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GEOTECHNICAL ENGINEERING SERVICES REPORT

For the

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION AND PROPOSED ACCESS ROAD MANATEE COUNTY, FLORIDA

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AND
PROPOSED ACCESS ROAD
MANATEE COUNTY, FLORIDA

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PSI *Information To Build On*
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The proposed access road will be approximately 1,500 feet long and 24 feet wide. Sections of the proposed road will be constructed over an existing filled Lena Road Landfill cell with remaining sections along an existing access road and berm area bordering the filled cell area.

If any of the noted information is incorrect or has changed, PSI must be notified so that we may amend the recommendations presented in this report, if appropriate.

1.3 PURPOSE AND SCOPE OF WORK

The purpose of this study was to obtain information on the general subsurface conditions at the proposed project site. The subsurface materials encountered were then evaluated with respect to the available project characteristics. In this regard, engineering assessments of the following items have been formulated:

1. Feasibility of utilizing a shallow foundation system for support of the proposed structures.
2. Design parameters required for the foundation system, including allowable bearing pressures, foundation levels and expected settlements.
3. Soil subgrade preparation, including stripping, grubbing and compaction. Engineering criteria for placement and compaction of approved structural fill materials.
4. Suitability and availability of materials on-site that may be moved during site grading for use as structural fill in the structure areas and as general backfill.
5. General location and description of potentially deleterious materials encountered in the borings which may interfere with construction progress or structure performance, including existing fills or surficial organics.
6. Identification of current groundwater levels and estimation of the seasonal high groundwater levels.
7. Construction considerations for foundation excavations, groundwater control, temporary side slopes, on-site soil suitability and unsuitable soil removal.

8. Pavement considerations and construction suggestions, considering encountered subgrade soil, slope benching, geotextile and fill placement.

The following services have been provided in order to achieve the preceding objectives:

1. Reviewed readily available published topographic and soils information. This published information was obtained from the "Lorraine, Florida" Quadrangle Map published by the United States Geological Survey (USGS) and the "Soil Survey of Manatee County, Florida" published by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS).

2. Executed a program of subsurface exploration consisting of subsurface sampling and field testing. We performed nineteen (19) Standard Penetration Test (SPT) borings within the proposed structure areas; the borings extended to a depth range from approximately twenty (20) to fifty (50) feet. In the SPT borings, samples were collected and Standard Penetration Test resistances were measured virtually continuously to a depth of 10 feet and on intervals of 5 feet thereafter. In addition, we performed seven (7) auger borings along the existing road/berm for the proposed access road. The borings varied in depth from three (3) to six (6) feet below existing grade. Volatile organic vapors were measured in soil samples obtained in the auger borings along the proposed access road.

3. Visually classified soil samples from the plant expansion boring locations in the laboratory using the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system within the proposed access road. Identified soil conditions at each boring location and formed an opinion of the site soil stratigraphy.

4. Collected groundwater level measurements and estimated the seasonal high groundwater level.

5. Prepared this formal engineering report which summarizes the course of study pursued, the field and laboratory data generated, subsurface conditions encountered, and our engineering recommendations in each of the pertinent topic areas.

The scope of services did not include an environmental assessment for determining the presence or absence of wetlands or hazardous or toxic materials in the soil, bedrock, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring profiles regarding odors, colors, unusual or suspicious items or conditions are strictly for the information of the client.

2.0 SITE AND SUBSURFACE CONDITIONS

2.1 SITE LOCATION AND DESCRIPTION

The site of the proposed construction is located in Manatee County, Florida. Specifically, the project is located within and adjacent to the existing Southeast Regional Wastewater Treatment Facility adjacent to the Lena Road Landfill. The property is located in Section 1, Township 35 South, Range 18 East in Manatee County, Florida. The topographic survey map published by the USGS titled "Lorraine, Florida" dated 1973 (photorevised 1987) was reviewed for ground surface features at the proposed project location. Based on this review, the natural ground surface elevation in the area prior to development was approximately 30 feet National Geodetic Vertical Datum (NGVD) of 1929. The vicinity maps shown on Sheet 1 in the Appendix of this report depict the location of the site.

This parcel of land is developed with the existing Southeast Regional Wastewater Treatment Plant. There are various existing structures, service roads, stormwater management ponds and grassed areas located throughout the site. During the time of our exploration the stormwater management ponds were dry and the ground surface was relatively firm.

2.2 MANATEE COUNTY SOIL SURVEY

The "Soil Survey of Manatee County, Florida" published by the USDA, SCS, was reviewed for general near surface soil information prior to development in the area. This information indicates there are two (2) primary mapping units at the project location. The soil map units encountered are as follows:

SOIL SERIES	USDA SEASONAL HIGH GROUNDWATER		RISK OF CORROSION	
	DEPTHS (ft)	MONTHS	UNCOATED STEEL	CONCRETE
EauGallie Fine Sand (20)	0.5 - 1.5	Jun-Oct	High	High
Floridana-Immokalee-Okeelanta Association (26)				
Floridana	+2.0-1.0	Jun-Feb	Moderate	Low
Immokalee	+2.0-1.0	Jun-Feb	High	High
Okeelanta	+1.0-0	Jun-Jan	High	Moderate

2.3 SUBSURFACE CONDITIONS

The subsurface conditions within the treatment plant expansion areas were explored using nineteen (19) Standard Penetration Test (SPT) borings. The SPT borings were drilled to depths of 20 to 50 feet below the existing ground surface. The access road was explored using seven (7) auger borings extended to depths of three (3) to six (6) feet below the ground surface on the west edge of the berm. The borings were located and drilled at locations that were based on a proposed site plan provided to the PSI Sarasota office. The borings were located in the field by PSI personnel from existing site features and the provided site plan. The approximate boring locations are presented on Sheets 2 and 7. The SPT borings were advanced utilizing rotary mud drilling methods and soil samples were routinely obtained during the drilling process at selected intervals. Drilling and sampling techniques were accomplished in general accordance with ASTM standards.

Select soil samples were tested in the laboratory to determine material properties for our evaluation. Laboratory testing was accomplished in general accordance with ASTM standards. Laboratory test results are shown adjacent to the soil profiles presented on Sheets 3 through 6 and Sheet 8.

Treatment Plant Expansion Areas

The subsurface materials encountered at the plant expansion boring locations consisted of sand, clay and limestone. Clean to clayey sands were penetrated in the upper 20 feet followed by clay. In some of the deeper borings a highly weathered limestone with clay seams was penetrated below the clay.

The relative density of the sands ranged from very loose to dense with SPT N-values varying from 2 to 35 blows per foot (bpf) of sampler penetration. However, in boring B-19 an SPT N-value of 50 blows per 5 inches of sampler penetration (practical refusal) was recorded. This inconsistency is believed to be due to the large phosphatic gravel encountered at this sample interval. The consistency of the clay was soft to hard with SPT N-values between 3 bpf to practical refusal. The limestone was seamy and inconsistent; however, typical SPT N-values reached practical refusal.

Access Road
The subsurface materials encountered along the proposed access road consisted of sand fill with a trace of clay, rock fragments and asphalt. The sand fill extended to boring termination depths of three (3) to six (6) feet below existing ground surface. All borings were located west of the slurry wall along the existing road. None of the borings were conducted within the existing adjacent filled Lena Road Landfill cell.

During the subsurface exploration, samples obtained from the borings were screened for organic vapors with a Heath Porta FID II (flame ionization detector) brand Organic Vapor Analyzer (OVA). The Porta FID II has a manufacturer's reported detection limit of 1 part per million (ppm). The OVA-FID was checked for quality assurance purposes prior to use with a 107 ppm methane in air standard. The methodology used for the organic vapor headspace analysis of the soil samples is described in Chapter 62-770.200 Florida Administrative Code and was completed as described below.

Soil samples were collected at two (2) foot intervals by directly spooning the sample from the hand auger into glass sample jars. The jars were half-filled with the soil sample then covered and sealed with aluminum foil, and allowed to volatize into the headspace for at least five (5) minutes. The organic vapor reading for each soil sample was determined by inserting the probe of the OVA-FID into the headspace of the sample container and recording the highest sustained reading. A second reading was taken with a carbon filter attachment on the OVA to screen for naturally occurring methane vapors. The resulting OVA reading was subtracted from the initial reading without the carbon filter to obtain a "net vapor" reading (i.e. hydrocarbons). The table below lists the filtered and unfiltered OVA readings at each boring location.

BORING NO.	SAMPLE DEPTH (FEET)	OVA READING (TOTAL) ppm	OVA READING (FILTERED)ppm	NET ORGANIC VAPORS (CALCULATED) ppm
AB-1	2-6	0	0	0
AB-2	2-6	*	*	*
AB-3	2-4	0	0	0

BORING NO.	SAMPLE DEPTH (FEET)	OVA READING (TOTAL) ppm	OVA READING (FILTERED)ppm	NET ORGANIC VAPORS (CALCULATED) ppm
AB-3	6	200	0	200
AB-4	2-4	0	0	0
AB-4	6	200	0	200
AB-5	2-6	0	0	0
AB-6	2-6	0	0	0
AB-7	2-4	0	0	0
AB-7	6	1200	0	1200
* Soil samples too damp to obtain reading Note: Methane/Organic based vapors present are calculated by subtracting filtered readings from unfiltered.				

