/DB

AGI
TECHNOLOGIES

Geotechnical Design Recommendations
Phase 1 Embankment Construction
Third Runway Project
Sea-Tac International Airport
Seatac, Washington

January 22, 1998

Prepared For :

HNTB Corporation
600 108th Avenue N.E., Suite 400
Bellevue, Washington 98004

AGI Project No. 14,190.211

AGI TECHNOLOGIES

A Report Prepared For :

HNTB Corporation
600 108th Avenue N.E., Suite 400
Bellevue, Washington 98004

GEOTECHNICAL DESIGN RECOMMENDATIONS
PHASE 1 EMBANKMENT CONSTRUCTION
THIRD RUNWAY PROJECT
SEA-TAC INTERNATIONAL AIRPORT
SEATAC, WASHINGTON

January 22, 1998

Dean M. White, P.E.
Associate Engineer

EXPIRES 11-11-99

John E. Newby, P.E.
President

AGI Technologies
11811 N.E. 1st Street
Suite 201
Bellevue, Washington 98005
425/453-8383

AGI Project No. 14,190.211.01

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

EXECUTIVE SUMMARY

AGI Technologies has completed geotechnical investigations and design recommendations for the 1998 Phase 1 Embankment Construction, an earthwork project associated with the construction of the third dependent runway at the Seattle-Tacoma International Airport (Sea-Tac). This report presents a discussion of the overall project, summarizes previous design reports, and provides the geotechnical recommendations for construction of the 1998 fill.

The Phase 1 embankment will consist of approximately 1,000,000 cubic yards of fill placed along the northern 1,100 feet of the existing west side runway embankment. The fill will be placed adjacent to and benched into the existing embankment. It will have a maximum thickness of 70 feet with a maximum slope height of approximately 90 feet.

Geotechnical explorations performed over the last 7 years have been used to characterize the area of the fill. The majority of the fill will be founded on dense Glacial Till, which should provide a firm foundation for the fill. We anticipate the removal of relatively minor amounts of unsuitable materials prior to placement of the embankment fill materials. The timing of the project, presence of a near-surface perched aquifer, and the moisture-sensitive nature of the Glacial Till will provide challenges to the contractor during initial stages of construction. A drainage blanket of clean, granular fill will be placed first across the entire area to mitigate the anticipated difficulties.

The embankment will be constructed as a zoned fill, with higher quality fills beneath the anticipated taxiway and runway alignments and lesser quality fills in the infield areas. Detailed discussion of the design concepts and our recommendations for the embankment construction are presented in the report. Slopes are considered temporary and will be constructed with 2:1 face slopes and sufficient subgrade preparation to achieve a factor of safety against sliding failure of 1.30. The magnitude of settlements will primarily depend on the embankment thickness and the compaction density and moisture content achieved by the contractor. The majority of the settlements are anticipated to take place relatively immediately. Settlement monitoring and fill quality control programs are recommended.

1.0 INTRODUCTION

1.1 BACKGROUND

This report presents AGI Technologies' (AGI) geotechnical recommendations for design and construction of the first phase of embankment construction (Phase 1 Embankment Construction) for the new third runway at Seattle-Tacoma International Airport (Sea-Tac). AGI's geotechnical engineering services are being provided to HNTB Corporation in support of engineering design studies they are conducting on behalf of the Port of Seattle (the Port).

AGI's geotechnical studies for the new runway project began in 1993. This report summarizes only the information specific to design and construction of the Phase 1 Embankment. A more complete understanding of the project's geotechnical background can be obtained by reviewing other reports we have produced to date (AGI, 1994a,b; 1995a,b; 1996a,b, c).

1.2 PROJECT DESCRIPTION

1.2.1 *Overview*

The new runway project includes an 8,500-foot-long by 150-foot-wide runway on Port of Seattle grid line E 11,300; a 100-foot parallel taxiway on grid line E 12,400; and associated interconnecting taxiways.[1] The north end of the proposed runway will align with the existing runway north threshold (N 20,850) and will be at about Elevation 411 feet. The south threshold will be at about Elevation 353 feet.[2]

The north and south runway threshold safety areas will be 1,000 feet long. The east and west safety areas will extend 250 feet from the runway centerline. There will be a 40-foot-wide perimeter access road with centerline 285 feet west of the planned runway centerline.

The runway and taxiways will be 150 feet and 100 feet wide, respectively. They will all have 35-foot-wide shoulders. The preliminary design concept includes an 18-inch-thick Portland cement concrete aircraft pavement and 18-inch-thick asphalt concrete shoulders, all underlain by 8 inches of crushed rock base.

Construction of the new third runway will involve a substantial amount of earthwork to achieve proposed grades for the runway, taxiways, and associated safety areas. The total fill quantity could be up to 15 million cubic yards. Total fill thickness will range up to about 160 feet. More typically,

---

[1] The Port of Seattle grid at Sea-Tac is oriented with north-south coordinates parallel to the existing runways. The existing Runway 16R/34L centerline is at E 13,000.

[2] Elevations in this report refer to 1929 NGVD datum.

the embankment will range between about 30 and 100 feet in height. As such, embankment construction will constitute one of the most significant earthwork projects in the Puget Sound region.

A large portion of the total fill for the new runway project will be placed in the main embankment area shown on **Figure 1**. Another large volume of fill will be placed to the north for the north safety area.

1.2.2 *Phase 1 Embankment*

The Phase 1 Embankment comprises a portion (about 1,000,000 cubic yards) of the main embankment situated as shown on **Figure 1**. The new fill will be constructed adjacent to and be benched into the existing fill to the west of Runway 16R/34L. The top of the Phase 1 Embankment fill will be at about Elevation 416 at the top of the new slope and will slope back east toward the existing fill at a 2 percent grade. The maximum fill thickness will be about 70 feet and the maximum slope height will be about 90 feet.

The Phase 1 Embankment is being considered a prototype for design and construction of other phases of the embankment. From a geotechnical-engineering standpoint, we are considering it a test fill.

1.3 SUBSURFACE EXPLORATIONS

We have performed numerous subsurface explorations in the main embankment area to date. The location of test borings and test pits by AGI and others in this area are listed in **Table 1** and shown on **Figure 1**. A detailed explanation of site geology and field exploration (along with exploration logs) and laboratory testing is provided in **Appendices A** and **B**, respectively.

2.0 SITE CONDITIONS

2.1 SURFACE

Surface conditions near the Phase 1 Embankment include an overgrowth of bushes and shrubs with both deciduous and evergreen trees. The site slopes generally westward to 12th Avenue South at about 8:1 (horizontal:vertical) with the exception of the existing embankment fill slope of approximately 2:1. Several unimproved roads, as well as a paved perimeter road, provide access to the site. Mounds of fill debris exist at a couple of locations in the main embankment area; however, they are generally south of the Phase 1 Embankment. Within the Phase 1 Embankment, areas of minor fill debris were encountered at previous home locations. Fill debris in this area consists of old concrete foundations, regraded soils, drain fields, and abandoned utilities. Home heating oil tanks and/or septic tanks may be uncovered during site preparation.

Several swales cross the site, predominantly on the southern half of the fill site at approximate gridlines N 18,500 and N 18,700. Flowing water was noted in the swales and seepage from the hillside was observed in isolated areas across the site. Ponded water was noted at a number of locations along the access road at the bottom (toe) of the existing embankment (approximate gridline at E 11,750).

A 36-inch City of Seattle water main crosses the site in an east-west direction at South 160th Street (approximate Grid N 19,300) and services the airport. An 8-inch lateral from this water main trends north-south and provides water at fire hydrants along an old perimeter fence line (E 11,750).

Based on available information, we understand that the 36-inch line is the only active line at this time. AGI reviewed plans for the water main, and supplemented that information by excavating five test pits to expose the line at a number of locations. Based on this information, we understand that the water main is constructed primarily of concrete cylinder pipe and has from 2.0 to 13.0 feet of soil cover in the area of the proposed 1998 fill.

2.2 SUBSURFACE CONDITIONS

2.2.1 *General*

The Phase 1 Embankment area is typically underlain by Glacial Till. To the west, it is covered with thin patches of Recessional Outwash and/or Colluvium. Soft, wet Colluvium can be present in the swales; however, most of the deeper swales and soft Colluvium deposits are located south of the Phase 1 Embankment. Underlying the Glacial Till is an Advance Outwash, which is in turn underlain by Pre-Vashon Drift.

The following paragraphs provide a brief summary of soil deposits encountered in the Phase 1 Embankment area. A description of the Sea-Tac area geology and geologic deposits is presented in

Appendix A, along with details of the materials encountered at each boring location on the boring logs. Simplified east-west cross sections through the main embankment area are presented on Figure 2. The N 20,000 cross section on Figure 2 is at approximately the center of the Phase 1 Embankment.

2.2.2 *Artificial Fill*

Artificial Fill occurs as the existing runway embankment along the east side of the Phase 1 Embankment area. Although most of the fill in the existing runway area appears to have been obtained during grading of portions of the airfield originally underlain by Till, large portions of the Fill adjacent to the Phase 1 Embankment appear to be derived from onsite Outwash or possibly imported sand and gravel fill from offsite sources.

Based on observations during site exploration and laboratory test results, it is apparent that, in general, the fill is medium dense to very dense in place and characterized by moderate to high strength and low compressibility. In-situ moisture contents are at or slightly above optimum based on comparison of moisture-density tests and compaction tests of bulk samples obtained during exploration. Densities in the upper 10 feet in the runway and taxiway areas are in the range of 94 to 97 percent compaction (based on ASTM D-1557 test procedure).

2.2.3 *Topsoil*

Topsoil, a deposit of organic rich soil, was found at the ground surface over a large portion of the main embankment area. We estimate that the average depth of topsoil in the Phase 1 Embankment area will be 6 to 8 inches. Previously developed areas have little or no Topsoil, but the more heavily vegetated depressions may have Topsoil between 12 and 18 inches thick.

2.2.4 *Recessional Outwash*

A thin layer of Recessional Outwash was encountered immediately west of the Phase 1 Embankment area. This unit generally comprises glaciofluvial sand and gravel with glacio-lacustrine fine silty sand overlying Till and partly filling depressions and former glacial channels. The predominant soil type is medium sand with localized deposits of coarse sand and gravel.

2.2.5 *Till*

A 20- to 40-foot-thick layer of Till underlies the entire Phase 1 Embankment area. Till encountered in our borings comprises a predominantly unsorted mixture of sand, silt, and gravel. It is cemented and highly compacted (often referred to as 'hardpan'). It is also likely to contain occasional boulders. Till is moderately to highly moisture sensitive because of its high fines content, which makes it difficult to work and compact when wet. The upper portion of the Till is weathered and less dense. Weathered Till encountered in our test borings is generally less than 5 feet thick.

2.2.6 *Advance Outwash*

Advance Outwash was encountered under the Till in our test borings. It typically comprises sand, silty sand, and gravel. Pockets of sandy silt with varying amounts of gravel occur within the deposit. Advance Outwash has been glacially overridden and is dense to very dense.

2.2.7 *Pre-Vashon Drift*

The Pre-Vashon Drift was encountered beneath the Advance Outwash and consists primarily of fine-grained lacustrine silts. Because it has been glacially overridden, it is also very dense or hard.

2.3 GROUNDWATER

2.3.1 *Perched Aquifer*

Two primary occurrences of groundwater are of concern in design of the main embankment. One is the existing and/or future aquifer perched on Glacial Till and the other is the aquifer in the Advance Outwash that is partially confined by the Glacial Till.

Groundwater occurs on the site as a perched aquifer in shallow deposits of shallow fill, Recessional Outwash, colluvium, topsoil, and weathered till over the Glacial Till. It is primarily recharged by surface precipitation on the site. Where fills have been placed for airport construction, this perched aquifer has become an unconfined aquifer in the fill that is recharged by surface infiltration in the unpaved airport area. The existing fill aquifer emerges at the toe of slope as seeps and springs. The seepage either recharges the perched aquifer below the toe of existing fill or moves down slope as surface water in swales in the surface topography.

Once the new runway is completed, the perched aquifer will become a fill aquifer within the main embankment. It will be recharged by surface infiltration over a large area of new and existing infield. Although it may take several years for this aquifer to fully develop after construction, it will eventually become a significant source of seepage flows and possibly pore pressures under the embankment.

2.3.2 *Confined Aquifer*

Groundwater occurs on the site as a confined aquifer in the Advance Outwash underlying the Glacial Till and on top of the Pre-Vashon Drift. It is recharged on the airport site by surface water infiltration where the Glacial Till was not present or was removed by grading. It is probably also recharged from areas outside the airport. Groundwater from the confined aquifer emerges as seepage or springs on the slope where the Glacial Till cap is thin or not present. These locations are generally to the south of the Phase 1 Embankment area. Artesian flow occurs from one well located approximately 1,000 feet south of the Phase 1 Embankment. The confined aquifer is the source of a large proportion of

streamflows in the deeper drainage swales between N 17,500 and N 19,000. It contributes to the wetlands located in these areas. Ultimately the confined aquifer discharges to Miller Creek.

For design of the remainder of the main embankment, interception and drainage of the seepage and springs from the confined aquifer at embankment subgrade will be a key factor for slope stability.

2.3.3 *Piezometers*

A number of test borings in the vicinity of the Phase 1 Embankment area were completed as piezometers. **Table 2** presents a summary of recent water levels at these locations.

3.0 DESIGN CONCEPTS

3.1 INTRODUCTION

This section outlines design objectives and criteria that guided our geotechnical engineering services. We have also included a general discussion on the essential design concept of embankment fill zonation. This report presents our conclusions and recommendations specifically for the Phase 1 Embankment, but design objectives for the entire main embankment have also been considered, given the fact that the Phase 1 Embankment is the prototype for later embankment construction.

3.2 EMBANKMENT ZONATION

We recommend that fill zonation be used to produce an optimized embankment comprised of fill placed with sufficient compactive effort so that overall embankment strength, compressibility, subgrade strength and compressibility, and long-term fill settlement are acceptable. A typical section illustrating the future fill embankment geometry and our recommended embankment fill zones are shown on **Figure 3**. The zones are described as follows.

Zone A

The purpose of Zone A is to provide a uniform, high modulus subgrade on which to construct high performance pavements. We recommend that this high strength and low compressibility zone be included to a depth of 5 feet below the runway and taxiway pavement (full-strength and shoulder) and base course. Consistent, high relative compaction levels should be achieved in Zone A; therefore, this zone should comprise good quality Import Select Fill.

The Phase 1 Embankment does not include any Zone A.

Zone B

The purpose of Zone B is to limit fill settlement to meet total and differential settlement criteria under the runway and taxiways. We recommend that this moderate strength and low compressibility zone be included within an envelope contained inside a 45-degree line extending down and outward from the edge of the full-strength pavement. Embankment fill materials in Zone B should be better quality imported fill materials and should be compacted within a controlled range of moisture content to moderate to high relative compaction levels.

The Phase 1 Embankment is comprised of about 40 percent Zone B, primarily under taxiways.

Better quality fill materials will also be required within the reinforced zone for stabilized earth slopes. Because there are no reinforced slopes in the Phase 1 Embankment, there is no Zone B requirement for reinforcing.

Zone C

The purpose of Zone C is to provide an opportunity to save embankment cost by incorporating a wider variety of available fill materials in areas of the embankment where lower strength and higher compressibility are acceptable. Zone C is all areas of the embankment not reserved for the other zones. The majority is in the infill zones of the embankment, which lie between the runway and taxiway fill zones. More variable compaction moisture content and low to moderate compaction effort can be used for embankment fill materials within Zone C.

The Phase 1 Embankment includes about 55 percent Zone C.

Zone D

The purpose of Zone D is to provide a limited area within the Zone C embankment where topsoil and overexcavated unsuitable materials could be placed at the contractor's option to save cost. This zone will settle more than other parts of the embankment and will have low strength. It is limited to the upper portion of the fill, has a maximum thickness of 20 feet, and is covered with a minimum 5 feet of Zone C to provide a firm layer for utilities and vehicle traffic. We further recommend that the organic content of Zone D be limited to less than 35 percent. Blending of topsoil and other fill material may be required to meet this limitation.

The Phase 1 Embankment may include as much as 5 percent Zone D.

3.3 SETTLEMENT

3.3.1 *Criteria*

Differential settlement of the runway pavement must be limited to a maximum of 1/2 inch in 50 feet, based on roughness criteria for aircraft takeoff or landing.

Total and differential settlement of the deep fill embankment is an essential design consideration. Because of the maximum 160-foot thickness of fill required to establish runway grades, total settlement of the embankment fill will be significant. In areas where the transition from shallow to deep fill areas occurs over short distances, particularly between N 17,050 and N 17,950, differential settlement could be significant.

Settlement of embankment fill supported on competent native soils is generally proportional to fill thickness. This settlement may result from several different mechanisms that will occur over different periods in the life of the embankment. The mechanisms are described in our previous reports and are summarized in the following sections.

3.3.2 *Foundation Settlement*

Settlement of the underlying native soils will occur as a result of surcharge pressures exerted by the embankment fill. Over the majority of the main embankment area, which is underlain by Recessional Outwash or Glacial Till, this settlement will be limited primarily to elastic compression occurring during placement of the embankment fill. The amount of elastic compression in glacially consolidated foundation soil is estimated to be less than 6 inches for the maximum 160-foot embankment height.

Additional foundation settlement will occur if topsoil is left in place. Due to the limited thickness of the topsoil compared to the embankment thickness and the fact that it will compress quickly under the high embankment loads, the impact on long-term settlement of leaving topsoil in place is limited even if future organic decomposition takes place. However, stability considerations may preclude leaving topsoil in place in much of the Phase 1 Embankment area, as discussed subsequently.

Significant post-placement fill settlement could occur due to consolidation of soft silt layers (Colluvium or Recessional Outwash silt) in the base of the swales along the alignment. These soft, compressible soils do not exist in appreciable amounts in the Phase 1 Embankment area. They do occur to the south in the area of greatest differential fill thickness. For later phases of embankment design, we recommended that consideration be given to partial or full overexcavation of soft compressible soils in areas underlying the runway and taxiways.

3.3.3 *Consolidation Settlement*

Settlement of the embankment material will also occur during and after fill placement due to self-weight. Where the embankment fill materials will be granular in nature, we expect this settlement will occur relatively quickly and phasing of runway construction can allow time for the majority to occur. Therefore, while consolidation settlement will be significant in deep fill areas, it should not affect the planned runway or taxiways other than consideration in estimating earthwork quantities. If fine-grained fill materials are used outside the runway and taxiway areas, a significant proportion of the consolidation settlement could occur following paving.

The amount of consolidation can vary from about 0.2 to 1.5 percent (1/4 inch to 1-3/4 inch per 10-foot thickness) for well-compacted fills. The lower end of the range is typical of very well compacted, well graded, granular fill materials, and the upper end is typical for well compacted, predominately fine-grained fill materials. Poorly compacted or highly organic fills can settle 4 to 10 percent (5 inches to 12 inches per 10-foot thickness, or more).

3.3.4 *Creep Settlement*

Creep settlement is a long-term process that occurs under conditions of constant stress (overburden pressure) and moisture content. The majority of creep settlement typically occurs within the first few years following fill placement. It is a result of gradual rearrangement of the material fragments due

to failure of the contact points between fragments. The magnitude of creep settlement correlates well with percentage air voids in the fill, which is a function of the relative compaction of the material and moisture content. Typical values of strain due to creep settlement for well compacted fills range between about 0.1 and 0.2 percent of fill thickness, corresponding to about 1/8 to 1/4 inch of settlement per 10 feet of embankment thickness. Creep strains for poorly compacted fills can be more than twice this range.

3.3.5 *Inundation Settlement*

Inundation settlement occurs as a result of increased moisture content of the fill. Inundation settlements are rapid in cases where the moisture content increase occurs quickly (for example, where groundwater level recovery takes place and inundates a fill on cessation of dewatering used to maintain a lower groundwater level during fill placement). Inundation settlement also occurs from the surface due to infiltration of precipitation. This process can occur over an extended period, particularly where soil permeability is relatively low, fill thickness is high, and the fill surface is covered by pavement.

Based on evaluation of soil moisture/density data from Boring B5-93, B1-96, and B8-96 drilled from on top of an unpaved portion of the existing airfield embankment, inundation by infiltration has apparently extended completely through the existing fill since embankment construction.

Fills particularly susceptible to inundation settlement are those placed with a high percent air void and low moisture content. Inundation strains for well-compacted fills are typically less than about 0.4 percent. This corresponds to about 1/2 inch of settlement per 10 feet of embankment thickness. Poorly compacted fills can exhibit inundation strains of 1.5 percent, corresponding to about 2 inches of settlement per 10 feet of embankment thickness.

Controlling the soil moisture content during fill placement can be used to reduce post-placement settlement due to inundation. There is a range of soil moisture content on either side of the optimum moisture content where it is possible to achieve a specified relative compaction given the same compactive effort. If the soil moisture is carefully controlled within the wet of optimum range, moderate relative compaction should be consistently achievable. The advantage of compacting wet of optimum is that on completion, the soil will be near complete saturation; therefore, increases in moisture content due to subsequent inundation will be minor. Accordingly, post-placement settlement due to inundation will be less. The main disadvantage in compacting wet of optimum is the moderate to high moisture sensitivity of most of the onsite soils, particularly fill derived from Glacial Till. It will be difficult to adequately control moisture of the onsite soils during the wetter winter months. If the material becomes too wet, it will generally not be practical to dry it back by aeration and scarification during the winter.

3.4 STABILITY

3.4.1 *Criteria*

The final embankment slopes should have a minimum factor of safety for slope stability of at least 1.50 for static conditions and at least 1.15 for the maximum design earthquake. Interim slopes should provide nearly the same factors of safety, but lower factors may be used if a higher risk of failure of the temporary slope can be accepted by the Port. Individual elements of the reinforced slopes and/or retaining walls associated with the final embankment configuration will have higher safety factors.

3.4.2 *Options*

For the final embankment slopes, we recommended that several options be considered including unreinforced slopes, reinforced earth slopes, reinforced (mechanically stabilized) earth walls, and other structural walls. The primary purpose for considering options is the potential for significant reduction in fill material volumes. The impact of the various slope options is illustrated on Figure 4. In some areas, steeper slope options will be required to limit encroachment of the fill into adjacent areas such as roads and wetlands.

The Phase 1 Embankment does not include any final embankment slopes. The interim slopes are designed as unreinforced earth slopes at a moderate inclination primarily to allow a wide range of embankment materials and limit erosion potential. Intermediate terraces are also included on the slope to intercept runoff on the slope face and reduce potential for surface erosion. Although all studies are not currently complete, we believe the interim slopes, designed as recommended in this report, will meet the above stability requirements.

3.4.3 *Embankment Subgrade*

Proper preparation of the embankment subgrade is critical for slope stability. If not performed properly, a thin layer of weak material may be left which can potentially become a failure or slide plane.

Proper preparation of the embankment subgrade for this purpose includes stripping of the organic topsoil layer and keying and benching of the fill material. Stripping topsoil removes the entire organic topsoil layer. Keying provides a firm toe for the face of the embankment slope. It consists of excavating a shallow trench along the embankment toe and backfilling with compacted embankment fill. Often a subdrain is included. Benching blends the native soil into the first lift of embankment fill and creates level surfaces on which to place and compact the fill. This results in a firm transition from the native soil and allows better, more consistent compaction in the first few lifts.

Subgrade preparation for stability is primarily required wherever the existing grade is steeper than about 8:1 (horizontal:vertical) and within a zone behind the toe of the embankment (temporary or

permanent) equal to at least 1.5 times the embankment height. The subgrade preparation area can be reduced to 0.75 times the embankment height if the Port is willing to assume the greater risk of failure associated with a reduced factor of safety on the order of 1.30.

Phase 1 Embankment will require subgrade preparation for stability over 30 to 60 percent of its footprint, depending on which of the above criteria are used.

3.4.4 *Drainage*

Drainage should be provided behind and beneath the embankment so that ground or surface water does not affect the stability of the embankment fill. If proper drainage is not installed, it is possible that groundwater could become trapped in the area beneath and behind the embankment, which would eventually fail as the water pressure pushes the fill to the west.

Two potential sources of water should be addressed. The first source is the groundwater seeping from the base of the existing, relatively free-draining fill adjacent to the Phase 1 Embankment area. This can be accomplished by placing a subdrain in a keyway excavated along the toe of the existing embankment. The second source is streamflows within the existing swales crossing the proposed alignment. This flow can be intercepted and controlled by installing a system of subdrains within the swale base to intercept and redirect the flow to a controlled discharge beyond the embankment.

3.5 VALUE ENGINEERING REVIEW

A value engineering review of the project design criteria occurred near the completion of the preparation of this report. After consideration of other related factors, the relatively temporary nature of the embankment, and the risks associated with the decision, the Port elected to use a minimum amount of stripping consistent with a factor of safety for slope stability of 1.30. AGI supported this decision and will assist with its implementation during construction.

4.0 RECOMMENDATIONS

4.1 SITE PREPARATION

4.1.1 *Clearing, Grubbing, and Stripping*

Site preparation consists of logging, clearing and grubbing trees and brush, stripping topsoil, installing temporary surface drainage and erosion controls, installing permanent subsurface drainage, and placing the protection materials over the existing 36-inch water main. Surface drainage and erosion controls are the responsibility of other design consultants. The site of the Phase 1 Embankment is shown on **Figure 5** and a cross section of the embankment at N 20,000 is shown on **Figure 6.**

Logging

All trees more than approximately 8 inches diameter will be logged under a separate contract before the Phase 1 Embankment Construction project.

Clearing and Grubbing

All remaining trees should be removed from the site. Root systems should be grubbed and, combined with branches, other brush, and mowed grass and undergrowth. These materials should then be chipped and disposed of properly offsite or other Port designated areas.

Remnants of prior site development such as foundations, pavement, septic tanks and drain fields, and heating oil tanks will be encountered during clearing and grubbing. Generally, these items may be left in place. Heating oil tanks should be removed or abandoned in place in accordance with state requirements. The Port staff and separate environmental contractors may best accomplish this. Large expanses (over 100 square feet) of pavement or concrete slabs should be broken into smaller pieces. Septic tanks should be backfilled with pea gravel.

Stripping

We recommend that all areas of the Phase 1 Embankment and in the area of the drainage swales and sedimentation pond be stripped of all surficial vegetation and organic topsoil before placing any fill. Alternatively, stripping could be limited to the drainage swales, sedimentation pond, all existing slopes over 8:1, and within a distance of 0.75 times the embankment height behind the toe of embankment.

Stripping depth will be variable and will be deeper within surface depressions. We estimate that the average depth of stripping required to remove vegetation and organic topsoil from the Phase 1

Embankment Construction area will be 6 to 8 inches. Previously developed areas will require little or no stripping. The stripping depth in the deeper, more heavily vegetated depressions may vary between 12 and 18 inches.

We recommend that the contractor be paid for stripping on a lump sum basis. At the contractor's option, the stripped material may be:

- Disposed of offsite.
- Processed onsite or offsite into a commercial topsoil product. Consideration should be given by the Port to provide the contractor an onsite area suitable for setting up a topsoil plant.
- Stockpiled and later incorporated into Embankment Fill in Zone D as described later in this report.

4.1.2 *Overexcavation of Unsuitable Material*

After clearing, grubbing, and stripping is completed, the site will be at Embankment Subgrade. Overexcavation below Embankment Subgrade to remove soft, weak, and compressible soils and existing fills may be necessary. We anticipate that the amount of overexcavation required in the Phase 1 Embankment Construction area will be limited to less than 2,000 cubic yards. The extent and depth of overexcavation should be determined in the field by an experienced geotechnical engineer familiar with the requirements of the fill design. The determination will be made based on hand probing, construction traffic, and possibly supplemental test pits.

We recommend that the contractor be paid for overexcavation on a unit price per cubic yard as determined by before and after surveys. At the contractor's option, the overexcavated material may be:

- Disposed of offsite.
- Stockpiled and later used for Embankment Fill in Zone C if it meets Zone C requirements or, if not, incorporated into Embankment Fill in Zone D as described later in this report.

4.1.3 *Drainage*

Temporary Drainage

Temporary drainage measures will be important given the anticipated duration of embankment construction. We expect these measures will include temporary detention ponds and siltation control measures. Construction staging, including development of detailed erosion control plans, will be essential to maintain the accessibility and stability of the site. Temporary grading plans should be designed so that low areas are not created where ponding of runoff on the embankment fill could occur. King County standards for temporary erosion and siltation control should be used.

Temporary control of groundwater may become necessary in some areas during overexcavation, particularly if construction takes place during a wetter season.

Permanent Drainage

Drainage should be provided behind and beneath the proposed embankment so that ground or surface water does not affect the stability of the embankment fill. We recommend installing a subdrain blanket consisting of a 4-foot-thick layer of Group 1 embankment fill material, as described in Section 4.2.2. The subdrain blanket should extend at least 8 feet in the vertical dimension up the 2:1 side slopes of the existing embankment fill slope.

4.1.4 *Water Main Protection*

Due to the near-surface location of the 36-inch water main and the planned heavy truck traffic on the haul roads crossing the water main, AGI recommends protection of the pipe at the locations where the haul road crosses the water line. To reduce the pressures transmitted from the vehicles to the pipeline, we recommend exposing the pipeline for 4 feet on either side of the crossing and installing a 2-foot-thick by 3-foot-wide section of expanded polystyrene (EPS) foam directly on the crown of the pipe. Structural backfill should be placed immediately over the EPS foam to reestablish original grade in the area, if necessary. Port-furnished 8 foot by 10 foot, 7-inch thick concrete panels should then be placed on a leveled grade, centered over the pipeline. Ramps should be constructed of gravel haul road material to transition traffic to the concrete panels. **Figure 7** presents these recommendations in graphical form. The intended effect of the above-described installation is to cause the transfer of truck loads to the soil materials on either side of the pipeline, rather than directly onto the pipeline itself.

At locations where the haul roads cross the water main and the top of the pipeline is deeper than 6 feet bgs, the pipeline may be protected with 1-inch steel utility plates. The steel plates should be placed on a level subgrade between 6 and 12 inches below existing grade, which should then be reestablished using the same crushed rock used for haul road construction.

4.2 EMBANKMENT

4.2.1 *Embankment Zonation and Geometry*

The Phase 1 Embankment should be comprised of Zone B, C, and possibly D as shown on **Figures 3** and **6**. We recommend that the slope be constructed at 2:1 with intermediate terraces 10 feet wide for each 40 feet of slope height. Terraces should be sloped gently into the embankment and be graded so that surface water can be conveyed to suitable collection points for tightlining down to the embankment toe to a permanent discharge away from the embankment.

4.2.2 *Embankment Fill Material*

Our recommendations for embankment fill material are based on the assumption that fill soils for the proposed embankment may be accepted from a variety of sources from around the Puget Sound. Soil types will range from fine (clay and silt) to coarse grained (gravel, cobbles, boulders) and may include some inert construction (concrete) debris. Through discussions with the Port of Seattle and construction contractors, the Port decided to specify primarily granular material for the Phase 1 Embankment. This is due to limitations on the time of construction, size of the area, frequency of trucks, and wet weather.

For the purposes of estimating compacted in-place fill material performance, AGI subdivided the range of available materials into six groups:

- *Group 1*: Well graded sand/gravel mixtures with less than 5 percent fines based on the portion passing the ¾-inch sieve. These would be classified as GW or SW by the Unified Soil Classification System (USCS). The gradation range for Group 1 Embankment Fill is listed on **Table 3** and is shown on **Figure 8**. Typical local materials meeting Group 1 specifications include Class A Pit Run Gravel, some natural deposits of Advance or Recessional Outwash, and some crushed or recycled products.

- *Group 2*: Well-graded sand/gravel mixtures with 5 to 12 percent fines based on the portion passing the ¾-inch sieve. These would have USCS classifications of GM or SM. The gradation range for Group 2 Embankment Fill is listed on **Table 3** and is shown on **Figure 8**. Typical local materials meeting Group 2 specifications include Class B Pit Run Gravel, a large proportion of natural Advance or Recessional Outwash deposits.

- *Group 3*: Poorly graded sands and/or gravels with less than 5 percent fines based on the portion passing the ¾-inch sieve. These would have USCS classifications of GP or SP. The gradation range for Group 3 Embankment Fill is listed on **Table 3** and is shown on **Figure 9**. Typical local materials meeting Group 3 specifications include the remaining natural deposits of Advance or Recessional Outwash and some crushed or recycled products.

- *Group 4*: Silty sand with gravel with 5 to 12 percent fines based on the portion passing the ¾-inch sieve. These would have a USCS classification of SM. The gradation range for Group 4 Embankment Fill is listed on **Table 3** and is shown on **Figure 9**. Typical local materials meeting Group 4 specifications include some Till and Alluvium deposits.

- *Group 5*: Silty sand or gravel with up to 50 percent fines based on the portion passing the ¾-inch sieve. These would have a USCS classification of SM or GM. Any gradation meeting the above 50 percent fines limit would be included in this group if it did not meet the requirements of Groups 1 through 4. Typical local materials meeting Group 4 specifications include Till and Alluvium deposits. 5

- *Group 6*: All fine-grained soil.

All Embankment fill material should consist of naturally occurring or processed materials and should be essentially free from wood waste or other extraneous or objectionable material. We recommend that the contractor be paid for embankment fill material on a per ton basis with the weight of fill determined using onsite scales.

4.2.3 *Subgrade Preparation*

Benching

We recommend that benching be performed in areas where fill is placed on a stripped Embankment Subgrade steeper than 8:1. The bench width should be adjusted as necessary to blend in the upper 6 inches of Embankment Subgrade into the Embankment Fill. This width varies depending on the slope of the Embankment Subgrade and the lift thickness.

Subgrade Protection

Excavation for benching will encounter existing Fill, possibly Recessional Outwash, and primarily Glacial Till. We expect the great majority of these materials can be excavated using conventional earthmoving equipment. The use of large bulldozers equipped with ripping teeth to break up the soil may be required for excavation into unweathered Glacial Till.

The majority of soils exposed during site preparation are moderately to highly moisture sensitive and will be difficult to work or compact when wet. Therefore, the time between the grubbing, stripping, and overexcavation and the placement of embankment fill should be limited.

If the Embankment Subgrade becomes wet and disturbed prior to fill placement, removal of some disturbed material or the placement of quarry spalls may be necessary to stabilize the initial lift of fill. Some latitude can be allowed to the contractor with respect to meeting compaction criteria on the initial lift of fill.

4.2.4 *Placement and Compaction*

Fill placement and compaction criteria for each Embankment Fill Material are shown in Table 4. Percent Compaction is the required in-place dry density of the material, expressed as a percentage of the maximum dry density of the same material as determined in the laboratory by ASTM Test Method D1557 (Modified Proctor). Optimum Moisture Content is the moisture content (percent by dry weight) corresponding to the maximum dry density of the same material as determined by ASTM Test Method D1557. Where the gradation of the Embankment Fill Material precludes the use of ASTM D1557, compaction should be achieved and the fill accepted after six passes of a minimum 15 ton segmented pad roller or other compaction equipment suitable to the material being placed. The number of passes may be reduced to five for Zone C fills.

It should be understood that the acceptability of many of the finer-grained soils commonly available as excess from construction sites in the Puget Sound is dependent on the moisture content of the

materials. Moisture content of the fill materials will vary with the soil type and weather conditions during the working season but could range from dryer to wetter than optimum moisture content with respect to compaction. If possible, the Port should obtain the results of recent testing by the earthwork contractor or geotechnical engineer for the potential borrow site that indicate the acceptability of the proposed fill. Such testing should include moisture content, grain size distribution, and Proctor compaction curves for each source of fill proposed.

Moisture conditioning should be performed by the contractor at the borrow site so that a consistent soil moisture content range is achieved for material delivered to the project. This will eliminate or minimize the need for moisture conditioning at the fill site. Fill should be dumped, graded, and compacted immediately upon delivery to the fill site.

All Embankment Fill Materials except Group 1 and 3 are moisture sensitive soils. It may be difficult or impossible to properly moisture condition these materials during the spring due to their moisture sensitivity. (Moisture-sensitive soil is soil containing more than 5 percent fines.)

Methods for compaction of fill material will vary depending on the material, time of year, and Percent Compaction requirements. Self-propelled segmented pad or sheepsfoot vibratory rollers with grading blades will probably be the most efficient compaction equipment for most of the fill material. Large towed sheepsfoot vibratory rollers may be more efficient for placement and compaction of Group 4 or 5 Embankment Fill Material. Rubber-tired or steel drum vibrating compactors may be more efficient for Group 1 and 3 Embankment Fill Material.

At all times, care must be taken to protect the surface of completed fills from changes in moisture content. This can include careful control of site drainage, sloping and sealing completed areas with smooth drummed rollers, and covering with plastic, tarps, or tents.

If the surface of a fill exceeds the moisture content requirements after a rainfall, the wet material should be stripped and stockpiled, allowed to drain, and possibly reused as On-Site Fill, or disposed of either at a designated on-site area or off site.

The final slope face should be compacted by face rolling or by overbuilding the slope past the final proposed edge and cutting the slope back to the final geometry.

4.2.5 *Expected Settlement Performance*

Zone B Embankment

Total settlement of the maximum 70 foot thick Zone B embankment is estimated to be slightly less than one foot. However, at least ½ will occur during fill placement. Another ¼ should take place within one year following construction, leaving less than 3 inches longer-term settlement due to creep and inundation settlement. Since part of the Phase 1 Embankment represents a surcharge load which will be removed in final grading, actual long term settlement will be even less.

Zone C Embankment

Total settlement of the maximum 70 foot thick Zone C embankment (without any Zone D) is estimated to be about 2 to 3 inches more than the Zone B embankment. About ½ of this increase will occur more than 1 year after fill placement, leaving about 4 inches longer-term settlement due to creep and inundation settlement. Again, actual long-term settlement will be even less due to the surcharge effect.

Zone C and D Embankment

Inclusion of a 10–foot thick Zone D in Zone C will increase expected total settlement by up to another 6 inches, depending on organic content. About ½ of this increase will occur more than 1 year after fill placement, leaving about 7 inches longer-term settlement due to consolidation, creep, and inundation settlement. Again, actual long-term settlement will be even less due to the surcharge effect.

4.2.6 *Instrumentation*

Because the Phase 1 Embankment will provide valuable information on the rate and magnitude of settlement, we recommend it be instrumented. As a minimum, standard settlement plates should be included. A typical detail is shown on **Figure 11**. Because typical settlement platforms only measure foundation settlement, we also recommend settlement and vertical pressure instrumentation be included within the fill. This will allow good data to be developed on the consolidation and creep settlement characteristics of the embankment which can be used to refine later embankment design.

Our recommendation is for three settlement stations located as shown on **Figure 5**. At each location, there would be a settlement platform. Settlement and pressure sensors should be installed by AGI at the base of fill and every 20 vertical feet at each settlement platform location. There will be three sensor locations at each outboard settlement station and two at the inboard settlement station. The sensors will be placed at least 25 feet from the settlement platform to assure they are in uniformly compacted fill. The instrumentation cables and tubes will be laid back to the settlement platform riser and then continued to the surface.

The contractor should assist with installation of the instrumentation system and should be liable for repair if it is damaged by construction equipment.

