SOILS & ENGINEERING SERVICES, INC.

CONSULTING CIVIL ENGINEERS

1102 STEWART STREET • MADISON, WISCONSIN 53713 • TELEPHONE: 608 • 274-7600

Earl H. Reichel, P.E.
Octavio Tejeda, P.E.

December 15, 1986

City Engineer's Office
City-County Building
Madison, Wisconsin 53709

9645

Attention: Mr. Arnold E. Milke

Subject: Preliminary Foundation Exploration
Garver Property
Fair Oaks and Sugar Avenues
Madison, Wisconsin

Gentlemen:

In accordance with your request, we have conducted the subject exploration which has consisted of the performance of seven standard soil borings. The purpose of the borings is to obtain information concerning the area subsoil conditions. It is the intent of this report to evaluate these conditions and offer preliminary recommendations concerning the design of the proposed building foundations.

The soil borings were located in the field by our personnel and they are approximately as indicated on Drawing 9645-1. The Soil Boring Records which depict the subsoil stratification at each boring are presented on Drawings 9645-2 through 9645-6. A print of each of these drawings is a part of this report.

Ground surface elevations at the boring locations were obtained by standard surveying procedures utilizing a benchmark of assumed Elevation 100.00. The benchmark is the top the fire hydrant located at the end of Sugar Avenue; North of the rail road tracks and in front of Garver Feeds. The boring locations were obtained by dimensioning from the Fair Oaks Avenue along the centerline of the railroad tracks approximately as indicated on Drawing 9645-1.

Groundwater was found between approximate Elevations 91 and 93 in the borings. In several of the borings, the water level readings were taken several days after the borings were initially performed and therefore, the water levels obtained should be well stabilized. Higher groundwater levels are to be expected in the area of the borings during the different seasons of the year. We anticipate that the groundwater will fluctuate influenced by rain fall, surface run-off, the stage of the nearby Starkweather Creek, other hydrological and hydrogeological factors.

The general soil stratigraphy in the area of the borings consists of fill materials over topsoil or peat over organic silt with some shells. These soils are resting upon fine sand with silt and/or silt. The stratigraphy often varied from the above generalized order given. The soil deposits and their characteristics also varied between borings. The fill materials varied in content, density, and strength. In some occasions the samples were frozen and a non-representative very high value of the Standard Penetration Test was obtained. The peat and organic silt was found from very soft to moderately soft. The silt and other granular soils were found mostly in a loose state. Please refer to the Soil Boring Records for a complete description of the soils encountered.

The site has been occupied by a variety and type of different buildings. We understand the proposed construction is to include several two and three story masonry buildings for residential use. The exact building locations and other details for the development are not known at this time.

Two types of possible foundations will be discussed in this report because of the compressible soils encountered. Based on the soil borings performed, we make the following comments and recommendations to be implemented during the design and construction of the proposed facilities:

SPREAD FOOTING FOUNDATION

1. For a shallow spread type foundation, we recommend the removal of all fill materials, topsoil, peat, and organic silt from under the proposed buildings and any other critical structures. The excavated materials could be stock piled for reuse in landscaped areas. These soils are not suitable for the support of the proposed structures. If practical, some of the more granular soil within the

fill materials could be stockpiled and reused in alternate layers with imported granular materials.

Although not anticipated because of the depth of undesirable soils, in addition to the above mentioned soils, we recommend the removal of any other soils needed to provide a minimum of 36 inches of compacted granular fill under footings. The above recommendation is to improve the bearing capacity of the natural soils and, more important, to provide a uniform bearing surface where the buildings could rest. It is the intent that the compacted granular fill minimize potential differential settlements.

2. The excavations are to extend as low as Elevation 75.5. Because of this and the high groundwater table, we anticipate that dewatering will be needed. The contractor should dewater the excavation as necessary with the equipment of his choice. The deeper section of excavations, such as the area of Boring 1A could be used to advantage during dewatering.

   Dewatering should extend for a minimum of twelve inches below the bottom of excavations and it should be accomplished before excavations start. The effectiveness of the dewatering system should be determined by monitoring wells or similar means located away from the proposed construction limits. The dewatering operation should be a continuous operation, and it should also continue until compacted granular fill is completely placed.

3. Excavations should be accomplished with a backhoe equipped with a cleaning bucket. A cleaning bucket is a conventional bucket except that the cutting edge is a continuous steel plate. This could also be accomplished by welding a plate in front of the cutting teeth. Excavations accomplished in this manner will minimize the disturbance to the

remaining natural soils that could otherwise occur by the travel of equipment.

Excavations under footings should extend down and out from the outer footing edges at a 1:1 slope or flatter. It is the intent to provide compacted granular fill in this area.

4. The excavated surfaces should be thoroughly cleaned and checked for soft soil areas. If any of these are found, they should be excavated. The resulting excavated surface should then be covered with a filter fabric followed by placement of twelve to eighteen inches of No. 2 stone (1 1/2 to 2 1/2 inches in size) or similar material. The filter fabric will provide a barrier between the coarse stone and the natural finer soils. It is also the intent that the stone layer be a solid base where compacted granular fill could be placed. The stone will also aid during the dewatering operation.

5. Compacted granular fill could then be used to raise grade to the desired elevation. The materials should consist of well graded sand or sand and gravel and placed in eight to twelve inch thick layers. Each layer should be thoroughly compacted to at least 95 percent of the maximum dry density as determined for the materials used in accordance with ASTM Test Designation D1557.

   Compacted granular fill under footings should extend down and out from the outer footing edges at a 1:1 slope or flatter.

6. When all the requirements outlined in Sections 1 through 5 above are met, preliminary allowable bearing pressures of 3000 pounds per square foot or more could be utilized for foundation design. The above figure is to provide for a uniform bearing pressure throughout the site. The bearing pressure to use on this site should be determined once the foundation and building

design are close to completion.

7. Basements are not recommended because of the high groundwater level.

PILE FOUNDATION

1. To avoid removing and replacing large quantities of fill materials, a pile foundation could be considered at this site. However, because of the shallow borings performed pile design criteria is not presented here. If this type of foundation is considered further, additional borings should be performed.

2. The borings suggest that the fill materials at the site are not of an organic nature. However, it should be determined if gases are generated. If this is the case then it is judged that a spread footing foundation will be a more economical solution.

3. If a pile foundation is chosen, then the floor should be a structural slab capable of transmitting the floor loads to the pile system. The utility lines to the building should be suspended from the building structure. Utility lines should be provided with flexible connections outside the building limits.

Economics as well as other considerations will dictate the type of foundation to be pursued further. For parking and driving areas, it will be uneconomical to replace the soft compressible soils, therefore, we recommend that enough soils be removed to provide a minimum of twenty four inches of sub-base compacted granular fill soils. The sub-base could be followed by six inches of base course and two to three inches of bituminous pavement.

For sidewalks and other low loaded structures we recommend a minimum of twelve inches of compacted granular fill soils be provided.

It should be emphasized that because of the presence of soft compressible soils under drives and sidewalks, some settlements could take place. The affected areas could be repaired as it becomes necessary.

All building sites as well as roadways should be graded to provide positive drainage away from the various structures to minimize potential surface water run-off problems, which in many instances are as troublesome as groundwater problems.

Safety precautions such as the ones required by OSHA should be enforced throughout the entire construction of the various individual projects. These include, but are not limited to, proper sloping and/or support of excavation walls.

Because of the preliminary nature of this exploration and the variable soil conditions encountered, we recommend that additional soil borings be performed to further determine the soil characteristics in the area of proposed buildings or if a pile foundation is considered further . Our preliminary recommendations should be reviewed and changed if necessary, once the design of the proposed construction is closer to completion.

The recommendations in this report are based on interpretation of the soils and information given on the Soil Boring Records and may not be based solely on the contents of the drillers field logs.

This report has been prepared for your exclusive use to aid in the evaluation of the subject property and for the intended use described herein. The nature and extent of soil variations between borings may not become evident until the time of construction. If variations are evident at that time, it will be necessary to reevaluate the recommendations given herein.