The above subsurface descriptions are of a generalized nature to highlight the major subsurface stratification features and material characteristics. The soil profiles included on Sheets 3 through 6 and Sheet 8 should be reviewed for specific information at individual boring locations. These profiles include soil descriptions, stratifications, penetration resistances and laboratory test results. The stratifications shown on the boring profiles represent the conditions only at the actual boring location. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition may be gradual.

2.4 GROUNDWATER INFORMATION

The groundwater depths were measured in the borings immediately after completion of drilling activities. The groundwater level was encountered from the ground surface to a depth of 1.5 to 7.5 feet below the existing ground surface within the proposed plant expansion area. The fluctuation of the static groundwater level is believed to be due to the elevation differences between boring locations. Groundwater was not encountered in the auger borings performed along the proposed access road.

It should be noted, that groundwater levels tend to fluctuate during periods of prolonged drought and extended rainfall and may be affected by man-made influences. In addition, a seasonal effect may also occur in which higher groundwater levels are normally recorded in rainy seasons. In this regard, it is anticipated the seasonal high groundwater level for the treatment plant expansion construction area will be encountered at an approximate depth of 1.5 feet below the existing ground surface.

If the groundwater level is critical to design or construction, groundwater observation wells should be installed on-site to monitor groundwater fluctuations over a period of time and permit more accurate determinations of wet season and dry season levels.

3.0 PLANT EXPANSION EVALUATION AND RECOMMENDATIONS

3.1 GENERAL

The following design recommendations have been developed on the basis of the previously described project characteristics and subsurface conditions encountered. If there are any changes in these project criteria, including project location on the site, a review must be made by PSI to determine if any modifications in the recommendations will be required. The findings of such a review should be presented in a supplemental report.

Once final design plans and specifications are available, a general review by PSI is strongly recommended as a means to check that the evaluations made in preparation of this report are correct and that earthwork and foundation recommendations are properly interpreted and implemented.

3.2 SITE PREPARATION

The following are our recommendations for overall site preparation and mechanical densification work for the construction of the proposed facility expansion, based on our boring results. These recommendations should be used as a guideline for the project general specifications prepared by the design engineer.

Prior to construction, the location of any existing underground utility lines within the construction area should be established. Provisions should then be made to relocate any interfering utility lines within the construction area to appropriate locations. In this regard, it should be noted that if abandoned underground pipes are not properly removed or plugged, they may serve as conduits for subsurface erosion which subsequently may result in excessive settlements.

Clearing - The site should be cleared; this primarily includes removing the existing grass and topsoil. It is recommended that this undesirable material be removed to the satisfaction of PSI, prior to further construction at the site. As a minimum, it is recommended that the clearing operations extend at least five (5) feet beyond the facility perimeters. Any topsoil or organic laden soil removed from the development area may be stockpiled in designated locations for use in areas to be grassed. Where the volume of topsoil exceeds that which can be used on-site, it should be disposed of off-site.

Filling Existing Ponds - We understand that some of the existing stormwater ponds and ditches may be filled. If this is necessary at the time of construction, we recommend the ponds be dewatered prior to filling with structural fill. The groundwater should be lowered to at least two (2) feet below the existing pond bottom. The pond bottoms should then be inspected by a PSI representative to determine if any unsuitable soil removal will be required. Once it is determined that the pond bottom is prepared for fill placement, proofrolling, filling and compacting should be completed as presented in the following sections.

Proofrolling - Following the clearing operations and excavations to the foundation levels, the exposed subgrade should be evaluated and proofrolled as directed by representatives of PSI to confirm that all unsuitable materials have been removed. Groundwater levels should be lowered to at least two (2) feet below the excavated ground surface prior to proofrolling. Groundwater levels should be established at the time of construction, and dewatering or lowering of the groundwater levels should be performed as needed. The proofrolling should consist of compaction with a large diameter, heavy static drum roller or equivalent. The static roller should have a drum weight of eight (8) to ten (10) tons. Careful observations should be made during proofrolling to help identify any areas of soft yielding soils that may require overexcavation and replacement.

A minimum of eight (8) overlapping passes should be made by the static roller over the structure areas, with the successive passes aligned perpendicular. It is recommended that within the structure areas, the fill soils and natural ground, be compacted to at least 95 percent of the modified Proctor maximum dry density (ASTM D-1557) to a minimum depth of one (1) foot below stripped grade.

Filling and Compacting - Following satisfactory completion of the initial compaction on the existing grade, the proposed structure areas may be brought up to appropriate finished subgrade levels as required. In general, based on the boring results, the majority of the on-site sandy material (SP/SP-SM) can be used as structural fill in the structure areas and as general subgrade fill and backfill in other areas. All fill should consist of fine sand with less than 12 percent passing the No. 200 sieve, free of rubble, organics, clay, debris and other unsuitable material. All materials to be used for backfill or compacted fill should be evaluated and, if necessary, tested by PSI, prior to placement to determine if they are suitable for the intended use. Approved sand fill should be placed in loose lifts not exceeding 12 inches in thickness and should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density. Density tests to confirm compaction should be performed in each fill lift before the next lift is placed.

Prior to beginning compaction, soil moisture contents may need to be controlled in order to facilitate proper compaction. If additional moisture is necessary to achieve compaction objectives, water should be applied in such a way that it will not cause erosion or removal of the subgrade soils. A moisture content within two (2) percentage points of the optimum indicated by the modified Proctor test is recommended prior to compaction of the natural ground and fill.

All foundation excavations should be observed by the geotechnical engineer or a representative to evaluate the extent of any fill and excessively loose, soft, or otherwise undesirable materials. If the foundation excavation appears suitable as load bearing materials, the bottom of foundation excavations should be compacted to develop a minimum density requirement of 95 percent of the maximum modified Proctor dry density, for a minimum depth of one (1) foot below the bottom of the footing depth, as determined by field density compaction tests. If groundwater is encountered during construction, dewatering measures should be implemented to adequately lower the groundwater levels to a depth of at least two (2) feet below footing excavations. Backfill soils placed adjacent to footings or walls should be carefully compacted with a light rubber-tired roller or hand operated vibratory plate compactor to avoid damaging the footings or walls. Approved sand fills to provide foundation embedment constraint should be placed in loose lifts not exceeding six (6) inches and should be compacted to a minimum of 95 percent of the modified Proctor maximum dry density.

If soft pockets are encountered in the footing excavations, the unsuitable materials should be removed and the footings may be located at a lower elevation. Alternatively, the proposed footing elevation may be re-established by backfilling after the undesirable material has been removed. This backfilling may be done with a very lean concrete or with a well-compacted, suitable fill such as clean sand, gravel, or crushed FDOT No. 57 or FDOT No. 67 stone. Sand backfill should be compacted to a dry density of at least 95 percent of the modified Proctor maximum dry density, as previously described.

A representative from our firm should be retained to provide on-site observation of earthwork and ground modification activities. Density tests should be performed in the top one (1) foot of compacted subgrade, each fill lift, and bottom of foundation excavations. It is important that PSI be retained to observe that the subsurface conditions are as we have discussed herein, and that foundation construction, ground modification and fill placement is in accordance with our recommendations.

3.3 FOUNDATION RECOMMENDATIONS

Based on our evaluation and analyses, the soils encountered are capable of supporting the proposed structures with proper subgrade preparation, including heavy static densification. We understand the headworks structure and the MCC/General buildings will be constructed on conventional shallow spread foundations and all other structures will have a combined floor and foundation system designed as a mat.

Based on the anticipated construction and recommended site preparation, the foundations for the structures should be designed for a net maximum allowable bearing pressure of 2500 pounds per square foot (psf). The foundations should bear on properly improved natural subgrade or on properly placed and compacted cohesionless (sand) fill. The existing sandy soils should be improved by heavy static compaction after stripping and grubbing to improve foundation support and reduce total and differential settlements.

All structure foundations should be embedded so that the bearing surface is a minimum of 18 inches below adjacent compacted grades on all sides. All footings should be constructed in a "dry" fashion.

Based on the soil conditions encountered at the site, the standard penetration resistance N-values and the recommended depth of footing bottoms; the modulus of vertical subgrade reaction "Kvs" should be on the order of 100 kips per cubic foot (kcf). However, if the site preparation recommendations are implemented a higher value in the range of 200 to 500 kcf can be expected to be obtained.

3.4 SETTLEMENT

The settlement of shallow foundations (headworks structure and the MCC/General buildings) supported on sandy soils should occur rapidly after loading. Thus, the majority of expected settlements should occur during construction as dead loads are imposed. Provided the recommended subgrade preparation operations are properly performed, the total settlement of the conventional shallow foundations should be less than ¾-inch, with differential settlement on the order of 50 percent of the total settlement. Differential settlement of this magnitude is usually considered tolerable for the anticipated construction.