4.2.7 *Haul Road*

Existing improved roadways will be used for the majority of the on-site haul routes accessing the 1998 fill area. While these roads are improved, they will most likely not stand up to repeated heavy truck traffic in their present condition. AGI recommends that 18 inches of crushed rock placed on existing subgrade be used to establish new or widen existing roadways where no previous roadway section is

present. Lesser thicknesses of crushed rock (nominally 6 inches over the majority of the roads) may be applied to upgrade existing improved roadways for the anticipated traffic. The contractor should be made responsible for maintenance of the haul roads and should anticipate that additional gravel surfacing materials may need to be applied and that regular grading of the surface may be necessary to keep the haul roads in a passable condition.

4.3 QUALITY CONTROL

Due to the size and complexity of the earthwork required for the proposed new runway, a very carefully planned and managed quality assurance and control program must be implemented to assure the completed fills meet their performance requirements. In addition to frequent compaction testing of completed fill, moisture contents and material types at the borrow source must be monitored. Duplicate testing and statistical controls should be implemented to further ensure accuracy and reliability of data.

In-place density testing should be performed frequently when each compaction procedure begins. This means whenever there is a change in fill materials or compaction equipment and methods. Once placement and compaction procedures have been proven to achieve the required Percent Compaction, the frequency of in-place density testing can be reduced to about one test per 1,000 yd^3. Test frequency can be further reduced after considerable experience is gained; however, we recommend a minimum of one test per 2,000 yd^3. Laboratory compaction tests of the maximum density should be initially performed at least once for every 10 in-place density tests in each material; then tests may later be reduced to one for every 20 in-place density tests. In addition, field compaction 'check points' should be utilized as necessary to ensure statistical control.

The size of this earthwork project warrants establishment of an on-site soil testing laboratory. We recommend the Port consider contracting for routine in-place density testing and compaction testing directly with a testing company.

AGI should be retained as the geotechnical engineer of record during construction to regularly observe and monitor the geotechnical aspects of project. To provide the necessary level of control at the borrow source and quality assurance and statistical control of fill testing, we believe an AGI engineer will be required on site nearly every day during sustained periods of earthwork. This will allow us to compare the actual conditions encountered with those expected by this investigation and to modify our recommendations, if necessary.

The contractor should be required to provide us and the testing laboratory with every reasonable facility for checking the workmanship for conformance. We will prepare a daily record of our observations, which will be made available to the contractor and to the Port. Our daily field reports and final report will form an important record of construction.

5.0 REFERENCES

AGI. 1994a. *Borrow Source Report, Proposed Third Dependent Runway, Seattle-Tacoma International Airport, SeaTac, Washington.* AGI Project No. 14,190.202. Prepared for HNTB Corporation by Applied Geotechnology Inc. (now AGI Technologies), Bellevue, Washington. March 10.

AGI. 1994b. *Preliminary Geotechnical Engineering Study, Proposed Third Dependent Runway, Seattle-Tacoma International Airport, SeaTac, Washington.* AGI Project No. 14,190.203. Prepared for HNTB Corporation by Applied Geotechnology Inc. (now AGI Technologies), Bellevue, Washington. March 30.

AGI. 1995a. *Borrow Source Study, Proposed New Runway, Seattle-Tacoma International Airport, SeaTac, Washington.* AGI Project No. 14,190.208. Prepared for HNTB Corporation by AGI Technologies, Bellevue, Washington. April 3.

AGI. 1995b. *Memorandum on Groundwater Issues, On-Site Borrow Areas 1 through 4.* AGI Project No. 14,190.208. Prepared for HNTB Corporation by AGI Technologies, Bellevue, Washington. May 24.

AGI. 1996a. *Preliminary Boring Logs, Proposed Fill Site and Hardstand.* AGI Project No. 14,190.210. Prepared for HNTB Corporation by AGI Technologies, Bellevue, Washington. February 28.

AGI. 1996b. *Technical Design Memorandum No. 1, Clearing, Grading, and Surface Preparation, Proposed Fill Site, Seattle-Tacoma International Airport, SeaTac, Washington.* AGI Project No. 14,190.210. Prepared for HNTB Corporation by AGI Technologies, Bellevue, Washington. April 23.

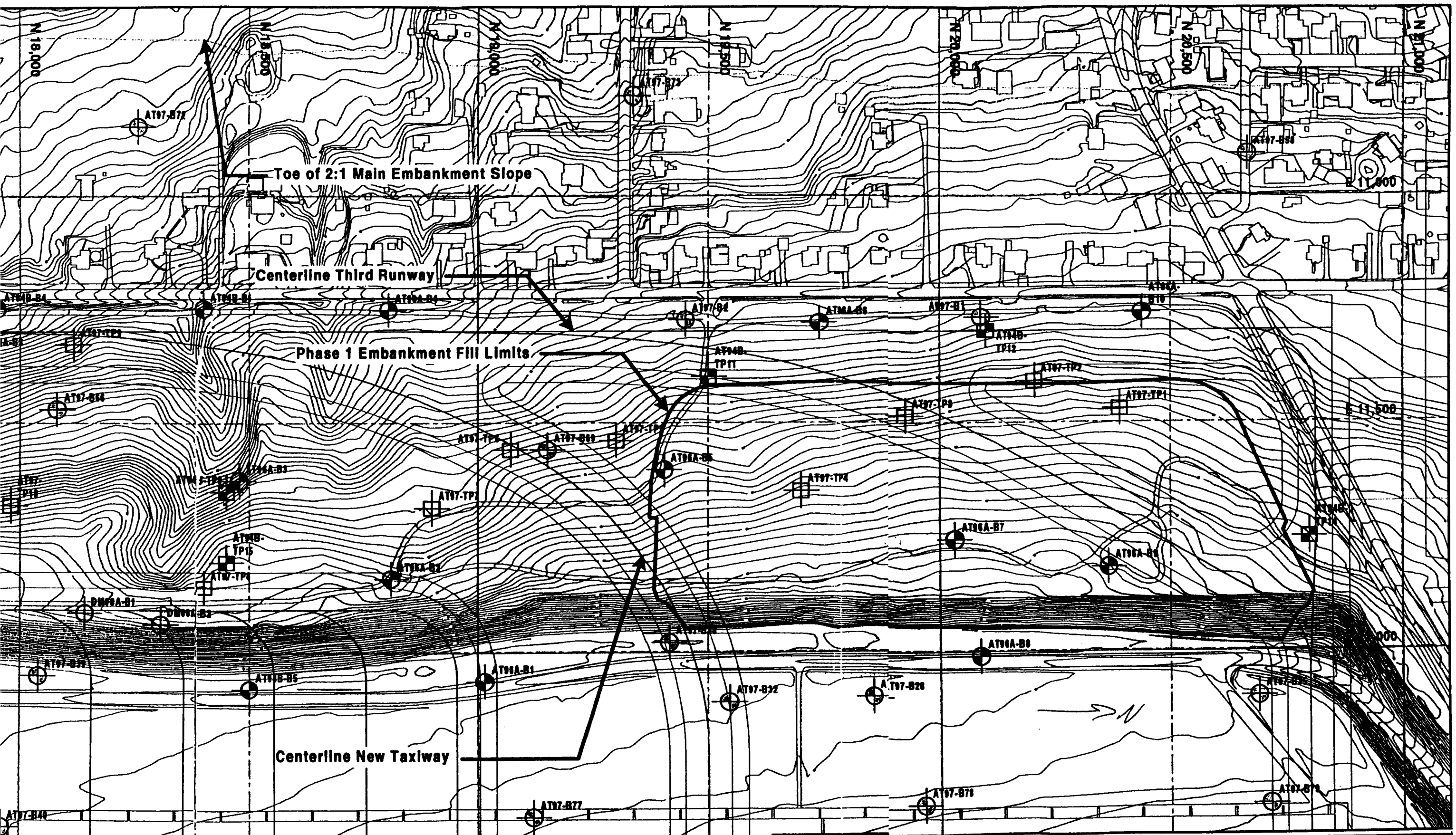
AGI. 1996c. *Technical Design Memorandum No. 2, Fill Acceptance, Placement, and Compaction, Proposed Fill Site, Seattle-Tacoma International Airport, SeaTac, Washington.* AGI Project No. 14,190.210. Prepared for HNTB Corporation by AGI Technologies, Bellevue, Washington. April 30.

DISTRIBUTION

3 Copies	HNTB Corporation 600 108th Avenue N.E., Suite 400 Bellevue, Washington 98004 Attention: Mr. James E. Thomson, P.E.
10 Copies	The Port of Seattle Seattle-Tacoma International Airport P.O. Box 68727 Seattle, Washington 98168-0727 Attention: Mr. John R. Rothnie, P.E.

JEN/DMW/llk

TABLES



Site Plan

HNTB / Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 1

AGI TECHNOLOGIES	PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14190211_...vsd	14,190.211.01	JEN	12/31/97		ALW	1/21/98

AR 025819

AT96a-8 AT97-B28

AT97-B78

AT96a-7

AT94btp-12

B1-97

Section at N 20,000

AT96a-1

AT97-B77

AT96a-2

AT97-B69

AT96a-4

Section at N 19,000

AT97-B39

AT97-B40

DM68a-1

AT97-B67

AT97-B66

AT94a-3

AT94b-4

11500

Section at N 18,000

12000

12500

Legend

LEGEND

Qaf - Fill

Qvs - Vashon Recessional Outwash

Qvt - Vashon Till

Qas - Advance Outwash

Qu - Pre-Vashon Drift

150 ft. 250 ft. 500 ft.

AGI TECHNOLOGIES

Geologic Sections

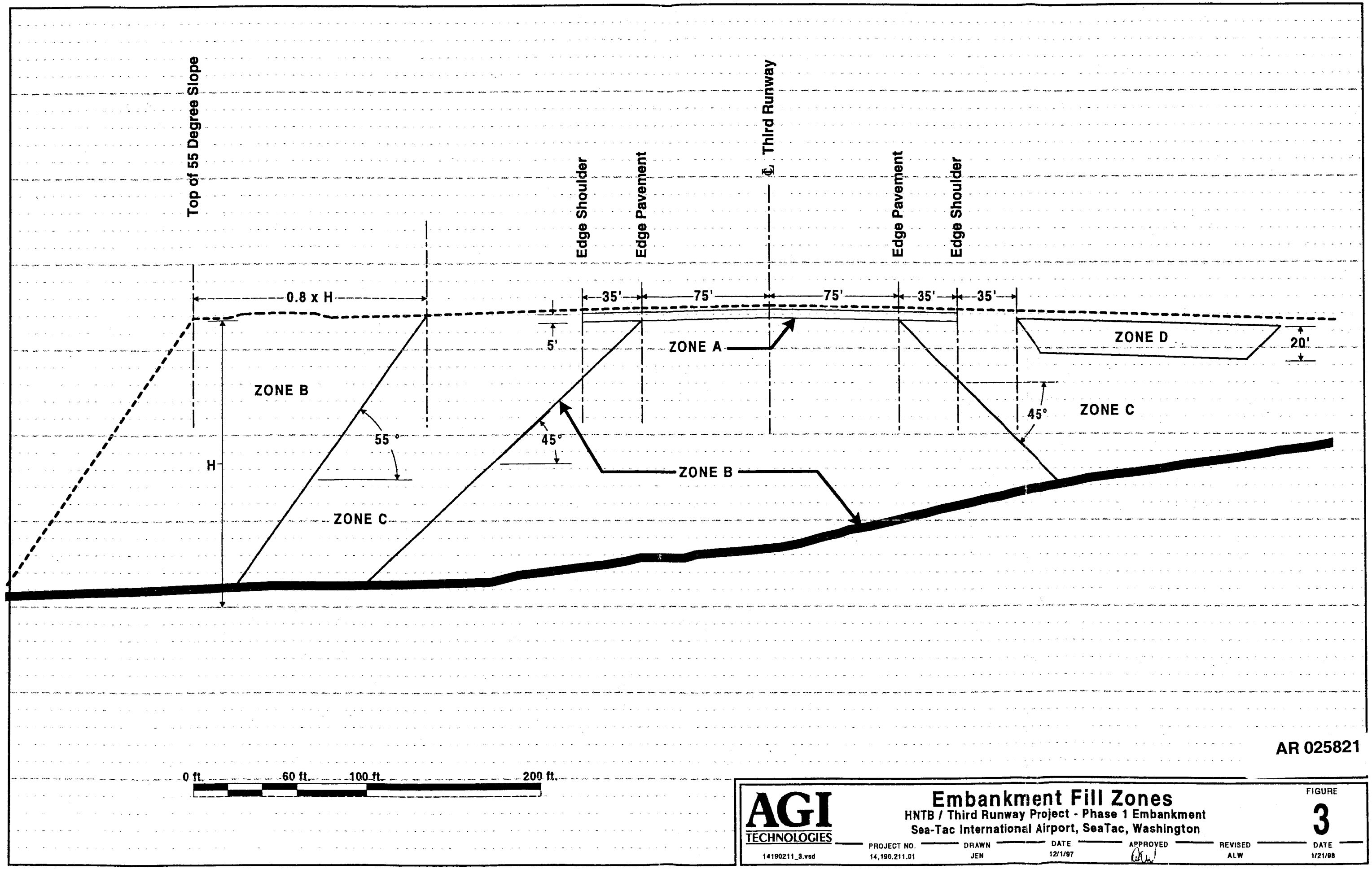
HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

FIGURE 2

14190211_2.vsd	PROJECT NO. 14,190.211.01	DRAWN JEN	DATE 12/31/97	APPROVED	REVISED ALW	DATE 1/21/98

AR 025820



AR 025821

Embankment Fill Zones

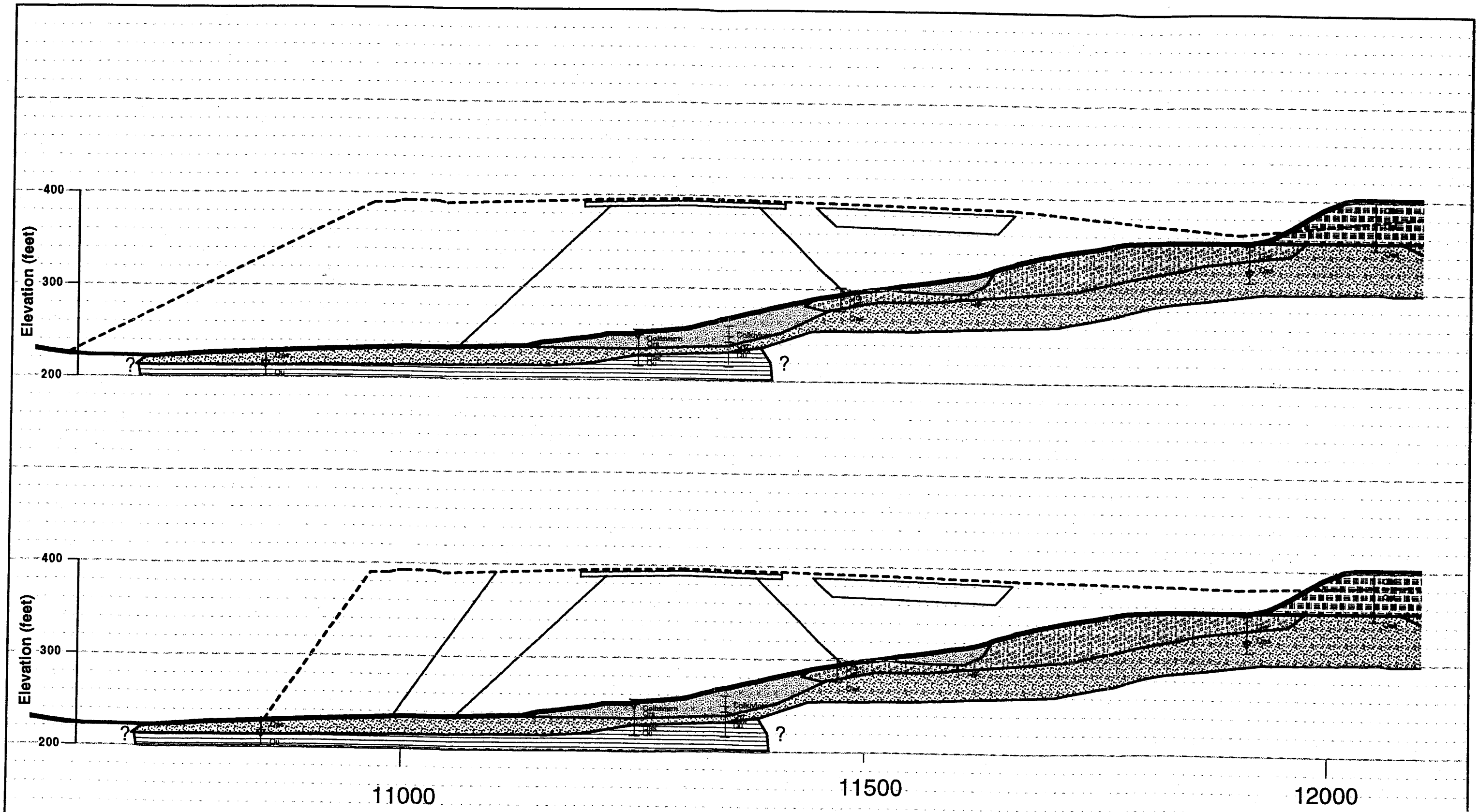
HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

FIGURE 3

AGI TECHNOLOGIES

14190211_3.vsd	PROJECT NO. 14,190.211.01	DRAWN JEN	DATE 12/1/97	APPROVED	REVISED ALW	DATE 1/21/98

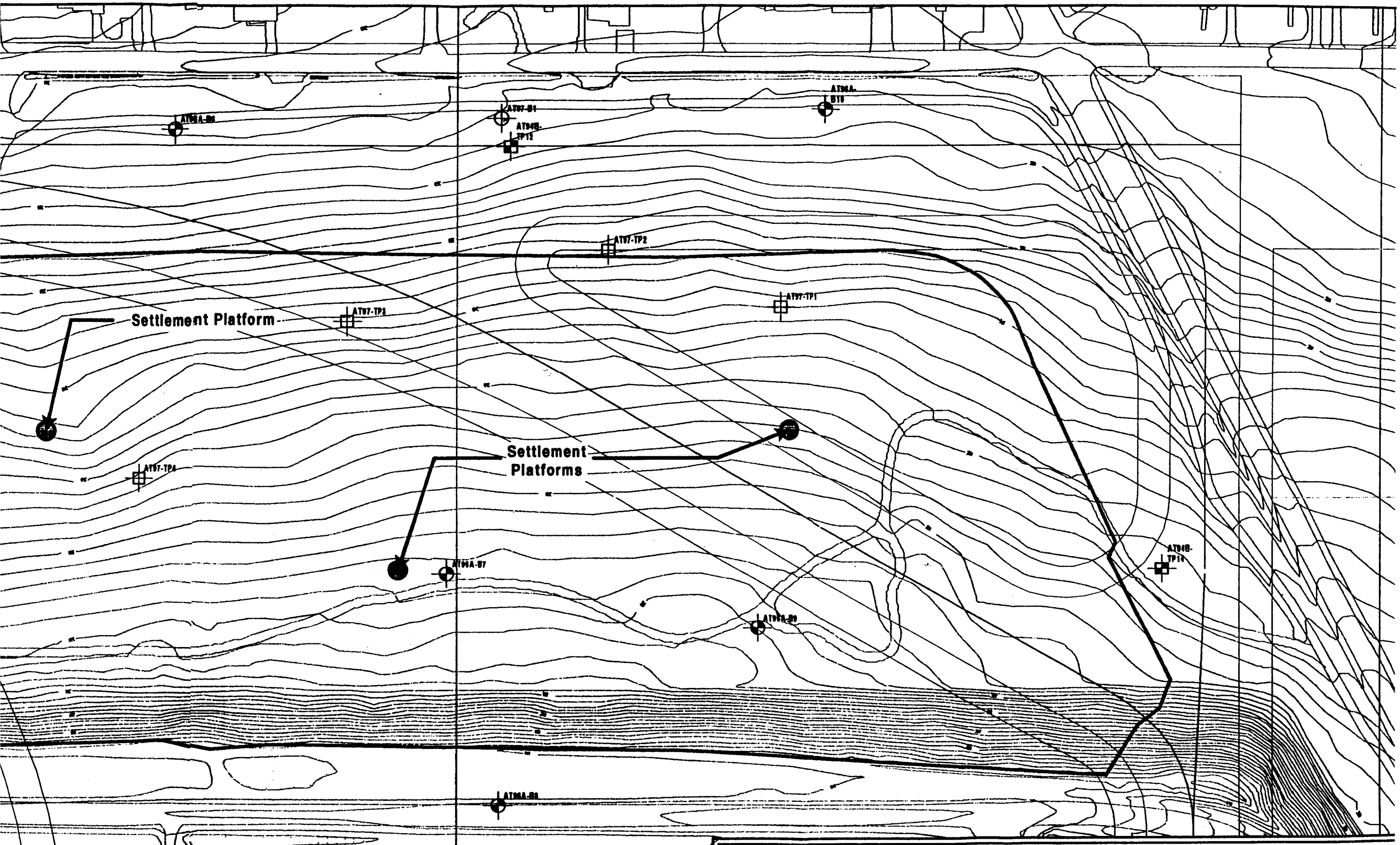


AR 025822

0 ft. 150 ft. 250 ft. 500 ft.

AGI TECHNOLOGIES	Maximum Embankment (N18,000) HNTB / Third Runway Project - Phase 1 Embankment Sea-Tac International Airport, SeaTac, Washington	FIGURE 4

14190211_4.vsd	PROJECT NO. 14,190.211.01	DRAWN JEN	DATE 12/1/97	APPROVED	REVISED ALW	DATE 1/21/98



AGI TECHNOLOGIES

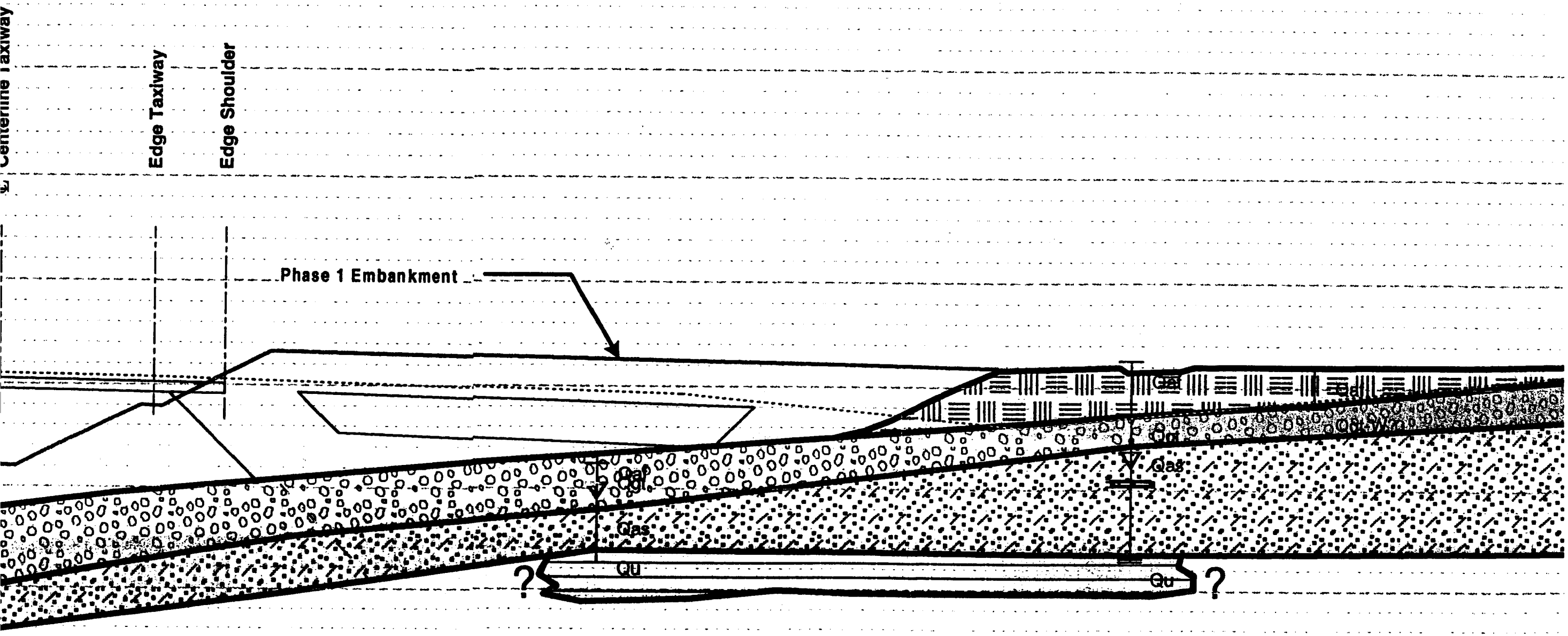
Phase 1 Embankment Plan

HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

FIGURE **5**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14190211_5.vsd	14,190.211.01	JEN	12/31/97	ALW	1/21/98



Phase 1 Embankment Cross Section (N 20,000)

HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

FIGURE 6

AGI TECHNOLOGIES

14190211_6.vsd	PROJECT NO. 14,190.211.01	DRAWN JEN	DATE 12/31/97	APPROVED	REVISED ALW	DATE 1/21/98

AR 025824

AGI TECHNOLOGIES

Table 1
Main Embankment Area Explorations
HNTB / Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

Database Exploration Number	Alternate Exploration Number	North Coordinate* (feet)	East Coordinate* (feet)	Elevation (feet)	Exploration Depth (feet)
AT91A-B30	B30-91	17,170	12,210	402.1	14.0
AT94A-B3	B3-94	17,900	11,350	260.0	44.0
AT94B-B4	B4-93	17,950	11,250	255.0	39.0
AT94B-B5	B5-93	18,500	12,080	408.0	49.0
AT94B-B6	B6-93	18,400	11,250	275.0	23.5
AT94B-TP6	TP6-93	17,000	11,650	380.0	9.0
AT94B-TP7	TP7-93	17,400	11,300	320.0	8.0
AT94B-TP9	TP9-93	18,450	11,650	325.0	7.5
AT94B-TP10	TP10-93	17,120	11,800	370.0	6.0
AT94B-TP11	TP11-93	19,500	11,400	325.0	5.0
AT94B-TP12	TP12-93	20,100	11,300	327.0	7.0
AT94B-TP14	TP14-93	20,800	11,750	353.0	8.0
AT94B-TP15	TP15-93	18,450	11,800	345.0	7.5
AT96A-B1	P1-96	19,015	12,064	408.0	88.0
AT96A-B2	B2-96	18,812	11,837	345.0	38.5
AT96A-B3	P3-96	18,478	11,627	325.0	74.0
AT96A-B4	P4-96	18,806	11,253	280.0	49.0
AT96A-B5	B5-96	19,404	11,604	343.0	58.5
AT96A-B6	B6-96	19,738	11,282	314.0	38.5
AT96A-B7	B7-96	20,032	11,754	367.0	54.0
AT96A-B8	P8-96	20,088	12,012	413.0	98.5
AT96A-B9	B9-96	20,366	11,814	367.0	58.5
AT96A-B10	P10-96	20,439	11,260	320.0	43.0
AT97-B1	B1-97	20,090	11,280	318.0	19.5
AT97-B2	B2-97	19,450	11,275	311.0	18.5
AT97-B6	B6-97	17,590	11,300	292.0	21.0
AT97-B7	B7-97	17,150	11,285	340.0	21.5
AT97-B12	B12-97	17,670	12,075	399.0	55.0
AT97-B28	B28-97	19,860	12,100	410.0	19.5
AT97-B32	B32-97	19,545	12,110	408.0	24.5
AT97-B34	B34-97	17,080	12,140	390.0	14.5
AT97-B35	B35-97	20,690	12,100	413.0	49.5
AT97-B38	B38-97	19,415	11,980	406.0	39.0
AT97-B39	B39-97	18,040	12,050	402.0	54.5

AGI TECHNOLOGIES

Table 1
Main Embankment Area Explorations
HNTB / Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

Database Exploration Number	Alternate Exploration Number	North Coordinate* (feet)	East Coordinate* (feet)	Elevation (feet)	Exploration Depth (feet)
AT97-B40	B40-97	17,960	12,380	403.0	50.0
AT97-B56	B56-97	17,185	10,925	322.0	48.5
AT97-B58	B58-97	20,665	10,910	303.0	30.0
AT97-B64	B64-97	17,090	12,405	398.0	26.0
AT97-B65	B65-97	17,750	12,410	399.0	50.5
AT97-B66	B66-97	18,080	11,470	302.0	25.5
AT97-B67	B67-97	17,825	11,600	312.0	30.0
AT97-B68	B68-97	17,660	11,505	296.0	60.5
AT97-B69	B69-97	19,150	11,560	334.0	26.0
AT97-B72	B72-97	18,255	10,850	233.0	33.0
AT97-B73	B73-97	19,335	10,785	267.0	30.0
AT97-B77	B77-97	19,120	12,360	410.0	29.5
AT97-B78	B78-97	19,965	12,335	416.0	30.0
AT97-B79	B79-97	20,715	12,335	417.0	45.0
AT97-TP1	TP1-97	20,390	11,470	344.0	3.5
AT97-TP2	TP2-97	20,205	11,410	342.0	4.0
AT97-TP3	TP3-97	19,925	11,485	339.0	4.0
AT97-TP4	TP4-97	19,700	11,650	355.0	3.5
AT97-TP5	TP5-97	19,300	11,540	335.0	4.0
AT97-TP6	TP6-97	19,070	11,560	331.0	7.0
AT97-TP7	TP7-97	18,900	11,685	332.0	6.5
AT97-TP8	TP8-97	18,400	11,855	354.0	6.0
AT97-TP9	TP9-97	18,115	11,330	277.0	10.0
AT97-TP10	TP10-97	17,980	11,680	335.0	7.0
AT97-TP11	TP11-97	17,550	11,760	339.0	6.5
DM66A-B13	B13-66	20,350	12,500	401.8	24.0
DM66A-B14	B14-66	19,360	12,500	426.8	36.0
DM66A-B15	B15-66	18,620	12,500	424.6	35.0
DM66A-B16	B16-66	17,390	12,500	399.3	25.0
DM68A-B1	B1-68	18,140	11,914	351.0	41.0
DM68A-B2	B2-68	18,305	11,939	320.0	42.0

Note:

* 1997 coordinates are preliminary only.

4190-211\Table 1.xls

AGI TECHNOLOGIES

Table 2
Groundwater Elevation Data
HNTB / Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

Well I.D.	Date Measured	Ground Surface Elevation (feet)	Groundwater Elevation (feet)
B1-96	01/30/96	408.0	Dry
AT96A-B1	01/14/98		Dry
B3-96	01/23/96	325.0	293.5
AT96A-B3	01/14/98	Unable to locate-Covered Over?	
B4-96	01/18/96	270.0 ~	252.5
AT96A-B4	01/14/98		~ 270.0
B8-96	01/26/96	413.0	365.0
AT96A-B8	01/14/98		397.1
B10-96	01/17/96	320.0	307.0
AT96A-B10	01/14/98		311.0
B69-97	10/16/97	334.0	326.3
AT97-B69	01/14/98		330.8

Table 3

Embankment Fill Material Gradation

HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

Fill Group	USCS	Percent Passing Sieve Sizes											
		6 Inch		3 Inch		3/4 Inch		U.S. No. 4		U.S. No. 40		U.S. No. 200 [a]	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Group 1	GW, SW		100%	97%	70%	77%	50%	50%	30%	15%	3%	5%	0%
Group 2	GM, SM		100%	97%	70%	85%	50%	65%	30%	30%	5%	12%	0%
Group 3	GP, SP		100%					90%	30%	60%	10%	5%	0%
Group 4	SM		100%					95%	50%	60%	20%	35%	12%
Group 5	SM, GM						100%	95%	50%	80%	35%	50%	15%
Group 6	CL, ML		100%										50%

Note :

a) Based on portion passing the 3/4-inch sieve.

AGI TECHNOLOGIES

Table 4

Embankment Fill Placement and Compaction Criteria

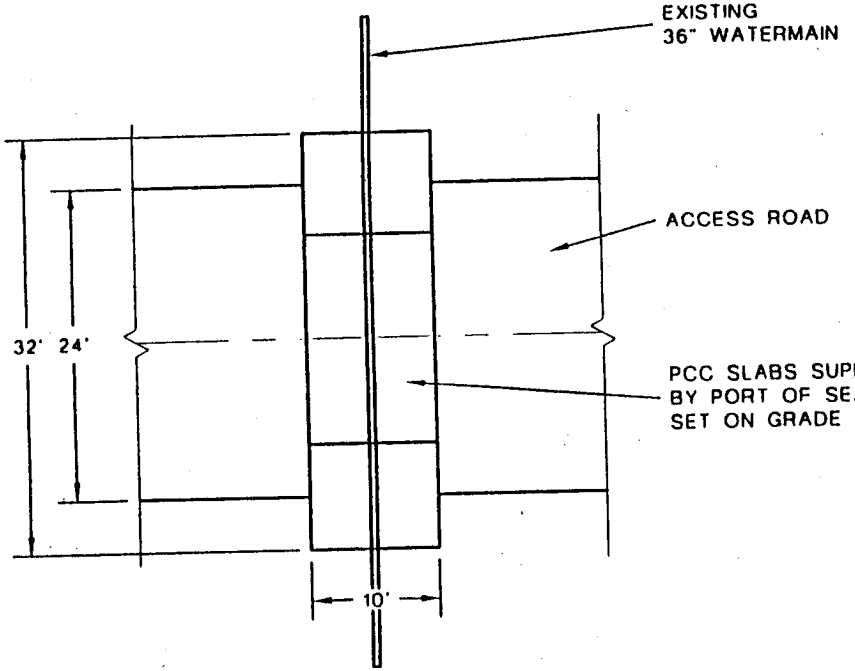
HNTB / Third Runway Project - Phase 1 Embankment

Sea-Tac International Airport, SeaTac, Washington

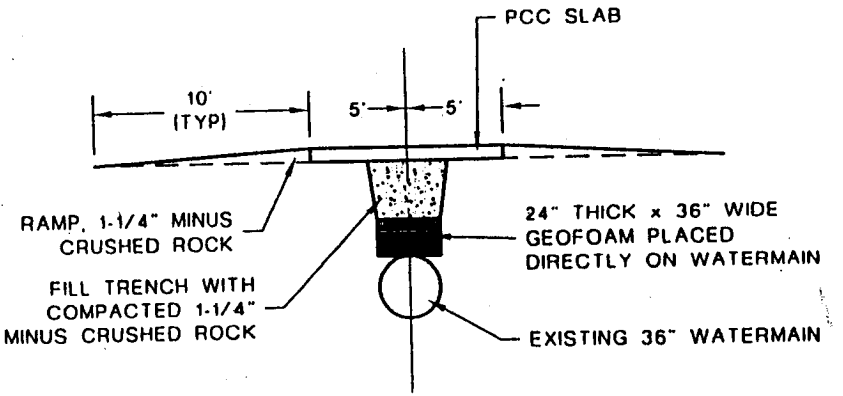
Fill Group	Zone A			Zone B			Zone C			Zone D		
	PC	MC	LT	PC	MC	LT	PC	MC	LT	PC	MC	LT
Group 1	95%	Open	8	90%	Open	12	88%	Open	18	--	--	--
Group 2	--	--	--	90%	-2 to +2	12	88%	-3 to +3	12	--	--	--
Group 3	95%	Open	8	90%	Open	8	88%	Open	12	--	--	--
Group 4	--	--	--	92%	-2 to +3	8	90%	-2 to +3	8	85%	+3 to -3	12
Group 5	--	--	--	--	--	--	90%	-2 to +3	8	85%	+3 to -3	12
Group 6	--	--	--	--	--	--	--	--	--	85%	-2 to +2	8

Notes :

PC - Percent Compaction by ASTM D1557 Test Method.
MC - Moisture Content for compaction in percent.
Open - As required to achieve compaction.
LT - Maximum loose lift thickness in inches.
-- Not suitable for this zone.



