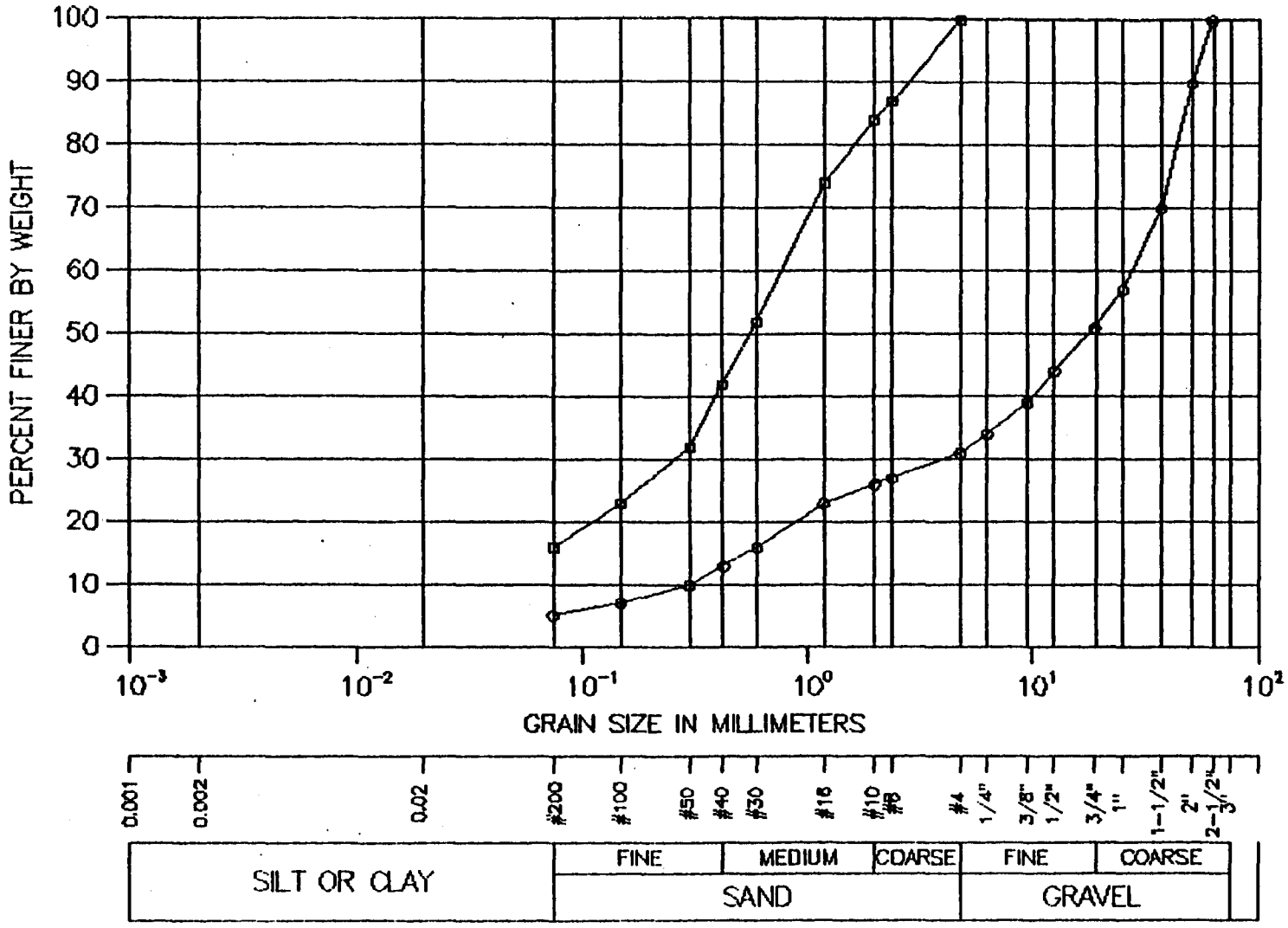
BORING LDB -- 03, SAMPLE G7



442

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

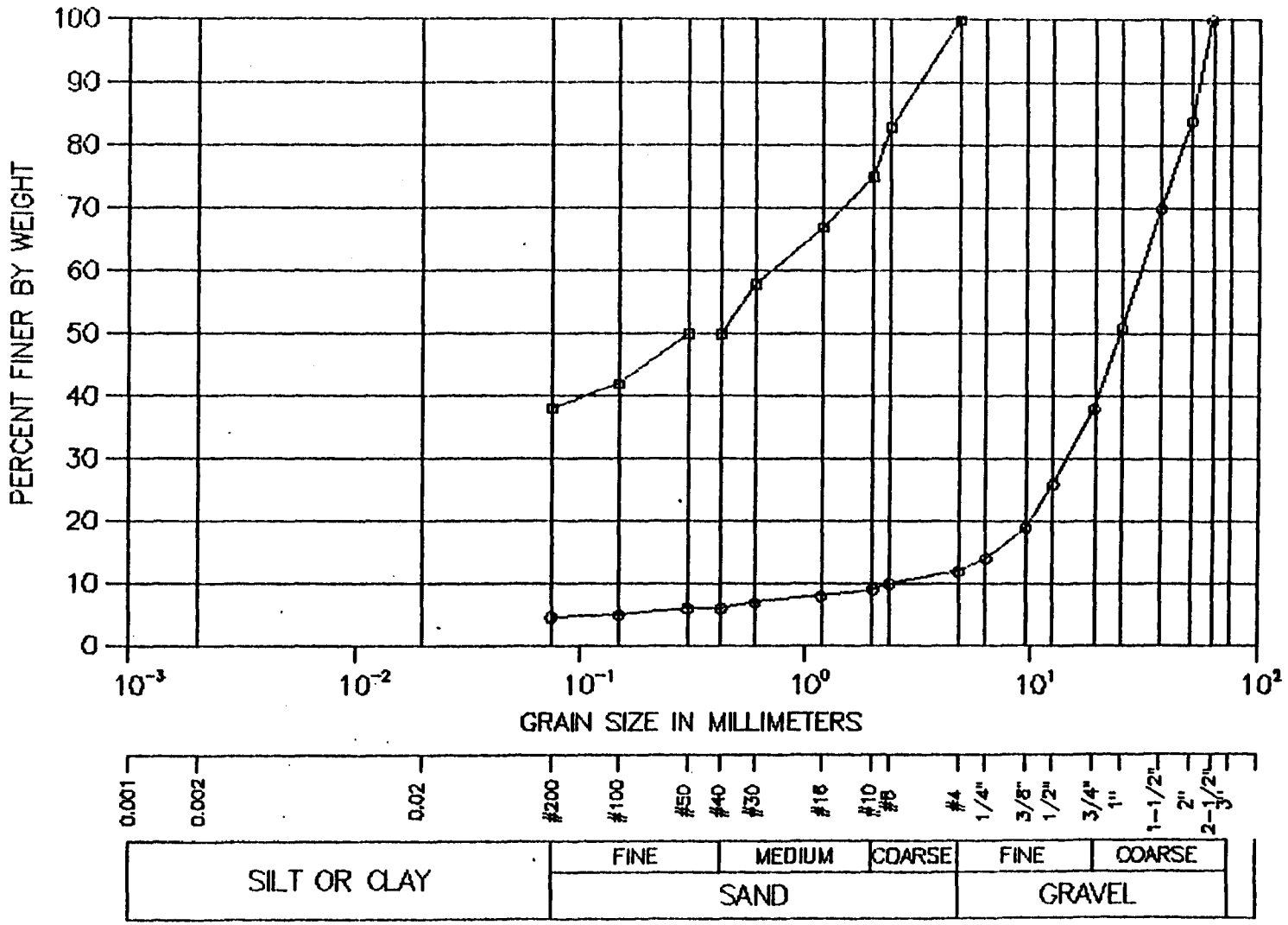
BORING LDB – 03, SAMPLE G9



443

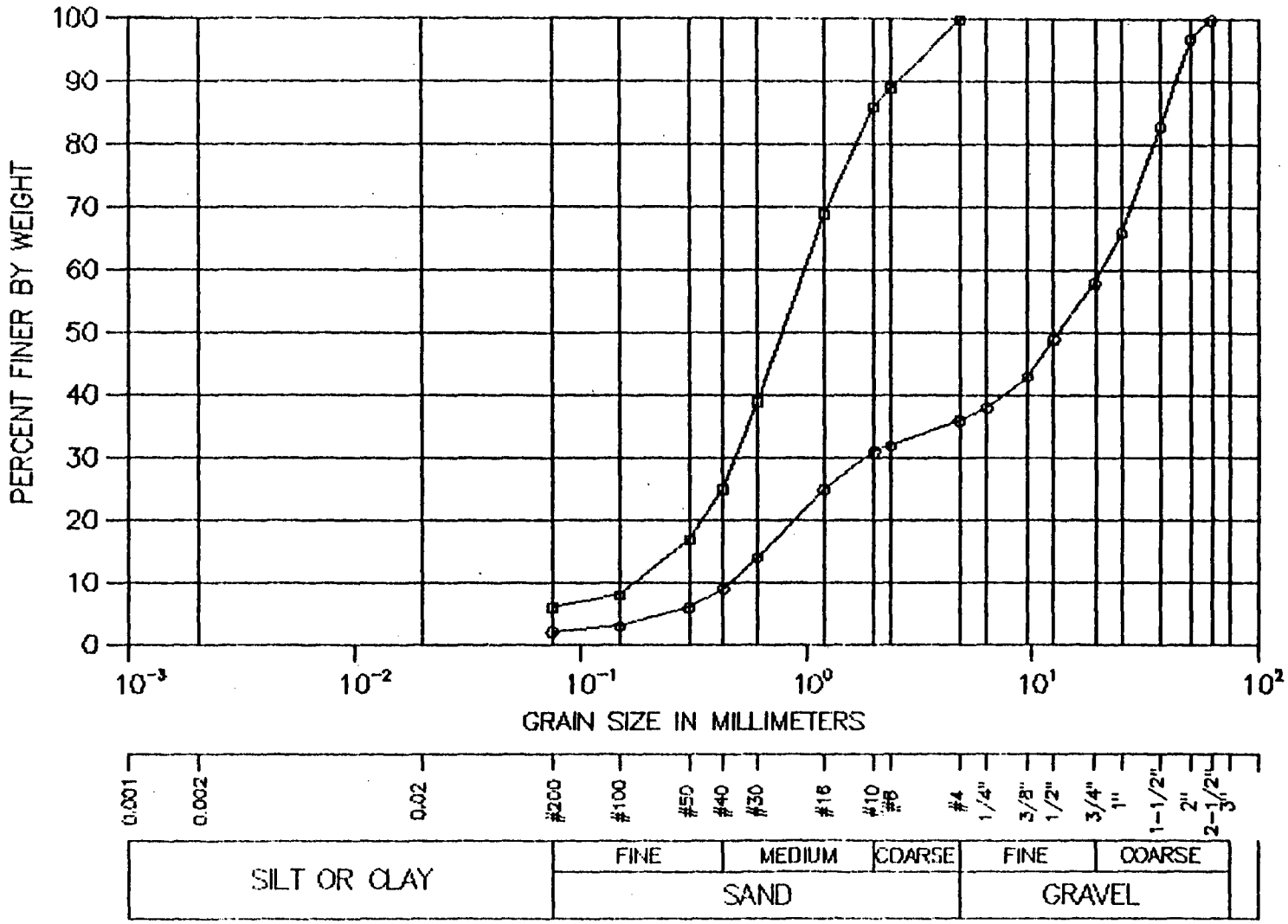
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 03, SAMPLE G1D



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

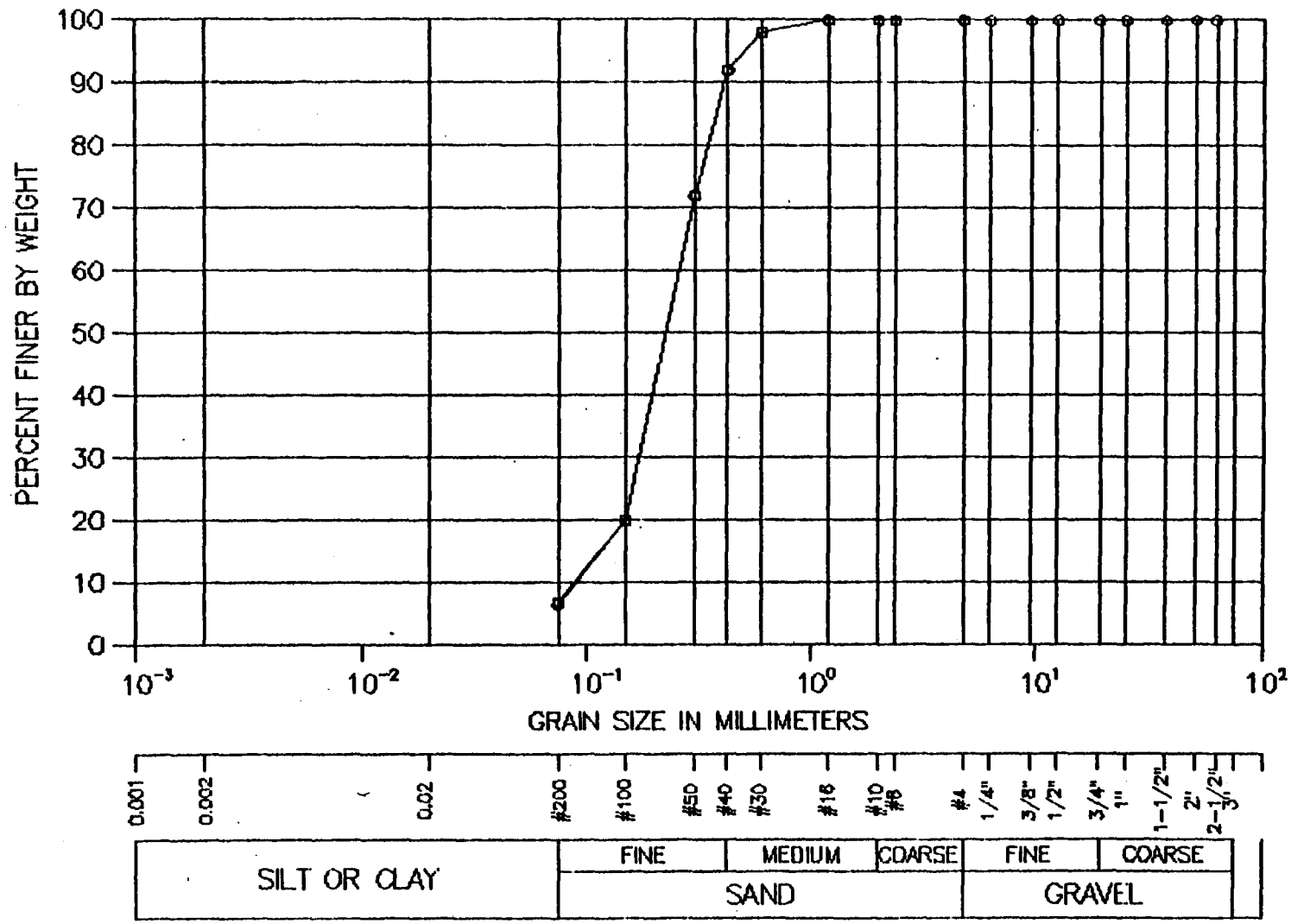
BORING LDB – 03, SAMPLE G12



44.5

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

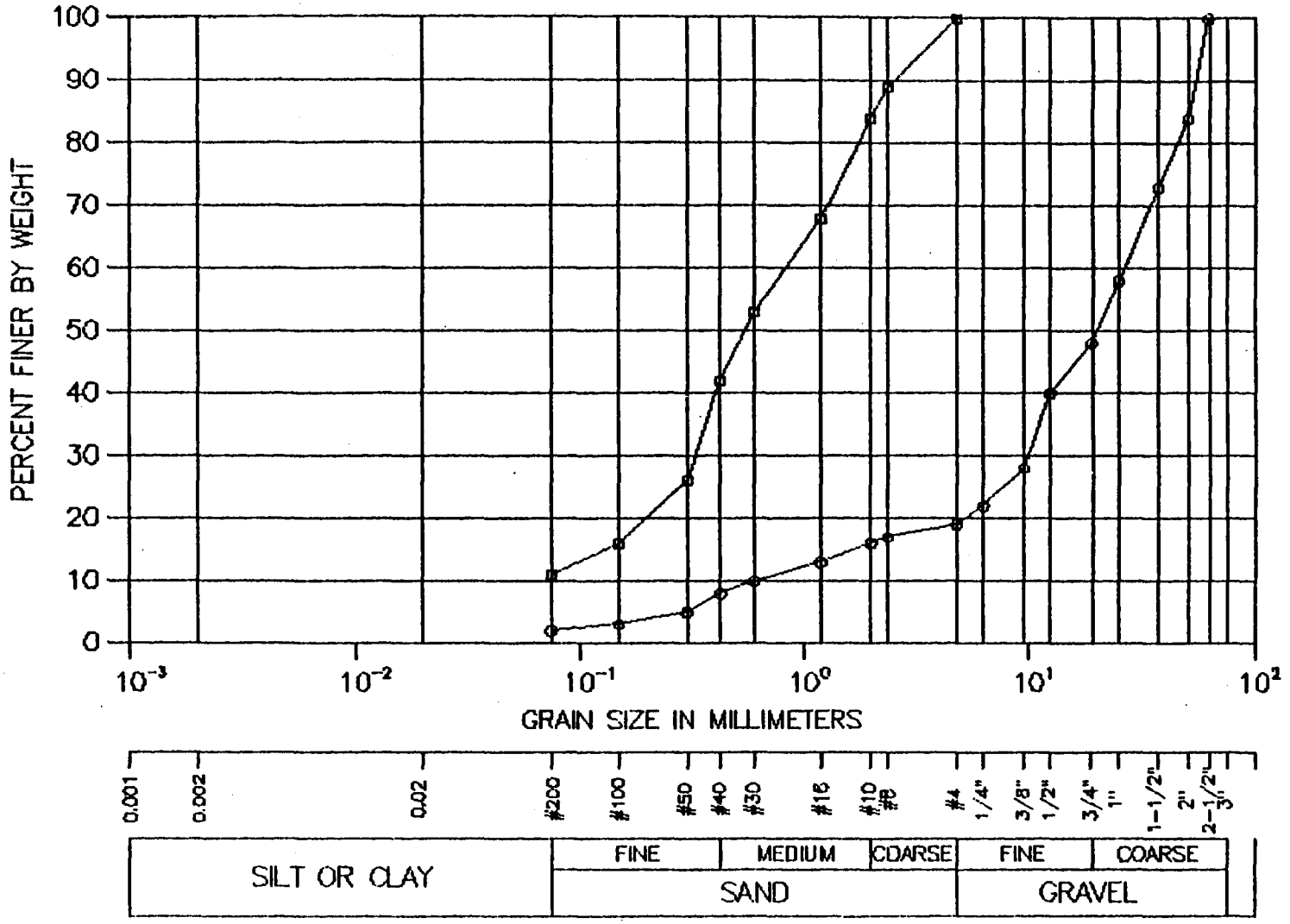
BORING LDB – 04, SAMPLE G3



4/96

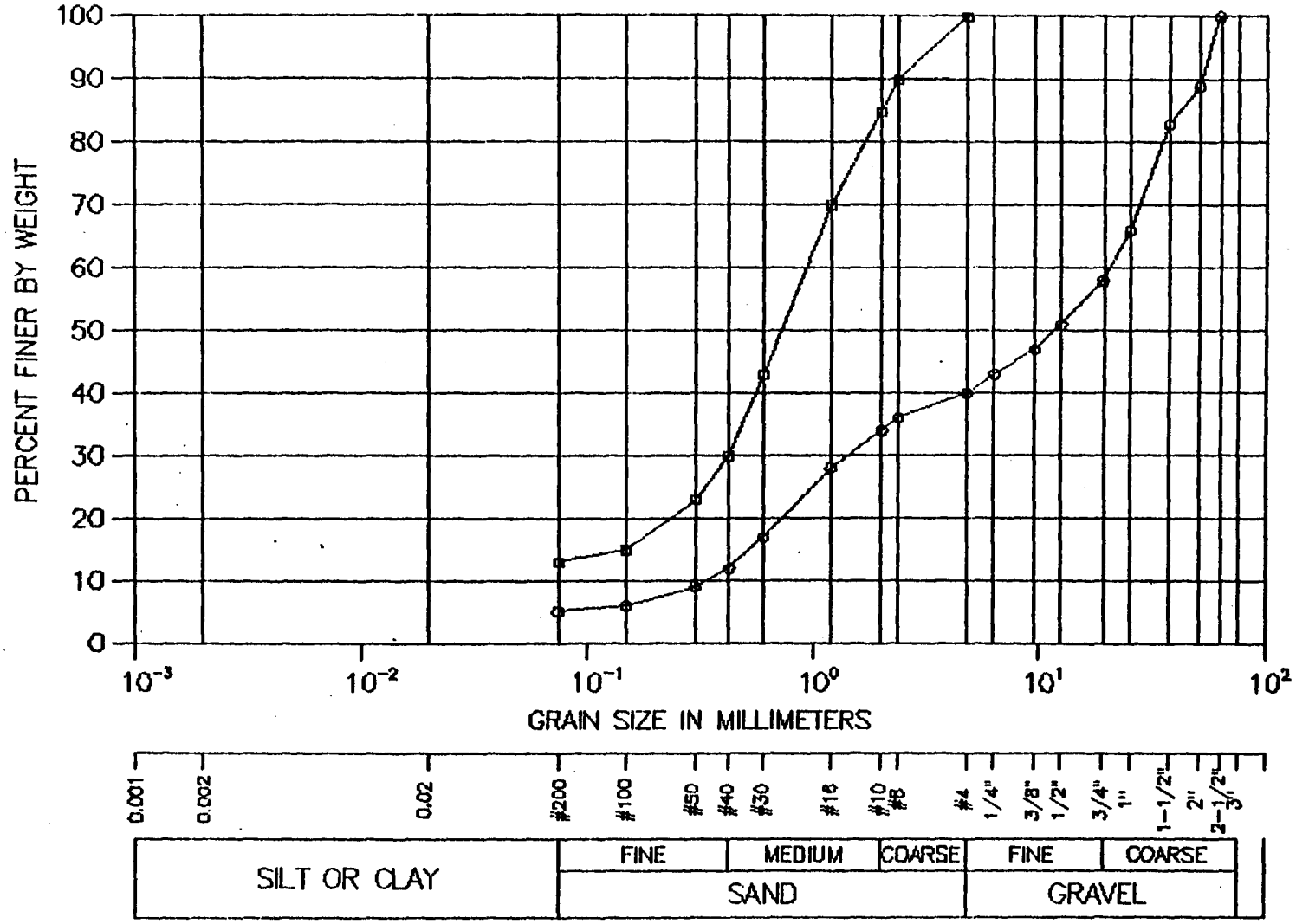
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 04, SAMPLE G4



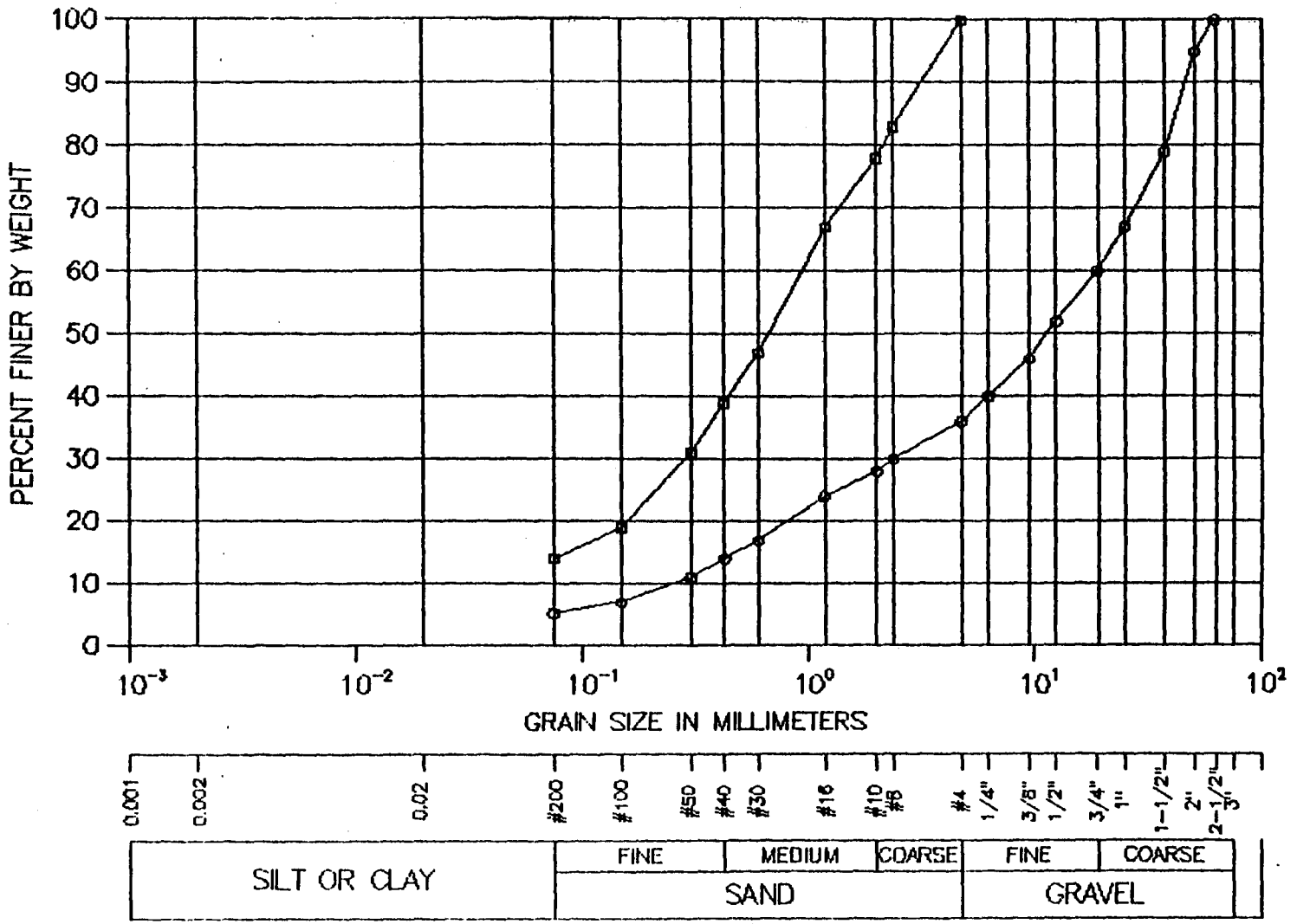
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 04, SAMPLE G6



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

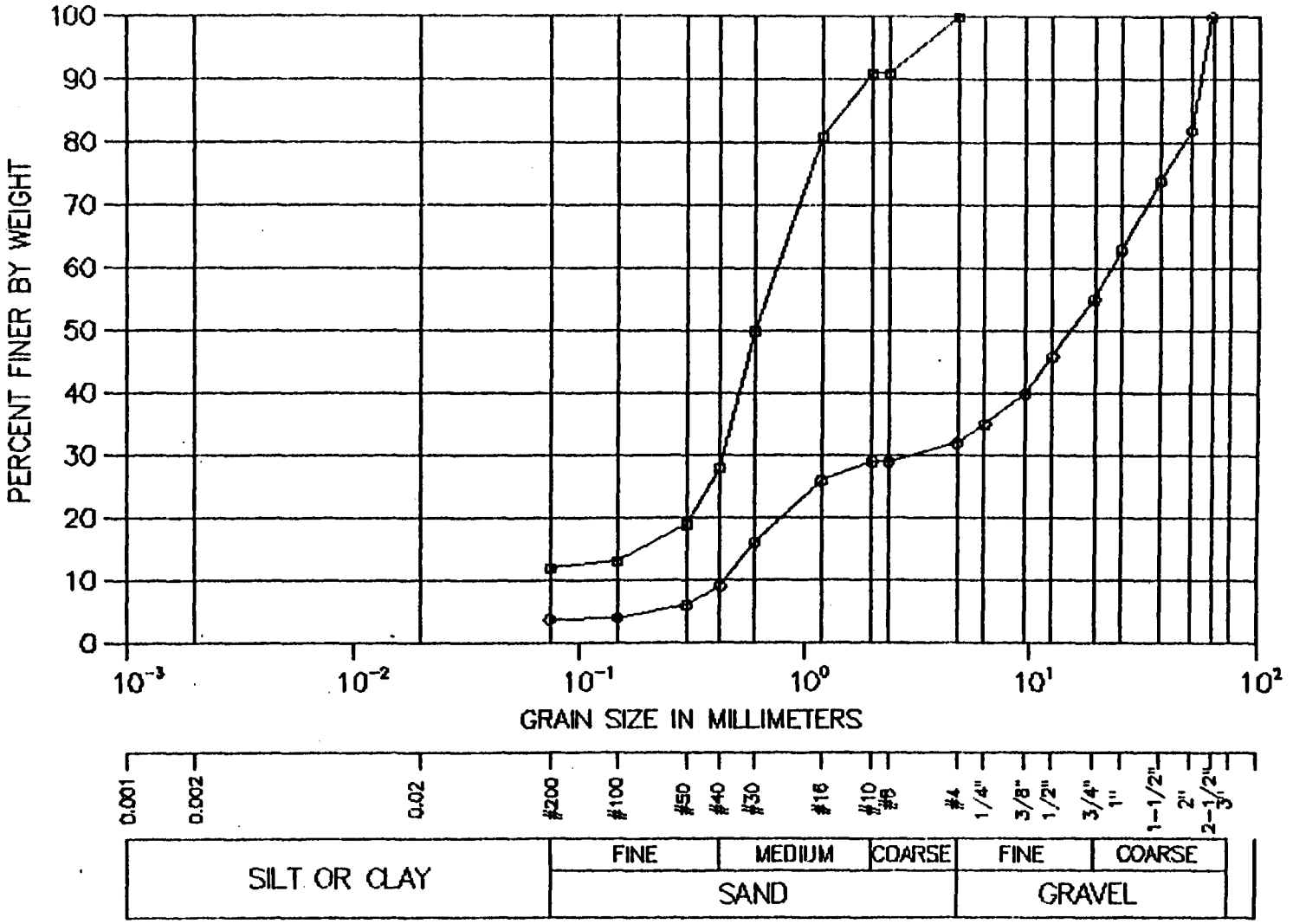
BORING LDB – 04, SAMPLE G7



6647

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

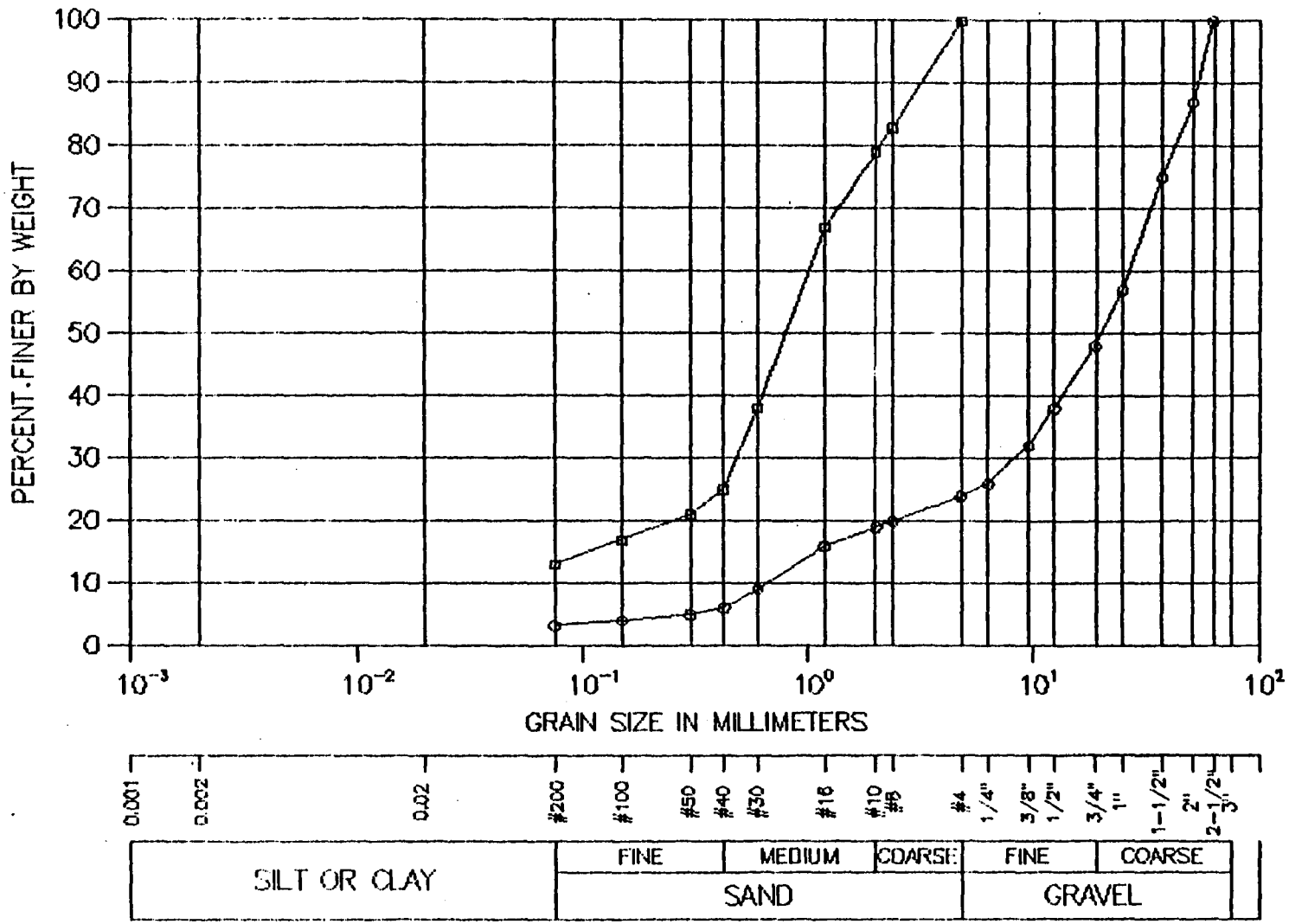
BORING LDB – 04, SAMPLE G8



450

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

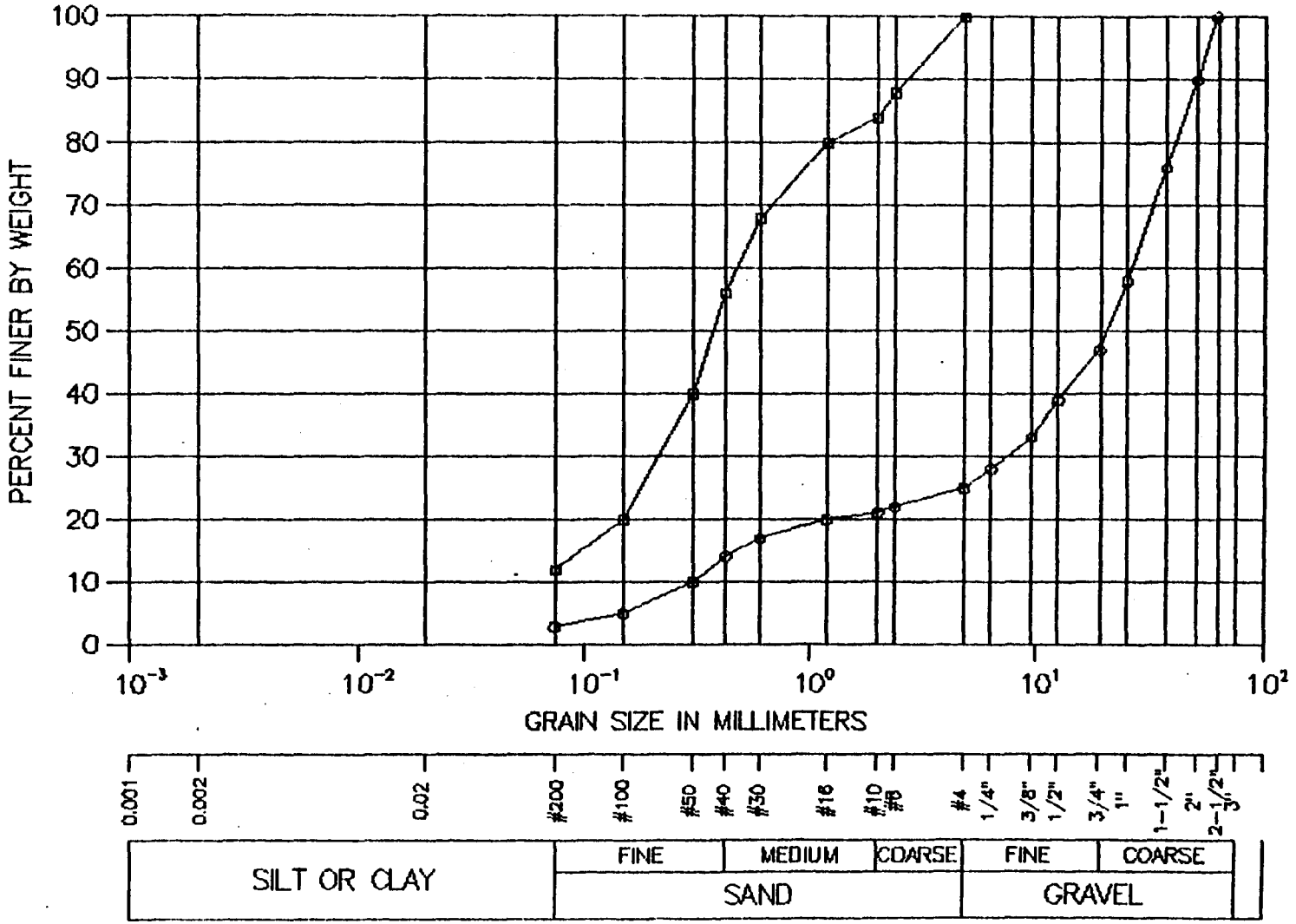
BORING LDB – 04, SAMPLE G10



151

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

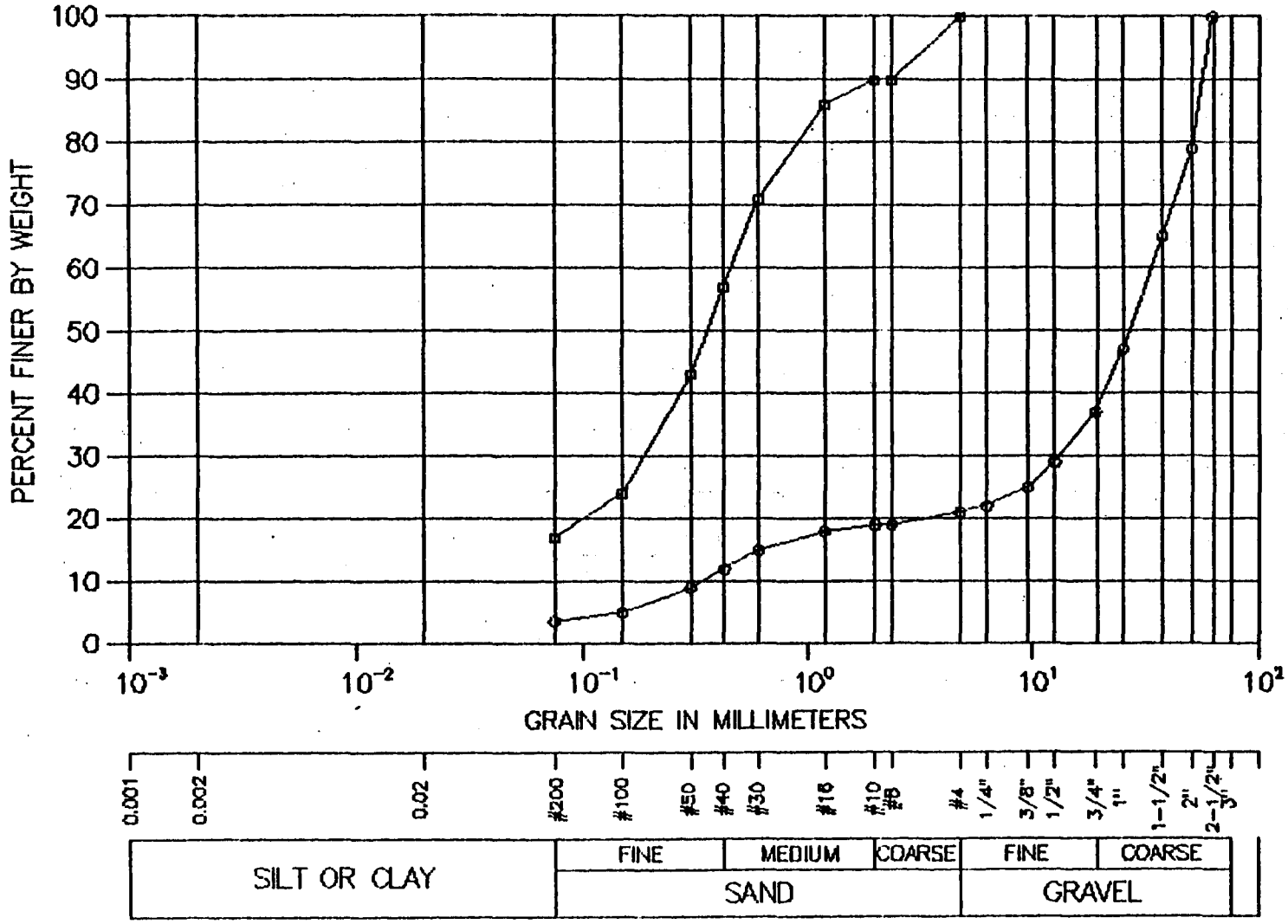
BORING LDB – 04, SAMPLE G11



45.2

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

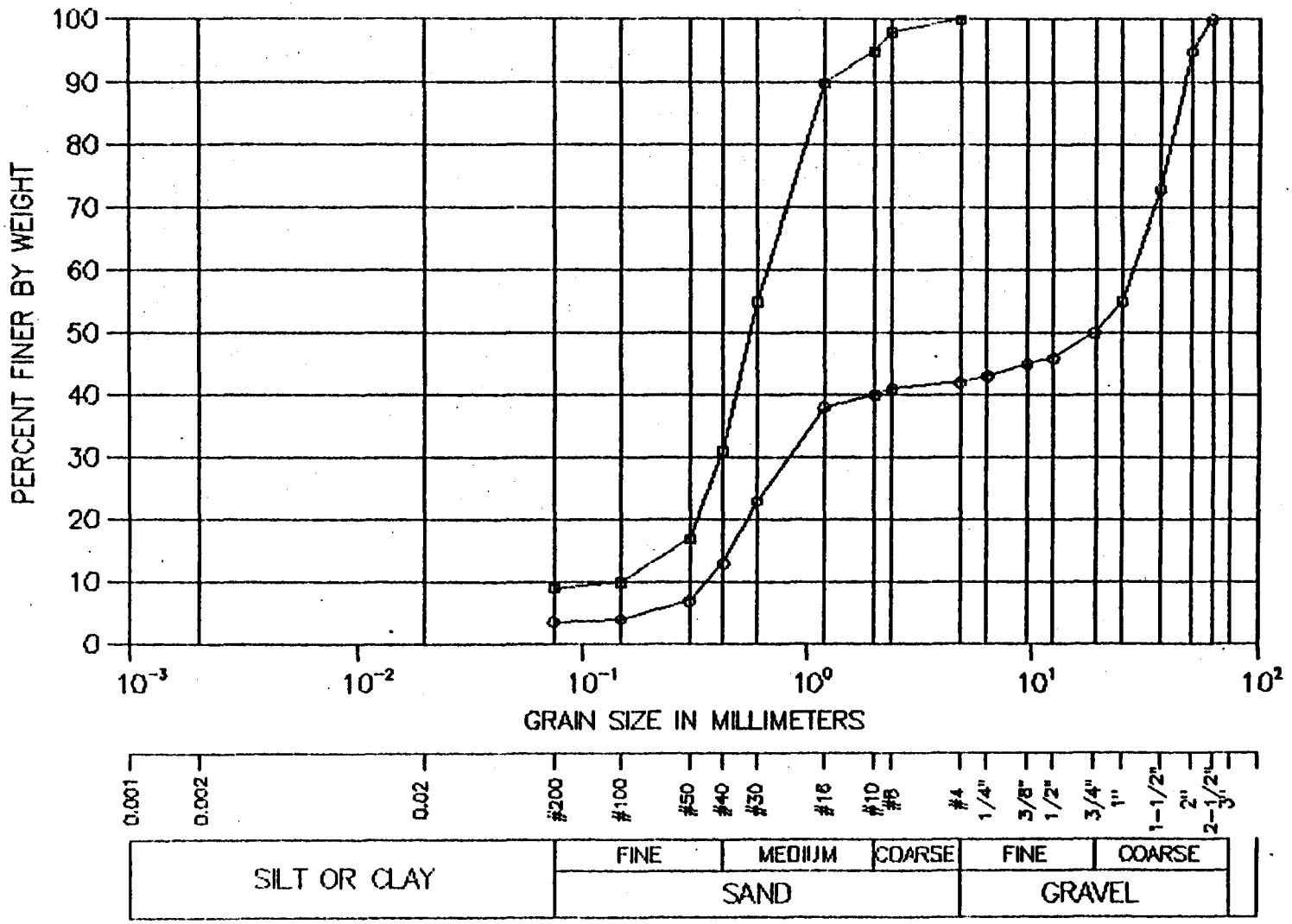
BORING LDB – 05, SAMPLE G2



453

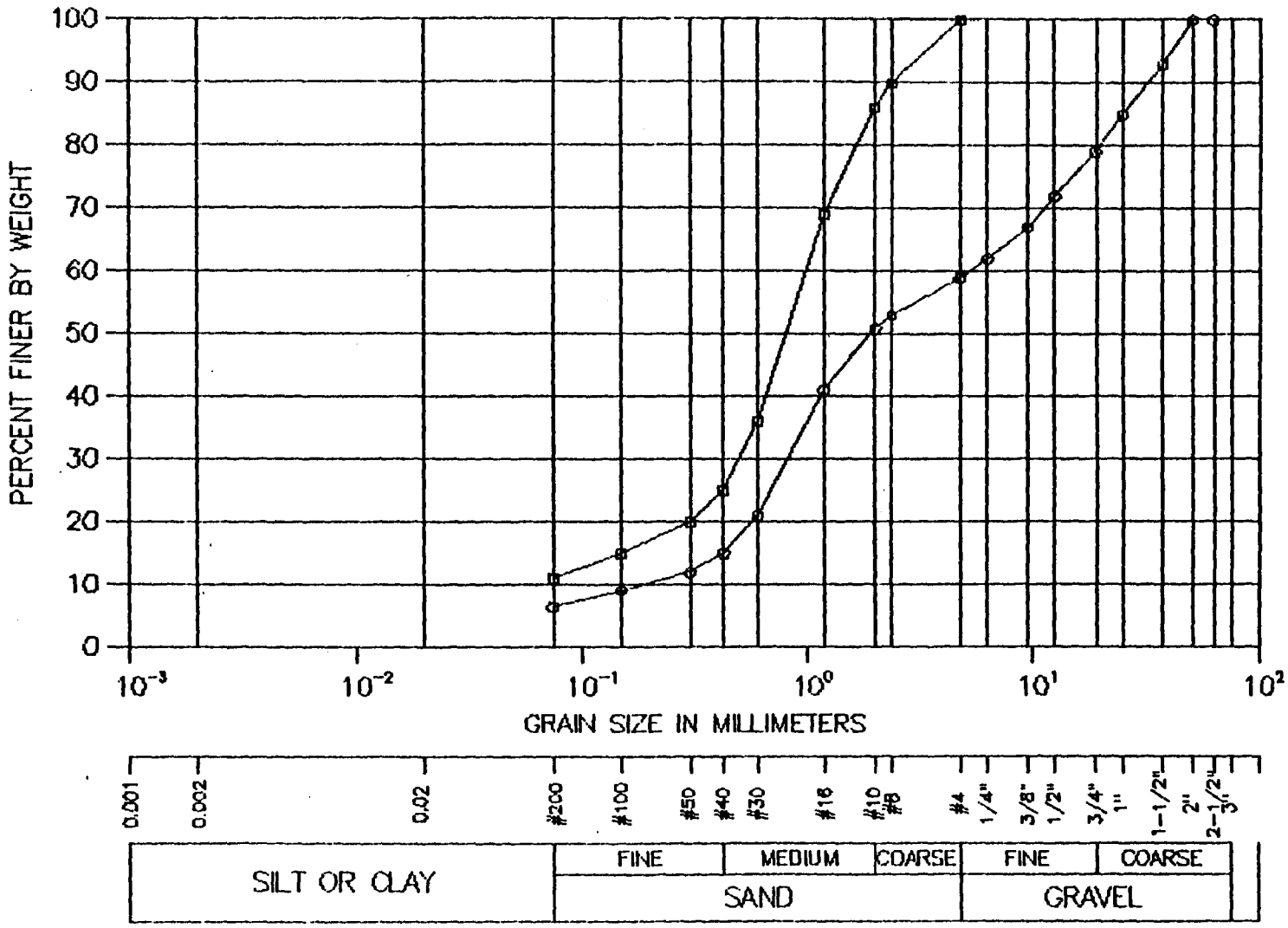
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 05, SAMPLE G4