Using an assumed contact pressure not to exceed 2,500 psf for the structures constructed on a mat type foundation, we anticipate the total settlement of these structures to be on the order of 1 to 2 inches. A majority of the settlement will occur upon first loading of the sandy soils. Of these structures the only area of concern would be the structures that will be connected to existing structures. The new loads may result in additional settlement of the existing structures and there will likely be some differential movement between the existing and new structures. Therefore, we recommend loading the water structures with water prior to making the final utility and plumbing connections. In addition, the structural design should account for the expected differential movement.

3.5 FLOOR SLABS

The floor slab for the MCC/General Buildings may be safely supported as a slab-on-grade provided any undesirable materials are removed and replaced with controlled structural fill. It is recommended that all ground floor slabs be "floating", that is, generally ground supported and not rigidly connected to walls or foundations. This is to minimize the possibility of cracking and displacement of the floor slabs because of differential movements between the slab and the foundation.

It is also recommended that the floor slab bearing soils be covered by a lapped polyethylene sheeting in order to minimize the potential for floor dampness which can affect the performance of glued tile and carpet (if any are used). This membrane should consist of a minimum six (6) mil single layer of non-corroding, non-deteriorating sheeting material placed to minimize seams and to cover all of the soil below the building floor. This membrane should be cut in cross shape for pipes or other penetrations; the membrane should extend to within 0.5 inch of all pipes or other penetrations. All seams of the membrane should be lapped at least 12 inches. Punctures or tears in the membrane should be repaired with the same or compatible material.

3.6 HYDROSTATIC UPLIFT

Structures below grade will be subjected to uplift pressures as a result of the relatively high groundwater level. In addition, the walls of the below grade structures will be subjected to lateral earth and hydrostatic pressures. The amount of hydrostatic pressure will be dependent upon the depth between the groundwater level and the bottom of the slab. The amount of hydrostatic pressure differential that will need to be accounted for is the difference between the seasonal high water level and the lowest level of water inside the below grade structures.

3.7 EARTH PRESSURE ON WALLS

The below grade structures should resist earth pressures from all sides. However, the following criteria are presented for design considerations. Foundation walls constructed below existing grades or which have adjacent compacted fill may be subjected to lateral at-rest or active earth pressures. Walls which are restrained at the top and bottom will be subjected to at-rest soil pressures equivalent to a fluid density of 52 pounds per cubic foot (pcf). Walls which are not restrained at the top and where sufficient movement may mobilize active earth pressures, an equivalent fluid density of 35 pcf can be used. At locations where the base of the walls extend below the groundwater level soil pressures can be calculated using half (½) the equivalent fluid densities given above (See table below for actual values); however, hydrostatic and seepage forces must then also be included. The above pressures do not include any surcharge effects for sloped backfill, point or area loads behind the walls and assume that adequate drainage provisions have been incorporated. The walls must be designed by the structural engineer to resist lateral earth and hydrostatic pressures. The table below lists the at-rest, active and passive earth pressure parameters.

EARTH PRESSURE CONDITION	TOTAL FLUID DENSITY (1) (pcf)	SUBMERGED FLUID DENSITY (*) (pcf)	RESPECTIVE COEFFICIENT OF EARTH PRESSURE
At-Rest (K_o)	52	26	0.50
Active (K_a)	35	14	0.33
Passive (K_p)	315	128	3.00

(1) These fluid densities are based on a clean sand backfill with an average internal friction angle of 30 degrees and a total unit weight of 105 pcf.
(*) Hydrostatic and seepage forces should be added to the submerged fluid densities when calculating total forces acting on retaining walls.
Coefficient of Sliding Friction "f" = 0.4

4.0 ACCESS ROAD EVALUATION AND RECOMMENDATIONS

4.1 GENERAL

We recommend design and construction follow current Manatee County specifications. In general, the existing shallow subsurface soils encountered in the borings performed are capable of supporting the proposed construction of a typical pavement section after proper subgrade preparation. It should be noted that the boring information only applies to the existing road and berm area. The segments of the site that are located over the existing filled landfill cell should be anticipated to experience unknown amounts of settlement due to unknown voids in the debris and decaying material. In addition, based on the OVA data obtained organic vapors are present at the project site.

In an attempt to distribute settlement over a large area and limit sharp dips in the proposed access road, we recommend the placement of two (2) layers of a geosynthetic, one (1) layer along the proposed alignment between the existing landfill cover and the new embankment and the other within the base material. This information is further discussed in the following sections.

4.2 SITE PREPARATION

Site preparation and roadway construction should be in accordance with Manatee County specifications. The following are the summaries of major concerns for overall site preparation and mechanical densification work for the proposed roadway construction, based on the anticipated construction and our subsurface exploration results.

Site Preparation Over Existing Road and Berm

1. The roadway area plus a margin of five (5) feet should be stripped and cleared of existing asphalt, surface vegetation, organic or root laden topsoil, and grubbed of roots and stumps. Organic soil or near surface clays and silts found and any other soils with organic content in excess of five (5) percent should be overexcavated and hauled elsewhere for restricted use. A Geotechnical Engineer should observe the stripped grade to document adequate depth of stripping prior to filling.

2. The stripped area should be levelled sufficiently to permit equipment traffic, cut to grade if necessary, and then compacted using a large diameter, self-propelled or tractor drawn vibratory roller. The vibratory drum roller should have a static drum weight of about four (4) tons and should be capable of exerting a minimum impact force of 15 tons. Careful observations should be made during proofrolling to help identify any areas of soft yielding soils that may require overexcavation and replacement. Compaction over the existing slurry wall should be completed with caution so as not to displace any slurry materials. Care should be used when operating the compactor near existing structures to avoid transmission of vibrations that could cause settlement damage or disturb occupants. Use of a smaller vibratory or static compactor may be necessary in some instances. Construction operations that may be affected by vibration, such as pouring concrete, should be scheduled at times when nearby compaction operations are not taking place.

3. Prior to beginning compaction, soil moisture contents may need to be controlled in order to facilitate proper compaction. If additional moisture is necessary to achieve compaction objectives, then water should be applied in

such a way that it will not cause erosion or removal of the subgrade soils. A moisture content within two (2) percentage points of the optimum indicated by the AASHTO test method T99, method C, is recommended.

4. A Geotechnical Engineer or a representative should be retained to provide on-site observation of earthwork activities. The Geotechnical Engineer or a representative would monitor the excavation of detrimental soil such as organics and plastic soils, placement of approved fills, proofrolling and provide compaction testing. Density tests should be performed in surficial sands after proofrolling and in each fill lift thereafter. It is important that careful observation be made to confirm that the subsurface conditions are as we have discussed herein, and that foundation construction and fill placement is in accordance with our recommendations.

Site Preparation Over Existing Landfill

1. The proposed roadway area within the existing landfill cell, plus a margin of five (5) feet, should be stripped and cleared of existing surface vegetation. In addition, the vent pipes located in the proposed roadway should be rerouted away from the construction area. The proposed roadway area will not require removal of buried organics or other unsuitable material other than the surficial grass due to the nature of the existing soils.

2. The stripped landfill, from the proposed toe of slope to the existing toe of slope, should be covered with a geosynthetic, such as Mirafi (HS-400) or equivalent. The geosynthetic should provide continuous separation between the existing ground and new fill. It should be noted that prior to the placement of the geosynthetic any exposed debris or sharp objects that could tear or damage the geosynthetic should be removed. The geosynthetic will help to distribute over a large area future roadway deformations due to settlement of the landfill debris. The geosynthetic should be placed in accordance with the manufacturers suggested recommendations. It should be noted that the stripped areas over the landfill do not require compaction prior to geosynthetic placement.

3. One (1) eighteen (18) inch thick, loose lift of fill should be placed over the geosynthetic prior to any compaction activities. During fill placement adjacent to the berm slope each fill lift should be tied into the existing slope by benching into the slope at least three (3) feet horizontal for each nine (9) inch lift. With each lift, the previous lift should be scarified to prevent creating a horizontal failure plane.

4. After completion of the initial fill lift, the remaining preparations, including compaction can be performed as outlined in steps 3 through 5 of **"Site Preparation Over Existing Road and Berm"**.

4.3 ACCESS ROAD PAVEMENT CONSIDERATIONS

In general, following the completion of the previously recommended clearing and grading operations, the existing shallow subsurface soils and newly compacted embankment should be acceptable for construction and support of a flexible (limerock base) type pavement section after subgrade preparation, provided drainage controls are implemented. Any fill utilized to elevate the cleared pavement areas to subgrade elevation should consist of reasonably clean (less than 12 percent passing the No. 200 sieve) fine sands uniformly compacted to a minimum density of 95 percent of the soil's modified Proctor maximum dry density.