A geotechnical engineer should review the final design and specification documents for this project to verify that our recommendations regarding the earthwork and foundation system, are implemented as intended. It is further recommended that a geotechnical engineer be present at the time of excavation and foundation work to observe compliance with the design concepts, specifications, and to modify the design, should subsurface conditions differ from those anticipated prior to construction. It is of extreme importance that soil bearing pressures, other soil parameters, and degree of compaction required be confirmed and/or determined at the time of construction.

This report has been prepared for the subject project in accordance with generally accepted soil and engineering practice at this time. No other warranty, expressed or implied is made.

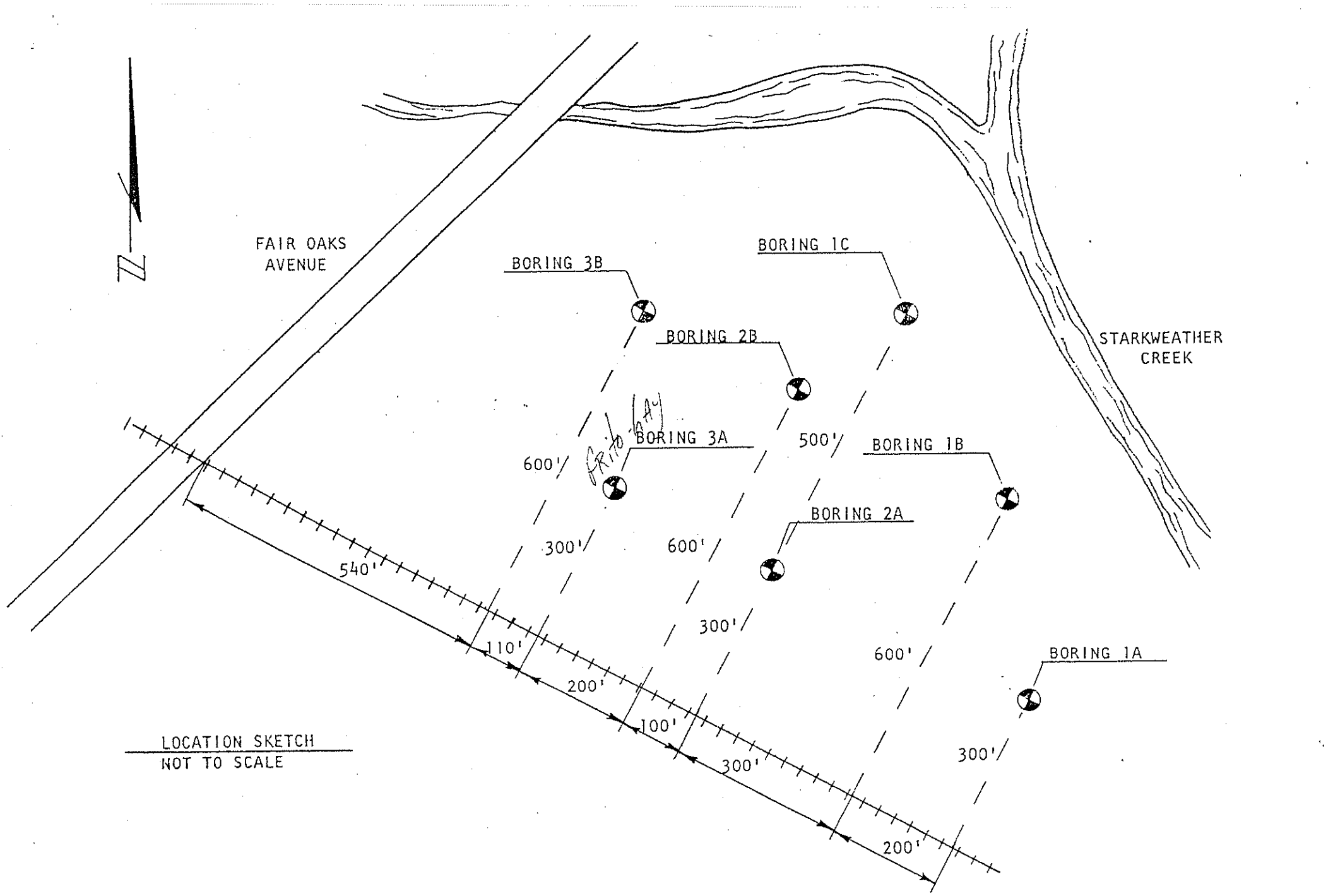
Please let us know if you have any questions concerning this submittal, or if could be of further assistance to you.

Respectfully submitted,

SOILS & ENGINEERING SERVICES, INC.

Octavio Tejeda, P.E.

OT/mdt



LOCATION SKETCH
NOT TO SCALE

SOIL BORING LOCATION
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

9645-1

SOILS & ENGINEERING SERVICES, INC.

NOTES

1. Borings performed by standard procedures (A.S.T.M. Test Designation D1586).

2. The number of blows required to drive the 2-inch O.D. Split Spoon Sampler 12 inches with a 140-lb. weight falling 30 inches is recorded on the right hand edge of each boring log. This is the "Standard Penetration Test".

3. Borings 1B, 1C and 2B were performed on November 20, 1986.

   Borings 1A, 2A, 3A and 3B were performed on November 24, 1986.

4. Holes filled in after water level check.

5. The boundary lines shown on the Soil Boring Records between different soil strata are approximate and may be gradual. The driller's field logs contain soil conditions, as interpreted by the drilling personnel, of soils between samples based on the equipment performance and the soil cuttings. The Soil Boring Records contain the soil conditions as interpreted by a geotechnical engineer after review of the driller's field logs and soil samples.

6. The Soil Boring Records are a part of the written report. When this information is to be included in bidding or reference documents, the written portion of the report, along with the Soil Boring Records, must be bound together as a separate document or section of the project specifications.

LEGEND

- Fill
- Black Peat (Pt)
- Gray Organic Silt (OL)- With Some Shells
- Gray Silt (ML)
- Gray Layers of Fine, Fine to Medium, and Fine to Coarse Sand (SP) With a Little Fine Gravel
- Brown Fine Sand With Silt (SP-SM)
- Topsoil
- Water Level at Time Shown After Completion of the Boring
- Brown Lean Clay (CL)
- Gray Fine to Medium Sand (SP)- With a Little Gravel