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

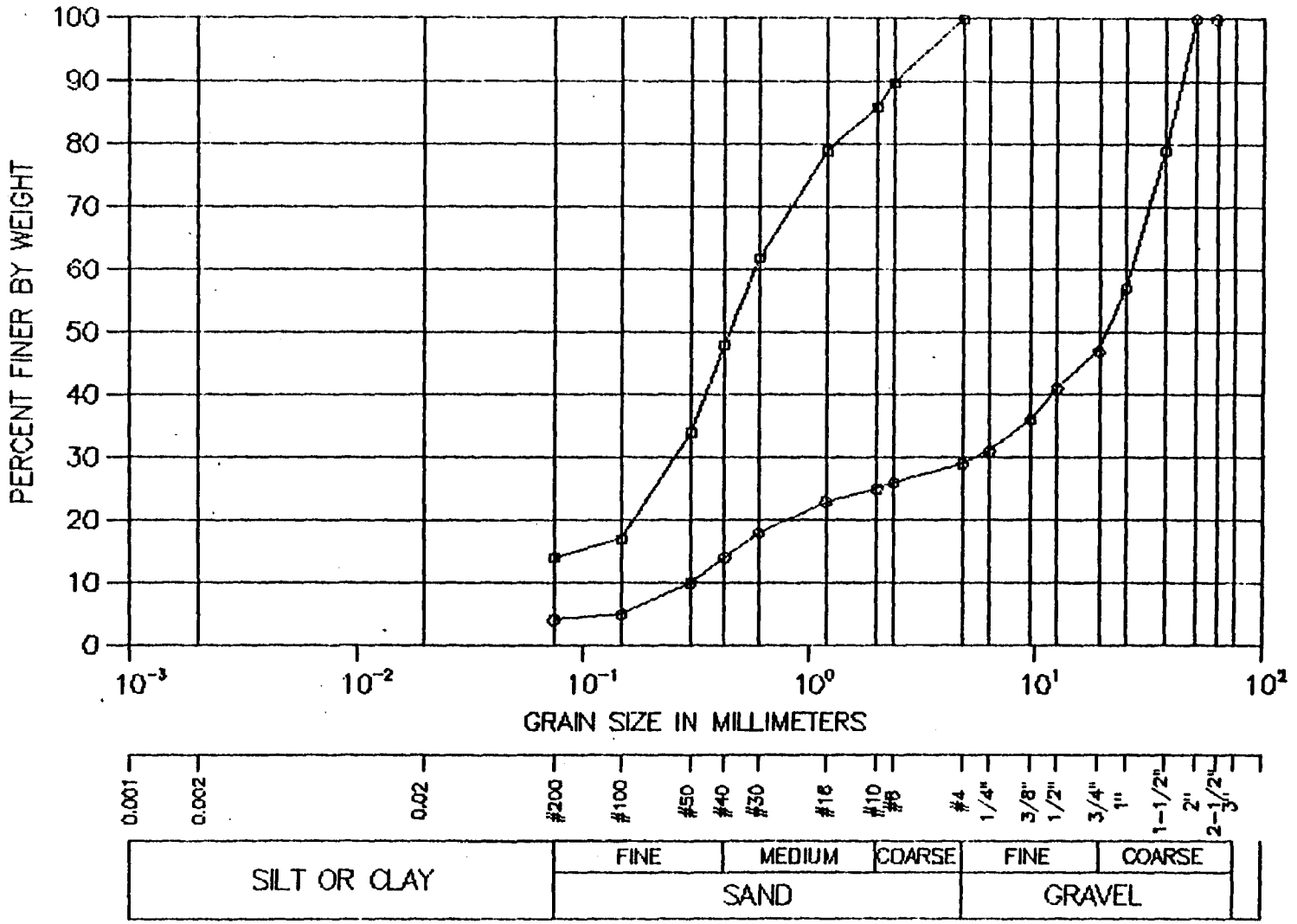
BORING LDB -- 05, SAMPLE G6



455

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

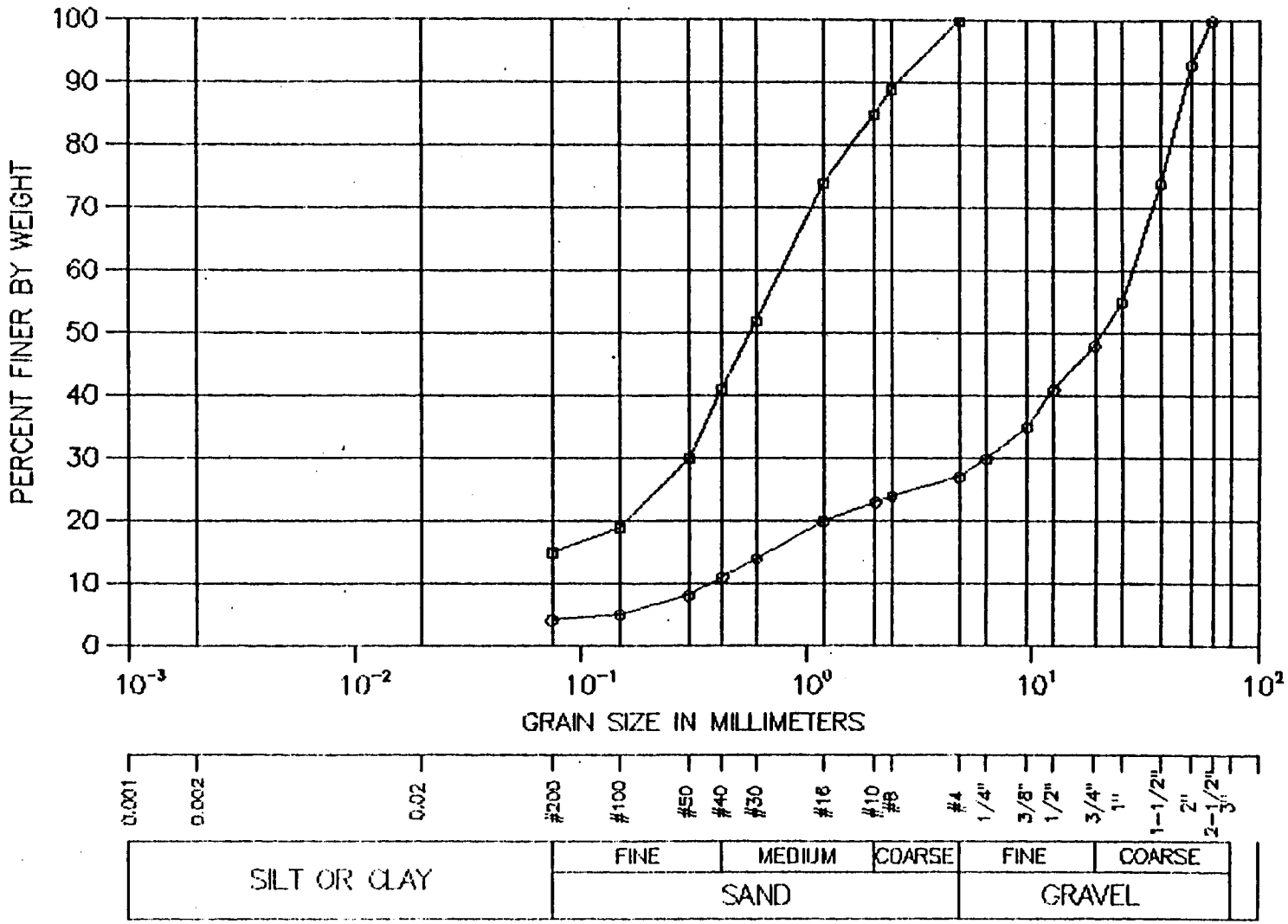
BORING LDB – 05, SAMPLE G7



2.5/1

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

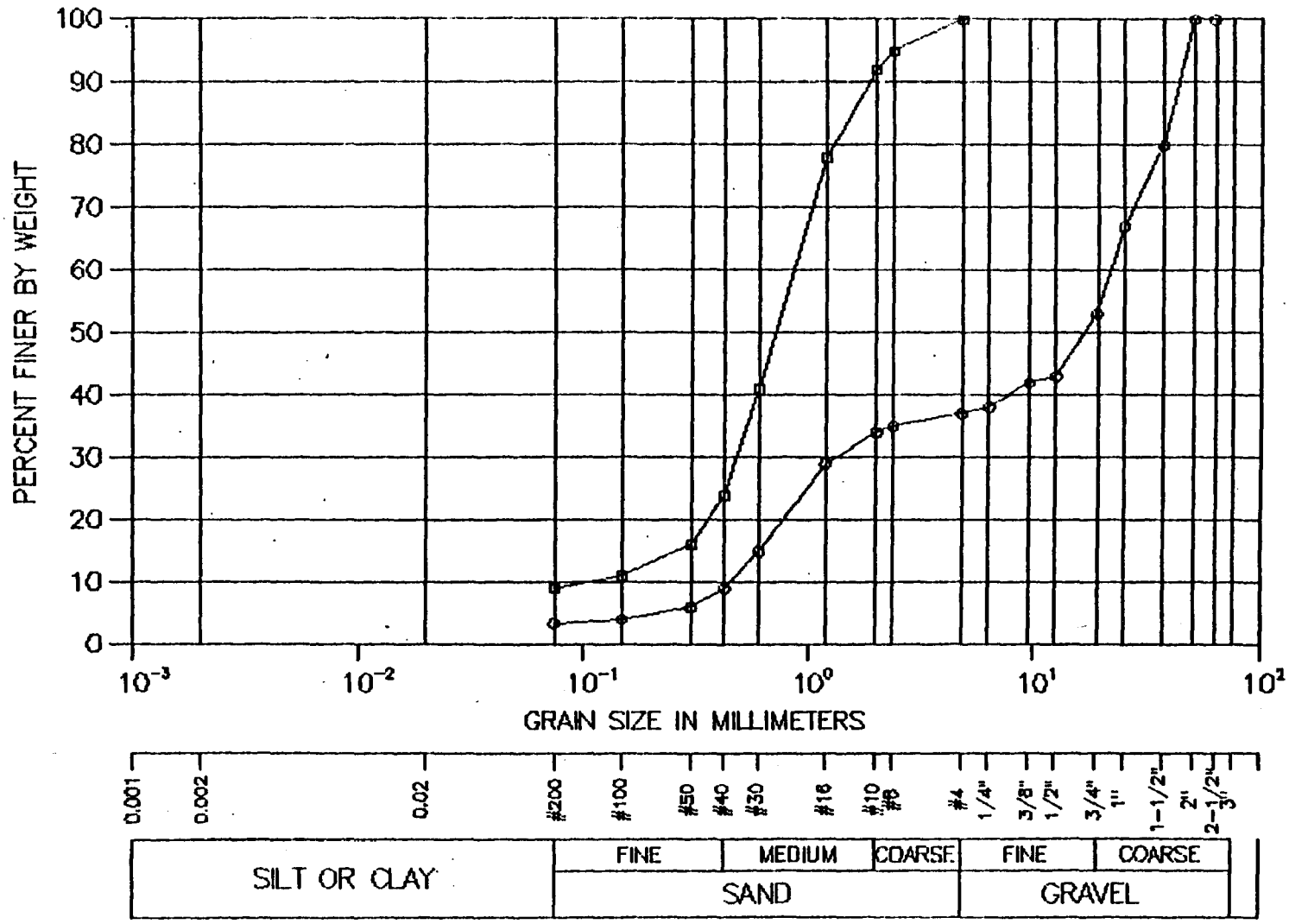
BORING LDB – 05, SAMPLE G8



457

PRICE ROAD TUNNEL - GRAIN SIZE ANALYSIS CURVE

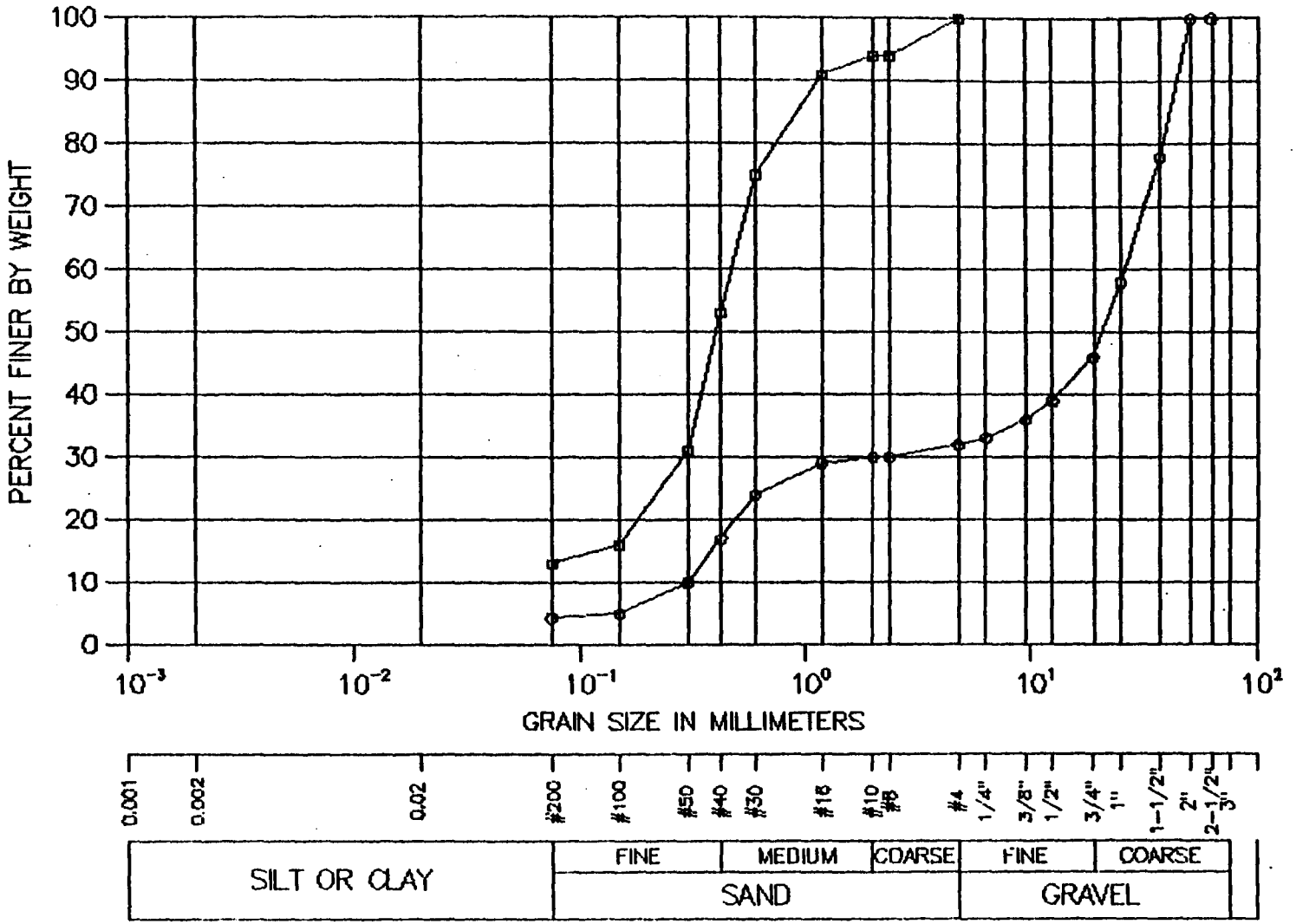
BORING LDB - 05, SAMPLE G9



ash

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

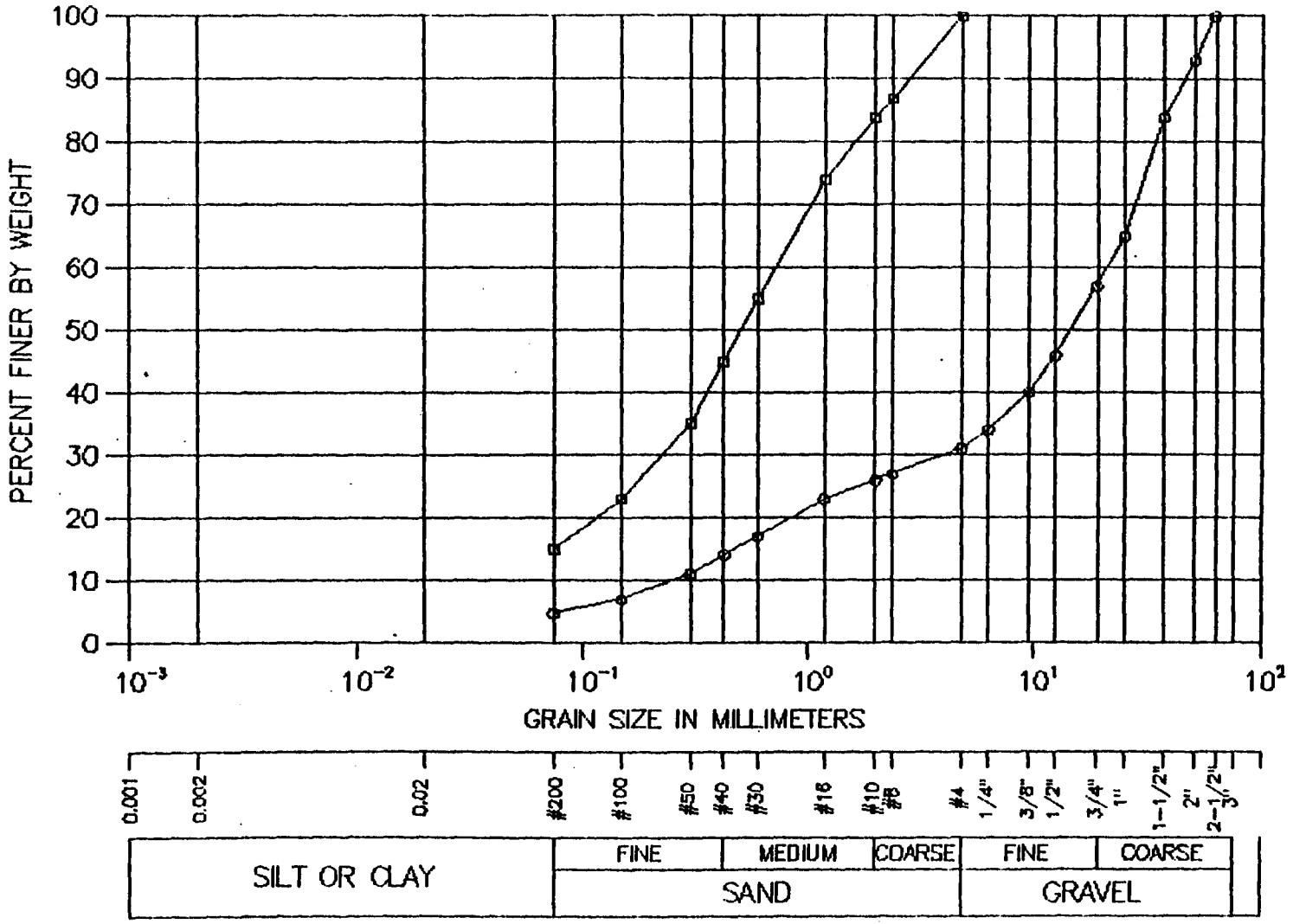
BORING LDB – 05, SAMPLE G10



457

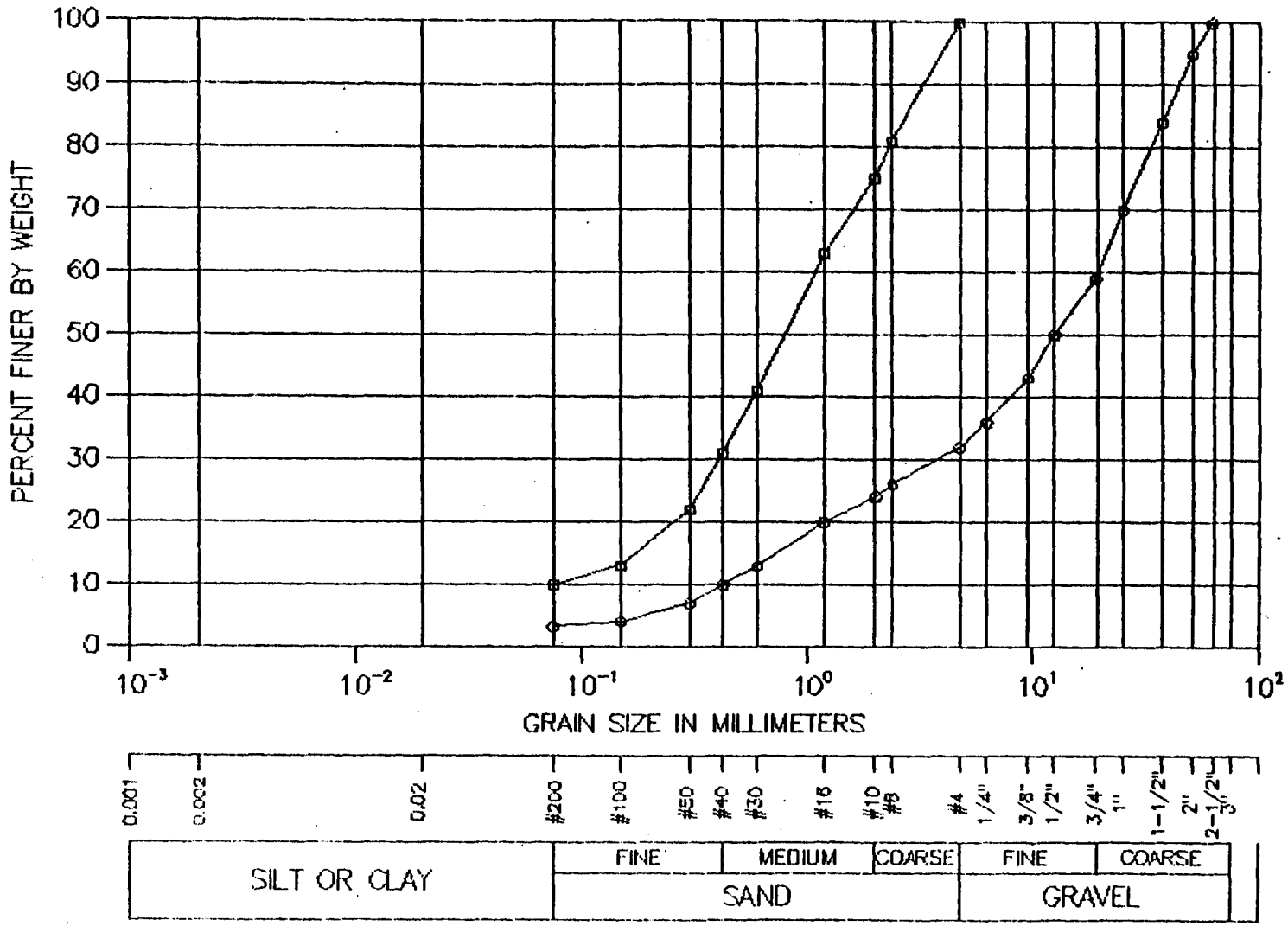
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 05, SAMPLE G11



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

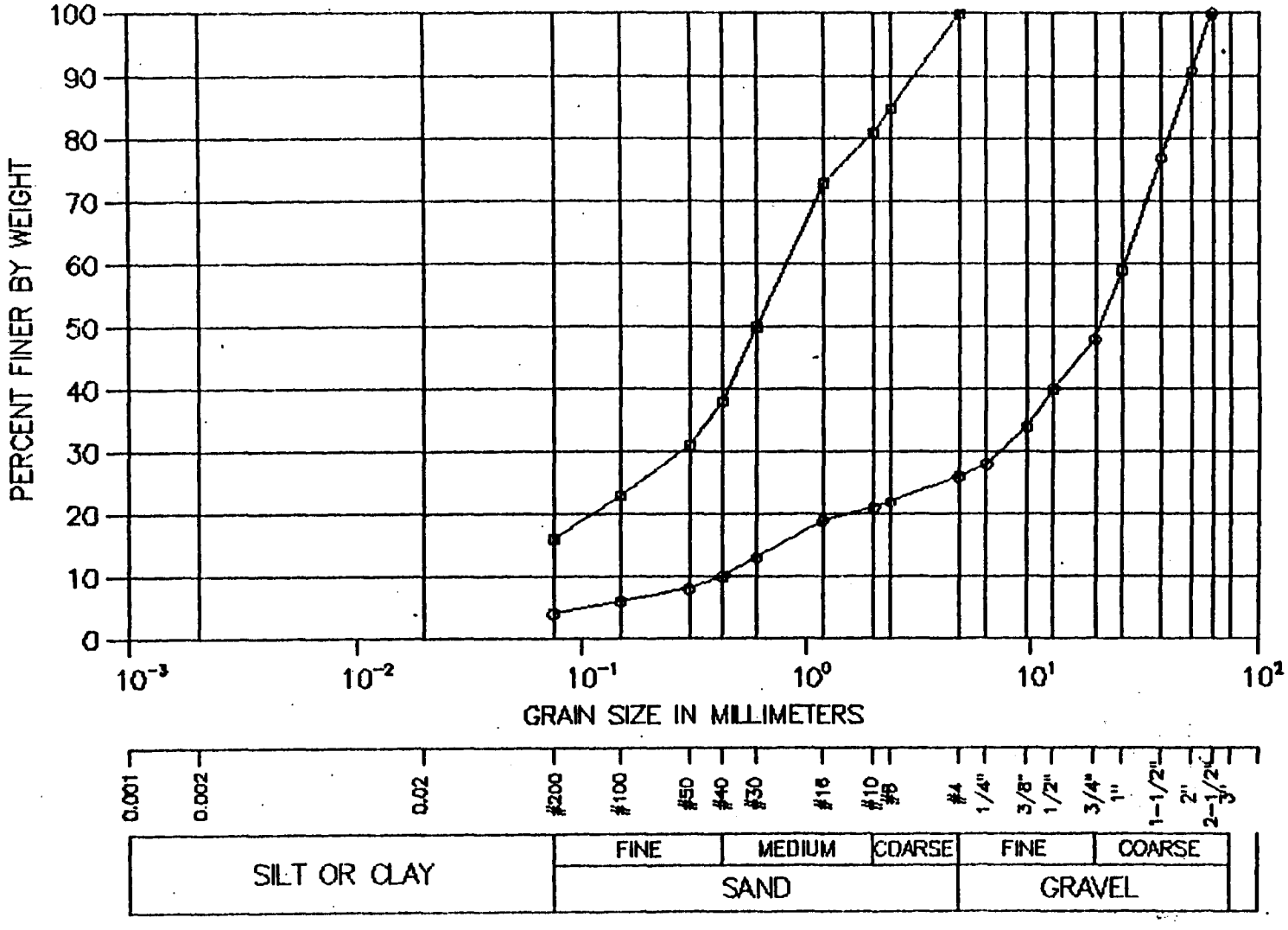
BORING LDB – 06, SAMPLE G1



4e1

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

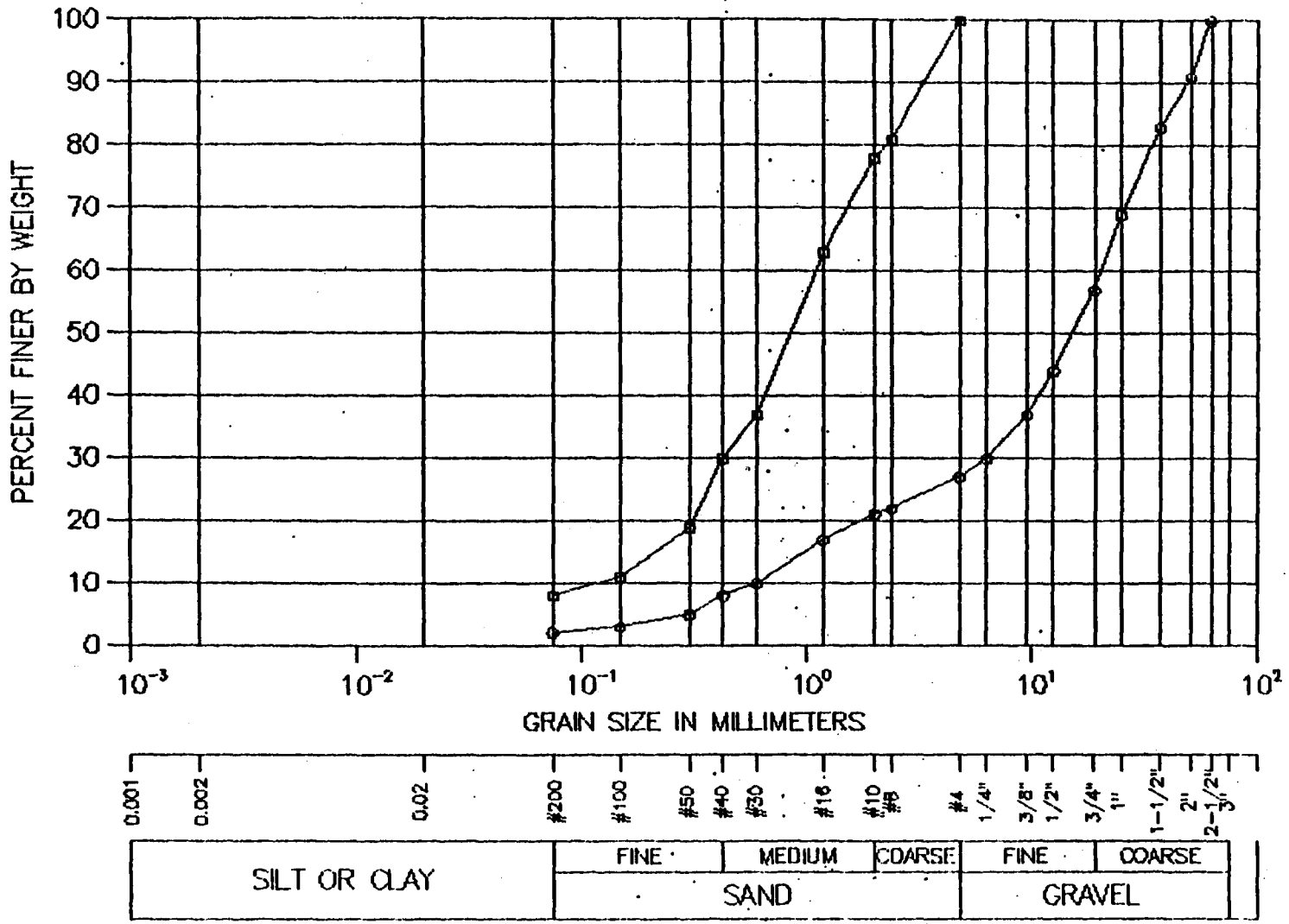
BORING LDB – 06, SAMPLE G4



462

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

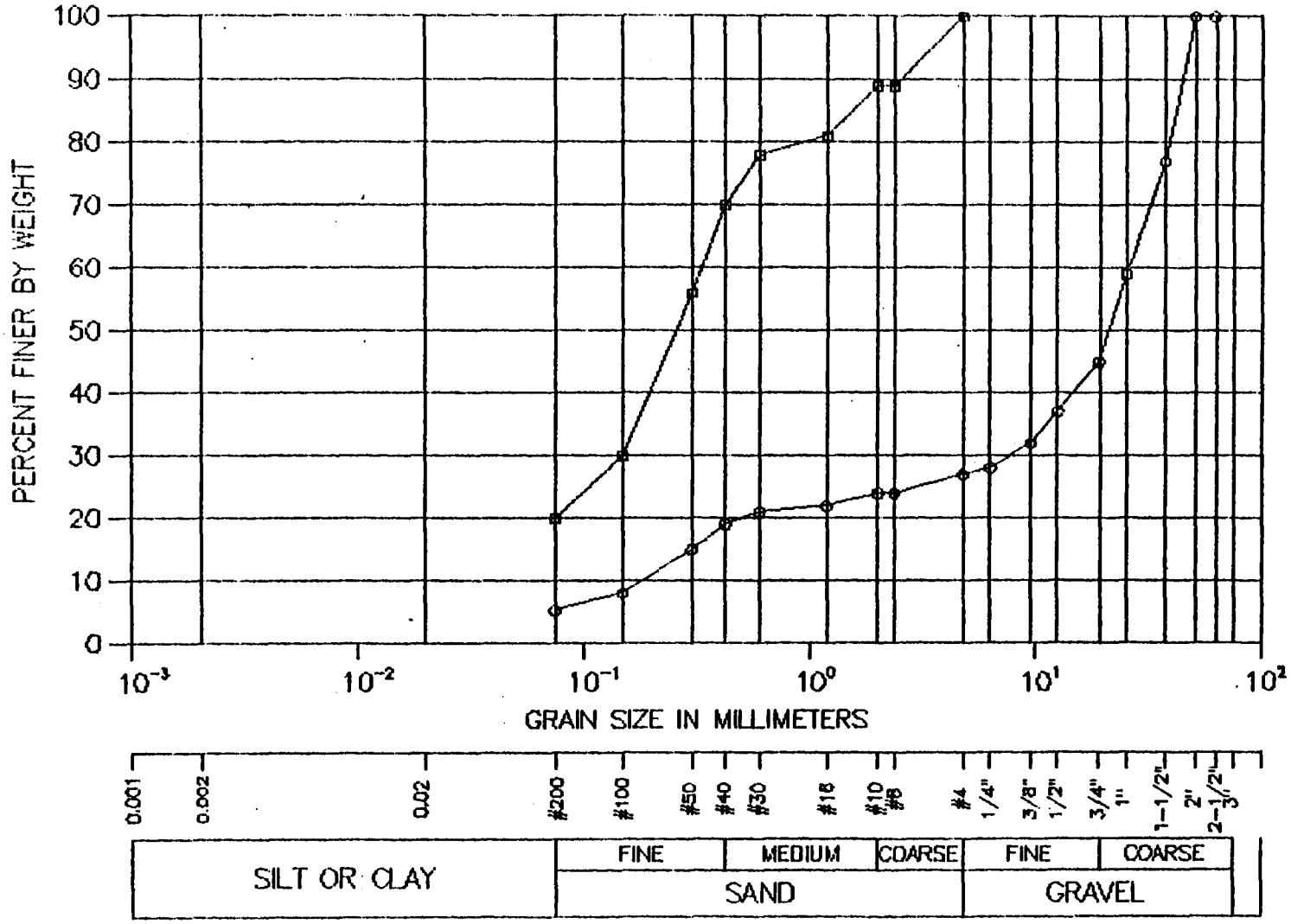
BORING LDB – 06, SAMPLE G5



445

PRICE ROAD TUNNEL - GRAIN SIZE ANALYSIS CURVE

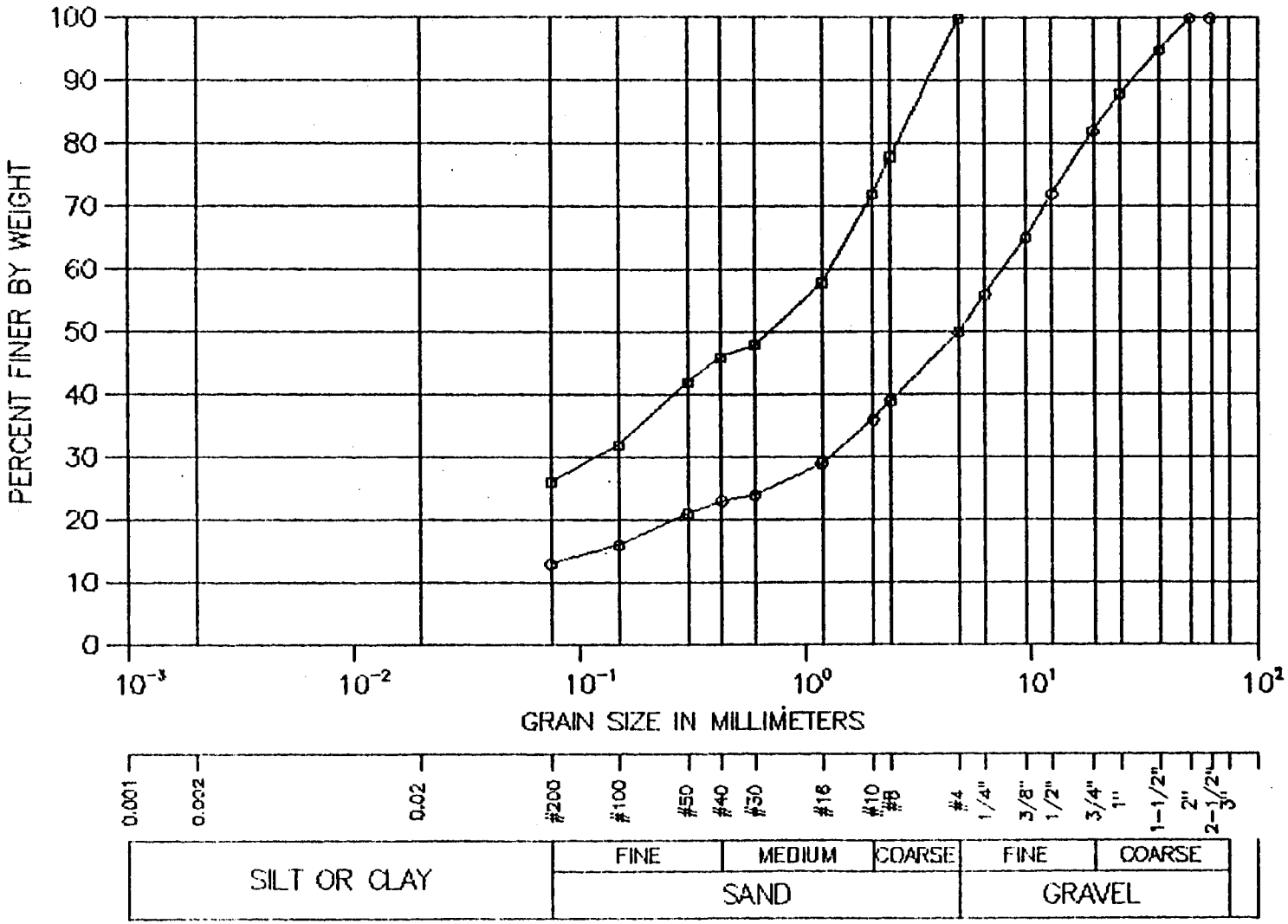
BORING LDB -- 06, SAMPLE G7



464

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

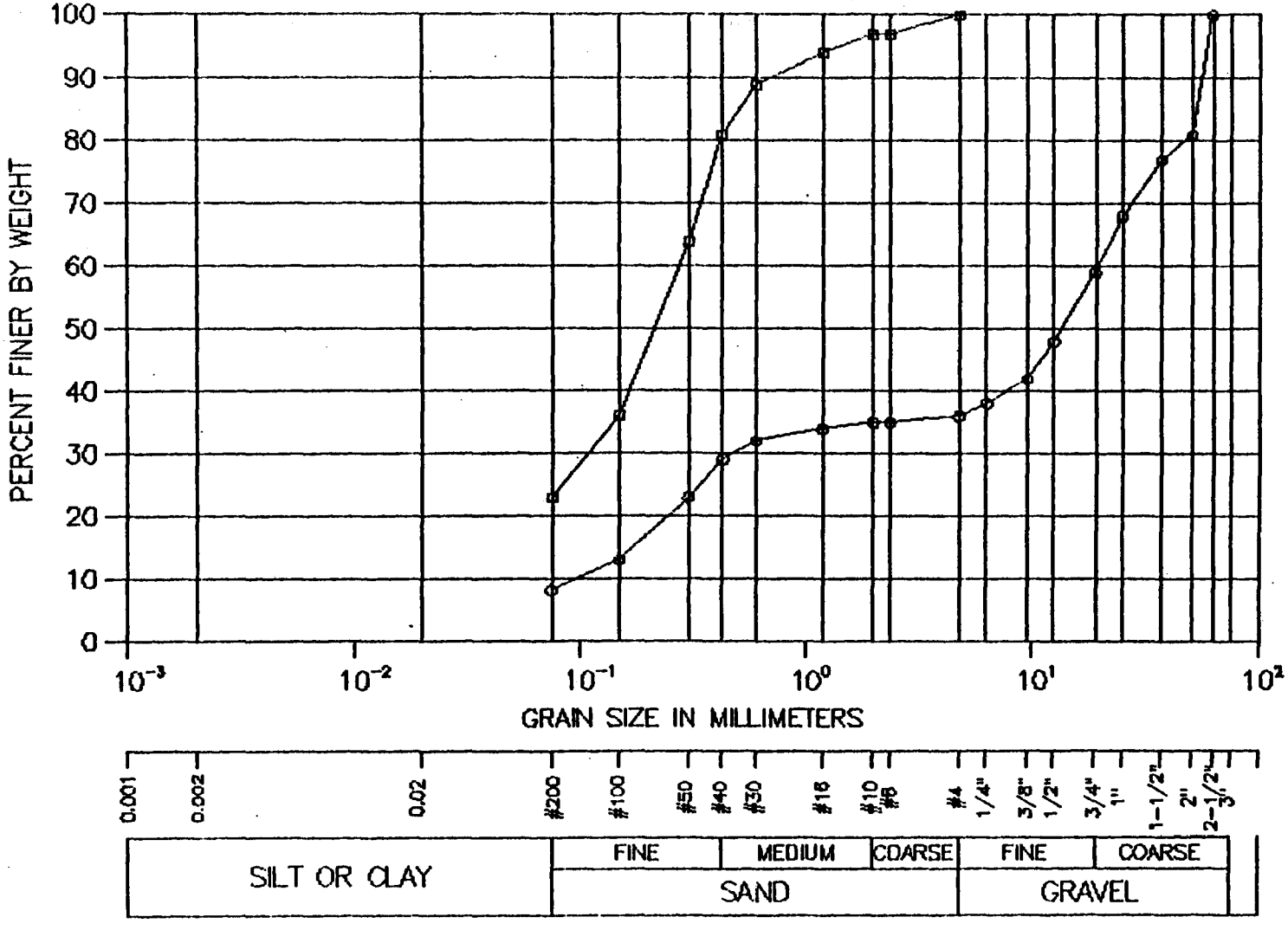
BORING LDB – 06, SAMPLE G8



465

PRICE ROAD TUNNEL - GRAIN SIZE ANALYSIS CURVE

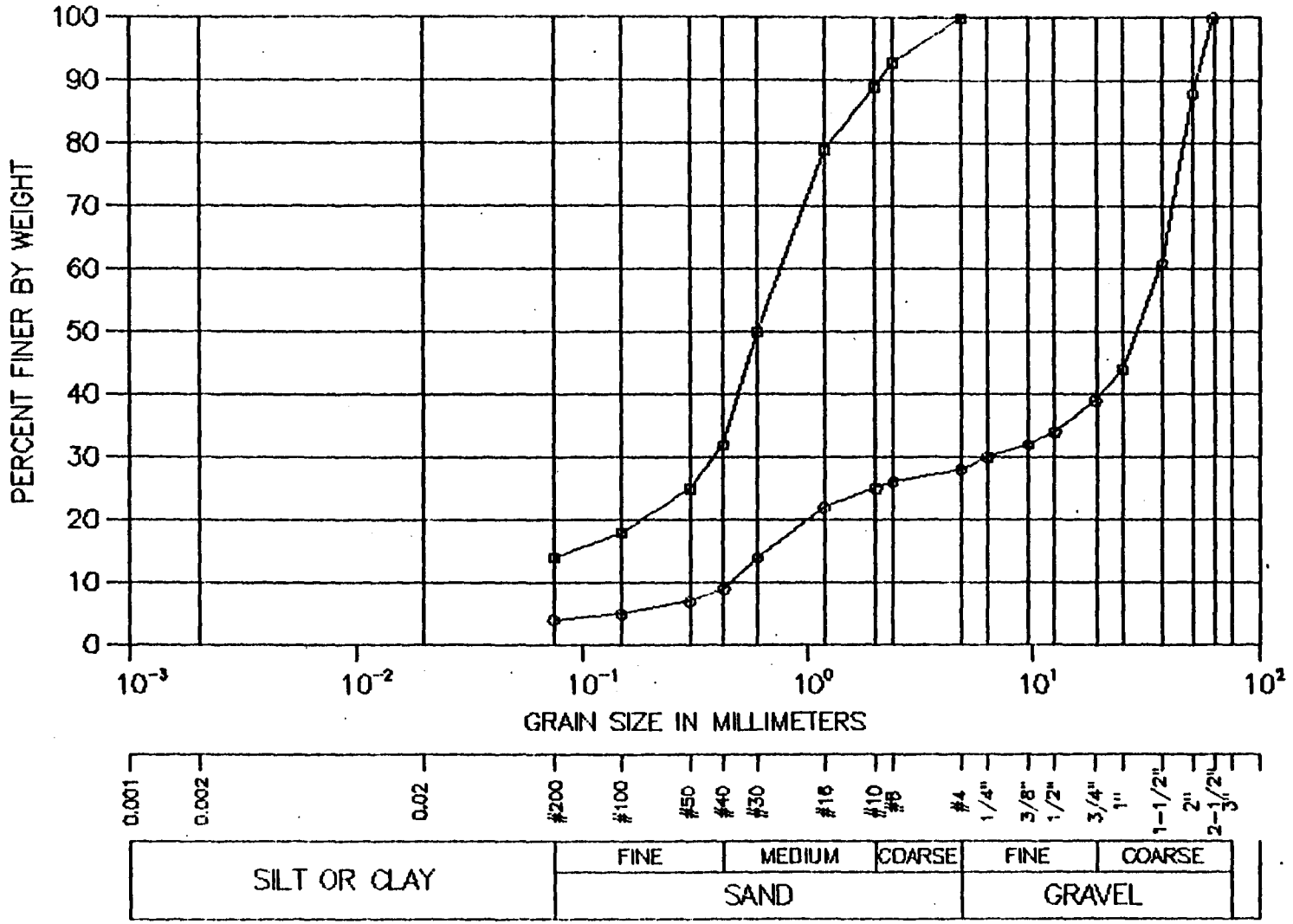
BORING LDB - 06, SAMPLE G10



466

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

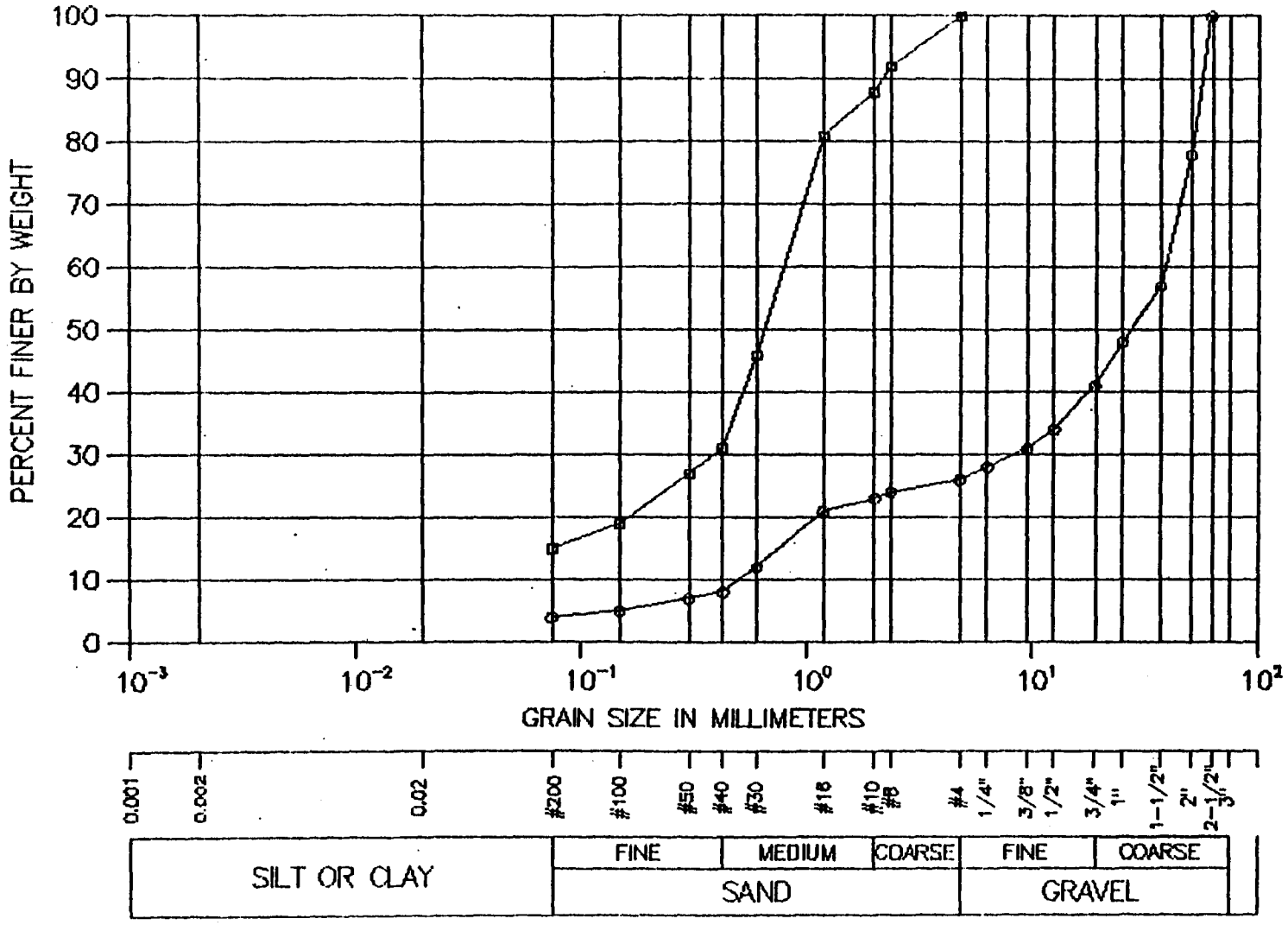
BORING LDB – 06, SAMPLE G12



1-44

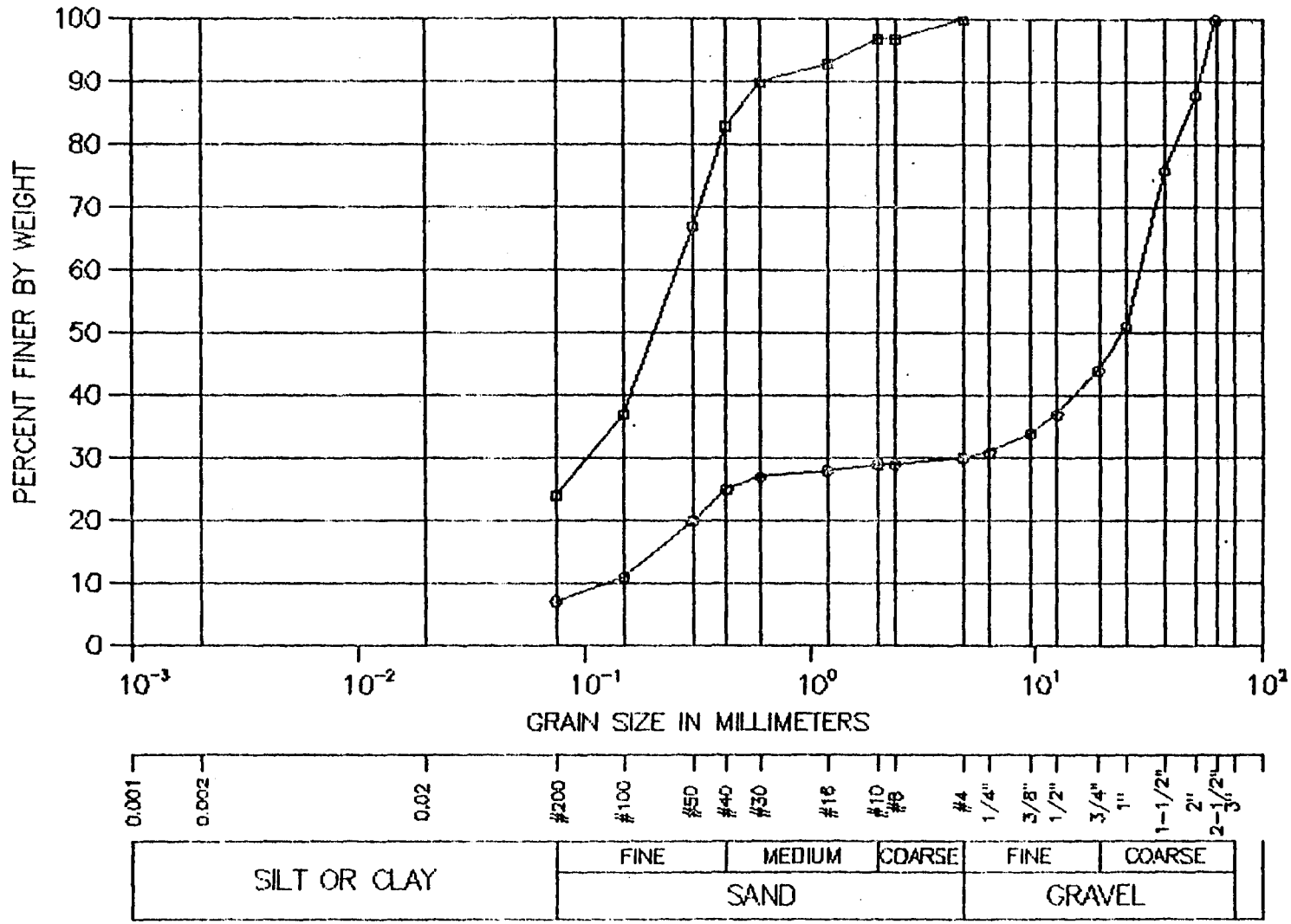
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 07, SAMPLE G1