Since the access road will be constructed well above seasonal high groundwater levels, a granular base, such as Limerock or crushed concrete, should be used. Limerock base material should meet FDOT requirements including compaction to 98 percent of its maximum dry density as determined by the modified Proctor test and a minimum LBR of 100 percent. Crushed concrete should have an LBR value of 100 percent and be graded in accordance with FDOT Standard Specification Section 204.

As a guideline for pavement design, we recommend that the base course be a minimum of eight (8) inches thick. Due to the debris present at the site, we recommend placing a layer of geosynthetic (HS-400 or equivalent) in the middle of the base. Placement of this geosynthetic will help to reduce sharp dips in the roadway due to potential settlement of the underlying debris. The geosynthetic should be placed in accordance with manufacturers suggestion based on its intended purpose. The subgrade below the base should be compacted to a minimum depth of 12 inches to at least 95 percent of the modified Proctor maximum dry density, and should be firm and true to line and grade prior to placement of base. Traffic should not be allowed on the subgrade as the base is placed to avoid rutting.

The asphaltic concrete structural course should consist of at least 2.0 inches of Type S asphaltic concrete material. Type S-I or S-III shall be utilized because of their durability qualities. The asphaltic concrete should meet standard FDOT material requirements and placement procedures as outlined in the current FDOT "Standard Specifications for Road and Bridge Construction". The asphalt should be compacted to a minimum of 96 percent of the Marshall maximum laboratory unit weight.

Actual pavement section thicknesses should be provided by the design civil engineer based on traffic loads, volume, and the owners design life requirements. The above sections represent minimum thicknesses representative of typical local construction practices. Because the proposed road will pass over suspect materials, higher than normal maintenance should be anticipated. All pavement materials and construction procedures should conform to appropriate Manatee County requirements.

4.4 EMBANKMENT CONSTRUCTION

Embankments should be constructed using materials in accordance with the FDOT Standard Index No. 505. This requires the use of soils with AASHTO Classification of A-1, A-3 or A-2-4 in the upper four (4) feet below the bottom of base or asphaltic concrete pavement, while soils with AASHTO Classification of A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, and A-7 (all with liquid limits less than 50) may be used in the lower portions of the embankment.

Clean sand materials (A-3 and A-2-4) can generally be placed in 12 inch loose lifts for the embankment. The A-2-4 soils and other materials with more fines are likely to require drying and placement in thinner lifts. The embankment fill areas should be constructed in accordance with Manatee County requirements.

5.0 GENERAL SITE EVALUATION AND CONSIDERATIONS

5.1 GENERAL

It is recommended that PSI be retained to provide observation and testing of construction activities involved in the foundation, earthwork, and related activities of this project. PSI cannot accept any responsibility for any conditions which deviate from those described in this report, if not engaged to also provide construction observation and testing for this project.

5.2 DRAINAGE AND GROUNDWATER CONCERNS

The groundwater levels presented in this report are the levels that were measured at the time of our field activities. Fluctuation should be anticipated. We recommend that the Contractor determine the actual groundwater levels at the time of the construction to determine groundwater impact on the construction procedure.

Depending upon groundwater levels at the time of construction, some form of dewatering will be required in the plant expansion areas to achieve the required excavation depths and compaction. Groundwater should be kept at least two (2) feet below the lowest working area to ensure a stable working surface and facilitate proper material placement and compaction. Groundwater can normally be controlled in shallow excavations by rim ditching and sump pumping. A standby pump is recommended to maintain constant pumping should the first pump breakdown. Deeper excavations will most likely require a well point system. If necessary, the dewatering system should be designed by an engineer based on the information provided herein and if necessary, full-scale pumping tests prior to construction. The design of the dewatering system was not part of this scope of work.

Water should not be allowed to collect in the foundation excavations, on the floor slab areas, or on prepared subgrades of the construction either during or after construction. Undercut or excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater, groundwater, or surface runoff. Positive site drainage should be provided to reduce infiltration of surface water around the perimeter of the building and surface drainage should be collected and discharged such that water is not permitted to infiltrate the backfill and floor slab areas of the building.

5.3 EXCAVATIONS

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. It is mandated by this federal regulation that excavations, whether they be utility trenches, basement excavations or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced, and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person", as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations.

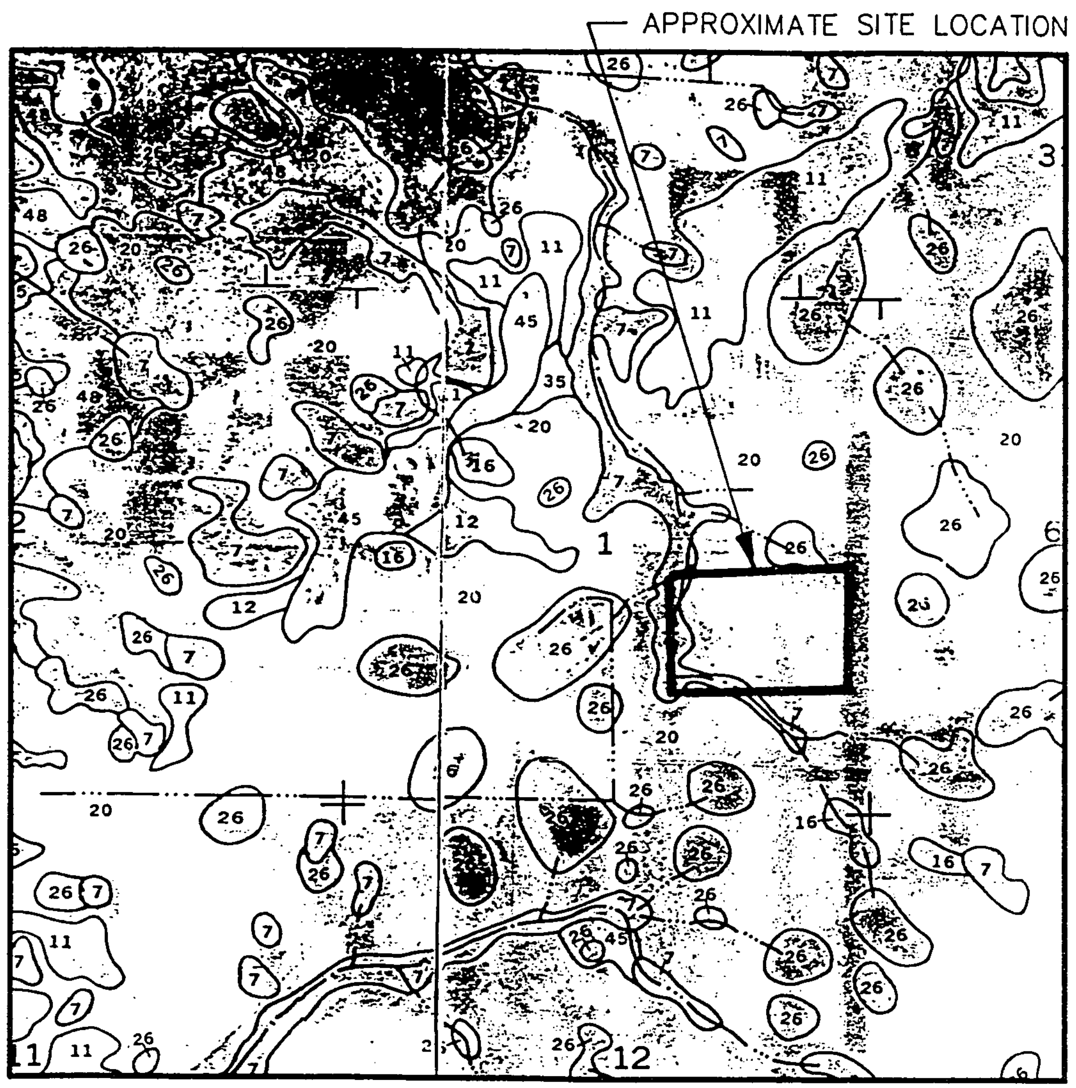
We are providing this information solely as a service to our client. PSI does not assume responsibility for construction site safety or the contractor's or other parties compliance with local, state, and federal safety or other regulations.

6.0 REPORT LIMITATIONS

The recommendations submitted are based on the available subsurface information obtained by PSI and design details furnished by others for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, PSI should be notified immediately to determine if changes in the foundation recommendations are required. If PSI is not retained to perform these functions, PSI will not be responsible for the impact of those conditions on the geotechnical recommendations for this project.