MOISTURE CONDITION OF SAMPLES

Dry	W - Wet
D - Damp	S - Saturated
M - Moist	

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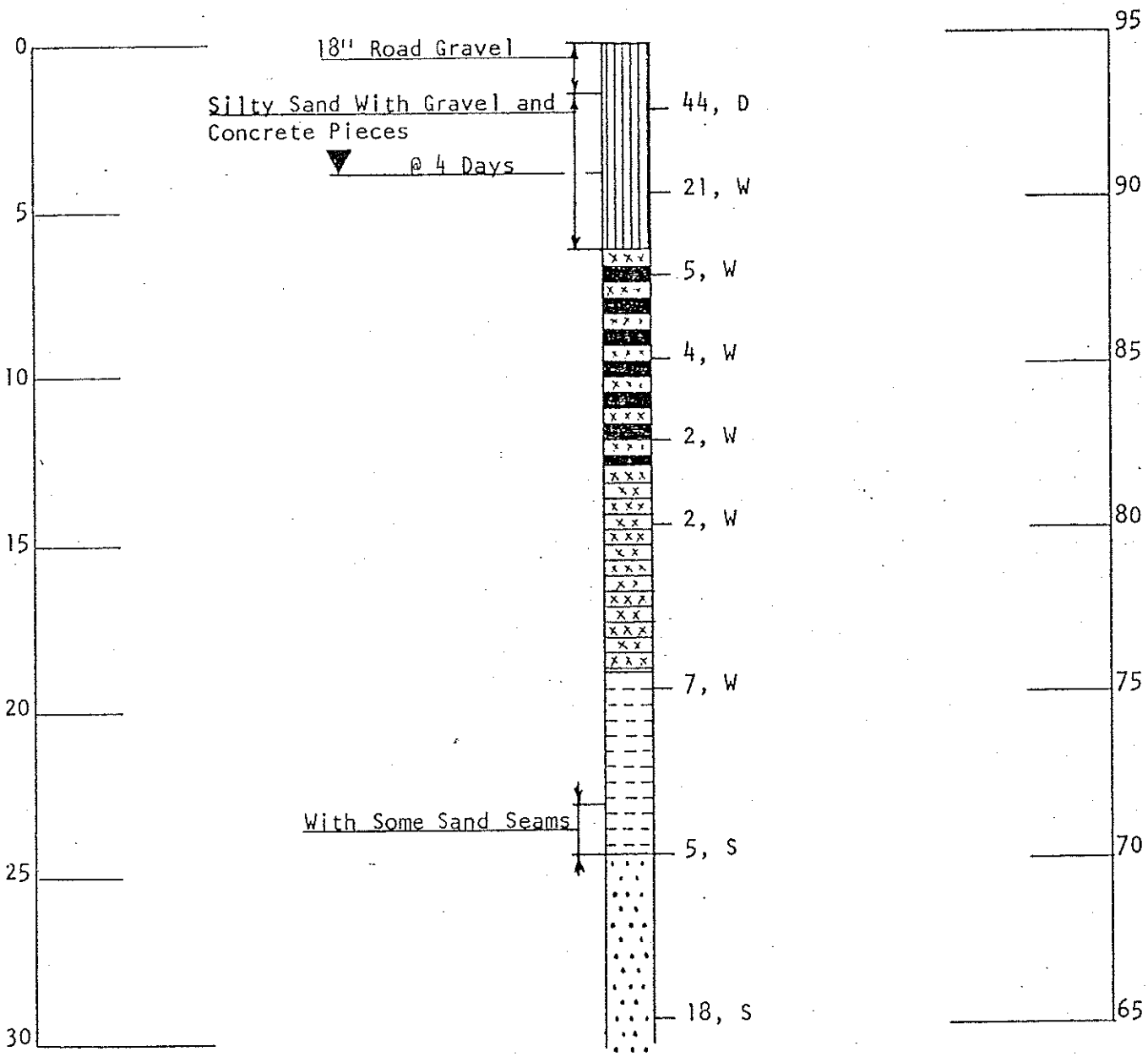
MADISON, WISCONSIN

SOIL BORING RECORD
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

9645-2

BORING 1A



FOR NOTES AND LEGEND, SEE DRAWING 9645-2

SOIL BORING RECORD
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

9645-3

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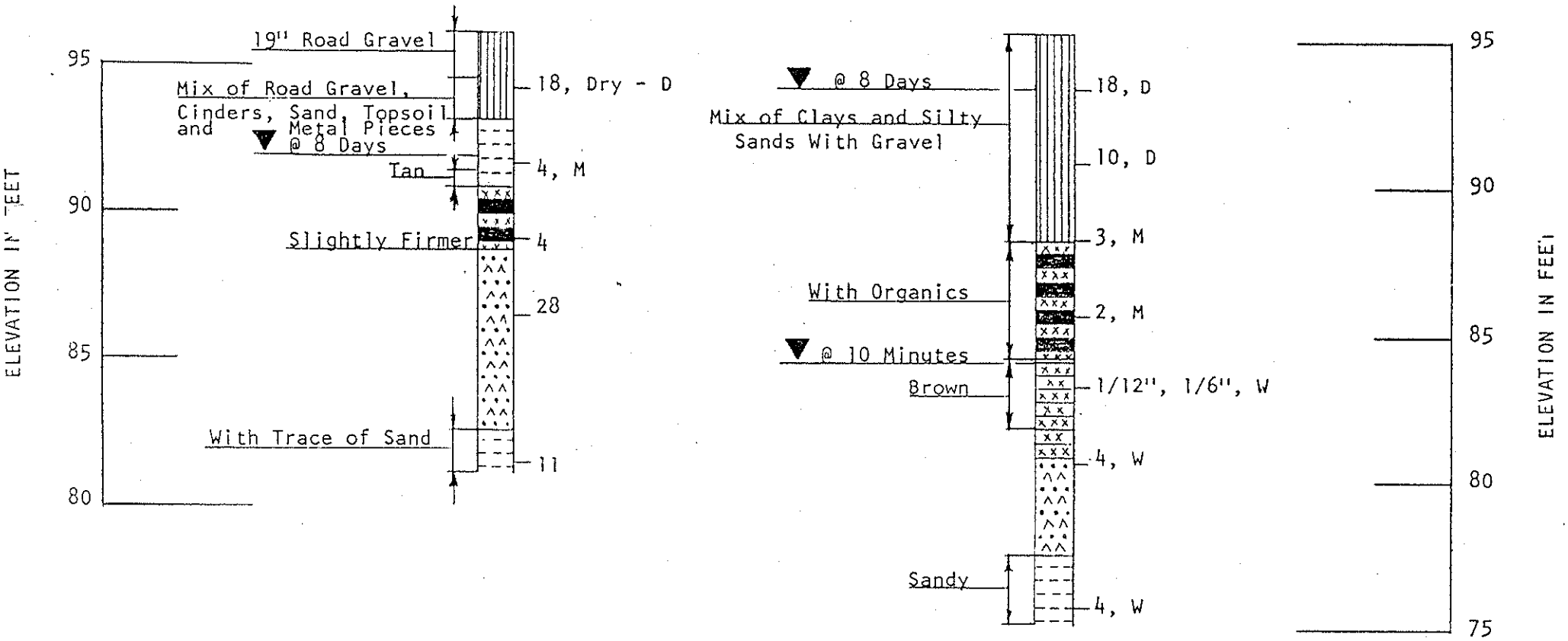
MADISON, WISCONSIN



FOR NOTES AND LEGEND, SEE DRAWING 9645-2

SOIL BORING RECORD
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

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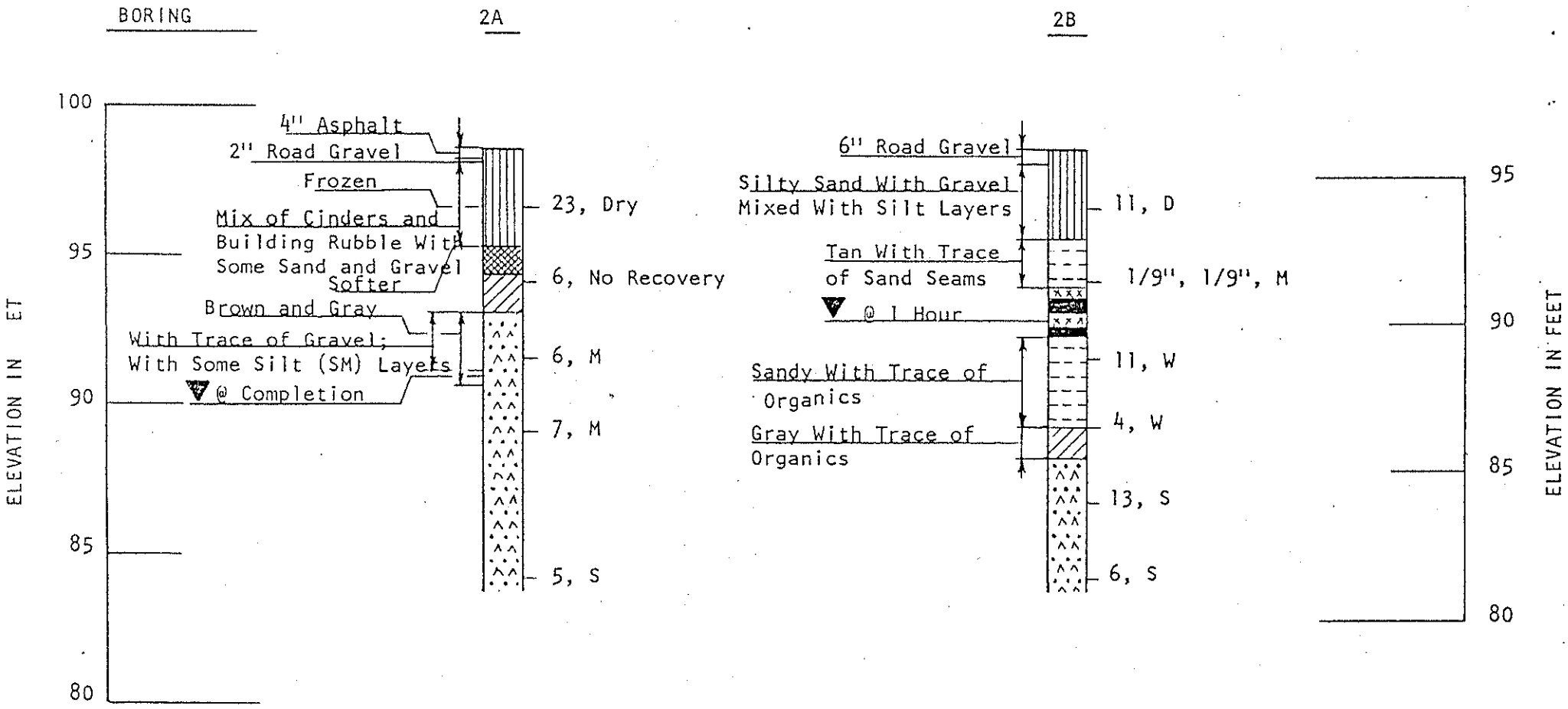