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

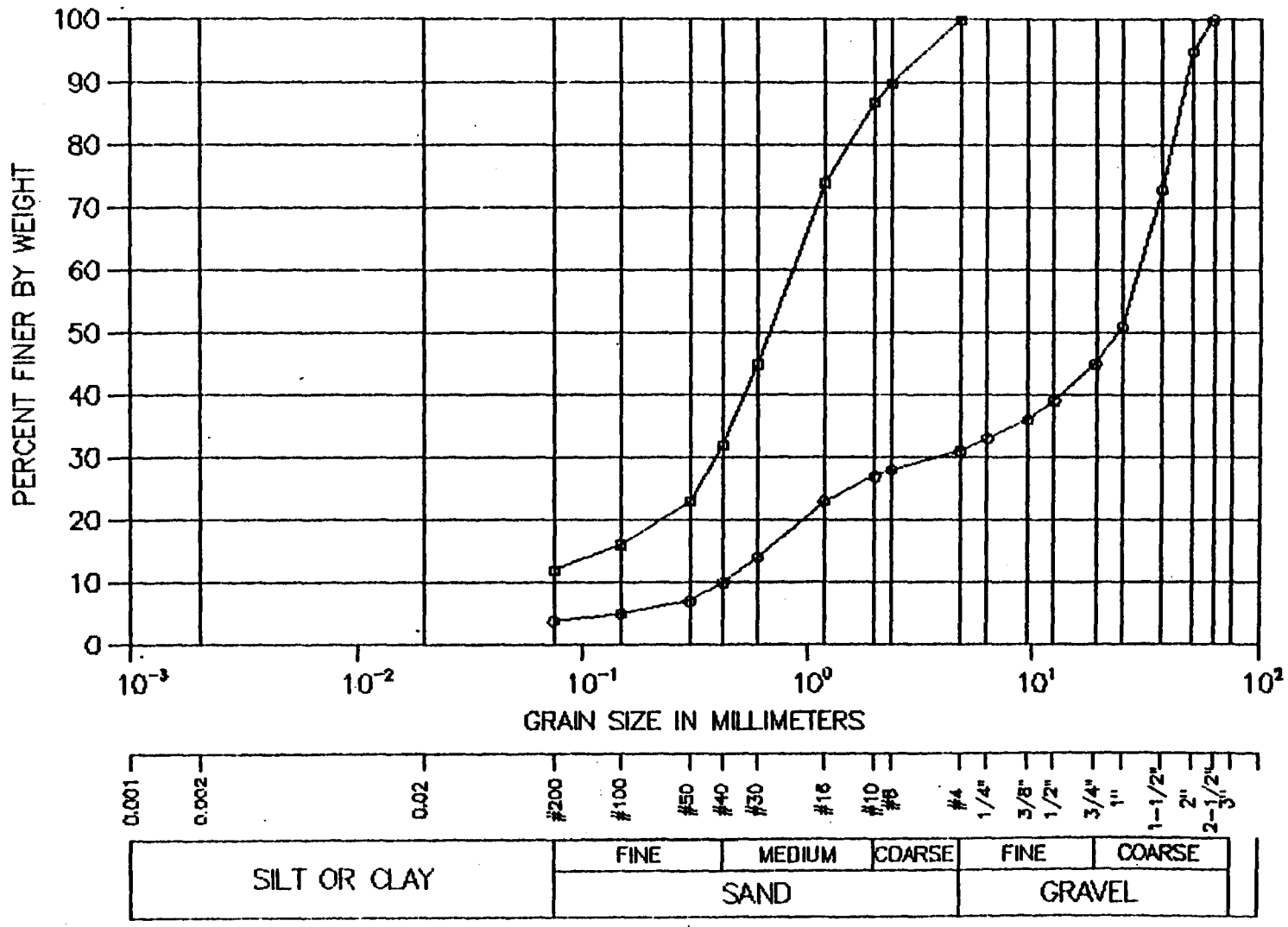
BORING LDB – 07, SAMPLE G4



1977

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

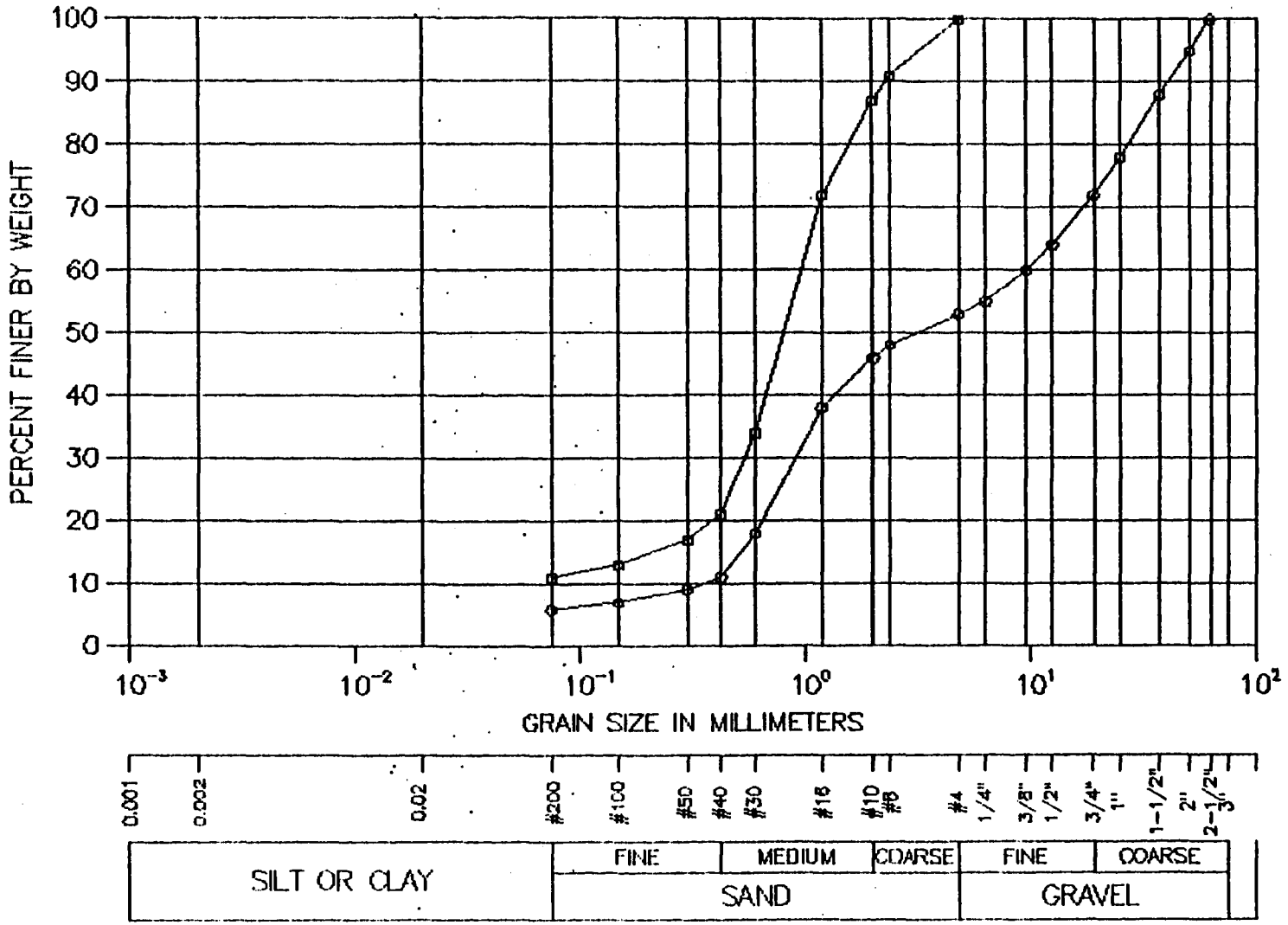
BORING LDB – 07, SAMPLE G5



47a

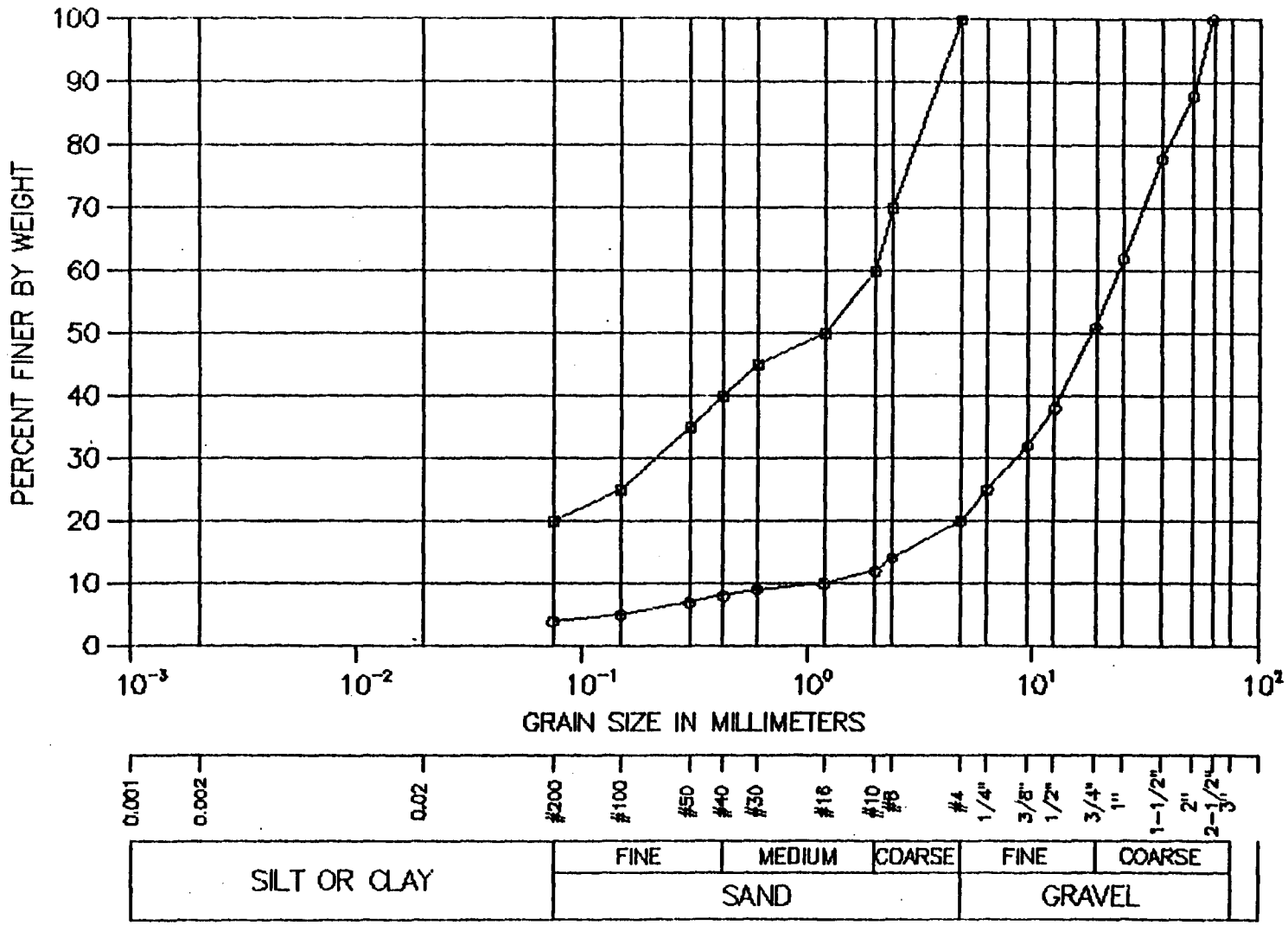
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 07, SAMPLE G7



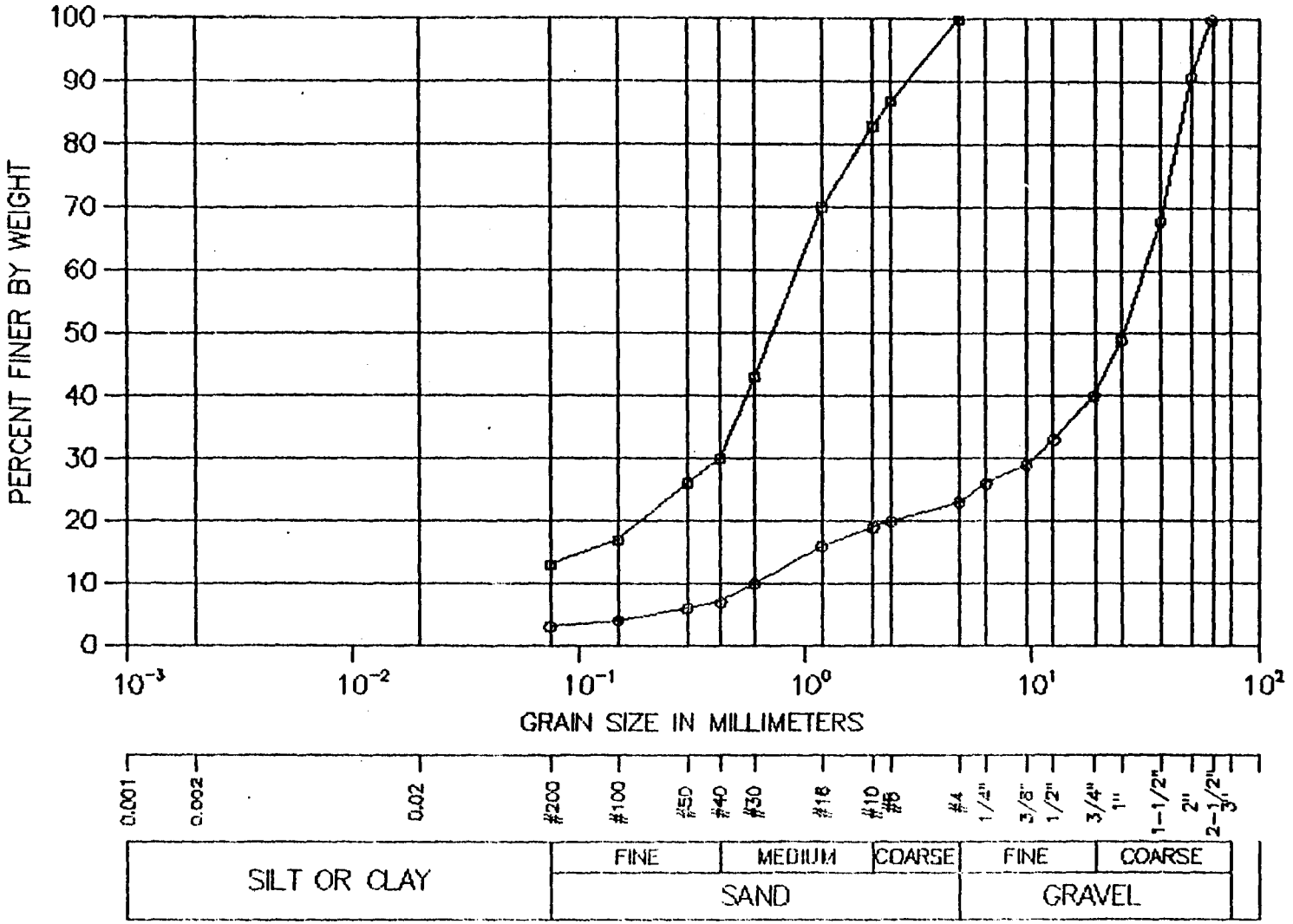
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 07, SAMPLE G8



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

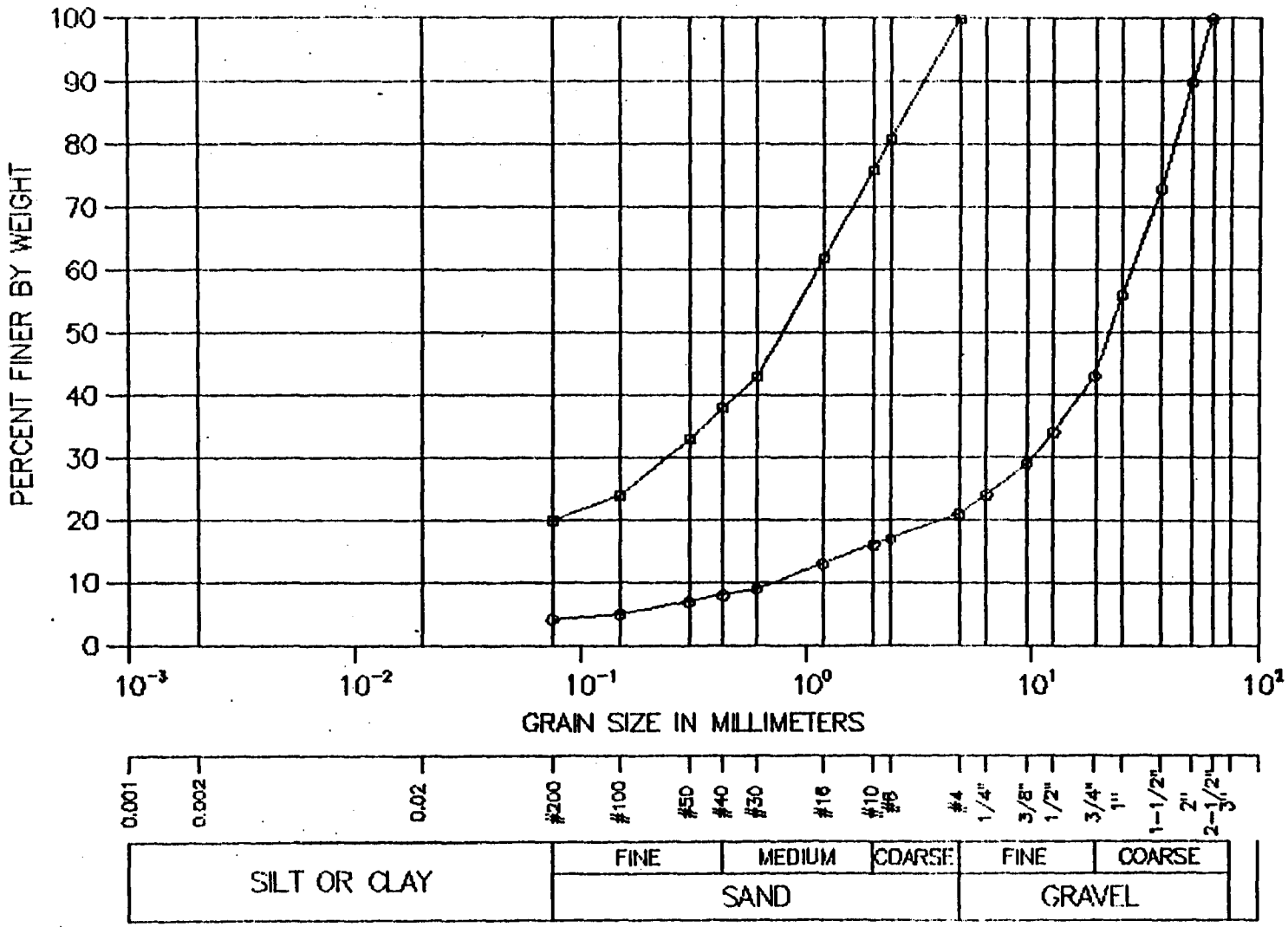
BORING LDB – 07, SAMPLE G1D



A173

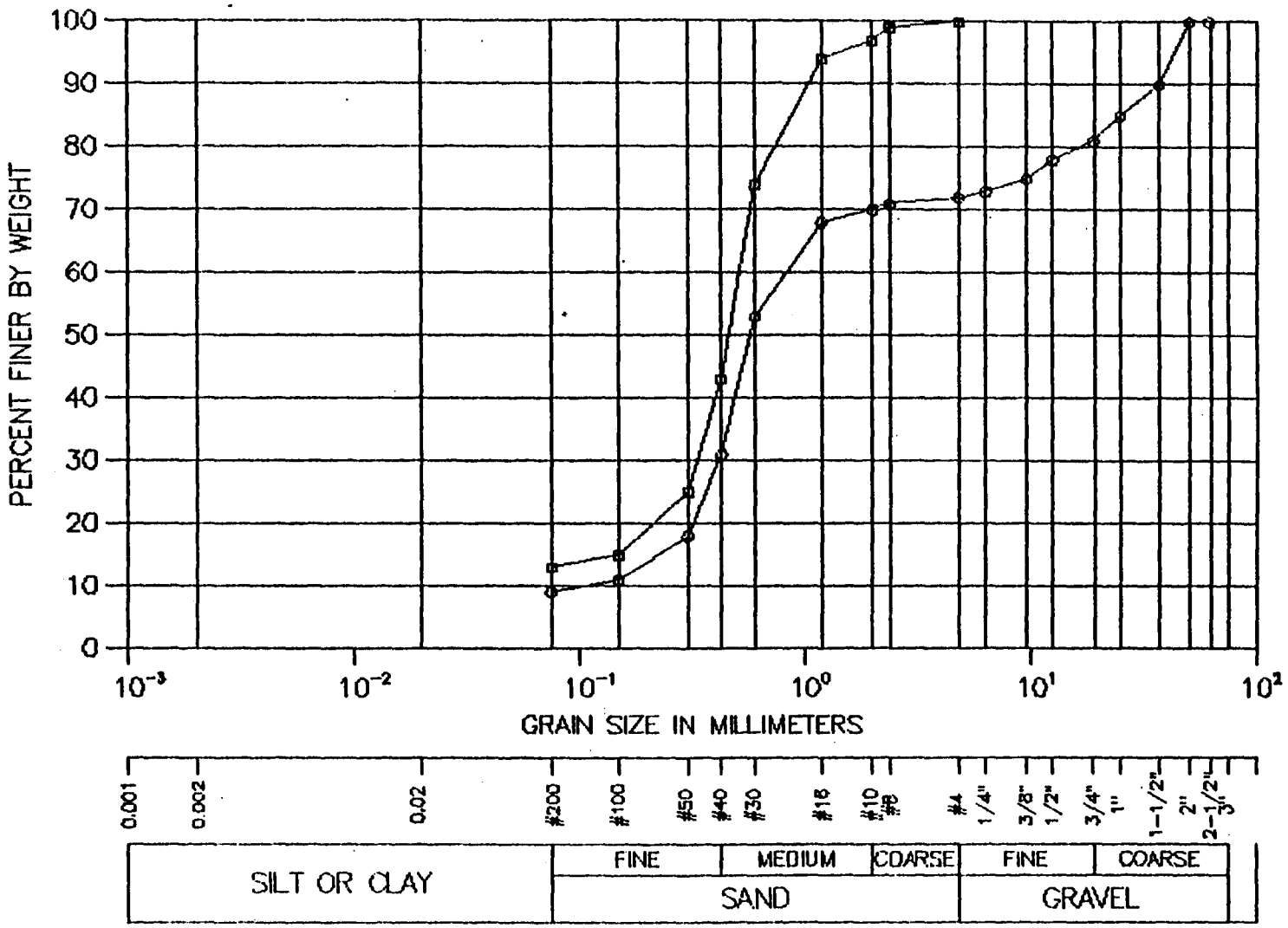
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 07, SAMPLE G12



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

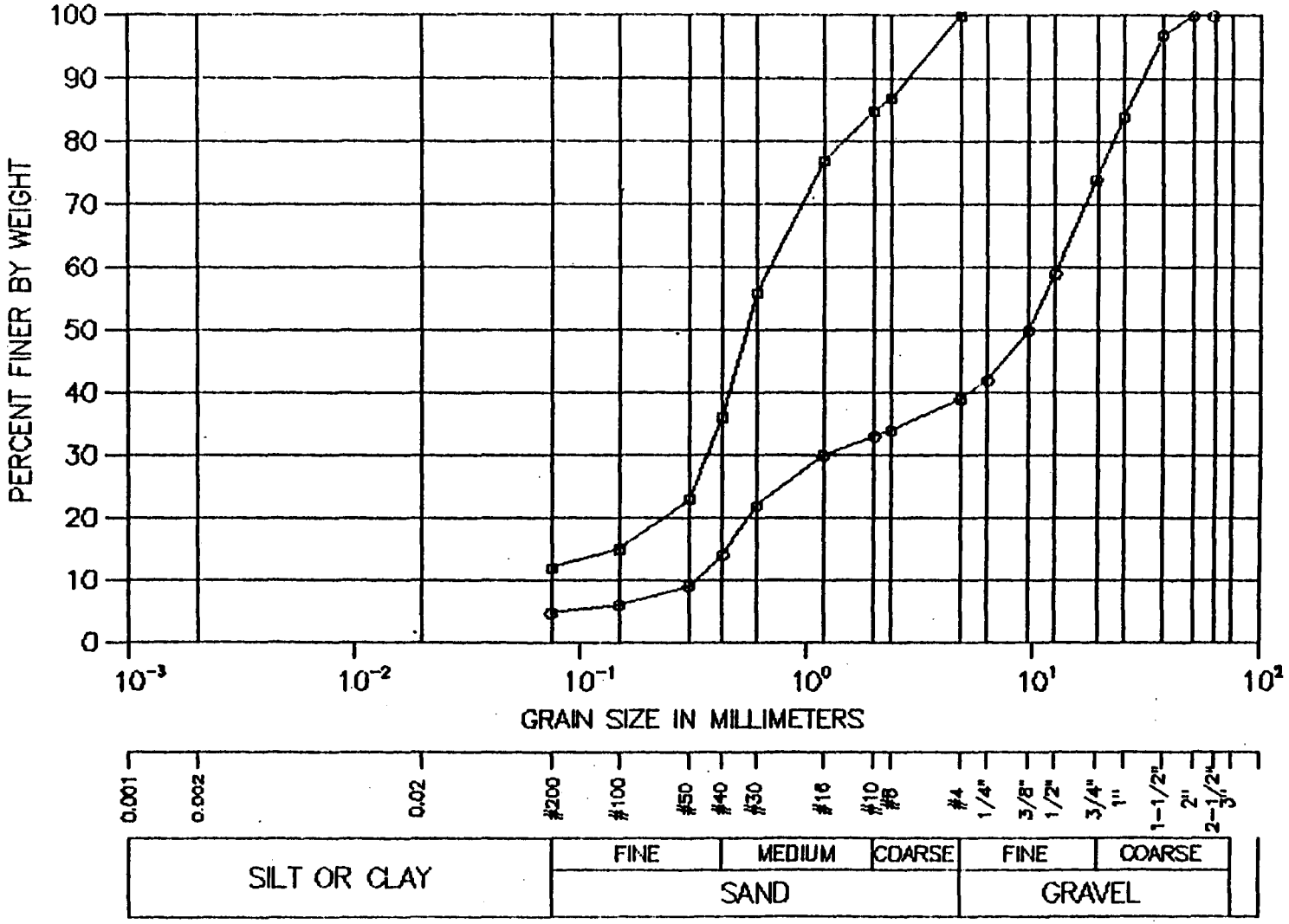
BORING LDB – 08, SAMPLE G2



475

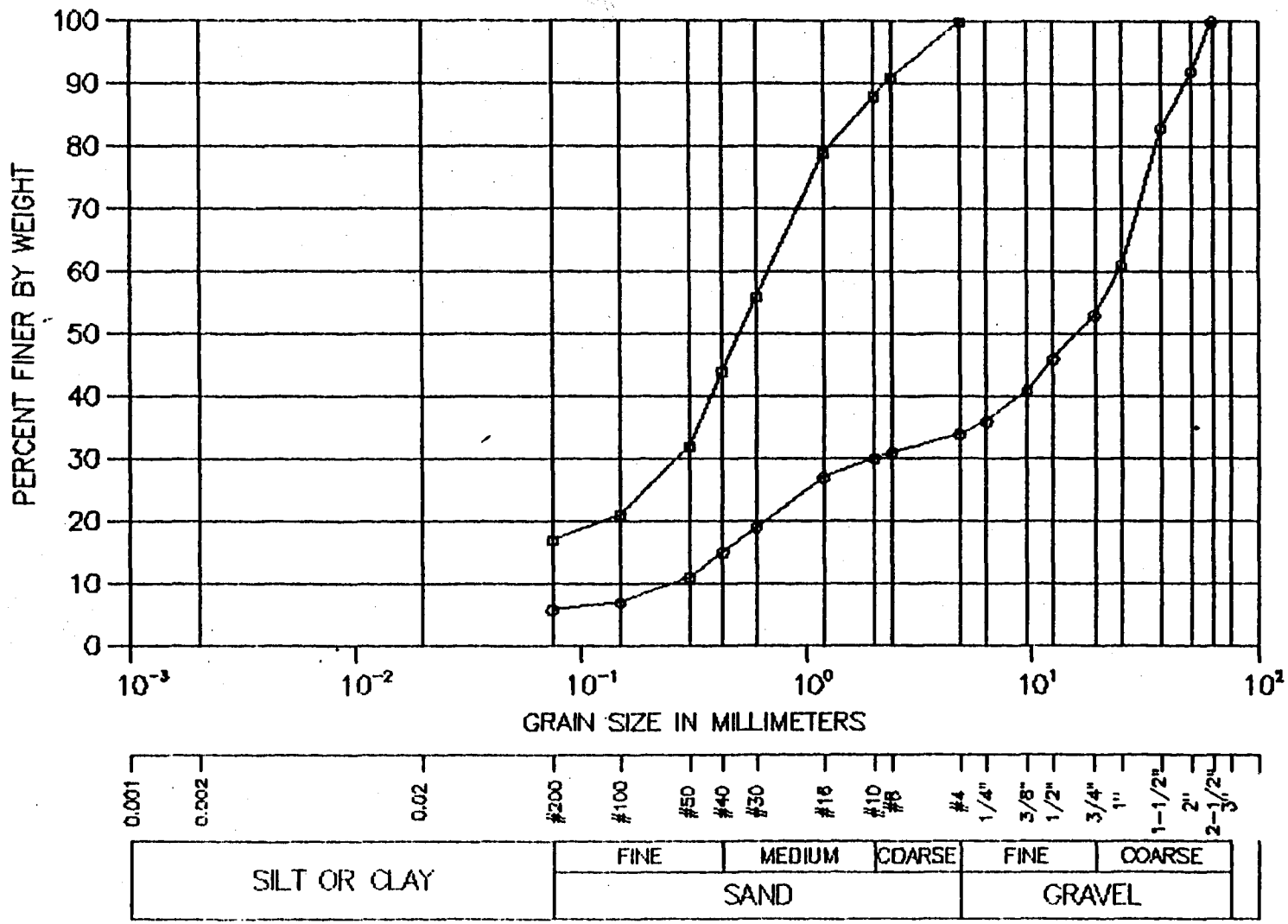
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB -- 08, SAMPLE G4



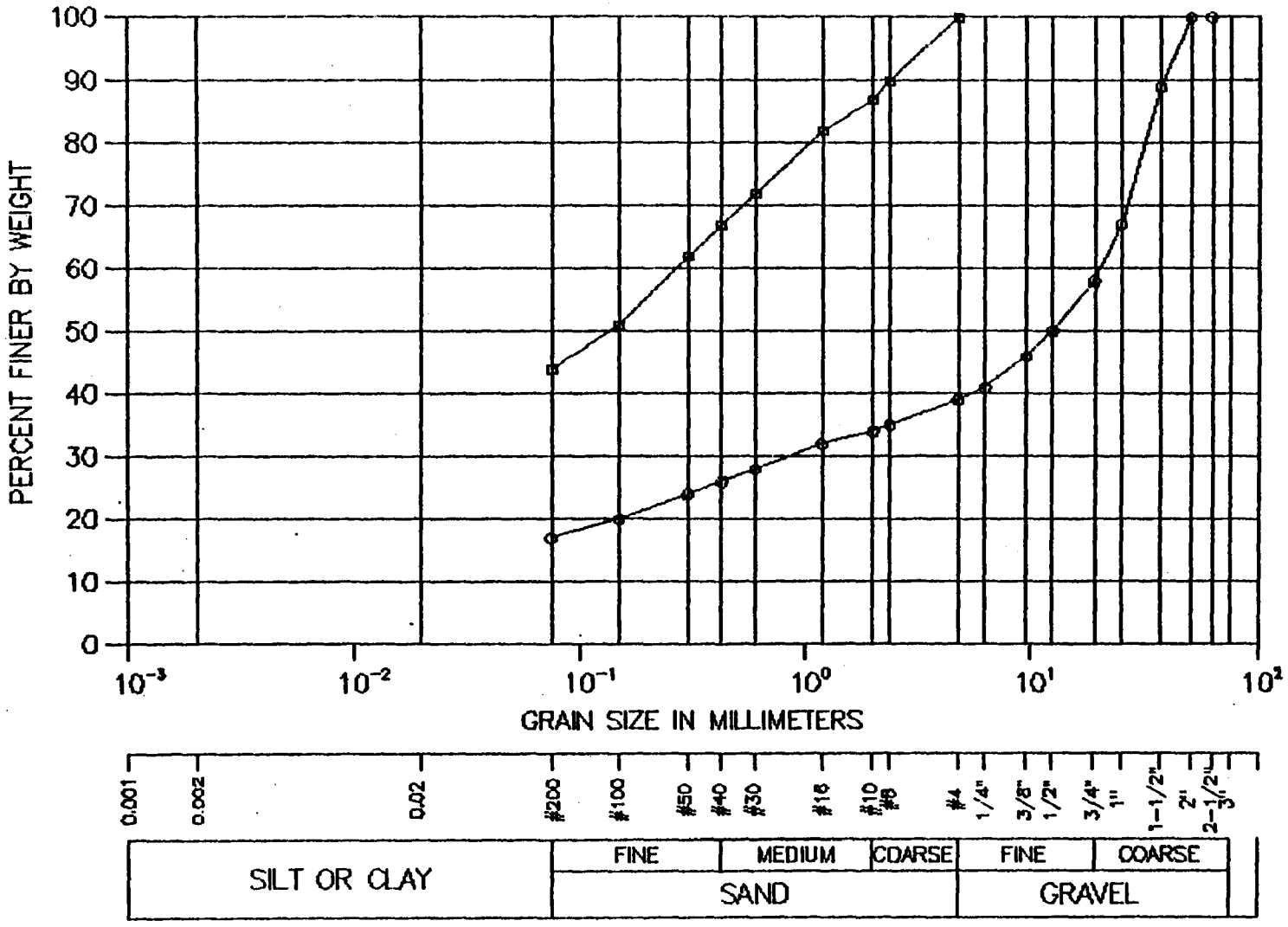
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 08, SAMPLE G5



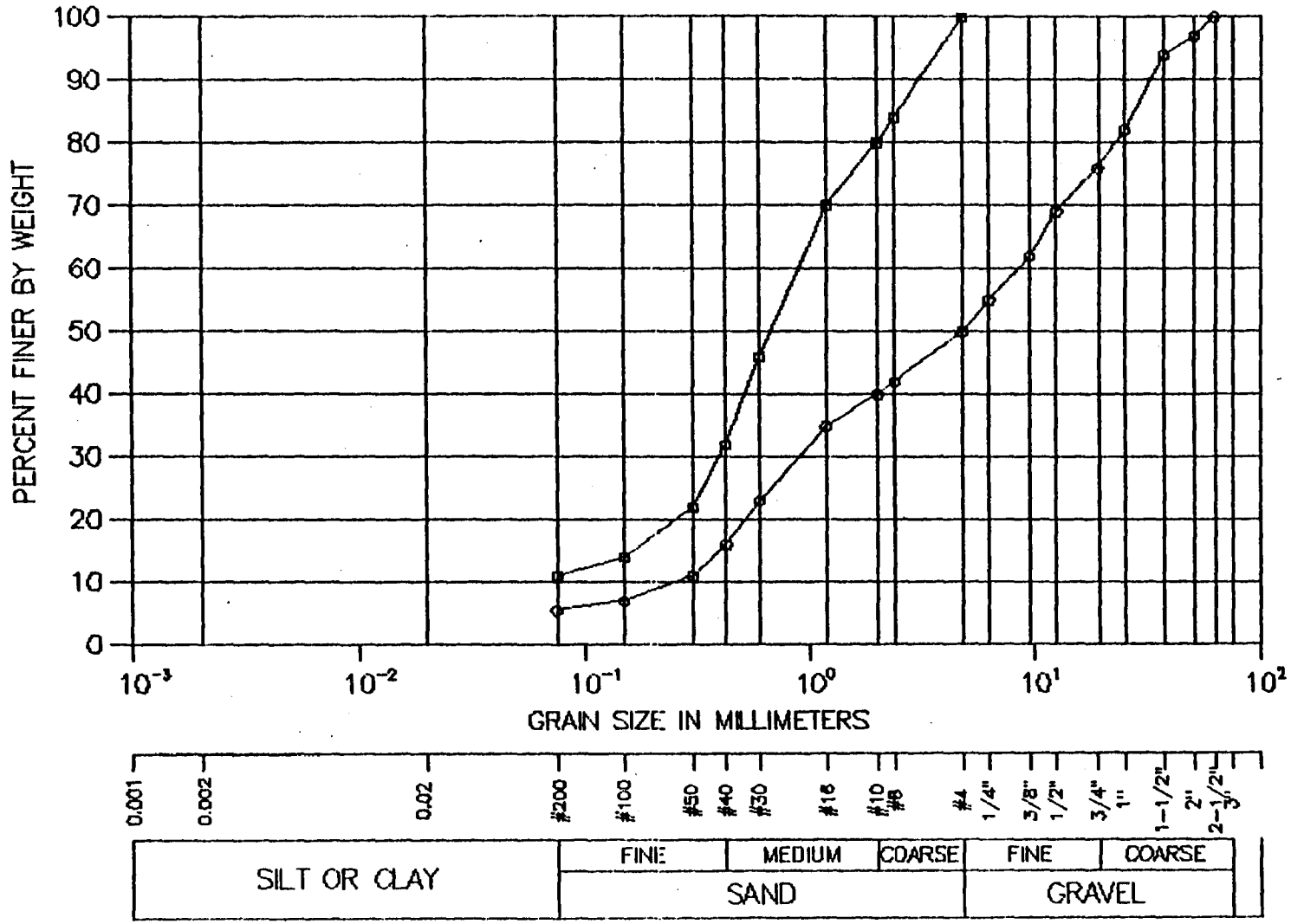
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 08, SAMPLE G7



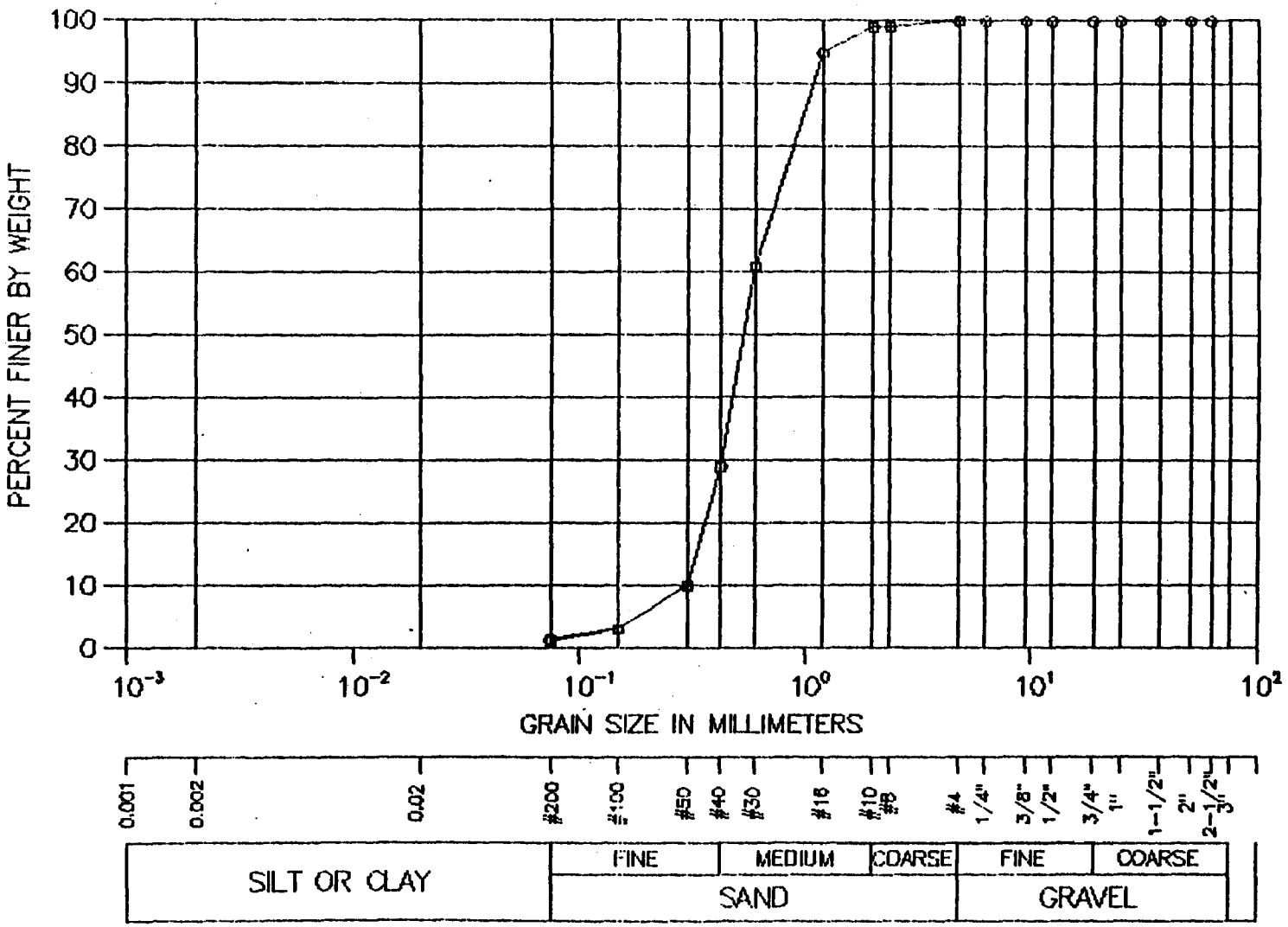
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 08, SAMPLE G8