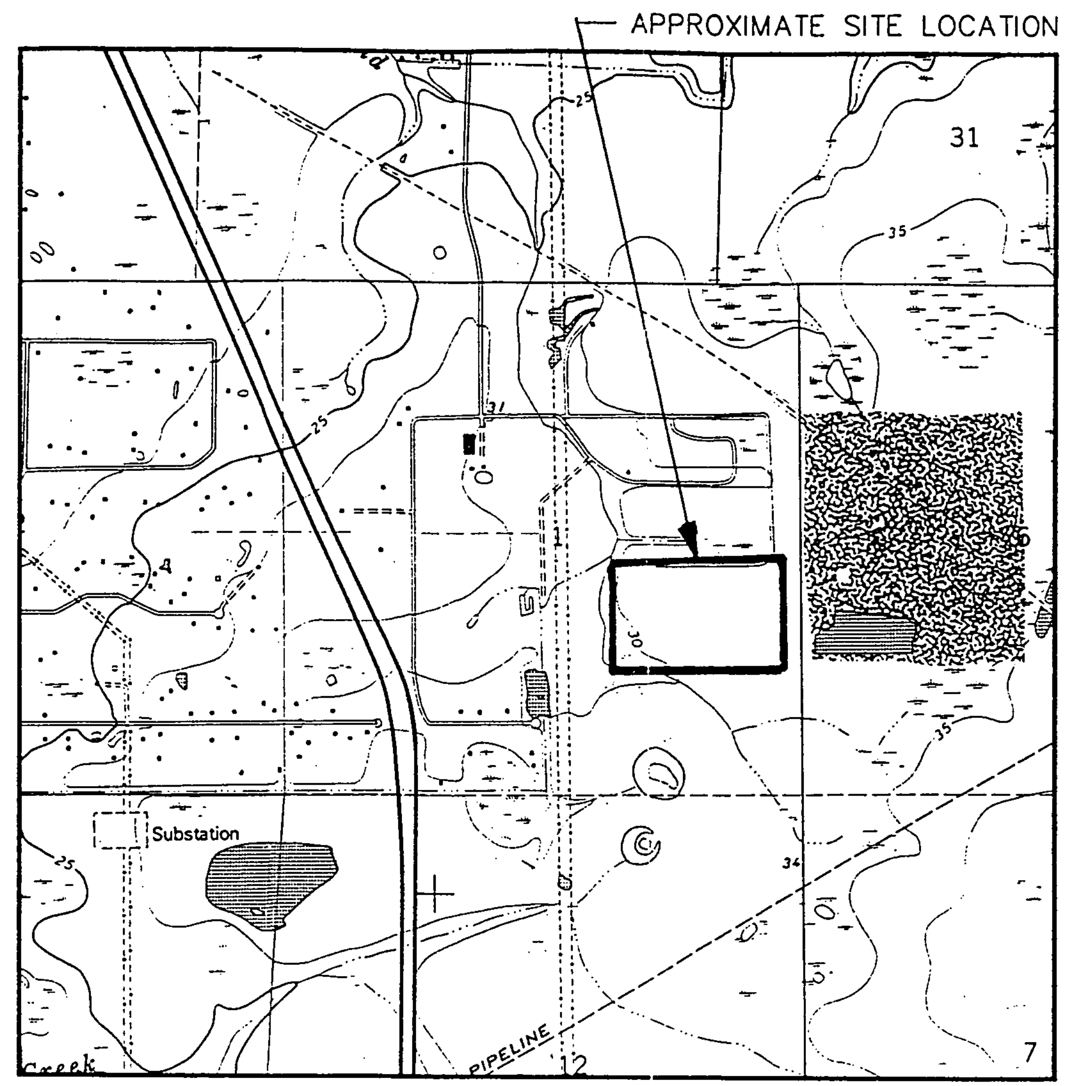
The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At that time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of McKim & Creed, Manatee County and their consultants for the specific application to the proposed Southeast Regional Wastewater Treatment Plant Expansion and access road project in Manatee County, Florida.



REFERENCE: USDA SCS; "SOIL SURVEY OF MANATEE COUNTY, FLORIDA"
TOWNSHIP: 35 SOUTH
RANGE: 18 EAST
SECTION: 1
ISSUED: 1983
PHOTO: 1979
SCALE: 1" = 2000'

USDA VICINITY MAP



REFERENCE: USGS "LORRAINE, FLORIDA" QUADRANGLE MAP
TOWNSHIP: 35 SOUTH
RANGE: 18 EAST
SECTION: 1
ISSUED: 1973
PHOTOREVISED: 1987
SCALE: 1" = 2000'

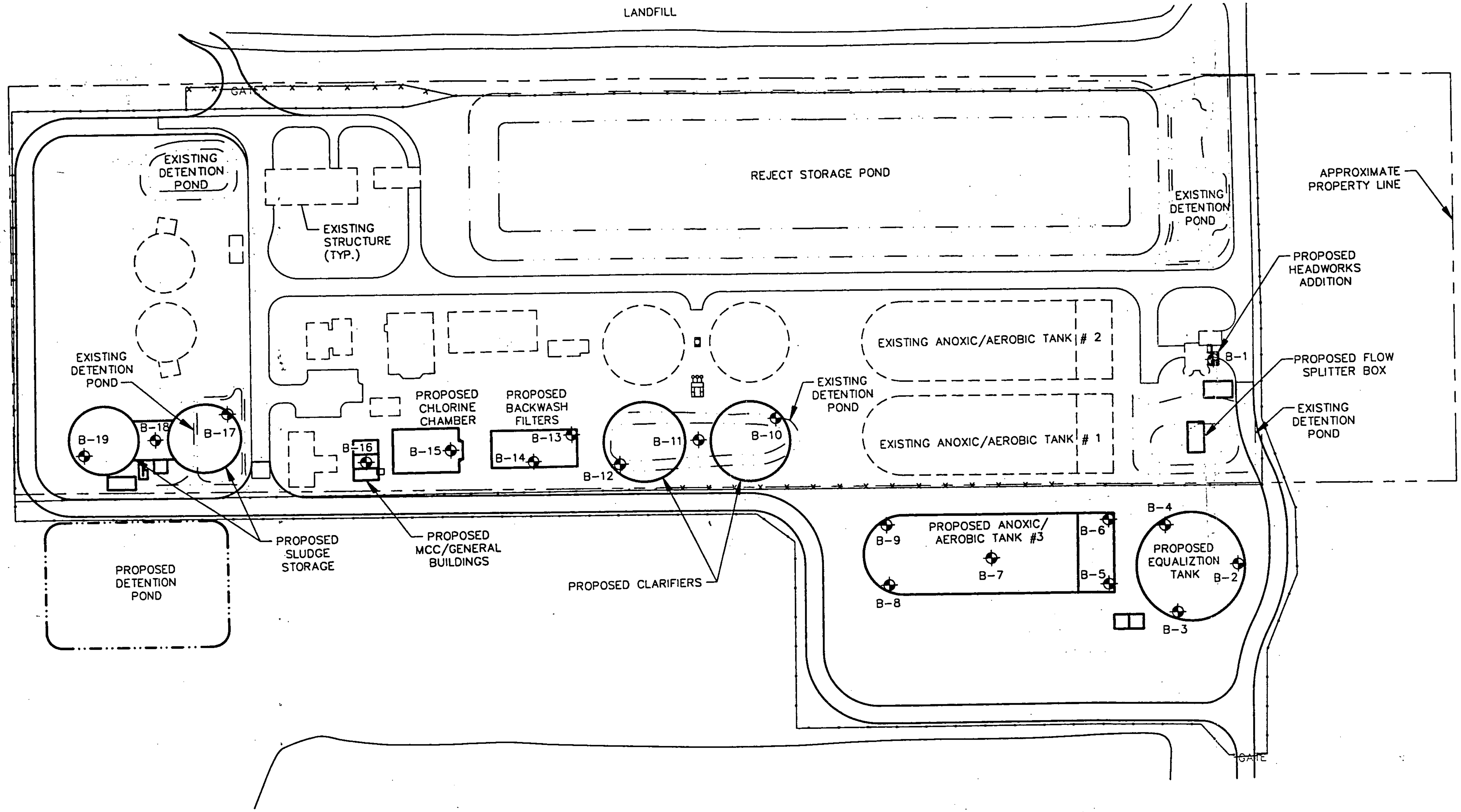
USGS VICINITY MAP

DRAWN	DLW
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

USDA & USGS VICINITY MAPS
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387-85096	SHEET 1



BORING LOCATION PLAN

N

0 150'