FOR NOTES AND LEGEND, SEE DRAWING 9645-2

SOIL BORING RECORD
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

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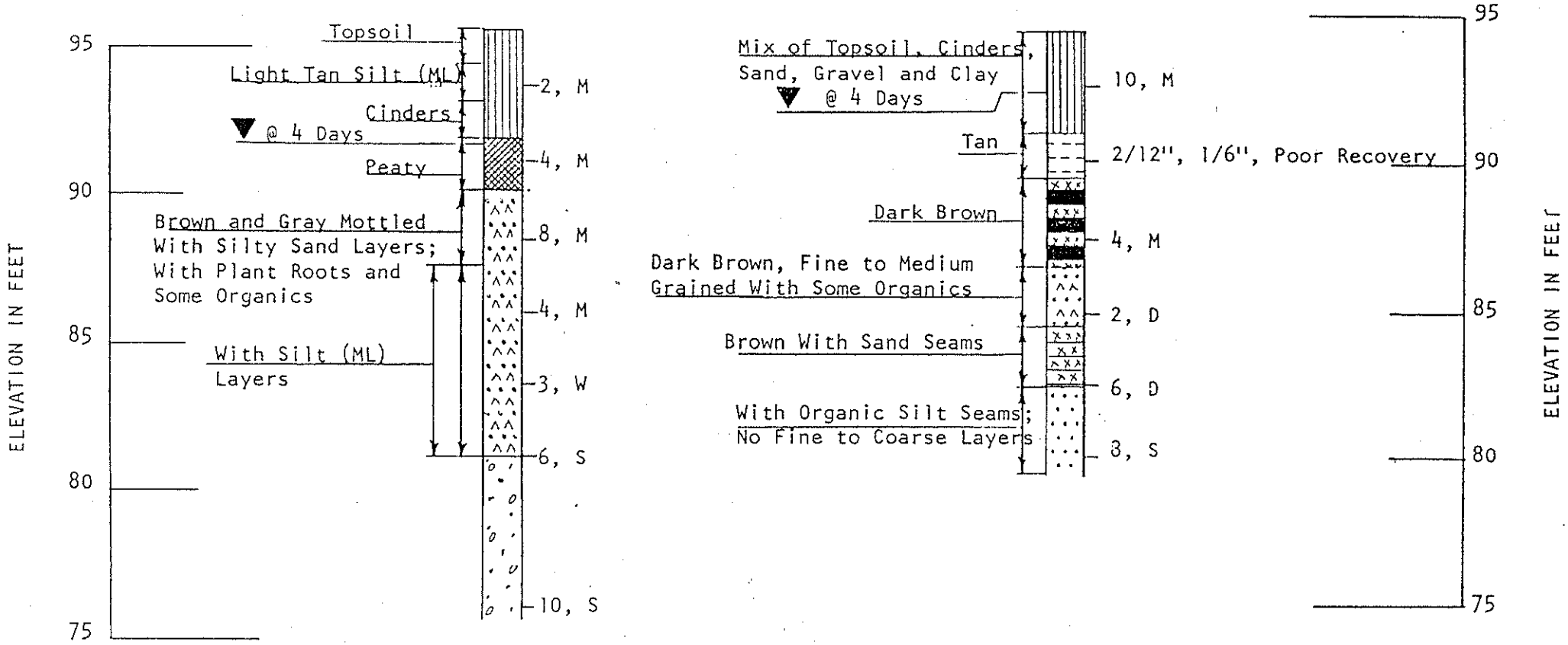

FOR NOTES AND LEGEND, SEE DRAWING 9645-2

SOIL BORING RECORD
GARVER PROPERTY
SUGAR AVENUE
MADISON, WISCONSIN

9645-6

SOILS & ENGINEERING SERVICES, INC.
MADISON, WISCONSIN

SUBSURFACE EXPLORATION

MADISON GAS & ELECTRIC GATEWAY SUBSTATION

MADISON, WISCONSIN

APRIL 2, 1984

This exploration has consisted of the performance of five standard soil borings located at the location stakes marked by Madison Gas & Electric personnel. The boring locations and logs are a part of this submittal.

Ground water was encountered very close to the ground surface and we anticipate that it will reach higher elevations during other seaons of the year influenced by the stage of the nea-by Starkweather creek.

Moderately dense to dense granular soils were encountered below 2 to 8 feet of depth. The materials near the surface are soft and wet and we recommend their complete removal from under structures. For driveways, we recommend the removal of topsoil and the brown and gray mottled silty clay to clayey silt. The removal of all the non-granular soils should be accomplished with backhoes to minimize soil disturbance by the travel of excavation equipment. Because of the potential for high ground water, dewatering of excavation areas will probably be necessary. Dewatering should be accomplished before excavations take place.

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Following excavations, the area could be built-up to the desired elevation utilizing compacted granular fill consisting of well graded sand or sand and gravel. This material should be placed in eight to ten inch layers, with each layer being thoroughly compacted to at least 95 percent of the maximum density as determined for the materials used in accordance with A.S.T.M. Test Designation D2557-78, Method D.

If the moisture content of the silty sand to sandy silt soils under driving areas is excessive, a filter fabric should be considered before placement of compacted granular fill. Excessive loads are not anticipated in the non-structure areas, and therefore, their removal will not be necessary. Settlements of 1/4 to 1 inch are anticipated with most of this settlement to take place during construction.

All foundations for structures should rest upon the natual granular soils or if desired upon compacted granular fill placed above this soil stratum. If compacted granular fill is used under footings, it should extend down and out from the outer footing edges at a 1:1 slope or flatter. Foundations resting as specified above could be designed for an allowable bearing pressure of 3,000 pounds per square foot at minumum frost depths. If a filter fabric is used, care should be exerecised when footing excavaitons take place to avoid ripping of the fabric.

Safety precautions, such as the ones required by O.S.H.A. should be enforced throughout the construction of the proposed facilities. These include, but are not limited to, proper sloping and/or support of excavation walls.

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REVISIONS mg&e appd			DESIGN CRITERIA	

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The recommendations in this report are based on interpretation of the soils and information given on the Soil Boring Records and may not be based solely on the contents of the drillers field logs.

This report has been prepared for your exclusive use to aid in the evaluation of the subject property and for the intended use described herein. Changes in the nature, design, or location of the construction may warrant changes to the recommendations given. Likewise, the nature and extent of variations between borings may not become evident until the time of construction. If variations are evident at that time, it will be necessary to re-evaluate the recommendations given herein.

A soils engineer should review the final design and specification documents for this project to verify that our recommendations regarding the earthwork and foundation system, are implemented as intended. It is further recommended that a soils engineer be present at the time of excavation and foundation work to observe compliance with the design concepts, specifications, and to modify the design, should subsurface conditions differ from those anticipated prior to construction. It is of extreme importance that soil bearing pressures, other soil parameters, and degree of compaction required be confirmed and/or determined at the time of construction.

This report has been prepared for the subject project in accordance with generally accepted soil and engineering practice at this time. No other warranty, expressed or implied is made.

Respectfully submitted,

SOILS & ENGINEERING SERVICES, INC.

Octavio Tejeda, P.E.