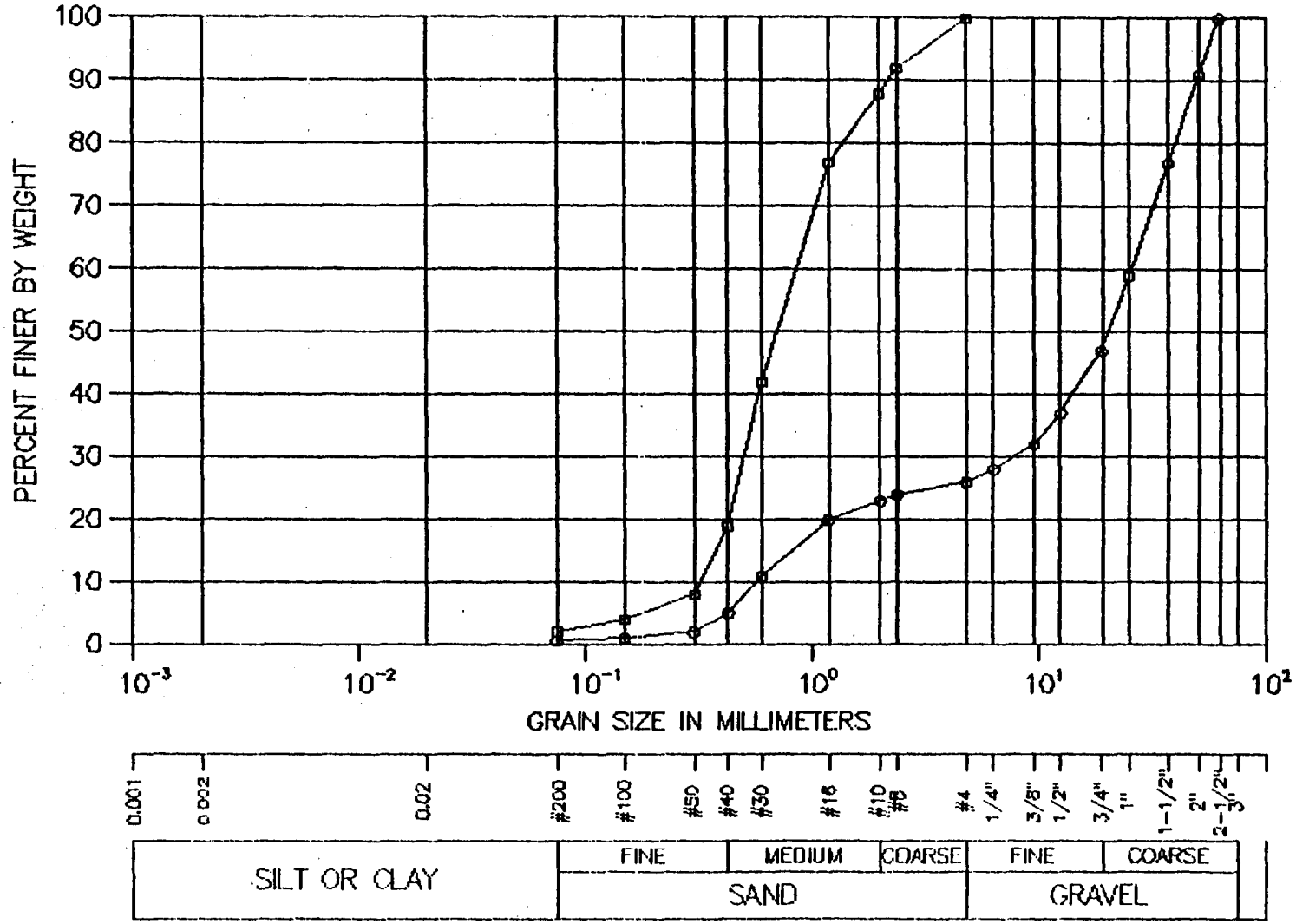
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 08, SAMPLE G10



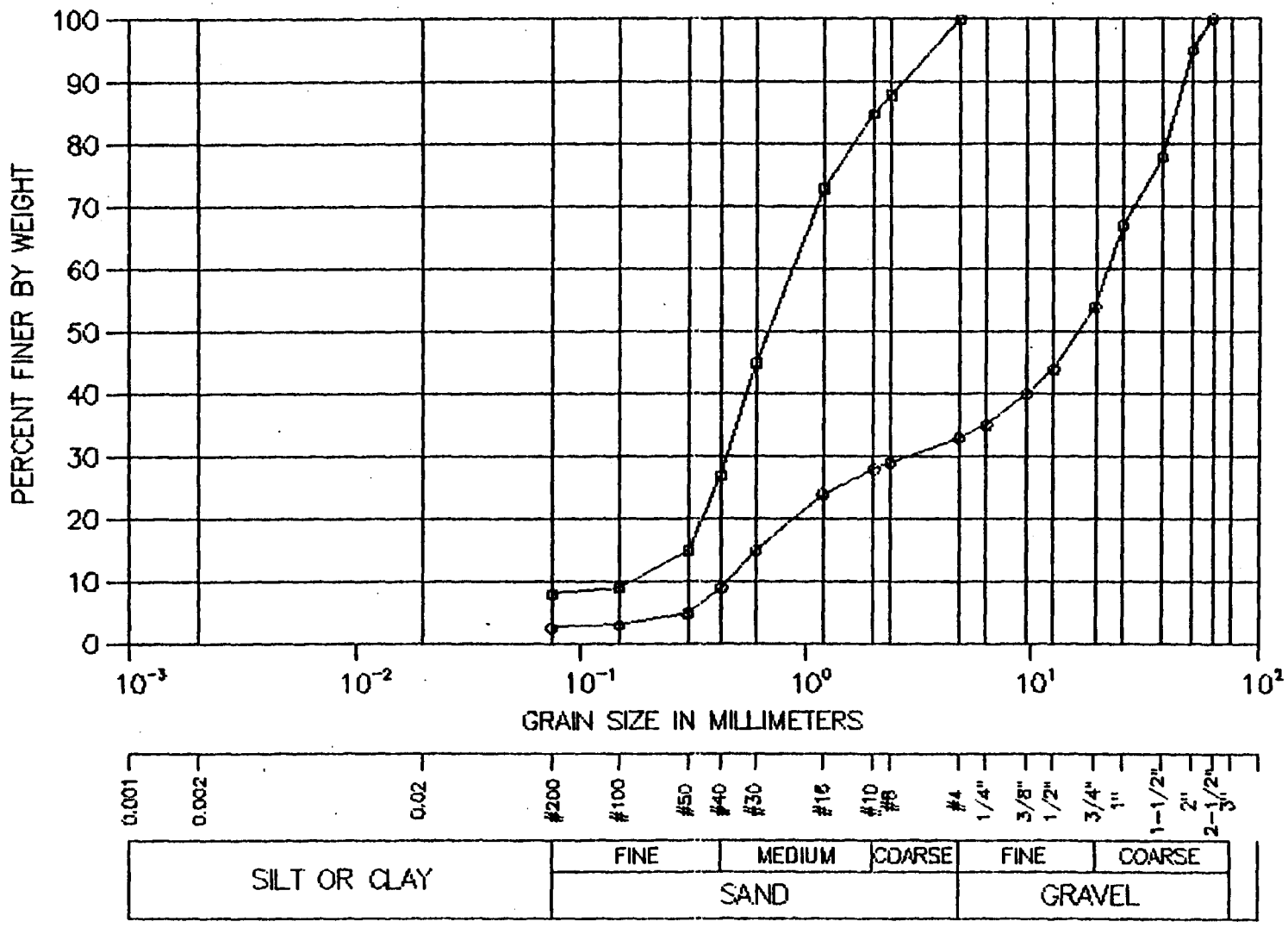
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 08, SAMPLE G12



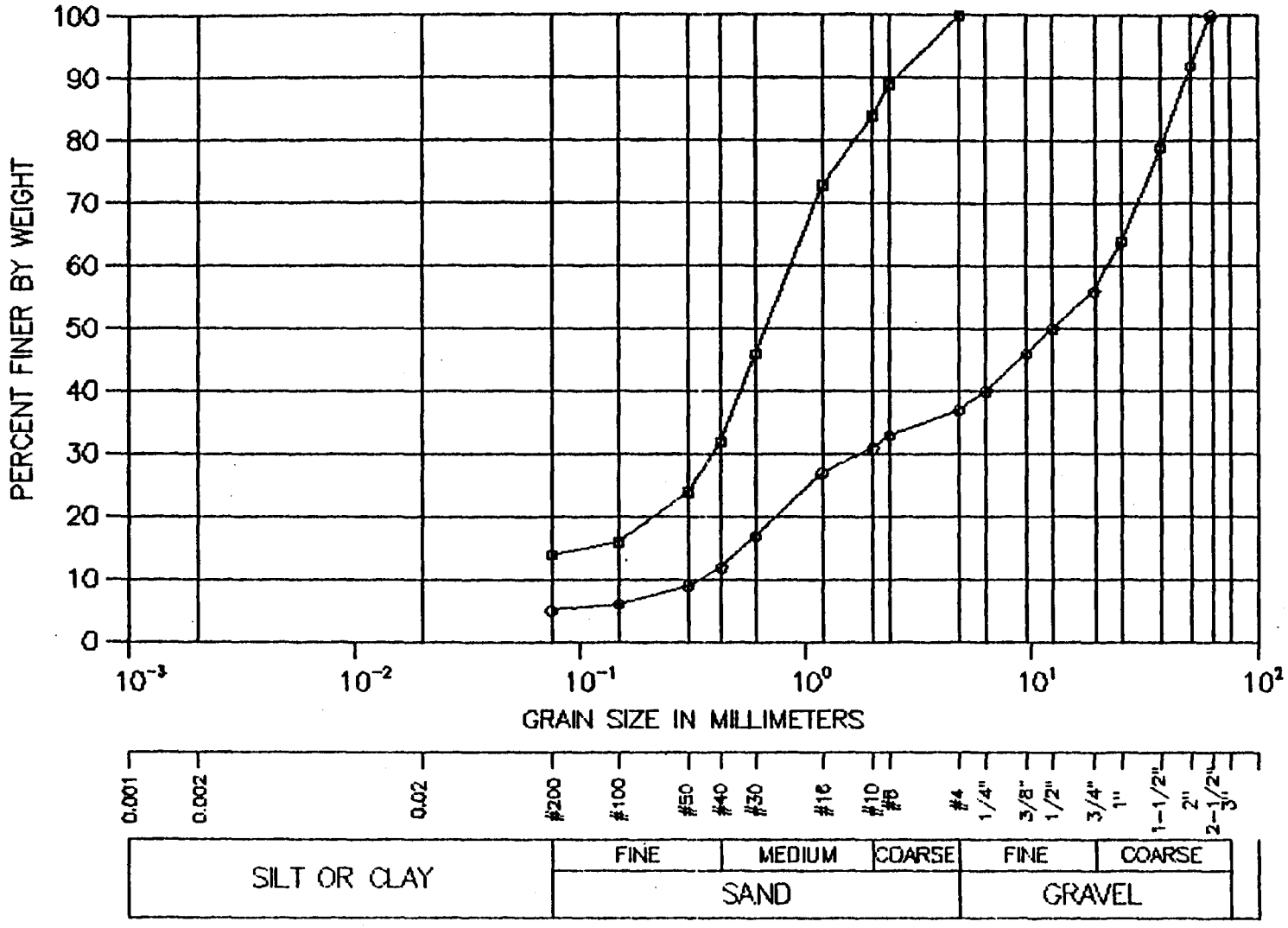
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 09, SAMPLE G1



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

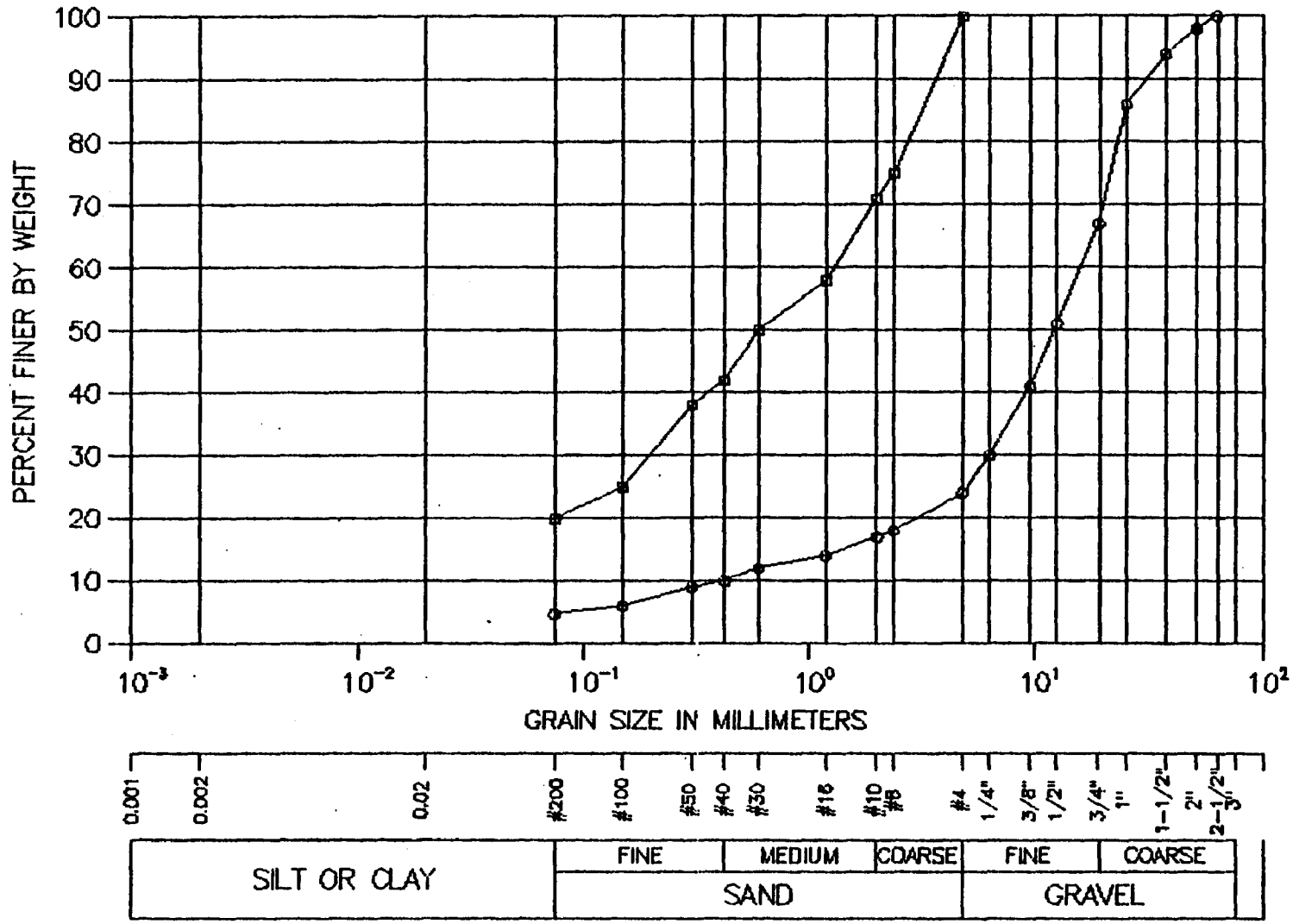
BORING LDB – 09, SAMPLE G4



4/15

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

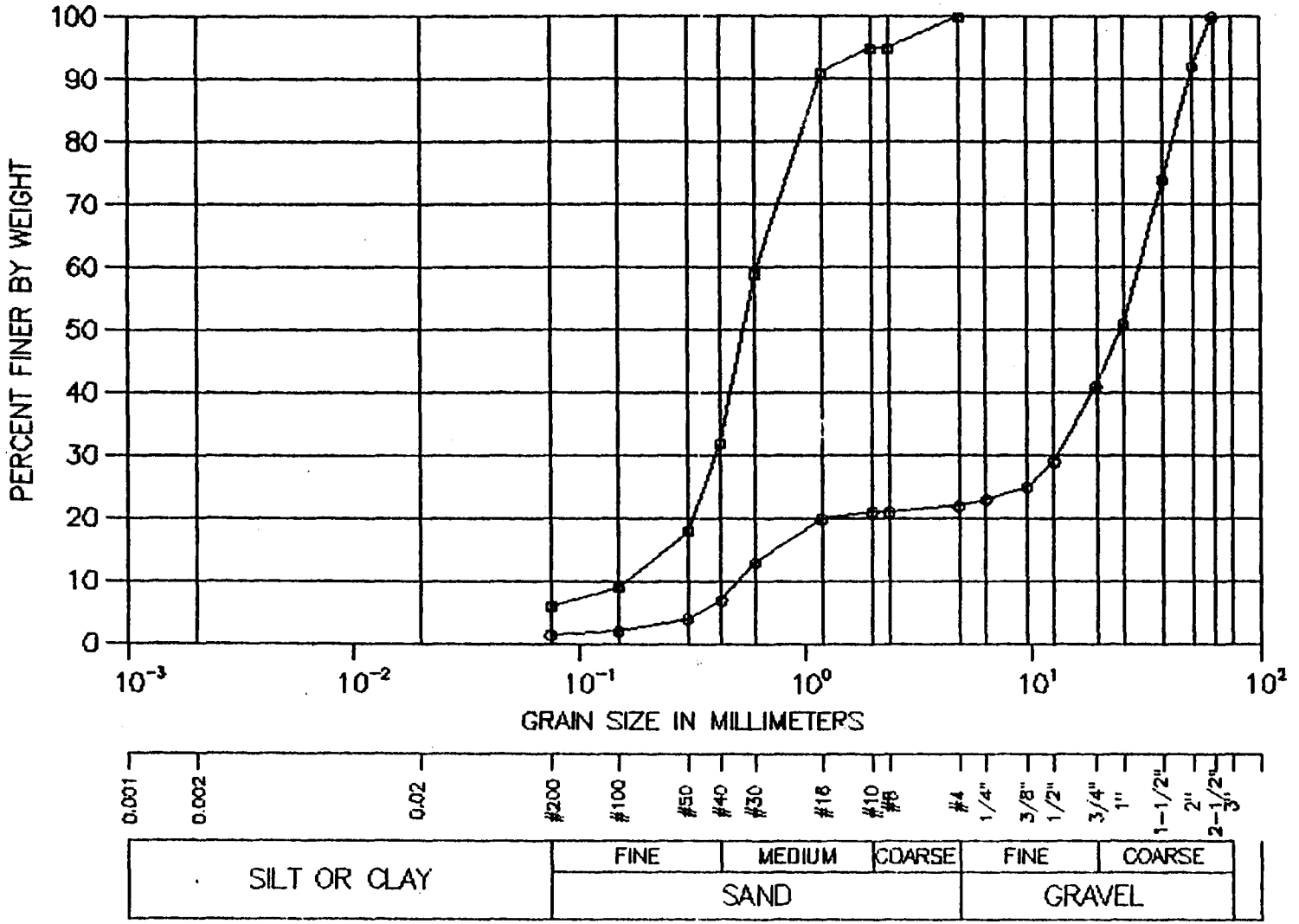
BORING LDB – 09, SAMPLE G5



484

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

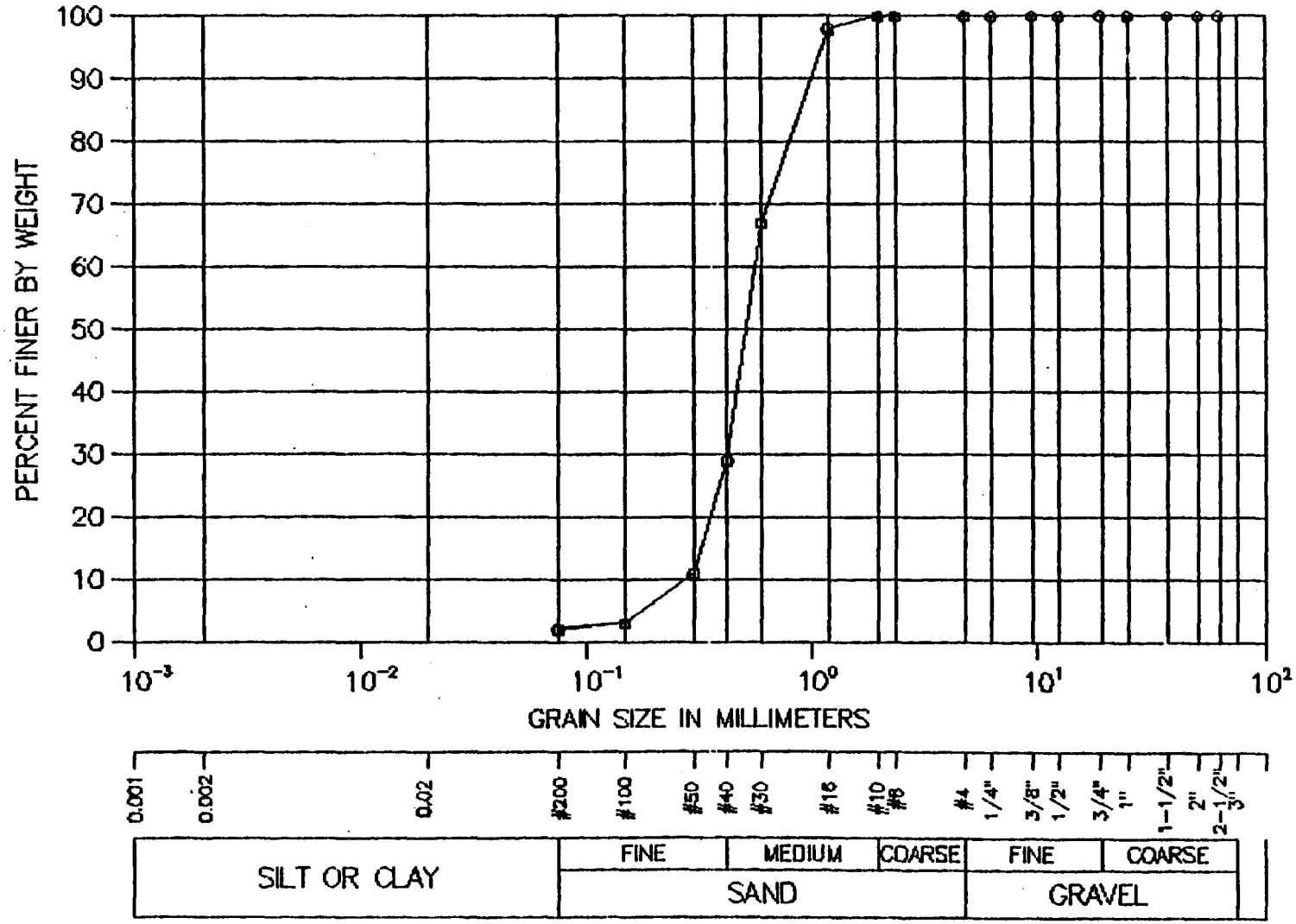
BORING LDB – 09, SAMPLE G9



5 of 7

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

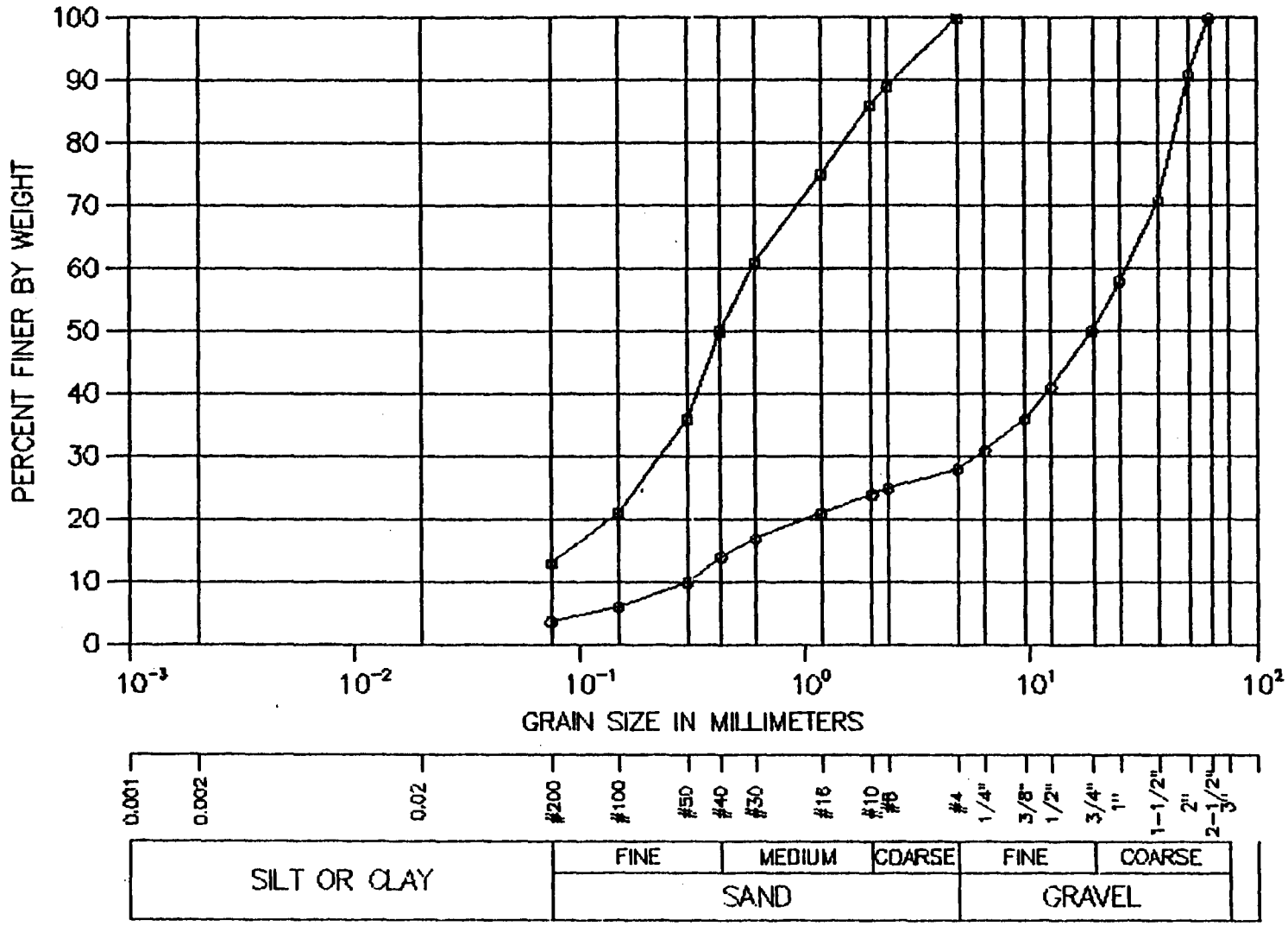
BORING LDB – 09, SAMPLE G11



44

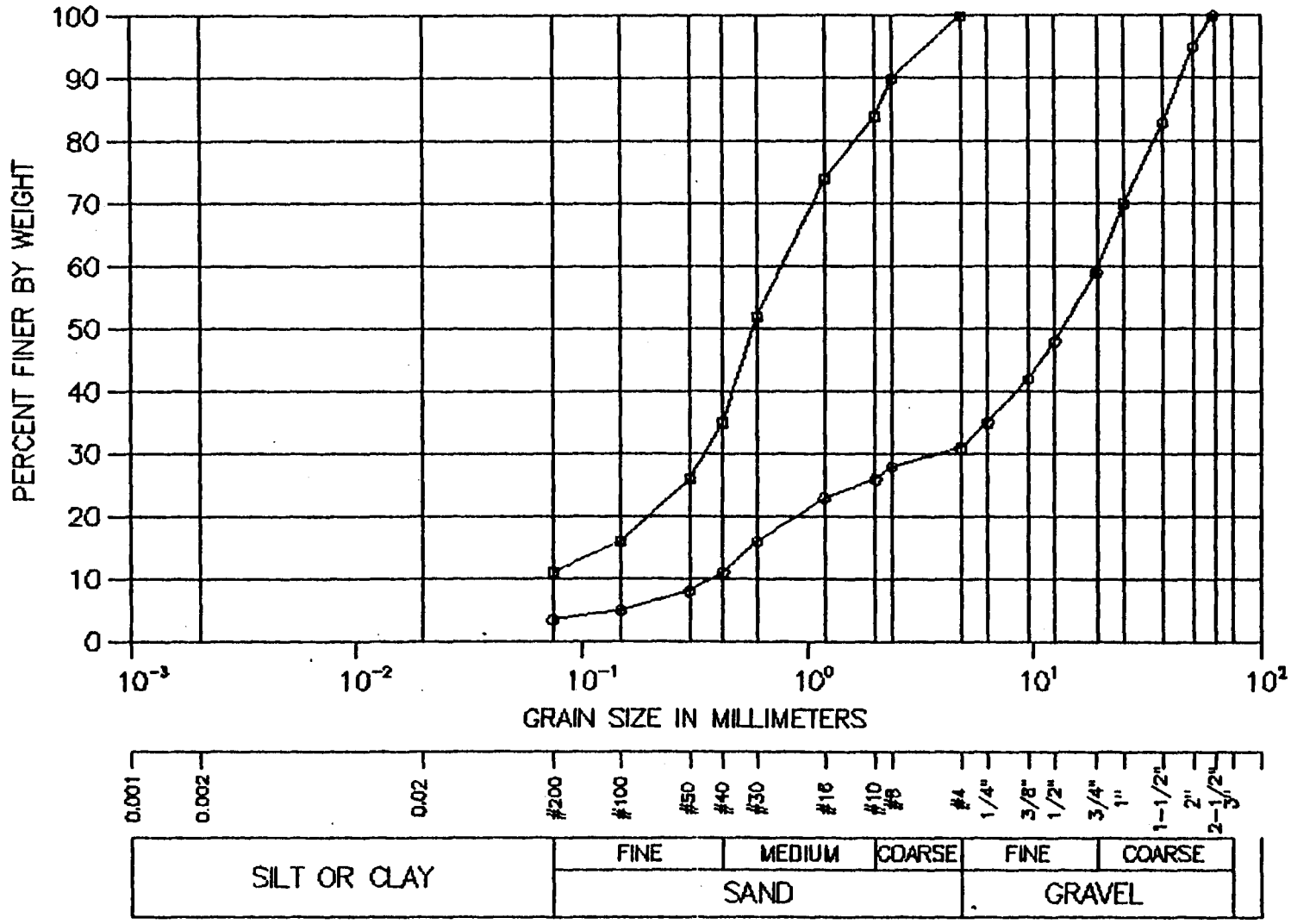
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 09, SAMPLE G12



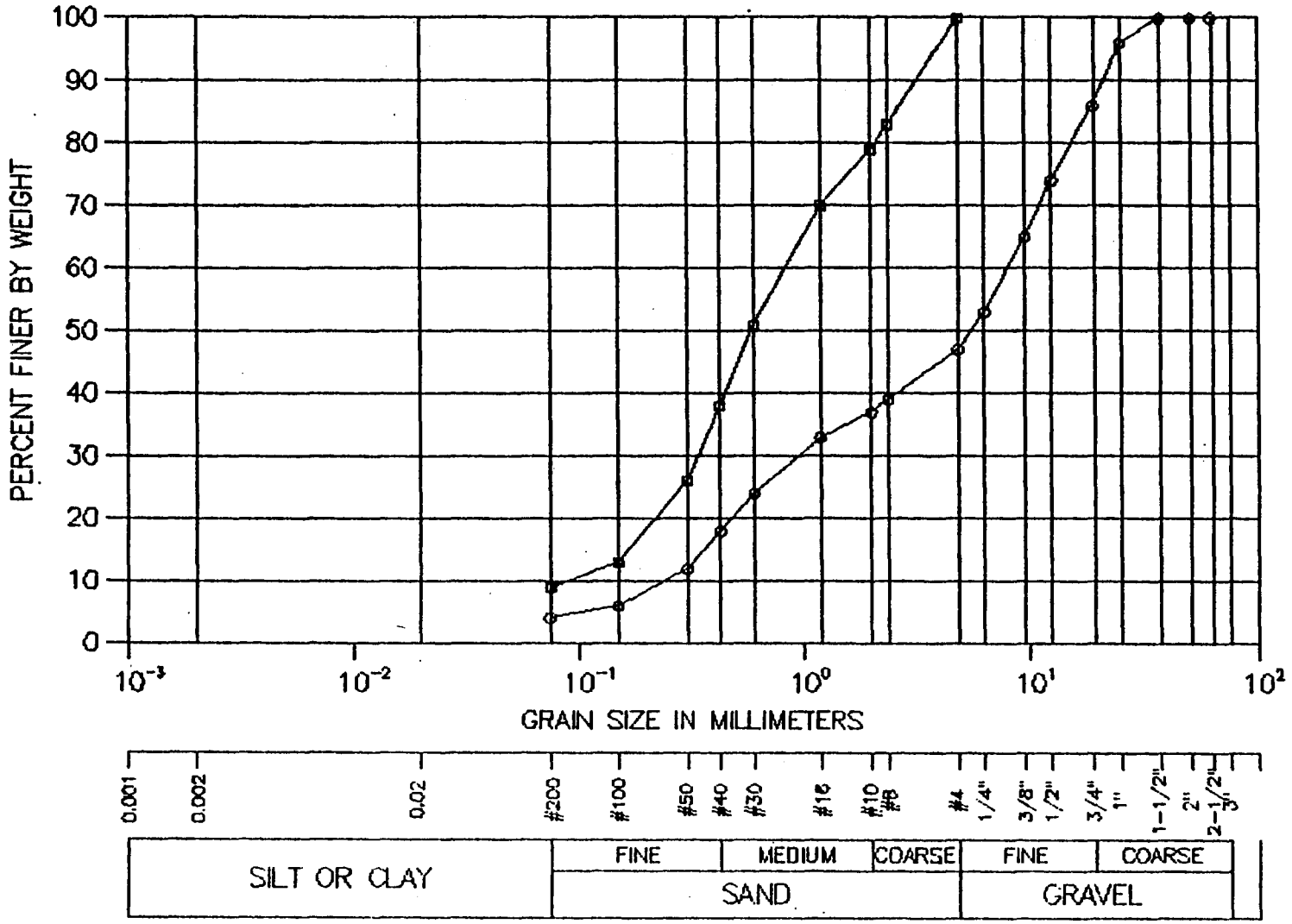
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 10, SAMPLE G1



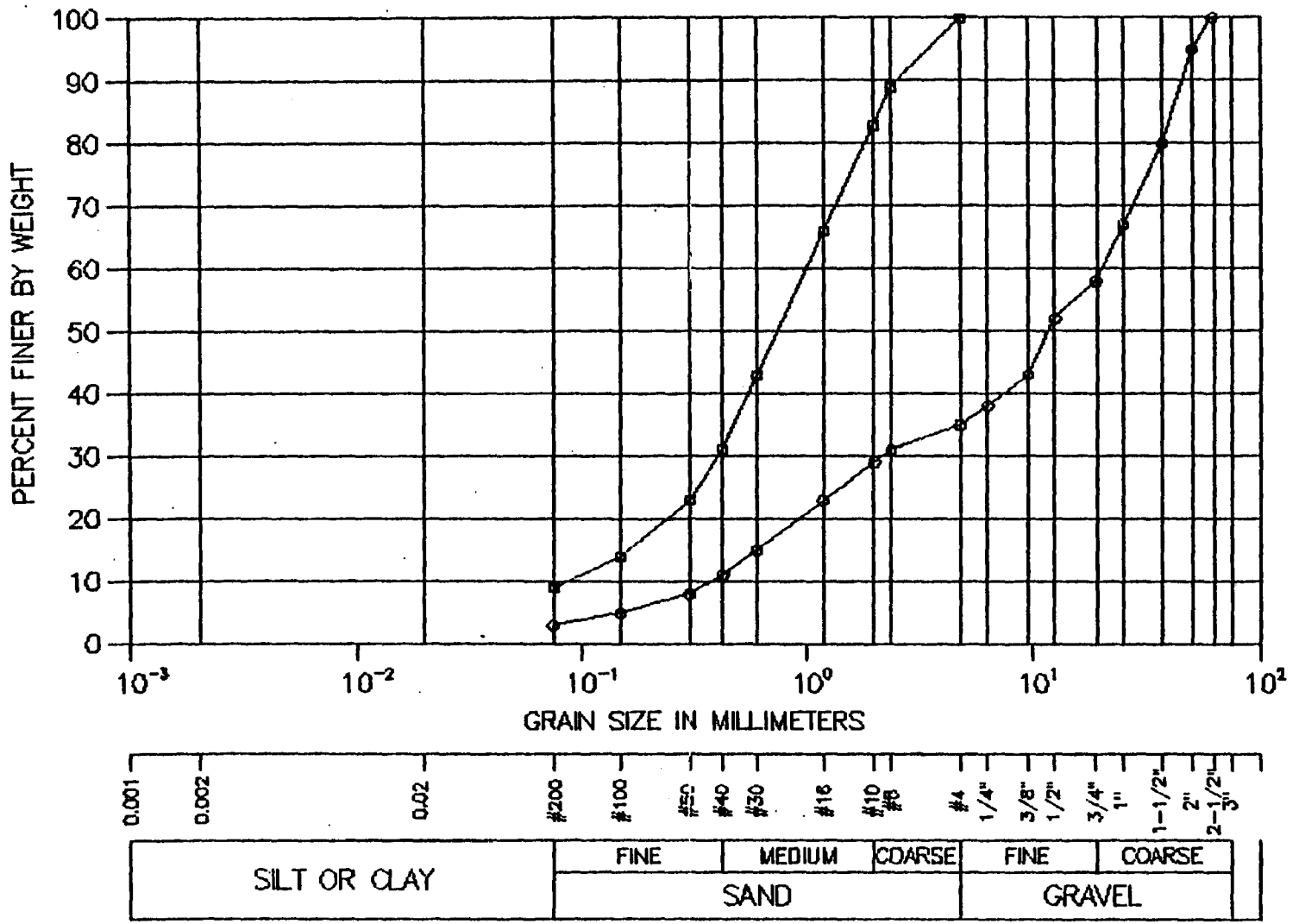
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 10, SAMPLE G3



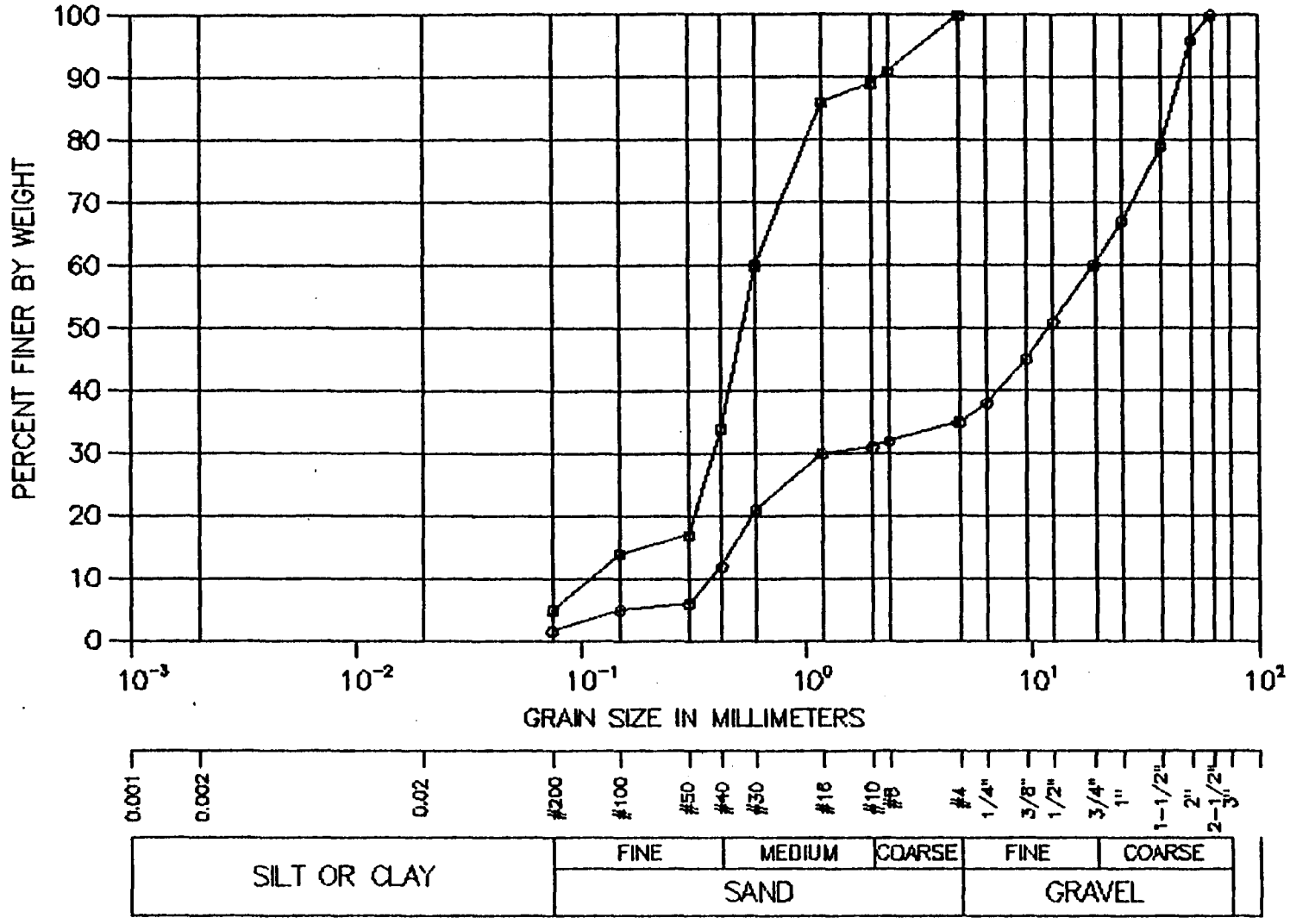
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 10, SAMPLE G5



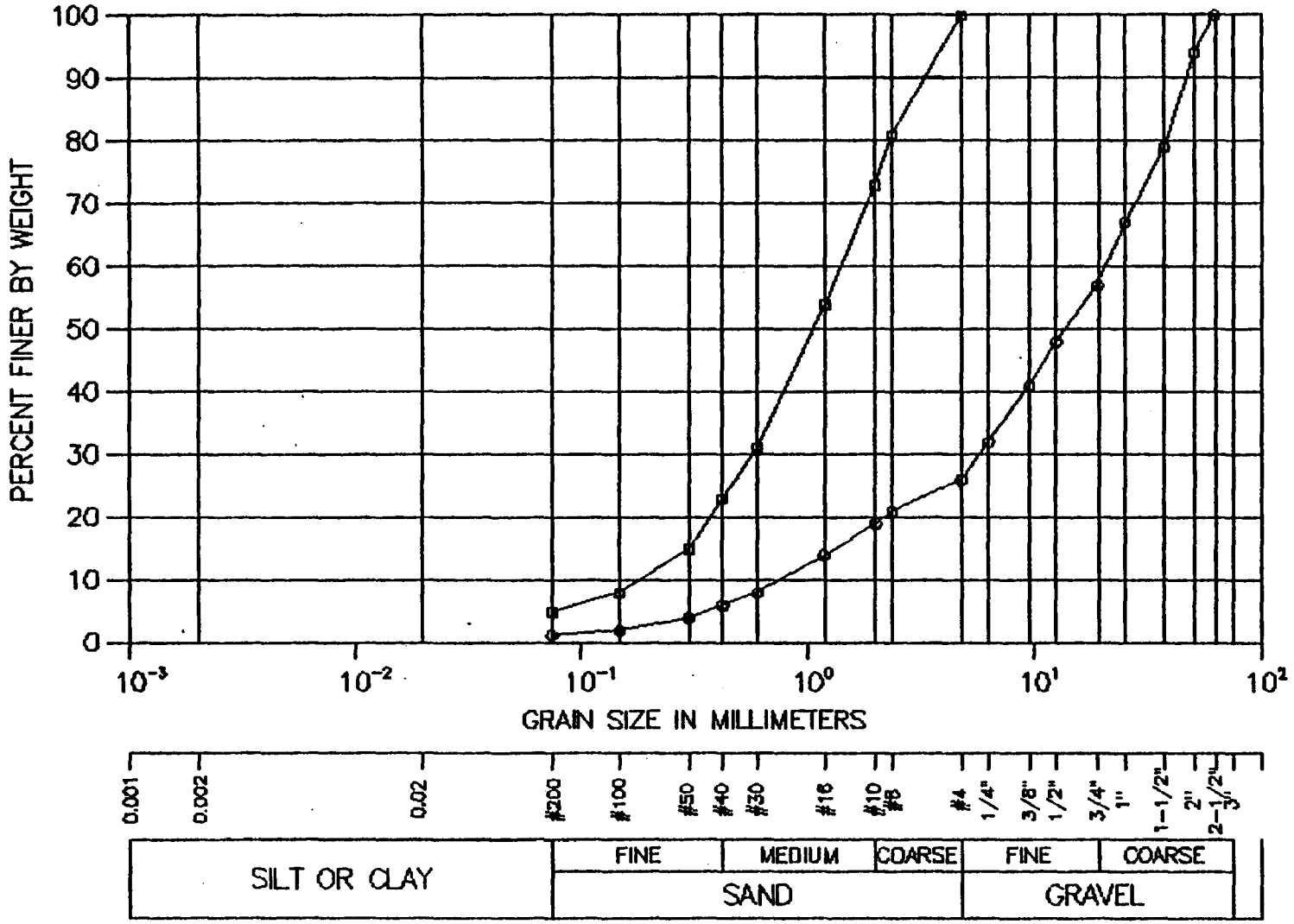
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 10, SAMPLE G6