PLAN
NTS



SECTION
NTS

AR 025830

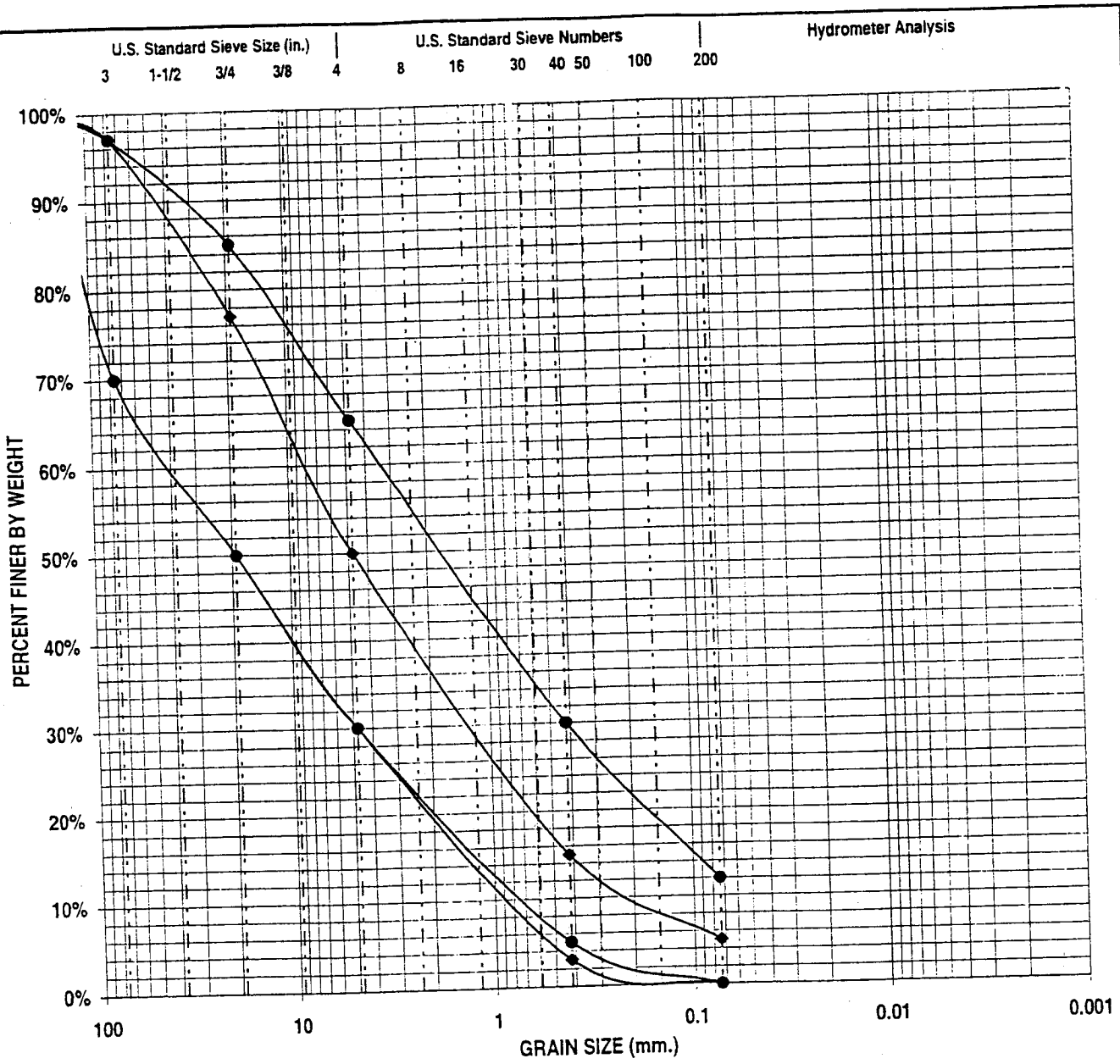
AGI TECHNOLOGIES

Water Main Protection Detail

HNTB/Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 7

190211s4.dwg	PROJECT NO. 14,190.211	DRAWN ALW	DATE 5 Jan 97	APPROVED	REVISED	DATE



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	SOURCE	CLASSIFICATION
◆	Embankment Fill; Group 1	Well Graded Sand and Gravel; GW / SW
◆	Embankment Fill; Group 1	Well Graded Sand and Gravel; GW / SW
●	Embankment Fill; Group 2	Silty Well Graded Sand and Gravel; GM / SM
●	Embankment Fill; Group 2	Silty Well Graded Sand and Gravel; GM / SM

AGI TECHNOLOGIES

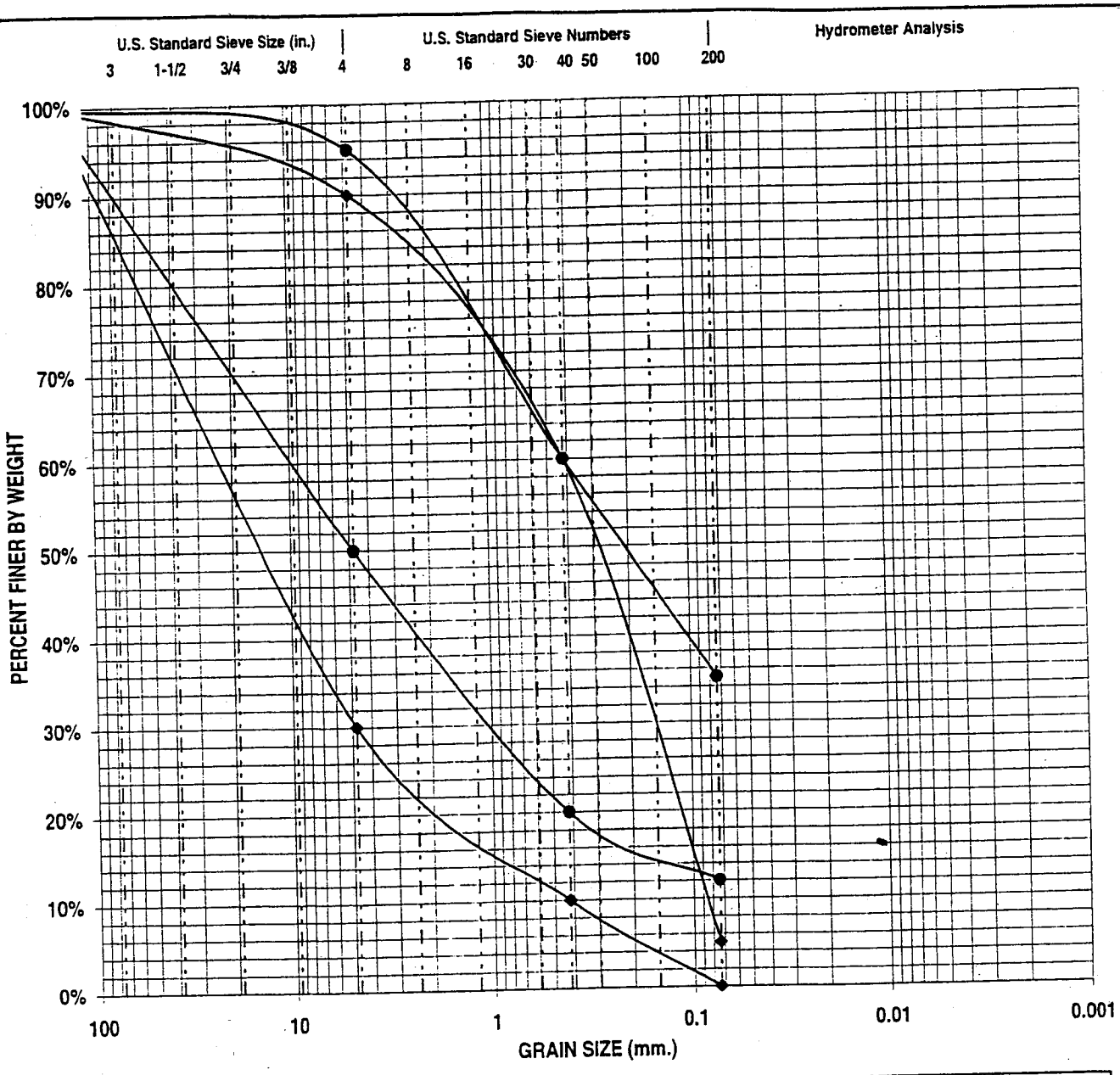
Fill Group 1 and 2

HNTB/Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 8

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	KAW	1/21/98			

AR 025831



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	SOURCE	CLASSIFICATION
◆	Embankment Fill; Group 3	Poorly Graded Sand and Gravel; GP / SP
◆	Embankment Fill; Group 3	Poorly Graded Sand and Gravel; GP / SP
●	Embankment Fill; Group 4	Silty Sand with Gravel; SM
●	Embankment Fill; Group 4	Silty Sand with Gravel; SM

AGI TECHNOLOGIES

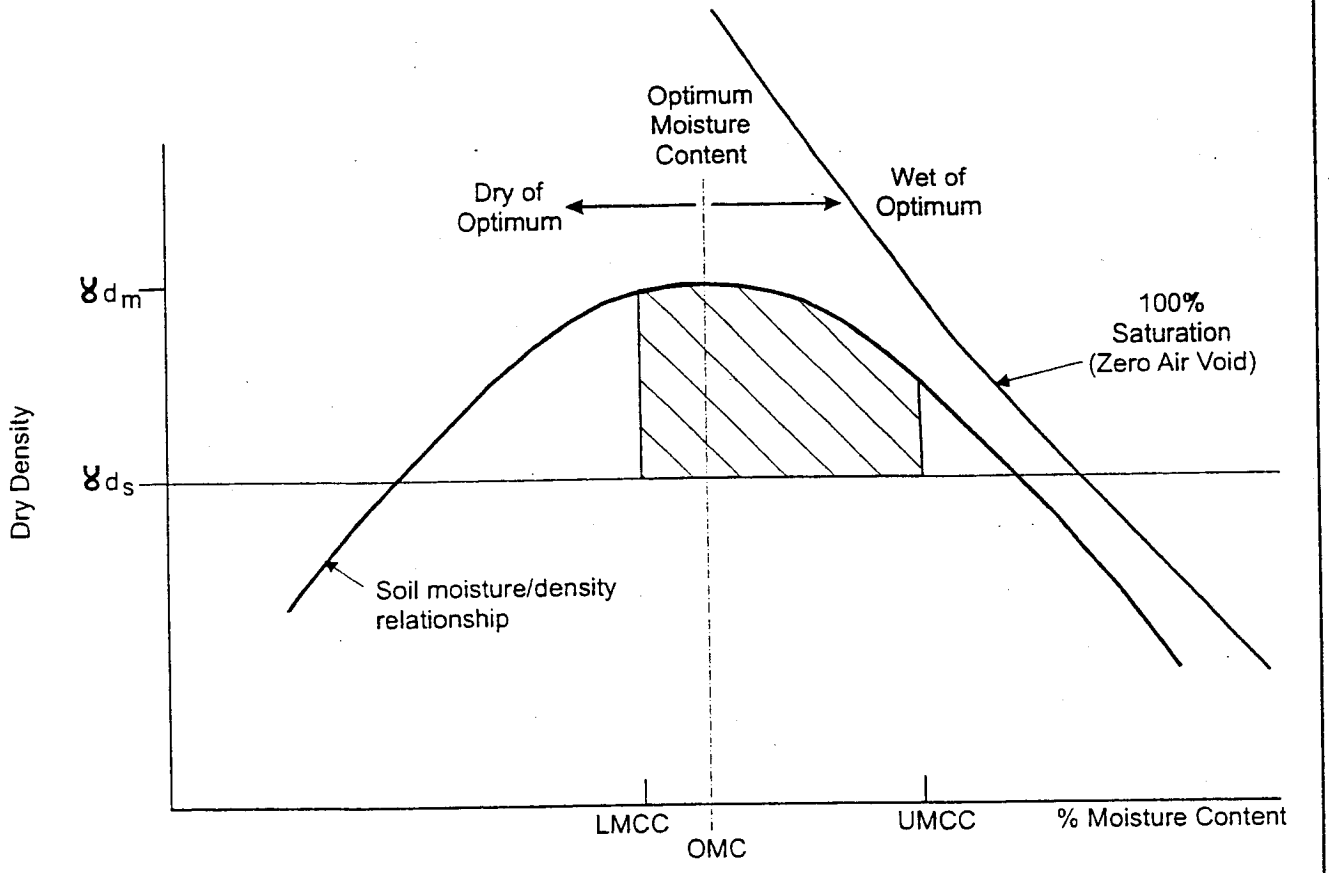
Fill Group 3 and 4

HNTB/Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 9

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	KAW	1/21/98			

AR 025832



	LEGEND
▨	Allowable moisture-density range during compaction
s	Percent saturation of compacted soil
γ_{d_m}	Maximum dry density of compacted soil
γ_{d_s}	Specified minimum relative compaction
OMC	Optimum moisture content for compaction of soil
LMCC, UMCC	Lower, upper moisture control criteria for compaction

AGI TECHNOLOGIES

Typical Moisture-Density Control Criteria

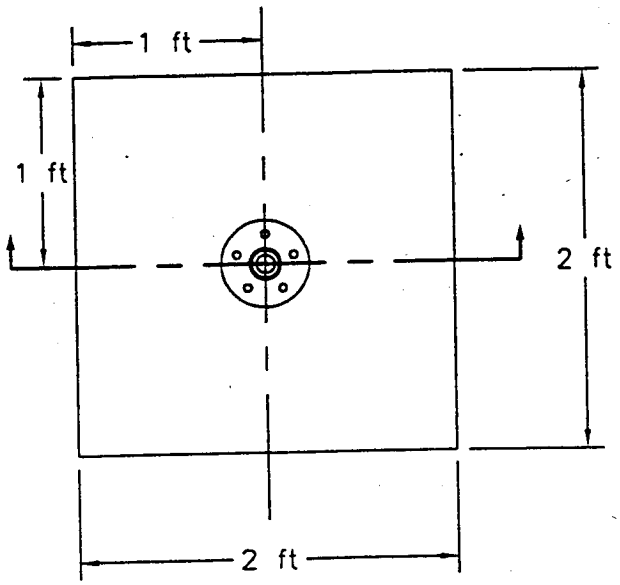
HNTB/Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 10

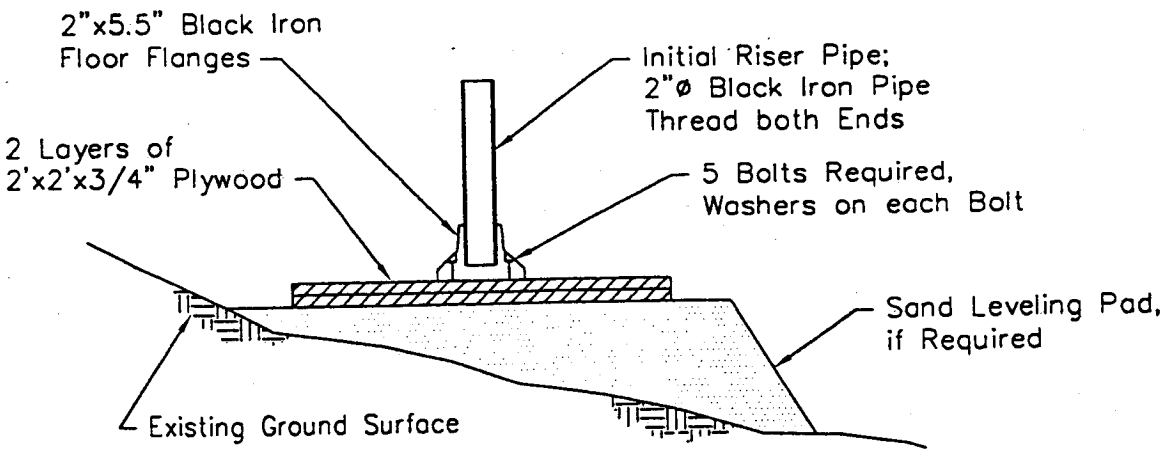
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
hntbgr.cdr	14,190.210	KM	24 Mar 94	BJA	4 Apr 96

AR 025833

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING



Add Coupling(s) and Riser Pipe(s) as required to maintain top of Riser Pipe at least 2 ft above top of fill.



AGI TECHNOLOGIES

Settlement Platform Detail

HNTB\Third Runway Project - Phase 1 Embankment
Sea-Tac International Airport, SeaTac, Washington

FIGURE 11

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	CEC	1 Dec 97			

190211s1.dwg

AR 025834

APPENDIX A

APPENDIX A

GEOLOGY AND FIELD EXPLORATION

GEOLOGY

Geologic Setting

Sea-Tac International Airport is located on the Des Moines Drift Plain within the Puget Lowland, a north-south-trending structural and topographic depression bordered on the west by the Olympic Mountains and on the east by the Cascade Mountains. The Lowland is underlain by Tertiary volcanic and sedimentary bedrock and is filled to present-day land surface with deep deposits of Quaternary glacial and nonglacial sediments.

Deposits of at least four glaciations have been identified in the southern Puget Lowland. The last of these major glaciations was named the Vashon. During the Vashon glaciation, a lobe of glacial ice emanating from the British Columbia coast ranges entered the Puget Lowland. The Vashon Glacier covered the entire Lowland with up to several thousand feet of ice, and at its maximum, extended a few miles south of Olympia. Fluvial (steam deposited), lacustrine (lake deposited), and direct ice contact processes associated with the advance and recession of the Vashon Glacier are responsible for the majority of the surface deposits and landforms throughout the Puget Lowland.

Geologic deposits we encountered in the airport area are discussed in the following paragraphs. The deposits are presented in general order from youngest to oldest, with the younger deposits generally overlying older deposits.

Topsoil

Topsoil, a deposit of organic rich soil, is found at the ground surface in undeveloped areas. An old Topsoil layer has been encountered beneath the original construction fill in some areas. The Old Topsoil is typically 6 to 12 inches thick and consists of medium dense silty sand with gravel and organics. This unit is characterized by moderate strength.

Artificial Fill

Artificial Fill (Qaf) occurs primarily as a result of initial site grading to establish a relatively level airfield area ranging between about Elevation 420 feet at the north end to about Elevation 350 feet at the south end. Fill placed during initial grading and construction in 1961 or 1962 was mostly derived from within or near the airport. The fill gradation is somewhat variable, but in general is comprised of brown to gray, fine to coarse sand with variable percentages of silt and gravel. Occasional cobbles were noted at some boring locations, as were occasional organics and silt layers. The majority of the Fill appears to have been obtained during grading of portions of the airfield originally underlain by Till.

Alluvium

Alluvium, a mixture of sand, silt, and clay, occurs at the surface in many of the on-site borrow areas. Alluvial deposits are the result of erosion and re-deposition of various geologic units since the Vashon glaciation. Alluvium generally occurs in low-lying areas (stream deposits) or at the base of slopes (slope wash or colluvium). Lacustrine Soil containing peat, silt, and clay may occur in shallow depressions or low-lying areas overlying Recessional Outwash.

Recessional Outwash

As the Vashon ice receded by melting and evaporation, large quantities of water flowed over the Puget Lowland cutting meltwater channels and depositing sediments into low-lying areas. These deposits are collectively known as Recessional Outwash (Qrs). This unit generally comprises fluvial sand and gravel or lacustrine sand. Recessional Outwash deposits typically overlie Till or Advance Outwash and partly fill depressions and former glacial channels. This deposit outcrops at the surface or underlies Surficial Deposits.

Till

Overriding Vashon glacial ice covered some areas with Till (Qgt), a nonsorted mixture of clay, silt, sand, and gravel. Other areas were simply eroded and sculpted by the moving ice. Till was compressed by the great weight of the overriding glacial ice and is generally dense to very dense. Where Till was exposed after retreat of the ice, the upper portion of the deposit was softened by exposure and is termed Weathered Till. This deposit outcrops at the surface or underlies a variable thickness of Recessional Outwash and Surficial Deposits.

Advance Outwash

Outwash streams of meltwater from the advancing Vashon glacier deposited sand and gravel over much of the area. This deposit is known as Advance Outwash (Qas). Advance Outwash encountered in our test borings typically comprises sand, silty sand, and gravel. Pockets of sandy silt with varying amounts of gravel occur within the deposit. Advance Outwash primarily underlies the Till but may be encountered immediately beneath Recessional Outwash in some areas (such as Area 3). It is sometimes difficult to distinguish from Recessional Outwash except where stratigraphic relationship is exposed or depositional form preserved. Advance Outwash has been glacially overridden and is considerably denser than Recessional Outwash.

Pre-Vashon Drift

Glacial drifts from two pre-Vashon glaciations – the Salmon Spring Glaciation and the older Stuck Glaciation – occur near Sea-Tac and generally underlie the Vashon deposits. These deposits are collectively referred to herein as Pre-Vashon Drift (Qu). An extensive sequence of Salmon Springs Drift is exposed in the cliffs bordering Commencement Bay. The Pre-Vashon Drift, as encountered in our explorations, consists primarily of fine-grained lacustrine silts encountered beneath the Advance Outwash or Till.

FIELD EXPLORATION

Subsurface Exploration

AGI Technologies (AGI) explored subsurface conditions in the proposed fill area starting in December 1993. Additional subsurface information was gathered in December 1994 and January 1996. This previous information and other background information from prior studies is attached. The most recent study, which started in September 1997 and was completed in November 1997, provided more extensive information for the final embankment design. Test borings and test pits are attached and are designated by exploration number-year drilled (for example: B1-97). Test pits and boring locations are shown on **Figure 1** of the text.

Exploration for this study was conducted in both the airport AOA and neighboring Port-owned properties. Test borings for this study ranged from 14.5 feet to a maximum of 60.5 feet BG9. Test borings were drilled using both a truck-mounted Mobile B-59 hollow-stem auger drill rig and a Drill Rig Specialties limited access rig where difficult access due to steep slopes or soft ground was encountered. Test pits were excavated with a Komatsu PC200 tracked excavator. Depth of test pits ranged from 3.5 feet to 10.0 feet bgs.

The test pit and test boring excavations were monitored by our engineers and geologists who determined specific exploration locations, examined and classified the geologic conditions and soils encountered, obtained representative soil samples, and recorded pertinent information including soil samples depths, stratigraphy, and soil engineering characteristics. Groundwater levels, where recorded on the logs, are those existing at the time exploration was completed. Soils are classified in accordance with the Unified Soil Classification System (USCS) and ASTM D-2487. The USCS is presented, with a key to the exploration logs, on the Soil Classification/Legend, Plate A1.

To obtain better quality and quantity soil samples from the test borings for laboratory testing purposes, we used a heavy-duty split-barrel sampler with a larger diameter than the Standard Penetration Test (SPT) split spoon. The sampler was driven 18 inches with a 300-pound hammer. For engineering analyses, it is necessary to correct the number of blows per foot obtained with the modified sampler to obtain an equivalent 'N-value'. The number of blows per foot actually recorded with the modified assembly; however, is the value shown at the appropriate sample depth on each boring log. Their locations are indicated on the boring logs by the symbol for an 'undisturbed sample' which is shown in the sample designation box on Plate A1.

All samples were sealed to limit moisture loss, labeled, and returned to our laboratory for further examination and testing. Test boring logs, modified to reflect the results of laboratory examination and testing, are presented on Plates A3 through A40. Test pit logs are presented on Plates A41 through A54. Stratification lines shown on the individual logs represent approximate boundaries between soil types; actual transitions may be either more gradual or more severe. The conditions depicted are for the date and location indicated only, and representative of conditions at other locations and times.

All explorations were located in the field from aerial maps supplied by the Port. These maps were generated from a 1993 orthographic projection. All exploration elevations were determined by interpolation between 5-foot contours, shown on the maps, and were laid out in each area by our field engineer or geologist. The locations and elevations should only be considered accurate to the degree implied by the method used.

Piezometer Design And Installation

Piezometers were installed in selected test borings in conformance with Washington State well construction standards by a Washington-licensed well driller. Plate A2 shows typical piezometer construction; the individual boring logs show specific piezometer completion details. The general procedures for piezometer construction were as follows:

- Boreholes drilled beyond screen depth were backfilled with silica sand to achieve desired base depth.
- PVC screen and blank sections were screwed together at land surface and lowered through the hollow-stem auger.
- The PVC casing consists of 1-inch-diameter, flush-thread coupled Schedule 80 PVC pipe with 0.020-inch milled slots comprising the screened interval. Screen lengths to 10 feet were used in the piezometers. The base of the screened interval was sealed with PVC bottom slip caps.
- The annulus between the PVC screen and the boring wall was backfilled with Colorado 10-20 silica sand to approximately 1 foot above the screen. The depth to the top of the backfill materials within the annulus was measured frequently with a fiberglass tape to maintain strict control of the piezometer construction and prevent overfilling the hollow-stem auger.
- Hydraulic seals were constructed of hydrated bentonite chips and bentonite grout placed above the sand pack to a depth of about 1 foot below ground surface to seal the piezometer from possible surface water contamination.
- Flush-mounted or standpipe protective steel monument cases with locking caps were installed over the plastic piezometer casing upon completion of construction. Monuments were set in concrete.

UNIFIED SOIL CLASSIFICATIONS SYSTEM

MAJOR DIVISIONS				TYPICAL NAMES
COARSE GRAINED SOILS (More than half is larger than No. 200 Sieve)	GRAVELS (More than half coarse fraction is larger than No. 4 sieve size)	Clean gravels with little or no fines	GW	Well graded gravels, gravel-sand mixtures
			GP	Poorly graded gravels, gravel-sand mixtures
		Gravels with over 12% fines	GM	Silty Gravels, poorly graded gravel-sand-silt mixtures
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures
	SANDS (More than half coarse fraction is larger than No. 4 sieve size)	Clean sands with little or no fines	SW	Well graded sands, gravelly sands
			SP	Poorly graded sands, gravelly sands
		Sands with over 12% fines	SM	Silty sand, poorly graded sand-silt mixtures
			SC	Clayey sands, poorly graded sand-clay mixtures
FINE GRAINED SOILS (More than half is smaller than No. 200 Sieve)	SILTS AND CLAYS (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic clays and organic silty clays of low plasticity
	SILTS AND CLAYS (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomacious fine sandy or silty soils, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			PT	Peat and other highly organic soils

SAMPLE
- ■ "Undisturbed"
- ⊠ Bulk/Grab
- □ Not Recovered
- ⊞ Recovered, Not Retained

CONTACT BETWEEN UNITS
- ——— Well Defined Change
- ——— Gradational Change
- - - - Obscure Change
- ▬▬ End of Exploration

BLOWS PER FOOT

Hammer is 300 pounds with 30-inch drop, unless otherwise noted
- S - SPT Sampler (2.0-Inch O.D.)
- T - Thin Wall Sampler (2.8-Inch Sample)
- H - Split Barrel Sampler (2.4-Inch Sample)

MOISTURE DESCRIPTION
- Dry - Considerably less than optimum for compaction
- Moist - Near optimum moisture content
- Wet - Over optimum moisture content
- Saturated - Below water table, in capillary zone, or in perched groundwater

PHYSICAL PROPERTY TESTS

Consol	-	Consolidation
LL	-	Liquid Limit
PL	-	Plastic Limit
Gs	-	Specific Gravity
SA	-	Size Analysis
TxS	-	Triaxial Shear
TxP	-	Triaxial Permeability
Perm	-	Permeability
Po	-	Porosity
MD	-	Moisture/Density
DS	-	Direct Shear
VS	-	Vane Shear
Comp	-	Compaction

UU - Unconsolidated, Undrained
CU - Consolidated, Undrained
CD - Consolidated, Drained

AGI TECHNOLOGIES

Soil Classification/Legend

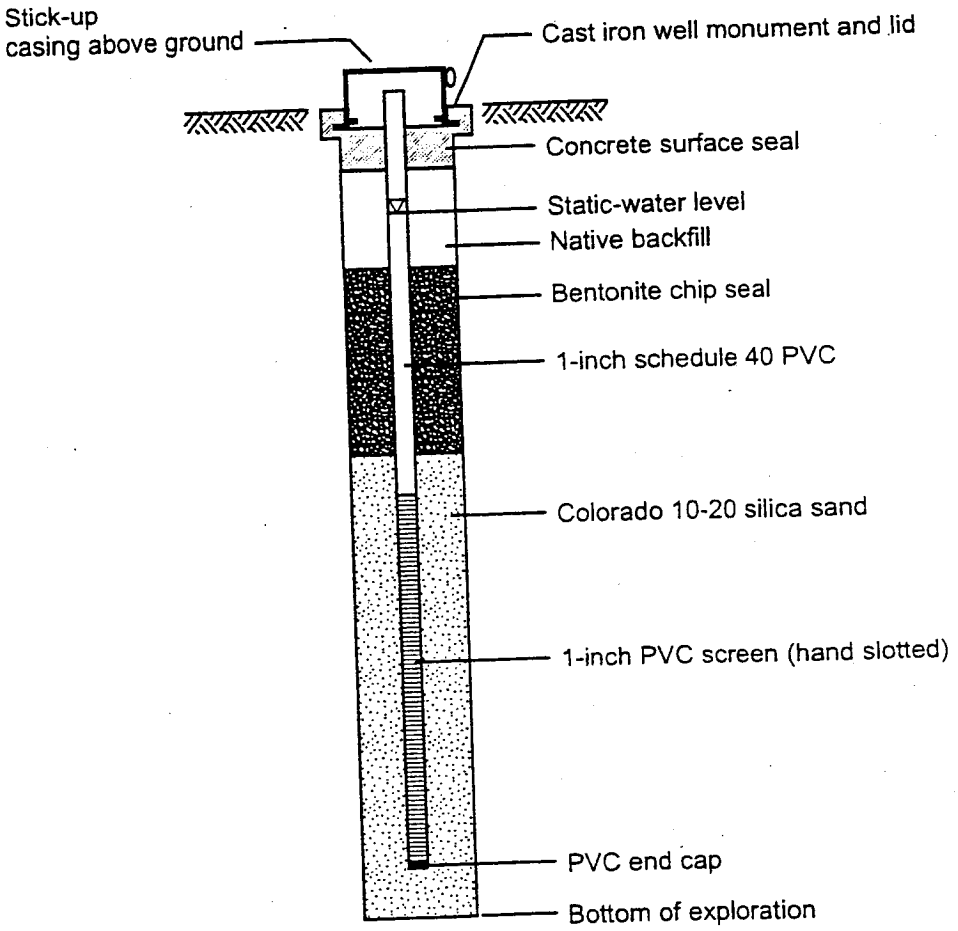
HNTB/SeaTac 1997 - Runway Investigation
SeaTac, Washington

PLATE **A1**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

soilClas.cdr

AR 025840



AGI TECHNOLOGIES

Piezometer Construction
HNTB/Runway Borrow Source Study
Seatac, Washington

PLATE **A2**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

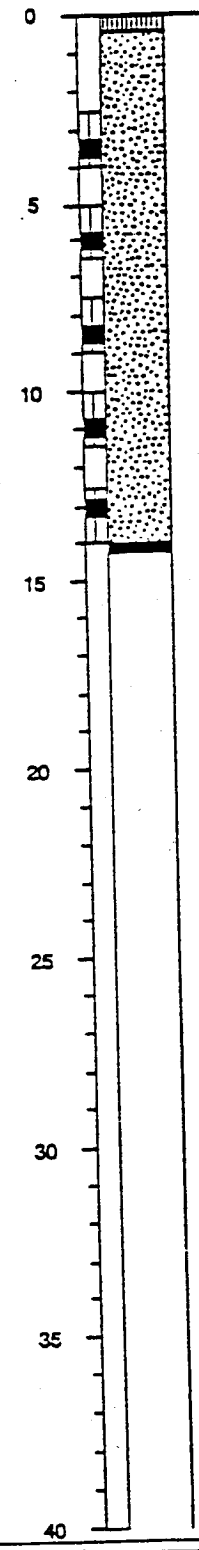
wel con.cdr

AR 025841

Equipment Mobile B-61 Date 1/25/91

Land Surface Elevation 402.1 feet Coordinates N17170, E12210

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	10.4	108	72
MD	15.7	108	88/11"
MD	8.2	106	87/11"
MD	9.3	105	81
MD	10.8	97	68



Sod layer.

BROWN SAND (SP) very dense, moist; fine to medium grained, with trace silt, and occasional gravel (Outwash).

No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT91-B30

HNTB/1991 and 1992 Airfield Pavement Reconstruction
SeaTac, Washington

PLATE A3

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	JFL	31 Jan 90			

AR 025842

P.O.S. Coordinates: E 11250 N 17950

Equipment Canterra CT-450

Land Surface Elevation 255 feet* Date 12/22/93

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth	Sample	
				0		GRAY SANDY SILT (ML) medium stiff, wet; with some organics and a trace of gravel (Colluvium).
MD	25.3	99	11			
				5		GRAY SAND (SP-SM) medium dense, saturated; fine grained, with some silt and a trace of fine gravel (Recessional Outwash).
			10			
				10		
			18			
MD	12.3	118	22			
				15		
MD	11.9	119	24			
				20		BROWN GRAY SAND (SP-SM) dense to very dense, saturated; fine grained, with silt and a trace of gravel (Advance Outwash).
MD	12.5	120	60			
				25		
MD	16.2	117	43			Becomes gray.
				30		
MD	30.1	91	27			GRAY SILT (ML) very stiff to hard, wet; laminated (Pre-Vashon Drift).
				35		
UC	31.3	95	35			
				40		Groundwater encountered at 7 feet during drilling.

*Datum: Port of Seattle

AGI TECHNOLOGIES

Log of Boring AT94b-B4

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

PLATE **A4**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.211	KM		29 March 94		

190203lg.pm5

AR 025843

P.O.S. Coordinates: E 12080 N 18500

Equipment Canterra CT-450

Land Surface Elevation 408 feet* Date 12/23/93

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth	Sample	
				0		Asphalt. Crushed rock base.
SA	7.8	127	52			GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Fill).
				5		GRAY SAND (SP) dense, moist; fine grained, with a trace of gravel (Fill).
MD	10.1	127	33			
				10		
MD	10.3	106	18			Becomes brown.
				15		
MD	8.6	114	27			
				20		
MD	17.1	117	31			Becomes moist to wet. GRAY SILTY SAND (SM) medium dense to dense, wet; fine to medium grained, with gravel (Fill).
				25		
MD	10.8	127	21			
				30		
MD	8.5	104	56			With layers of gray sand, and a trace of rootlets.
				35		
MD	13.8	119	24			
				40		

*Datum: Port of Seattle

AGI TECHNOLOGIES

Log of Boring AT94b-B5 (0-40')

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

PLATE **A5**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.211	KM		29 March 94		

190203lg.pm5

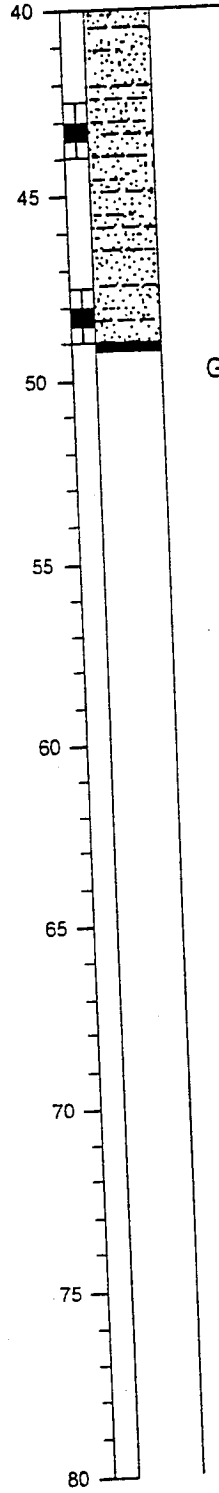
AR 025844

P.O.S. Coordinates: E 12080 N 18500

Equipment Canterra CT-450

Land Surface Elevation 408 feet* Date 12/23/93

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth	Sample
MD	5.9	120	37	40	
				45	
MD	5.2	116	28		
				50	
				55	
				60	
				65	
				70	
				75	
				80	



Groundwater not encountered during drilling.

*Datum: Port of Seattle

PLATE

A6

Log of Boring AT94b-B5 (40-49')

HNTB/Third Runway Preliminary Engineering Design

Sea-Tac, Washington

AGI TECHNOLOGIES

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.211	KM		29 March 94		

190203lg.pm5

AR 025845

P.O.S. Coordinates: E 11250 N 18400

Equipment Canterra CT-450

Land Surface Elevation 275 feet* Date 12/22/93

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth	Sample	
				0		BROWN SILTY SAND (SM) very loose, moist; fine grained, with a trace of organics (Recessional Outwash).
M	13.4		2			
				5		GRAY SAND (SP) medium dense, saturated; fine to coarse grained, with some silt and gravel (Recessional Outwash).
MD	11.7	116	16			
				10		GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).
MD	14.5	111	92/9"			
				15		
MD	7.0	114	100/5"			
				20		Groundwater encountered at 7.5 feet during drilling.
				25		
				30		
				35		
				40		

*Datum: Port of Seattle

PLATE A7

AGI TECHNOLOGIES

Log of Boring AT94b-B6

HNTB/Third Runway Preliminary EngineeringDesign
Sea-Tac, Washington

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.211	KM		29 March 94		

190203lg.pm5

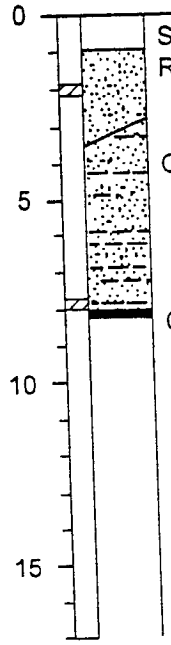
AR 025846

Laboratory Tests | Moisture Content | Dry Density | Depth | Sample

Test Pit Number 5

P.O.S. Coordinates
E 11350
N 15800

Date 12/10/93 Elevation 380 feet



Sod.

RED BROWN SAND (SP) medium dense, moist to wet; fine grained, with some silt (Recessional Outwash).

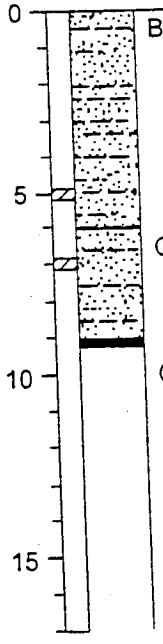
GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with gravel and occasional cobbles (Glacial Till).

Groundwater not encountered.

Test Pit Number 6

P.O.S. Coordinates
E 11650
N 17000

Date 12/10/93 Elevation 380 feet



BROWN SILTY SAND (SM) dense to very dense, moist; fine to coarse grained, with gravel, and occasional cobbles, asphalt chunks (Fill).

GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with gravel (Fill).

Groundwater not encountered.

PLATE

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP5 and TP-6

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

A8

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

190203TP.p65

Test Pit Number 7

P.O.S. Coordinates
E 11300
N 17400

Date 12/13/93 Elevation 320 feet

Laboratory Tests	Moisture Content	Dry Density	Depth	Sample
			0	
PI	30.2		5	
			10	
			15	

Sod.
BROWN SANDY SILT (ML) stiff, moist to wet; interbedded with brown silty sand (Colluvium).

GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).

Groundwater not encountered.

Test Pit Number 8

P.O.S. Coordinates
E 11400
N 21900

Date 12/14/93 Elevation 285 feet

Laboratory Tests	Moisture Content	Dry Density	Depth	Sample
			0	
PI	34.6		5	
M	23.5		10	
			15	

Sod.
BROWN SILT (ML) medium stiff, moist; with organics and rootlets and occasional sand layers.

BROWN GRAY SANDY SILT (ML) stiff, wet; mottled, with a trace of fine gravel.

Groundwater not encountered.

PLATE

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP7 and TP8

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

A9

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

190203TP.p65

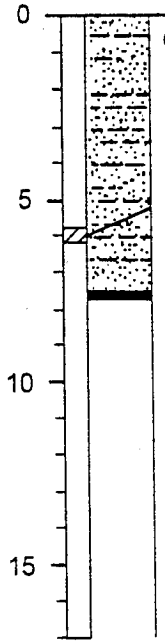
AR 025848

Laboratory Tests | Moisture Content | Dry Density | Depth | Sample

Test Pit Number 9

P.O.S. Coordinates
E 11650
N 18450

Date 12/10/93 Elevation 325 feet



GRAY BROWN SILTY SAND (SM) medium dense to dense, moist; fine to coarse grained, with gravel and occasional cobbles (Fill).

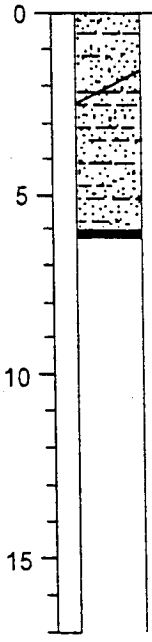
GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with gravel (Glacial Till).

Groundwater not encountered.

Test Pit Number 10

P.O.S. Coordinates
E 11800
N 17120

Date 12/10/93 Elevation 370 feet



RED BROWN SILTY SAND (SM) medium dense to dense, moist; mottled, fine grained, with a trace of gravel (Fill).

LIGHT BROWN SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).

Groundwater not encountered.

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP9 and TP10

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

PLATE **A10**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

190203TP.p65

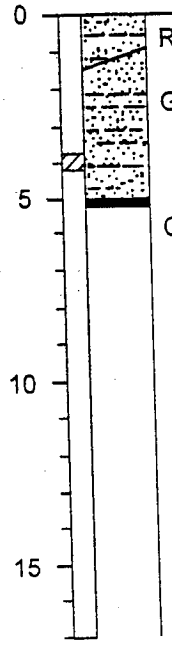
AR 025849

Laboratory Tests | Moisture Content | Dry Density | Depth | Sample

Test Pit Number 11

P.O.S. Coordinates
E 11400
N 19500

Date 12/10/93 Elevation 325 feet



RED BROWN SILTY SAND (SM) dense to very dense, moist; fine to medium grained, with gravel (Glacial Till).

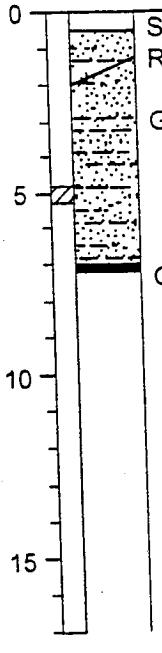
GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).

Groundwater not encountered.

Test Pit Number 12

P.O.S. Coordinates
E 11300
N 20100

Date 12/10/93 Elevation 327 feet



Sod.

RED BROWN SILTY SAND (SM) dense, moist; mottled, fine to coarse grained, with gravel (Glacial Till).

GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with gravel and occasional cobbles (Glacial Till).

Groundwater not encountered.