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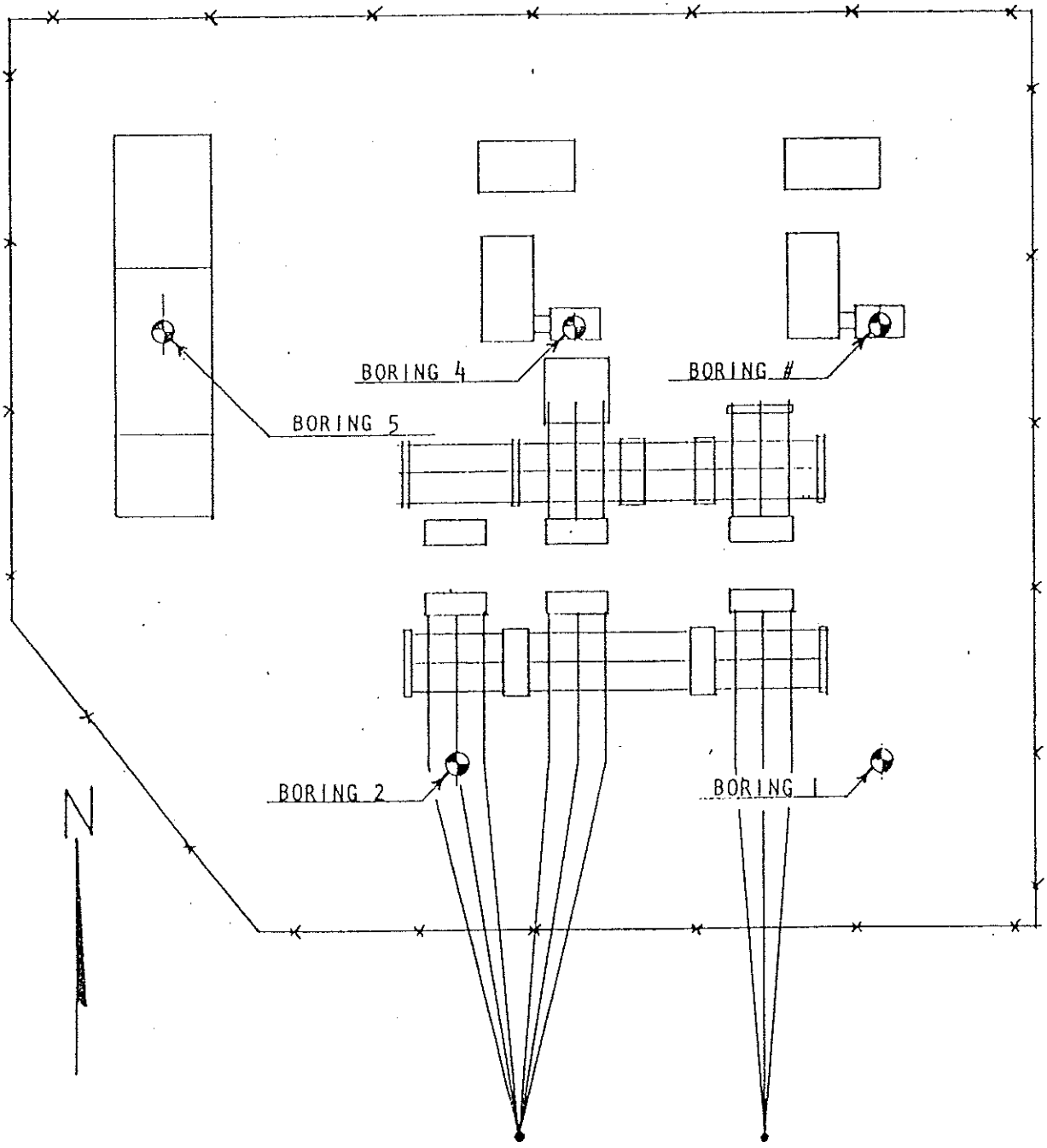

BORING LOCATION SKETCH
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MADISON GAS & ELECTRIC COMPANY

GATEWAY SUBSTATION

DESIGN CRITERIA

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NOTES

1. Borings performed by standard procedures (A.S.T.M. Test Designation D1586-67).
2. The number of blows required to drive the 2-inch O.D. Split Spoon Sampler 12 inches with a 140-lb. weight falling 30 inches is recorded on the right hand edge of each boring log. This is the "Standard Penetration Test".
3. Boring 1 was performed March 15, and Borings 2 to 5 were performed March 16, 1984.
4. Holes filled in after water level check.
5. The boundary lines shown on the Soil Boring Records between different soil strata are approximate and may be gradual. The driller's field logs contain soil conditions, as interpreted by the drilling personnel, of soils between samples based on the equipment performance and the soil cuttings. The Soil Boring Records contain the soil conditions as interpreted by a geotechnical engineer after review of the driller's field logs and soil samples.

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LEGEND

- Topsoil
- Brown and Gray Mottled Silty Clay to Clayey Silt
- Gray Very Silty Sand to Sandy Silt, Trace to Some Clay
- Tan to Brown Stratified Fine Sand, Fine to Medium Sand; Occasional Layers of Fine to Coarse Sand and Small Gravel
- ▼ Water Level at Time Shown After Completion of the Boring.
- q_p = Penetrometer Reading; Tons/Sq.Ft.

MOISTURE CONDITION OF SAMPLES

Dry	W - Wet
D - Damp	S - Saturated
M - Moist	

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MADISON GAS & ELECTRIC COMPANY

GATEWAY SUBSTATION

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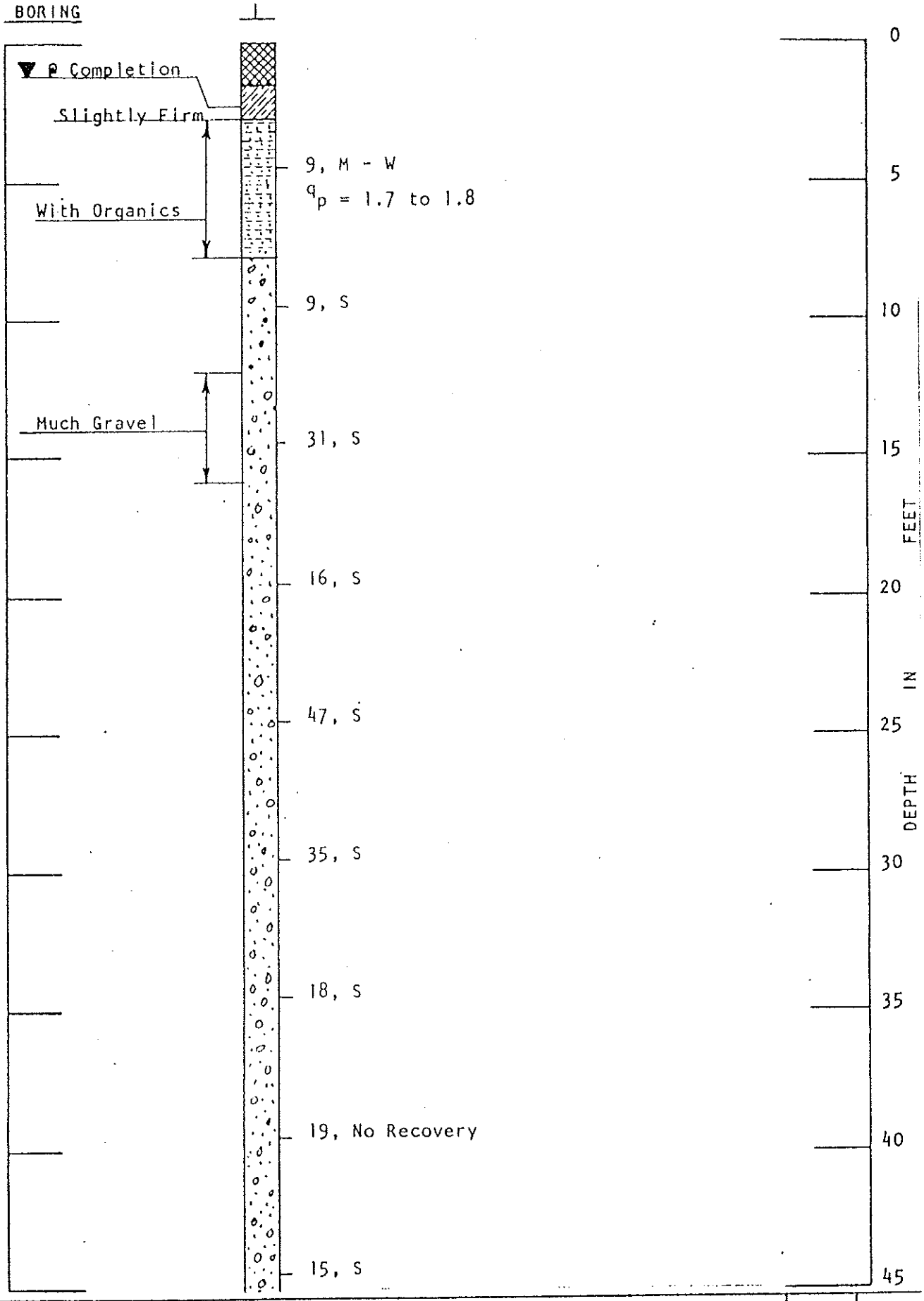
BORING