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

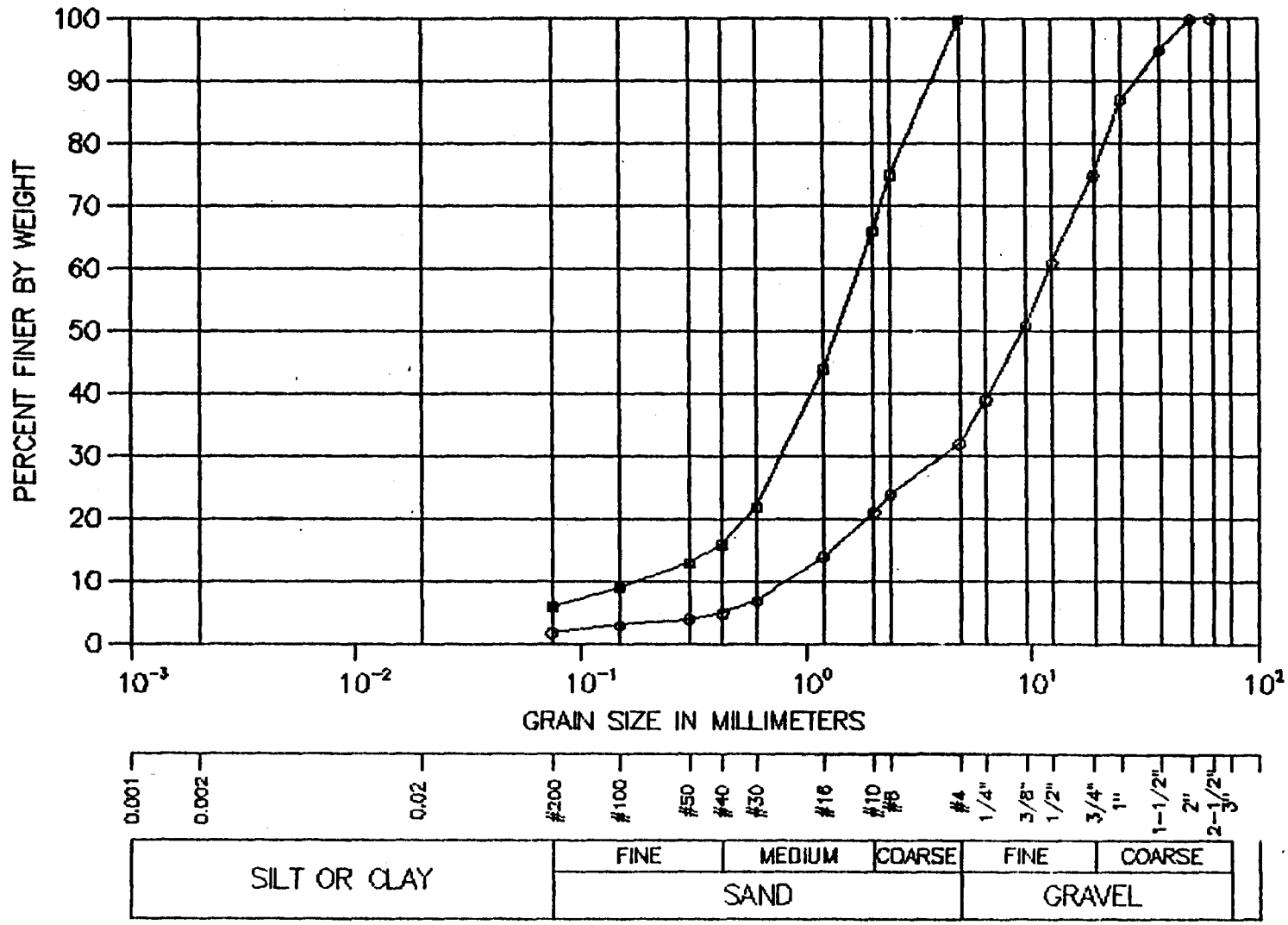
BORING LDB – 10, SAMPLE G8



452

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

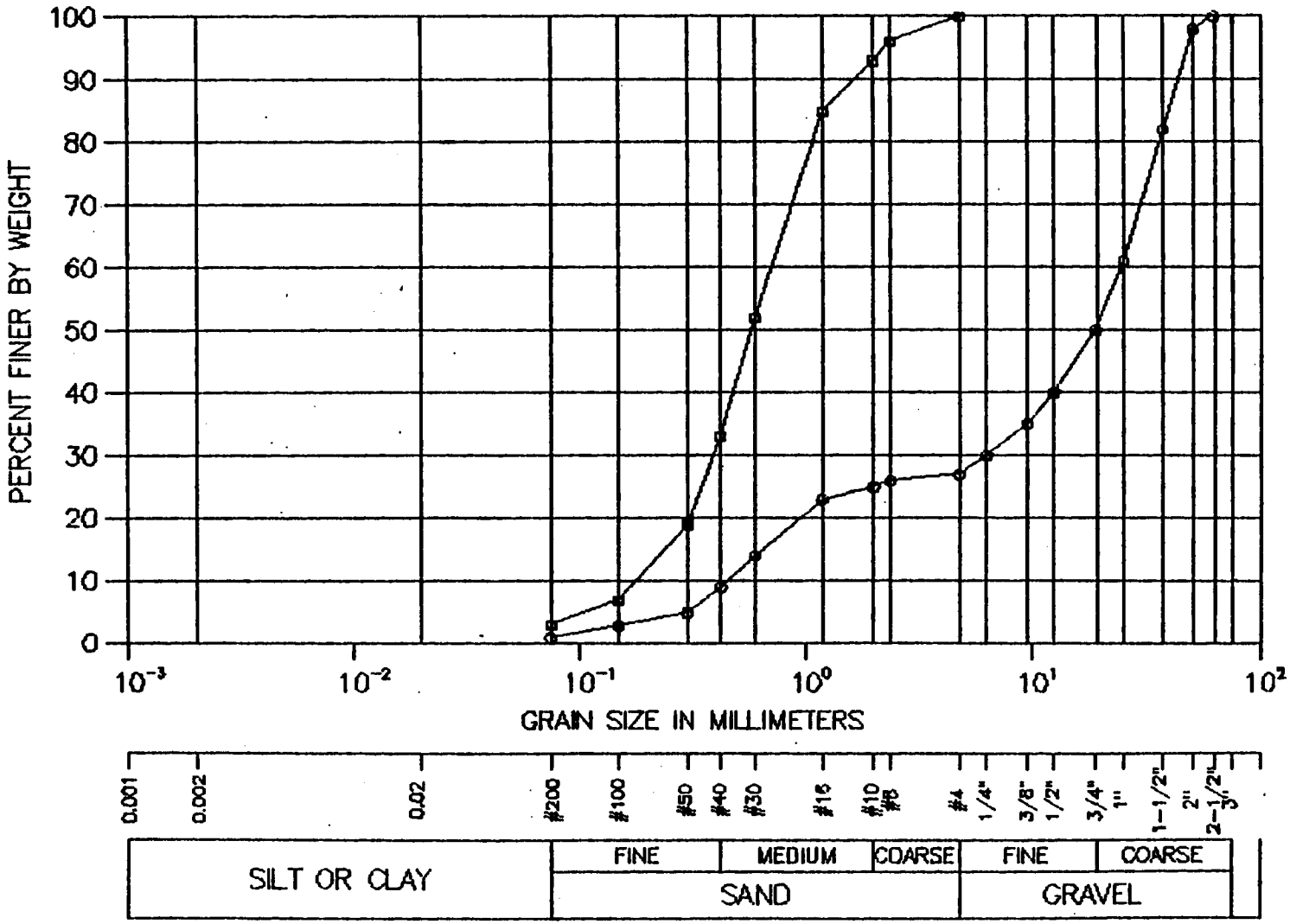
BORING LDB – 10, SAMPLE G10



443

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

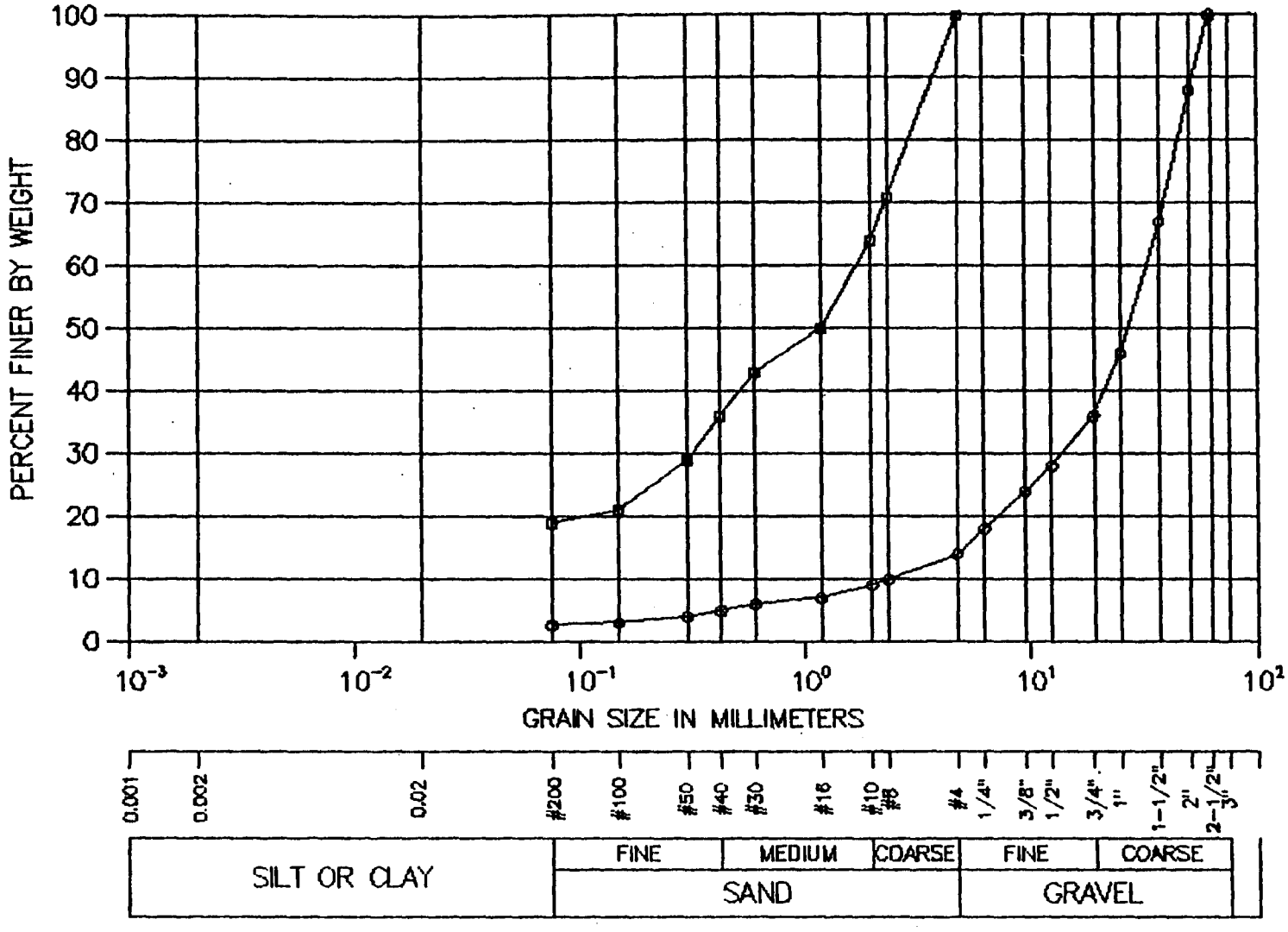
BORING LDB – 10, SAMPLE G11



494

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

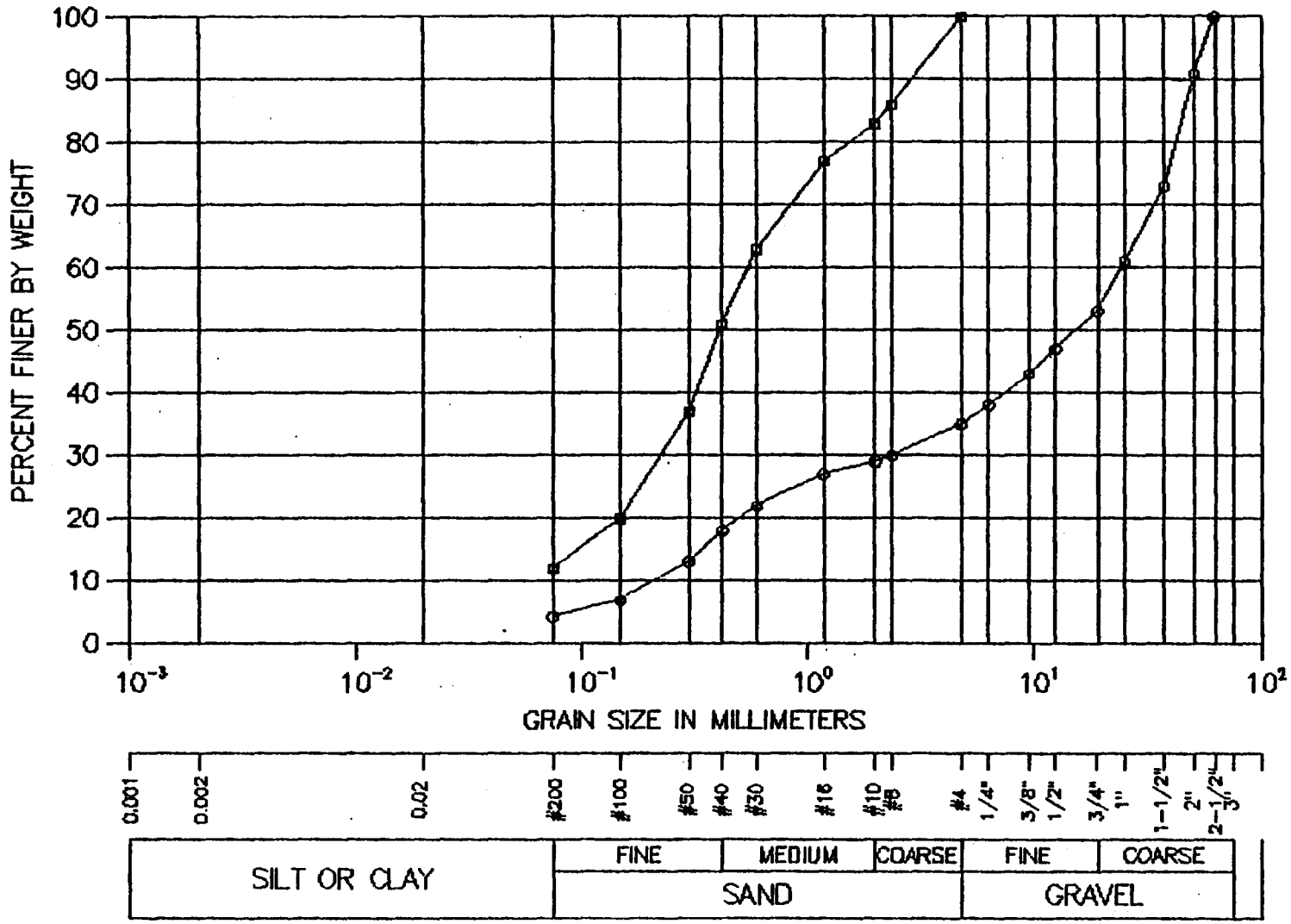
BORING LDB – 13, SAMPLE G1



495

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

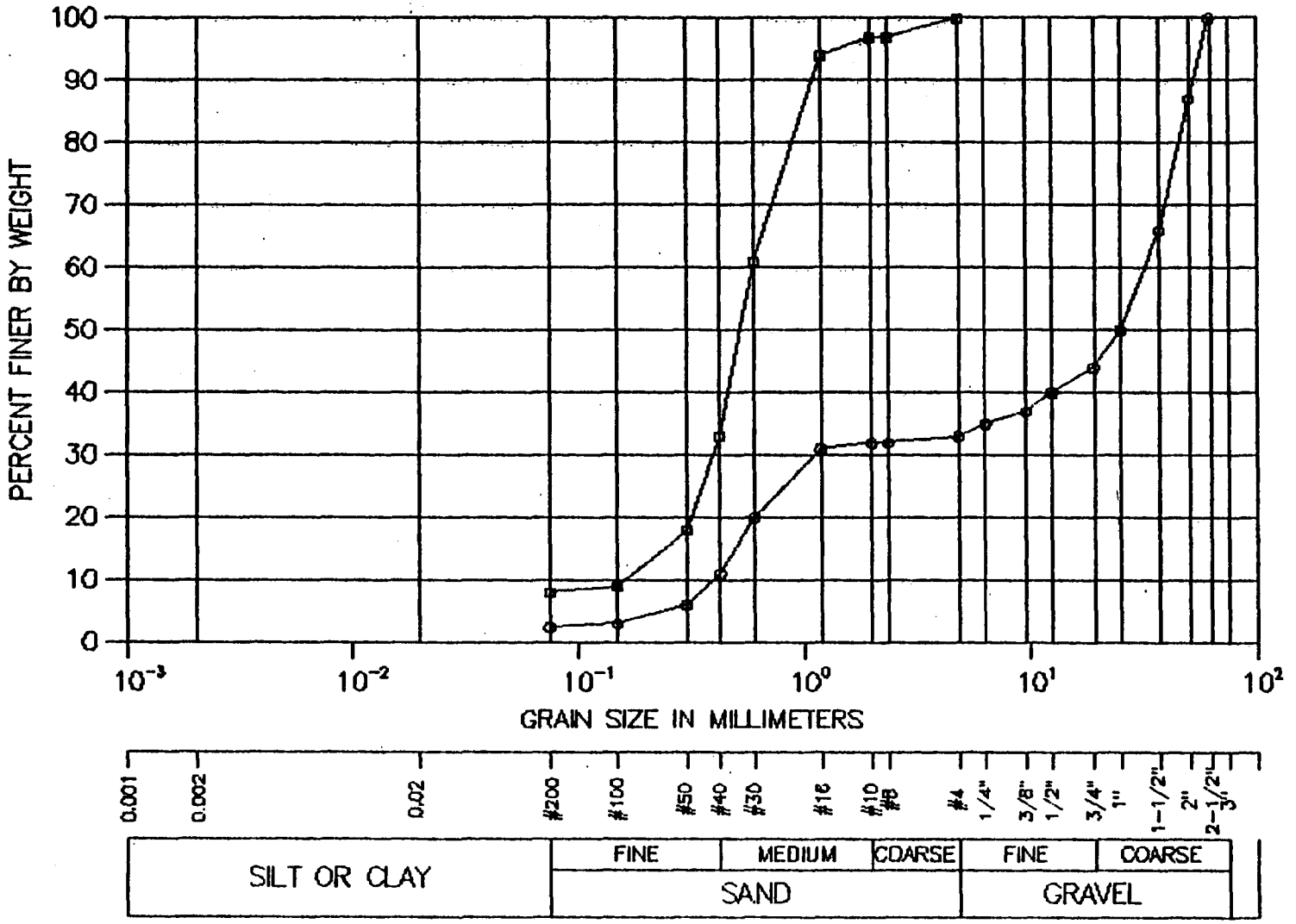
BORING LDB – 13, SAMPLE G3



4/96

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

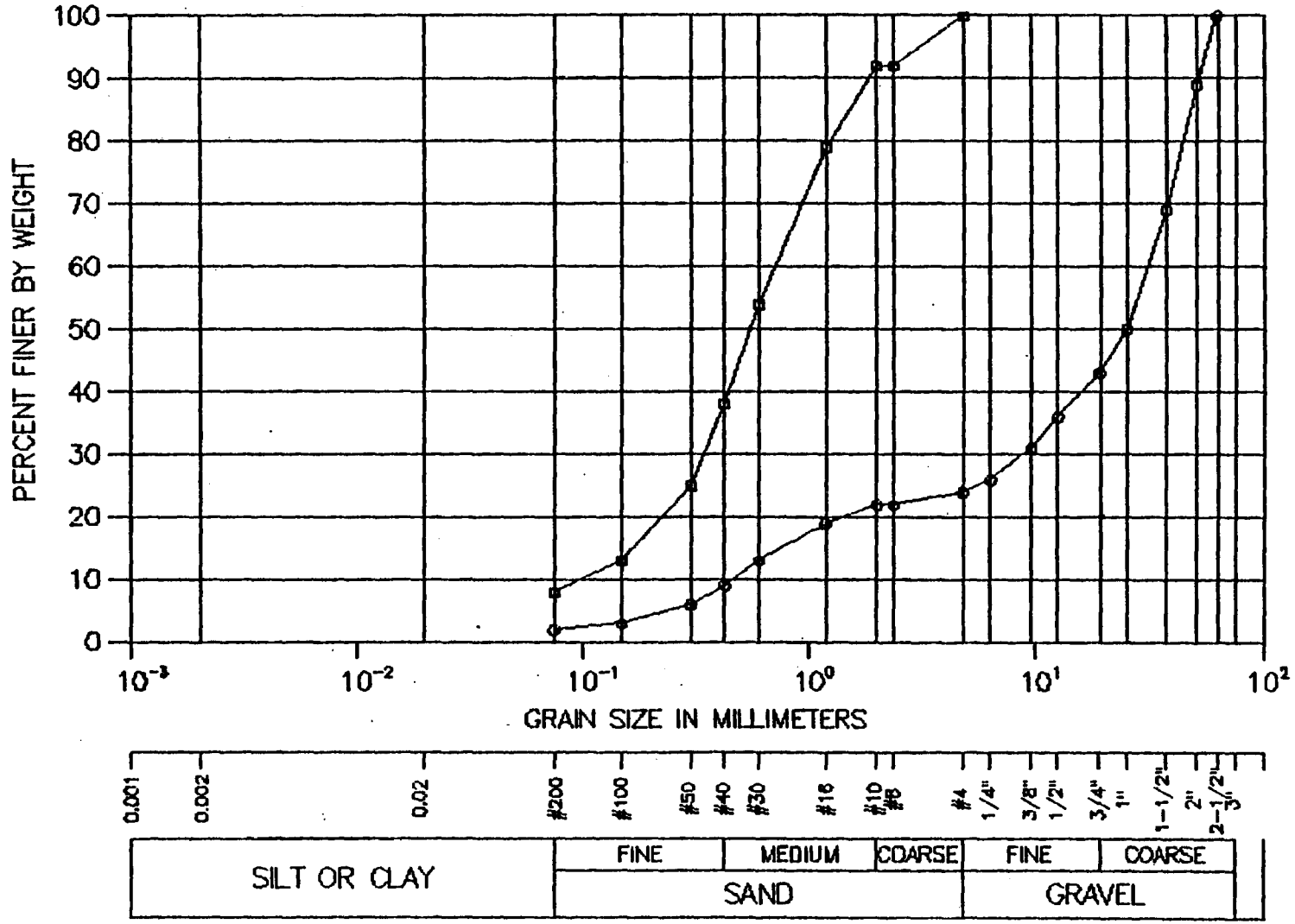
BORING LDB – 13, SAMPLE G4



497

PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

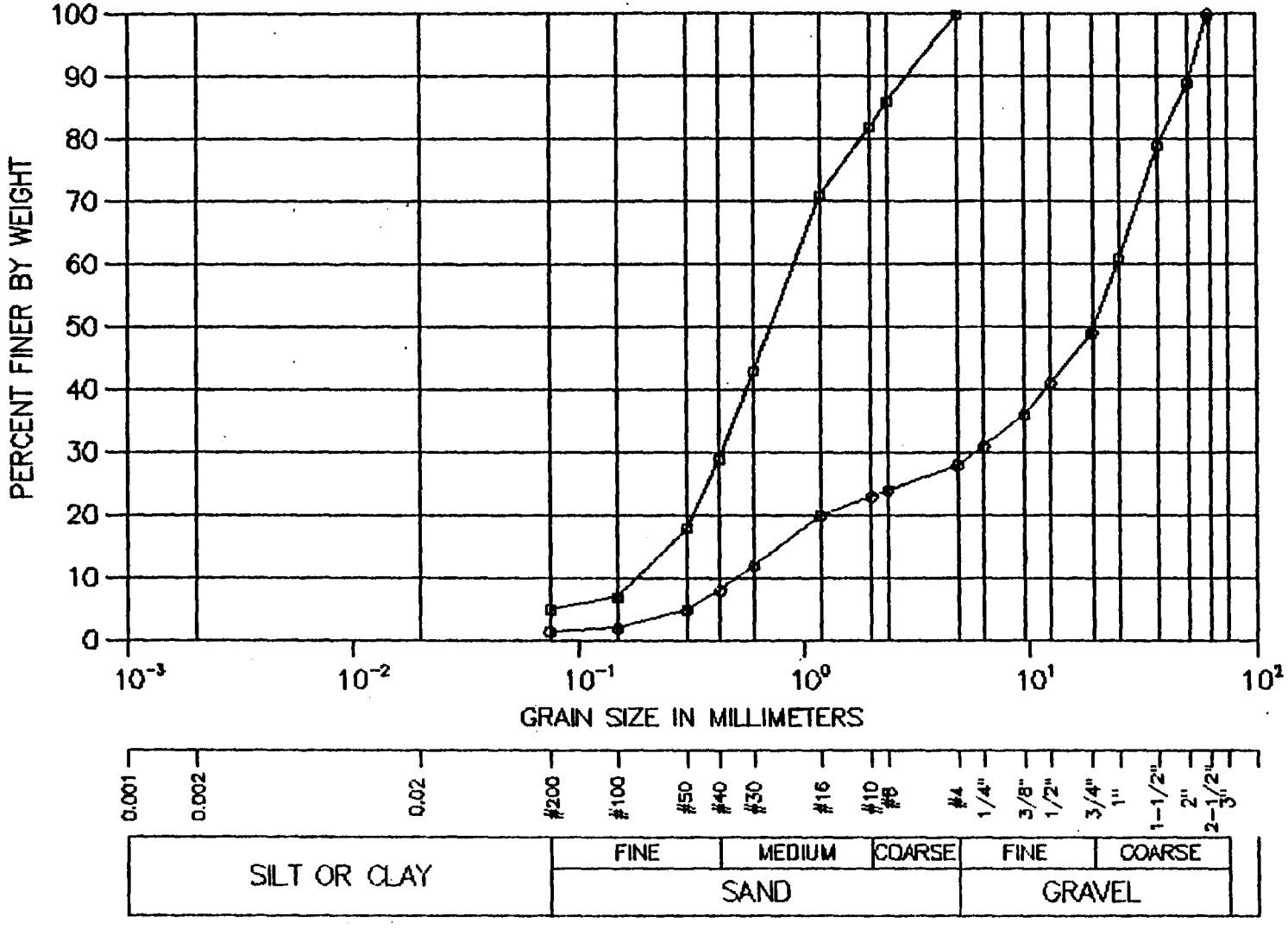
BORING LDB – 13, SAMPLE G6



4/92

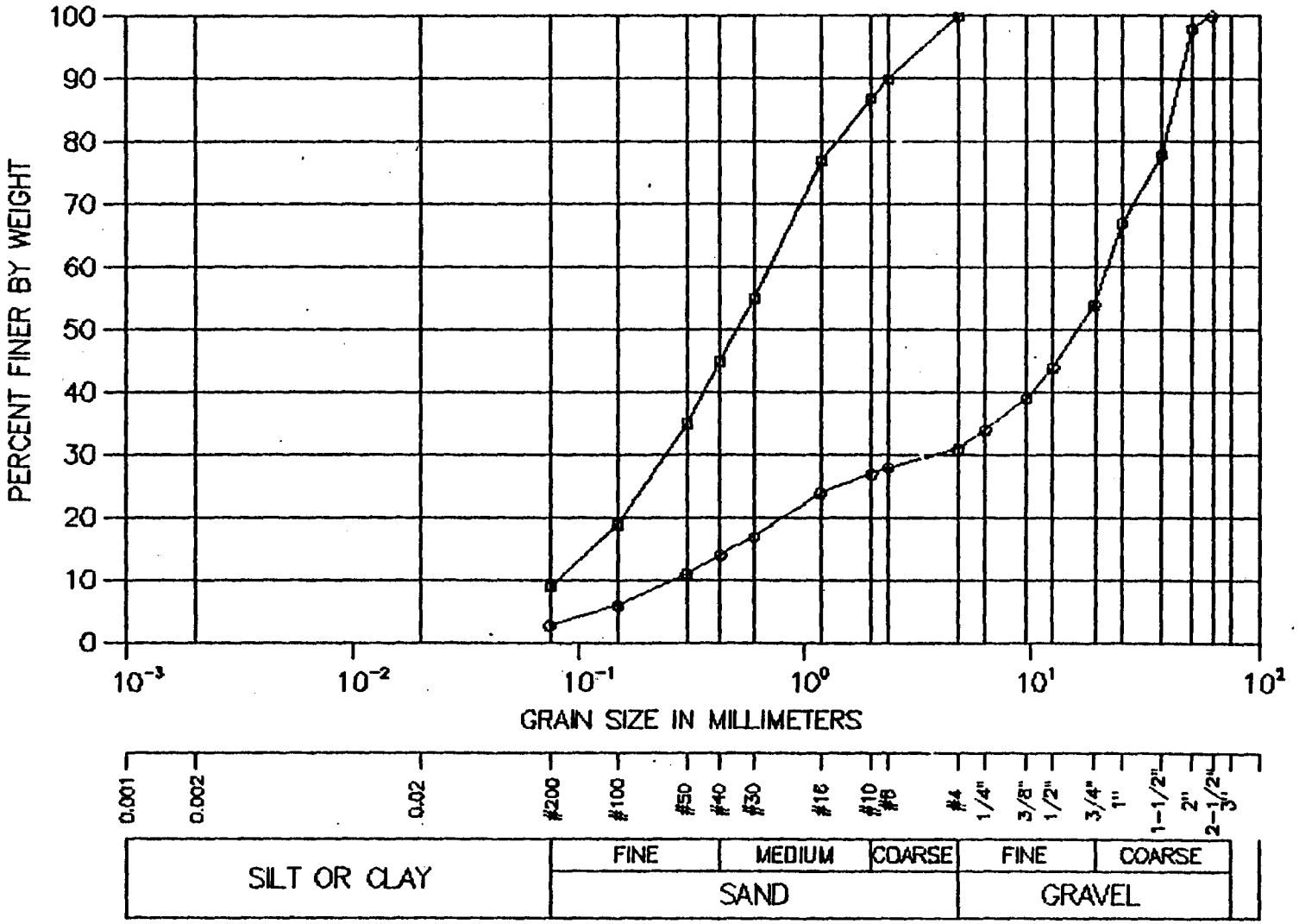
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 13, SAMPLE G8



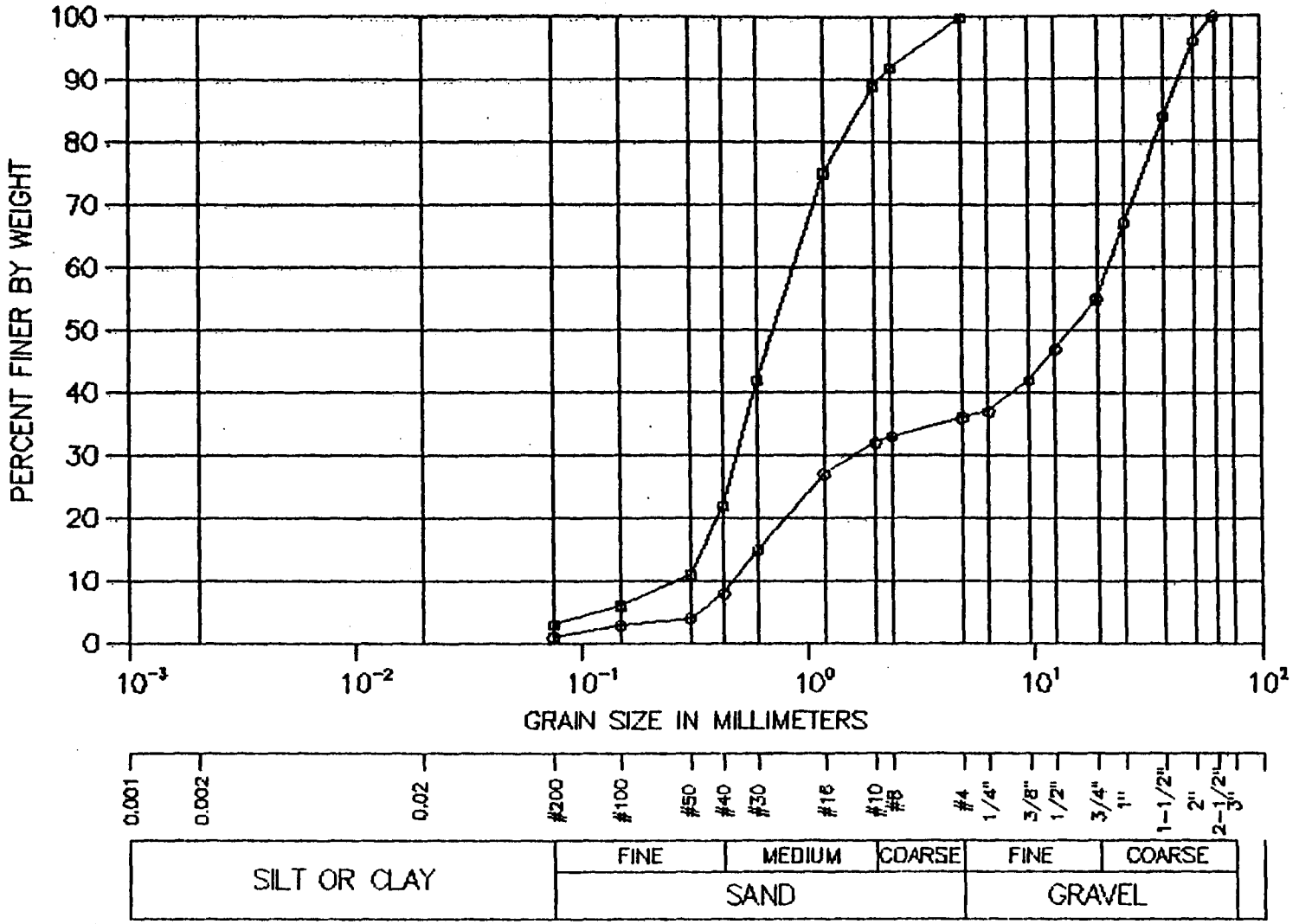
PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 13, SAMPLE G10



PRICE ROAD TUNNEL – GRAIN SIZE ANALYSIS CURVE

BORING LDB – 13, SAMPLE G11



105

HNTB
HOWARD NEEDLES TAMMEN & BERGENDOFF

MEMO

Date 6/12/87

To Tracy Lyman

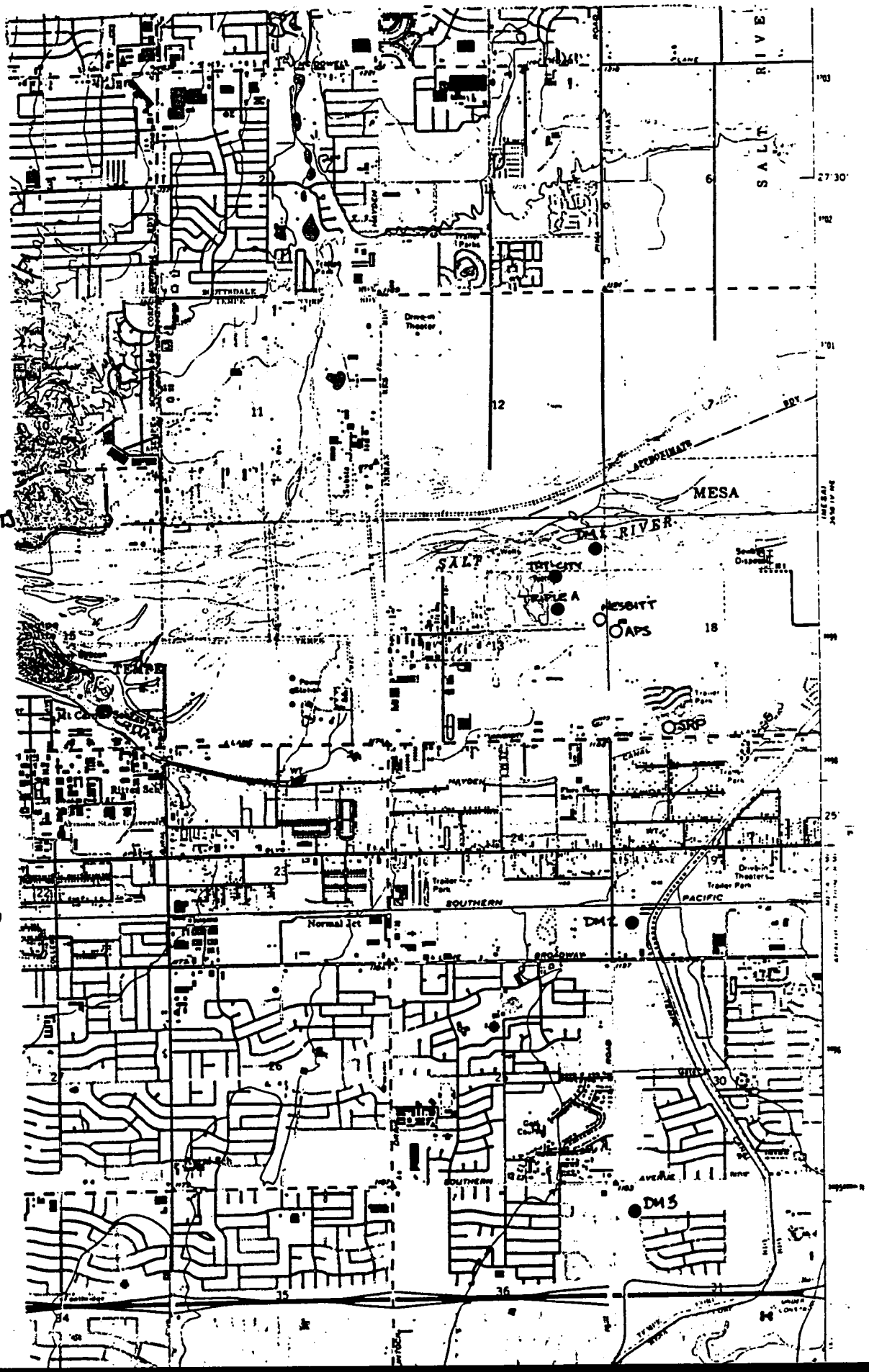
From Dave McCarthy

- INFORMATION ☐
- COMMENT ☐
- NOTE & FILE ☐
- NOTE & ANSWER ☐
- PLEASE PREPARE REPLY FOR MY SIGNATURE ☐
- PLEASE RETURN ☒

Here is the most recent information I've received from Dames and Moore re: groundwater along the drainage Tunnel alignment. It may be info that you have already seen. They should have an actual report by the first of next week.
If you have any more questions feel free to give me a call.
602-954-7420

DM.

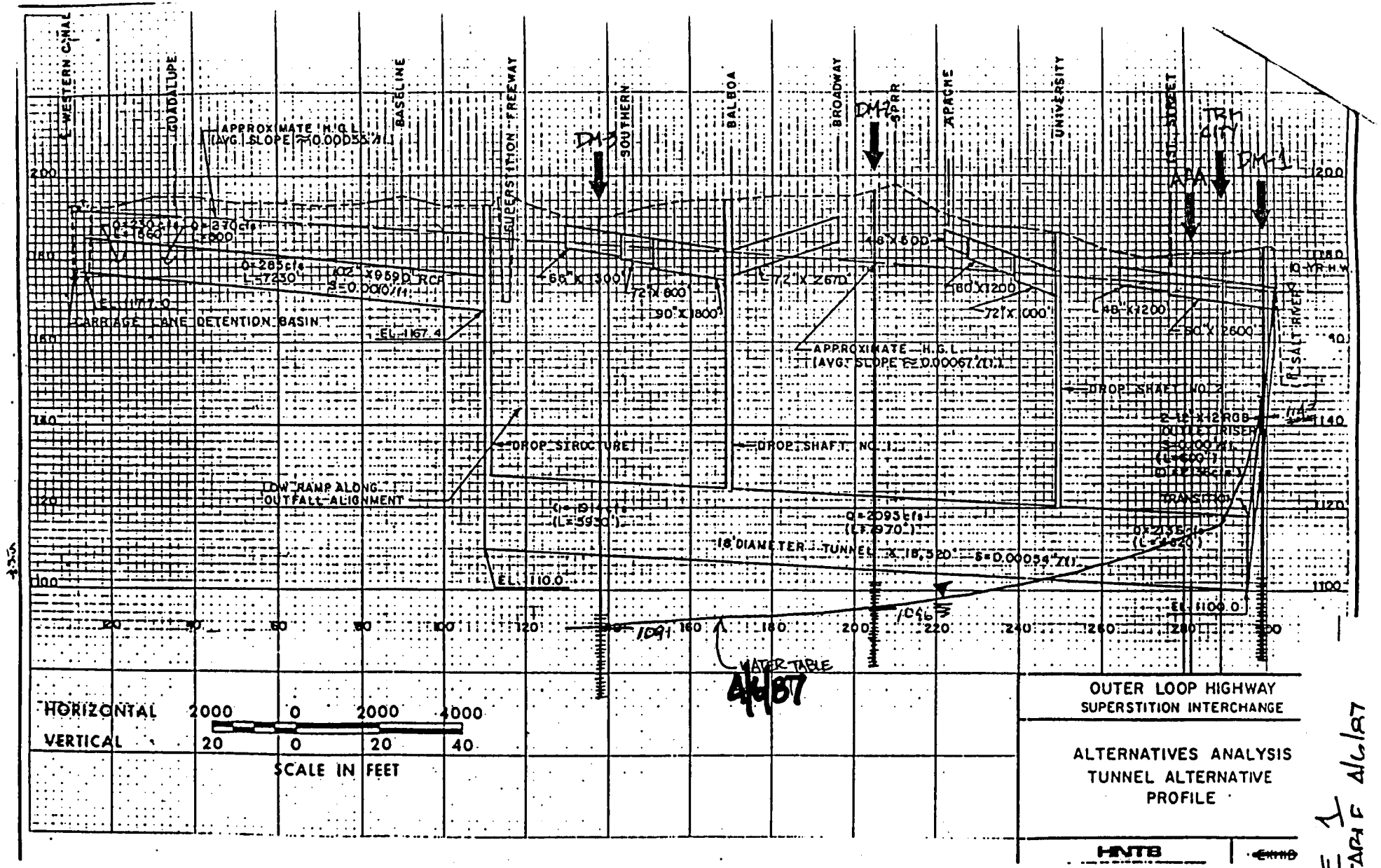
GN109-174-30M



● W.L. MEASUREMENTS

○ POSSIBLE AQUIFER TEST

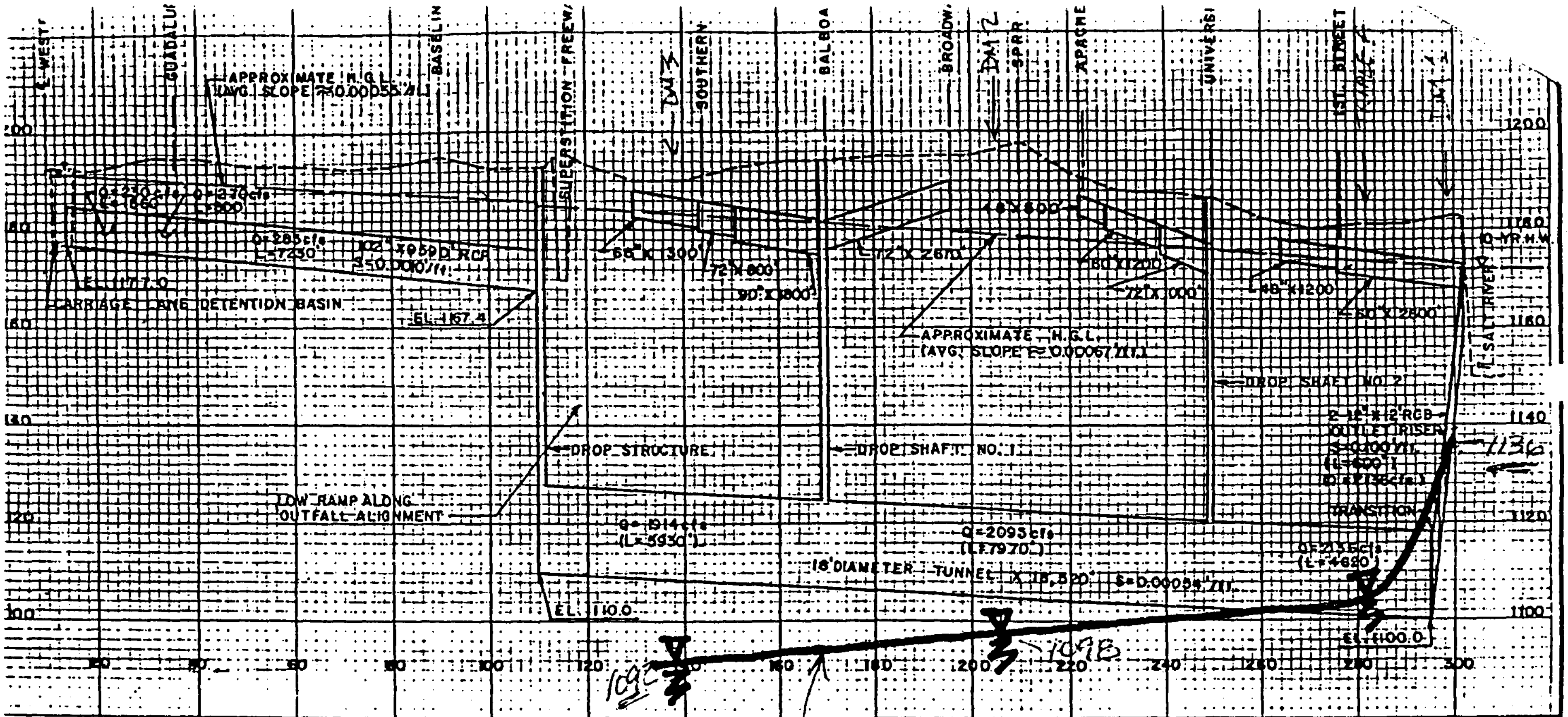
SAS
6/5/87
15519-001-33



4/4/87

15519-001-33
4/5/87 SAS

FIGURE 1
WATER TABLE 4/6/87



HORIZONTAL 2000 0 2000 4000

VERTICAL 20 0 20 40

SCALE IN FEET

OUTER LOOP HIGHWAY
SUPERSTITION INTERCHANGE

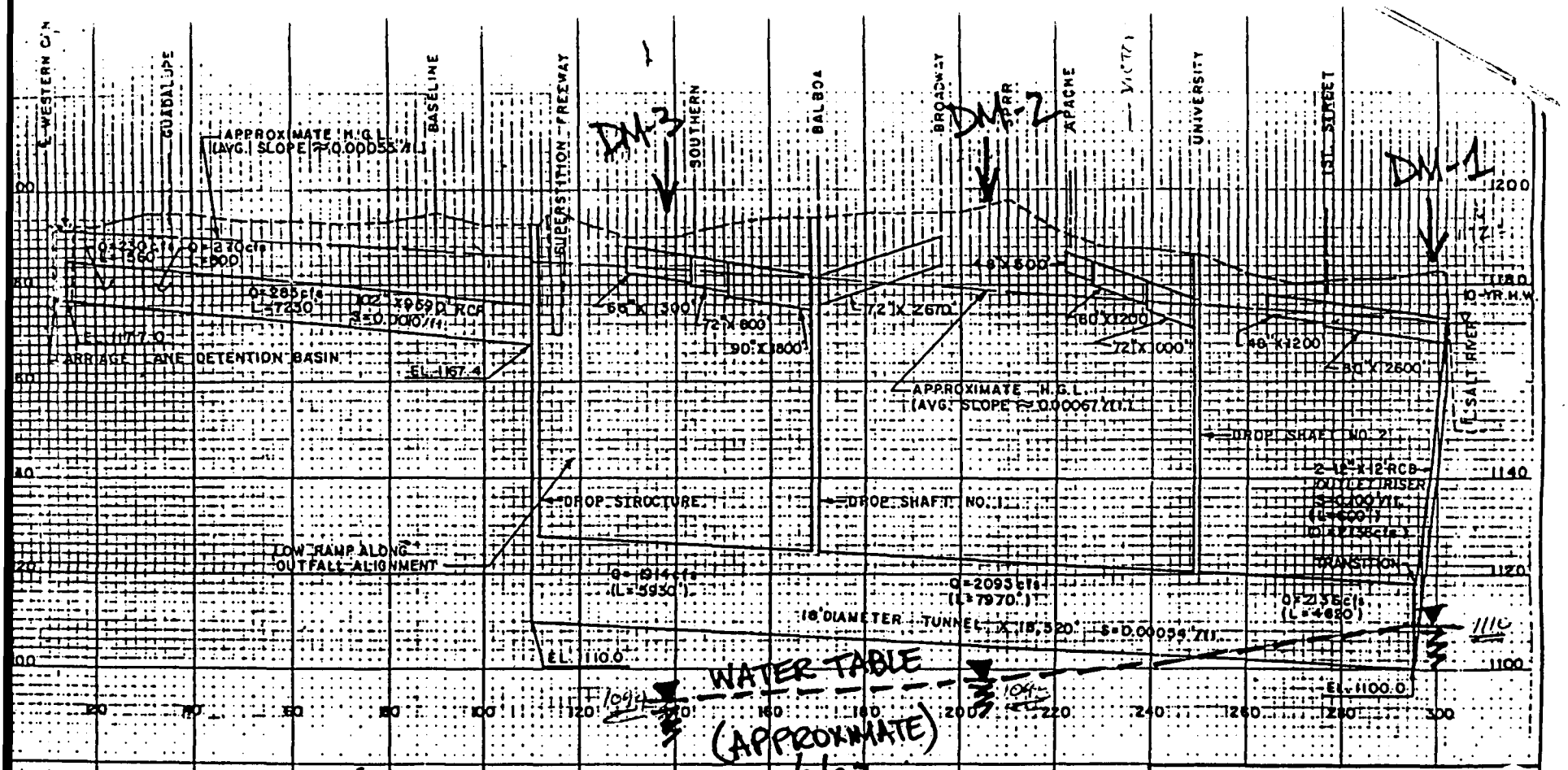
ALTERNATIVES ANALYSIS
TUNNEL ALTERNATIVE
PROFILE

HNTB

EXHIBIT 2

15519-001-33
6/5/87 SAS

505



OUTER LOOP HIGHWAY
SUPERSTITION INTERCHANGE

ALTERNATIVES ANALYSIS
TUNNEL ALTERNATIVE
PROFILE

HNTB

EXHIBIT 2

19519-001-33
6/5/87 SAS

DAMES & MOORE A PROFESSIONAL LIMITED PARTNERSHIP
POINTE CORPORATE CENTRE, 7500 NORTH DREAMY DRAW DRIVE, SUITE 145
PHOENIX, ARIZONA 85020 (602) 371-1110

RECEIVED
JUN 15 1987
H. N. T. B.

June 15, 1987

Howard Needles Tammen and Bergendoff
Anchor Centre Two - Suite 400
2207 East Camelback Road
Phoenix, Arizona 85016

Attn: Mr. Robert W. Luscombe

Preliminary Water Level Report
for Price Road Drainage Tunnel

Gentlemen:

I have enclosed the water level report for the wells along the drainage tunnel alignment. If you have any questions about the data or the study results, please call me.

Very truly yours,

DAMES & MOORE

Steve A. Smith
Project Manager

SAS/pak

Enclosure

PRELIMINARY WATER LEVEL REPORT
FOR PRICE ROAD DRAINAGE TUNNEL

1.0 MEASURED WELLS

Beginning January 7, 1987, two privately owned wells have been used for measuring water levels. These two wells are referred to as the AAA well and Tri-City well. Three monitor wells, DM1, DM2, and DM3 were subsequently drilled. Water level measurements began at these three wells February 12, 1987. Locations of these five wells are shown on the attached map.

2.0 METHODS

Water levels have been measured using the wetted tape method. With this method, carpenter's chalk is applied to the lower portion of a steel tape and the tape is lowered into the well. After the tape has been lowered to a point below the estimated water level in the well, the tape is retrieved and the water level determined from the wetted portion of the tape.

3.0 WELL CONSTRUCTION

Well completion diagrams for DM1, DM2, and DM3 are included in this report. The depth of these wells varies from 90' to 115'.

The Tri-City well is reported to have been drilled in 1963. The well has a total depth of 300 feet and is cased for 250 feet. The casing is steel with a diameter of 10 inches (ADWR Well Registry). The well is fitted with an electric turbine pump. The pump was operating or had just been operating prior to all water level readings.

The AAA well is reported to have been drilled in 1947. The well is 166 feet deep and cased to the same depth. The casing is steel with a diameter of 6 inches (ADWR Well Registry). The well is fitted with an electric submersible pump and is used for domestic supply.

4.0 RESULTS

Water levels have risen considerably at the DM1, AAA and Tri-City Wells since measurements began. After approximately week 6 of the measuring program, a severe local storm caused local runoff to discharge from the Indian Bend Wash into the Salt River Channel near wells DM1, AAA, and Tri-City. The hydrograph enclosed in this report shows the immediate response to these flows in well DM1.