PLATE

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP11 and TP12

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

A11

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

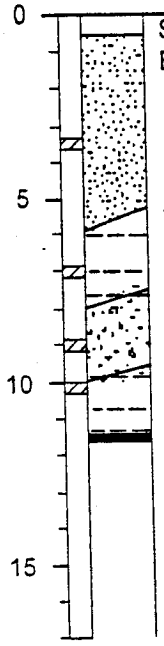
190203TP.p65

Laboratory Tests	Moisture Content	Dry Density	Depth	Sample

Test Pit Number 13

P.O.S. Coordinates
E 11300
N 21550

Date 12/14/93 Elevation 295 feet



0 Sod.

BROWN SAND (SP) medium dense, moist; fine grained, with some silt and a trace of gravel and organics.

5

BROWN SANDY SILT (ML) medium stiff, wet; interbedded with layers of BROWN SAND (SP).

PI 34.6

BROWN SAND AND GRAVEL (SW) medium dense, wet to saturated; with some silt.

M 26.7

10 BLUE GRAY SILT (ML) medium stiff, moist with a trace of organics and sand.

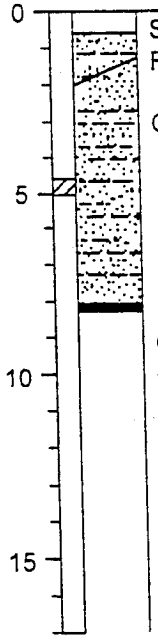
Groundwater seepage encountered at 6 and 10 feet.

15

Test Pit Number 14

P.O.S. Coordinates
E 11750
N 20800

Date 12/10/93 Elevation 353 feet



0 Sod.

RED BROWN SILTY SAND (SM) dense, moist; fine to medium grained, with gravel (Glacial Till).

5 GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).

Groundwater not encountered.

10

15

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP13 and TP14

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

PLATE **A12**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

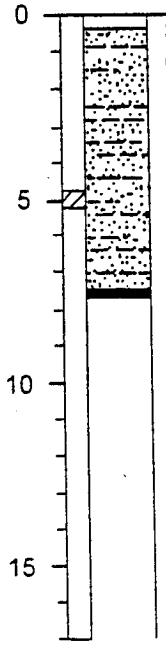
190203TP.p65

Laboratory Tests | Moisture Content | Dry Density | Depth | Sample

Test Pit Number 15

P.O.S. Coordinates
E 11800
N 18450

Date 12/13/93 Elevation 345 feet



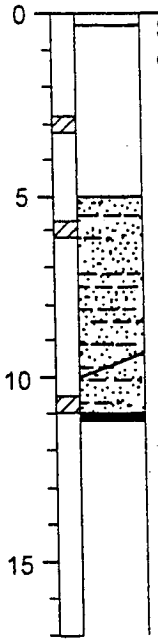
Sod.
GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, with gravel (Glacial Till).

Groundwater not encountered.

Test Pit Number 16

P.O.S. Coordinates
E 11700
N 13450

Date 12/13/93 Elevation 368 feet



Sod.
GRAY BROWN SAND (SP-SM) medium dense, wet; fine grained, with silt and a trace of gravel (Fill).

M 17.1

GRAY SILTY SAND (SM) dense, moist; fine to medium grained, with gravel and a trace of organics (Fill).

GRAY BROWN SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Glacial Till).

Groundwater seepage encountered at 5 and 10 feet.

AGI TECHNOLOGIES

Log of Test Pits AT94b-TP15 and TP16

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

PLATE **A13**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	KM		29 March 94		

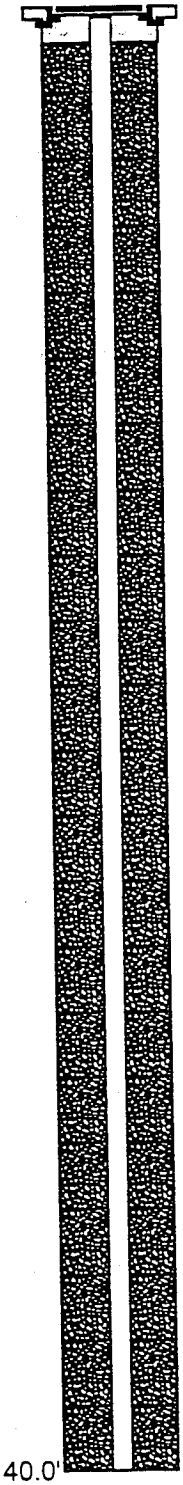
190203TP.p65

P.O.S. Coordinates: N 19,015 E 12,064

Equipment Mobile B59

Land Surface Elevation 408 feet

Completion Date 1/30/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Asphalt Gravel basecourse. BROWN GRAY SILTY SAND (SM) very dense, wet; fine to medium grained, with a trace of gravel.
MD MA	11.1	113.7	61	5		
MD MA DS	8.4	136.3	55	10		
MD	10.3	128.2	32	15		Becomes brown gray, dense, wet.
MD	7.8	133.7	55	20		Becomes very dense.
						Easier drilling from 20-22.5' bgs.
MD MA DS	10.1	129.4	74	25		
						Becomes dense, with a trace of organics.
MD	14.5	100.7	48	30		
			50/2"			Sampler driven on cobbles at 33' bgs.
				35		
MD MA	10.5	102.9	50/3"			BROWN GRAY SILTY SAND (SM) very dense, moist to wet; fine to medium grained, with some gravel and pockets of fine to medium grained sand.
				40		

AGI TECHNOLOGIES

Log of Piezometer AT96-B1 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A14**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2.cdr

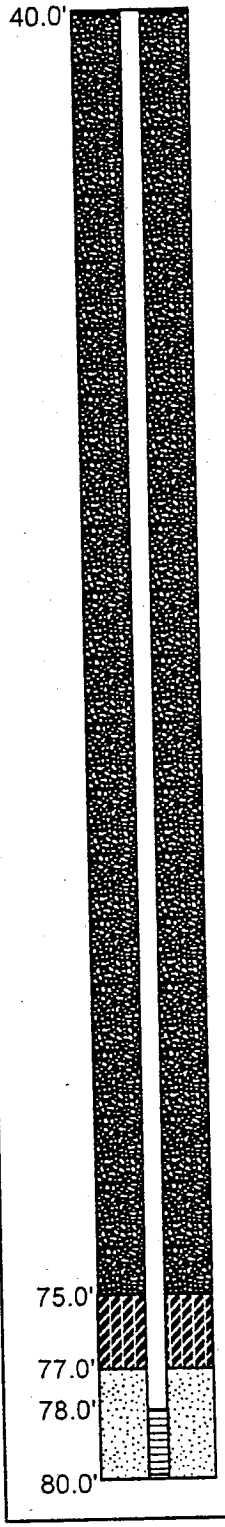
AR 025853

P.O.S. Coordinates: N 19,015 E 12,064

Equipment Mobile B59

Land Surface Elevation 408 feet

Completion Date 1/30 /96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		
				45		
MD	14.6	111.8	50/4"	50		GRAY SAND (SP) dense, wet; fine to medium grained.
MD	10.8	121.3	50/3"	55		BROWN GRAY SILTY SAND (SM) very dense, wet; fine to medium grained, mottled with gravel (Fill).
MD	9.2	114.4	50/5"	60		BROWN GRAY SILTY SAND (SM-SP) very dense, wet; fine grained (Recessional Outwash).
						BROWN GRAY SAND (SP) very dense, wet; fine to medium grained (Recessional Outwash).
MD MA DS	7.1	109.4	59	65		Becomes fine grained.
MD	12.1	108.4	50/3"	70		GRAY SILTY SAND (SM) very dense, wet; fine to coarse grained, with gravel (Till).
MD	6.2	120.7	50/4"	75		
MD	3.1	117.7	50/5"	80		LIGHT GRAY SAND (SP) very dense, moist; fine to medium grained, with a trace of silt and gravel (Advance Outwash).

AGI TECHNOLOGIES

Log of Piezometer AT96-B1 (40-80')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A15**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2more.cdr

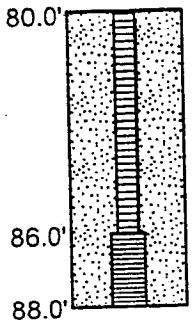
AR 025854

P.O.S. Coordinates: N 19,015 E 12,064

Equipment Mobile B59

Land Surface Elevation 408 feet

Completion Date 1/30/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
MD	6.0	107.3	50/5"	80	
MD	6.3	102.2	100/3"	85	
				90	
				95	
				100	
				105	
				110	
				115	
				120	

Becomes wet.

GRAY SILTY SAND (SM) very dense, wet; fine to medium grained, with some gravel.

Boring terminated at 88 feet bgs on 1/30/96.

Piezometer installed on 1/30/96.

Groundwater not encountered during drilling.

AGI TECHNOLOGIES

Log of Piezometer AT96-B1 (80-88')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A16

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	11 Feb 96			

B2most.cdr

AR 025855

P.O.S. Coordinates: N 18,812 E 11,837

Equipment Mobile B59

Land Surface Elevation 345 feet

Completion Date 1/22/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		RED BROWN SANDY SILT (ML) soft, moist to wet; with fine to coarse grained sand and organics (Fill).
MD	35.6	92.9	50/5"	5		BROWN GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel (Till).
MD MA DS	13.1	118.5	34	10		Becomes dense, with lenses of coarse sand.
			50/4"	15		
						GRAY SAND (SP) very dense, moist; fine grained.
MD MA DS	8.9	109.4	50/5.5"	20		
						Becomes fine to medium grained.
MD	5.2	102.0	50/5.5"	25		
						Becomes brown, wet to saturated.
MD	20.6	102.8	60	30		
						Becomes gray, saturated.
MD	20.4	106.9	50/5"	35		
						Boring terminated on 1/22/96.
MD MA DS	22.1	108.0	50/2"	40		Boring backfilled with cuttings and bentonite. Groundwater encountered at 32.5 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT96-B2

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A17

boring.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 25 Feb 96	APPROVED	REVISED	DATE

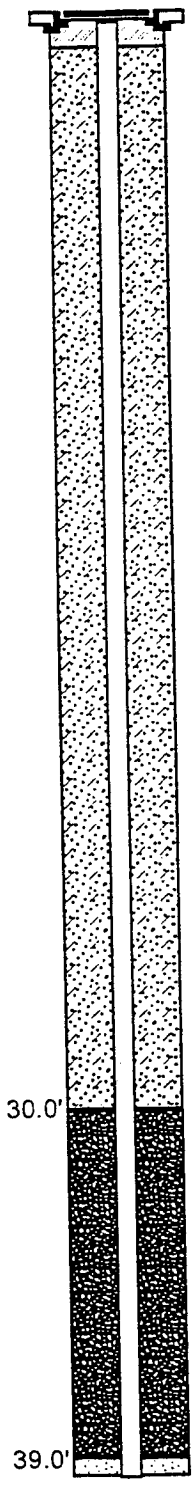
AR 025856

P.O.S. Coordinates: N 18,478 E 11,627

Equipment Mobile B59

Land Surface Elevation 325 feet

Completion Date 1/23/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SANDY SILT (ML) medium stiff, wet; with organics (Fill).
MD	13.5	118.5	28			BROWN GRAY SILTY SAND (SM) medium dense, moist; mottled, with gravel, (Weathered Till).
				5		
MD	9.2	137.6	42			Becomes dense with organic seam.
				10		GRAY BROWN SAND (SP-SW) very dense, moist; fine to coarse grained, with some silt (Advance Outwash).
MD MA	7.3	134.7	68			
				15		
MD	11.5	112.8	50/5"			RED BROWN SAND (SP) very dense, moist; fine to medium grained, with some gravel.
				20		
MD MA DS	5.9	100.4	50/5"			
				25		
MD	12.8	111.7	50/5.5"			Becomes brown, wet.
				30		
MD			50/5.5"			Becomes saturated.
				35		
			50/3"			
				40		

AGI TECHNOLOGIES

Log of Piezometer AT96-B3 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A18**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2.cdr

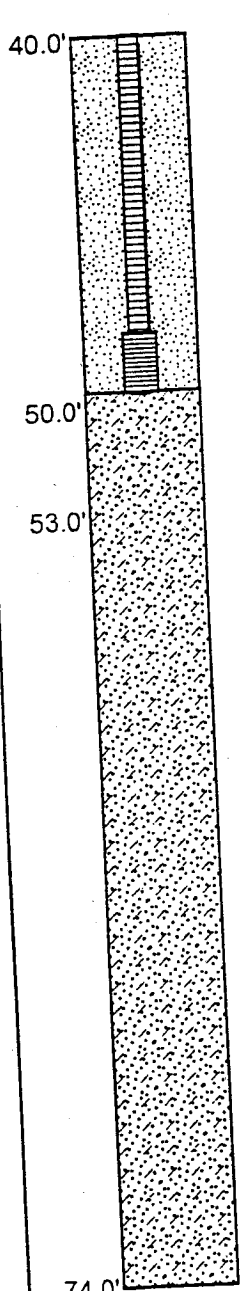
AR 025857

P.O.S. Coordinates: N 18,478 E 11,627

Equipment Mobile B59

Land Surface Elevation 325 feet

Completion Date 1/23/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		GRAY SILTY SAND (SM-SP) very dense, saturated; fine grained.
MD	25.4	102.4	50/5.5"	45		
MD	31.6	92.5	50/6"	50		GRAY SILT (ML) very hard, wet.
MD	33.5	95.1	50/4"	55		GRAY SAND (SP) very dense, saturated; fine grained, with some silt.
MD	22.3	109.9	50/4"	60		With interbedded silt seams.
			50/4"	65		GRAY SANDY SILT (ML-SM) very dense, wet to saturated; fine grained.
			63	70		GRAY SILT (ML) very hard, wet to saturated; with a trace of fine sand.
MD	25.1	104.3	50/4"	75		GRAY SANDY SILT (ML-SM) very hard, saturated; fine grained.
				80		Boring terminated at 74 feet bgs. Groundwater encountered at 31.5 feet bgs during drilling. Piezometer installed on 1/23/96.

AGI TECHNOLOGIES

Log of Piezometer AT96-B3 (40-74')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A19

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2more.cdr

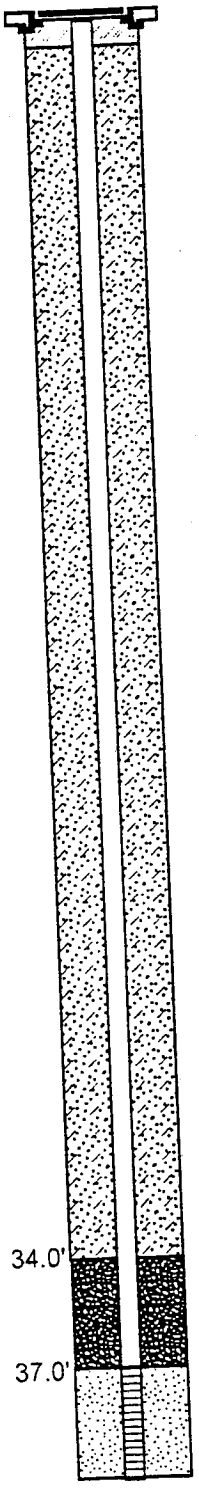
AR 025858

P.O.S. Coordinates: N 18,806 E 11,253

Equipment Mobile B59

Land Surface Elevation 280 feet

Completion Date 1/18/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SANDY SILTY (ML) medium stiff, saturated; with organics (Fill).
						BROWN SAND (SP) medium dense, wet; fine to medium grained (Recessional).
			13			
				5		BROWN SILTY SAND (SM) very dense, wet to saturated; with gravel.
MD	19.9	114.4	58			
				10		GRAY SILTY SAND (SM) very dense, moist to wet; fine to medium grained, with gravel (Till).
MD DS -200	7.8	125.2	50/6"			
				15		GRAY SAND (SP) very dense, wet to saturated, fine to medium grained, with a trace of gravel and silt.
MD	15.7	118.9	50/5"			
				20		GRAY SILTY SAND (SM) very dense, wet to saturated; fine to medium grained.
MD	16.3	116.0	50/5"			
				25		Interbedded lenses of clean sand.
MD	13.3	125.5	50/3"			
				30		Becomes saturated, fine to coarse grained.
MD DS -200	17.0	115.6	50/5"			
				35		With cobbles at 36'.
MD	24.8	101.5	50/5.5"			Becomes fine grained.
				40		

AGI TECHNOLOGIES

Log of Piezometer AT96-B4 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A20**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

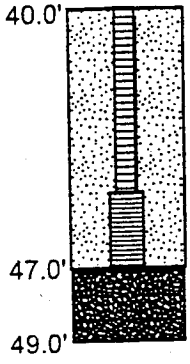
B2.cdr

AR 025859

P.O.S. Coordinates: N 18,806 E 11,253

Equipment Mobile B59

Land Surface Elevation 280 feet Completion Date 1/17/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
MD	16.3	114.1	50/5.5"	40	
MD	17.6	112.4	39	45	
				50	
				55	
				60	
				65	
				70	
				75	
				80	

GRAY SAND (SP) very dense, saturated; fine to medium grained.

GRAY SILT (ML) very hard, wet; with trace sand.

GRAY SAND (SP) dense, saturated; fine grained, with silt.

Boring terminated at 49 feet bgs.
Groundwater encountered at 17.5 feet bgs during drilling.
Piezometer installed on 1/18/96.

AGI TECHNOLOGIES

Log of Piezometer AT96-B4 (40-49')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A21

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2more.cdr

AR 025860

P.O.S. Coordinates: N 19,738 E 11,282

Equipment Mobile B59

Land Surface Elevation 343 feet

Completion Date 1/22/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SANDY SILT (ML) medium stiff, moist to wet; with organic debris.
			50/1"			
				5		Cobbles from 2.5 to 5.5 feet bgs. BROWN GRAY SILTY SAND (SM) very dense, wet; fine to medium grained, with gravel.
MD	10.6	122.9	50/5"	10		
MD	9.5	124.4	50/5"	15		
MD	11.2	119.5	50/4.5"	20		
MD	10.5	101.7	50/6"	25		
MD	9.2	104.9	50/3"	30		GRAY SAND (SP) very dense, wet to saturated; fine to medium grianed, with some silt and a trace of gravel.
			50/5.5"	35		
MD DS	15.9	121.8	50/5"	40		

AGI TECHNOLOGIES

Log of Boring AT96-B5 (0 - 40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A22

boring.cdr	PROJECT NO 14,190.211	DRAWN ECR	DATE 25 Feb 96	APPROVED	REVISED	DATE

AR 025861

P.O.S. Coordinates: N 19,404 E 11,604

Equipment Mobile B59

Land Surface Elevation 343 feet

Completion Date 1/22/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		Becomes fine grained and saturated.
MD	20.9	114.7	50/5.5"	45		BROWN GRAY SILTY SAND (SM) very dense, saturated; fine grained, with a trace of gravel.
MD MA DS	15.2	120.2	50/5"	50		Becomes brown.
MD	22.2	106.5	50/5"	55		BROWN GRAY SAND (SP-SM) very dense, saturated; with silt.
MD	24.8	105.3	50/5"	60		Boring terminated at 58.5 feet bgs during drilling. Boring backfilled with cuttings and bentonite. Groundwater encountered at 41.5 feet bgs during drilling.
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT96-B5 (40-58.5')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A23

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

boring40.cdr

AR 025862

P.O.S. Coordinates: N 19,738 E 11,282

Equipment Mobile B59

Land Surface Elevation 314 feet

Completion Date 1/16/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SANDY SILT (ML) medium stiff, wet; with roots (Fill).
MD	19.2	112.1	13			BROWN GRAY SILTY SAND (SM) medium dense, moist; fine to coarse grained, mottled, with gravel.
				5		GRAY SAND (SP) dense, wet; fine to medium grained, with a trace of silt.
MD	22.9	108.5	37			
				10		GRAY SILTY SAND (SM) very dense, moist to wet; fine to coarse grained, with gravel (TIII).
MD	8.2	128.5	50/5"			
				15		
-200			50/5"			Increasing silt content.
				20		
			50/2"			
				25		
MD	8.1	107.8	50/5.5"			
				30		GRAY SAND (SP) very dense, saturated, fine to medium grained, with a trace of silt.
MD DS	15.5	117.7	50/5"			
				35		Silt content increases at 38 feet.
						Boring terminated at 38.5 feet bgs during drilling.
MD	11.5	125.4	50/4"			Boring backfilled with cuttings and bentonite.
				40		Groundwater encountered at 33 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT96-B6

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A24**

boring.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 25 Feb 96	APPROVED	REVISED	DATE

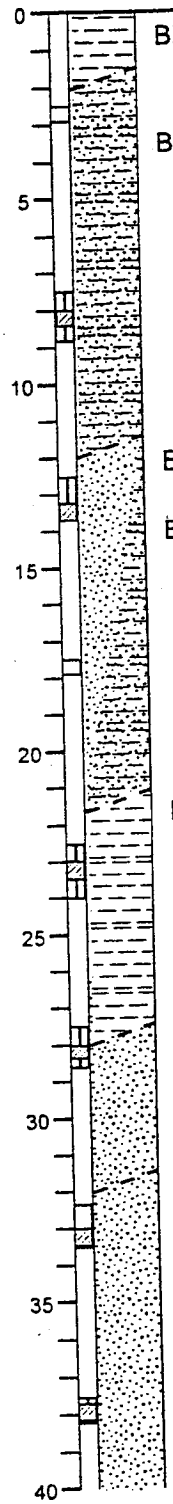
AR 025863

P.O.S. Coordinates: N 20,032 E 11,754

Equipment Mobile B59

Land Surface Elevation 367 feet

Completion Date 1/24/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
			35/4"	BROWN SANDY SILT (ML) medium stiff, wet; with organics (Fill).
				BROWN GRAY SILTY SAND (SM) very dense, moist; with gravel (Till).
MD	8.6	127.5	50/4"	
MD DS -200	17.0	123.3	50/5"	BROWN SILTY SAND (SP-SM) very dense, wet to saturated; with trace roots. Becomes wet at 13 feet.
			50/5"	
MD	28.3	98.9	50/5"	LIGHT BROWN SANDY SILT (ML) very hard, saturated; fine grained sand, with lenses of medium to coarse grained sand.
MD	20.8	108.5	50/5.5"	GRAY SAND (SP) very dense, saturated; fine to medium grained, with silt.
				BROWN SAND (SP) very dense, wet; fine to coarse grained, (Advance Outwash).
MD DS	7.4	109.2	50/5"	
MD	8.0	105.0	50/2"	

AGI TECHNOLOGIES

Log of Boring AT96-B7 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE **A25**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	25 Feb 96			

boring.cdr

AR 025864

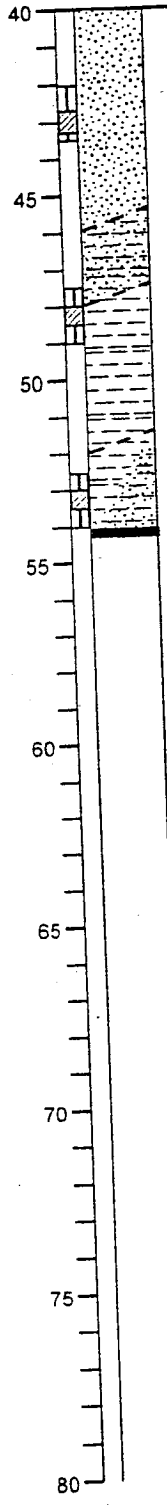
P.O.S. Coordinates: N 20,032 E 11,754

Equipment Mobile B59

Land Surface Elevation 343 feet

Completion Date 1/22/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	8.7	115.6	50/5.5"
			50/6"
DS			50/5.5"



BROWN SILTY SAND (SM) very dense, saturated; fine grained.

BROWN SILT (ML) very hard, saturated; with some fine sand.

GRAY SANDY SILT (ML-SM) very hard, saturated; with lenses of fine sand.

Boring terminated at 54 feet bgs on 1/24/96.
Boring backfilled with cuttings and bentonite.
Groundwater encountered at 18 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT96-B7 (40-54')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A26

boring40.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 24 Feb 96	APPROVED	REVISED	DATE

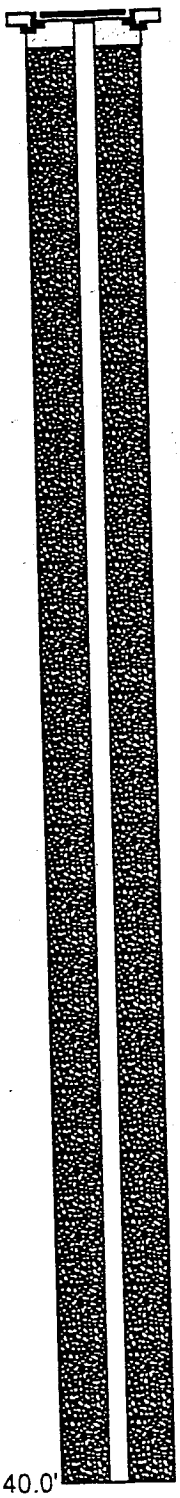
AR 025865

P.O.S. Coordinates: N 19,738 E 11,282

Equipment Mobile B59

Land Surface Elevation 413 feet

Completion Date 1/26/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Asphalt BROWN SANDY SILT (ML) medium stiff, wet; with organics.
MD	7.8	135.6	38			BROWN GRAY SILTY SAND (SM) dense, moist; fine to medium grained, with gravel (Fill).
				5		
MD DS	8.8	123.9	32			
				10		
MD	20.2	93.0	78			
				15		
MD	6.1	135.7	72			GRAY SILTY SAND (SM) very dense, moist to wet; fine to medium grained, with some gravel and a trace of organics.
				20		Easier driling at 21'.
MD	13.0	125.3	63			With peat fragments.
				25		
MD	12.2	121.7	50/6"			BROWN GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, with gravel.
				30		
MD	8.3	106.3	50/5"			
				35		
MD DS -200	8.8	105.9	50/6"			Becomes wet; decreasing silt content.
				40		

AGI TECHNOLOGIES

Log of Piezometer AT96-B8 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A27

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2.cdr

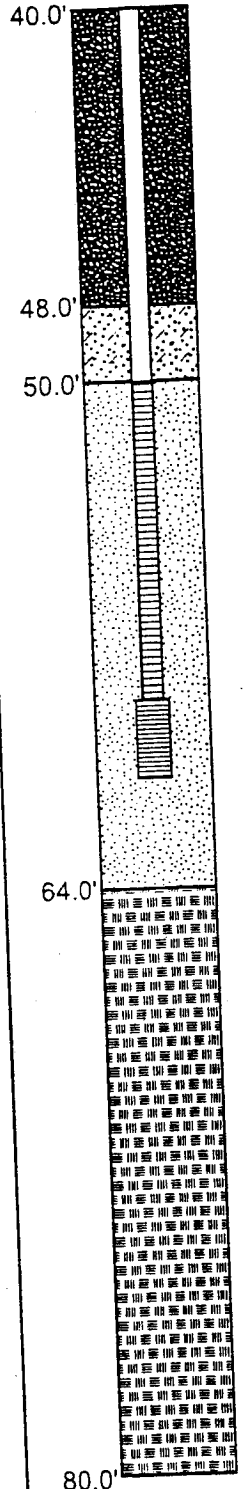
AR 025866

P.O.S. Coordinates: N 20,088 E 12,012

Equipment Mobile B59

Land Surface Elevation 413 feet

Completion Date 1/25/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		BROWN SAND (SP) very dense, wet; fine grained.
MD	9.1	97.5	50/4"	45		
MD	15.8	114.5	50/5.5"			Becomes saturated.
				50		GRAY SAND (SP) very dense, saturated; fine to medium grained, with a trace of gravel.
MD	20.5	111.2	50/5"			
MD DS	20.9	106.9	50/3"	55		Light heaving sands.
MD	17.5	112.3	51	60		GRAY SILTY SAND (SM) very dense, saturated; fine grained.
MD	21.2	108.2	50/6"	65		GRAY SAND (SP) very dense, saturated; fine grained, with some silt.
MD	22.8	110.5	50/3"	70		BROWN SILTY SAND (SP-SM) very dense, saturated; fine to medium grained.
MD	14.9	116.6	50/4.5"	75		RED BROWN SAND (SP) very dense, wet to saturated; fine to medium grained, mottled, with a trace of gravel and silt.
				80		

AGI TECHNOLOGIES

Log of Piezometer AT96-B8 (40-80')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A28

PROJECT NO	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2more.cdr

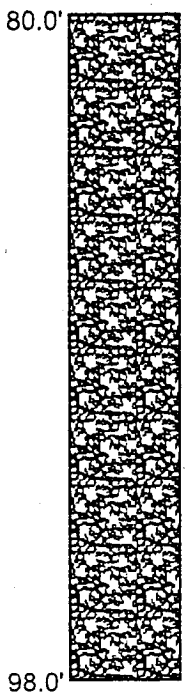
AR 025867

P.O.S. Coordinates: N 20,088 E 12,012

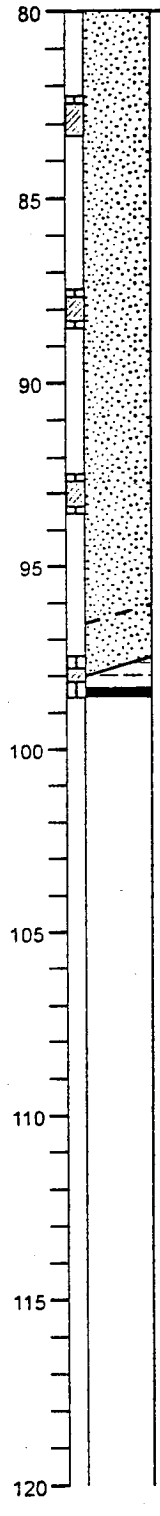
Equipment Mobile B59

Land Surface Elevation 413 feet

Completion Date 1/25/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	6.1	94.5	50/5"
MD	6.3	89.5	50/6"
MD	7.2	87.3	50/6"
MD	13.4	106.8	50/5"



Becomes fine grained.

BROWN SAND (SP) very dense, wet; fine grained, with some silt.

GRAY SILT (ML) very hard, wet; with some sand

Boring terminated at 98.5 feet bgs on 1/25/96.
Groundwater encountered at 48 feet bgs during drilling.
Piezometer installed on 1/26/96.

AGI TECHNOLOGIES

Log of Piezometer AT96-B8 (80-98.5')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A29

PROJECT NO	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	11 Feb 96			

B2most.cdr

AR 025868

P.O.S. Coordinates: N 20,366 E 11,814

Equipment Mobile B59

Land Surface Elevation 367 feet

Completion Date 1/16/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILT (ML) medium stiff, wet; with sand and roots (Fill).
MD	8.9	134.7	50/5"			BROWN GRAY SILTY SAND (SM) very dense, moist; fine to medium grained, mottled, with gravel (Weathered Till).
				5		
MD	9.0	131.1	50/5"			
				10		Becomes gray.
MD DS	7.2	92.3	50/5"			
				15		Driller notes sand encountered.
						BROWN SAND (SP-SM) very dense, wet to saturated; fine to medium grained, with some gravel.
MD	13.8	124.9	59			
				20		Interbedded with sandy silt.
MD	19.8	110.8	70			
				25		BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained sand.
MD	13.9	128.4	58			
				30		GRAY SILTY SAND (SM) very dense, moist; fine to coarse grained, mottled, with gravel (Till).
MD -200	13.0	107.2	50/5"			
				35		
			50/4"			
				40		

AGI TECHNOLOGIES

Log of Boring AT96-B9 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A30

PROJECT NO	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	25 Feb 96			

boring.cdr

AR 025869

P.O.S. Coordinates: N 20,366 E 11,814

Equipment Mobile B59

Land Surface Elevation 367 feet Completion Date 1/16/96

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		RED BROWN SAND (SP) very dense, moist; fine to medium grained, mottled, with silt (Advance Outwash).
MD	7.4	113.5	50/5"	45		
						Becomes fine grained with trace silt.
MD MA DS	12.4	104.4	50/5.5"	50		
						BROWN SAND (SP) very dense, moist; fine grained.
MD	5.6	95.4	50/5"	55		
						Becomes light brown.
MD	14.8	96.4	50/5"	60		Boring terminated at 58.5 feet bgs during drilling. Boring backfilled with cuttings and bentonite. Groundwater encountered at 17 feet bgs during drilling.
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT96-B9 (40-58.5')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A31

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
boring40.cdr	14,190.211	ECR	24 Feb 96		

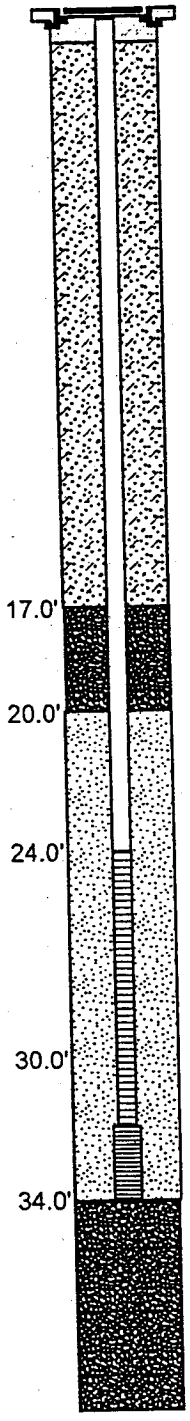
AR 025870

P.O.S. Coordinates: N 20,439 E 11,260

Equipment Mobile B59

Land Surface Elevation 320 feet

Completion Date 1/17/96



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SANDY SILT (ML) medium stiff, wet; with roots (Fill).
			10			BROWN SAND (SP) loose, wet; with silt and occasional roots (Recessional Outwash).
				5		
			50/5"			
				10		GRAY SILTY SAND (SM) very dense, saturated; fine to coarse grained, with a trace of gravel (Till).
MD DS -200	10.7	133.0	63			
				15		Gravel at 16.5 feet.
MD	8.1	124.7	50/3"			Becomes moist to wet.
				20		
MD	9.2	115.7	50/5.5"			
				25		
			50/5"			
				30		With interbedded fine sand.
MD DS -200	8.5	119.3	50/5.5"			
				35		
			50/5.5"			
				40		

AGI TECHNOLOGIES

Log of Piezometer AT96-B10 (0-40')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A32

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2.cdr

AR 025871

P.O.S. Coordinates: N 20,439 E 11,260

Equipment Mobile B59

Land Surface Elevation 320 feet

Completion Date 1/17/96

Depth (feet)	Sample	Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
40.0' – 43.0'		MD	19.2	119.3	50/6"

Trace gravel at 41.5'.
Becomes saturated.

Boring terminated at 43 feet bgs.
Groundwater encountered at 13 feet bgs during drilling.
Piezometer installed on 1/17/96.

AGI TECHNOLOGIES

Log of Piezometer AT96-B10 (40-43')

HNTB/P.O.S. Runway
SeaTac, Washington

PLATE A33

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	24 Feb 96			

B2more.cdr

AR 025872

P.O.S. Coordinates: N 20,090 E 11,280

Equipment Mobile B59

Land Surface Elevation 318 feet

Completion Date 9/12/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		REDDISH BROWN SAND (SW) loose to medium dense, moist, fine to coarse grained, with trace gravel (Recessional Outwash).
DS	18.3	108	15	5		REDDISH BROWN GRAY SILTY SAND (SM) medium dense, moist, fine grained, mottled (Recessional Outwash).
			19	10		GRAY SILTY SAND (SM) medium dense, wet to saturated, fine grained.
MD	16.0	124	83	15		GRAY SILTY SAND (SM), very dense, moist, fine to coarse grained with fine gravel (Till).
MD	7.1	134	68	20		Boring terminated at 19.5 feet bgs. Groundwater encountered at 13 feet bgs during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B1

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A34

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

boring.cdr

AR 025873

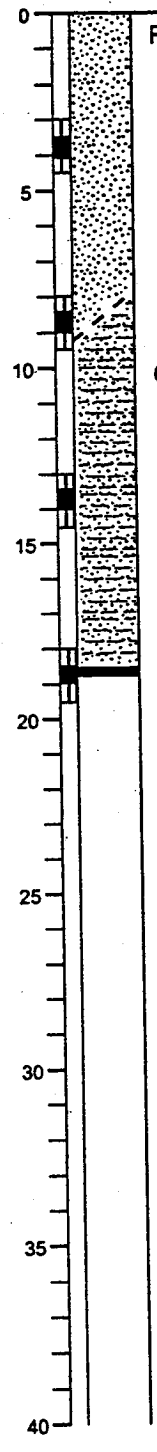
P.O.S. Coordinates: N 19,450 E 11,275

Equipment Mobile B59

Land Surface Elevation 312 feet

Completion Date 9/12/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	8.5	107	16
MD	11.8	121	21
MD	10.2	127	74
MD	11.1	113	50/5"



REDDISH BROWN SAND (SP-SM) medium dense, moist, fine grained with silt, trace gravel (Recessional Outwash).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse sand, with fine gravel (Till).

Boring terminated at 18.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B2

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A35

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

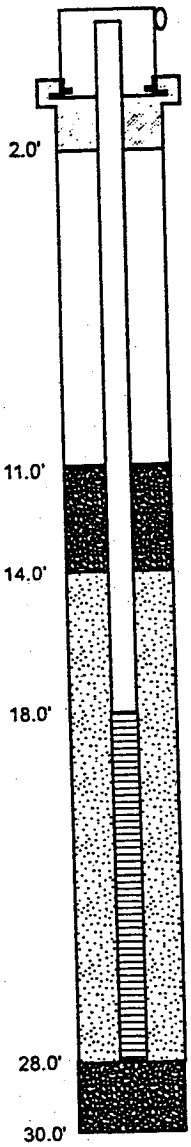
boring.cdr

AR 025874

P.O.S. Coordinates: N 16,630 E 11,255

Equipment Mobile B59

Land Surface Elevation 358.7 feet Date 9/15/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY BROWN SILTY SAND (SM) medium dense, moist, fine with wood and organics (Fill).
MD	12.9	100	14	5		
						GRAY SAND (SW) loose, wet, fine to coarse grained, with silt and trace gravel.
DS	19.3	112	7	10		
						BROWN SAND (SP-SM) medium dense, saturated, fine grained, with fine silt laminations (Advance Outwash).
MD	25.0	103	18	15		
MD	22.3	105	53	20		Heaving sands.
						Becomes dense.
			50/5"	25		
			50/5"			
				30		Boring terminated at 28.7 feet bgs. Groundwater encountered at 13 feet bgs during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B3

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A36

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

AR 025875

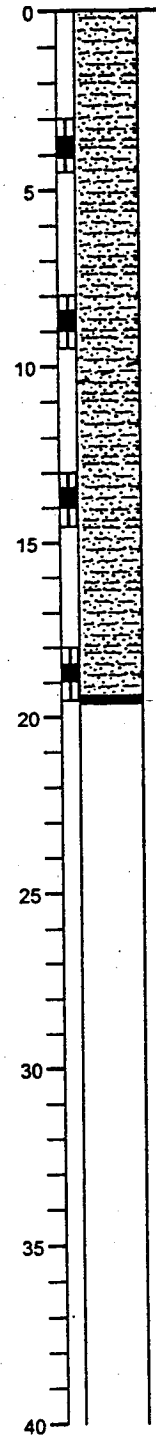
P.O.S. Coordinates: N 16,310 E 11,300

Equipment Mobile B59

Land Surface Elevation 378 feet

Completion Date 9/15/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	9.6	132	50/5"
MD	8.4	116	50/6"
MD	7.2	120	50/5"
			50/5.5"



REDDISH BROWN SILTY SAND (SM) very dense, moist, fine to medium grained with trace fine gravel (Weathered Till).