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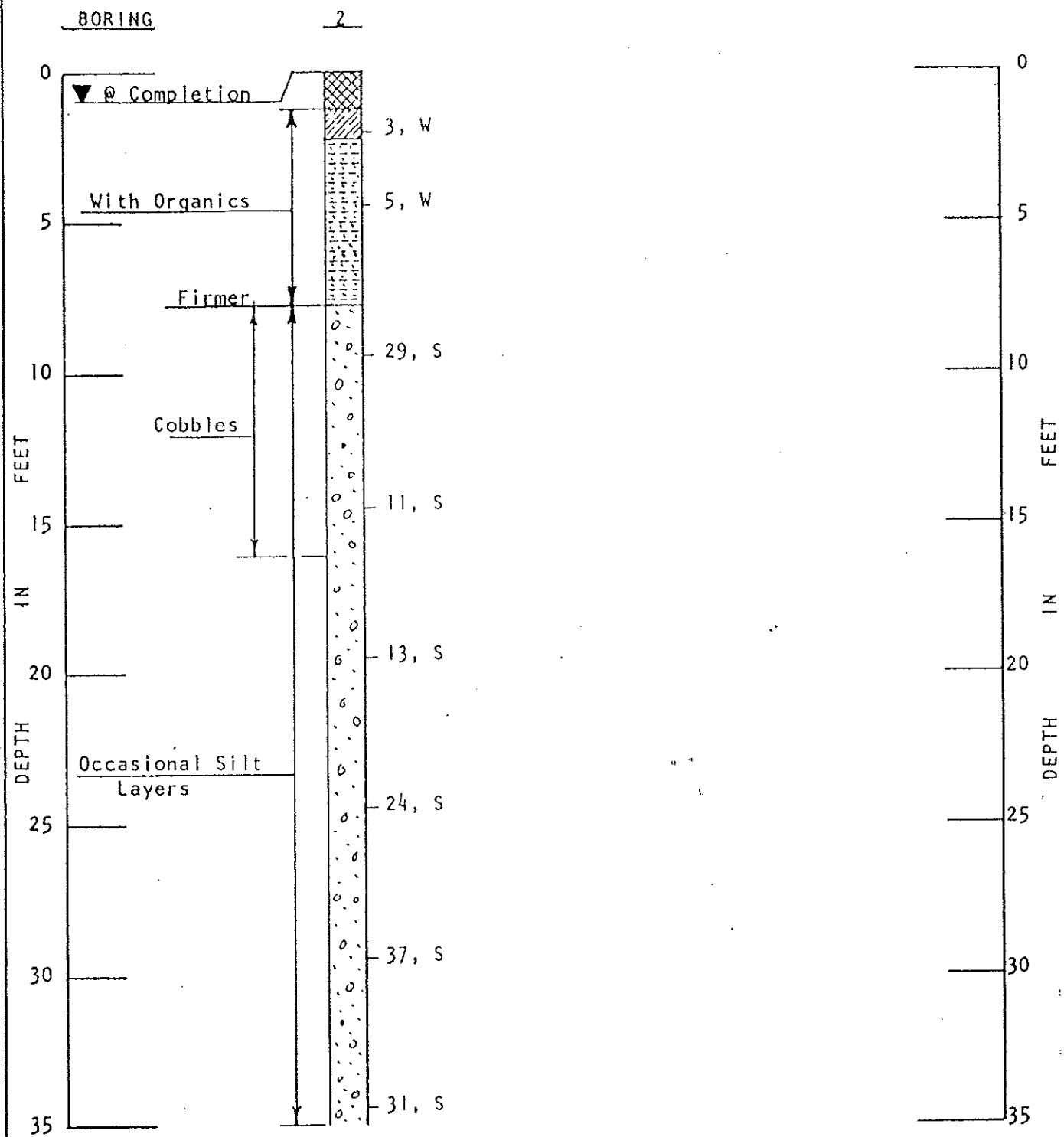

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GATEWAY SUBSTATION.

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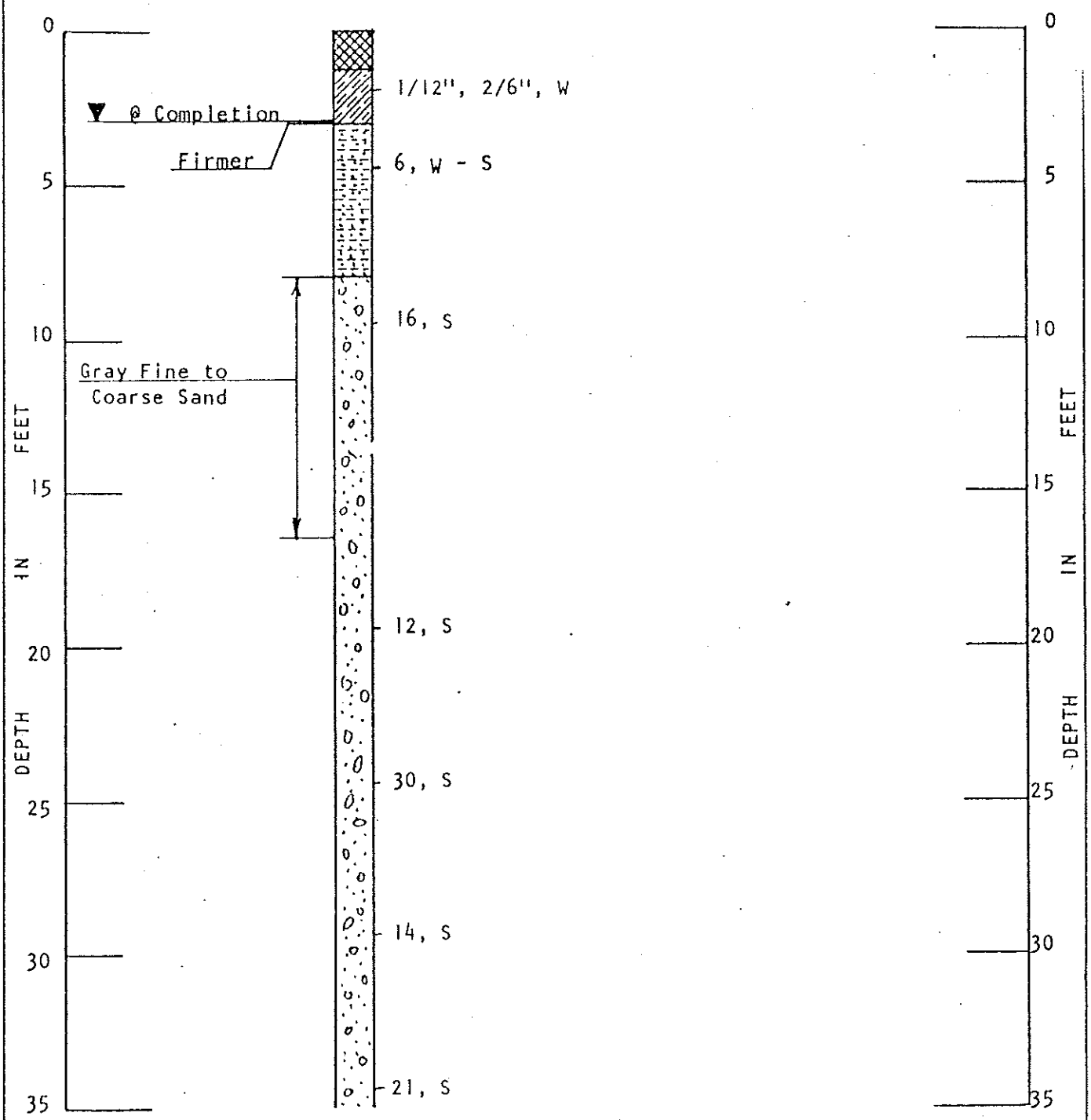
BORING 3