PLAN SCALE

LEGEND

⌖ Approximate SPT boring location

DRAWN	KES
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

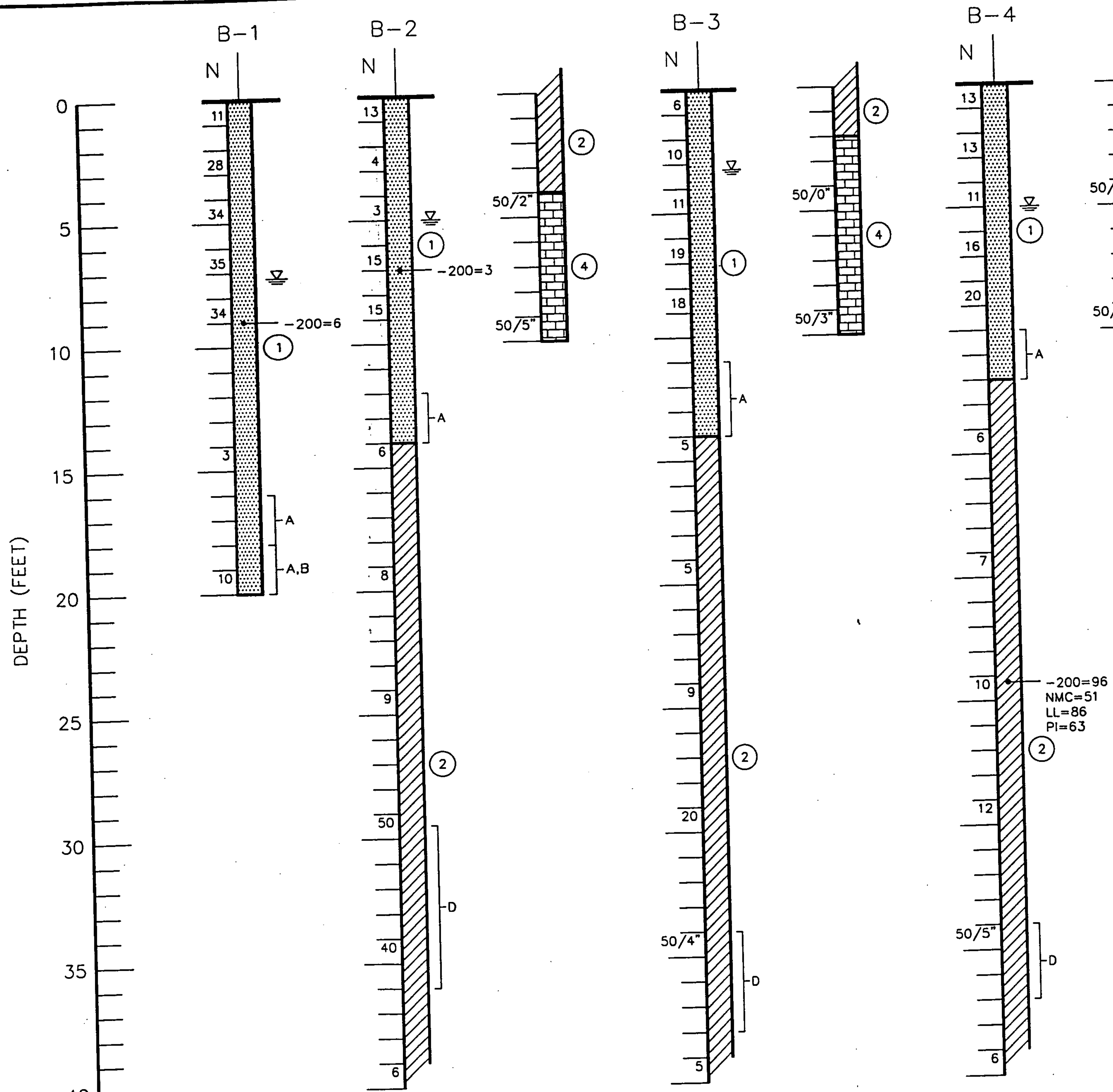
GEOTECHNICAL SERVICES

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387-85096	SHEET 2



LEGEND

(1)	Light to dark gray clean to slightly silty fine SAND (SP/SP-SM)
(2)	Tan/gray/green slightly sandy to silty CLAY (CH)
(3)	Gray clayey fine SAND (SC)
(4)	Highly weathered LIMEROCK with clayey seams
SP	Unified Soil Classification System (ASTM D 2487) group symbol as determined by visual review
∇	Groundwater level, July 1998
N	SPT N-value in blows/foot
50/6"	Fifty blows for six inches
-200	Fines passing No. 200 sieve (%)
NMC	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit (%)
PI	Plasticity Index (%)
A	With phosphatic gravel
B	With broken marine shell
C	Trace organics
D	Indurated

SOIL PROFILES

0 5'

VERTICAL SCALE

DRAWN	KES
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

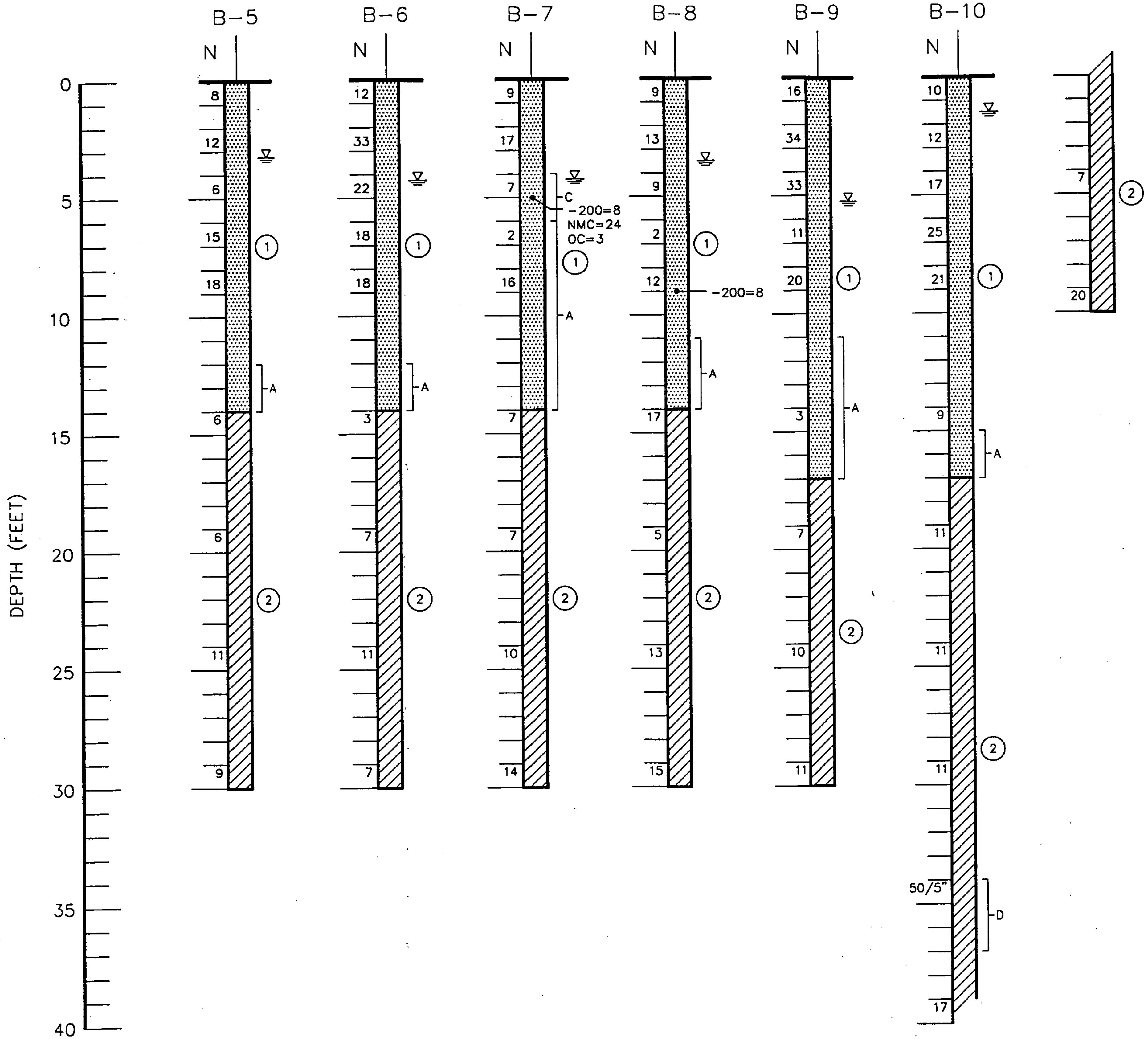
GEOTECHNICAL SERVICES

SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION

MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387-85096	SHEET 3



LEGEND

① Light to dark gray clean to slightly silty fine SAND (SP/SP-SM)

② Tan/gray/green slightly sandy to silty CLAY (CH)

③ Gray clayey fine SAND (SC)

④ Highly weathered LIMEROCK with clayey seams

SP Unified Soil Classification System (ASTM D 2487) group symbol as determined by visual review

Groundwater level, July 1998

N SPT N-value in blows/foot

50/6" Fifty blows for six inches

-200 Fines passing No. 200 sieve (%)

NMC Natural Moisture Content (%)

OC Organic Content (%)

LL Liquid Limit (%)

PI Plasticity Index (%)

A With phosphatic gravel

B With broken marine shell

C Trace organics

D Indurated

SOIL PROFILES

0 5'