GRAY SILTY SAND (SM) very dense, moist, fine to medium grained with trace gravel (Till).

Boring terminated at 19.4 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B4

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A37

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
boring.cdr	14,190.211	ECR	13 October 97		

AR 025876

P.O.S. Coordinates: N 15,940 E 11,280

Equipment Mobile B59

Land Surface Elevation 377 feet

Completion Date 9/15/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Topsoil 16".
						REDDISH BROWN SILTY SAND (SM) very dense, moist, fine to medium grained, trace gravel (Weathered Till).
MD	5.8	114	50/5.5"	5		
			50/5.5"	10		GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with trace gravel (Till).
MD	7.4	131	95	15		
MD	9.8	129	84	20		Boring terminated at 19.5 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B5

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A38

boring.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 13 October 97	APPROVED	REVISED	DATE

AR 025877

P.O.S. Coordinates: N 17,590 E 11,300

Equipment Mobile B59

Land Surface Elevation 292 feet

Completion Date 9/16/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
					Topsoil 18".
					GRAY SILT (ML) very stiff, moist, with fine sand.
PL			28	5	
DS	28.7	96	25	10	
					GRAY SILTY SAND (SM) dense, moist, fine to medium grained, some gravel (Pre Vashon Drift).
MD	11.4	127	32	15	
MD	10.8	127	38	20	
					Boring terminated at 21.0 feet bgs.
					No groundwater encountered during drilling.
				25	
				30	
				35	
				40	

AGI TECHNOLOGIES

Log of Boring AT97-B6

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A39

boring.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 13 October 97	APPROVED	REVISED	DATE

AR 025878

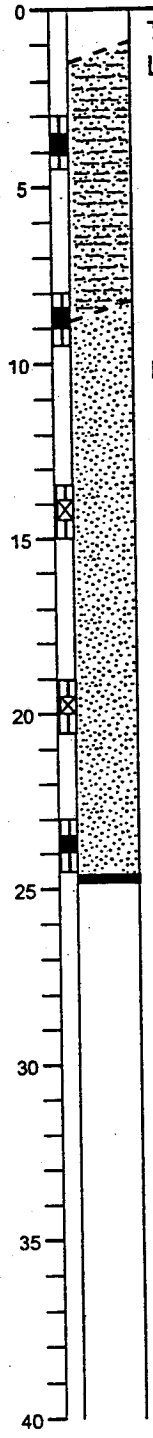
P.O.S. Coordinates: N 17,150 E 11,285

Equipment Mobile B59

Land Surface Elevation 340 feet

Completion Date 9/16/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	6.2	105	30
MD	14.4	111	30
			13
			16
DS	21.7	109	16



Topsoil 12".

LIGHT BROWN SILTY SAND (SM) medium dense to dense, dry, fine to medium grained, trace gravel (Fill).

BROWN SAND (SP-SM) medium dense, moist to wet, fine grained, (Advance Outwash).

Boring terminated at 24.5 feet bgs.

Groundwater encountered at 18 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B7

HNTB/SeaTac 1997- Runway Investigation

SeaTac, Washington

PLATE A40

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

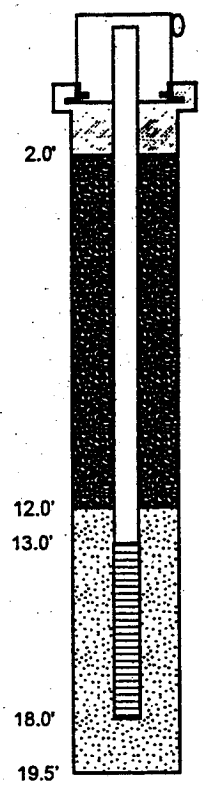
boring.cdr

AR 025879

P.O.S. Coordinates: N 15,610 E 11,635

Equipment Mobile B59

Land Surface Elevation 377 feet Date 9/16/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Topsoil BROWN SAND (SP-SM) dense, moist, fine to medium grained, trace gravel (Advance Outwash).
MD	14.0	104	50	5		
MD	14.8	114	68	10		Becomes wet. BROWN SAND (SP) dense, saturated, fine grained, (Advance Outwash).
MD	17.4	115	42	15		
DS	21.0	109	86	20		Becomes very dense. Boring terminated at 19.5 feet bgs . Groundwater encountered at 18 feet bgs during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B8

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A41

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

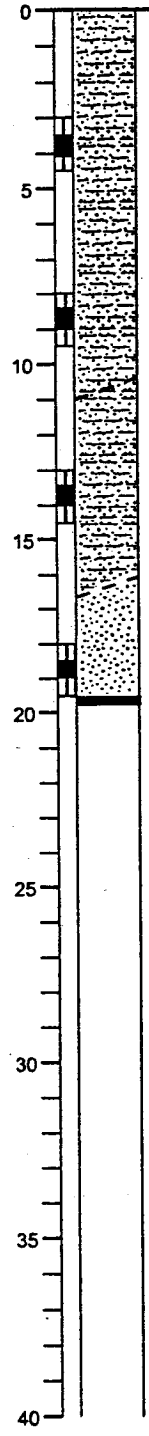
AR 025880

P.O.S. Coordinates: N 15,170 E 11,570

Equipment Mobile B59

Land Surface Elevation 374 feet Completion Date 9/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	7.5	118	50/5"
MD	8.4	122	50/5.5"
MD	10.9	124	50/5"
MD	23.7	105	44



BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel, mottled (Weathered Till).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).

BROWN SAND (SP) dense, saturated, fine grained (Advance Outwash).

Boring terminated at 19.5 feet bgs.
Groundwater encountered at 18 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B9

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A42

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

boring.cdr

AR 025881

P.O.S. Coordinates: N 15,230 E 11,270

Equipment Mobile B59

Land Surface Elevation 3367 feet

Completion Date 9/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Topsoil 12".
			67			BROWN GRAY SILTY SAND (SM) very dense, dry, fine to medium grained, with some gravel (Weathered Till).
				5		
MD	9.2	125	96			
				10		
			50/4"			GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel (Till).
				15		
MD	10.0	112	50/5"			
				20		Boring terminated at 18.5 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B10

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE, A43

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
boring.cdr	14,190.211	ECR	13 October 97		

AR 025882

P.O.S. Coordinates: N 15,460 E 11,270

Equipment Mobile B59

Land Surface Elevation 370 feet

Completion Date 9/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	8.9	122	50/5.5"	5	
DS			50/5.5"	10	
MD	9.3	114	50/5.5"	15	
MD	7.8	105	50/5.5"	20	
				25	
				30	
				35	
				40	

Topsoil 12".

BROWN GRAY SILTY SAND (SM) very dense, dry, fine to medium grained, with some gravel (Weathered Till).

GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with some gravel (Till).

Boring terminated at 19.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B11

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A44

boring.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 13 October 97	APPROVED	REVISED	DATE

AR 025883

P.O.S. Coordinates: N 17,670 E 12,075

Equipment Mobile B59

Land Surface Elevation 399 feet

Completion Date 9/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN AND GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Fill).
MD	9.5	123	28	5		
MD	9.2	127	28	10		
MD	8.9	129	43	15		
MD	9.7	121	52	20		With pockets of fine sand.
						Becomes very dense.
MD	15.2	110	73	25		
			24	30		
Txs,Txp	9.4	127	47	35		
						BROWN-GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with some gravel (Till).
MD	8.4	120	50/3"	40		

AGI TECHNOLOGIES

Log of Boring AT97-B12 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A45

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr 14,190.211	ECR	13 October 97			

AR 025884

P.O.S. Coordinates: N 17,670 E 12,075

Equipment Mobile B59

Land Surface Elevation 399 feet

Completion Date 9/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
MD	7.2	110	50/5.5"	40	
MD	7.5	112	50/4"	45	
MD	11.7	110	82	50	
				55	
				60	
				65	
				70	
				75	
				80	

BROWN-GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with some gravel (Till).

BROWN SAND (SP) very dense, moist, fine grained, with some silt (Advance Outwash).

Boring terminated at 55.0 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B12 (40'-55')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A46

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Bor2-40.cdr

AR 025885

P.O.S. Coordinates: N 16,410 E 11,610

Equipment Mobile B59

Land Surface Elevation 386 feet

Completion Date 9/18/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	9.2	105	18	5	
MD	9.4	110	20	10	
				15	
				20	
				25	
				30	
				35	
				40	

BROWN SILTY SAND (SM) medium dense, moist, fine grained, with some gravel, asphalt, organics (Fill).

Boring abandoned at 15.0 feet bgs during drilling on fill debris.

No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B13

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

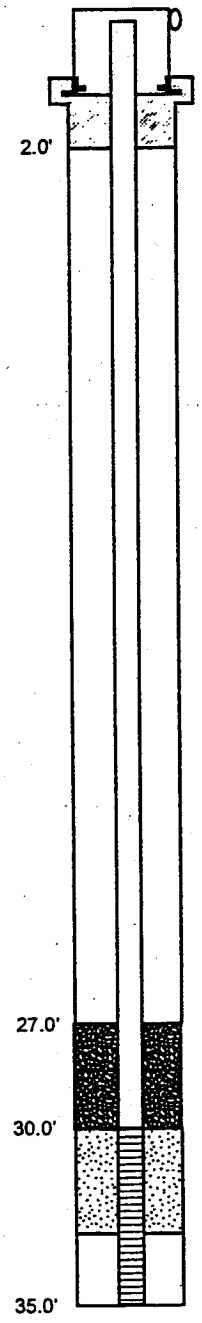
PLATE A47

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr	14,190.211	ECR	13 October 97		

P.O.S. Coordinates: N 16,405 E 11,610

Equipment Mobile B59

Land Surface Elevation 386 feet Date 9/18/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, with gravel (Fill).
			20	5		
			51	10		
			3	15		Becomes very loose.
			50/3"	20		Sampler driven on concrete debris.
MD	8.7	133	50/5.5"	25		BROWN SAND (SW) very dense, saturated, fine to coarse grained, some fine gravel and silt (Advance Outwash).
MD	10.7	134	84	30		
			50/4"	35		Boring terminated at 35.0 feet bgs. Groundwater encountered at 18.5 feet bgs during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B14

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A48

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

AR 025887

P.O.S. Coordinates: N 13,010 E 11,200

Equipment Mobile B59

Land Surface Elevation 359 feet

Completion Date 9/18/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Topsoil 12". BROWN SILTY SAND (SM) medium dense, moist, fine grained, with some gravel and asphalt (Fill).
MD	11.8	116	15	5		
			5	10		Becomes loose.
MD	11.4	120	3	15		Becomes very loose.
MD	13.9	105	4	20		
MD	8.2	112	34	25		BROWN SAND (SP) dense, moist, fine grained, with some silt (Advance Outwash).
				30		Boring terminated at 25.5 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B15

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A49

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring2.cdr

AR 025888

P.O.S. Coordinates: N 13,155 E 11,620

Equipment Mobile B59

Land Surface Elevation 367 feet

Completion Date 9/18/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY AND BROWN SILTY SAND (SM) medium dense, moist, fine to coarse grained, with some gravel (Fill).
MD	9.7	123	15	5		
MD	9.7	93	7	10		Becomes loose.
MD	12.8	111	15	15		GRAY-BROWN SILTY SAND (SM) very dense, moist, fine to medium grained, with some gravel, mottled (Weathered Till).
MD	10.9	130	57	20		Boring terminated at 20.0 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B16

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A50

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring2.cdr

AR 025889

P.O.S. Coordinates: N 13,635 E 11,800

Equipment Mobile B59

Land Surface Elevation 372 feet

Completion Date 9/18/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) loose, moist, fine grained, with some gravel, trace organics (Fill).
MD	7.3	109	7	5		
MD	15.9	115	4	10		
			50/2"	15		Sampler driven on debris.
						GRAY SAND (SP) medium dense, moist, fine grained.
MD	8.3	120	15	20		GRAY BROWN SILTY SAND (SM) medium dense, moist, fine grained, with some gravel, mottled.
						Boring terminated at 19.5 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B17

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A51

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr 14,190.211	ECR	13 October 97			

AR 025890

P.O.S. Coordinates: N 11,605 E 11,250

Equipment Mobile B59

Land Surface Elevation 350 feet

Completion Date 9/19/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, dry, fine to medium grained, some gravel (Fill).
MD	9.4	122	24	5		
MD	8.5	122	31	10		With coarse gravel.
						GRAY SAND (SP) medium dense, moist, fine grained.
MD	12.3	113	24	15		
						GRAY AND BROWN SILTY SAND (SP) dense, moist, fine grained, trace gravel.
MD	9.0	121	31	20		
MD	16.2	113	24	25		
MD	12	120	24	30		
MD	9.4	131	21	35		Boring terminated at 34.5 feet bgs. Groundwater encountered at 23.0 feet bgs during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B18

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A52

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr	14,190.211	ECR	13 October 97		

AR 025891

P.O.S. Coordinates: N 11,850 E 11,170

Equipment Mobile B59

Land Surface Elevation 351 feet

Completion Date 9/19/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
			50/4"		
				5	
MD	8.1	112	37		
				10	
MD	7.9	116	41		
				15	
MD	9.7	123	37		
				20	
				25	
				30	
				35	
				40	

BROWN-GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel (Fill).

Boring terminated at 19.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B19

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A53

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr	14,190.211	ECR	13 October 97		

AR 025892

P.O.S. Coordinates: N 11,700 E 11,385

Equipment Mobile B59

Land Surface Elevation 352 feet

Completion Date 9/19/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	8.1	132	42	5	
MD	6.6	130	11	10	
MD	13.2	124	29	15	
MD	12.6	123	24	20	
MD	8.6	120	22	25	
				30	
				35	
				40	

BROWN-GRAY SILTY SAND (SM) dense, moist, fine to medium grained, with gravel (Fill).

Boring terminated at 24.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B20

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A54

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring2.cdr

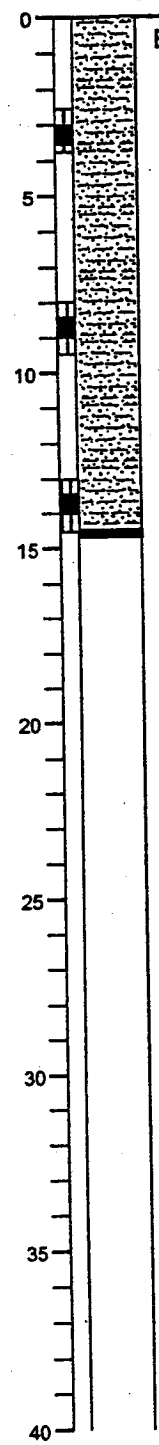
AR 025893

P.O.S. Coordinates: N 14,450 E 11,800

Equipment Mobile B59

Land Surface Elevation 370 feet

Completion Date 9/19/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
MD	8.1	109	27	BROWN-GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, some gravel (Weathered Till).
MD	9.3	115	82	Becomes very dense.
MD,DS	11.2	122	38	Boring terminated at 14.5 feet bgs. No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B21

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE **A55**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring2.cdr	14,190.211	ECR	13 October 97		

AR 025894

P.O.S. Coordinates: N 13,900 E 12,170

Equipment Mobile B59

Land Surface Elevation 374 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	5.7	102	20		
				5	
			22		
				10	
MD	6.5	122	50/5.5"		
				15	
				20	
				25	
				30	
				35	
				40	

GRAY -BROWN SILTY SAND (SP/SM) medium dense, moist, fine grained, trace gravel (Fill).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with fine gravel (Weathered Till).

Boring terminated at 14.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B22

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A56

Boring2.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 13 October 97	APPROVED	REVISED	DATE

AR 025895

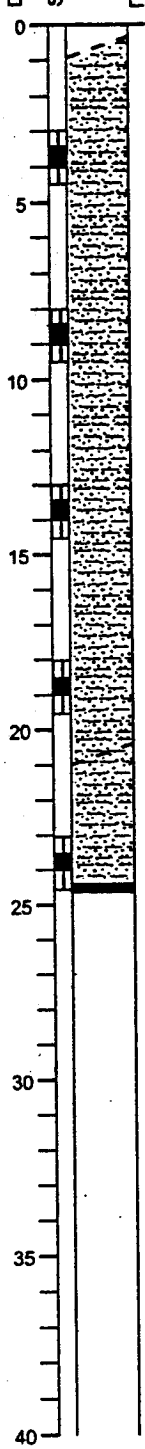
P.O.S. Coordinates: N 13,300 E 12,025

Equipment Mobile B59

Land Surface Elevation 367 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Sample
MD	9.6	127	20	
MD	10.4	121	21	
MD	7.2	122	37	
MD	8.7	127	57	
MD	7.8	131	50/5"	



Topsoil 12".

BROWN-GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Fill).

GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel (Till).

Boring terminated at 24.5 feet bgs.

No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B23

HNTB/SeaTac 1997- Runway Investigation

SeaTac, Washington

PLATE A57

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring3.cdr

AR 025896

P.O.S. Coordinates: N 13,175 E 12,275

Equipment Mobile B59

Land Surface Elevation 369 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	7.0	109	27		
				5	
MD	7.0	120	46		
				10	
MD	22.8	90	4		
				15	
			47		
				20	
MD	12.0	117	47		
				25	
MD	9.3	112	53		
				30	
			49		
				35	
				40	

GRAY BROWN SILTY SAND (SM/SP) medium dense, moist, fine to medium grained, trace gravel (Fill).

GRAY SAND (SP) very dense, moist, fine grained, trace silt (Advance Outwash).

Boring terminated at 34.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B24

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A58

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring3.cdr

AR 025897

P.O.S. Coordinates: N 14,425 E 12,360

Equipment Mobile B59

Land Surface Elevation 377 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	16.2	99	36	5	
MD	15.5	105	77	10	
				15	
				20	
				25	
				30	
				35	
				40	

BROWN-GRAY SAND (SP) dense, moist, fine grained, trace gravel and silt (Advance Outwash).

Becomes very dense.

Boring terminated at 10.0 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B25

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A59

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring3.cdr	14,190.211	ECR	13 October 97		

AR 025898

P.O.S. Coordinates: N 14,630 E 11,950

Equipment Mobile B59

Land Surface Elevation 372 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	5.3	107	46	5	
MD	11.8	121	47	10	
				15	
				20	
				25	
				30	
				35	
				40	

GRAY SAND (SP) dense, moist, fine grained, occasional gravel, trace silt (Advance Outwash).

Boring terminated at 10.0 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-26

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A60

Boring3.cdr	PROJECT NO. 14,190.211	DRAWN ECR	DATE 13 October 97	APPROVED	REVISED	DATE

AR 025899

P.O.S. Coordinates: N 14,965 E 11,750

Equipment Mobile B59

Land Surface Elevation 374 feet

Completion Date 9/22/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SAND (SP) dense, moist, occasional gravel (Advance Outwash).
MD	9.6	106	48	5		
MD	5.4	132	71	10		BROWN GRAY SILTY GRAVEL (GM) very dense, moist, fine to coarse grained, with some sand.
MD,PL	27.2	99	42	15		DARK BROWN SANDY SILT (ML) very stiff, moist, very fine grained.
MD	20.4	107	22	20		GRAY SILTY SAND (SP) medium dense, saturated, fine grained.
MD	20.3	108	74	25		Becomes very dense.
						Boring terminated at 25.0 feet bgs. Groundwater encountered at 23.5 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B27

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A61

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring3.cdr	14,190.211	ECR	13 October 97		

AR 025900

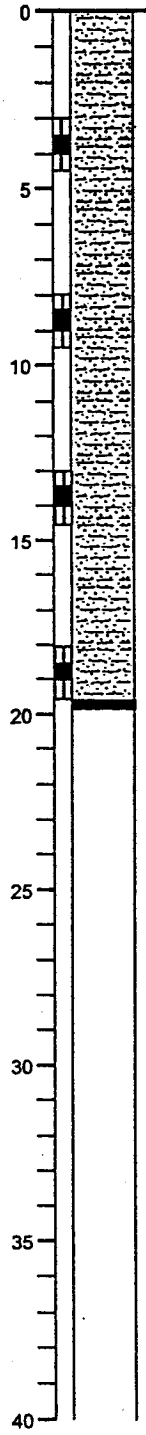
P.O.S. Coordinates: N 19,860 E 12,100

Equipment Mobile B59

Land Surface Elevation 410 feet

Completion Date 9/23/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
MD	12.1	121	7
MD	12.8	120	9
DS	18.0	126	22
MD	12.1	121	60



BROWN GRAY SILTY SAND (SM) loose, moist, fine to medium grained, some gravel (Fill).

Becomes very dense.

Boring terminated at 19.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B28

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A62

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring3.cdr	14,190.211	ECR	13 October 97		

AR 025901

P.O.S. Coordinates: N 12,180 E 11,940

Equipment Mobile B59

Land Surface Elevation 358 feet

Completion Date 9/23/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with gravel (Fill).
MD	7.5	111	12			
				5		
			18			
				10		
MD	9.5	127	33			
				15		
MD	10.1	127	97	20		GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Till).
MD	9.3	127	86			
				25		Boring terminated at 24.5 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B29

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A63

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring3.cdr	14,190.211	ECR	13 October 97		

AR 025902

P.O.S. Coordinates: N 12,440 E 11,900

Equipment Mobile B59

Land Surface Elevation 359 feet

Completion Date 9/23/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, some gravel (Fill).
MD	7.6	126	15	5		
						BROWN GRAY SILTY SAND (SM/SP) medium dense, moist, fine to medium grained, some gravel and sand.
MA	9.2		24	10		
						Becomes wet.
MD	13.7	120	60	15		BROWN GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, occasional gravel (Till).
MD	9.9	123	70	20		Boring terminated at 19.5 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B30

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A64

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring3.cdr

AR 025903

P.O.S. Coordinates: N 12,875 E 11,370

Equipment Mobile B59

Land Surface Elevation 362 feet

Completion Date 9/23/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained (Fill).
MD,MA	5.9	115	24	5		
MD	10.1	90	4	10		Contains organics and wood debris, becomes loose.
MD	25.2	91	5	15		
MD	9.6	92	72	20		GRAY BROWN SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel (Till).
						Boring terminated at 19.5 feet bgs.
						No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B31

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A65

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring3.cdr	14,190.211	ECR	13 October 97		

AR 025904

P.O.S. Coordinates: N 19,545 E 12,110

Equipment Mobile B59

Land Surface Elevation 408 feet

Completion Date 9/23/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, some gravel (Fill).
MD	9.9	119	22	5		
DS			37	10		Becomes dense, with sand layers.
			77	15		
MD	13.9	118	32	20		BROWN GRAY SILTY SAND (SM) dense, moist, fine to medium grained, some gravel
MD	10.4	131	50/4"	25		Boring terminated at 24.5 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B32

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A66

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring3.cdr

AR 025905

P.O.S. Coordinates: N 16,535 E 12,205

Equipment Mobile B59

Land Surface Elevation 391 feet Completion Date 9/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	6.4	104	33		
				5	
			37		
				10	
			56		
				15	
MD	12.3	112	57		
				20	
				25	
				30	
				35	
				40	

BROWN SAND (SP) dense, moist, fine grained (Advance Outwash).

Boring terminated at 19.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B33

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A67

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring4.cdr	14,190.211	ECR	13 October 97		

AR 025906

P.O.S. Coordinates: N 17,080 E 12,140

Equipment Mobile B59

Land Surface Elevation 390 feet

Completion Date 9/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Fill).
MD	6.9	118	60	5		DARK GRAY SAND (SP) dense, moist, fine grained (Advance Outwash).
DS	13.0	117	22	10		
MD	12.9	125	49	15		BROWN SILTY SAND (SM) dense, moist, fine to medium grained, with gravel.
						Boring terminated at 14.5 feet bgs. No groundwater encountered during drilling.
				20		
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B34

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A68

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

AR 025907

P.O.S. Coordinates: N 20,690 E 12,100

Equipment Mobile B59

Land Surface Elevation 413 feet

Completion Date 9/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK BROWN SILTY SAND (SM) medium dense, moist, fine grained, trace gravel, organics.
			17	5		
MD	8.8	127	20	10		
						Mixed organic debris.
MD	12.5	116	9	15		
DS	10.4	129	27	20		
MA	10.7		24	25		Becomes wet.
MD	13.3	112	60	30		With coarse sand.
			37	35		
MD	10.7	124	24	40		

AGI TECHNOLOGIES

Log of Boring AT97-B35 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A69

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

AR 025908

P.O.S. Coordinates: N 20,690 E 12,100

Equipment Mobile B59

Land Surface Elevation 413 feet

Completion Date 9/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				40	
MD	4.6	130	56	45	
MD	5.7	104	67	50	
				55	
				60	
				65	
				70	
				75	
				80	

DARK BROWN SILTY SAND (SM) medium dense, moist, fine grained, trace gravel, organics.

GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Till).

GRAY SAND (SP) very dense, moist, fine grained (Advance Outwash).

Boring terminated at 49.5 feet bgs.

Groundwater encountered at 23 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B35 (40'-49.5')

HNTB/SeaTac 1997- Runway Investigation

SeaTac, Washington

PLATE A70

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Bor2-40.cdr

AR 025909

P.O.S. Coordinates: N 11,870 E 10,870

Equipment Mobile B59

Land Surface Elevation 350 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) dense, moist, fine to medium grained, with gravel (Fill).
			38	5		
MD	14.4	122	31	10		GRAY SAND (SP) dense,moist, with some silt (Fill).
						DARK GRAY BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, with gravel and organics (Fill).
MD	18.2	118	24	15		
			13	20		
						GRAY SILTY SAND (SM) very dense, moist, fine to coarse sand, some gravel (Till).
MD,MA	8.4	122	57	25		
MD	11.7	120	50/6"	30		Boring terminated at 30.0 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B36

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE **A71**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring4.cdr	14,190.211	ECR	13 October 97		

AR 025910

P.O.S. Coordinates: N 13,900 E 11,485

Equipment Mobile B59

Land Surface Elevation 356 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY BROWN SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel and organics (Fill).
MD,MA	18.3	118	26	5		
MD	16.7	114	17	10		
			29	15		
M	10.6		31	20		
			18	25		With concrete debris.
			50/1"	30		Sampler driven on debris.
DS	11.5	127	8	35		Becomes loose, wet.
MD	16.2	118	10	40		

AGI TECHNOLOGIES

Log of Boring AT97-B37 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A72

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

AR 025911

P.O.S. Coordinates: N 13,900 E 11,485

Equipment Mobile B59

Land Surface Elevation 356 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		GRAY BROWN SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel and organics (Fill).
MD	63.1	75	18	45		
MD	10.6	120	43	50		GRAY SILTY SAND (SM) dense, moist, fine to medium grained, with some gravel (Till).
MD,MA	10.1	128	44	55		Boring terminated at 55.0 feet bgs . No groundwater encountered during drilling.
				60		
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT97-B37 (40'-55')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A73

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Bor2-40.cdr

AR 025912

P.O.S. Coordinates: N 19,415 E 11,980

Equipment Mobile B59

Land Surface Elevation 406 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Fill).
MD	17.8	117	14	5		
MD	14.0	118	20	10		
DS	11.3	137	16	15		
			17	20		
MD,MA	10.6	131	41	25		Becomes dense.
			50/5"	30		Sampler driven on coarse gravel.
						GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel (Till).
MD	14.3	123	64	35		
MD	13.7	124	50/4"	40		Boring terminated at 39.0 feet bgs. No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B38

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A74

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

AR 025913

P.O.S. Coordinates: N 18,040 E 12,050

Equipment Mobile B59

Land Surface Elevation 402 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	13.8	125	22	5	
MD	12.1	115	24	10	
MD	25.3	108	35	15	
			39	20	
MD	8.0	131	51	25	
			40	30	
MD	10.6	126	47	35	
			57	40	

BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, some gravel, organics (Fill).

AGI TECHNOLOGIES

Log of Boring AT97-B39 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE **A75**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

P.O.S. Coordinates: N 18,040 E 12,050

Equipment Mobile B59

Land Surface Elevation 402 feet

Completion Date 9/25/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, some gravel, organics (Fill).
TxS,TxP			23	45		
						BROWN SAND (SP) very dense, moist, fine grained (Advance Outwash).
MD	6.7	101	54	50		
MD	8.8	118	50/5.5"	55		Boring terminated at 54.5 feet bgs. No groundwater encountered during drilling.
				60		
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT97-B39 (40'-54.5')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A76

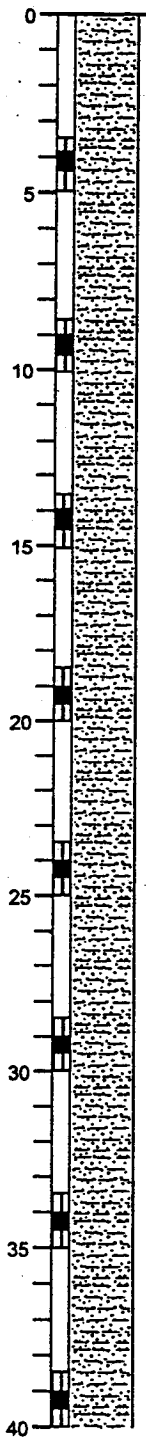
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bor2-40.cdr	14,190.211	ECR	13 October 97		

P.O.S. Coordinates: N 17,960 E 12,380

Equipment Mobile B59

Land Surface Elevation 403 feet

Completion Date 9/26/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
				BROWN SILTY SAND (SM) dense, moist, fine to coarse grained, with fine gravel (Fill).
MD	12.1	117	35	
MD	8.1	129	43	
MD	16.6	100	2	Becomes very loose, wet.
MD	12.8	124	11	
				Wet zones.
MD	12.5	129	27	
MD	9.1	126	77	
MD	11.8	113	24	
MD	15.1	111	26	

AGI TECHNOLOGIES

Log of Boring AT97-B40 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A77

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring4.cdr

AR 025916

P.O.S. Coordinates: N 17,960 E 12,380

Equipment Mobile B59

Land Surface Elevation 403 feet

Completion Date 9/26/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				40	
MD	10.1	88	2	45	
MD	14.3	119	79	50	
				55	
				60	
				65	
				70	
				75	
				80	

BROWN SILTY SAND (SM) dense, moist, fine to coarse grained, with fine gravel (Fill).

BROWN SAND (SP)very loose, moist, fine grained with trace organics.

BROWN GRAY SILTY SAND (SM) very dense, moist, some gravel (Till).

Boring terminated at 50.0 feet bgs.
Groundwater encountered at 23 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B40 (40'-50')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A78

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

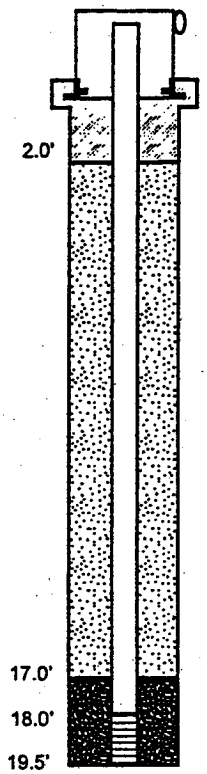
Bor2-40.cdr

AR 025917

P.O.S. Coordinates: N 21,850 E 12,145

Equipment Mobile B-61

Land Surface Elevation 303 feet Date 9/30/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) loose, moist, fine to medium grained, organics (Fill).
MD	14.9	110	8	5		DARK BROWN TO BLACK ORGANIC SILT (OL) soft, wet (Topsoil).
DS	17.4		11	10		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with trace gravel (Weathered Till).
MD	12.1		20	15		
MD	18.9		13	20		GRAY BROWN SAND (SP) medium dense, wet, medium grained (Advance Outwash).
				25		Boring terminated at 19.5 feet bgs. Groundwater encountered at 18 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B41

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A79

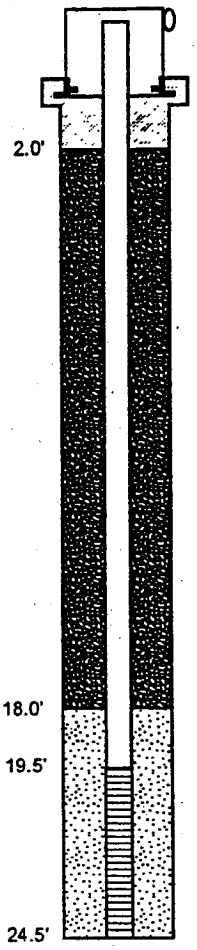
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bwells.cdr 14,190.211	ECR	15 October 97			

AR 025918

P.O.S. Coordinates: N 21,355 E 11,845

Equipment Mobile B-61

Land Surface Elevation 322 feet Date 9/30/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN AND GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with sand and gravel (Fill).
MD	15.3	106	22	5		GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).
MD	8.5	133	50/5.5"	10		
MD	10.5	126	56	15		BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained, with some gravel (Advance Outwash).
MD	15.3	112	61	20		BROWN SAND (SW) dense, wet, fine to coarse grained (Advance Outwash).
MD,SA	17.1	111	35	25		Boring terminated at 24.5 feet bgs. Groundwater encountered at 23 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B42

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A80

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

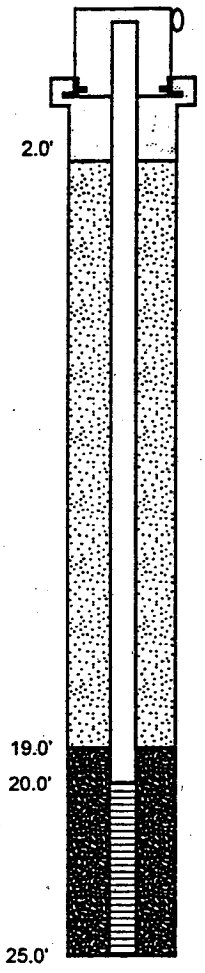
Bwells.cdr

AR 025919

P.O.S. Coordinates: N 21,470 E 11,560

Equipment Mobile B-61

Land Surface Elevation 313 feet Date 9/30/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SAND (SP) medium dense, moist, medium grained, some gravel (Fill).
			13			
				5		BROWN GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, some gravel and coarse sand (Till).
MD	9.8	128	59	10		
						Becomes fine to coarse grained and wet.
MD	11.3	130	97/10"	15		
						Becomes saturated.
MD	14.5		50/3"	20		BROWN SAND (SP) very dense, saturated, fine to medium grained, with trace gravel and silt (Advance Outwash).
MD	23.5	104	60	25		
						Boring terminated at 25.0 feet bgs. Groundwater encountered at 18.5 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B43

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A81

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

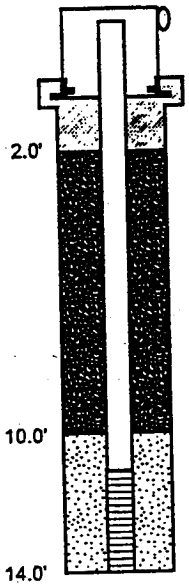
Bwells.cdr

AR 025920

P.O.S. Coordinates: N 14,895 E 12,385

Equipment Mobile B-61

Land Surface Elevation 380 feet Date 10/1/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
MD	4.4	102	42	5	
MD	7.3	114	67	10	
MD	24.9	105	37	15	
				20	
				25	
				30	
				35	
				40	

GRAY BROWN SAND (SP) dense, moist, fine to medium grained (Advanced Outwash).

Becomes very dense and with some sand and gravels at 9.5 feet bgs.

Becomes dense, wet and with some coarse sand.