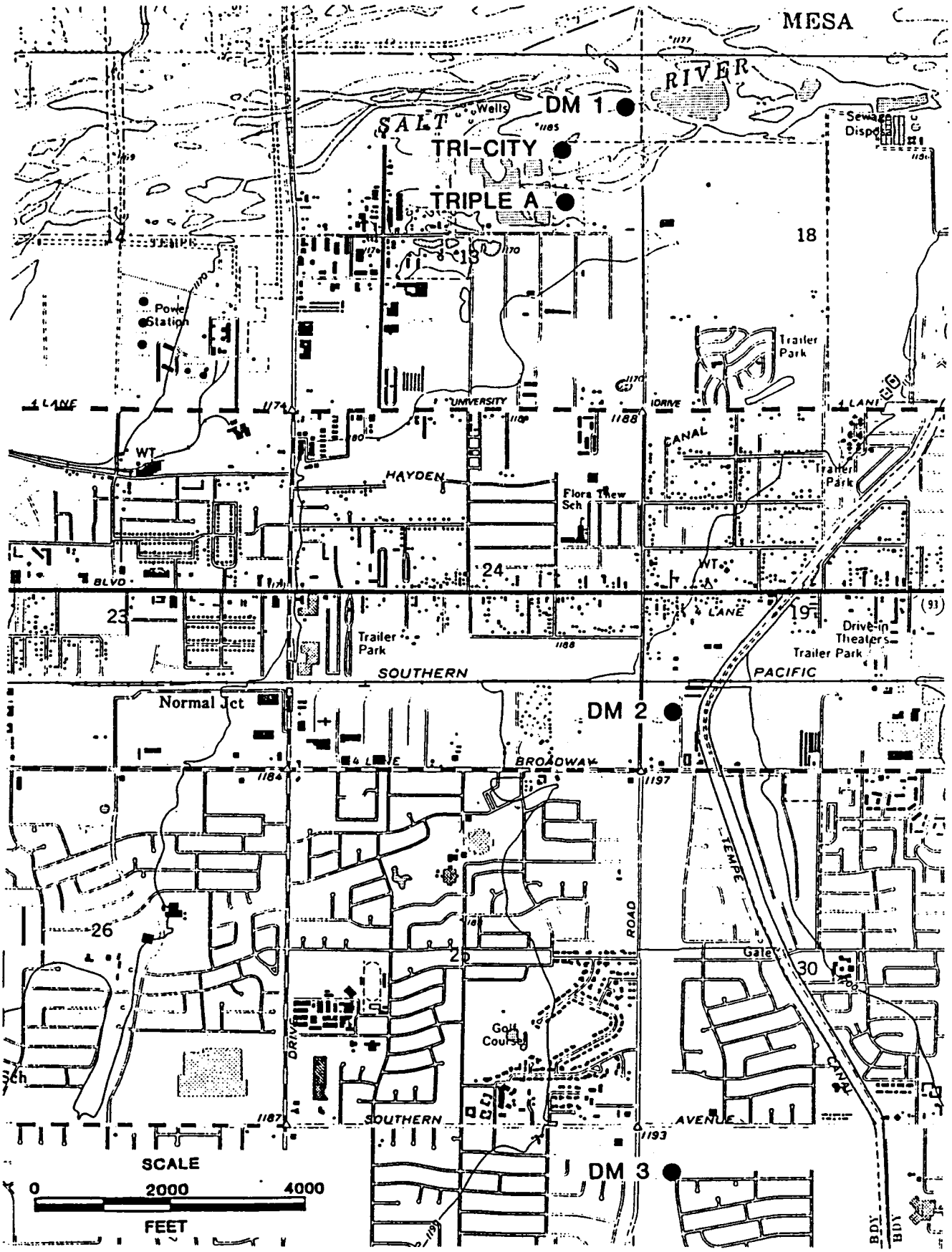
During week 9 of the study, heavy rains on the Upper Salt and Verde River drainage resulted in controlled releases by Salt River Project over Granite Reef Diversion Dam. River flow information was obtained by telephone via the Salt River Project Information Line. These flows are plotted on the attached graph and represent relative rates of releases. They do not represent actual flows near the wells. Discharge is measured at a gaging station near Granite Reef Dam upstream from Price Road. At the relatively low discharges which were recorded, a significant amount of flow is probably lost to infiltration.

Response to the releases into the Salt River are represented by a second peak in well DM1. All wells show a measurable response to these releases, although the three wells nearest the river show the greatest response.

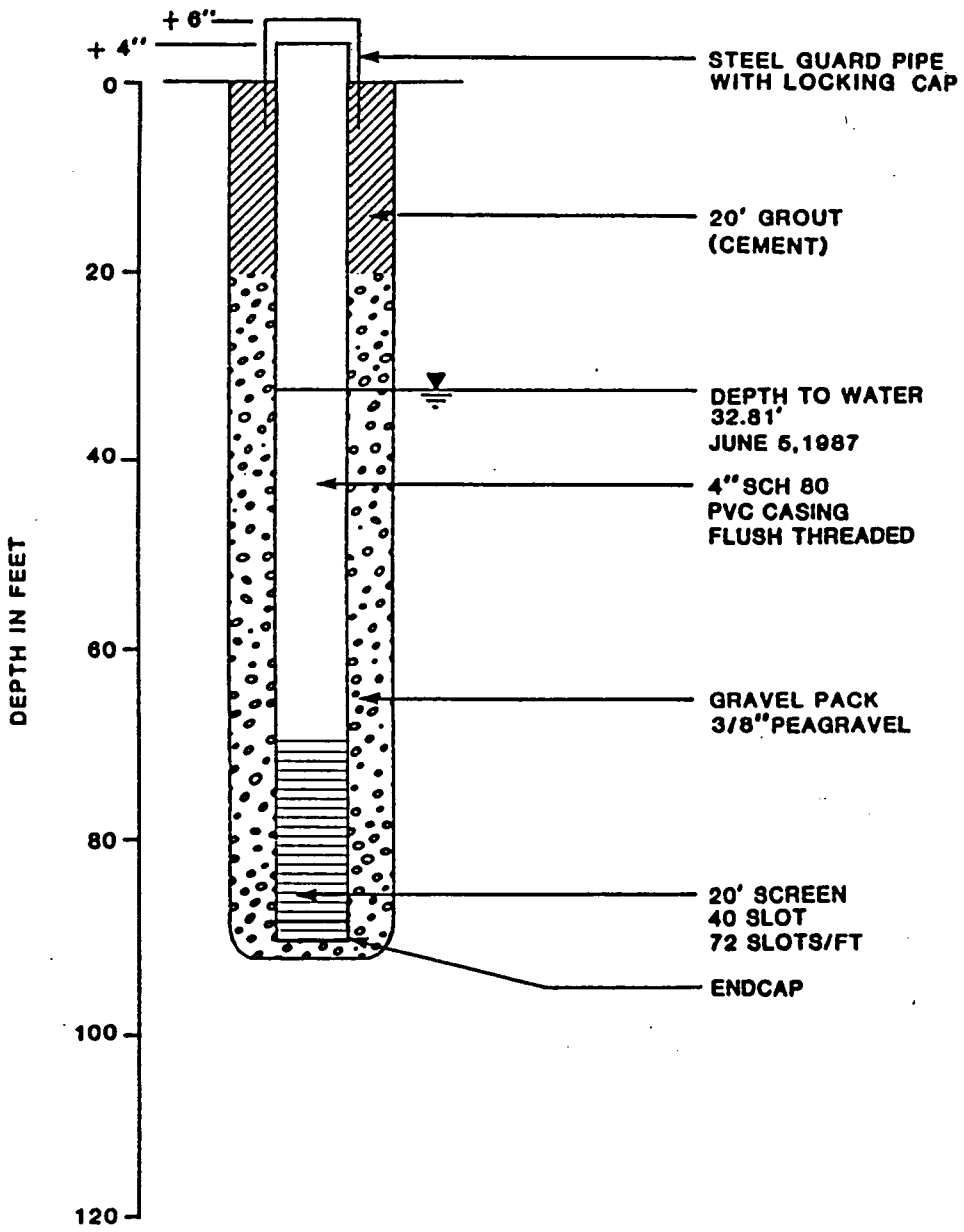
Water levels are currently stabilized. There is an indication that water leves in wells DM1 and AAA are beginning to decline but the Tri-City and DM2 wells are beginning to show slight increases in water levels. This may be attributed to the "flattening out" of the mound of recharge resulting from the river flows.

5.0 CONCLUSIONS

The position of water table close to the river is extremely sensitive to the presence of water in the river channel. The results from the monitor wells indicate that the alluvium has a high hydraulic conductivity. Any dewatering system used for tunnel construction should be designed on the basis of a high water table resulting from river releases.

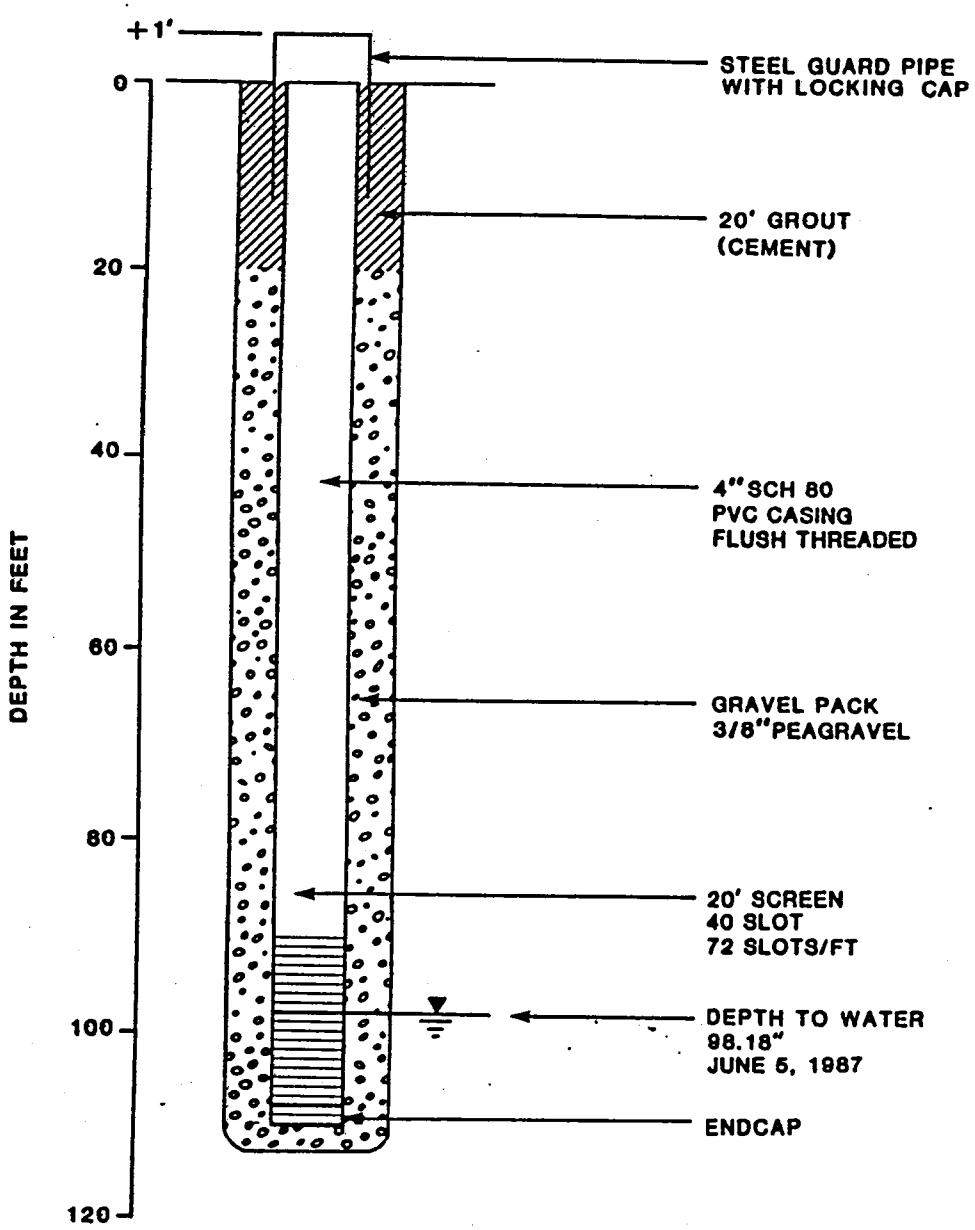


WELL LOCATION MAP

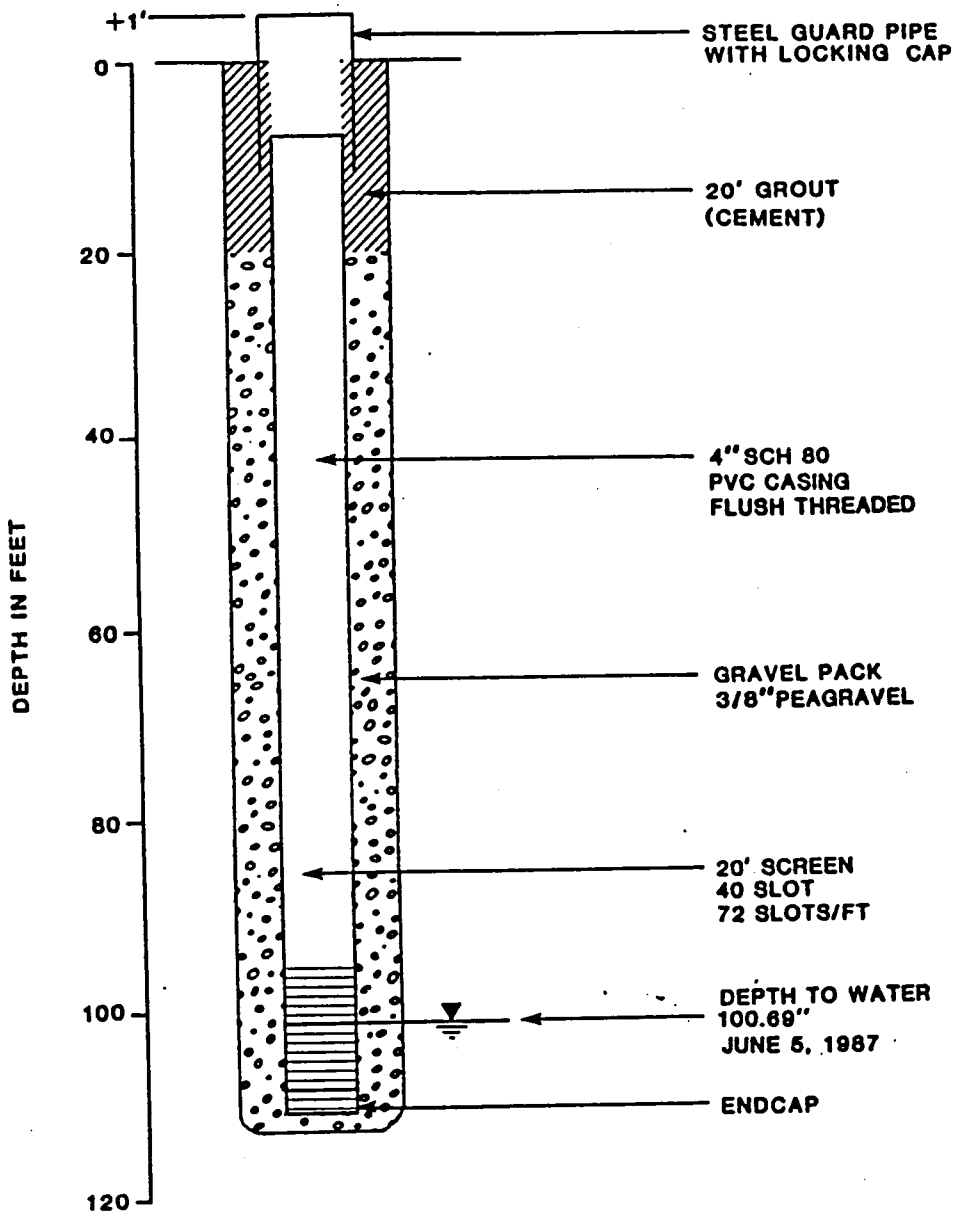


WELL COMPLETION DIAGRAM FOR DM-1

512



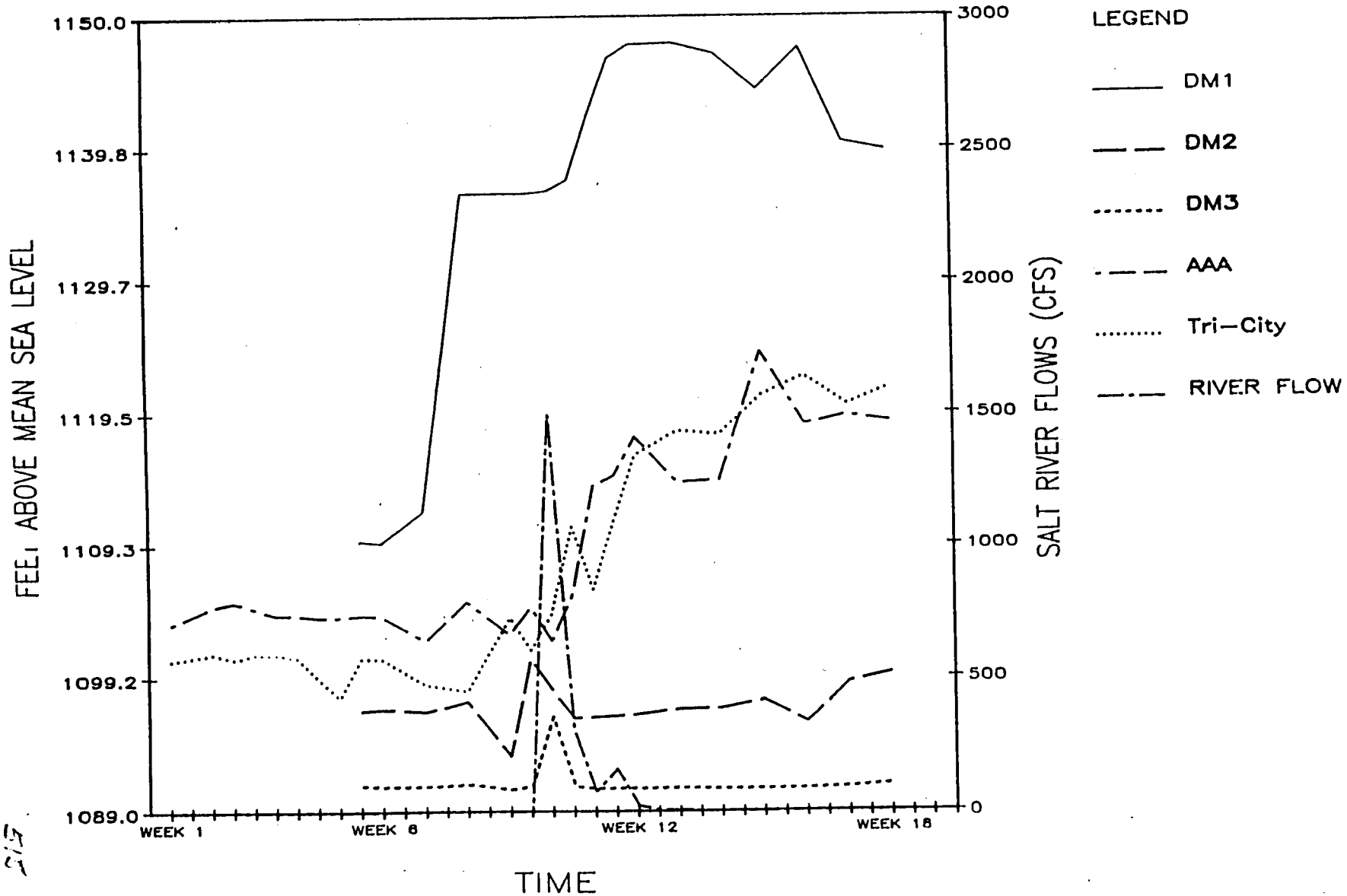
WELL COMPLETION DIAGRAM FOR DM-2



WELL COMPLETION DIAGRAM FOR DM-3 514

PRICE ROAD DEWATERING PROJECT — HNTB

WATER LEVEL MEASUREMENTS



WATER LEVEL MEASUREMENTS
(IN FEET ABOVE MEAN SEA LEVEL)
June 15, 1987

MEASURE DATE	DM1	DM2	DM3	AAA	TRI-CITY	SALT RIVER FLOWS (CFS)
1/07/87	*	*	*	1103.36	1100.52	*
1/09/87	*	*	*	1104.74	1101.22	*
1/12/87	*	*	*	1105.05	1100.62	*
1/14/87	*	*	*	1104.53	1101.02	*
1/16/87	*	*	*	1104.03	1101.02	*
1/22/87	*	*	*	1104.03	1100.72	*
1/28/87	*	*	*	1103.83	1099.13	*
2/05/87	*	*	*	1103.89	1097.67	*
2/12/87	1109.70	1096.71	1090.99	1104.03	1100.65	*
2/13/87	*	1096.80	1090.95	*	*	*
2/13/87	*	*	1090.97	*	*	*
2/17/87	1109.49	1096.82	1090.89	1103.90	1100.59	*
2/26/87	1111.98	1096.59	1090.87	1102.03	1098.65	*
3/09/87	1136.44	1097.40	1091.05	1105.07	1098.13	*
3/09/87	*	1097.40	*	*	*	*
3/13/87	1136.46	1093.16	1090.63	1102.51	1103.82	*
3/16/87	1136.44	1100.36	1090.93	1104.63	1101.32	*
3/19/87	1136.63	1096.22	1096.23	1102.00	1104.05	1500
3/23/87	1137.46	1096.09	1090.86	1105.60	1110.82	300
3/26/87	1139.62	1096.22	1090.72	1113.53	1108.97	*
3/26/87	1140.29	*	1090.66	1113.82	1106.39	75
3/30/87	1146.44	1096.29	1090.73	*	1111.30	160
3/30/87	1147.19	*	*	1114.73	1111.25	20
4/06/87	1147.87	1096.41	1090.75	1117.71	1116.33	5
4/13/87	1147.94	1096.79	1090.78	1114.15	1118.17	5
4/20/87	1147.06	1096.86	1090.65	1114.39	1117.90	*
4/27/87	1144.29	1097.47	1090.70	1124.25	1120.97	*
5/05/87	1147.57	1095.76	1090.73	1118.64	1122.40	*
5/19/87	1140.30	1098.81	1090.82	1119.37	1120.21	*
6/05/87	1139.65	1099.48	1091.04	1118.86	1121.47	*

NOTE: SALT RIVER FLOWS WERE OBTAINED FROM SALT RIVER PROJECT'S RECORDED TELEPHONE REPORTS.

RESULTS OF GROUND-WATER INVESTIGATION FOR THE PRICE ROAD DRAINAGE TUNNEL TEMPE, ARIZONA

August 14, 1987

Dames & Moore
Pointe Corporate Centre
7500 N. Dreamy Draw Drive, Suite 145
Phoenix, Arizona 85020

TABLE OF CONTENTS

	Page
INTRODUCTION	1
Purpose of Study	1
Methods	1
WELL CONSTRUCTION	2
RESULTS	2
Soils	2
Water Levels	2
Water Quality	3
Aquifer Test	4
DISCUSSION	5

APPENDIX A SURVEY NOTES
APPENDIX B WATER LEVEL DATA SHEETS
APPENDIX C WATER QUALITY RESULTS
APPENDIX D AQUIFER TEST DATA

LIST OF TABLES
(Tables follow text)

1 WATER LEVEL MEASUREMENT DATA
2 RESULTS OF WATER ANALYSES FOR HNTB
3A PURGEABLE HALOCARBONS
3B ORGANOCHLORINE AND ORGANOPHOSPHOROUS PESTICIDES

LIST OF FIGURES
(Figures follow tables)

1 WELL LOCATION MAP
2 WELL COMPLETION DIAGRAM DM-1
3 WELL COMPLETION DIAGRAM DM-2
4 WELL COMPLETION DIAGRAM DM-3
5 PRICE ROAD DRAINAGE TUNNEL HYDROGRAPH
6 PUMPING TEST ANALYSIS
STRAIGHT LINE APPROXIMATION METHOD
7 RECOVERY ANALYSIS

518

RESULTS OF GROUND-WATER INVESTIGATION FOR THE PRICE ROAD DRAINAGE TUNNEL TEMPE, ARIZONA

INTRODUCTION

Purpose of Study

The purposes of this study were to investigate ground-water levels, to measure the quality of the ground-water, and to make a preliminary assessment of the aquifer characteristics near the alignment of the proposed Price Road drainage tunnel. This report is our final report on this investigation.

Methods

To accomplish the purposes of this study, Dames & Moore utilized four existing wells and installed three new monitor wells. The four existing wells are:

- Tri-City Redi Mix (Tri-City)
- Triple A Auto Wrecking (AAA)
- Salt River Project 24.3E-3N (SRP)
- Nesbitt

The Tri-City and AAA wells were used for measuring water levels. Water samples were taken from the SRP and Nesbitt wells for water quality analysis. A pump test was performed on the SRP well to measure the aquifer characteristics.

Three monitor wells were installed by Dames & Moore during this study. These wells are identified as DM-1, DM-2, and DM-3. These wells were measured for water levels and sampled for water quality analysis.

Samples were obtained in the Dames & Moore wells with a portable electric submersible pump. Other wells were sampled using the existing, permanently installed pumps. Water quality samples were analyzed for the

major inorganics, metals, purgeable halocarbons, and organochlorine and organophosphorous pesticides. The samples were analyzed by Analytical Technologies, Inc. using methods approved by the EPA. Analytical Technologies, Inc. is a state-certified laboratory.

WELL CONSTRUCTION

Locations of the three wells installed by Dames & Moore are shown on Figure 1. The wells were drilled by Layne Western Company, Inc. using an AP 1000, dual wall, reverse circulation, percussion hammer drill rig. Wells were drilled to a point about 20 feet below the water table. Final depths were 90 to 115 feet. Drilling was conducted from February 2 to February 9, 1987. Well construction diagrams for DM-1, DM-2, and DM-3 are shown on Figures 2, 3, and 4, respectively. The elevations of the wells were measured by Brady Engineering and Land Surveying Company. Survey notes are included in Appendix A.

RESULTS

Soils

The soils encountered during drilling were predominantly sandy gravels. The upper 7 feet of DM-2 was a layer of sandy clay. A moist, sandy gravel was found in DM-1 from about 40 feet to 48 feet. Similar conditions existed in DM-3, with the sandy gravel present from 41 to 43 feet. Soils in all three wells conform to descriptions and thicknesses of the Upper Alluvial Unit (UAU) present throughout the valley. The drillers log for the SRP well indicates bedrock may possibly have been encountered at a depth of 720 to 730 feet.

Water Levels

Water levels were measured in the Tri-City and AAA wells beginning January 7, 1987. Measurement began in the three Dames & Moore wells February 12, 1987. Table 1 lists the water levels and dates of measurement

in the five wells monitored. Field data is located in Appendix B. Measurements in the Tri-City and AAA wells were made twice weekly through January. Upon completion of the Dames & Moore wells, scheduled measurements were made weekly until May 19, 1987. Final measurements were taken once a month.

Figure 5 is a graph showing the water levels and approximate discharge in the Salt River from January 7, 1987 to July 8, 1987. During late February and the month of March, water levels rose in DM-1, the AAA well, and the Tri-City well. The rise in these wells is attributed to heavy rains in the Phoenix area from February 24 to 28, 1987, and releases from Granite Reef Dam which began on March 16, 1987. The SRP releases continued until about April 20, 1987, and caused a ground-water mound to form under the Salt River channel. This mound was formed due to water infiltrating the river soils and gravels to recharge the aquifer.

After releases in the river channel were discontinued, the mound persisted. However, by June 19, 1987, water levels in DM-1, close to the river, had decreased 10 feet from the maximum level which was measured in March. Water levels in DM-2 were still rising in July, presumably due to spreading and flattening of the ground-water mound.

Water Quality

Sample for water quality analyses were taken February 26, March 3, April 6, and July 9, 1987. Table 2 lists the date of sampling and results for inorganics and metals. Purgeable halocarbons and pesticides are given in Table 3. Laboratory data results for all analyses are included in Appendix C.

In terms of dissolved solids content, water quality in the area of the Price Road tunnel is some of the best in the central part of the Salt River Valley. The analyses show that none of the Maximum Contaminant Levels (MCLs) are exceeded, except for nitrate in three analyses. The level of nitrate is only slightly higher than the MCL of 10.0 ppm.

Several of the Recommended Maximum Contaminant Levels (RMCLs) are exceeded. These are chloride, iron, manganese, and total dissolved solids. However, the RMCLs are not enforceable standards, and the constituents that exceed the RMCL commonly occur in high concentrations in ground water in the Salt River Valley.

Detectable levels of volatile organic compounds were not found in any sample analyzed (Table 3A). The concentrations of organochlorine and organophosphate pesticides are below detection limits and/or drinking water standards, except in one sample from DM-1 (April 6, 1987). The concentration of Heptachlor epoxide was 0.39 ug/l which exceeds the RMCL of 0.0 ug/l in the same sample. The source of these pesticides is not known, but they occur in only the shallowest ground water closest to the river. Their presence may be related to recharge from the Salt River or recharge from the Mesa Wastewater Treatment Plant, just upriver from DM-1.

Aquifer Test

An aquifer test was performed on SRP 24.3E-3N on July 9, 1987 to help measure aquifer characteristics. The well was pumped at about 3,000 gallons per minute for 6 hours. During pumping, drawdown was measured. After the pump was turned off, recovery measurements were made for 5 1/2 hours. Aquifer characteristics show that the transmissivity of the aquifer is about 83,000 gpd/ft. Figure 6 shows the drawdown analysis using the straight line approximation method. Figure 7 shows the recovery analysis. Drawdown and recovery data are presented in Appendix D.

Salt River Project conducted a pump test for 24.3E-3N on June 11, 1986. Results from this test give a transmissivity value of 90,000 gpd/ft and a permeability of 34.9 ft/day. These values are comparable to Dames & Moore's pump test results.

The transmissivity value derived from the test is an average value for the test interval and it can be converted to hydraulic conductivity using the length of this interval. When it was constructed, the SRP well was screened from 145 to 720 feet, but the present depth is only 641 feet.

522

Therefore, using the length of the test interval as the depth from the static water level to the bottom of the well, 528 feet, the average hydraulic conductivity is 22.8 ft/day. However, the drillers log for the SRP well shows that the lower 19% of the test interval probably has a lower hydraulic conductivity than the upper part. The hydraulic conductivity of the upper part of the aquifer is probably greater than the average value.

DISCUSSION

Results from this investigation show that the water table is relatively shallow near the Salt River at the present time. The recharge mound created by the runoff in the river channel in February and March did not dissipate significantly by July 1987. Water level measurements show that the water table responds rapidly to recharge from the river. Even if the mound dissipates, it could reappear within a period of a few days if additional releases or runoff occurs.

Dewatering will be required for construction of a drainage tunnel below the water table. At other locations along the Salt River, water pumped for dewatering has required treatment to meet discharge permit standards. However, results from monitor wells and private wells show that treatment will probably not be required for water pumped near Price Road. The quality of the ground water is generally good. However, additional tests will be required to assess the quality of water from the actual dewatering system.

If dewatering wells are installed west of Price Road, along First Street, additional water quality studies should be made. Known sources of potential ground-water contamination are present on First Street west of Price Road, including the Tempe Landfill.

Table 1

WATER LEVEL MEASUREMENT DATA
PRICE ROAD DRAINAGE TUNNEL

Date	Water Level (MSL)				
	DM-1	DM-2	DM-3	Tri-City	AAA
1/7/87	--	--	--	1100.52	1103.36
1/9/87	--	--	--	1101.22	1104.64
1/12/87	--	--	--	1100.62	1104.95
1/14/87	--	--	--	1101.02	1104.43
1/16/87	--	--	--	1101.02	1104.33
1/22/87	--	--	--	1100.72	1104.03
1/28/87	--	--	--	1099.13	1103.73
2/5/87	--	--	--	1097.67	1103.79
2/12/87	1109.70	1096.79	1090.96	1100.65	1103.93
2/17/87	1109.49	1096.82	1090.89	1100.59	1103.80
2/26/87	1111.98	1096.59	1090.87	1098.65	1101.93
3/9/87	1136.44	1097.40	1091.05	1098.13	1104.97
3/13/87	1136.63	1093.16	1090.63	1103.82	1102.41
3/16/87	1137.48	1100.56	1090.93	1101.32	1104.53
3/19/87	1139.62	1098.22	1096.18	1104.05	1101.90
3/23/87	1145.29	1096.09	1090.86	1110.82	1105.50
3/26/87	1146.44	1096.22	1090.72	1105.97	1113.72
3/30/87	1147.19	1096.29	1090.73	1111.30	1114.63
4/6/87	1147.87	1096.41	1090.75	1116.33	1117.61
4/13/87	1147.94	1096.79	1090.78	1118.17	1114.05
4/20/87	1146.06	1096.86	1090.65	1117.90	1114.29
4/27/87	1144.29	1097.47	1090.70	1120.97	1124.15
5/5/87	1147.57	1095.76	1090.73	1122.40	1118.54
5/19/87	1140.30	1098.81	1090.83	1120.21	1119.27
6/5/87	1139.68	1099.48	1091.04	1121.47	1118.76
7/8/87	1136.29	1100.46	1091.75	1114.12	1114.43

Table 2

RESULTS OF WATER ANALYSES FOR HNIB
(PRICE ROAD GROUND-WATER STUDY)

INORGANICS AND METALS (MG/L)

Constituent	24.3E-3N		Nesbitt	IM-1	IM-2	IM-3	Drinking Water Standards	
	2/26/87	2/26/87	2/26/87	3/3/87	3/3/87	3/3/87	MCL	RMCL
Calcium	59.2	60.4	36.1	15.2	95.2	32.3		
Chloride	228	243	163	54.7	337*	88.5		250
Copper	<0.020	<0.020	0.04	<0.020	0.068	<0.020		1
Iron	0.47*	<0.050	<0.050	1.08*	1.16*	0.602*		0.3
Manganese	0.023	0.014	0.011	0.155*	0.359*	0.118*		0.05
Magnesium	25.4	25.6	18.0	5.85	38.9	15.3		
Sodium	189	189	146	62	226	166		
Zinc	0.011	<0.010	<0.010	0.019	0.058	0.022		5
Sulfate	102	66.6	39.6	28.2	98.2	63.3		250
Alkalinity	250	242	206	102	308	230		
Hardness	252	256	164	NA	NA	144		
pH	7.39	7.45	7.38	7.63	7.42	7.63		6.5-8.5
TDS	813*	770*	582*	255	1040*	624*		500
Arsenic	<0.010	<0.010	0.034	0.024	<0.010	<0.010	0.05	
Barium	0.05	0.06	<0.04	0.04	0.13	0.04	1.0	
Cadmium	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.010	
Chromium	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.05	
Fluoride	0.25	0.23	0.25	0.95	0.56	0.41	4.0	
Lead	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.05	
Mercury	<0.0002	0.0006	<0.0002	0.0002	<0.0002	<0.0002	0.002	
Nitrate	10.8*	10.5*	2.9	4.2	11.8*	3.9	10.0	
Selenium	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	
Silver	0.008	<0.001	0.003	0.001	0.008	0.003	0.05	
Potassium	NA	4.5	4.04	3.2	5.8	3.6		

NA = Not Analyzed
* = Exceeds Drinking Water Standard
MCL = Maximum Contaminant Level (Enforceable Standard)
RMCL = Recommended Maximum Contaminant Level

Table 3A

PURGEABLE HALOCARBONS (UG/L)
(VOLATILE ORGANIC COMPOUNDS)

	24.3E-3N			Nesbitt			DM-1		DM-2		DM-3	
	2/26/87	2/26/87	7/9/87	2/26/87	4/6/87	4/6/87	3/3/87	4/6/87	3/3/87	4/6/87	3/3/87	4/6/87
All Compounds Analyzed by EPA Method 601	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

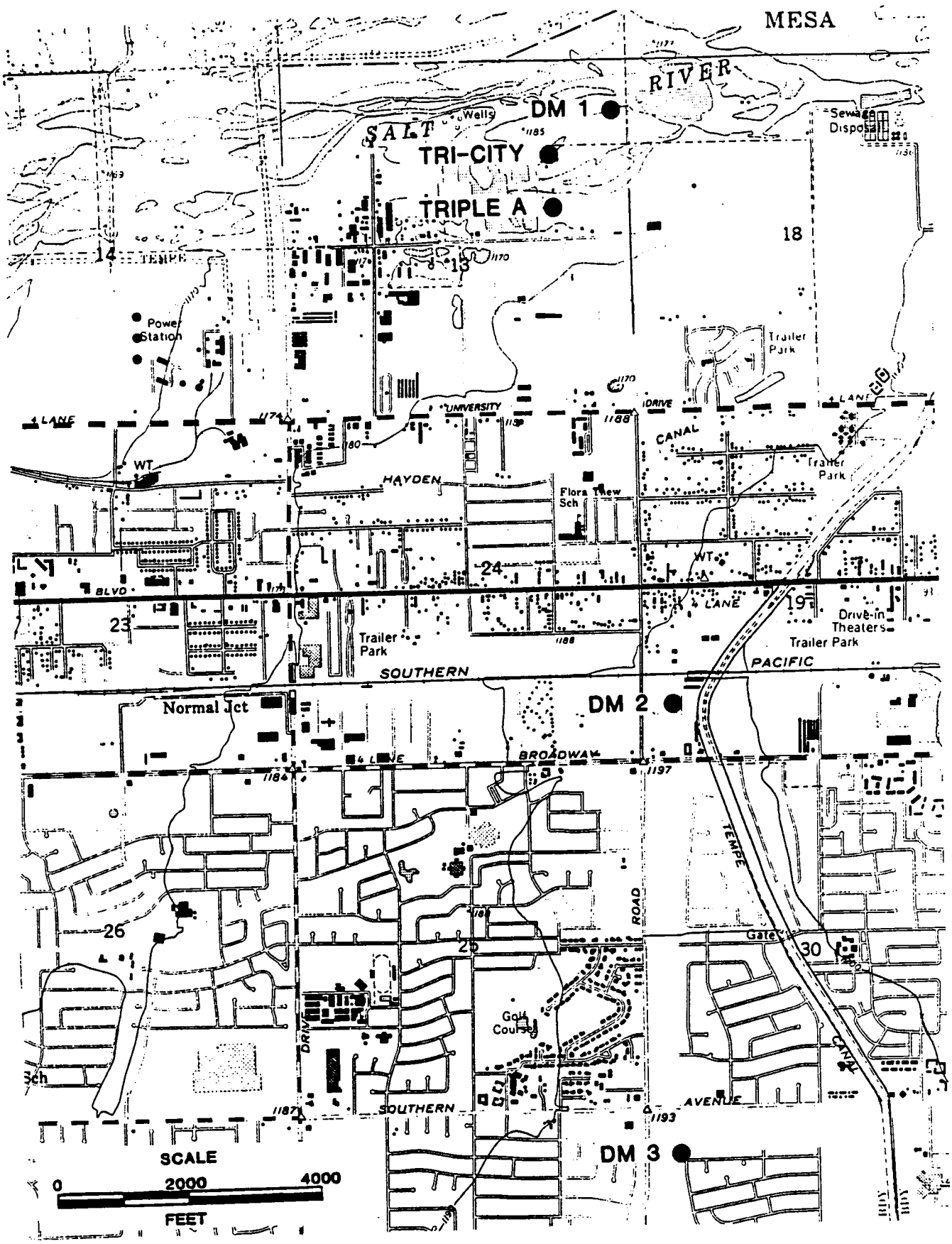
ND = Not Detected; All Detection Limits Less Than or Equal to Drinking Water Standards

Table 3B

ORGANOCHLORINE AND ORGANOPHOSPHOROUS PESTICIDES (UG/L)

Constituent	DM-1	DM-2	DM-3	Nesbitt		24.3E-3N	Drinking Water Stds	
	4/6/87	4/6/87	4/6/87	4/6/87	4/6/87	7/9/87	MCL	RMCL
Delta BHC	1.1	0.22	ND	ND	ND	ND		
Heptachlor Epoxide	0.39*	ND	ND	ND	ND	ND		0
Endrin	0.32*	ND	ND	ND	ND	ND	0.2	
4-4 DDT	0.46	ND	ND	ND	ND	ND		
O-Demeton	ND	1.2	ND	ND	ND	ND		
All Other Compounds Analyzed by EPA Methods 608 & 614	ND	ND	ND	ND	ND	ND		

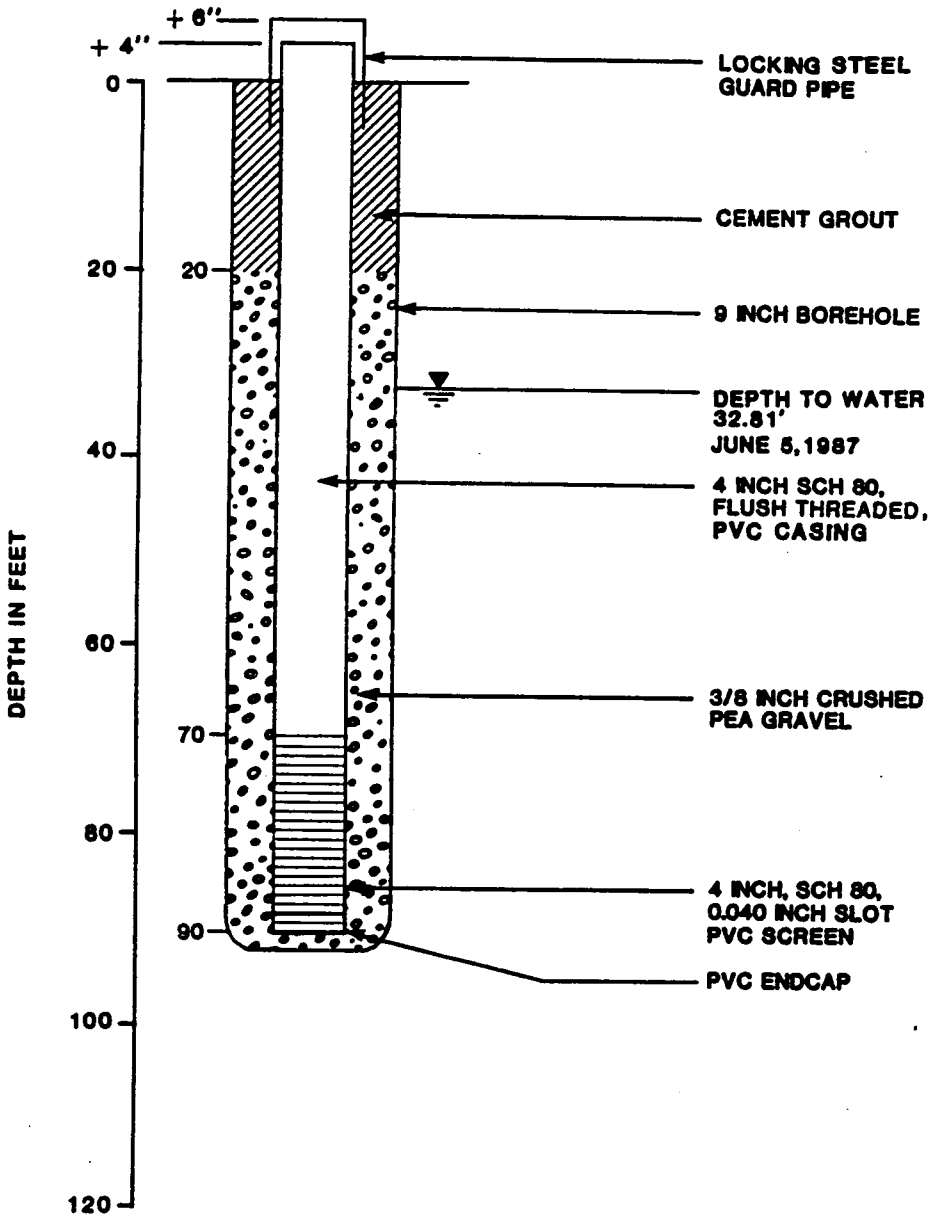
ND = Not Detected; All Detection Limits Less Than or Equal to Drinking Water Standards
MCL = Maximum Contaminant Level (Enforceable Standard)
RMCL = Recommended Maximum Contaminant Level
* = Exceeds Drinking Water Standards