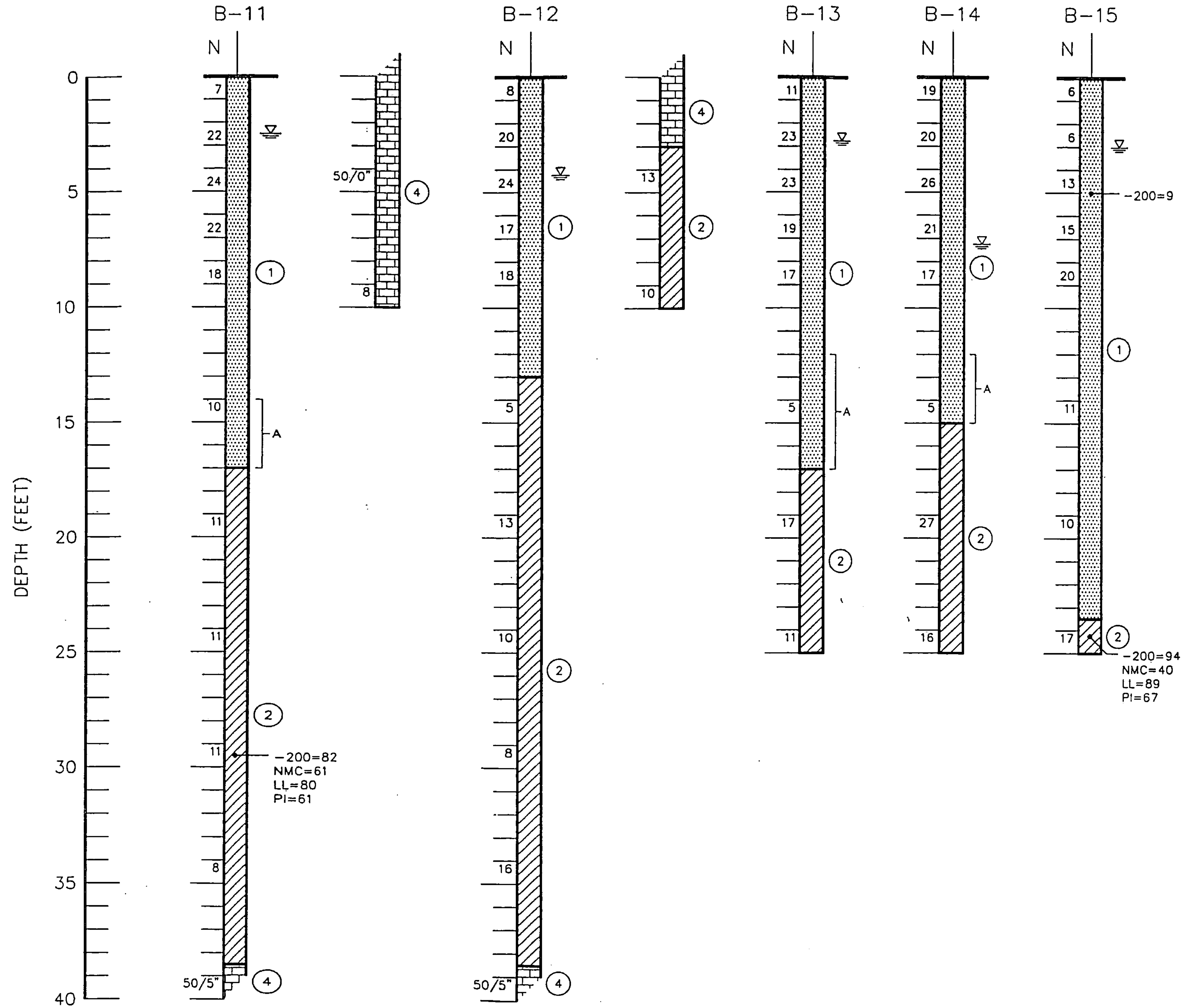
VERTICAL SCALE

DRAWN	KES
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

GEOTECHNICAL SERVICES
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387-85096	SHEET 4



SOIL PROFILES

0 5'
VERTICAL SCALE

LEGEND

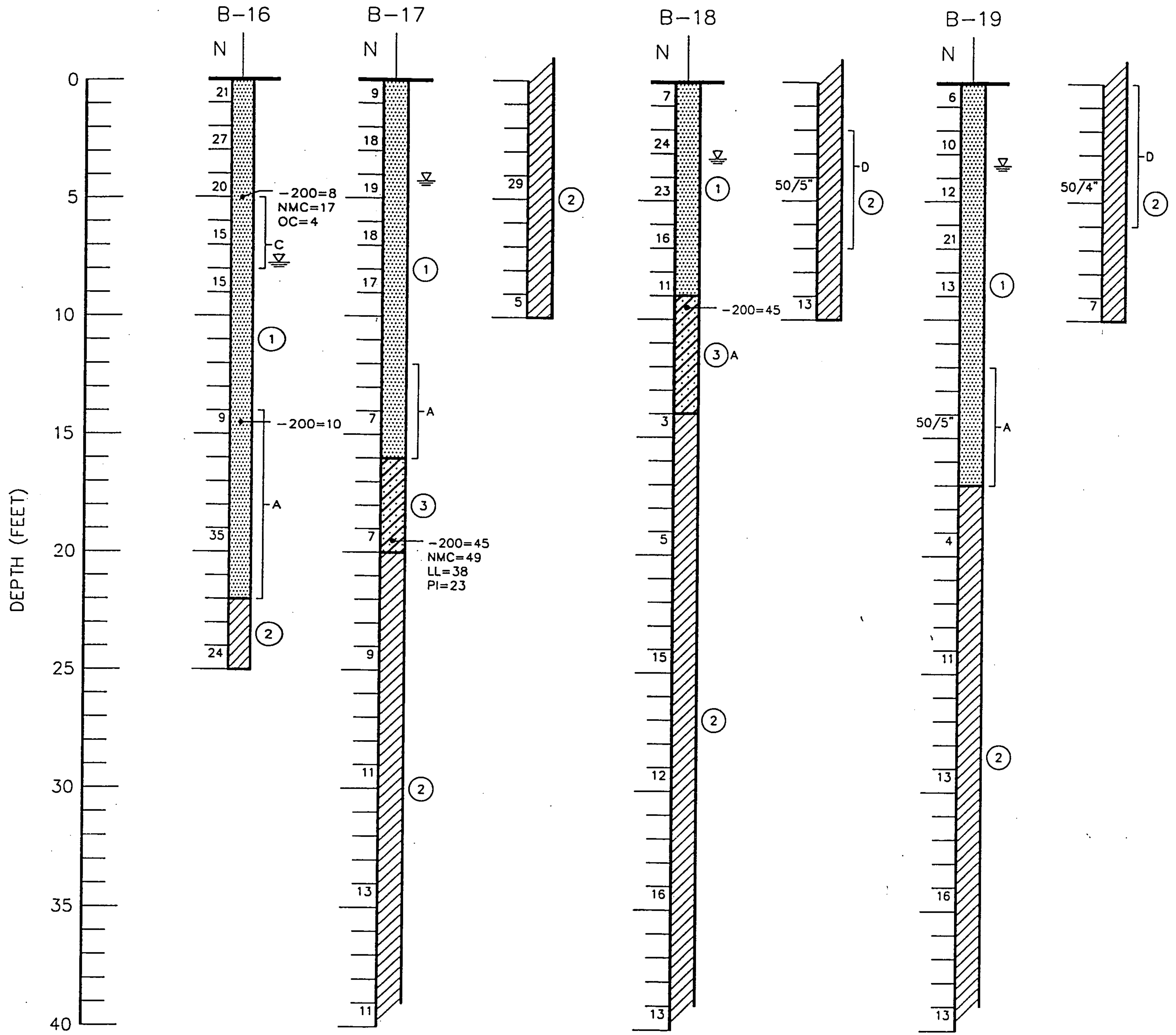
(1)	Light to dark gray clean to slightly silty fine SAND (SP/SP−SM)
(2)	Tan/gray/green slightly sandy to silty CLAY (CH)
(3)	Gray clayey fine SAND (SC)
(4)	Highly weathered LIMEROCK with clayey seams
SP	Unified Soil Classification System (ASTM D 2487) group symbol as determined by visual review
▽	Groundwater level, July 1998
N	SPT N−value in blows/foot
50/6"	Fifty blows for six inches
−200	Fines passing No. 200 sieve (%)
NMC	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit (%)
PI	Plasticity Index (%)
A	With phosphatic gravel
B	With broken marine shell
C	Trace organics
D	Indurated

DRAWN	KES
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

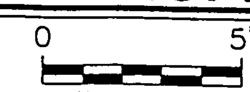
GEOTECHNICAL SERVICES
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387−85096	SHEET 5