Boring terminated at 14.5 feet bgs.
Groundwater encountered at 13 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B44

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A82

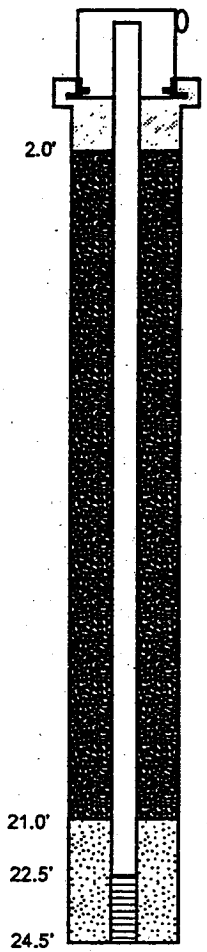
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

P.O.S. Coordinates: N 15,705 E 12,380

Equipment Mobile B-61

Land Surface Elevation 387 feet Date 10/1/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SAND (SP) dense, moist, fine grained (Advance Outwash).
MD	6.2	102	34	5		
MD	10.5	103	40	10		Becomes with some silt and very dense.
MD	20.8	105	68	15		BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with some fine gravel (Advance Outwash).
MD	14.9	115	56/11.5"	20		Becomes wet and fine to medium grained.
MD	21.3	108	74/11.5"	25		Boring terminated at 24.5 feet bgs. Groundwater encountered at 23 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B45

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A83

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

AR 025922

P.O.S. Coordinates: N 16,530 E 12,380

Equipment Mobile B59

Land Surface Elevation 393 feet

Completion Date 10/1/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Advanced Outwash).
MD,CONSOL	6.2	119	17			
				5		BROWN GRAY SAND (SP) very dense, moist, fine to medium grained (Advanced Outwash).
MD	5.3	101	55			
				10		
MD	15.6	106	69			Becomes fine grained.
				15		
			54			Becomes dense.
				20		
MD	3.5	110.7	58			Becomes fine to coarse grained with trace fine gravel.
				25		
			28			Becomes medium dense and fine grained.
				30		Becomes brown and wet.
MD	24.8	100	32			
				35		Boring terminated at 34.5 feet bgs. No groundwater encountered during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B46

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A84

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring4.cdr	14,190.211	ECR	13 October 97		

AR 025923

P.O.S. Coordinates: N 16,530 E 12,380

Equipment Mobile B59

Land Surface Elevation 393 feet

Completion Date 10/1/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SAND (SP) medium dense, moist, fine to medium grained, trace gravel (Fill).
MD	8.0	121	30	5		
MD	9.1	101	34	10		
MD	7.3		32	15		
MD	7.9	128	11	20		
MD	27.6		50/1"	25		DARK BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel and organics at top of drive.
MD	7.2	123	53	30		BROWN GRAY SAND (SP) dense, moist, fine grained, with some gravel (Advanced Outwash).
				35		Boring terminated at 29.5 feet bgs. No groundwater encountered during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B47

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A85

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring4.cdr	14,190.211	ECR	13 October 97		

AR 025924

P.O.S. Coordinates: N 13,700 E 12,350

Equipment Mobile B59

Land Surface Elevation 369 feet

Completion Date 10/2/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SAND (SP) dense, moist to wet, fine grained, trace gravel (Fill).
MD	14.4	120	35	5		
						GRAY SILTY SAND (SM) medium dense, moist to wet, fine to coarse grained, with gravel (Fill).
MD	11.8	125	26	10		
						GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).
MD	7.6	112	50/5.5"	15		
MD	9.6	116	50/6"	20		BROWN GRAY SAND (SP) very dense, moist, fine grained, no gravel (Advanced Outwash).
			60	25		Boring terminated at 24.5 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B48

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A86

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97	GAM		

Boring4.cdr

AR 025925

P.O.S. Coordinates: N 12,970 E 12,360

Equipment Mobile B59

Land Surface Elevation 366 feet

Completion Date 10/1/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		
MD	10.6	103	21			BROWN SAND (SP) medium dense, moist, fine grained, trace gravel (Fill).
				5		
			47			Becomes dense.
				10		
MD	5.7	140	96			BROWN GRAY SILTY SAND (SM) very dense, fine to medium grained, with gravel (Till).
				15		Boring terminated at 14.5 feet bgs. No groundwater encountered during drilling.
				20		
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B49

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A87

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring4.cdr 14,190.211	ECR	13 October 97			

AR 025926

P.O.S. Coordinates: N 12,710 E 12,360

Equipment Mobile B59

Land Surface Elevation 365 feet Completion Date 10/2/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
MD	12.8	113	18	0		GRAY AND BROWN SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel and organics. (Fill).
MD	11.3		22	5		
MD	3.9	125	87	10		GRAY SAND (SP) very dense, moist, fine to medium grained, with gravel.
MD	11.9	125	5	15		
MD	8.8	120	50/5.5"	20		GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Till).
MD	8.2	128	81	25		
MD	9.8	101	75	30		BROWN GRAY SAND (SP) very dense, moist, medium grained (Advanced Outwash).
				35		Boring terminated at 34.5 feet bgs. No groundwater encountered during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B50

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A88

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

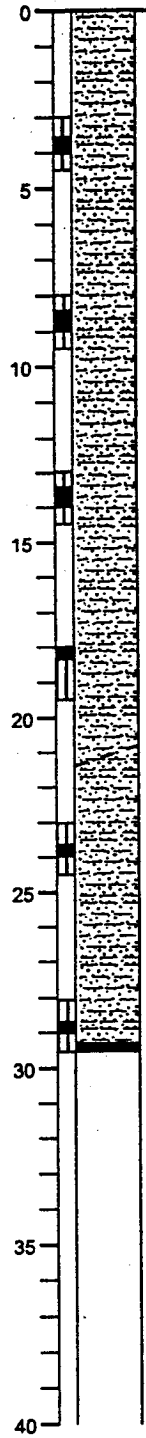
AR 025927

P.O.S. Coordinates: N 12,115 E 12,365

Equipment Mobile B59

Land Surface Elevation 359 feet

Completion Date 10/2/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK GRAY SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel and organics (Fill).
MD	10.0	117	17	5		
MD	13.0	114	43	10		
MD	7.9	112	49	15		
			50/2"	20		Sampler driven on cobble.
						GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Till).
MD	7.9	109	50/5"	25		
MD	8.5	122	50/6"	30		Boring terminated at 29.5 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B51

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A89

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

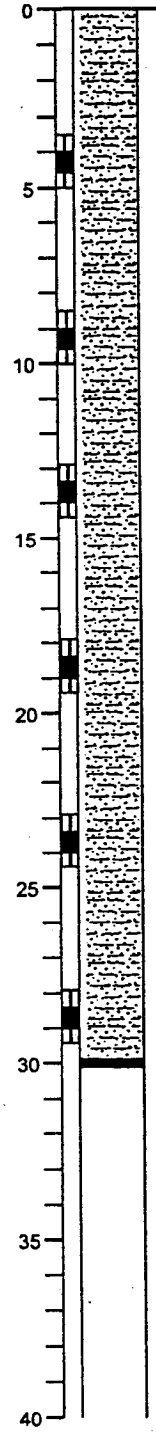
AR 025928

P.O.S. Coordinates: N 15,200 E 10,830

Equipment Mobile B59

Land Surface Elevation 353 feet

Completion Date 10/6/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY SILTY SAND (SM) very dense, moist, fine grained, trace fine gravel (Till).
			60	5		
			60	10		
			76	15		
CU-TxS	9.8	129	50/5.5"	20		With fine sand interbeds.
			50/5.5"	25		
MD	5.7	125	50/5"	30		Boring terminated at 30.0 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B52

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A90

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

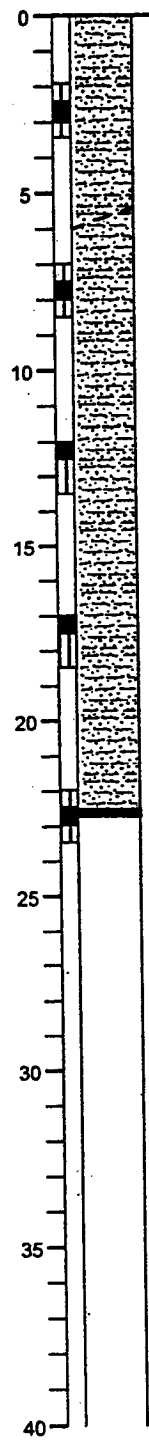
AR 025929

P.O.S. Coordinates: N 14,740 E 10,995

Equipment Mobile B59

Land Surface Elevation 332 feet

Completion Date 10/6/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
MD	12.8	123	20	REDDISH BROWN SILTY SAND (SM) medium dense, moist, fine grained, trace fine gravel (Weathered Till).
MD	10.3	124	50/6"	GRAY SILTY SAND (SM) very dense, moist, fine grained, with some gravel (Till).
			50/5"	
			50/5"	
MD	10	119	50/5"	Boring terminated at 22.5 feet bgs. No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B53

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A91

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring5.cdr

AR 025930

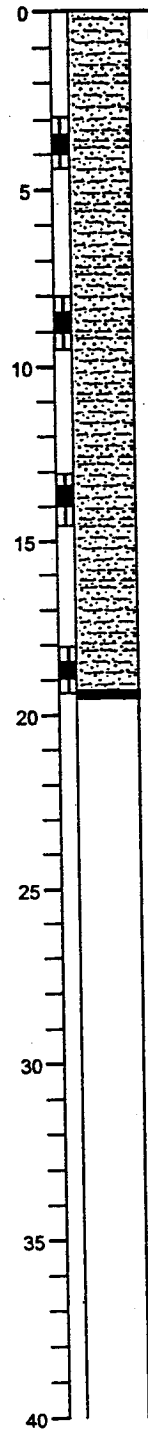
P.O.S. Coordinates: N 15,700 E 10,885

Equipment Mobile B59

Land Surface Elevation 362 feet

Completion Date 10/6/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot
CU-TxS	10.3	125	61
MD	7.9	130	90/9"
M	7.3		50/5"
MD	7.1	118	91/9"



GRAY SILTY SAND (SM) very dense, moist, fine grained, with gravel (Till).

Boring terminated at 19.5 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B54

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A92

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring5.cdr

AR 025931

P.O.S. Coordinates: N 16,685 E 11,135

Equipment Mobile B59

Land Surface Elevation 355 feet

Completion Date 10/8/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK BROWN CLAY (CL) soft, moist, with organics and wood debris (Fill).
			3	5		
MD	43.6	76	1	10		With some sand.
						BROWN GRAY SILTY SAND (SM) dense, wet, fine to medium grained with gravel (Advance Outwash).
			47	15		
MD	9.1	133	56	20		Boring terminated at 20.0 feet bgs. Groundwater encountered at 18.5 feet bgs during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B55

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A93

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

AR 025932

P.O.S. Coordinates: N 17,185 E 10,925

Equipment Mobile B59

Land Surface Elevation 322 feet

Completion Date 10/6/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY SILTY SAND (SM) loose, moist, fine grained, with gravel.
MD	13.9	119	10	5		
			11	10		BROWN SAND (SP) loose, moist, fine to medium grained, with some gravel (Advance Outwash).
SA,DS	12.9		27	15		Becomes medium dense.
			36	20		Becomes dense, wet.
			56	25		
MD	23.0	104	46	30		
			66	35		
MD	20.7	107	55	40		

AGI TECHNOLOGIES

Log of Boring AT97-B56 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A94

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

AR 025933

P.O.S. Coordinates: N 17,185 E 10,925

Equipment Mobile B59

Land Surface Elevation 322 feet

Completion Date 10/6/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				40	
M	22.4		62	45	
M	25.2			50	
				55	
				60	
				65	
				70	
				75	
				80	

BROWN SAND (SP) loose, moist, fine to medium grained, with some gravel (Advance Outwash).

GRAY SILT (ML) very stiff, wet, with trace sand (Pre Vashon Drift).

Boring terminated at 48.5 feet bgs.
Groundwater encountered at 23.5 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B56 (40'-48.5')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A95

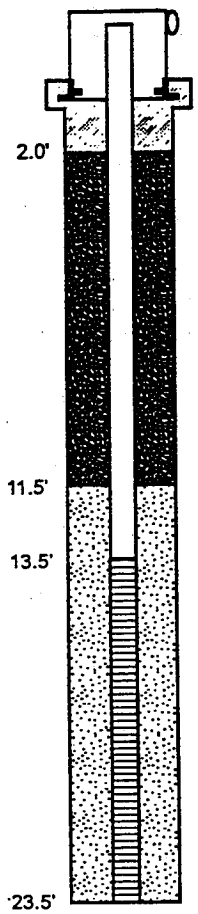
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bor2-40.cdr	14,190.211	ECR	13 October 97		

AR 025934

P.O.S. Coordinates: N 18,970 E 10,450

Equipment Mobile B-61

Land Surface Elevation 236 feet Date 10/9/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY SAND (SP) loose to medium dense, moist, fine to medium grained (Advance Outwash).
MD	20.1	98	10	5		
MD	18.5	109	5	10		CLAYEY SILT (ML) medium stiff, moist, with some sand.
						GRAY SANDY SILT (ML) hard, wet, interbedded with gray sand (SP), medium dense, saturated, fine grained.
DS	12.5		38	15		
						GRAY SILTY GRAVEL (GM) very dense, saturated, fine to coarse grained.
SA	8.2		65	20		
						GRAY SAND (SP) very dense, saturated, medium to coarse grained, with trace silt.
M	19.4		50/5.5"	25		
						Boring terminated at 25.5 feet bgs. Groundwater encountered at 13.5 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B57

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A96

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

AR 025935

P.O.S. Coordinates: N 20,665 E 10,910

Equipment Mobile B59

Land Surface Elevation 303 feet

Completion Date 10/9/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SAND (SP) medium dense, moist, fine grained, trace gravel (Recessional Outwash).
MD	12.0	104	12	5		
DS	10.9		8	10		BROWN GRAY SILTY SAND (SM) loose, moist, fine to coarse grained, (Recessional Outwash).
SA	8.1		23	15		GROWN GRAY SAND (SP) medium dense, moist, fine to medium grained, with gravel and coarse sand (Recessional Outwash).
DS	11.5		23	20		BROWN GRAY SILTY SAND (SM) medium dense, wet, fine grained with gravel, (Weathered Till).
			50/4"	25		GRAY SANDY SILT (ML) hard, moist, trace fine gravel and sand seams (Till).
DS	7.6		50/4"	30		Boring terminated at 30.0 feet bgs. Groundwater encountered at 18.5 feet bgs during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B58

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A97

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

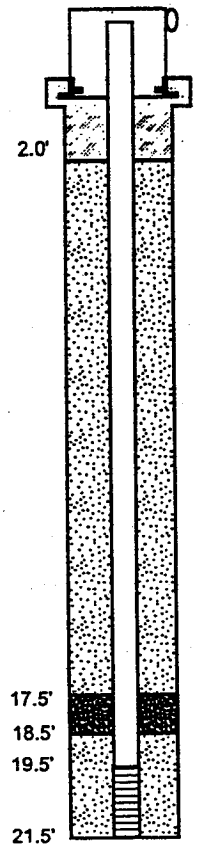
Boring5.cdr

AR 025936

P.O.S. Coordinates: N 13,970 E 10,980

Equipment L10-T Track Rig

Land Surface Elevation 310 feet Date 10/10/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN AND GRAY SILTY SAND (SM) very dense, dry, fine to coarse grained, with trace gravel (Weathered Till).
MD	7.2	103	58	5		
						GRAY BROWN SAND (SP) very dense, moist, fine grained, with trace gravel and some silt (Advance Outwash).
SA	6.7		48	10		
			50/6"	15		Becomes medium grained.
						BROWN SAND (SW) very dense, wet to saturated, fine to coarse grained with gravel.
MD	14.4	119	50/6"	20		
						Boring terminated at 21.5 feet bgs. Groundwater encountered at 20 feet bgs during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B59

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A98

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells.cdr

P.O.S. Coordinates: N 13,980 E 10,740

Equipment L10-T Track Rig

Land Surface Elevation 312 feet

Completion Date 10/10/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK BROWN SILTY SAND (SM) very dense, moist, fine to medium grained, with cobbles, organics (Fill).
			50/5"	5		
DS	4.8		50/6"	10		DARK BROWN SAND (SP) very dense, moist, fine to medium grained, trace gravel (Advance Outwash).
			50/6"	15		Becomes fine to coarse.
MD	7.2	121	50/5"	20		
			50/6"	25		
MD	13.5	117	50/5"	30		Boring terminated at 31.5 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B60

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A99

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

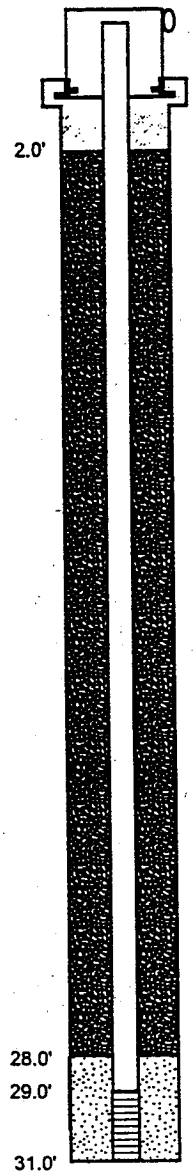
Boring5.cdr

AR 025938

P.O.S. Coordinates: N 13,730 E 10,740

Equipment L10-T Track Rig

Land Surface Elevation 325 feet Date 10/10/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				0	
					GRAY BROWN SILTY SAND (SM) dense, moist, fine grained, with gravel (Weathered Till).
MD	11.2	122	48	5	
					GRAY BROWN SAND (SP) dense, moist, fine to medium grained (Advance Outwash).
MD	19.6	101	40	10	
			50/6"	15	Becomes medium grained and without gravel.
MD	9.6	113	50/6"	20	
SA	6.1		50/5"	25	
MD	19.5	101	50/6"	30	Boring terminated at 31.5 feet bgs. Groundwater encountered at 30 feet bgs during drilling.
				35	
				40	

AGI TECHNOLOGIES

Log of Boring AT97-B61

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A100

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	15 October 97			

Bwells2.cdr

AR 025939

P.O.S. Coordinates: N 13,400 E 10,850

Equipment L10-T Track Rig

Land Surface Elevation 327 feet

Completion Date 10/13/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SAND (SP) very dense, moist, fine to medium sand, with silt and gravel and coarse sand (Advance Outwash).
MD	5.5	128	50/4"	5		
MD	3.1	109	62	10		
			50/5"	15		BROWN SAND (SW) very dense, moist, fine to coarse grained with gravel.
MD	5.5	107	50/4"	20		
				25		Boring terminated at 21.5 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B62

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A101

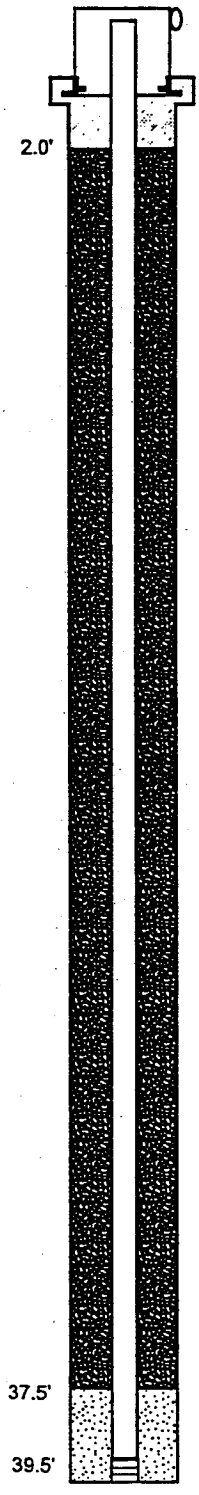
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring5.cdr	14,190.211	ECR	13 October 97		

AR 025940

P.O.S. Coordinates: N 13,070 E 10,850

Equipment L10-T Track Rig

Land Surface Elevation 328 feet Date 10/13/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).
			50/6"	5		
MD	3.6	117	50/5"	10		
MD	12.0	110	50/6"	15		GRAY BROWN SAND (SP) very dense, moist, fine to medium grained, trace gravel (Advance Outwash).
MD	4.4	111	50/5"	20		Becomes fine to coarse grained.
			34	25		
MD	5.9	103	50/4"	30		Becomes fine to medium grained.
			50/5"	35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B63 (0-40')

HNTB/SeaTac 1997-Runway Investigation

SeaTac, Washington

PLATE A102

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bwells2.cdr	14,190.211	ECR	15 October 97		

AR 025941

P.O.S. Coordinates: N 17,090 E 12,405

Equipment L10-T Track Rig

Land Surface Elevation 398 feet

Completion Date 10/13/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY BROWN SAND (SP) very dense, moist, fine grained (Fill).
MD	14.7	110	50/6"	5		
						BROWN GRAY SILTY SAND (SM) very dense, moist, very fine to coarse grained, with coarse gravel and organics (Fill).
MD	9.6	120	50/5"	10		
			26	15		Becomes dark brown.
			23	20		BROWN SAND (SP) dense, moist, fine grained, trace gravel.
MD	5.0	108	50/5"	25		GRAY SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).
						Boring terminated at 26.0 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B64

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A104

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring5.cdr

AR 025942

P.O.S. Coordinates: N 17,750 E 12,410

Equipment L10-T Track Rig

Land Surface Elevation 399 feet

Completion Date 10/14/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Fill).
MD	10.2	117	73	5		
			69	10		BROWN SAND (SP) dense, moist, fine to coarse grained, with trace gravel (Fill).
			50/5"	15		
MD	13.7	114	37	20		
			34	25		GRAY SILTY SAND (SM) dense, moist, fine to coarse grained, with gravel (Fill).
MD	14.8	111	39	30		Becomes with hard debris. Becomes with organics.
			50/4"	35		Becomes without organics and very dense.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B65 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A105

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring6.cdr	14,190.211	ECR	13 October 97		

AR 025943

P.O.S. Coordinates: N 17,750 E 12,410

Equipment Mobile B59

Land Surface Elevation 399 feet

Completion Date 10/14/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		GRAY SILTY SAND (SM) dense, moist, fine to coarse grained, with gravel (Fill).
						Wet zone at 44.2 feet.
			50/5"	45		Becomes wet.
						GRAY SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).
MD	9.4	106	50/5.5"	50		Boring terminated at 50.5 feet bgs. Perched groundwater encountered at 45 feet bgs during drilling.
				55		
				60		
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT97-B65 (40'-50.5')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A106

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bor2-40.cdr	14,190.211	ECR	13 October 97		

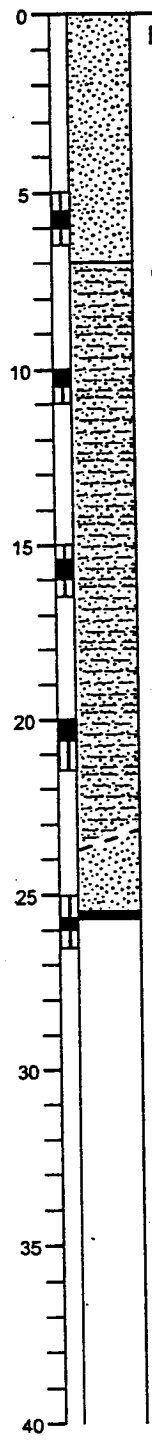
AR 025944

P.O.S. Coordinates: N 18,080 E 11,470

Equipment L10-T Track Rig

Land Surface Elevation 302 feet

Completion Date 10/15/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
				BROWN SAND (SP) loose, moist, fine to medium grained, with some silt and organics (Recessional Outwash).
			9	
				GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with gravel (Till).
MD	9.0	129	50/4"	
M	6.6		50/5"	
			50/3.5"	
				GRAY SAND (SP) very dense, moist, fine to medium grained, trace gravel (Advance Outwash).
MD	12.7	121	50/3"	
				Boring terminated at 25.5 feet bgs.
				No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B66

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A107

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring6.cdr	14,190.211	ECR	13 October 97		

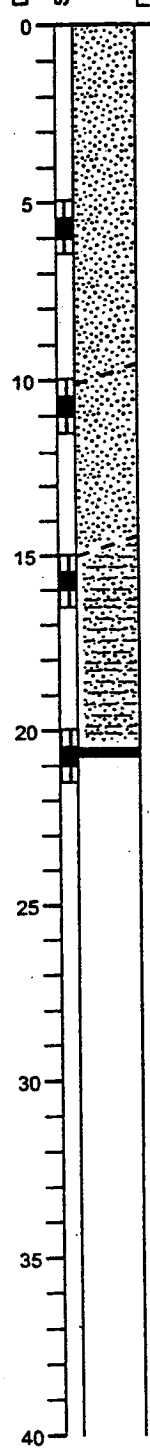
AR 025945

P.O.S. Coordinates: N 17,825 E 11,600

Equipment L10-T Track Rig

Land Surface Elevation 312 feet

Completion Date 10/15/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	
				DARK BROWN AND BROWN SAND (SP) dense, moist, fine to medium grained, with some silt, with trace coarse gravel (Recessional Outwash).
MD	7.5	105	35	
			59	BROWN SAND (SP) dense, moist, fine to coarse grained, with some gravel and silt (Weathered Till).
MD	8.0	126	50/4"	GRAY SILTY SAND (SM) very dense, moist, fine to medium grained, with some coarse gravel (Till).
			50/5.5"	

Boring terminated at 30.0 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B67

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A108

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025946

P.O.S. Coordinates: N 17,660 E 11,505

Equipment L10-T Track Rig

Land Surface Elevation 296 feet

Completion Date 10/15/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) dense, moist, fine to medium grained (Advance Outwash).
MD	13.5	120	47	5		
						Becomes saturated.
MD	16.9	111	28	10		GRAY SILT (ML) hard, moist, with some fine sand interbeds (Pre Vashon Drift).
MD	17.8	111	44	15		
			66	20		GRAY CLAYEY SILT (MH) hard, moist, fractured, laminated.
MD	27.1	95	54	25		
			50/4"	30		
CU-TxS	32.1	89	46	35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B68 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A109

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025947

P.O.S. Coordinates: N 17,660 E 11,505

Equipment L10-T Track Rig

Land Surface Elevation 296 feet

Completion Date 10/15/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
CU-TxS	28.8	95	51	40	
CU-TxS	30.8	96	54	45	
MD	29.7	94	50/5.5"	50	
MD	33.3	90	45	55	
MD	29.0	93	50/5.5"	60	
				65	
				70	
				75	
				80	

GRAY CLAYEY SILT (MH) hard, moist fractured, laminated

Boring terminated at 60.5 feet bgs.

Perched groundwater encountered at 8 feet bgs during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B68 (40'-60.5')

HNTB/SeaTac 1997- Runway Investigation

SeaTac, Washington

PLATE A110

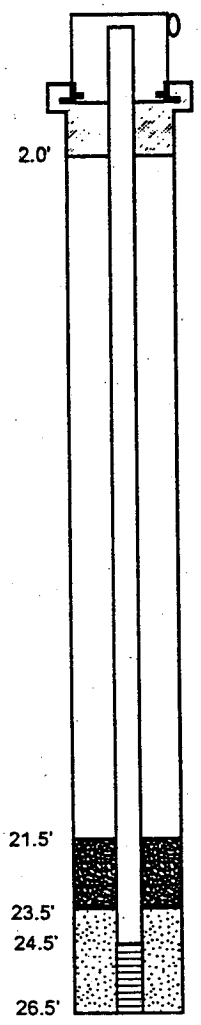
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bor2-40.cdr	14,190.211	ECR	13 October 97		

AR 025948

P.O.S. Coordinates: N 19,150 E 11,560

Equipment L10-T Track Rig

Land Surface Elevation 334 feet Date 10/16/97



Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) loose, moist, fine grained, mottled.
			9	5		
						Becomes brown, dense, fine to coarse grained with gravel.
			31	10		
MD	12.4	126	50/5.5"	15		Becomes gray, very dense, with sand seams.
MD	12.8	116	100/10"	20		
						GRAY SAND (SP) dense, wet, fine to medium grained, with trace gravel (Advance Outwash).
MD	13.4	115	50/4"	25		Boring terminated at 26.0 feet bgs. Groundwater encountered at 25 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B69

HNTB/SeaTac 1997-Runway Investigation

SeaTac, Washington

PLATE A111

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Bwells2.cdr	14,190.211	ECR	15 October 97		

AR 025949

P.O.S. Coordinates: N 21,370 E 12,190

Equipment L10-T Track Rig

Land Surface Elevation 337 feet

Completion Date 10/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		Misc. Fill material, concrete topsoil. BROWN SAND (SP) dense, dry, fine to medium grained, with some gravel (Fill).
M	4.1		39	5		
						BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel.
			68	10		
						BROWN GRAY SAND (SP) very dense, moist, fine grained, trace gravel (Advance Outwash).
MD	14.7	106	50/6"	15		
						Becomes fine to medium grained.
			50/5"	20		
						Boring terminated at 21.0 feet bgs. No groundwater encountered during drilling.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B70

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A112

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025950

P.O.S. Coordinates: N 21,145 E 11,400

Equipment L10-T Track Rig

Land Surface Elevation 314 feet

Completion Date 10/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel (Weathered Till).
MD	10.7	124	29	5		
						Becomes very dense.
MD	10.3	134	79	10		
			50/5"	15		BROWN GRAY SAND (SP) very dense, wet, fine to medium grained (Advance Outwash).
MD	23.7	102	50/4"	20		
						Boring terminated at 21.5 feet bgs. Groundwater encountered at 17 feet during drilling. Groundwater measured at 12 feet bgs prior to backfilling boring.
				25		
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B71

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A113

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Boring6.cdr	14,190.211	ECR	13 October 97		

AR 025951

P.O.S. Coordinates: N 18,255 E 10,850

Equipment L10-T Track Rig

Land Surface Elevation 233 feet

Completion Date 10/17/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		LIGHT BROWN GRAY SILTY SAND (SM-SP) medium dense, moist, fine grained, trace gravel, mottled (Recessional Outwash).
			35	5		Becomes wet.
						With silt interbeds.
MD	18.8	114	56	10		Becomes dense.
				15		GRAY SAND (SP) very dense, wet, fine to medium grained, with trace gravel and silt.
M	19.5		70/11"			
			50/5"	20		GRAY SILTY SAND (SM) very dense, saturated, fine to coarse grained, with gravel (Till).
				25		With sand interbeds.
M	11.3.		50/2"			
						Driller notes hard drilling.
			130/6"	30		
M	10.4		70/4"			
				35		Boring terminated at 33.0 feet bgs. Groundwater encountered at 17 feet bgs during drilling.
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B72

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A114

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025952

P.O.S. Coordinates: N 19,335 E 10,785

Equipment Mobile B59

Land Surface Elevation 267 feet

Completion Date 10/20/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK BROWN SILTY SAND (SM) loose, moist, fine grained, with some gravel and organics (Fill).
			3	5		
MD	30.5	88.2	5	10		GRAY SILT (ML) medium stiff, moist, with some organics.
						GRAY SILTY SAND (SM) very dense, wet, fine to medium grained, with some gravel (Till).
			50/5.5"	15		
			50/4.5"	20		
MD	10.7	128	50/5"	25		Boring terminated at 24.0 feet bgs. Groundwater encountered at 13.5 feet bgs during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B73

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A115

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025953

P.O.S. Coordinates: N 16,010 E 10,920

Equipment Mobile B59

Land Surface Elevation 359 feet

Completion Date 10/20/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		GRAY BROWN SILTY SAND (SM) medium dense, moist, fine to coarse grained, with some coarse gravel (Fill).
MD	13.5	120	40	5		GRAY BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained, with some gravel (Till).
MD	14.5	121	50/5"	10		
			50/5.5"	15		
SA	9.4		50/5.5"	20		Becomes wet.
			50/6"	25		Boring terminated at 24.0 feet bgs. No groundwater encountered during drilling.
				30		
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B74

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A116

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025954

P.O.S. Coordinates: N 11,405 E 12,425

Equipment Mobile B59

Land Surface Elevation 356 feet

Completion Date 10/21/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN GRAY SILTY SAND (SM) medium dense, moist, fine to coarse grained, with gravel (Fill).
			10	5		
MD	8.4	120	22	10		
						BROWN SILTY SAND (SP/SM) medium dense, moist, fine to medium grained, with some organics (Fill).
			12	15		
						BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).
MD	8.7	119	50/5"	20		
			50/4"	25		
MD	7.8	111	50/5"	30		
			50/5.5"	35		
M	9.1		50/5"	40		GRAY SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).

AGI TECHNOLOGIES

Log of Boring AT97-B76 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A118

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring6.cdr

AR 025955

P.O.S. Coordinates: N 11,405 E 12,425

Equipment Mobile B59

Land Surface Elevation 356 feet

Completion Date 10/21/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample
				40	
			72		
				45	
				50	
				55	
				60	
				65	
				70	
				75	
				80	

GRAY SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).

Boring terminated at 45.0 feet bgs.
No groundwater encountered during drilling.

AGI TECHNOLOGIES

Log of Boring AT97-B76 (40-45.0')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A119

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Bor2-40.cdr

AR 025956

P.O.S. Coordinates: N 19,120 E 12,360

Equipment Mobile B59

Land Surface Elevation 410 feet

Completion Date 10/21/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained, with some gravel (Till).
MD	9.4	127	50/5.5"	5		
			50/6"	10		
MD	8.3	119	50/5.5"	15		
						BROWN GRAY SILTY SAND (SP/SM) very dense, moist, fine to medium grained, with gravel, interbedded.
MD	6.8	113	50/5.5"	20		
			50/5"	25		BROWN SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).
MD	12.0	102	50/6"	30		Boring terminated at 29.5 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B77

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A120

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring7.cdr

AR 025957

P.O.S. Coordinates: N 19,965 E 12,335

Equipment Mobile B59

Land Surface Elevation 416 feet Completion Date 10/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		DARK BROWN GRAY SILTY SAND (SM) dense, moist, fine to medium grained, with some gravel and organics (Fill).
MD	16.4	113	32	5		
						BROWN GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained with gravel (Weathered Till).
MD	10.9	127	82	10		
MD	10.2	129	70	15		
			50/3"			
MD	11.6	122	50/5"	20		
MD	9.1	120	60	25		BROWN SAND (SP) very dense, moist, fine to medium grained (Advance Outwash).
MD	8.6	109	60	30		
						Boring terminated at 30.0 feet bgs. No groundwater encountered during drilling.
				35		
				40		

AGI TECHNOLOGIES

Log of Boring AT97-B78

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A121

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring7.cdr

AR 025958

P.O.S. Coordinates: N 20,715 E 12,335

Equipment Mobile B59

Land Surface Elevation 417 feet

Completion Date 10/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				0		BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Fill).
MD	10.7	123	18	5		
						Becomes wet.
MD	12.5	128	23	10		
						Water at 13.0 feet.
						Becomes gray and brown, loose.
			8	15		
						Becomes with organics.
MD	17.1	102	5	20		
						With trace coarse sand.
MD	15.3	117	11	25		
						Becomes dark brown with peat and other organics.
MD	18.3	92	32	30		
						Cobbles at 32.0 feet bgs.
			50/5.5"			Becomes very dense, with some gravel (Fill).
				35		BROWN SAND (SP) very dense, moist, fine grained (Advance Outwash).
MD	4.4	108	63	40		

AGI TECHNOLOGIES

Log of Boring AT97-B79 (0-40')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A122

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

Boring7.cdr

AR 025959

P.O.S. Coordinates: N 20,715 E 12,335

Equipment Mobile B59

Land Surface Elevation 417 feet

Completion Date 10/24/97

Laboratory Tests	Moisture Content (%)	Dry Density (pcf)	Blows per Foot	Depth (feet)	Sample	
				40		BROWN SAND (SP) very dense, moist, fine grained (Advance Outwash).
			55			
				45		Boring terminated at 45.0 feet bgs. Groundwater encountered at 13 feet bgs during drilling.
				50		
				55		
				60		
				65		
				70		
				75		
				80		

AGI TECHNOLOGIES

Log of Boring AT97-B79 (40-45')

HNTB/SeaTac 1997- Runway Investigation
SeaTac, Washington

PLATE A123

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	13 October 97			

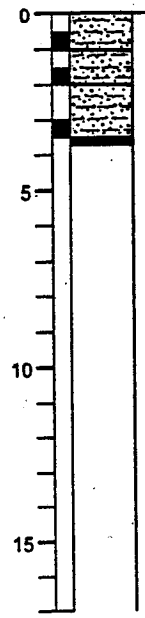
Bor2-40.cdr

AR 025960

Test Pit Number TP1-97

Land Surface Elevation 344 feet Date 11/21/97

Laboratory Tests	Moisture Content (%)
M	20.1
M	18.6
MD	12.2



DARK BROWN SILTY SAND (SM) loose, moist to wet, fine to medium grained, with roots and organics (Topsoil).

RED BROWN SILTY SAND (SM) dense, moist to wet, fine to medium grained, with fine gravel, (Weathered Till).

GRAY BROWN SILTY SAND (SM) dense, moist, fine to coarse grained, with gravel, cemented (Till).

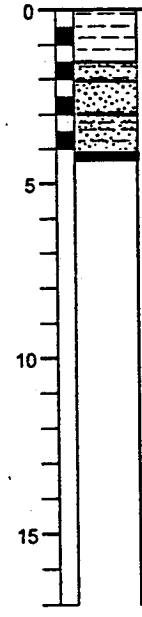
Groundwater seepage encountered at 2 feet bgs during excavation.

Test pit terminated at 3.5 feet bgs.

Test Pit Number TP2-97

Land Surface Elevation 336 feet Date 11/21/97

M	22.0
M	22.8
M	23.8
MD	13.7



DARK BROWN SANDY SILT (ML) soft, moist, with roots and organics (Topsoil).

BROWN SILTY SAND (SM) loose, wet, fine to medium grained (Fill).

BROWN SAND (SP) medium dense, moist to wet, fine to medium grained with some gravel (Recessional Outwash).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel, cemented (Till).

Groundwater seepage encountered at 3 feet bgs during excavation.

Test pit terminated at 4.0 feet bgs.

AGI TECHNOLOGIES

Log of Test Pits AT97-TP1 and AT97-TP2

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A124

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	19 December 97			

Testpit.cdr

AR 025961

Test Pit Number TP3-97

Land Surface Elevation 339 feet Date 11/21/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
M	21.2	0	
M	19.1		
M	18.6	5	
		10	
		15	

SILTY SAND (SM) loose, moist to wet, fine to medium grained, with roots and organics (Fill).

RED BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Recessional Outwash).

GRAY SILTY SAND (SM) dense, moist, fine to coarse grained, with gravel, cemented (Till).

Groundwater seepage encountered at 3 feet bgs during excavation.

Test pit terminated at 4.0 feet bgs.

Test Pit Number TP4-97

Land Surface Elevation 357 feet Date 11/21/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
M	25.3	0	
M	18.9		
M	14.6	5	
		10	
		15	

DARK BROWN SILTY SAND (SM) loose, moist, with roots and organics (Topsoil).

RED BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained, with some gravel (Recessional Outwash).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel, cemented (Till).

Groundwater seepage encountered at 7 feet bgs during excavation.

Test pit terminated at 3.5 feet bgs.

AGI TECHNOLOGIES

Log of Test Pits AT97-TP3 and AT97-TP4

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

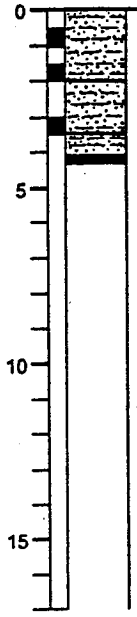
PLATE A125

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
Testpit.cdr 14,190.211	ECR	19 December 97			

Test Pit Number TP5-97

Land Surface Elevation 335 feet Date 11/21/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
M	21.0	0	
M	17.4	5	
		10	
		15	



SILTY SAND (SM) loose, moist, fine to coarse grained, with asphalt, roots, organics (Fill).

SILTY SAND (SM) medium dense, saturated, fine to medium grained, with gravel, weathered (Weathered Till).

GRAY SILTY SAND (SM) very dense, wet, fine to coarse grained, with gravel (Till).

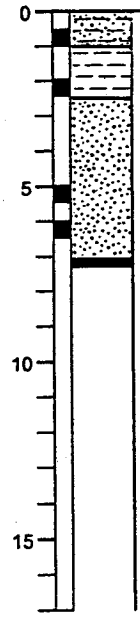
Groundwater seepage encountered at 2 feet bgs during excavation.

Test pit terminated at 4.0 feet bgs.

Test Pit Number TP6-97

Land Surface Elevation 331 feet Date 11/21/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
M	27.1	0	
M	23.6	5	
M	9.1		
M	10.2	10	
		15	



BROWN SILTY SAND (SM) loose, moist, fine to medium grained, with roots, charcoal, organics, and gravel (Fill).

RED BROWN SANDY SILTY (ML) hard, moist, trace gravel, oxidized (Weathered Till).

RED BROWN SAND (SP) dense, moist, fine to medium grained, with gravel, oxidized (Advance Outwash).

Test pit terminated at 7.0 feet bgs.

No groundwater encountered during excavation.

AGI TECHNOLOGIES

Log of Test Pits AT97-TP5 and AT97-TP6

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A126

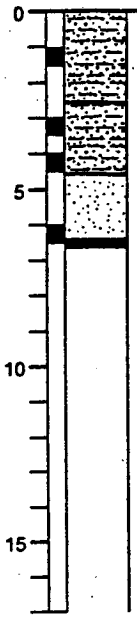
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	19 December 97			

Testpit.cdr

Test Pit Number TP7-97

Land Surface Elevation 332 feet Date 11/24/97

Laboratory Tests	Moisture Content (%)
M	9.9
M	13.9
M	25.3
M	7.3



BROWN SILTY SAND (SM) medium dense, moist, fine to medium grained with gravel, organics (Fill).

GRAY BROWN SILTY SAND (SM) dense, moist, fine to medium grained, occasional pockets, mottled (Weathered Advance Outwash).

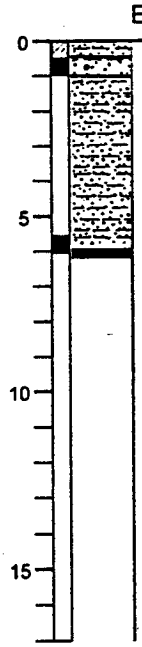
GRAY BROWN SAND (SP) dense, moist, fine grained, with some silt (Advance Outwash).

Test pit terminated at 6.5 feet bgs.
No groundwater encountered during excavation.

Test Pit Number TP8-97

Land Surface Elevation 354 feet Date 11/24/97

Laboratory Tests	Moisture Content (%)
M	18.2
MD	10.7



RED BROWN SILTY SAND (SM) loose, moist to wet, fine to medium grained, with some gravel, (Fill).

BROWN GRAVELLY SAND (SW) dense, moist, fine to coarse grained, with some silt.

GRAY BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel, cemented (Till).

Test pit terminated at 6.0 feet bgs.
No groundwater seepage encountered during excavation.