WELL LOCATION MAP

Figure 1

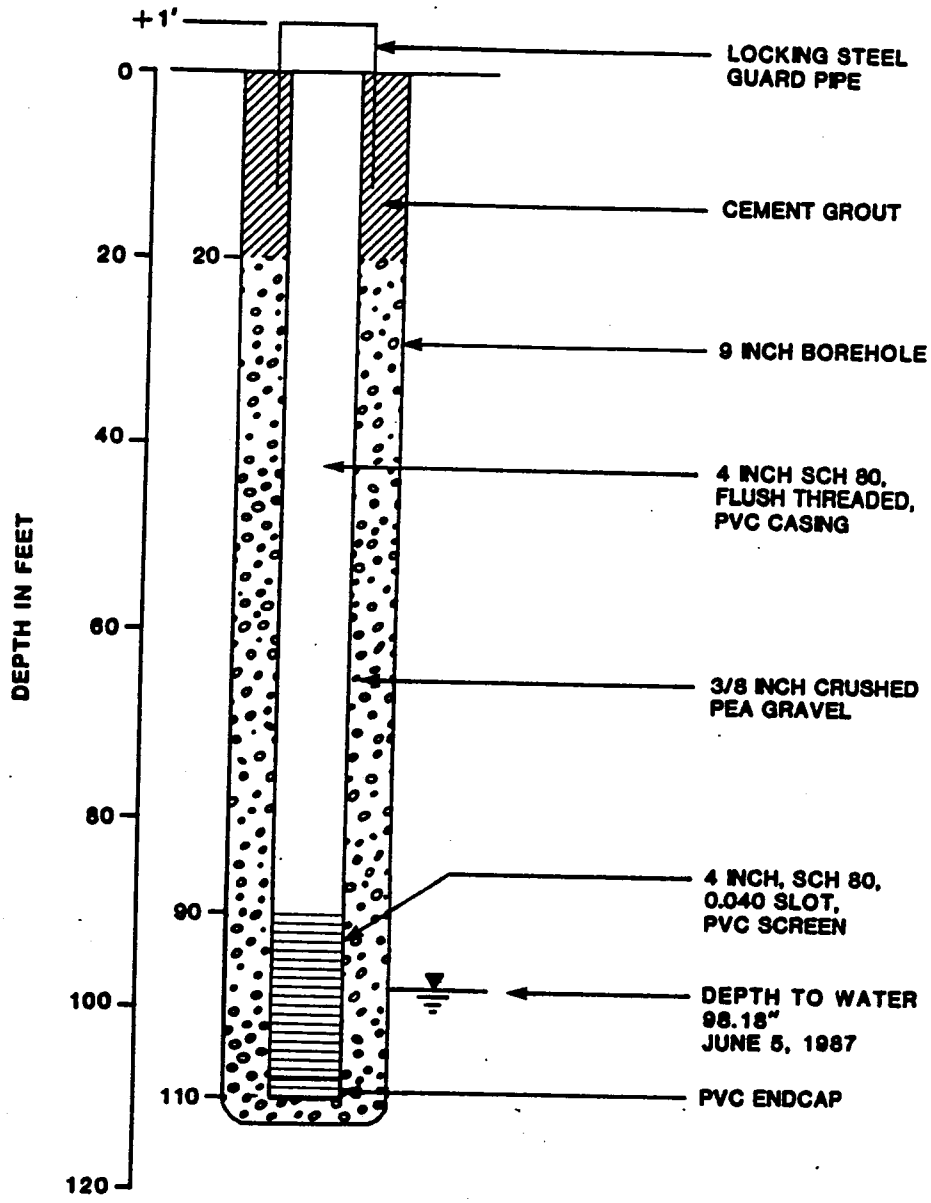
527



WELL COMPLETION DIAGRAM DM-1

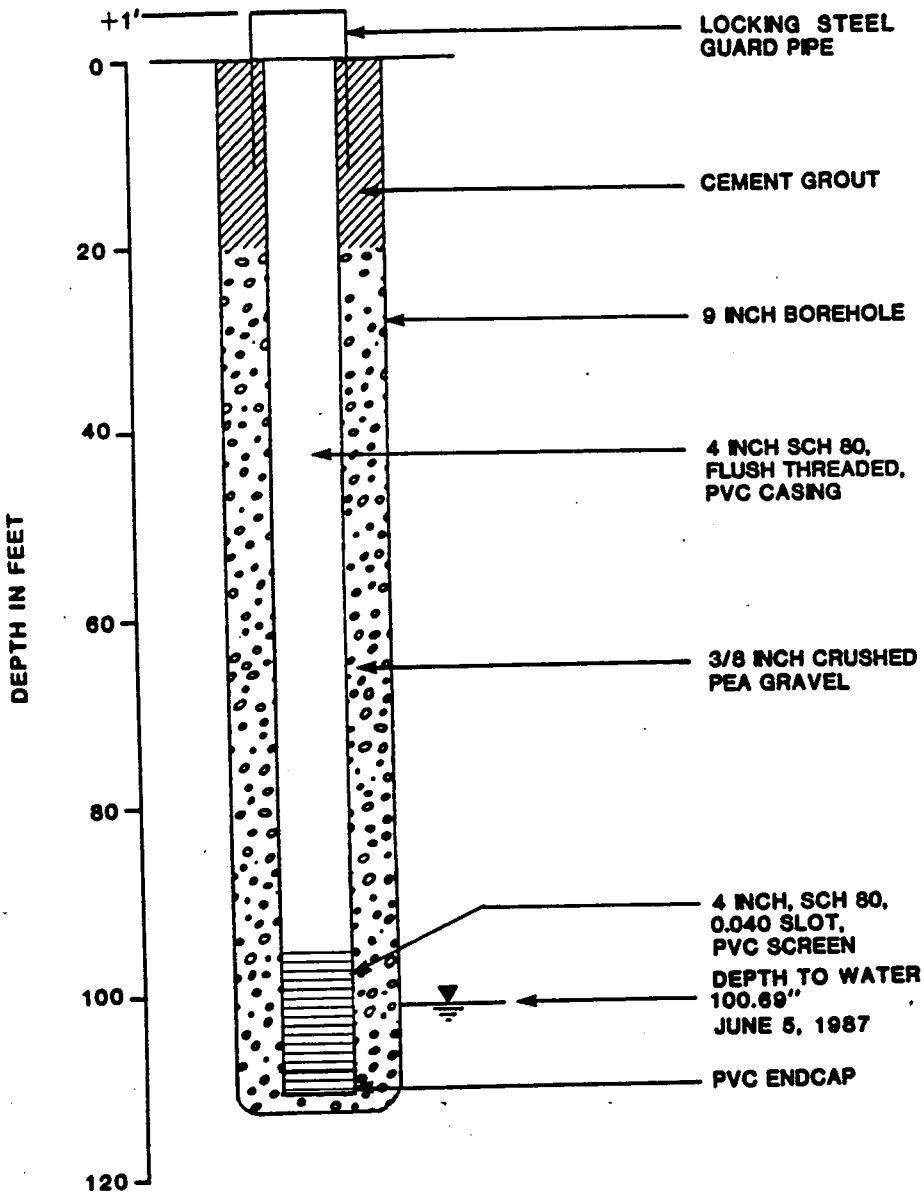
Figure 2

528



WELL COMPLETION DIAGRAM DM-2

Figure 3

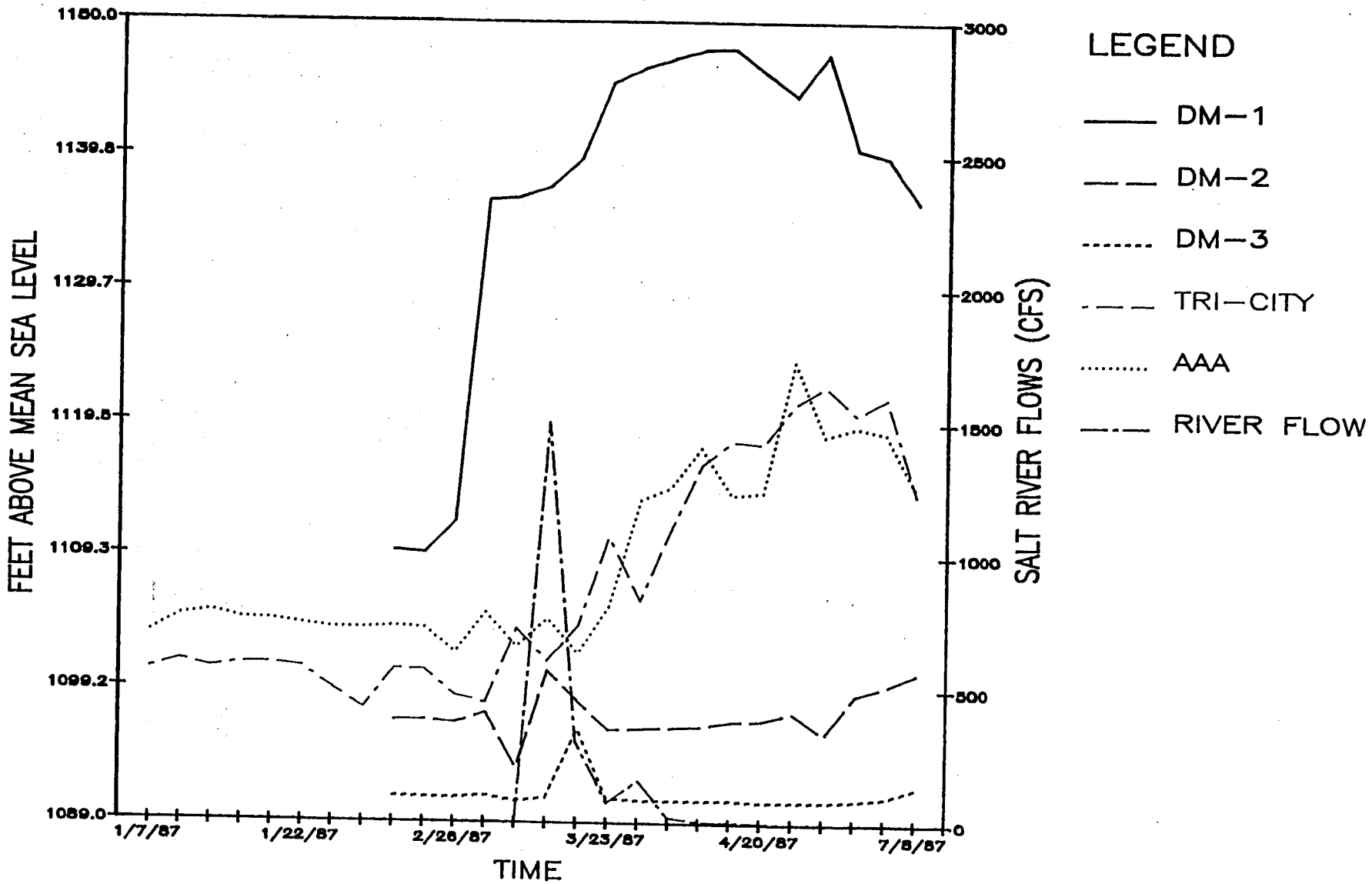


WELL COMPLETION DIAGRAM DM-3

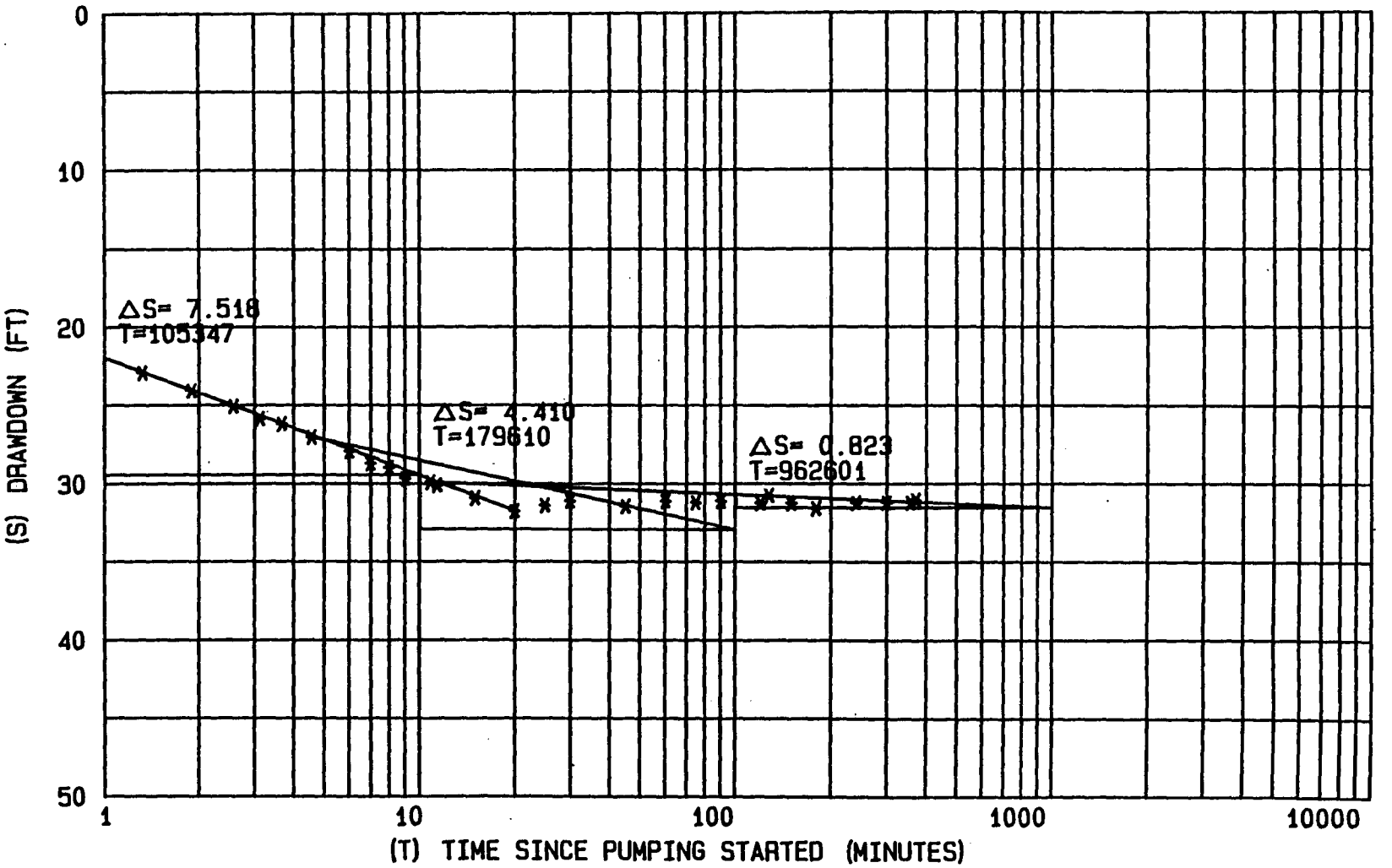
Figure 4

530

PRICE ROAD DRAINAGE TUNNEL
HYDROGRAPH
FIGURE 5



PUMPING TEST ANALYSIS STRAIGHT LINE APPROXIMATION METHOD

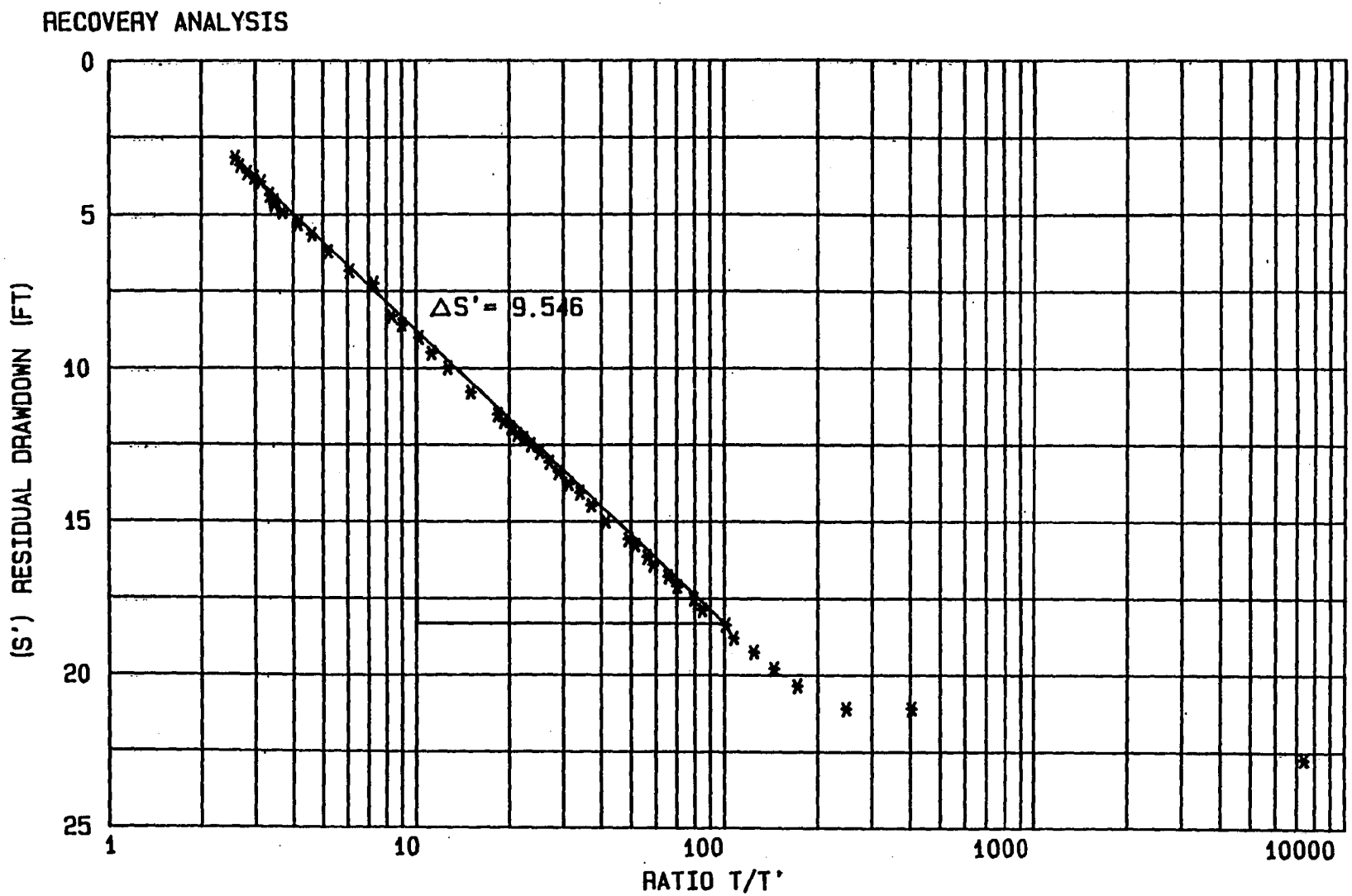


PROJECT: HNTB FILE: 15519-001 LOCATION: TEMPE -PRICE RD	WELL NO.: 24.3E - 3N Q= 3000 USGPM S.W.L.= 112.85	ΔS= T= S=

DAMES & MOORE

Figure 6

532



PROJECT: HNTB FILE: 15519-001 LOCATION: TEMPE - PRICE RD	WELL NO.: 24.3E - 3N Q= 3000 USGPM S.W.L.= 112.85	ΔS'= 9.546 FT T= 82971 USGPD/FT S=

DAMES & MOORE

Figure 7

APPENDIX A

SURVEY NOTES

LJHNTB 3.4 Rec'd 2/24/87
15519-001-33 GAS

BRADY ENGINEERING AND LAND SURVEYING CO.

Land Surveying Civil Engineering

1042 East Guadalupe Rd., Suite 100

Tempe, Arizona 85283 Phone 839-4000

February 18, 1987

Mr. Dave Broermann
DAMES & MOORE
7500 N. Dreamy Draw Drive
Suite 145
Phoenix, Arizona 85202

REF: ELEVATION AND LOCATION CERTIFICATION OF CERTAIN MONITOR WELL LOCATED ALONG PRICE ROAD, TEMPE, ARIZONA.

Dear Dave:

This is to certify that Brady Engineering and Land Surveying has field checked certain monitor well sites located within the vicinity of Price Road from the Superstition Freeway to the Salt River.

We find the elevation to be as follows:

1. Well located at the Northeast corner of Pebble Beach Drive and Price Road - lip of well casing (painted orange) 1191.73.

This elevation was derived from a benchmark described as top of brass cap in handhole located at the intersection of Price Road and Southern Avenue, elevation 1190.69 per City of Tempe datum.

2. Well located at the Southwest corner of Broadway and Price Roads - lip of well casing elevation (painted orange) 1197.66.

This elevation was derived from a benchmark described as top of brass cap in handhole located at the intersection of Broadway and Price Roads, elevation 1196.22 per City of Tempe datum.

3. Well located in the rockyard near the conveyer belt North of 1st Street - top of well casing (painted orange) 1173.03.

4. Well located near the American Towing Building - top of flat plate (painted orange) elevation 1181.83.

5. Well located near the Tri-City Rock - top of ring (painted orange) elevation 1181.52.

534

Dennis H. Brady, L.S. Robert N. Hermon, P.E.

Wells 3, 4, and 5 elevations were derived from a benchmark described as top of brass cap in handhole located at the intersection of Price Road and University Drive, elevation 1186.35 per City of Tempe.

Respectfully,

Christopher E. Aulerich, R.L.S.

CEA/ssb

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
19809
CHRISTOPHER E.
AULERICH
Signed 2/18
ARIZONA

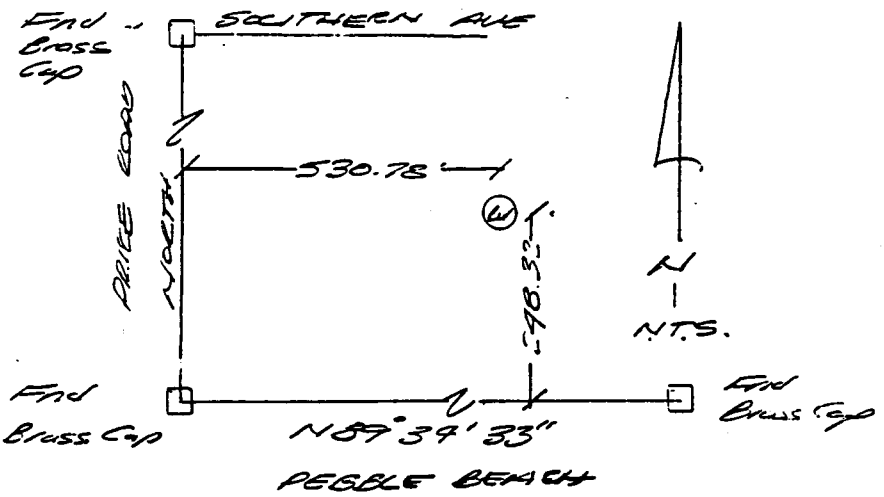
55

BRADY ENGINEERING AND LAND SURVEYING CO.
1042 E. GUADALUPE ROAD, SUITE 100
TEMPE, ARIZONA 85283
PHONE 839-4000

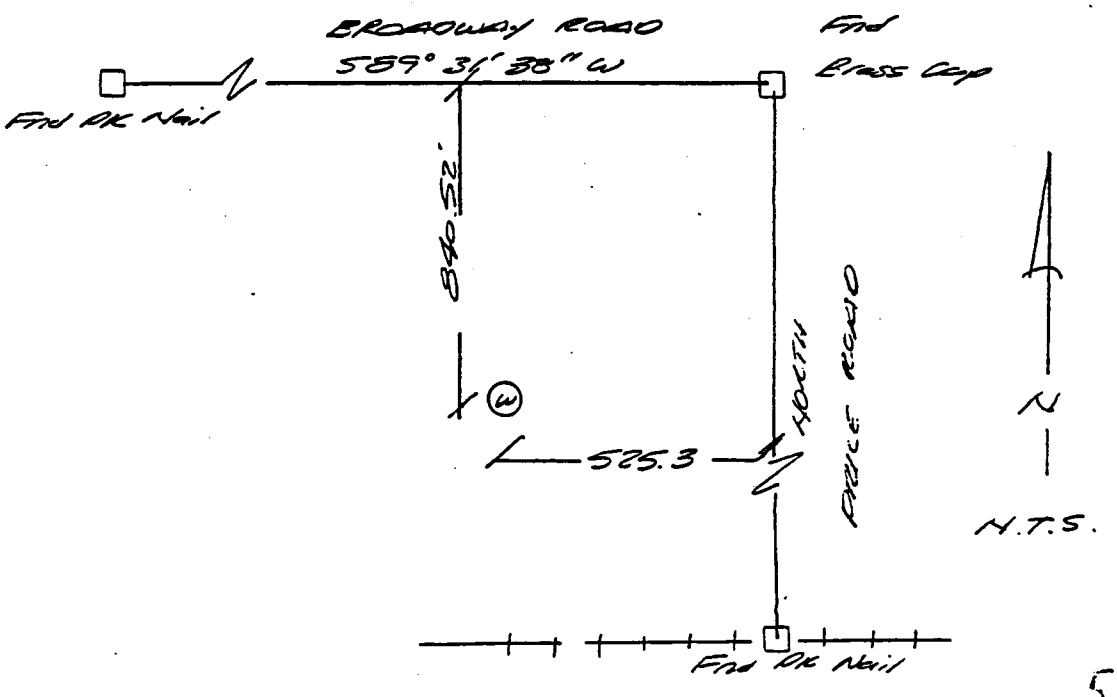
PAGE _____ OF _____ PAGES

PROJECT _____ DATE _____

Monitor Well No. 1



Monitor Well No. 2



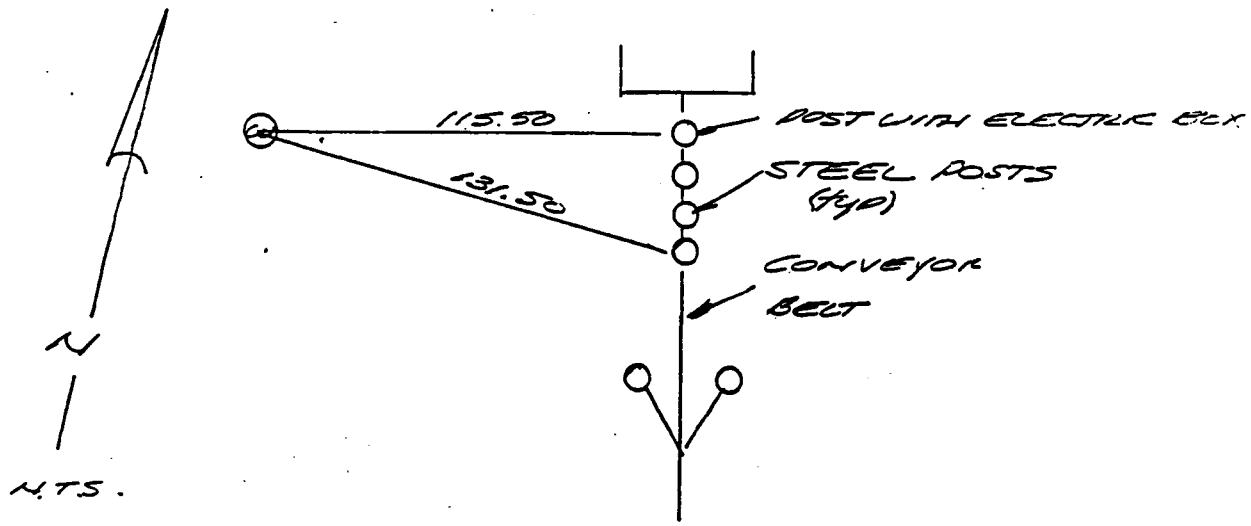
536

BRADY ENGINEERING AND LAND SURVEYING CO.
1042 E. GUADALUPE ROAD, SUITE 100
TEMPE, ARIZONA 85283
PHONE 839-4000

PAGE_____OF_____PAGES

PROJECT_____ DATE_____

Monitor Well No. 3



APPENDIX B

WATER LEVEL DATA SHEETS

537/1

UNITED 3.1

WATER LEVEL DATA SHEET
WELL NO. DM-1

SHEET NO. 1 OF ___

JOB NO. 15519-001

DESCRIPTION

☐ IRRIGATION ☐ NON-PRODUCING

☐ DOMESTIC ☒ MONITOR

ELEV. OF GROUND SURFACE: 1173±

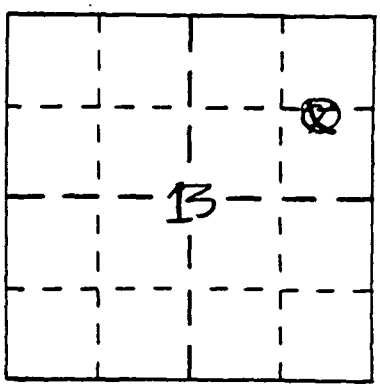
ELEV. OF MEASURING POINT: 1173.03

1172.49 AFTER 3/20

DESCRIPTION OF MEASURING POINT: TOP STEEL CASE UNTIL 3/23/87; NEW MP 3/23/87 TOP PLASTIC CASING 0.54' LOWER THAN OLD MP

WELL LOCATION

PRICE & RIVER BOTTOM



SEC. 13 T. 1N R. 4E

INIT.	DATE	TIME	HOLD (FT.)	± CORR. (FT.)	DEPTH TO WATER (FT.)	METHOD	COMMENTS
DB	2/12/87	1000	70	-6.67	63.33	STEEL TAPE	
[illegible]	2/17/87	[illegible]	[illegible]	-11.46	[illegible]3.54	"	
DB	2/26/87	1107	70	-8.95	61.05	"	
DB	3/9/87	1715	60	-23.41	36.59	"	WATER UP 2-3' IN POND TO WEST RIVER S UP
[illegible]	3/9/87	1718	45	-8.43	36.57	"	
[illegible]	3/9/87	1725	40	-3.41	36.59	"	
GF	3/13/87	0916	110	73.6	36.4	"	Good cut
GF	3/16/87	0910	109	73.45	35.55	"	Good cut
GF	3/19/87	0858	110	76.59	33.41	"	" " - Trucks driving over
GF	3/23/87	0848	110	82.80	27.20	"	Good cut; New MP 0.54 lower
GF	3/26/87	0828	110	83.95	26.05	"	" "
GF	3/30/87	0824	100	74.70	25.30	"	" "
GF	4/6/87	0806	100	75.38	24.62	"	" "; Top [illegible]
"	4/13/87	1604	30.00	5.45	24.55	"	" "
"	4/20/87	0801	30.00	3.57	26.43	"	" "
"	4/27/87	0815	30.00	1.80	28.20	"	" "
"	5/5/87	0839	30.00	5.08	24.92	"	" "
"	5/19/87	0848	35.00	2.81	32.19	"	" "
"	6/5/87	0806	35.00	2.19	32.81	"	" "
"	7/8/87	1422	45.00	8.80	36.20	"	" "

WATER LEVEL DATA SHEET
WELL NO. DM-2

SHEET NO. 1 OF ___

JOB NO. 15519-001

DESCRIPTION

☐ IRRIGATION ☐ NON-PRODUCING

☐ DOMESTIC ☒ MONITOR

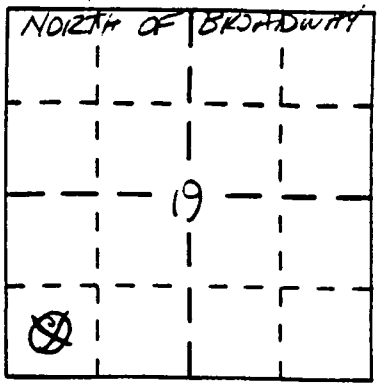
ELEV. OF GROUND SURFACE: 1197±

ELEV. OF MEASURING POINT: 1197.66

DESCRIPTION OF MEASURING POINT: TOP STEEL CASE

WELL LOCATION

PRICE ROAD & GRANADA



SEC. 19 T. 1N R. 5E

INIT.	DATE	TIME	HOLD (FT.)	+ CORR. - (FT.)	DEPTH TO WATER (FT.)	METHOD	COMMENTS
DB	2/12/87	0930	105	-4.13	100.87	STEEL TAPE	
"	"	"	107	-6.14	100.86	"	
DB	2/25/87	837	105	-4.16	101.34	"	
DB	2/26/87	1003	105	-3.93	101.07	"	
DB	3/9/87	1650	102	-1.74	100.26	"	
DB	3/9/87	1650	104	-3.74	100.26	"	
GF	3/13/87	0902	180	-75.5	104.5	"	Good Cut
GF	3/16/87	0843	175	-77.9	97.1	"	Good Cut
GF	3/19/87	0843	170	70.56	99.44	"	" "
GF	3/23/87	0835	175	73.43	101.57	"	" "
GF	3/26/87	0815	175	73.56	101.44	"	" "
GF	3/30/87	0809	175	73.63	101.37	"	" "
GF	4/6/87	0846	175	73.75	101.25	"	" "
"	4/13/87	1624	105	4.13	100.87	"	" "
"	4/20/87	0748	105	4.20	100.80	"	" "
"	4/27/87	0804	105	4.81	100.19	"	" "
"	5/5/87	0824	105	3.10	101.90	"	" "
GF	6/14/87	0835	105	6.15	98.85	"	" "
"	6/15/87	0750	105	6.82	98.18	"	" "
"	7/8/87	1411	105	7.80	97.20	"	" "

316.41

1098.81

WATER LEVEL DATA SHEET
WELL NO. DM-3

SHEET NO. 1 OF ___

JOB NO. 15519-001

DESCRIPTION

☐ IRRIGATION ☐ NON-PRODUCING

☐ DOMESTIC ☒ MONITOR

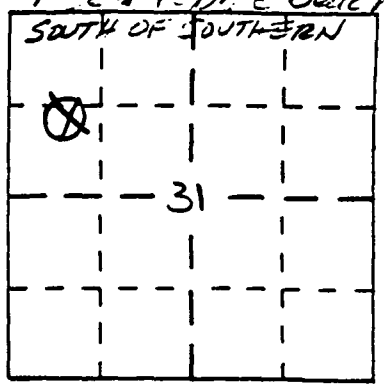
ELEV. OF GROUND SURFACE: 1191±

ELEV. OF MEASURING POINT: 1191.73

DESCRIPTION OF MEASURING POINT: TOP STEEL CASE

WELL LOCATION

Drive & Replace Dock SOUTH OF SOUTHERN



SEC. 31 T. 1N R. 5E

INIT.	DATE	TIME	HOLD (FT.)	± CORR. (FT.)	DEPTH TO WATER (FT.)	METHOD	COMMENTS
DB	2/12/87	1045	110	-9.23	100.74	STEEL TAPE	
"	"	1046	105	-4.22	100.78	"	
"	"	1047	110	-9.24	100.76	"	
		[illegible]	[illegible]	[illegible]	[illegible]	"	
DB	2/26/87	1004	103	-2.16	100.86	"	
DB	3/9/87	1645	105	-4.32	100.68	"	
GF	3/13/87	0830	180	78.9	101.1	"	Questionable reading
GF	3/16/87	0826	175	74.2	100.8	"	Good cut
GF	3/19/87	0835	170	74.45	95.55?	"	Good cut - error?
GF	3/23/87	0824	175	74.13	100.87	"	Good cut; measured twice
GF	3/26/87	0800	175	73.99	101.01	"	Good cut
"	"	0804	180	78.93	101.07	"	Good cut, check measure
GF	3/30/87	0758	180	79.00	101.00	"	Good cut
GF	4/6/87	0831	180	79.02	100.98	"	" "
GF	4/13/87	1631	105	4.05	100.95	"	" "
"	4/20/87	0738	105	3.92	101.08	"	" "
"	4/27/87	0753	105	3.97	101.03	"	" "
"	5/5/87	0820	105	4.00	101.00	"	" "
GF	5/19/87	0824	105	4.10	100.90	"	" "
"	6/5/87	0739	105	4.31	100.69	"	" "
"	7/8/87	1400	105	5.02	99.98	"	" "

See Bill Patterson - Mgr 967-7597

WATER LEVEL DATA SHEET
WELL NO. TRICITY REDIMIX

SHEET NO. 1 OF ___

JOB NO. HNTB

DESCRIPTION

☐ IRRIGATION ☐ NON-PRODUCING

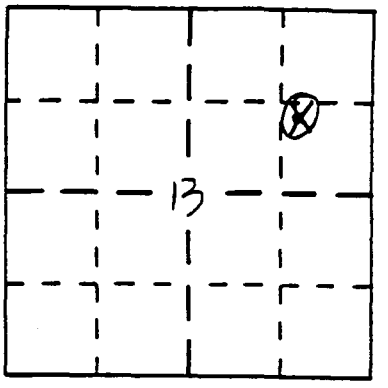
☐ DOMESTIC ☒ INDUSTRIAL

ELEV. OF GROUND SURFACE: 1181 ±

ELEV. OF MEASURING POINT: 1181.52

DESCRIPTION OF MEASURING POINT: UPPER SURFACE OF PUMP BASE, MEASURING THROUGH HOLE IN SOUTH SIDE

WELL LOCATION



SEC. 13 T. 1N R. 4E

INIT.	DATE	TIME	HOLD (FT.)	± CORR. (FT.)	DEPTH TO WATER (FT.)	METHOD	COMMENTS
SS	1/7/87	0850	100	19 ±	81 ±	STEEL TAPE	PUMP RUNNING, POOR CUT
SS	1/9/87	0715	83	-2.7	80.3	"	GOOD CUT
GF	1/12/87	0750	82	-1.1	80.9	"	" " [illegible]
GF	1/14/87	8:24	82	-1.5	80.5	"	" " [illegible]
				.5	80.5		
DB	1/22/87	1000	82	-1.2	80.8	"	" " " "
DB	1/28/87	1236	85	-2.61	82.39	"	PUMPING
DB	2/5/87	910	85	-1.15	83.85	"	PUMPING, GOOD CUT
DB	2/12/87	1010	85	-4.13	80.87	"	PUMPING
DB	[illegible]	[illegible]	[illegible]	-4.57	80.43	"	PUMPING
DB	2/26/87	1045	85	-2.13	82.87	"	PUMPING
DB	3/9/87	1730	85	-1.61	83.39	"	PUMPING GOOD CUT
GF	3/13/87	0952	155	77.3	77.7	"	Pumping
GF	3/16/87	0932	155	74.8	80.2	"	Good Cut, pump on
GF	3/19/87	0917	155	77.53	77.47	"	" " ; pump off
GF	3/23/87	0907	155	74.30	70.70	"	Pump on ; good cut
GF	3/26/87	0856	150	74.45	75.55	"	Good cut, pump on
GF	"	0900	150	74.87	75.13	"	" " , pump off
GF	3/30/87	0847	145	74.78	70.22	"	" " , pump off
GF	3/30/87	0851	145	74.73	70.27	"	" " " on
GF	4/6/87	0924	140	74.81	65.19	"	Good Cut; Pump on
"	4/13/87	1551	70.00	6.65	63.35	"	" " " "
"	4/20/87	0819	70.00	6.38	63.62	"	" " " "
"	4/27/87	0834	65.00	4.45	60.55	"	" " ; Pump on
"	5/5/87	0854	65.00	5.88	59.12	"	" " ; Pump on
GF	5/12/87	0854	65.00	3.69	61.31	"	" " Pump on
"	6/5/87	0826	65.00	4.95	60.05	"	" " ; Pump on
GF	7/8/87	1440	75.00	7.60	67.40	"	" " "

WATER LEVEL DATA SHEET
WELL NO. TRIPLE A AUTO WRECKING

SHEET NO. 1 OF ___

JOB NO. HATB

DESCRIPTION

☐ IRRIGATION ☐ NON-PRODUCING

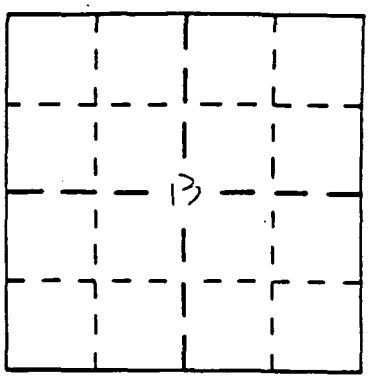
☒ DOMESTIC ☐ _____

ELEV. OF GROUND SURFACE: 1180 I

ELEV. OF MEASURING POINT: 1181.83

DESCRIPTION OF MEASURING POINT: UPPER SURFACE OF WELL SEAL, MEASURE THROUGH VENT HOLE

WELL LOCATION



SEC. 13 T. 1N R. 4E

John Arneson 967-3479

INIT.	DATE	TIME	HOLD (FT.)	± CORR. (FT.)	DEPTH TO WATER (FT.)	METHOD	COMMENTS
[illegible]	1/7/87	0840	80	-1.53	78.47	STEEL TAPE	GOOD CUT, PUMP OFF
[illegible]	1/9/87	0710	80	-2.81	77.19	"	" "
GF	1/12/87	[illegible]	80	-3.12	76.88	"	" "
GF	1/14/87	8:14	80	-2.60	77.40	"	" "
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	"	
DB	1/22/87	0955	80	-2.20	77.80	"	" "
DB	1/28/87	1431	80	-1.90	78.10	"	"
DB	2/5/87	905	84	-5.96	78.04	"	"
DB	2/12/87	1000	85	-7.10	77.90	"	"
DB	2/17/87	[illegible]	[illegible]	-6.97	73.03	"	"
DB	2/26/87	1035	85	5.10	79.90	"	" "
DB	3/9/87	1735	90	-3.14	76.86	"	
GF	3/13/87	0934	150	70.58	79.42	"	Difficult to get tape "
GF	3/16/87	0924	155	77.70	77.30	"	Good Cut
GF	3/19/87	0908	150	70.06	79.93	"	" "
GF	3/23/87	0855	150	73.67	76.33	"	Good cut, pump off
GF	3/26/87	0842	140	72.00±	68.00±	"	Approx reading
GF	3/26/87	0847	140	71.89	68.11	"	Good cut
GF	3/30/87	0833	140	72.80	67.20	"	
GF	4/6/87	0917	135	70.78	64.22	"	Good cut
"	4/13/87	1543	70.00	2.22	67.78	"	" "
"	4/20/87	0811	70.00	2.46	67.54	"	" "
"	4/27/87	0826	60.00	2.32	57.68	"	" "
"	5/5/87	0848	65.00	1.71	63.29	"	" "
"	5/19/87	0854	65.00	2.44	62.56	"	" "
"	6/5/87	0819	"	1.93	63.07	"	" "
"	7/8/87	1431	70.00	2.52	67.40	"	" "

17.61

.15

.37

.543

DATA SHEET (BOND)
FORM 9500-25

DEPARTMENT OF NATURAL RESOURCES

SALT RIVER FLOWS 236-5929

	GRAN. REEF SPILLS (CFS)
3/16-17/87	SCART RELEASES
3/20/87	1500
3/26/87	300
3/30/87	75
	160
4/6/87	20
4/13/87	5
4/17/87	5
4/20/87	0
4/24/87	0
Winter releases ended	

6-71

APPENDIX C

WATER QUALITY RESULTS

3.2
15519-001-33

AnalyticalTechnologies, Inc. 2113 S. 48th Street Suites 107-110 Tempe, AZ 85282 (602) 438-1530

GW & WASTE MGMT. (33)
RECEIVED
APR 17 1987
FILE
CC

28 March 1987

Dames & Moore
7500 N. Dreamy Draw Drive, #145
Phoenix, AZ 85020

Accession: 9383

Date Received: 02/26/87

Attention: Steve Smith

Project: Analytical Testing of Water Samples

Comments: Samples Held Upon Request Until 03/04/87

Supervisory Review: [signature]

Date of Report: 3/28/87

Note: Samples will be disposed of within 30 days unless otherwise notified.

RGM/kas

Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

544

EPA METHOD 601/602
PROJECT: WATERS

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
ANALYSIS DATE: 03/05/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: TRIP BLANK
LOCATION:
LAB SAMPLE #:
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

106 % SURROGATE RECOVERY

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/28/87

SECONDARY STANDARDS
PROJECT: WATERS

(243E-3W)

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: SRP-1
LOCATION:
LAB SAMPLE #: 9383-1
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	CALCIUM (Ca)	2	0.2	59.2
03/18/87	CHLORIDE (Cl)	100	0.10	228
03/18/87	COPPER (Cu)	1	0.020	ND
03/18/87	IRON (Fe)	1	0.050	0.47
03/18/87	MANGENESE (Mn)	1	0.010	0.023
03/04/87	MAGNESIUM (Mg)	3	0.04	25.4
03/18/87	SODIUM (Na)	50	0.6	189
03/18/87	ZINC (Zn)	1	0.010	0.011
03/18/87	SULFATE (SO4)	4	0.10	102
03/04/87	ALKALINITY (ALK)	1	1	250
03/04/87	HARDNESS	--	0.5	252
03/04/87	CORROSIVITY (pH)	--	----	7.39
03/06/87	TOTAL DISSOLVED SOLIDS (TDS)	1	10	813

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH DATE: 03/28/87

SECONDARY STANDARDS
PROJECT: WATERS

Blind Duplicate
(24.3E-3N)

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: DUP-2
LOCATION:
LAB SAMPLE #: 9383-3
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	CALCIUM (Ca)	2	0.050	60.4
03/19/87	CHLORIDE (Cl)	25	0.10	243
03/18/87	COPPER (Cu)	1	0.020	ND
03/18/87	IRON (Fe)	1	0.050	ND
03/18/87	MANGENESE (Mn)	1	0.010	0.014
03/04/87	MAGNESIUM (Mg)	1	0.050	25.6
03/18/87	SODIUM (Na)	50	0.050	189
03/18/87	ZINC (Zn)	1	0.010	ND
03/18/87	SULFATE (SO4)	1	0.10	66.6
03/24/87	ALKALINITY (ALK)	1	1	242
03/04/87	HARDNESS	--	0.5	256
03/04/87	CORROSIVITY (pH)	--	----	7.45
03/06/87	TOTAL DISSOLVED SOLIDS (TDS)	1	10	770

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH DATE: 03/28/87

PRIMARY STANDARDS
PROJECT: WATERS

(24.3E-3N)

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: SRP-1
LOCATION:
LAB SAMPLE #: 9383-1
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	ARSENIC (As)	1	0.010	ND
03/09/87	BARIUM (Ba)	1	0.04	0.05
03/09/87	CADMIUM (Cd)	1	0.003	ND
03/09/87	CHROMIUM (Cr)	1	0.010	ND
03/04/87	FLUORIDE (F)	1	0.05	0.25
03/06/87	LEAD (Pb)	1	0.002	ND
03/11/87	MERCURY (Hg)	1	0.0002	ND
03/06/87	NITRATE (NO3-N)	1	0.10	10.8
03/06/87	SELENIUM (Se)	1	0.010	ND
03/04/87	SILVER (Ag)	1	0.001	0.008
03/04/87	POTASSIUM (K)	10	0.2	59.2 ?

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH DATE: 03/28/87

PRIMARY STANDARDS
PROJECT: WATERS

24.3E-3N
Blind duplicate

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: DUP-2
LOCATION:
LAB SAMPLE #: 9383-3
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	ARSENIC (As)	1	0.010	ND
03/09/87	BARIUM (Ba)	1	0.04	0.06
03/09/87	CADMIUM (Cd)	1	0.003	ND
03/09/87	CHROMIUM (Cr)	1	0.010	ND
03/04/87	FLUORIDE (F)	1	0.05	0.23
03/06/87	LEAD (Pb)	1	0.002	ND
03/11/87	MERCURY (Hg)	1	0.0002	0.0006
03/06/87	NITRATE (NO3-N)	1	0.10	10.5
03/06/87	SELENIUM (Se)	1	0.010	ND
03/04/87	SILVER (Ag)	1	0.001	ND
03/04/87	POTASSIUM (K)	25	0.02	4.5

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH DATE: 03/28/87

549

EPA METHOD 601/602
PROJECT: WATERS

24.3E-3N

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
ANALYSIS DATE: 03/05/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: SRP-1
LOCATION:
LAB SAMPLE #: 9383-1
UNITS: ug/l
DILUTION FACTOR: 10

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.2	ND
BROMOMETHANE	0.6	ND
DICHLORODIFLUOROMETHANE	0.4	ND
VINYL CHLORIDE	0.5	ND
CHLOROETHANE	1	ND
METHYLENE CHLORIDE	0.2	ND
TRICHLOROFLUOROMETHANE	0.7	ND
1,1-DICHLOROETHENE	0.7	ND
1,1-DICHLOROETHANE	0.5	ND
TRANS-1,2-DICHLOROETHENE	0.9	ND
CHLOROFORM	0.5	ND
1,2-DICHLOROETHANE	0.7	ND
1,1,1-TRICHLOROETHANE	0.3	ND
CARBON TETRACHLORIDE	0.8	ND
BROMODICHLOROMETHANE	0.4	ND
1,2-DICHLOROPROPANE	0.3	ND
TRANS-1,3-DICHLOROPROPENE	1.1	ND
TRICHLOROETHENE	0.6	ND
DIBROMOCHLOROMETHANE	0.7	ND
1,1,2-TRICHLOROETHANE	0.3	ND
CIS-1,3-DICHLOROPROPENE	0.7	ND
2-CHLOROETHYLVINYL ETHER	0.3	ND
BROMOFORM	0.9	ND
1,1,2,2-TETRACHLOROETHANE	0.3	ND
TETRACHLOROETHENE	0.3	ND
BENZENE	2	NA
TOLUENE	4	NA
CHLOROBENZENE	1.6	ND
ETHYLBENZENE	1	NA
1,3-DICHLOROBENZENE	4	ND
1,2-DICHLOROBENZENE	4	ND
1,4-DICHLOROBENZENE	6	ND

111 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
SAMPLE MATRIX REQUIRED DILUTION

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/28/87

EPA METHOD 601/602
PROJECT: WATERS

(24.3E-3N Blind duplicate)

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
ANALYSIS DATE: 03/05/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DUP-2
LOCATION:
LAB SAMPLE #: 9383-3
UNITS: ug/l
DILUTION FACTOR: 10

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.2	ND
BROMOMETHANE	0.6	ND
DICHLORODIFLUOROMETHANE	0.4	ND
VINYL CHLORIDE	0.5	ND
CHLOROETHANE	1	ND
METHYLENE CHLORIDE	0.2	ND
TRICHLOROFLUOROMETHANE	0.7	ND
1,1-DICHLOROETHENE	0.7	ND
1,1-DICHLOROETHANE	0.5	ND
TRANS-1,2-DICHLOROETHENE	0.9	ND
CHLOROFORM	0.5	ND
1,2-DICHLOROETHANE	0.7	ND
1,1,1-TRICHLOROETHANE	0.3	ND
CARBON TETRACHLORIDE	0.8	ND
BROMODICHLOROMETHANE	0.4	ND
1,2-DICHLOROPROPANE	0.3	ND
TRANS-1,3-DICHLOROPROPENE	1.1	ND
TRICHLOROETHENE	0.6	ND
DIBROMOCHLOROMETHANE	0.7	ND
1,1,2-TRICHLOROETHANE	0.3	ND
CIS-1,3-DICHLOROPROPENE	0.7	ND
2-CHLOROETHYLVINYL ETHER	0.3	ND
BROMOFORM	0.9	ND
1,1,2,2-TETRACHLOROETHANE	0.3	ND
TETRACHLOROETHENE	0.3	ND
BENZENE	2	NA
TOLUENE	4	NA
CHLOROBENZENE	1.6	ND
ETHYLBENZENE	1	NA
1,3-DICHLOROBENZENE	4	ND
1,2-DICHLOROBENZENE	4	ND
1,4-DICHLOROBENZENE	6	ND

112 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
SAMPLE MATRIX REQUIRED DILUTION

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/28/87

EPA METHOD 601/602
PROJECT: WATERS

Nesbitt Well

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
ANALYSIS DATE: 03/05/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: NG-3
LOCATION:
LAB SAMPLE #: 9383-2
UNITS: ug/l
DILUTION FACTOR: 10

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.2	ND
BROMOMETHANE	0.6	ND
DICHLORODIFLUOROMETHANE	0.4	ND
VINYL CHLORIDE	0.5	ND
CHLOROETHANE	1	ND
METHYLENE CHLORIDE	0.2	ND
TRICHLOROFLUOROMETHANE	0.7	ND
1,1-DICHLOROETHENE	0.7	ND
1,1-DICHLOROETHANE	0.5	ND
TRANS-1,2-DICHLOROETHENE	0.9	ND
CHLOROFORM	0.5	ND
1,2-DICHLOROETHANE	0.7	ND
1,1,1-TRICHLOROETHANE	0.3	ND
CARBON TETRACHLORIDE	0.8	ND
BROMODICHLOROMETHANE	0.4	ND
1,2-DICHLOROPROPANE	0.3	ND
TRANS-1,3-DICHLOROPROPENE	1.1	ND
TRICHLOROETHENE	0.6	ND
DIBROMOCHLOROMETHANE	0.7	ND
1,1,2-TRICHLOROETHANE	0.3	ND
CIS-1,3-DICHLOROPROPENE	0.7	ND
2-CHLOROETHYLVINYL ETHER	0.3	ND
BROMOFORM	0.9	ND
1,1,2,2-TETRACHLOROETHANE	0.3	ND
TETRACHLOROETHENE	0.3	ND
BENZENE	2	NA
TOLUENE	4	NA
CHLOROBENZENE	1.6	ND
ETHYLBENZENE	1	NA
1,3-DICHLOROBENZENE	4	ND
1,2-DICHLOROBENZENE	4	ND
1,4-DICHLOROBENZENE	6	ND

105 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
SAMPLE MATRIX REQUIRED DILUTION

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/28/87

PRIMARY STANDARDS
PROJECT: WATERS

Nesbitt Well

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: NG-3
LOCATION:
LAB SAMPLE #: 9383-2
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	ARSENIC (As)	1	0.010	0.034
03/09/87	BARIUM (Ba)	1	0.04	ND
03/09/87	CADMIUM (Cd)	1	0.003	ND
03/09/87	CHROMIUM (Cr)	1	0.010	ND
03/04/87	FLUORIDE (F)	1	0.05	0.25
03/06/87	LEAD (Pb)	1	0.002	ND
03/11/87	MERCURY (Hg)	1	0.0002	ND
03/06/87	NITRATE (NO3-N)	1	0.10	2.9
03/06/87	SELENIUM (Se)	1	0.010	ND
03/04/87	SILVER (Ag)	1	0.001	0.003
03/04/87	POTASSIUM (K)	10	0.02	4.04

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH DATE: 03/28/87

SECONDARY STANDARDS
PROJECT: WATERS

Nesbitt Well

SAMPLE DATE: 02/26/87
LAB RECEIPT DATE: 02/26/87
MATRIX: WATER

SAMPLE ID: NG-3
LOCATION:
LAB SAMPLE #: 9383-2
UNITS: mg/l

ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
03/04/87	CALCIUM (Ca)	1	0.050	36.1
03/19/87	CHLORIDE (Cl)	25	0.10	163
03/18/87	COPPER (Cu)	1	0.020	0.04
03/18/87	IRON (Fe)	1	0.050	ND
03/18/87	MANGENESE (Mn)	1	0.010	0.011
03/04/87	MAGNESIUM (Mg)	3	0.04	18.0
03/18/87	SODIUM (Na)	50	0.050	146
03/18/87	ZINC (Zn)	1	0.010	ND
03/18/87	SULFATE (SO4)	1	0.10	39.6
03/04/87	ALKALINITY (ALK)	1	1	206
03/04/87	HARDNESS	--	0.5	164
03/04/87	CORROSIVITY (pH)	--	----	7.38
03/06/87	TOTAL DISSOLVED SOLIDS (TDS)	1	10	582

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISORY REVIEW: R. GERRY MCCULLOUGH RGM DATE: 03/28/87

ION BALANCE

SAMPLE ID: 9383-1 (24.3E-3N)

ANIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
CHLORIDE	228		0.02821	6.4319	
FLUORIDE	0.25		0.05264	0.0132	
NITRATE	10.8	x 4.43	0.01613	0.7717	
PHOSPHATE	---		0.03159	----	
SULFATE	102		0.02082	2.1236	
ALKALINITY	250		0.02	5.0	
					14.34

CATIONS	RESULT mg/L	FACTOR	me/L	TOTAL me/L
ARSENIC	ND	0.06667	----	
CALCIUM	59.2	0.04990	2.9541	
MAGNESIUM	25.4	0.08229	2.0902	
POTASSIUM	5.4	0.02558	0.1381	
SODIUM	189	0.04350	8.2215	
ANIONS & CATIONS	870			
TDS	813			
				13.40

7 % RPD

ION BALANCE

SAMPLE ID: 9383-2 (Nesbitt Well)

ANIONS	RESULT mg/L	FACTOR	me/L	TOTAL me/L
CHLORIDE	153	0.02821	4.3161	
FLUORIDE	0.25	0.05264	0.0131	
NITRATE	2.9 x 4.43	0.01613	0.2072	
PHOSPHATE	---	0.03159	----	
SULFATE	39.6	0.02082	0.8245	
ALKALINITY	206	0.02	4.12	
				9.48

CATIONS	RESULT mg/L	FACTOR	me/L	TOTAL me/L
ARSENIC	----	0.06667	----	
CALCIUM	36.1	0.04990	1.8014	
MAGNESIUM	18.0	0.08229	1.4812	
POTASSIUM	4.04	0.02558	0.1033	
SODIUM	146	0.04350	6.351	
ANIONS & CATIONS	606			
TDS	582			
				9.74

4 % RPD

ION BALANCE

SAMPLE ID: 9383-3 (24.3E-3rd Blind Duplicate)

ANIONS	RESULT mg/L	FACTOR	me/L	TOTAL me/L
CHLORIDE	243	0.02821	5.0595	
FLUORIDE	0.23	0.05264	0.0121	
NITRATE	10.5 x 4.43	0.01613	0.7503	
PHOSPHATE	---	0.03159	----	
SULFATE	66.6	0.02082	1.3866	
ALKALINITY	242	0.02	4.84	
				12.05

CATIONS	RESULT mg/L	FACTOR	me/L	TOTAL me/L
ARSENIC	----	0.06667	----	
CALCIUM	60.4	0.04990	3.0140	
MAGNESIUM	25.6	0.08229	2.1066	
POTASSIUM	4.5	0.02558	0.1151	
SODIUM	189	0.04350	8.2215	
ANIONS & CATIONS	842			
TDS	770			
				13.46

9 % RPD

3.2
15519-001-33

AnalyticalTechnologies, Inc. 2113 S. 48th Street Suites 107-110 Tempe, AZ 85282 (602) 438-1530

20 March 1987

MAR 26 1987

Dames & Moore
7500 N. Dreamy Draw Drive, #145
Phoenix, AZ 85020

Accession: 9404

Date Received: 03/04/87

Attention: Steve Smith

Project: Analytical Testing of Water Samples

Supervisory Review: _____

Date of Report: 3/20/87

RGM/rmt

Note: Samples will be disposed of within 30 days unless otherwise notified.