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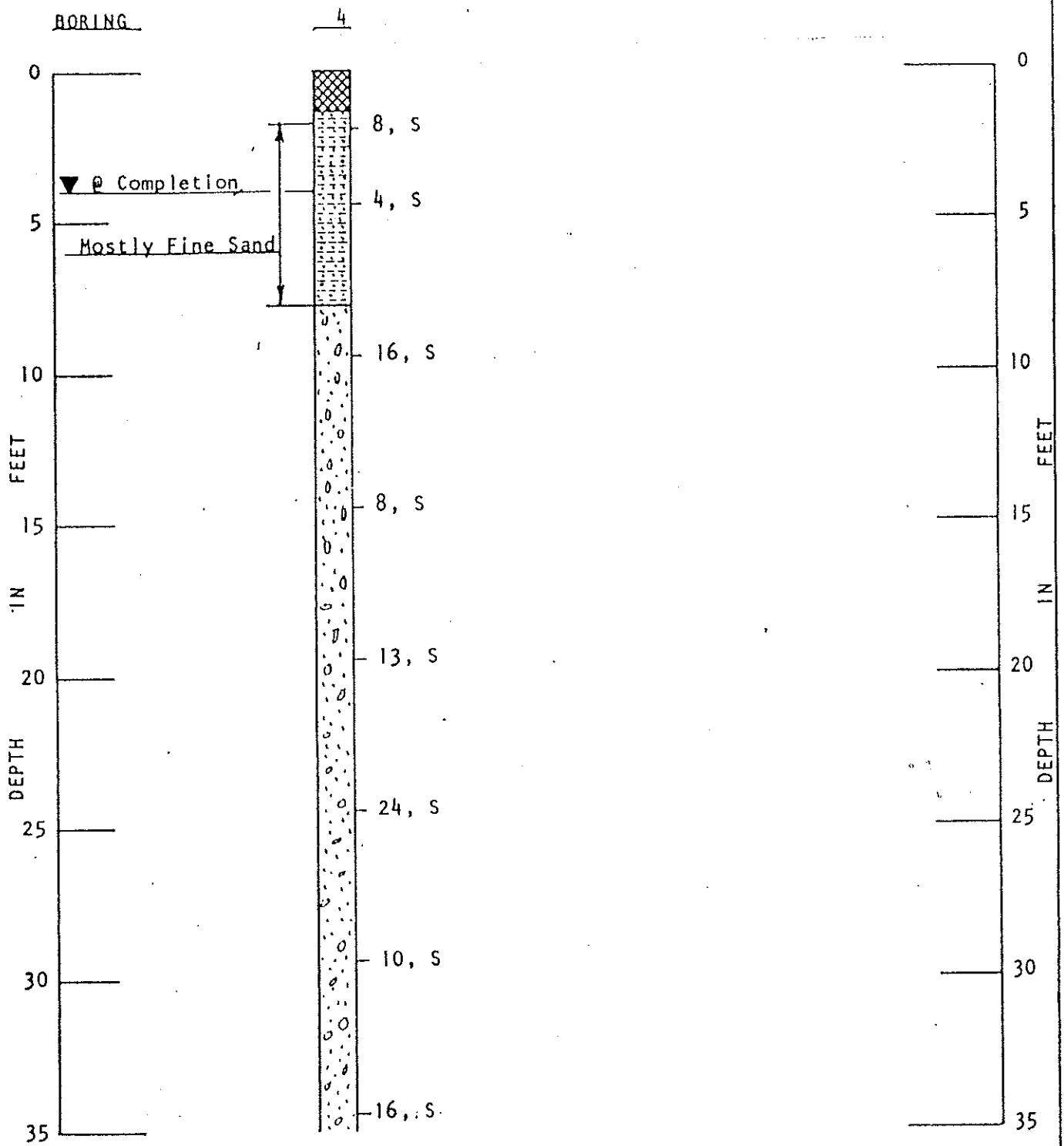

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GATEWAY SUBSTATION

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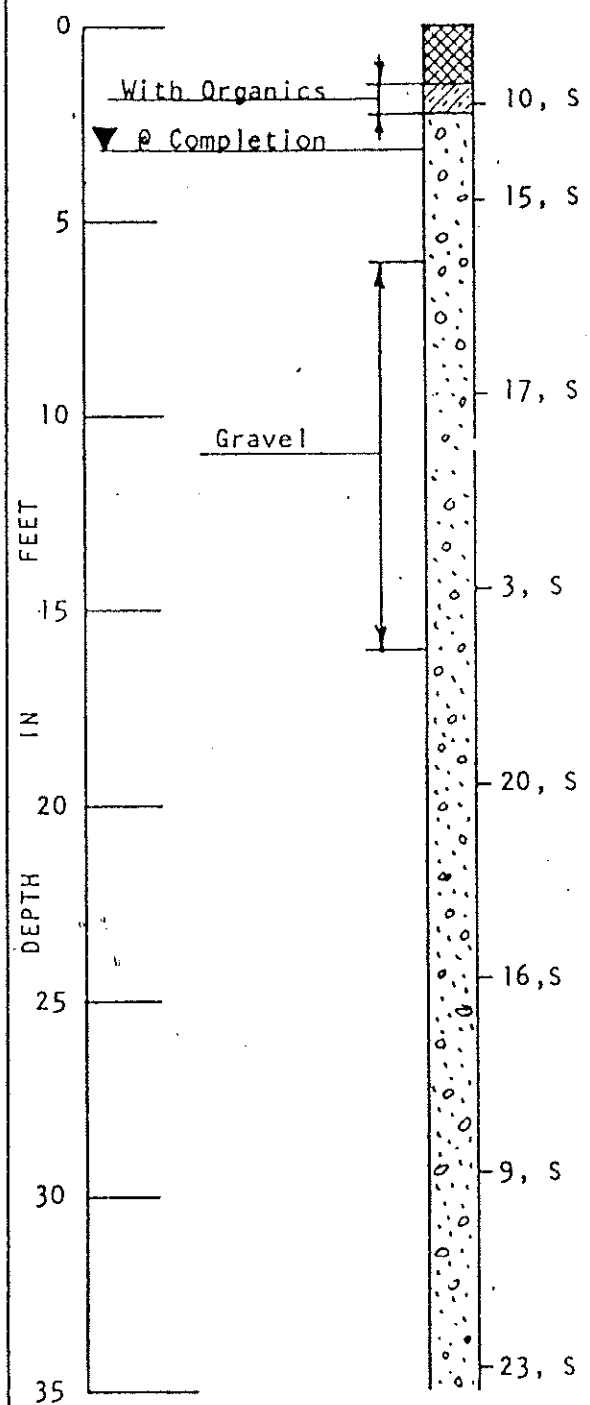
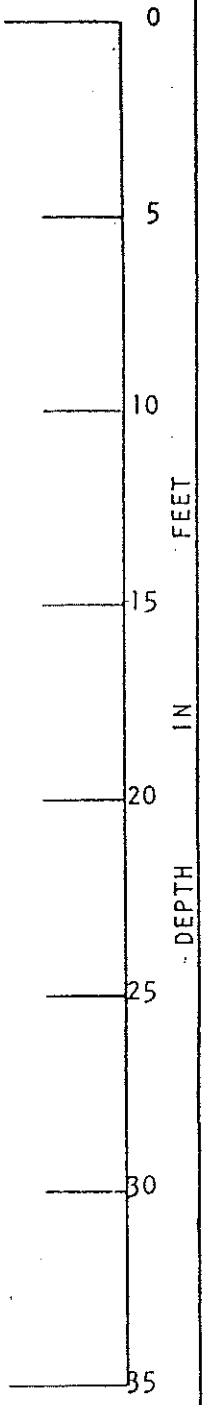
BORING 5