AGI TECHNOLOGIES

Log of Test Pits AT97-TP7 and AT97-TP9

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE **A127**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	19 December 97			

Testpit.cdr

AR 025964

Test Pit Number TP9-97

Land Surface Elevation 277 feet Date 11/24/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
		0	
M	14.8		
		5	
M,PL,LL	31.6		
		10	
		15	

DARK BROWN SILTY SAND (SM) loose, moist, fine to medium grained, with roots and organics (Topsoil)..

GRAY BROWN SAND (SP) dense, moist, fine to medium grained, with occasional gravel and silty pockets (Advance Outwash).

REDDISH GRAY BROWN SILT (ML) stiff, wet, with some fine sand, mottled.

Test pit terminated at 10.0 feet bgs .
No groundwater seepage encountered during excavation.

Test Pit Number TP10-97

Land Surface Elevation 336 feet. Date 11/24/97

Laboratory Tests	Moisture Content (%)	Depth (feet)	Sample
		0	
M	17.9		
M	10.6	5	
		10	
		15	

DARK BROWN SILTY SAND (SM) loose, moist, fine to medium grained, with roots and organics (Topsoil).

RED BROWN SAND (SP) dense, moist, fine to medium grained, with occasional gravel and trace silt (Recessional Outwash).

GRAY BROWN SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel, cemented (Till).

Test pit terminated at 7.0 feet bgs.
No groundwater seepage encountered during excavation.

AGI TECHNOLOGIES

Log of Test Pits AT97-TP9 and AT97-TP10

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

PLATE A128

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	19 December 97			

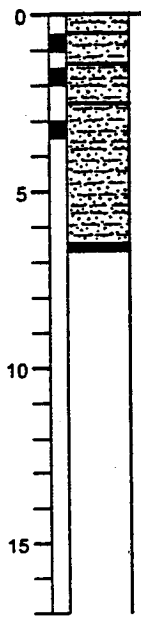
Testpit.cdr

AR 025965

Test Pit Number TP11-97

Land Surface Elevation 342 feet Date 11/24/97

Laboratory Tests	Moisture Content (%)
M	19.9
M	20.1
M	12.4



DARK BROWN SILTY SAND (SM) loose, moist, fine to medium grained, with roots and organics (Topsoil).

RED BROWN SILTY SAND (SM) dense, moist, fine to medium grained, with occasional gravel (Recessional Outwash).

RED BROWN SANDY SILT (SM-ML) dense, moist, fine to coarse grained sand, with gravel, oxidized (Weathered Till).

GRAY SILTY SAND (SM) very dense, moist, fine to coarse grained, with gravel (Till).

Test pit terminated at 6.5 feet bgs.

No groundwater seepage encountered during excavation.

AGI TECHNOLOGIES

Log of Test Pit AT97-TP11

HNTB/SeaTac 1997-Runway Investigation
SeaTac, Washington

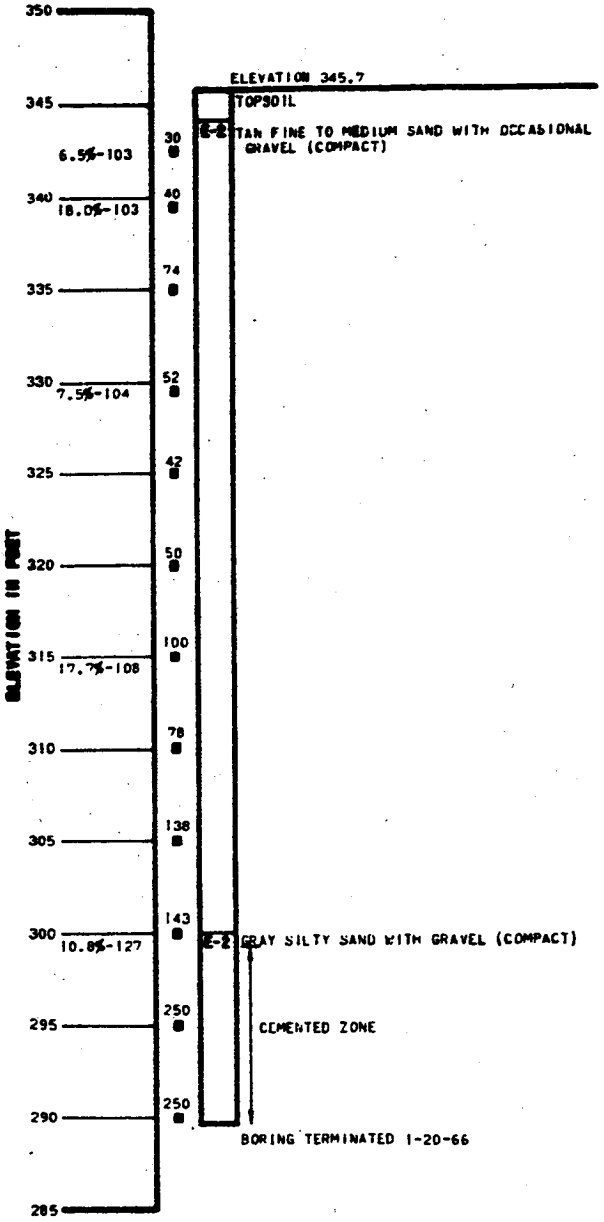
PLATE A129

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	ECR	19 December 97			

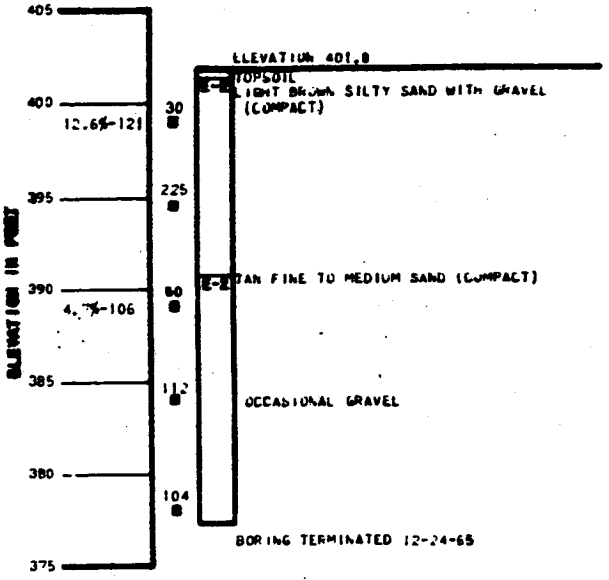
Testpit.cdr

AR 025966

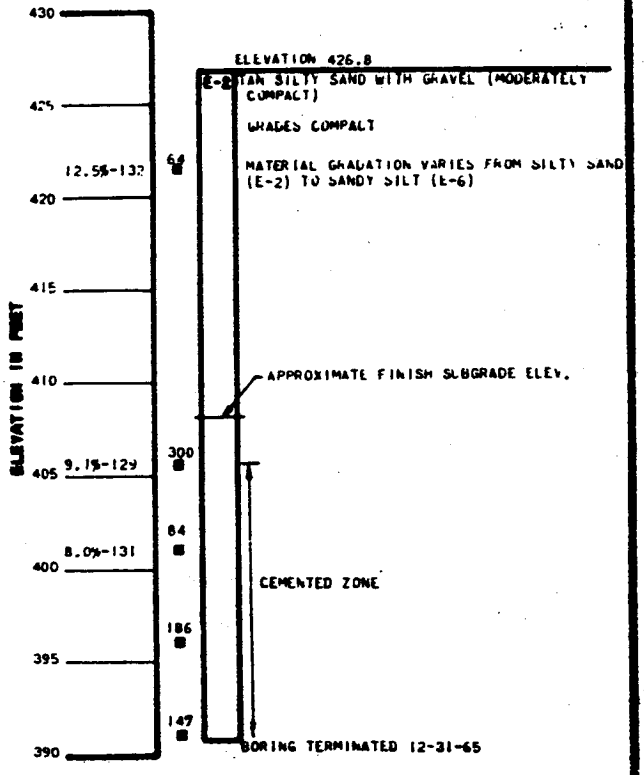
BORING 12



BORING 13

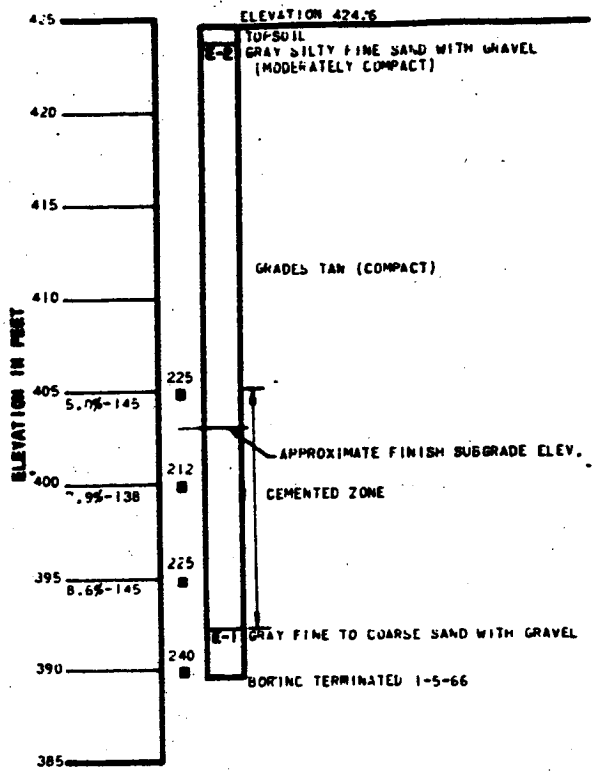


BORING 14

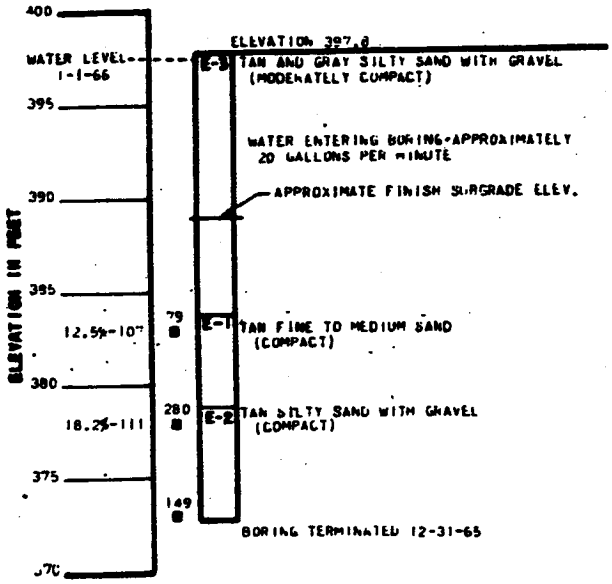


LOG OF BORINGS

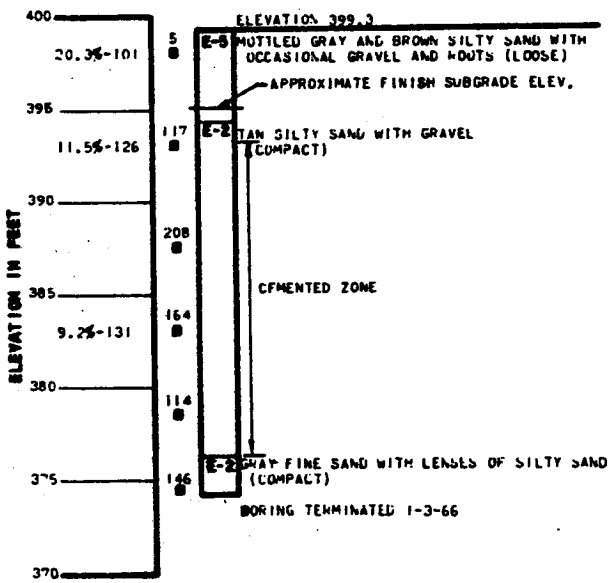
BORING 15



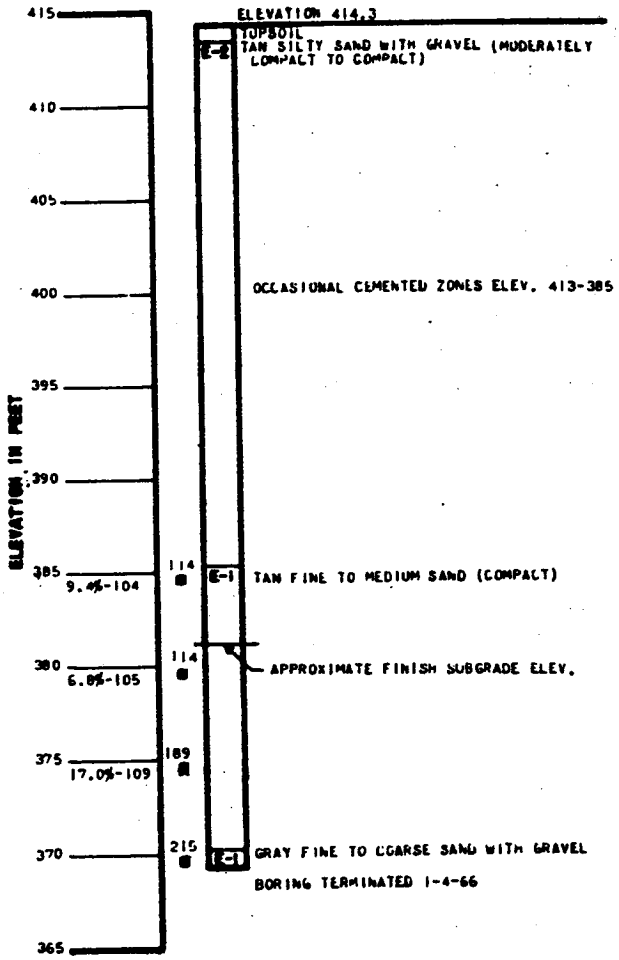
BORING 17



BORING 16

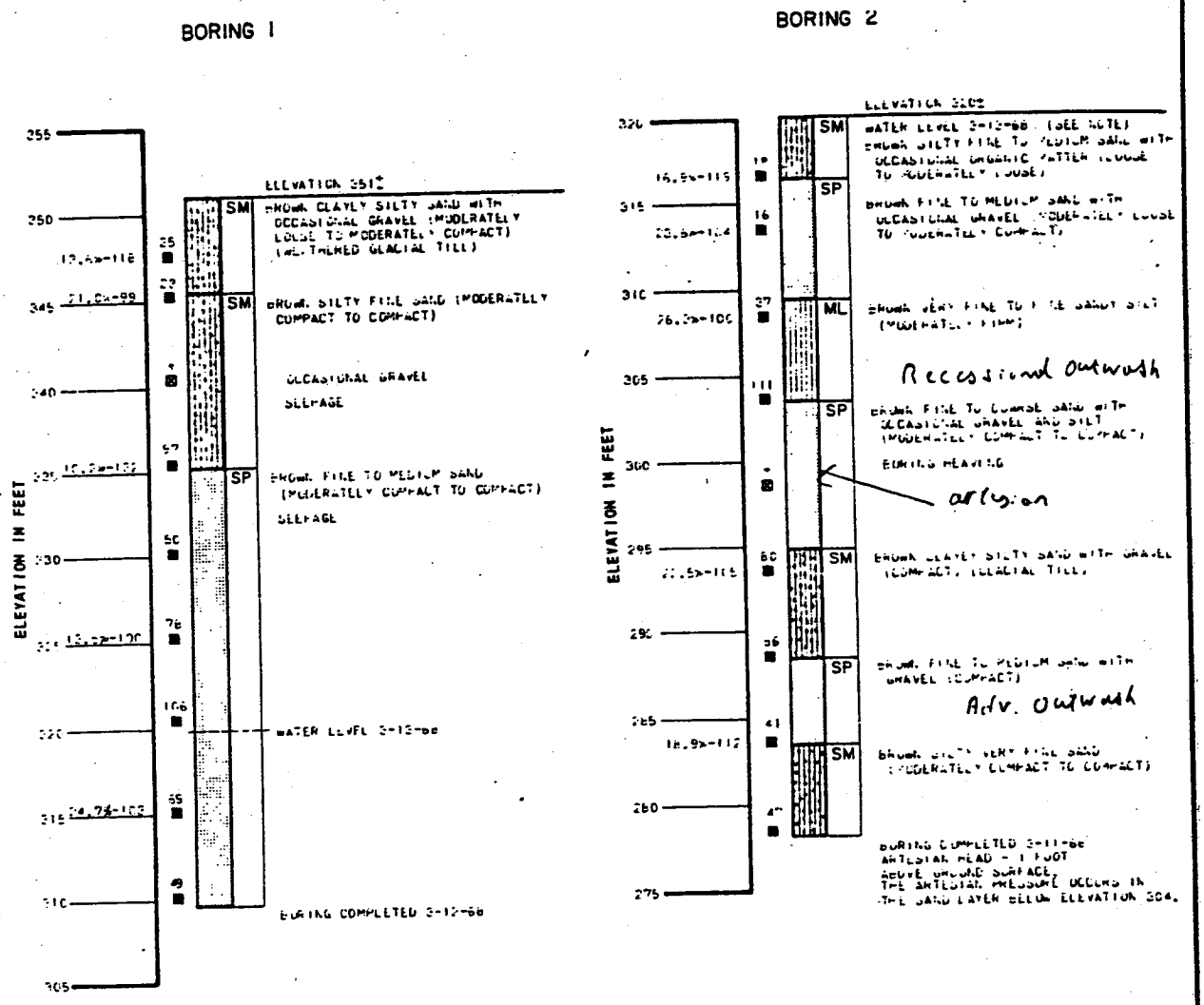


BORING 18



LOG OF BORINGS

PLATE A-5



NOTE: ELEVATIONS REFER TO U.S.C. AND G.S. DATUM.

LOG OF BORINGS

DAMES & MOORE

PLATE A-1

APPENDIX B

AGI
TECHNOLOGIES

APPENDIX B

LABORATORY TESTING

GENERAL

We conducted laboratory tests on numerous representative soil samples to better determine soil classification of the geologic deposits and soil units encountered, and to evaluate the materials' general physical properties and engineering characteristics. A brief description of the tests performed for this study is provided below. The results of some laboratory tests performed on specific samples are provided at the appropriate sample depth on the individual exploration logs that are presented in Appendix A. Other laboratory test results are presented in this appendix and referenced on the exploration logs. Laboratory test results from previous studies conducted by AGI and other parties are also presented in this appendix.

It is important to note that these test results may not accurately represent all variations of in situ soil conditions. The results are used in guiding our engineering judgment. AGI cannot be responsible for the interpretation by others of these data.

In accordance with our General Conditions, the soil samples for this project will be discarded after a period of 30 days following completion of this report unless we are otherwise directed in writing.

SOIL CLASSIFICATION

All soil samples were visually examined in the field by our representative. The samples were subsequently packaged and transported to our Bellevue laboratory where they were reexamined and the original description checked and verified or modified. With the help of information obtained from the other classification tests, described below, samples are described in general accordance with the Unified Soil Classification System and ASTM Standard D 2487-85. The resulting descriptions are provided at the appropriate sample locations on the exploration logs and are qualitative only. The Soil Classification/Legend, Plate A1 (Appendix A), provides pictorial symbols that match the written descriptions.

MOISTURE AND DENSITY

Moisture content and dry density tests were performed on numerous samples obtained from the test borings. The purpose of these tests is to approximately ascertain the in-place moisture content and the associated dry unit weight (dry density) of the soil sample tested. The moisture content is determined in general accordance with the ASTM Standard D 2216-92 and the dry unit weight is computed on the basis of this result and the volume of the sample container. The information obtained assists us by providing qualitative information regarding soil strength and compressibility. The results of moisture and density testing are presented at the appropriate sample depths on the exploration logs.

PARTICLE SIZE ANALYSIS

A detailed particle size analysis was conducted in general accordance with ASTM Standard D 422-92 on numerous soil samples to determine their size distribution. The information gained from this analysis allows us to provide a detailed description and classification of the in-place materials. In turn, this information helps us to understand how the in-place materials will react to conditions such as seepage, construction traffic, loading, and so forth. The results of tests completed at the time of this report are presented in this appendix.

ATTERBERG LIMITS

For soil units with large amounts of fines we performed several Atterberg Limit tests on the finer materials to determine the soils' plasticity characteristics and as an aid in accurate classification. These tests include the liquid and plastic limits that were performed in accordance with ASTM Standard D 4318-84. The plastic index, the difference between the liquid and plastic limits, is then determined. The results of the liquid limit provide a measure of the tested soils' shear strength and is analogous to the direct shear test. When coupled with the plastic index, the results help us to classify the in-place soils based on these soil characteristics. The results of these tests are presented at the appropriate sample depths on the exploration logs.

DIRECT SHEAR TEST

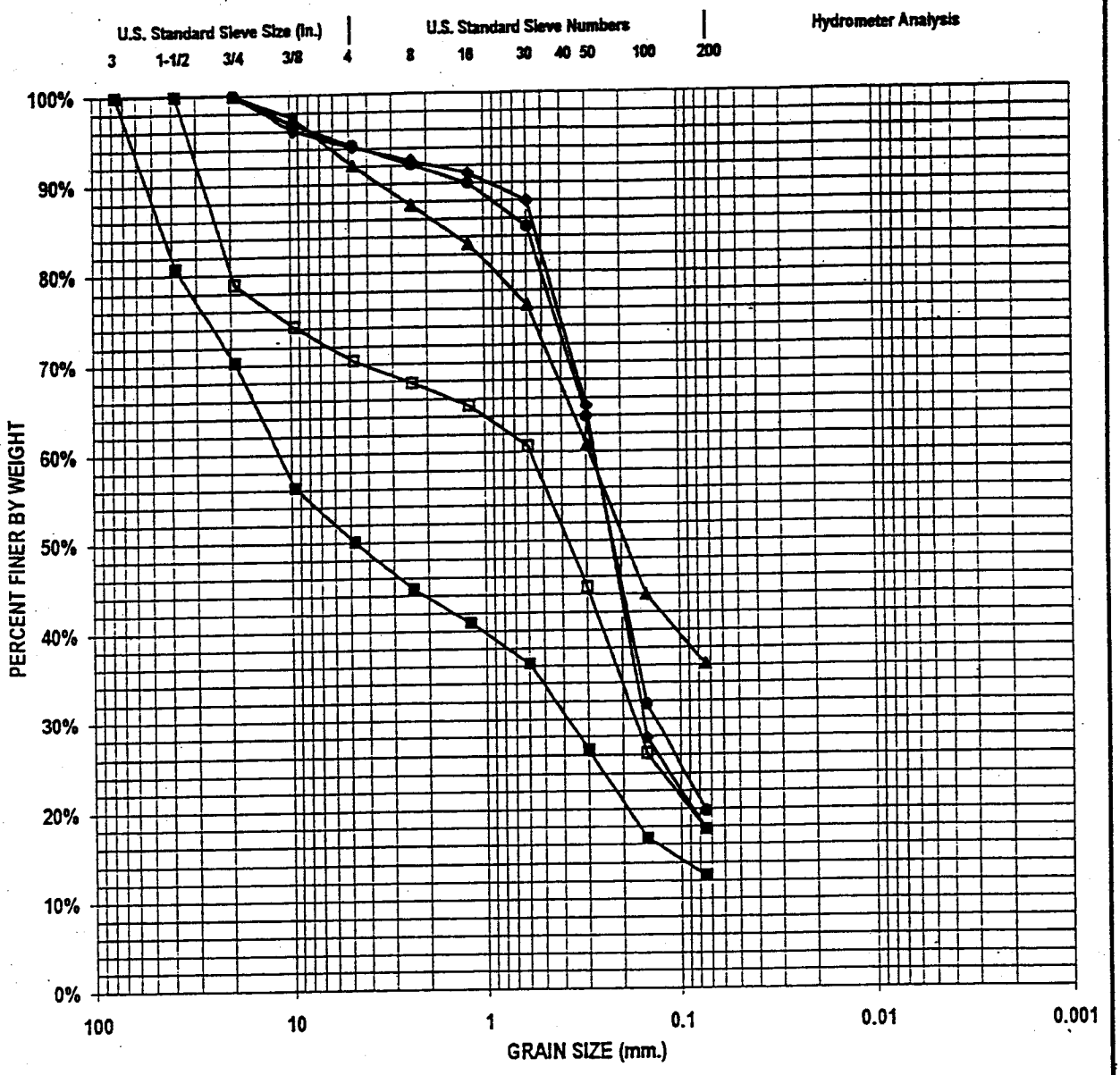
We performed direct shear tests on relatively undisturbed samples to determine the shear strength of the in-place soils. The tests were performed, in general accordance with ASTM Test Method D-3080-72(79), on samples at the field moisture conditions and/or under increased moisture conditions. A normal load, appropriate to the anticipated embankment conditions, was applied to the test sample and the sample was then sheared under a constant strain control. The results of these tests are presented in this appendix.

ONE DIMENSIONAL CONSOLIDATION TEST

To determine the approximate compressibility of the soft soils underlying the site, we performed one dimensional consolidation tests on relatively undisturbed samples. These tests, which were performed in general accordance with ASTM Test Method D-2435-80, were conducted on fully saturated samples. The results obtained provide an indication of the degree of plastic deformation of the soil with time and aid in making an approximation of the magnitude and rate of settlement of the compressible soils under the design loads with time. The results are presented as part of this appendix.

TRIAXIAL TEST

We performed a series of triaxial tests, in accordance with ASTM Test Method D-2850-82, on relatively undisturbed soil samples from the field. This test determines the unconsolidated, undrained compressive strength of a cylindrical sample used in the stress/strain controlled application of an axial load while the sample is subjected to a confining pressure. Data obtained from the test is used for determining strength properties and stress-strain relationships for the tested soils. The results of tests completed at the time of this report are presented as part of this appendix.



	Coarse	Fine	Coarse	Medium	Fine	
COBBLES	GRAVEL		SAND			SILT OR CLAY

SYMBOL	SOURCE	CLASSIFICATION
◆	B30-97; 9 ft	Brown Silty SAND (SM); Dense, moist
●	B31-97; 4 ft	Brown Silty SAND (SM) ; Dense, moist
▲	B35-97; 24 ft	Reddish Brown Silty SAND (SM); Dense, moist
□	B36-97; 24 ft	Reddish Brown Silty SAND (SM); Dense, moist
■	B37-97; 4 ft	Gray Sandy Gravel (GW); Dense, moist

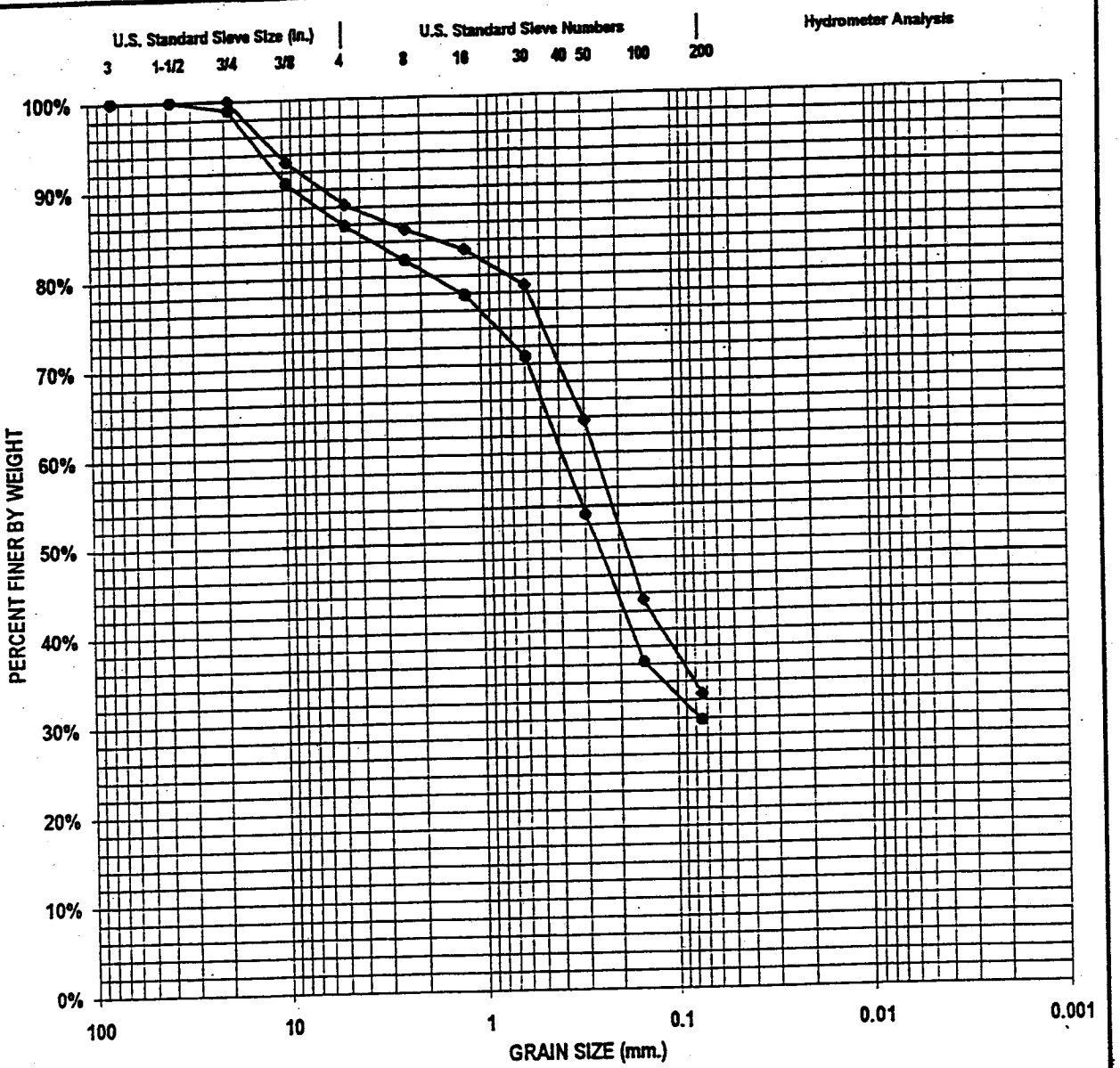
AGI TECHNOLOGIES

Particle Size Analysis

HNTB / Seatac Third Runway
Seatac, Washington

PLATE
B1

Project No.	Drawn	Date	Approved	Date	Revised	Date
hntbgsb31-37	14,190.211	JMM	12/04/97			



COBBLES	GRAVEL		SAND			SILT OR CLAY
	Coarse	Fine	Coarse	Medium	Fine	

SYMBOL	SOURCE	CLASSIFICATION
◆	B37-97; 54 ft	Dark Gray Silty SAND (SM); Dense, moist
●	B38-97; 24 ft	Brown Silty SAND (SM) ; Dense, moist

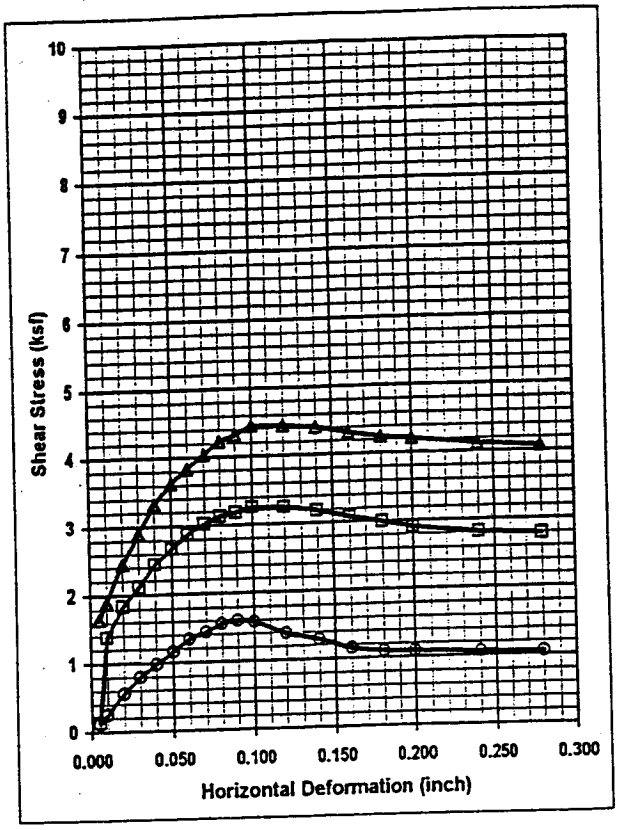
AGI TECHNOLOGIES

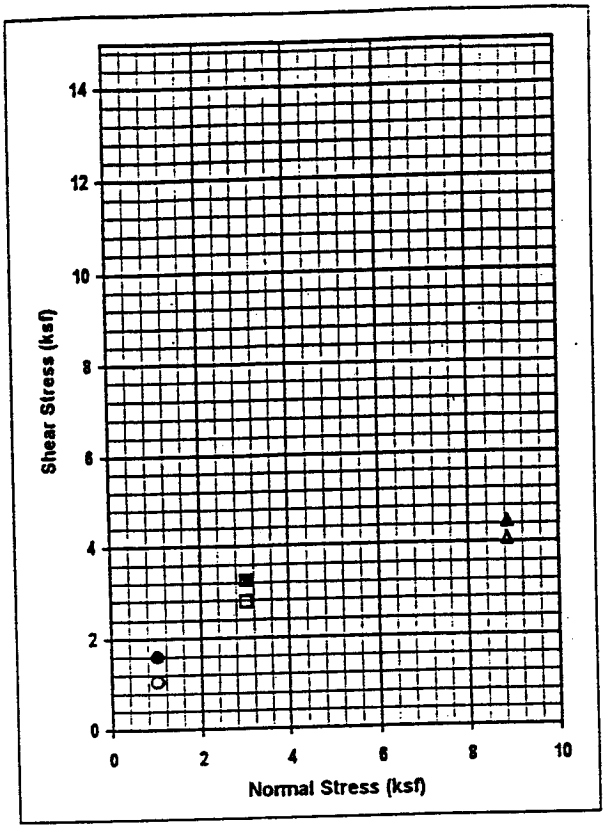
Particle Size Analysis

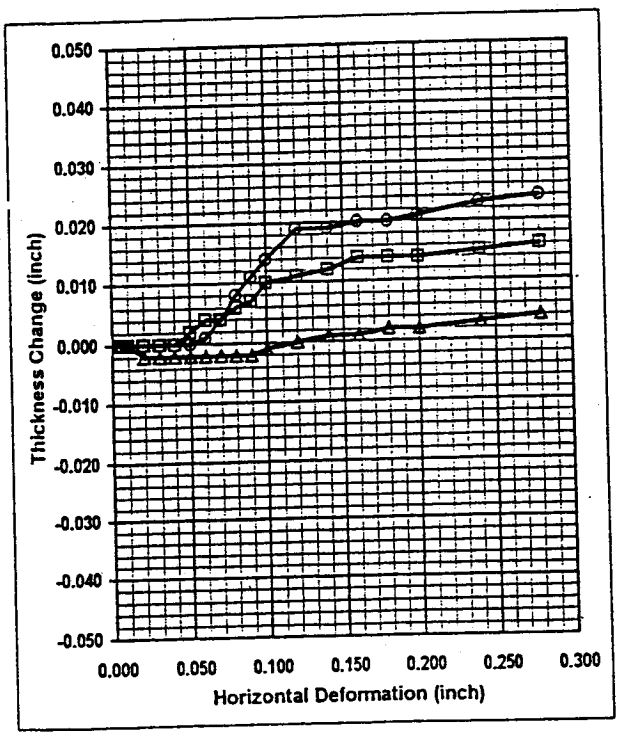
HNTB / Seatac Third Runway
Seatac, Washington

PLATE **B2**

Project No.	Drawn	Date	Approved	Date	Revised	Date
hntbgsb31-37	14,190.211	JMM	12/04/97			







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	2.41
Height (in.)	1.00	0.99	1.00
Water Content (%)	20.7	18.8	18.3
Void Ratio	0.61	0.53	0.59
Saturation (%)	93.7	98.6	85.8
Dry Density (pcf)	106.7	112.5	108.2
Specific Gravity	2.75	2.75	2.75
Post Consolidation			
Dry Density (pcf)	122.1	116.6	116.1
Void Ratio	0.41	0.47	0.48
Post Failure			
Water Content (%)	20.7	18.6	18.3
Dry Density (pcf)	118.8	114.7	115.7
Void Ratio	0.44	0.50	0.48
Saturation (%)	128.1	103.1	104.0
Failure			
Normal Stress (ksf)	1.01	3.03	8.86
Maximum Shear Stress (ksf)	1.60	3.25	4.46
Residual Shear Stress (ksf)	1.05	2.78	4.07
Axial Strain at Failure (inch)	0.09	0.10	0.10
Time to Failure (min.)	1.58	1.75	1.75

Sample : ; B1-97 @ 4 feet; Gray-Brown Silty Sand (SM) Recessional Outwash

AGI TECHNOLOGIES

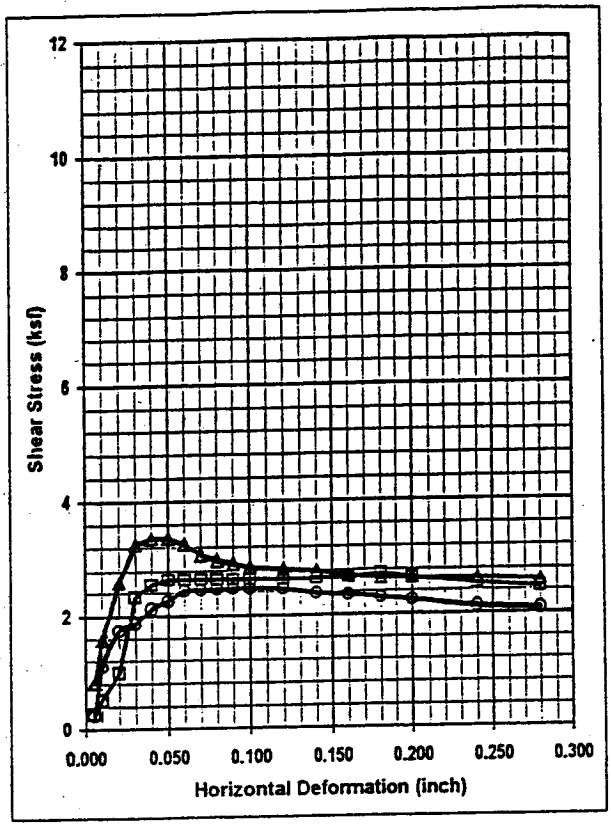
Direct Shear Test Results

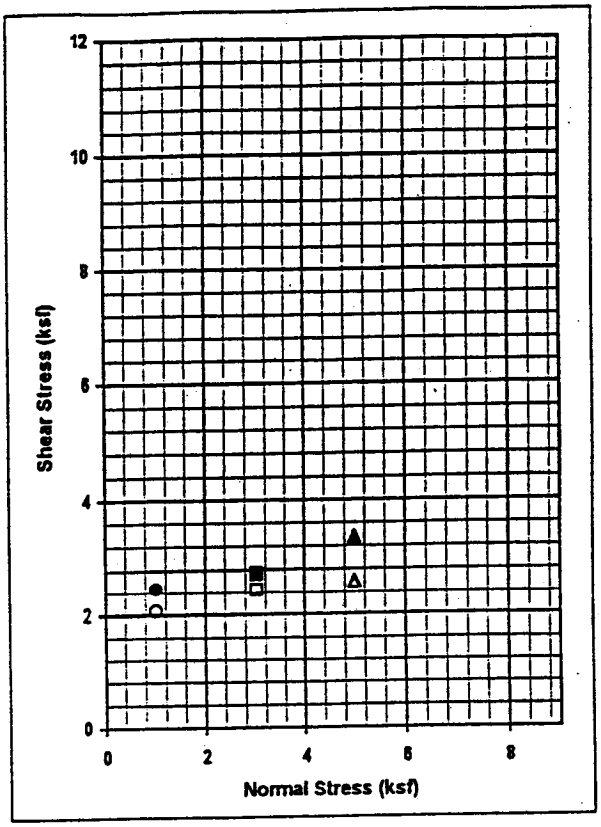
HNTB / Seatac Third Runway Investigation
Seatac, Washington