Corporate Offices: 5550 Morehouse Drive San Diego, CA 92121 (619) 458-9141

601 ORGANICS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87
SAMPLE CODE: FB

WELL ID: TRIP BLANK
LEVEL ID:
LAB SAMPLE #: 9404
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	NA
427	TOLUENE	0.4	NA
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	NA
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND

112 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

601 ORGANICS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87
SAMPLE CODE: FB

WELL ID: DM-1
LEVEL ID:
LAB SAMPLE #: 9404-1
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	NA
427	TOLUENE	0.4	NA
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	NA
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND

105 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

601 ORGANICS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87
SAMPLE CODE: FB

WELL ID: DM-2
LEVEL ID:
LAB SAMPLE #: 9404-2
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	NA
427	TOLUENE	0.4	NA
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	NA
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND

102 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

601 ORGANICS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87
SAMPLE CODE: FB

WELL ID: DM-3
LEVEL ID:
LAB SAMPLE #: 9404-3
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	NA
427	TOLUENE	0.4	NA
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	NA
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND

97.2 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

METALS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-1
LEVEL ID:
LAB SAMPLE #: 9404-1
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
201	--------	Sb	1	0.020	NA
202	03/05/87	As	1	0.010	0.024
203	03/09/87	Ba	1	0.04	0.04
204	--------	Be	1	0.010	NA
205	03/09/87	Cd	1	0.003	ND
206	--------	Cr 6	1	0.01	NA
207	03/09/87	Cr Tot	1	0.010	ND
208	03/18/87	Cu	1	0.020	ND
209	03/06/87	Pb	1	0.002	ND
210	03/11/87	Hg	1	0.0002	0.0002
211	--------	Ni	1	0.010	NA
212	03/06/87	Se	1	0.010	ND
213	03/04/87	Ag	1	0.001	0.001
214	--------	Tl	1	0.020	NA
215	03/18/87	Zn	1	0.010	0.019

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

METALS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-2
LEVEL ID:
LAB SAMPLE #: 9404-2
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
201	--------	Sb	1	0.020	NA
202	03/05/87	As	1	0.010	ND
203	03/09/87	Ba	1	0.04	0.13
204	--------	Be	1	0.010	NA
205	03/09/87	Cd	1	0.003	ND
206	--------	Cr 6	1	0.01	NA
207	03/09/87	Cr Tot	1	0.010	ND
208	03/18/87	Cu	1	0.020	0.068
209	03/06/87	Pb	1	0.002	ND
210	03/11/87	Hg	1	0.0002	ND
211	--------	Ni	1	0.010	NA
212	03/06/87	Se	1	0.010	ND
213	03/04/87	Ag	1	0.001	0.008
214	--------	Tl	1	0.020	NA
215	03/18/87	Zn	1	0.010	0.058

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

METALS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-3
LEVEL ID:
LAB SAMPLE #: 9404-3
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
201	--------	Sb	1	0.020	NA
202	03/05/87	As	1	0.010	ND
203	03/09/87	Ba	1	0.04	0.04
204	--------	Be	1	0.010	NA
205	03/09/87	Cd	1	0.003	ND
206	--------	Cr 6	1	0.01	NA
207	03/09/87	Cr Tot	1	0.010	ND
208	03/18/87	Cu	1	0.020	ND
209	03/06/87	Pb	1	0.002	ND
210	03/11/87	Hg	1	0.0002	ND
211	--------	Ni	1	0.010	NA
212	03/06/87	Se	1	0.010	ND
213	03/04/87	Ag	1	0.001	0.003
214	--------	Tl	1	0.020	NA
215	03/18/87	Zn	1	0.010	0.022

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

IONS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-1
LEVEL ID:
LAB SAMPLE #: 9404-1
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
101	--------	NH3	1	0.10	NA
102	--------	B	1	0.50	NA
103	03/14/87	Ca	10	0.050	15.2
104	03/18/87	Fe	1	0.050	1.08
105	03/04/87	Mg	10	0.04	5.85
106	03/16/87	Mn	1	0.010	0.155
107	03/04/87	K	1	1.0	3.2
108	03/16/87	Na	1	0.06	62
110	03/18/87	Cl	25	0.10	54.7
111	03/04/87	F	1	0.5	0.95
112	--------	KN	1	0.050	NA
113	03/06/87	NO3-N	1	0.10	4.2
114	--------	PO4	1	0.050	NA
115	03/18/87	SO4	1	0.10	28.2

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

IONS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-2
LEVEL ID:
LAB SAMPLE #: 9404-2
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
101	--------	NH3	1	0.10	NA
102	--------	B	1	0.50	NA
103	03/14/87	Ca	10	0.050	95.2
104	03/18/87	Fe	1	0.050	1.16
105	03/04/87	Mg	10	0.04	38.9
106	03/16/87	Mn	1	0.010	0.359
107	03/04/87	K	1	0.02	5.8
108	03/16/87	Na	1	0.06	226
110	03/18/87	Cl	25	0.10	337
111	03/04/87	F	1	0.5	0.56
112	--------	KN	1	0.050	NA
113	03/06/87	NO3-N	1	0.10	11.8
114	--------	PO4	1	0.050	NA
115	03/18/87	SO4	1	0.10	98.2

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

IONS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-3
LEVEL ID:
LAB SAMPLE #: 9404-3
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT
101	--------	NH3	1	0.10	NA
102	--------	B	1	0.50	NA
103	03/14/87	Ca	10	0.050	32.3
104	03/18/87	Fe	1	0.050	0.602
105	03/04/87	Mg	10	0.04	15.3
106	03/16/87	Mn	1	0.010	0.118
107	03/04/87	K	1	0.02	3.6
108	03/16/87	Na	1	0.06	166
110	03/18/87	Cl	25	0.10	88.5
111	03/04/87	F	1	0.5	0.41
112	--------	KN	1	0.050	NA
113	03/06/87	NO3-N	1	0.10	3.9
114	--------	PO4	1	0.050	NA
115	03/18/87	SO4	1	0.10	63.3

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

562

INDICATORS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-1
LEVEL ID:
LAB SAMPLE #: 9404-1
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT	UNITS
304	03/04/87	ALK	1	1	102	mg/l as CaCO3
305	03/06/87	TDS	1	10	255	mg/l
306	--------	TOC	1	0.5	ND	mg/l
307	--------	TOX	1	0.010	ND	mg/l
308	--------	BOD	-	1	ND	mg/l
309	--------	COD	1	10	ND	mg/l
310	--------	CN	1	0.01	ND	mg/l
311	--------	PHEN	1	0.02	ND	mg/l
312	03/04/87	pH		----	7.63	

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

INDICATORS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-2
LEVEL ID:
LAB SAMPLE #: 9404-2
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT	UNITS
304	03/04/87	ALK	1	1	308	mg/l as CaCO3
305	03/06/87	TDS	1	10	1040	mg/l
306	--------	TOC	1	0.5	ND	mg/l
307	--------	TOX	1	0.010	ND	mg/l
308	--------	BOD	-	1	ND	mg/l
309	--------	COD	1	10	ND	mg/l
310	--------	CN	1	0.01	ND	mg/l
311	--------	PHEN	1	0.02	ND	mg/l
312	03/04/87	pH		----	7.42	

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

INDICATORS - WATER
PROJECT:

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
SAMPLE CODE: FO

WELL ID: DM-3
LEVEL ID:
LAB SAMPLE #: 9404-3
UNITS: mg/l

D&M NUMBER	ANALYSIS DATE	CONSTITUENT NAME	DILUTION FACTOR	DETECTION LIMIT	RESULT	UNITS
304	03/04/87	ALK	1	1	230	mg/l as CaCO3
305	03/06/87	TDS	1	10	624	mg/l
306	--------	TOC	1	0.5	ND	mg/l
307	--------	TOX	1	0.010	ND	mg/l
308	--------	BOD	-	1	ND	mg/l
309	--------	COD	1	10	ND	mg/l
310	--------	CN	1	0.01	ND	mg/l
311	--------	PHEN	1	0.02	ND	mg/l
312	03/04/87	pH		----	7.63	
		HARDNESS		0.5	144	

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/09/87

ION BALANCE

SAMPLE ID: DM-2 9404-2

ANIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
CHLORIDE	337		0.02821	9.5068	
FLUORIDE	0.56		0.05264	0.0177	
NITRATE	11.8	X 4.43	0.01613	0.8432	
PHOSPHATE	--		0.03159	--	
SULFATE	98.2		0.02082	2.0445	
ALKALINITY	308		0.02	6.16	
					18.57

CATIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
ARSENIC	ND		0.06667	--	
CALCIUM	95.3		0.04990	4.7556	
MAGNESIUM	38.9		0.08229	3.2011	
POTASSIUM	5.8		0.02558	0.1484	
SODIUM	226		0.04350	9.831	
ANIONS & CATIONS	1122				17.94
TDS	1040				
	8%	% RPD		3%	

ION BALANCE

SAMPLE ID: DM-3 9404-3

ANIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
CHLORIDE	54.7		0.02821	1.5431	
FLUORIDE	0.95		0.05264	0.0500	
NITRATE	4.2	X 4.43	0.01613	0.3001	
PHOSPHATE	--		0.03159	--	
SULFATE	28.2		0.02082	0.5871	
ALKALINITY	102		0.02	2.04	
					4.52

CATIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
ARSENIC	--		0.06667	--	
CALCIUM	15.2		0.04990	0.7585	
MAGNESIUM	5.85		0.08229	0.4814	
POTASSIUM	3.2		0.02558	0.0819	
SODIUM	62		0.04350	2.697	
ANIONS & CATIONS	276				4.09
TDS	255				
	8%	% RPD		10%	

ION BALANCE

SAMPLE ID: DM-3 9404-3

ANIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
CHLORIDE	88.5		0.02821	2.4966	
FLUORIDE	0.41		0.05264	0.0216	
NITRATE	3.9	X 4.43	0.01613	0.2787	
PHOSPHATE	--		0.03159	--	
SULFATE	63.3		0.02082	1.3179	
ALKALINITY	230		0.02	4.6	
					8.71

CATIONS	RESULT mg/L		FACTOR	me/L	TOTAL me/L
ARSENIC	ND		0.06667	--	
CALCIUM	32.3		0.04990	1.6117	
MAGNESIUM	15.3		0.08229	1.2590	
POTASSIUM	3.6		0.02558	0.0921	
SODIUM	166		0.04350	7.221	
ANIONS & CATIONS	589				10.11
TDS	624				
	6%	% RPD		14.8%	

QUALITY CONTROL
*ANALYSIS: 601/602

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87

WELL ID: 9404-3
LEVEL ID:
UNITS: ug/l

D&M #	CONSTITUENTS	ACCES FO# ORIGN RESULT ppm	ACCES FO# LAB SPLIT ppm	FO# ROD A&D %	SPIKE CONC ppm	FO# SPIKE RESULT ppm	FO# % REC	ACCES FO# SPIKE DUP ppm	FO# DUP RPD %	FO# RPD %
406	METHYLENE CHLORIDE	ND			100	111	111	129	129	15
407	TRICHLOROFLUOROMET	ND			100	93.3	93	99.1	99	6
408	1,1-DICHLOROETHENE	ND			100	84.2	84	99.6	100	17
409	1,1-DICHLOROETHANE	ND			100	95.9	96	104	104	8
414	CARBON TETRACHLORI	ND			100	99.4	99	108	108	9
416	1,2-DICHLOROPROPAN	ND			100	94.8	95	110	110	15
425	TETRACHLOROETHENE	ND			100	97.1	97	102	102	5

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

QUALITY CONTROL
*ANALYSIS: METALS

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87

WELL ID: 9404
LEVEL ID:
UNITS: ug/l

D&M #	CONSTITUENTS	ACCES FO# ORIGN RESULT ppm	ACCES FO# LAB SPLIT ppm	FO# ROD A&D %	SPIKE CONC ppm	FO# SPIKE RESULT ppm	FO# % REC	ACCES FO# SPIKE DUP ppm	FO# DUP RPD %	FO# RPD %
202	As	0.007	0.007	0						
203	Ba	0.06	0.06	0	20.0	18.2	91			
205	Cd	ND	ND	NA	0.250	0.257	103			
207	Cr TOT	0.100	0.091	9	1,000	1.056	101			
208	Cu	0.068	0.064	6	0.501	0.574	108			
209	Pb	0.006	0.007	15	SA	SA	SA			
210	Hg	ND	ND	NA	0.0050	0.0052	104			
212	Se	ND	ND	NA	0.025	0.024	96			
213	Ag	0.003	0.003	0	1.000	0.992	99			
215	Zn	0.058	0.060	3	0.250	0.316	114			

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

QUALITY CONTROL
*ANALYSIS: IONS

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87

WELL ID: 9404
LEVEL ID:
UNITS: ug/l

D&M #	CONSTITUENTS	ACCES FO# ORIGN RESULT ppm	ACCES FO# LAB SPLIT ppm	FO# ROD A&D %	SPIKE CONC ppm	FO# SPIKE RESULT ppm	FO# % REC	ACCES FO# SPIKE DUP ppm	FO# DUP RPD %	FO# RPD %
103	Ca	32.33	32.44	0	25.00	40.86	99			
104	Fe	0.470	0.480	2	SA	SA	SA			
105	Mg	5.85	5.78	1	5.00	7.70	96			
106	Mn	0.359	0.348	3	1.000	1.249	107			
107	K	0.177	0.179	1	0.500	0.545	91			
108	Na	9.05	8.86	2	10.00	15.2	106			
110	Cl	228	223	2	10.0	12.9	107			
111	F	2.78	2.79	1	2.00	4.64	93			
115	SO4	1980	1960	1	10.0	29.6	98			

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

QUALITY CONTROL
*ANALYSIS: INDICATORS

SAMPLE DATE: 03/03/87
LAB RECEIPT DATE: 03/04/87
ANALYSIS DATE: 03/05/87

WELL ID: 9404
LEVEL ID:
UNITS: ug/l

D&M #	CONSTITUENTS	ACCES FO# ORIGN RESULT ppm	ACCES FO# LAB SPLIT ppm	FO# ROD A&D %	SPIKE CONC ppm	FO# SPIKE RESULT ppm	FO# % REC	ACCES FO# SPIKE DUP ppm	FO# DUP RPD %	FO# RPD %
303	ALK	250	246	2						
305	TDS	813	842	4						

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 03/20/87

3'2
15519-001-33

AnalyticalTechnologies, Inc. 2113 S. 48th Street Suites 107-110 Tempe, AZ 85282 (602) 438-1530

MAY 18 1987
DAMES & MOORE
PHOENIX

01 May 1987

Dames & Moore
7500 North Dreamy Draw Drive
Phoenix, AZ 85020

Accession: 9530

Date Received: 04/07/87

Attention: Steve Smith

Project: 15519-001

Note: Verbal results to Steve Smith by L. Davis on 05/04/87.

Supervisory Review: [signature]

Date of Report: 5/1/87

Note: Samples will be disposed of within 30 days unless otherwise notified.

RGM/rmt

EPA METHOD 601/602
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: TRIP BLANK
LOCATION:
LAB SAMPLE #: 9530
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

102 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: TRIP BLANK
LOCATION:
LAB SAMPLE #: 9530
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

101 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-1
LOCATION:
LAB SAMPLE #: 9530-1
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

99 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-2
LOCATION:
LAB SAMPLE #: 9530-2
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

103 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-3
LOCATION:
LAB SAMPLE #: 9530-3
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

101 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

Blind duplicate
Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DUP-A
LOCATION:
LAB SAMPLE #: 9530-4
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

106 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 601/602
PROJECT: 15519-001

Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/10/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: N.R.M.
LOCATION:
LAB SAMPLE #: 9530-5
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
CHLOROMETHANE	0.02	ND
BROMOMETHANE	0.06	ND
DICHLORODIFLUOROMETHANE	0.04	ND
VINYL CHLORIDE	0.05	ND
CHLOROETHANE	0.1	ND
METHYLENE CHLORIDE	0.02	ND
TRICHLOROFLUOROMETHANE	0.07	ND
1,1-DICHLOROETHENE	0.07	ND
1,1-DICHLOROETHANE	0.05	ND
TRANS-1,2-DICHLOROETHENE	0.09	ND
CHLOROFORM	0.05	ND
1,2-DICHLOROETHANE	0.07	ND
1,1,1-TRICHLOROETHANE	0.03	ND
CARBON TETRACHLORIDE	0.08	ND
BROMODICHLOROMETHANE	0.04	ND
1,2-DICHLOROPROPANE	0.03	ND
TRANS-1,3-DICHLOROPROPENE	0.11	ND
TRICHLOROETHENE	0.06	ND
DIBROMOCHLOROMETHANE	0.07	ND
1,1,2-TRICHLOROETHANE	0.03	ND
CIS-1,3-DICHLOROPROPENE	0.07	ND
2-CHLOROETHYLVINYL ETHER	0.03	ND
BROMOFORM	0.09	ND
1,1,2,2-TETRACHLOROETHANE	0.03	ND
TETRACHLOROETHENE	0.03	ND
BENZENE	0.2	ND
TOLUENE	0.4	ND
CHLOROBENZENE	0.16	ND
ETHYLBENZENE	0.1	ND
1,3-DICHLOROBENZENE	0.4	ND
1,2-DICHLOROBENZENE	0.4	ND
1,4-DICHLOROBENZENE	0.6	ND

100 % SURROGATE RECOVERY

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 608
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
MATRIX: WATER
ANALYSIS DATE: 04/24/87
ANALYST: RGM

SAMPLE ID: DM-1
LOCATION:
LAB SAMPLE #: 9530-1
UNITS: ug/l
DILUTION FACTOR: 1 liter: 10ml

CONSTITUENT NAME	DETECTION LIMIT ppb	RESULT
ALPHA-BHC	0.1	ND
BETA-BHC	0.1	ND
DELTA-BHC	0.1	1.1
GAMMA-BHC (LINDANE)	0.1	ND
HEPTACHLOR	0.1	ND
ALDRIN	0.1	ND
HEPTACHLOR EPOXIDE	0.1	0.39
ENDOSULFAN I	0.1	ND
4-4 DDE	0.1	ND
DIELDRIN	0.1	ND
ENDRIN	0.1	0.32
ENDOSULFAN II	0.1	ND
4-4 DDD	0.1	ND
ENDRIN ALDEHYDE	0.1	ND
4-4 DDT	0.1	0.46
ENDOSULFAN SULFATE	0.1	ND
CHLORDANE	0.25	ND
TOXAPHENE	0.25	ND
PCB 1016	0.25	ND
PCB 1221	0.25	ND
PCB 1232	0.25	ND
PCB 1242	0.25	ND
PCB 1248	0.25	ND
PCB 1254	0.25	ND
PCB 1260	0.25	ND

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 608
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
MATRIX: WATER
ANALYSIS DATE: 04/24/87
ANALYST: RGM

SAMPLE ID: DM-2
LOCATION:
LAB SAMPLE #: 9530-2
UNITS: ug/l
DILUTION FACTOR: 1 liter: 10ml

CONSTITUENT NAME	DETECTION LIMIT ppb	RESULT
ALPHA-BHC	0.1	ND
BETA-BHC	0.1	ND
DELTA-BHC	0.1	0.22
GAMMA-BHC (LINDANE)	0.1	ND
HEPTACHLOR	0.1	ND
ALDRIN	0.1	ND
HEPTACHLOR EPOXIDE	0.1	ND
ENDOSULFAN I	0.1	ND
4-4 DDE	0.1	ND
DIELDRIN	0.1	ND
ENDRIN	0.1	ND
ENDOSULFAN II	0.1	ND
4-4 DDD	0.1	ND
ENDRIN ALDEHYDE	0.1	ND
4-4 DDT	0.1	ND
ENDOSULFAN SULFATE	0.1	ND
CHLORDANE	0.25	ND
TOXAPHENE	0.25	ND
PCB 1016	0.25	ND
PCB 1221	0.25	ND
PCB 1232	0.25	ND
PCB 1242	0.25	ND
PCB 1248	0.25	ND
PCB 1254	0.25	ND
PCB 1260	0.25	ND

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 608
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
MATRIX: WATER
ANALYSIS DATE: 04/24/87
ANALYST: RGM

SAMPLE ID: DM-3
LOCATION:
LAB SAMPLE #: 9530-3
UNITS: ug/l
DILUTION FACTOR: 1 liter: 10ml

CONSTITUENT NAME	DETECTION LIMIT ppb	RESULT
ALPHA-BHC	0.1	ND
BETA-BHC	0.1	ND
DELTA-BHC	0.1	ND
GAMMA-BHC (LINDANE)	0.1	ND
HEPTACHLOR	0.1	ND
ALDRIN	0.1	ND
HEPTACHLOR EPOXIDE	0.1	ND
ENDOSULFAN I	0.1	ND
4-4 DDE	0.1	ND
DIELDRIN	0.1	ND
ENDRIN	0.1	ND
ENDOSULFAN II	0.1	ND
4-4 DDD	0.1	ND
ENDRIN ALDEHYDE	0.1	ND
4-4 DDT	0.1	ND
ENDOSULFAN SULFATE	0.1	ND
CHLORDANE	0.25	ND
TOXAPHENE	0.25	ND
PCB 1016	0.25	ND
PCB 1221	0.25	ND
PCB 1232	0.25	ND
PCB 1242	0.25	ND
PCB 1248	0.25	ND
PCB 1254	0.25	ND
PCB 1260	0.25	ND

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 608
PROJECT: 15519-001

Blind duplicate
Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
MATRIX: WATER
ANALYSIS DATE: 04/24/87
ANALYST: RGM

SAMPLE ID: DUP-A
LOCATION:
LAB SAMPLE #: 9530-4
UNITS: ug/l
DILUTION FACTOR: 1 liter: 10ml

CONSTITUENT NAME	DETECTION LIMIT ppb	RESULT
ALPHA-BHC	0.1	ND
BETA-BHC	0.1	ND
DELTA-BHC	0.1	ND
GAMMA-BHC (LINDANE)	0.1	ND
HEPTACHLOR	0.1	ND
ALDRIN	0.1	ND
HEPTACHLOR EPOXIDE	0.1	ND
ENDOSULFAN I	0.1	ND
4-4 DDE	0.1	ND
DIELDRIN	0.1	ND
ENDRIN	0.1	ND
ENDOSULFAN II	0.1	ND
4-4 DDD	0.1	ND
ENDRIN ALDEHYDE	0.1	ND
4-4 DDT	0.1	ND
ENDOSULFAN SULFATE	0.1	ND
CHLORDANE	0.25	ND
TOXAPHENE	0.25	ND
PCB 1016	0.25	ND
PCB 1221	0.25	ND
PCB 1232	0.25	ND
PCB 1242	0.25	ND
PCB 1248	0.25	ND
PCB 1254	0.25	ND
PCB 1260	0.25	ND

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 608
PROJECT: 15519-001

Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
MATRIX: WATER
ANALYSIS DATE: 04/24/87
ANALYST: RGM

SAMPLE ID: N.M.R.
LOCATION:
LAB SAMPLE #: 9530-5
UNITS: ug/l
DILUTION FACTOR: 1 liter: 10ml

CONSTITUENT NAME	DETECTION LIMIT ppb	RESULT
ALPHA-BHC	0.1	ND
BETA-BHC	0.1	ND
DELTA-BHC	0.1	ND
GAMMA-BHC (LINDANE)	0.1	ND
HEPTACHLOR	0.1	ND
ALDRIN	0.1	ND
HEPTACHLOR EPOXIDE	0.1	ND
ENDOSULFAN I	0.1	ND
4-4 DDE	0.1	ND
DIELDRIN	0.1	ND
ENDRIN	0.1	ND
ENDOSULFAN II	0.1	ND
4-4 DDD	0.1	ND
ENDRIN ALDEHYDE	0.1	ND
4-4 DDT	0.1	ND
ENDOSULFAN SULFATE	0.1	ND
CHLORDANE	0.25	ND
TOXAPHENE	0.25	ND
PCB 1016	0.25	ND
PCB 1221	0.25	ND
PCB 1232	0.25	ND
PCB 1242	0.25	ND
PCB 1248	0.25	ND
PCB 1254	0.25	ND
PCB 1260	0.25	ND

NOTE: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

AnalyticalTechnologies, Inc.
San Diego ● Phoenix ● Seattle

Chain of Custody

DATE 4/6/87 PAGE 1 OF 1

PROJ. MGR. STEVE SMITH
COMPANY DAMES & MOORE
ADDRESS 7500 N DREAMY DRAW DRIVE
PHOENIX AZ 85020

SAMPLERS (SIGNATURE) [signature] (PHONE NO.)

ANALYSIS REQUEST

SAMPLE ID.	DATE	TIME	MATRIX	LAB ID.	BASE/NEU/ACID CMPDS. GC/MS/ 625/8270	VOLATILE CMPDS. GC/MS/ 624/8240	PESTICIDES/PCB 608/8080	POLYNUCLEAR AROMATIC 610/8310	PHENOLS, SUB PHENOLS 604/8040	HALOGENATED VOLATILES 601/8010	AROMATIC VOLATILES 602/8020	TOTAL ORGANIC CARBON 415/9060	TOTAL ORGANIC HALIDES 9020	PETROLEUM HYDROCARBONS 418	6/4		PRIORITY POLLUTANT METALS (13)	CAM METALS (18) TTLC/STLC	EP TOX METALS (8)	SWDA-INORGANICS PRIMARY/SECONDARY	HAZARDOUS WASTE PROFILE				NUMBER OF CONTAINERS
1 DM-1	4/6		H2O				1			2					1										4
2 DM-2	4/6		"				1			2					1										4
3 DM-3	4/6		"				1			2					1										4
4 DUP-A	4/6		"				1			2					1										4
5 N.R.M.	4/6		"				1			2					1										4
TRIP BLANK										1															1

PROJECT INFORMATION	SAMPLE RECEIPT	
PROJECT: 15519-001	TOTAL NO. OF CONTAINERS	25
PQ NO.	CHAIN OF CUSTODY SEALS	
SHIPPING ID. NO.	REC'D GOOD CONDITION/COLD	
	CONFORMS TO RECORD	
	LAB NO. 9530	

SPECIAL INSTRUCTIONS/COMMENTS:
Broke #2 & #3 VOA' at LAB

RELINQUISHED BY 1.	RELINQUISHED BY 2.	RELINQUISHED BY 3.
[signature]		
(Signature) (Time)	(Signature) (Time)	(Signature) (Time)
DAVID BRECHMAN 4/6		
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name) (Date)
DAMES & MOORE		
(Company)	(Company)	(Company)
RECEIVED BY 1.	RECEIVED BY 2.	RECEIVED BY (LABORATORY) 3.
(Signature) (Time)	(Signature) (Time)	(Signature) (Time)
		[signature] 1640
(Printed Name) (Date)	(Printed Name) (Date)	(Printed Name)
		THOMAS M. GRAIF 4/6
(Company)	(Company)	ANALYTICAL TECHNOLOGIES, INC.

ATI LABORATORIES: SAN DIEGO (619) 458-9141 PHOENIX (602) 438-1530

DISTRIBUTION: WHITE, CANARY · ANALYTICAL TECHNOLOGIES, INC. ● PINK · ORIGINATOR

242

EPA METHOD 614
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-1
LOCATION:
LAB SAMPLE #: 9530-1
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	ND
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 614
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-2
LOCATION:
LAB SAMPLE #: 9530-2
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	1.2
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 614
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DM-3
LOCATION:
LAB SAMPLE #: 9530-3
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	ND
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 614
PROJECT: 15519-001

Blind duplicate
Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: DUP-A
LOCATION:
LAB SAMPLE #: 9530-4
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	ND
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 614
PROJECT: 15519-001

Nesbitt

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: N.R.M.
LOCATION:
LAB SAMPLE #: 9530-5
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	ND
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

EPA METHOD 614
PROJECT: 15519-001

SAMPLE DATE: 04/06/87
LAB RECEIPT DATE: 04/07/87
ANALYSIS DATE: 04/29/87
MATRIX: WATER
ANALYST: MGB

SAMPLE ID: TRIP BLANK
LOCATION:
LAB SAMPLE #: 9530
UNITS: ug/l
DILUTION FACTOR: 1

CONSTITUENT NAME	DETECTION LIMIT	RESULT
o-DEMETON	1.0	ND
s-DEMETON	1.0	ND
DIAZINON	1.0	ND
DISULFOTON	1.0	ND
METHYLPARATHION	1.0	ND
MALATHION	1.0	ND
ETHYL PARATHION	1.0	ND
ETHION	1.0	ND
AZINPHOSMETHYL (GUTHION)	10.	ND

COMMENTS: ND = NOT DETECTED
NA = NOT ANALYZED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 05/01/87

Received 8/11/87
SAS
15519-001-33

AnalyticalTechnologies, Inc. 2113 S 48th Street Suite 107 Tempe, AZ 85282 (602) 438-1530

11 AUGUST 1987

Dames & Moore
7500 N. Dreamy Draw Dr.
Suite 145
Phoenix, Arizona 85020

Accession: 3014

Date Received: 7/10/87

Attention: Steve Smith

Project: HNTB

Supervisory Review: [signature]

Date of Report: 8-11-87

RGM/jmo

Note: Samples will be disposed of within 30 days unless otherwise notified.

591

601/602 ORGANICS - WATER
PROJECT: HNTB

SAMPLE DATE: 7/09/87
LAB RECEIPT DATE: 7/10/87
ANALYSIS DATE: 7/23/87
SAMPLE CODE: O

WELL ID: 24.3E-3N
LEVEL ID:
LAB SAMPLE #: 3014-1
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	ND
427	TOLUENE	0.4	ND
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	ND
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND
433	TRICHLOROTRIFLUOROETHANE	0.05	ND
434	ACETONE	50	ND
435	O,P-XYLENE	0.18	ND
436	M-XYLENE	0.15	ND

86.3 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 11 AUGUST 1987

600

601/602 ORGANICS - WATER
PROJECT: HNTB

ANALYSIS DATE: 7/23/87
SAMPLE CODE: O

WELL ID: TRIP BLANK
LAB SAMPLE #: 3014
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
401	CHLOROMETHANE	0.02	ND
402	BROMOMETHANE	0.06	ND
403	DICHLORODIFLUOROMETHANE	0.04	ND
404	VINYL CHLORIDE	0.05	ND
405	CHLOROETHANE	0.1	ND
406	METHYLENE CHLORIDE	0.02	ND
407	TRICHLOROFLUOROMETHANE	0.07	ND
408	1,1-DICHLOROETHENE	0.07	ND
409	1,1-DICHLOROETHANE	0.05	ND
410	TRANS-1,2-DICHLOROETHENE	0.09	ND
411	CHLOROFORM	0.05	ND
412	1,2-DICHLOROETHANE	0.07	ND
413	1,1,1-TRICHLOROETHANE	0.03	ND
414	CARBON TETRACHLORIDE	0.08	ND
415	BROMODICHLOROMETHANE	0.04	ND
416	1,2-DICHLOROPROPANE	0.03	ND
417	TRANS-1,3-DICHLOROPROPENE	0.11	ND
418	TRICHLOROETHENE	0.06	ND
419	DIBROMOCHLOROMETHANE	0.07	ND
420	1,1,2-TRICHLOROETHANE	0.03	ND
421	CIS-1,3-DICHLOROPROPENE	0.07	ND
422	2-CHLOROETHYLVINYL ETHER	0.03	ND
423	BROMOFORM	0.09	ND
424	1,1,2,2-TETRACHLOROETHANE	0.03	ND
425	TETRACHLOROETHENE	0.03	ND
426	BENZENE	0.2	ND
427	TOLUENE	0.4	ND
428	CHLOROBENZENE	0.16	ND
429	ETHYLBENZENE	0.1	ND
430	1,3-DICHLOROBENZENE	0.4	ND
431	1,2-DICHLOROBENZENE	0.4	ND
432	1,4-DICHLOROBENZENE	0.6	ND
433	TRICHLOROTRIFLUOROETHANE	0.05	ND
434	ACETONE	50	ND
435	O,P-XYLENE	0.18	ND
436	M-XYLENE	0.15	ND

102 % SURROGATE RECOVERY

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 11 AUGUST 1987

601

ACCESSION: 3014

QUALITY CONTROL DATA: 8185
METHOD 601 & 602

CLIENT: DAMES & MOORE
UNITS: ug/l

D&M NUMBER		FOUND	95% CONFIDENCE RANGE
406	METHYLENE CHLORIDE	107	88.2 - 150
409	1,1-DICHLOROETHANE	71.3	68.7 - 113
411	CHLOROFORM	90.9	81.6 - 138
413	1,1,1-TRICHLOROETHANE	86.8	72.8 - 117
414	CARBON TETRACHLORIDE	103	87.2 - 145
415	BROMODICHLOROMETHANE	140	106 - 172
418	TRICHLOROETHENE	89.9	85.2 - 143
419	DIBROMOCHLORMETHANE	170	145 - 249
423	BROMOFORM	203	157 - 271
425	TETRACHLOROETHENE	138	87.8 - 150
428	CHLOROBENZENE	78.1	56.9 - 103
426	BENZENE	69.0	45.8 - 87.0

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 11 AUGUST 1987

602

608 ORGANICS - WATER
PROJECT: HNTB

SAMPLE DATE: 7/09/87
LAB RECEIPT DATE: 7/10/87
ANALYSIS DATE: 7/24/87
SAMPLE CODE: O

WELL ID: 24.3E-3N
LEVEL ID:
LAB SAMPLE #: 3014-1
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
501	A - BHC	0.1	ND
502	B - BHC	0.1	ND
504	D - BHC	0.1	ND
503	C - BHC	0.1	ND
505	HEPTACHLOR	0.1	ND
506	ALDRIN	0.1	ND
507	HEPTACHLOR EPOXIDE	0.1	ND
508	ENDOSULFAN I	0.1	ND
509	4-4 DDE	0.1	ND
510	DIELDRIN	0.1	ND
511	ENDRIN	0.1	ND
512	ENDOSULFAN II	0.1	ND
513	4-4 DDD	0.1	ND
514	ENDRIN ALDEHYDE	0.1	ND
515	4-4 DDT	0.1	ND
516	ENDOSULFAN SULFATE	0.1	ND
517	CHLORDANE	50.0	ND
518	TOXAPHENE	50.0	ND
519	PCB 1016	50.0	ND
520	PCB 1221	50.0	ND
521	PCB 1232	50.0	ND
522	PCB 1242	50.0	ND
523	PCB 1248	50.0	ND
524	PCB 1254	50.0	ND
525	PCB 1260	50.0	ND

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 11 AUGUST 1897

614 ORGANICS - WATER
PROJECT: HNTB

SAMPLE DATE: 7/09/87
LAB RECEIPT DATE: 7/10/87
ANALYSIS DATE: 7/20/87
SAMPLE CODE: O

WELL ID: 24.3E-3N
LEVEL ID:
LAB SAMPLE #: 3014-1
UNITS: ug/l
DILUTION FACTOR: 1

D & M NUMBER	CONSTITUENT NAME	DETECTION LIMIT	RESULT
	O-DEMETON	0.20	ND
	S-DEMETON	0.20	ND
	DIAZINON	0.20	ND
	DISULFOTON	0.20	ND
	METHYLPARATHION	0.20	ND
	MALATHION	1.0	ND
	ETHYL PARATHION	0.20	ND
	ETHION	0.20	ND
	AZINPHOSMETHYL (GUTHION)	2.0	ND

NOTE: ND = NOT DETECTED

SUPERVISOR'S SIGNATURE: R. GERRY MCCULLOUGH DATE: 11 AUGUST 1897

504

APPENDIX D

AQUIFER TEST DATA

604/1

PUMPING TEST - DRAWDOWN DATA

PROJECT: HNTB
LOCATION: TEMPE - PRICE ROAD
DATUM POINT: 1.1FT ABOVE PAD
PUMPING RATE: 3000 USGPM
AQUIFER THICKNESS: 528.15
CONDITIONS: UNCONFINED

FILE NO.: 15519-001
WELL NO.: 24.3E - 3N
ELEV. OF DATUM POINT:
STATIC WATER LEVEL: 112.85
R = ----- FROM
SCREEN INTERVAL: 145 TO 641

TIME			ELAPSED TIME	WATER LEVEL	DRAWDOWN	CORRECTED DRAWDOWN	(Q)
DY	HR	MN	t (MIN)	(ft)	s (ft)	s' (ft)	(USGPM)
1	0	0	0.00	112.850	0.000	0.000	3000.0000
1	0	0	0.35	130.110	17.260	16.978	3000.0000
1	0	1	0.72	133.380	20.530	20.131	3000.0000
1	0	1	1.33	135.780	22.930	22.432	3000.0000
1	0	2	1.90	136.950	24.100	23.550	3000.0000
1	0	3	2.58	137.940	25.090	24.494	3000.0000
1	0	3	3.12	138.750	25.900	25.265	3000.0000
1	0	4	3.67	139.050	26.200	25.550	3000.0000
1	0	5	4.57	139.920	27.070	26.376	3000.0000
1	0	6	6.00	140.830	27.980	27.239	3000.0000
1	0	7	7.00	141.600	28.750	27.968	3000.0000
1	0	8	8.00	141.850	29.000	28.204	3000.0000
1	0	9	9.00	142.550	29.700	28.865	3000.0000
1	0	11	10.83	142.800	29.950	29.101	3000.0000
1	0	11	11.42	142.970	30.120	29.261	3000.0000
1	0	15	15.00	143.800	30.950	30.043	3000.0000
1	0	20	20.00	144.630	31.780	30.824	3000.0000
1	0	25	25.00	144.260	31.410	30.476	3000.0000
1	0	30	30.00	144.000	31.150	30.231	3000.0000
1	0	45	45.00	144.300	31.450	30.514	3000.0000
1	1	0	60.00	143.970	31.120	30.203	3000.0000
1	1	15	75.00	144.070	31.220	30.297	3000.0000
1	1	30	90.00	144.000	31.150	30.231	3000.0000
1	2	0	120.00	144.120	31.270	30.344	3000.0000
1	2	8	128.00	143.620	30.770	29.874	3000.0000
1	2	30	150.00	144.140	31.290	30.363	3000.0000
1	3	0	180.00	144.450	31.600	30.655	3000.0000
1	4	0	240.00	144.090	31.240	30.316	3000.0000
1	5	0	300.00	144.050	31.200	30.278	3000.0000
1	5	58	358.00	144.050	31.200	30.278	3000.0000

DAMES & MOORE

PUMPING TEST - DRAWDOWN DATA

PROJECT: HNTB
LOCATION: TEMPE - PRICE ROAD
DATUM POINT: 1.1FT ABOVE PAD
PUMPING RATE: 3000 USGPM
AQUIFER THICKNESS: 528.15
CONDITIONS: UNCONFINED

FILE NO.: 15519-001
WELL NO.: 24.3E - 3N
ELEV. OF DATUM POINT:
STATIC WATER LEVEL: 112.85
R = ----- FROM
SCREEN INTERVAL: 145 TO 641

TIME			ELAPSED TIME	WATER LEVEL	DRAWDOWN	CORRECTED DRAWDOWN	Q
DY	HR	MN	t (MIN)	(ft)	s (ft)	s' (ft)	(USGPM)
1	6	10	370.00	143.900	31.050	30.137	3000.0000
							VALUE USED 3000.0000

DAMES & MOORE

PUMPING TEST - RECOVERY DATA

PROJECT: HNTB
LOCATION: TEMPE - PRICE ROAD
DATUM POINT: 1.1FT ABOVE PAD
PUMPING RATE: 3000 USGPM
AQUIFER THICKNESS: 528.15
CONDITIONS: UNCONFINED

FILE NO.: 15519-001
WELL NO.: 24.3E - 3N
ELEV. OF DATUM POINT:
STATIC WATER LEVEL: 112.85
R = ----- FROM
SCREEN INTERVAL: 145 TO 641

TIME			PUMPING STARTED	PUMPING ENDED	RATIO	WATER LEVEL	RESIDUAL DRAWDOWN
DY	HR	MN	t (MIN)	t' (MIN)	t/t'	(ft)	(ft)
1	6	10	370.00	0.00	0.00	143.900	31.050
1	6	10	370.05	0.05	7402.81	135.600	22.750
1	6	11	370.92	0.92	403.17	133.950	21.100
1	6	12	371.50	1.50	247.67	133.950	21.100
1	6	12	372.17	2.17	171.51	133.200	20.350
1	6	13	372.58	2.58	144.41	132.650	19.800
1	6	13	373.00	3.00	124.33	132.100	19.250
1	6	14	373.50	3.50	106.71	131.630	18.780
1	6	14	373.72	3.72	100.46	131.200	18.350
1	6	14	374.42	4.42	84.71	130.730	17.880
1	6	15	374.72	4.72	79.39	130.350	17.500
1	6	15	375.33	5.33	70.42	129.960	17.110
1	6	16	375.72	5.72	65.69	129.650	16.800
1	6	16	376.42	6.42	58.63	129.250	16.400
1	6	17	376.72	6.72	56.06	129.000	16.150
1	6	17	377.33	7.33	51.48	128.620	15.770
1	6	18	377.72	7.72	48.93	128.450	15.600
1	6	19	379.17	9.17	41.35	127.850	15.000
1	6	20	380.25	10.25	37.10	127.320	14.470
1	6	21	381.25	11.25	33.89	126.900	14.050
1	6	22	382.25	12.25	31.20	126.610	13.760
1	6	23	383.25	13.25	28.92	126.240	13.390
1	6	24	384.25	14.25	26.96	125.910	13.060
1	6	25	385.33	15.33	25.14	125.580	12.730
1	6	26	386.42	16.42	23.53	125.340	12.490
1	6	27	387.42	17.42	22.24	125.140	12.290
1	6	28	388.25	18.25	21.27	125.000	12.150
1	6	29	389.33	19.33	20.14	124.780	11.930
1	6	30	390.33	20.33	19.20	124.570	11.720
1	6	31	391.33	21.33	18.35	124.360	11.510

DAMES & MOORE

PUMPING TEST - RECOVERY DATA

PROJECT: HNTB
LOCATION: TEMPE - PRICE ROAD
DATUM POINT: 1.1FT ABOVE PAD
PUMPING RATE: 3000 USGPM
AQUIFER THICKNESS: 528.15
CONDITIONS: UNCONFINED

FILE NO.: 15519-001
WELL NO.: 24.3E - 3N
ELEV. OF DATUM POINT:
STATIC WATER LEVEL: 112.85
R = ----- FROM
SCREEN INTERVAL: 145 TO 641

TIME			PUMPING STARTED	PUMPING ENDED	RATIO	WATER LEVEL	RESIDUAL DRAWDOWN
DY	HR	MN	t (MIN)	t' (MIN)	t/t'	(ft)	(ft)
1	6	36	396.33	26.33	15.05	123.640	10.790
1	6	42	401.67	31.67	12.68	122.840	9.990
1	6	46	406.33	36.33	11.18	122.350	9.500
1	6	50	410.17	40.17	10.21	121.880	9.030
1	6	56	416.33	46.33	8.99	121.440	8.590
1	7	1	420.50	50.50	8.33	121.160	8.310
1	7	9	428.72	58.72	7.30	120.100	7.250
1	7	23	443.08	73.08	6.06	119.700	6.850
1	7	38	458.33	88.33	5.19	119.050	6.200
1	7	53	473.33	103.33	4.58	118.500	5.650
1	8	8	488.08	118.08	4.13	118.150	5.300
1	8	28	508.00	138.00	3.68	117.750	4.900
1	8	40	520.40	150.40	3.46	117.510	4.660
1	8	41	521.13	151.13	3.45	117.420	4.570
1	8	48	528.23	158.23	3.34	117.210	4.360
1	9	4	543.67	173.67	3.13	116.790	3.940
1	9	18	558.00	188.00	2.97	116.650	3.800
1	9	33	573.00	203.00	2.82	116.500	3.650
1	9	51	591.00	221.00	2.67	116.280	3.430
1	10	5	605.00	235.00	2.57	116.010	3.160

DAMES & MOORE

608