SOIL PROFILES



LEGEND

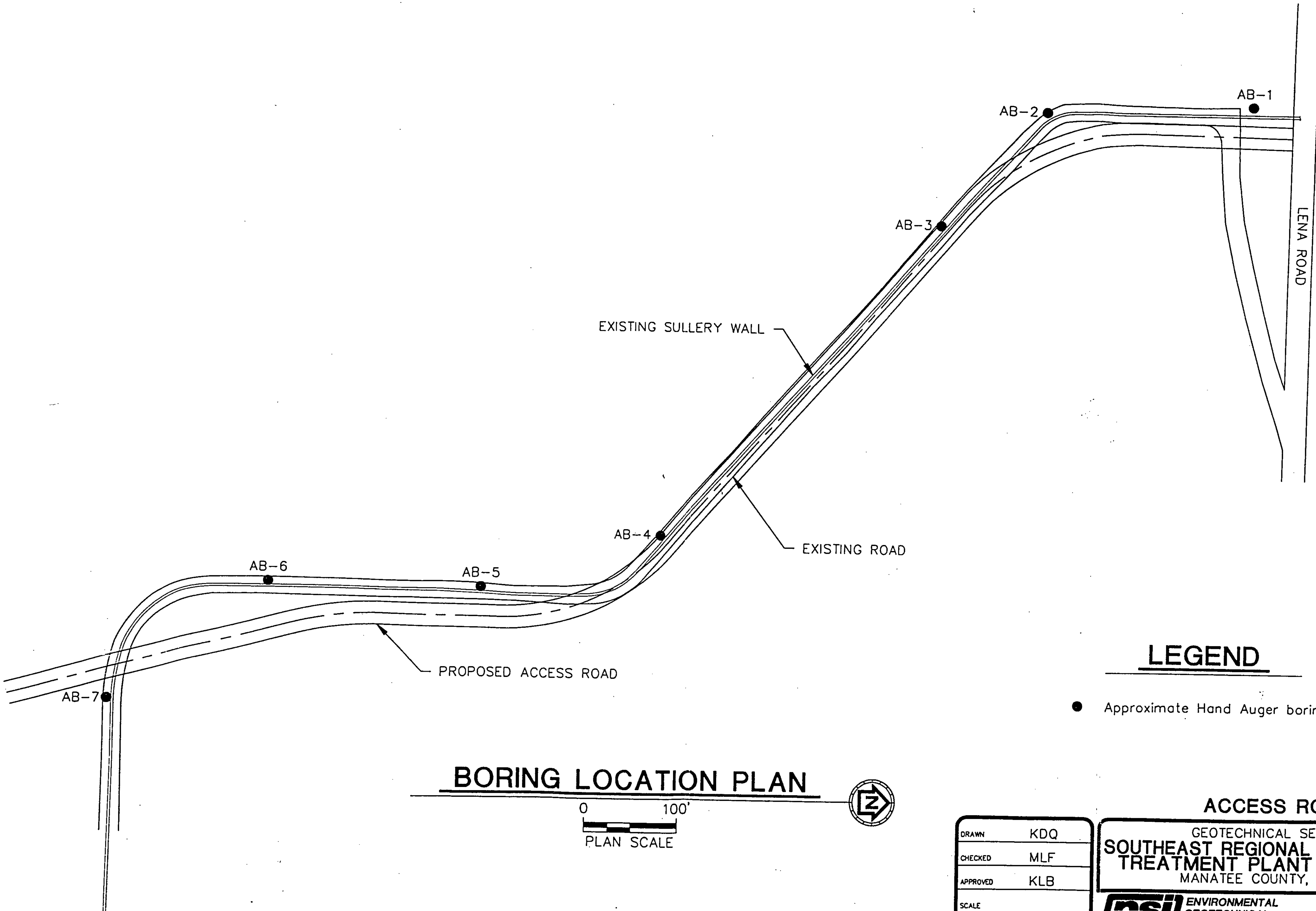
(1)	Light to dark gray clean to slightly silty fine SAND (SP/SP-SM)
(2)	Tan/gray/green slightly sandy to silty CLAY (CH)
(3)	Gray clayey fine SAND (SC)
(4)	Highly weathered LIMEROCK with clayey seams
SP	Unified Soil Classification System (ASTM D 2487) group symbol as determined by visual review
▽	Groundwater level, July 1998
N	SPT N-value in blows/foot
50/6"	Fifty blows for six inches
-200	Fines passing No. 200 sieve (%)
NMC	Natural Moisture Content (%)
OC	Organic Content (%)
LL	Liquid Limit (%)
PI	Plasticity Index (%)
A	With phosphatic gravel
B	With broken marine shell
C	Trace organics
D	Indurated

DRAWN	KES
CHECKED	MTJ
APPROVED	MTJ
SCALE	NOTED

GEOTECHNICAL SERVICES
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
JULY 98	387-85096	SHEET 6



LEGEND

● Approximate Hand Auger boring location

BORING LOCATION PLAN

0 100'
PLAN SCALE

N

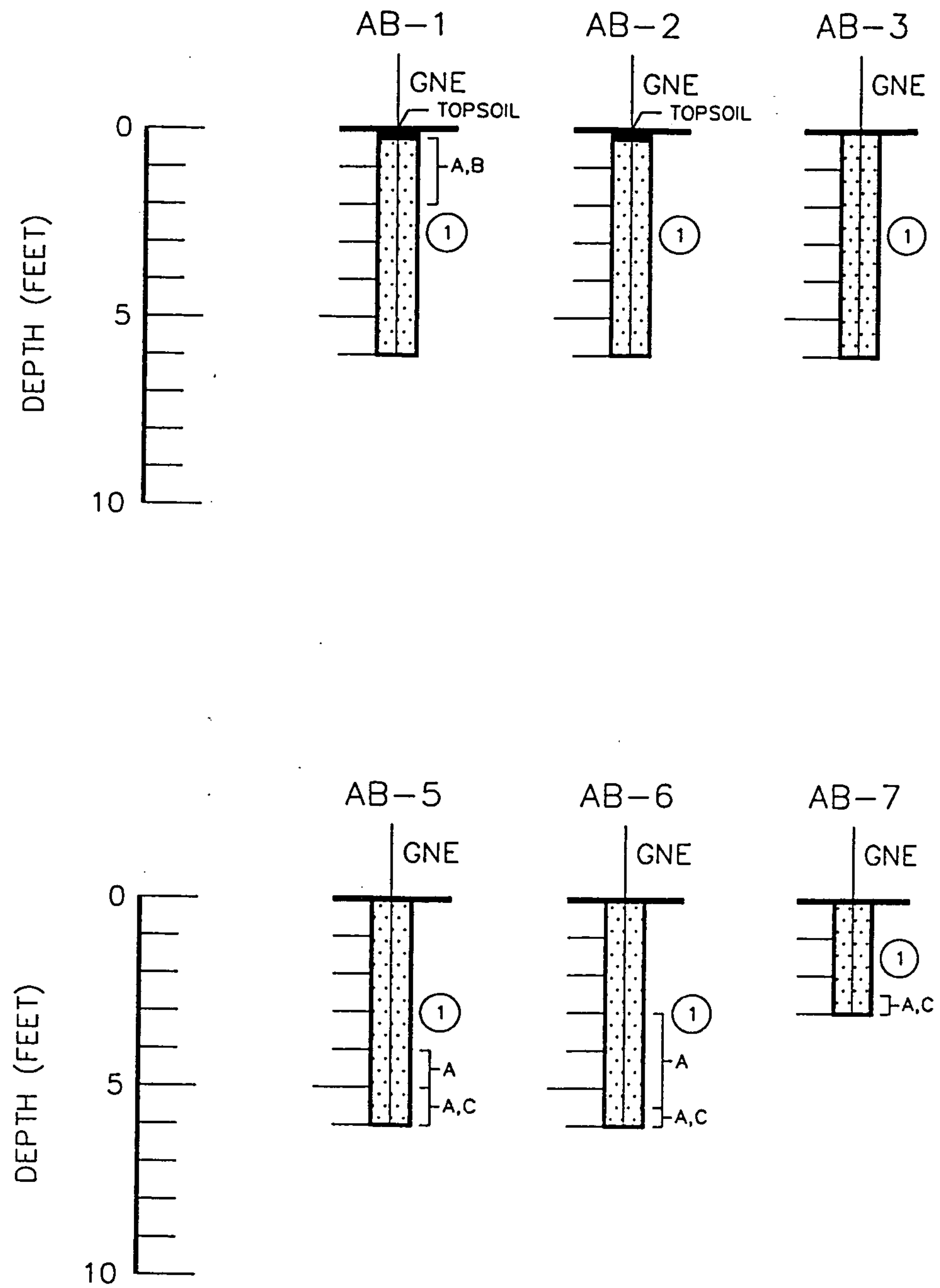
ACCESS ROAD

DRAWN	KDQ
CHECKED	MLF
APPROVED	KLB
SCALE	NOTED

GEOTECHNICAL SERVICES
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

psi ENVIRONMENTAL GEOTECHNICAL CONSTRUCTION

DATE	PROJ. NO.	
NOV 98	387-85096	SHEET 7



SOIL PROFILES

0 5'
VERTICAL SCALE

LEGEND

(1)	Light to dark brown clean slightly silty SAND (A-3) Fill material
A-3	AASHTO group symbol as determined by visual review
GNE	Groundwater level not encountered
A	With rock fragments
B	With trace asphalt
C	With trace clay

DRAWN	KDQ
CHECKED	MLF
APPROVED	KLB
SCALE	NOTED

GEOTECHNICAL SERVICES
SOUTHEAST REGIONAL WASTEWATER TREATMENT PLANT EXPANSION
MANATEE COUNTY, FLORIDA

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DATE	PROJ. NO.	
NOV 98	387-85096	SHEET 8