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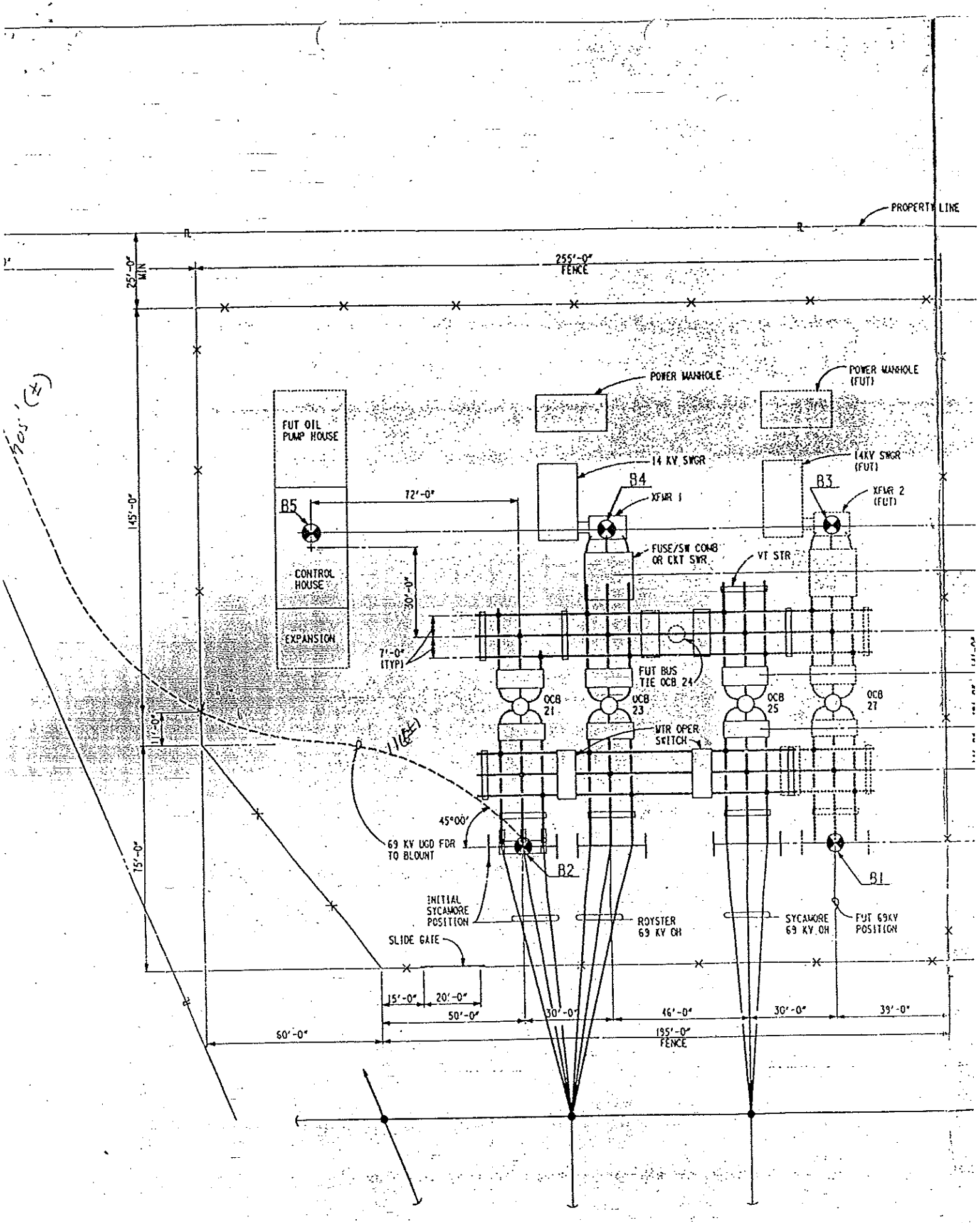
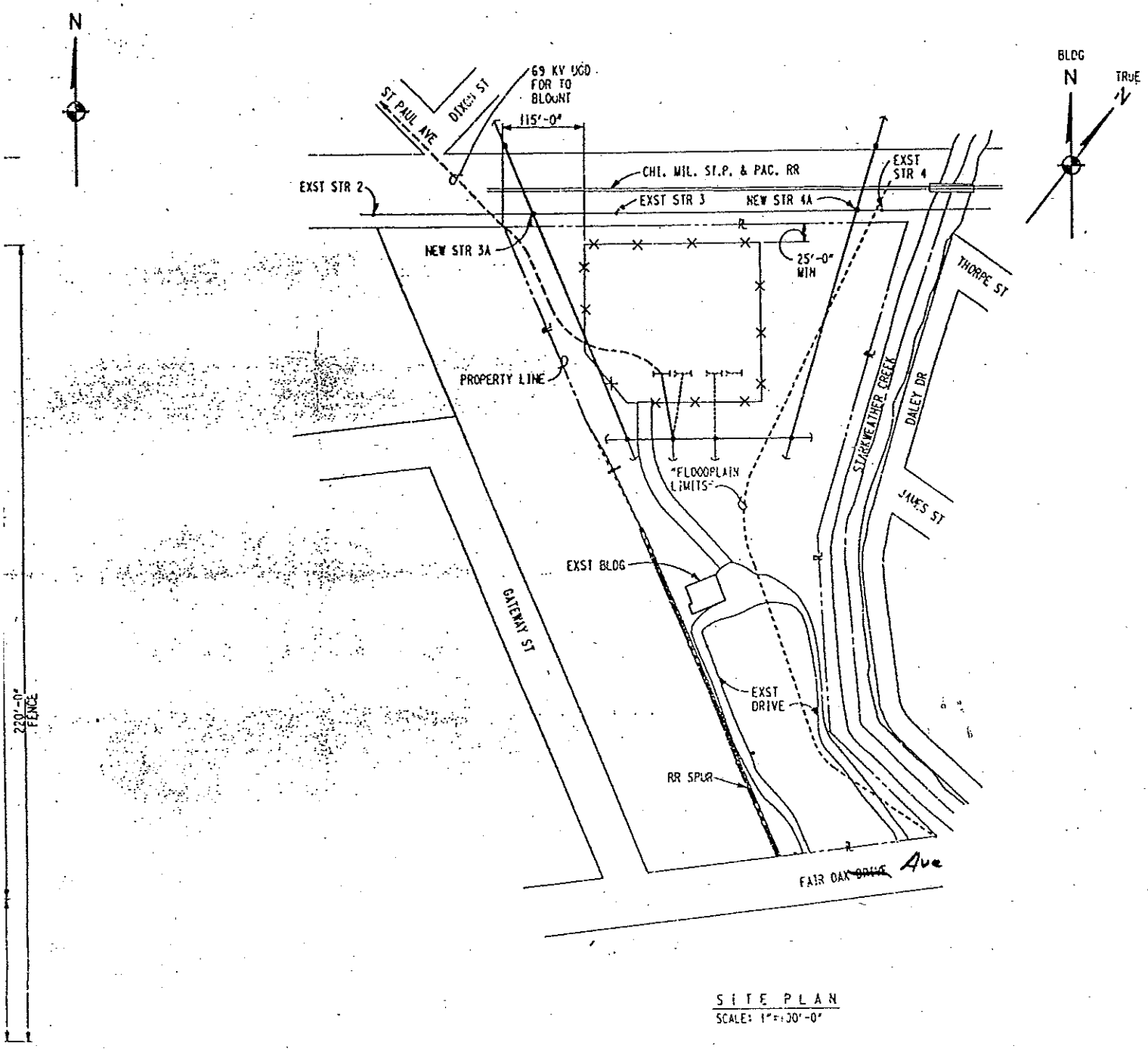


GENERAL ARRANGEMENT PLAN

SCALE: 1"-20'-0"

LEGEND:

BORING LOCATION
45'-0" DEPTH -
35'-0" DEPTH -



SITE PLAN
SCALE: 1"=30'-0"