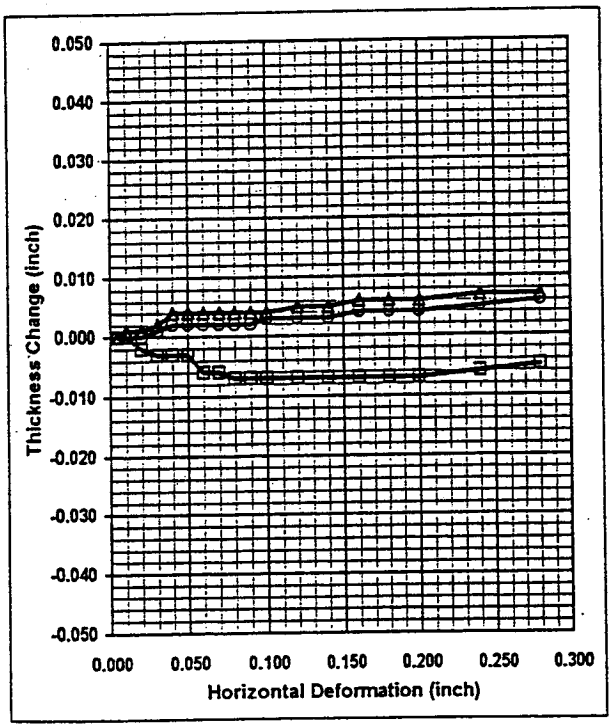
PLATE **B3**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
b1974ft.xls 14,190.210	HHH	10/31/97	[illegible]		

AR 025975







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.42	2.41
Height (in.)	1.00	1.00	1.00
Water Content (%)	27.1	28.7	26.9
Void Ratio	0.74	0.78	0.74
Saturation (%)	99.0	99.1	97.7
Dry Density (pcf)	97.0	94.6	96.7
Specific Gravity	2.70	2.70	2.70
Post Consolidation			
Dry Density (pcf)	99.2	100.0	102.3
Void Ratio	0.70	0.69	0.65
Post Failure			
Water Content (%)	27.0	28.3	26.3
Dry Density (pcf)	98.6	100.5	101.6
Void Ratio	0.71	0.68	0.66
Saturation (%)	102.9	112.7	107.7
Failure			
Normal Stress (ksf)	1.01	3.01	5.00
Maximum Shear Stress (ksf)	2.46	2.72	3.35
Residual Shear Stress (ksf)	2.07	2.44	2.59
Axial Strain at Failure (inch)	0.10	0.18	0.04
Time to Failure (min.)	1.96	3.53	0.78

Sample : SILT; B6-97 @ 10 feet; Gray SILT (ML) TILL

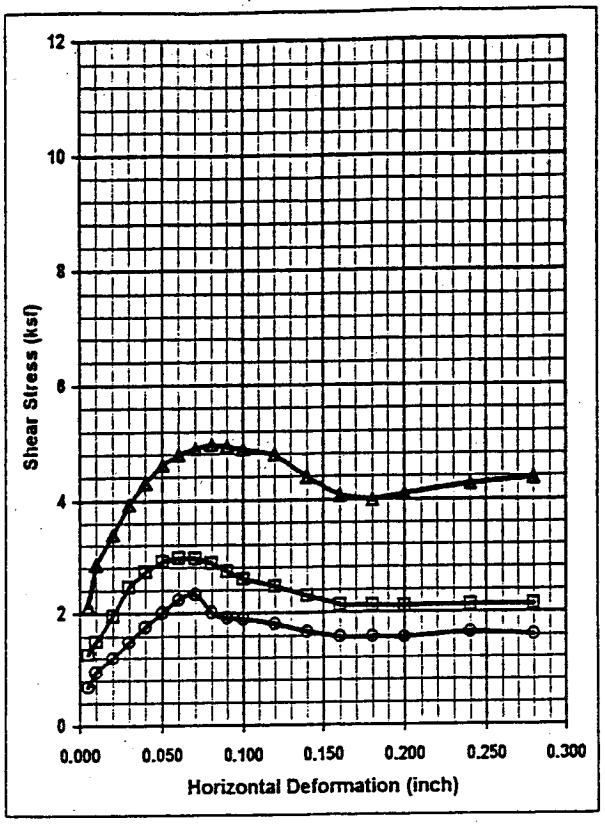
AGI TECHNOLOGIES

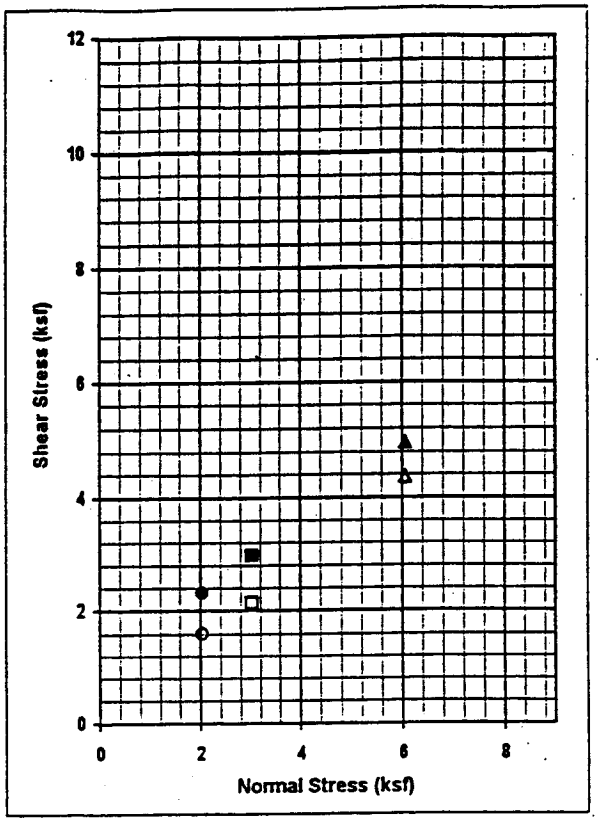
Direct Shear Test Results

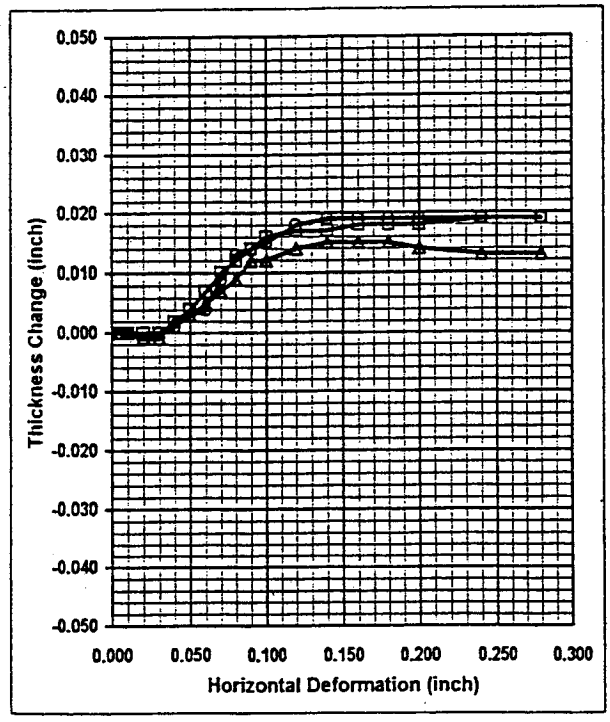
HNTB / Seatac Third Runway
Seatac, Washington

PLATE **B4**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
b697@10.xls 14,190.211	HHH	11/11/97			







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.40	2.40	2.40
Height (in.)	0.99	1.00	1.00
Water Content (%)	21.7	20.4	19.6
Void Ratio	0.55	0.56	0.53
Saturation (%)	106.7	99.1	101.3
Dry Density (pcf)	109.3	108.9	111.2
Specific Gravity	2.72	2.72	2.72
Post Consolidation			
Dry Density (pcf)	111.7	110.8	114.4
Void Ratio	0.52	0.53	0.48
Post Failure			
Water Content (%)	23.0	22.4	21.5
Dry Density (pcf)	109.5	108.7	112.9
Void Ratio	0.55	0.56	0.50
Saturation (%)	113.8	108.3	116.5
Failure			
Normal Stress (ksf)	2.03	3.01	6.06
Maximum Shear Stress (ksf)	2.32	2.97	4.96
Residual Shear Stress (ksf)	1.61	2.14	4.36
Axial Strain at Failure (inch)	0.07	0.06	0.08
Time to Failure (min.)	1.40	1.20	1.60

Sample : Brown SAND; B7-97@ 23.5 ft; (SP)

Advanced Outwash

AGI TECHNOLOGIES

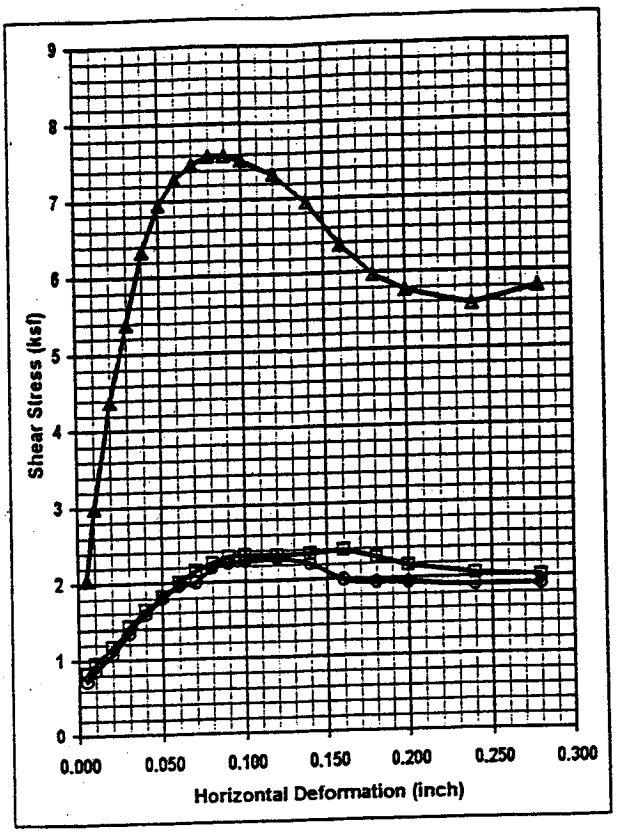
Direct Shear Test Results

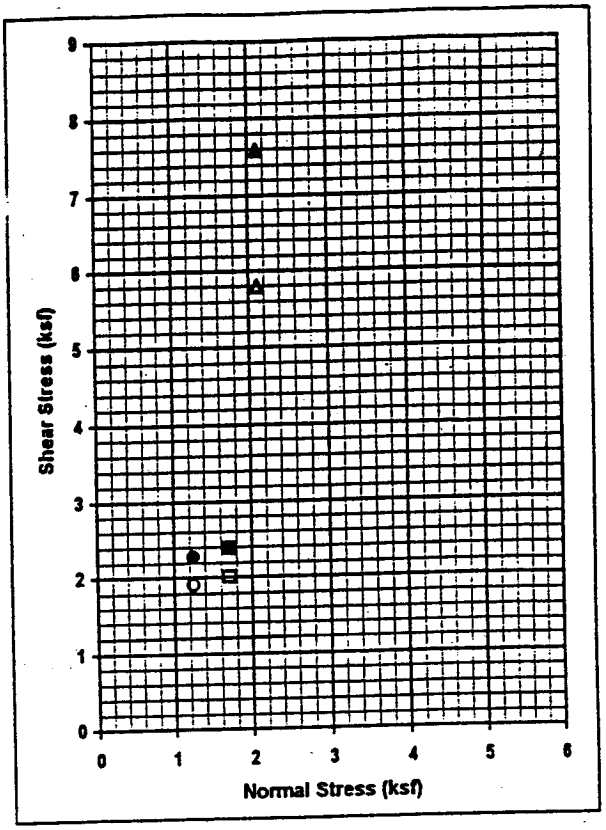
HNTB / Seatac Third Runway
Seatac, Washington

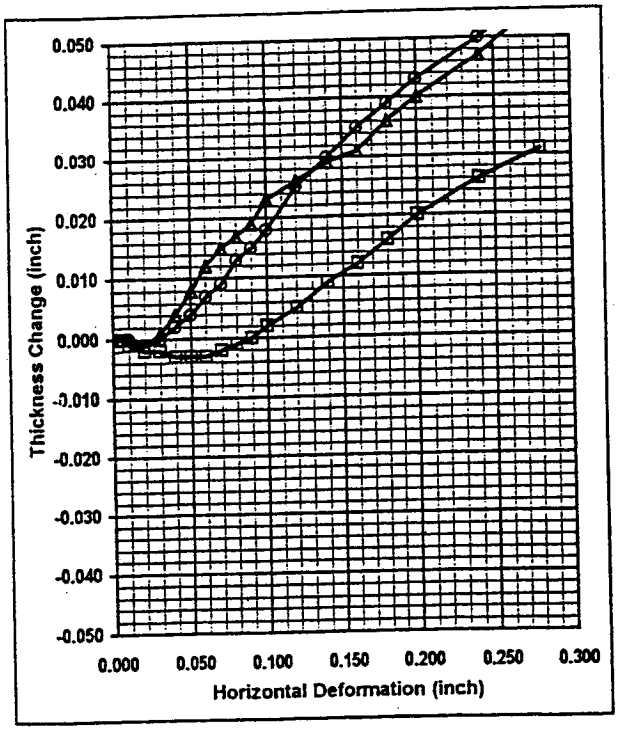
PLATE **B5**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
b7@23.5ds.xls	14,190.211	HHH	12/8/97		

AR 025977







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.42	2.41	2.42
Height (in.)	1.00	0.99	1.00
Water Content (%)	18.0	10.1	9.8
Void Ratio	0.34	0.32	0.32
Saturation (%)	144.9	84.5	82.6
Dry Density (pcf)	126.1	127.4	127.6
Specific Gravity	2.70	2.70	2.70
Post Consolidation			
Dry Density (pcf)	128.6	129.5	129.8
Void Ratio	0.31	0.30	0.30
Post Failure			
Water Content (%)	11.2	10.2	9.8
Dry Density (pcf)	121.4	125.5	122.8
Void Ratio	0.39	0.34	0.37
Saturation (%)	78.1	80.4	71.2
Failure			
Normal Stress (ksf)	1.24	1.70	2.11
Maximum Shear Stress (ksf)	2.28	2.39	7.59
Residual Shear Stress (ksf)	1.91	2.01	5.80
Axial Strain at Failure (inch)	0.12	0.16	0.08
Time to Failure (min.)	2.35	3.14	1.57

Sample : Brown Silty SAND; B28-97@13.5'; (SM) FILL

AGI TECHNOLOGIES

Direct Shear Test Results

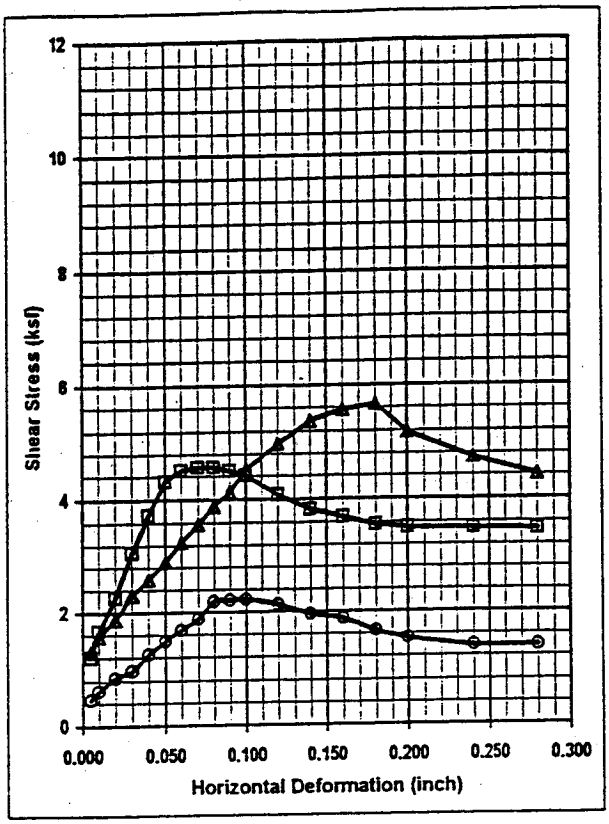
HNTB / Seatac Third Runway
Seatac, Washington

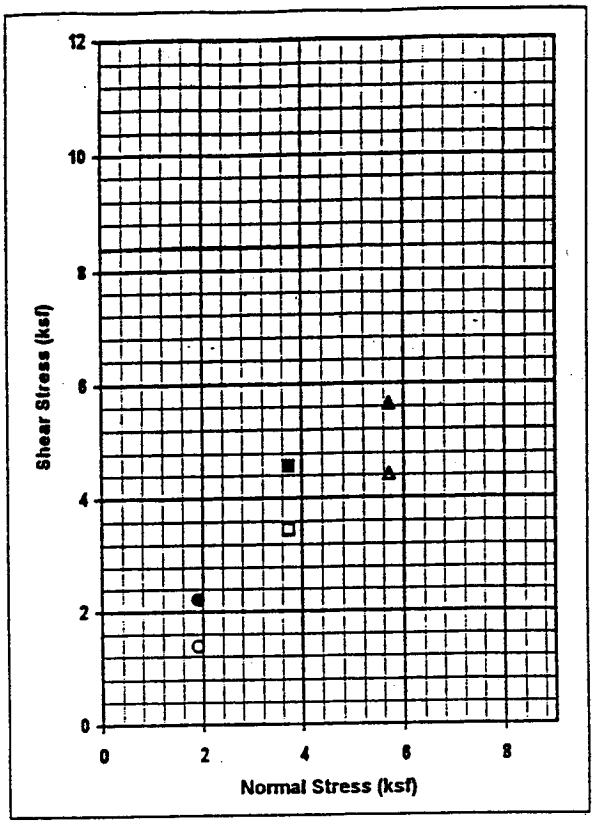
PLATE **B6**

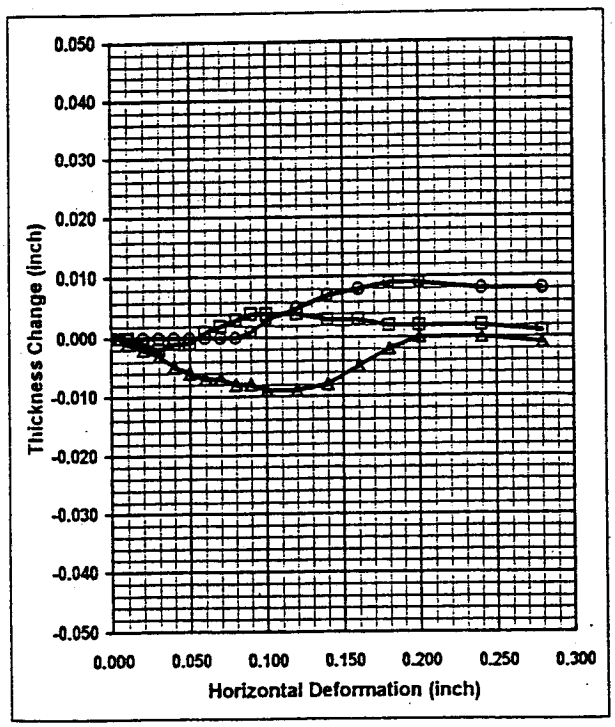
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	JMM	12/5/97			

b28@13.5ds.xls

AR 025978







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	2.40
Height (in.)	1.00	1.00	1.00
Water Content (%)	10.7	9.4	10.4
Void Ratio	0.42	0.32	0.29
Saturation (%)	68.6	81.3	96.1
Dry Density (pcf)	119.3	129.0	131.3
Specific Gravity	2.72	2.72	2.72
Post Consolidation			
Dry Density (pcf)	124.5	130.3	131.4
Void Ratio	0.36	0.30	0.29
Post Failure			
Water Content (%)	13.9	12.2	12.2
Dry Density (pcf)	123.5	130.2	131.5
Void Ratio	0.37	0.30	0.29
Saturation (%)	101.3	109.1	114.7
Failure			
Normal Stress (ksf)	1.91	3.73	5.71
Maximum Shear Stress (ksf)	2.21	4.56	5.64
Residual Shear Stress (ksf)	1.38	3.46	4.41
Axial Strain at Failure (inch)	0.10	0.07	0.18
Time to Failure (min.)	4.35	3.04	7.83

Sample : Gray-Brown Silty SAND; B32-97@ 9 ft; (SM) FILL

AGI TECHNOLOGIES

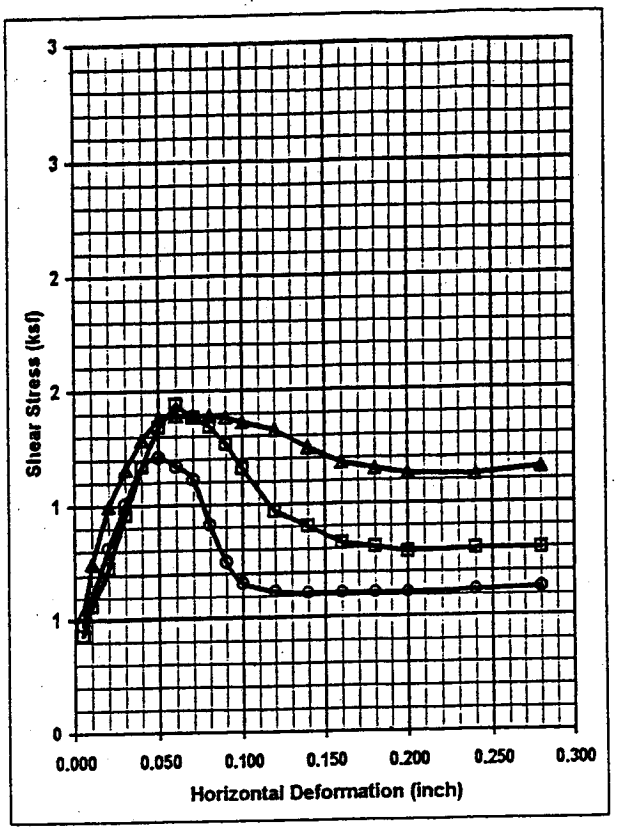
Direct Shear Test Results

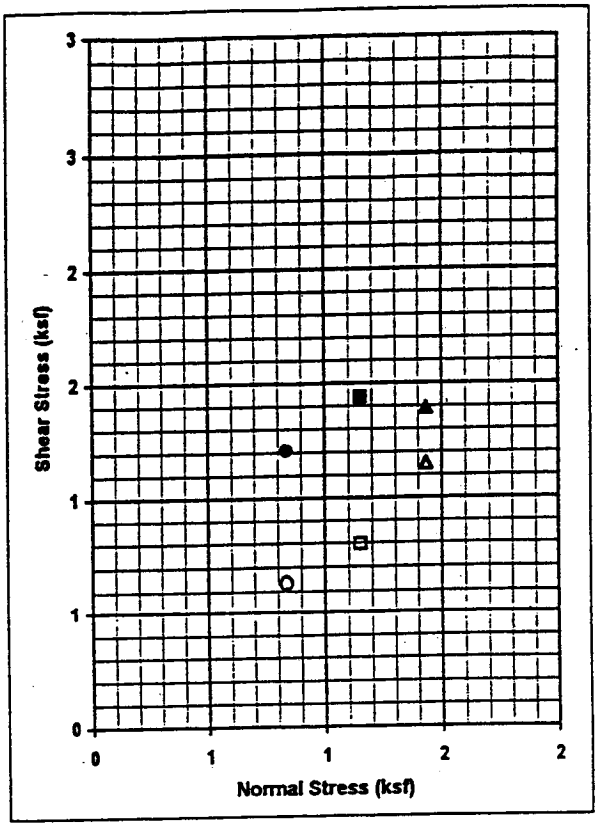
HNTB / Seatac Third Runway
Seatac, Washington

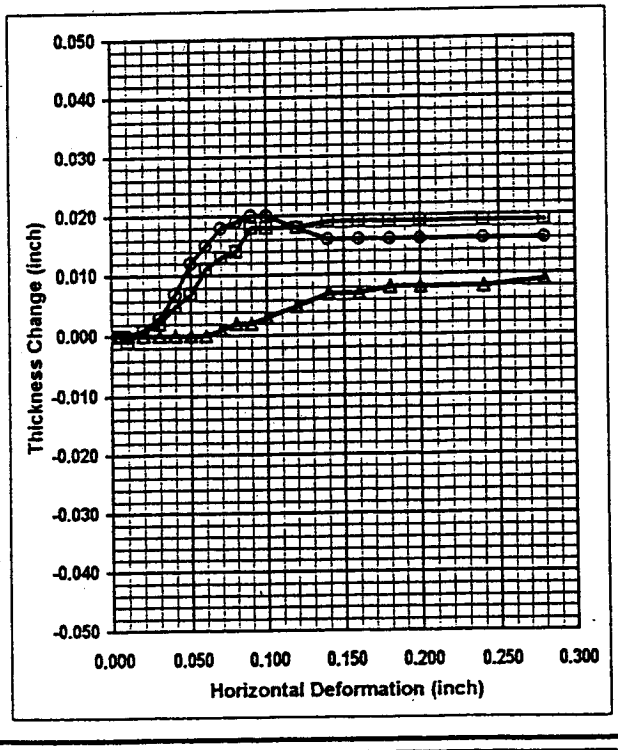
PLATE **B7**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
b32@9ftds.xls 14,190.211	HHH	12/9/97			

AR 025979







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	2.40
Height (in.)	1.00	1.00	0.99
Water Content (%)	13.0	12.7	11.5
Void Ratio	0.45	0.45	0.39
Saturation (%)	78.8	77.0	80.3
Dry Density (pcf)	117.1	117.1	122.3
Specific Gravity	2.72	2.72	2.72
Post Consolidation			
Dry Density (pcf)	118.8	120.6	122.6
Void Ratio	0.43	0.41	0.38
Post Failure			
Water Content (%)	15.1	15.3	16.2
Dry Density (pcf)	116.9	118.2	121.5
Void Ratio	0.45	0.44	0.40
Saturation (%)	91.0	95.5	111.0
Failure			
Normal Stress (ksf)	0.84	1.15	1.43
Maximum Shear Stress (ksf)	1.21	1.44	1.39
Residual Shear Stress (ksf)	0.63	0.80	1.15
Axial Strain at Failure (inch)	0.05	0.06	0.06
Time to Failure (min.)	2.17	2.61	2.61

Sample : Gray SAND; B34-97@ 9 ft; (SP) Advance Outwash

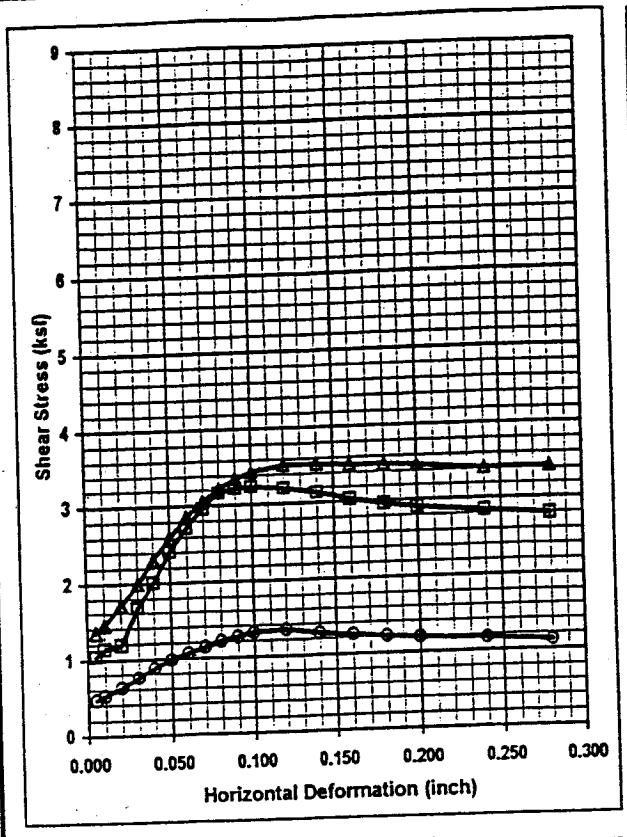
AGI TECHNOLOGIES

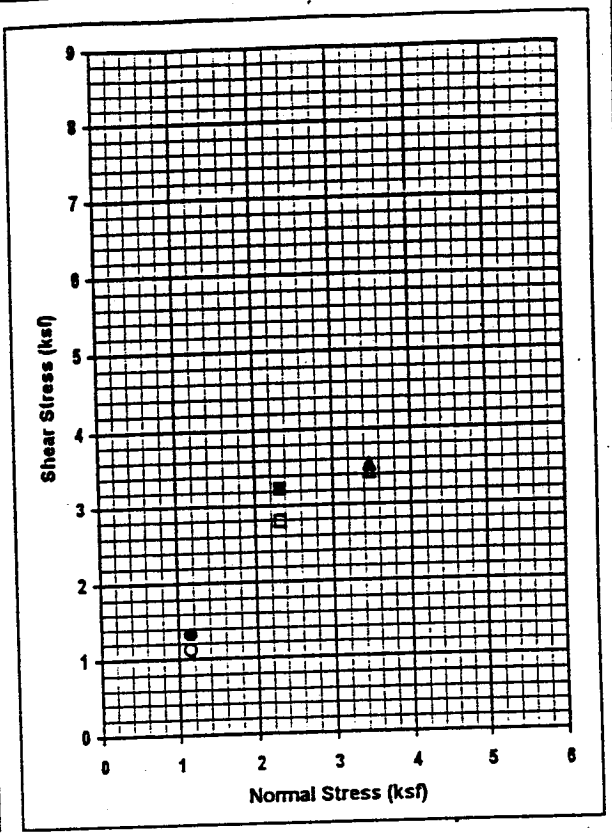
Direct Shear Test Results

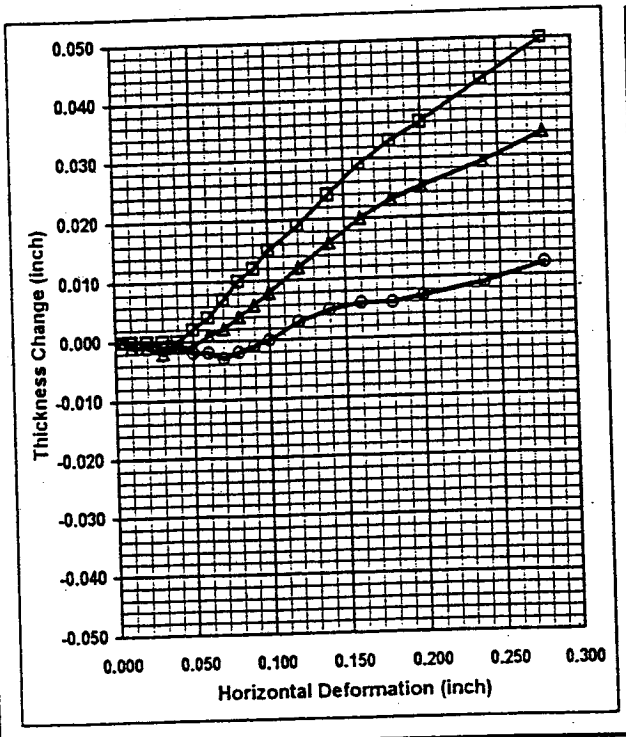
HNTB / Seatac Third Runway
Seatac, Washington

PLATE **B8**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
b34@9ds.xls	14,190.211	HHH	12/9/97		







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	2.41
Height (in.)	1.00	1.00	1.00
Water Content (%)	12.7	10.4	12.8
Void Ratio	0.29	0.30	0.35
Saturation (%)	116.6	92.9	98.9
Dry Density (pcf)	130.2	129.2	124.9
Specific Gravity	2.70	2.70	2.70
Post Consolidation			
Dry Density (pcf)	130.4	132.7	127.5
Void Ratio	0.29	0.27	0.32
Post Failure			
Water Content (%)	11.9	12.9	14.1
Dry Density (pcf)	128.8	126.2	123.2
Void Ratio	0.31	0.34	0.37
Saturation (%)	103.9	103.9	103.4
Failure			
Normal Stress (ksf)	1.15	2.33	3.47
Maximum Shear Stress (ksf)	1.32	3.23	3.53
Residual Shear Stress (ksf)	1.11	2.79	3.43
Axial Strain at Failure (inch)	0.12	0.10	0.12
Time to Failure (min.)	6.00	5.00	6.00

Sample : Gray-Brown Silty SAND; B35-97@19'; (SM)

AGI TECHNOLOGIES

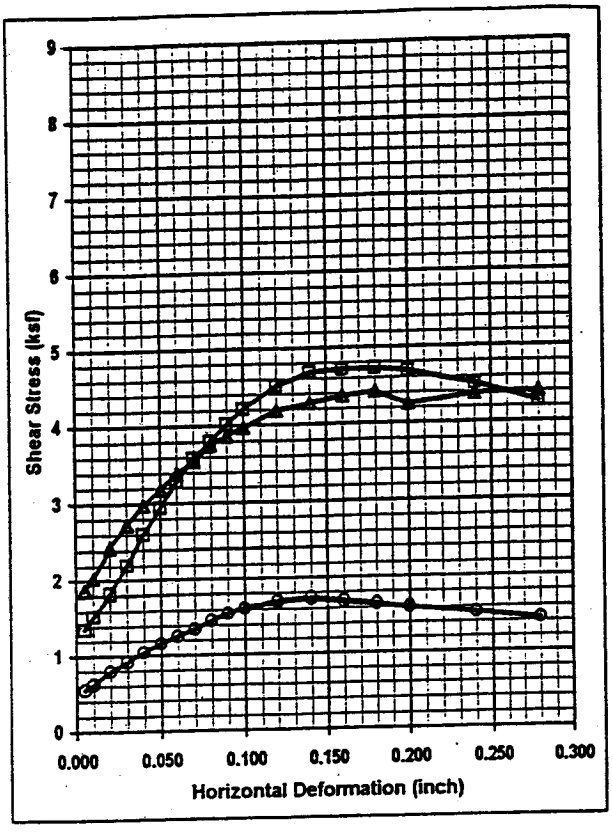
Direct Shear Test Results

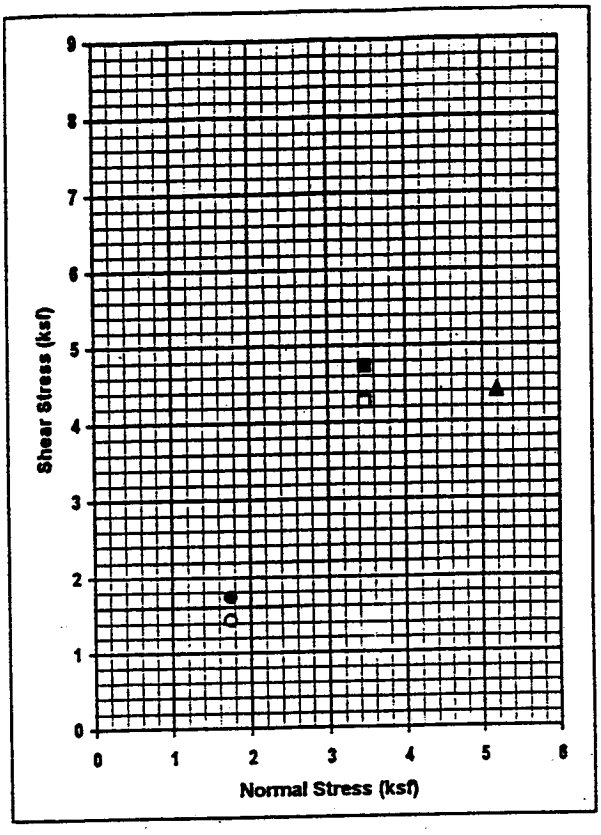
HNTB / Seatac Third Runway
Seatac, Washington

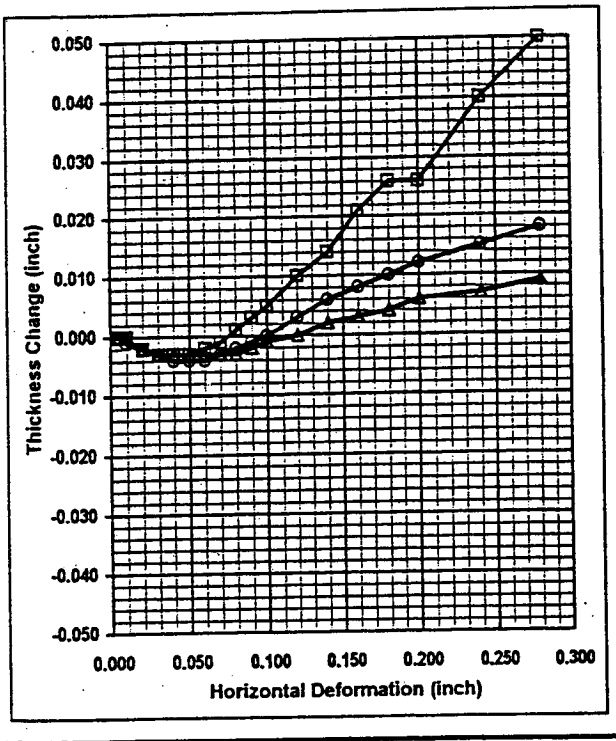
PLATE **B9**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	JMM	12/4/97			

b35@19ds.xls







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	2.42
Height (in.)	1.01	1.00	1.00
Water Content (%)	12.1	10.8	11.5
Void Ratio	0.28	0.24	0.23
Saturation (%)	118.9	119.2	137.6
Dry Density (pcf)	132.1	135.3	137.4
Specific Gravity	2.70	2.70	2.70
Post Consolidation			
Dry Density (pcf)	132.5	135.7	137.8
Void Ratio	0.27	0.24	0.22
Post Failure			
Water Content (%)	11.9	11.2	7.2
Dry Density (pcf)	130.1	129.3	136.6
Void Ratio	0.29	0.30	0.23
Saturation (%)	109.2	99.4	82.8
Failure			
Normal Stress (ksf)	1.75	3.48	5.19
Maximum Shear Stress (ksf)	1.73	4.72	4.42
Residual Shear Stress (ksf)	1.44	4.26	4.40
Axial Strain at Failure (inch)	0.14	0.18	0.18
Time to Failure (min.)	3.50	4.50	4.50

Sample : Light Gray Silty SAND; B38-97@14'; (SM) Fill

AGI TECHNOLOGIES

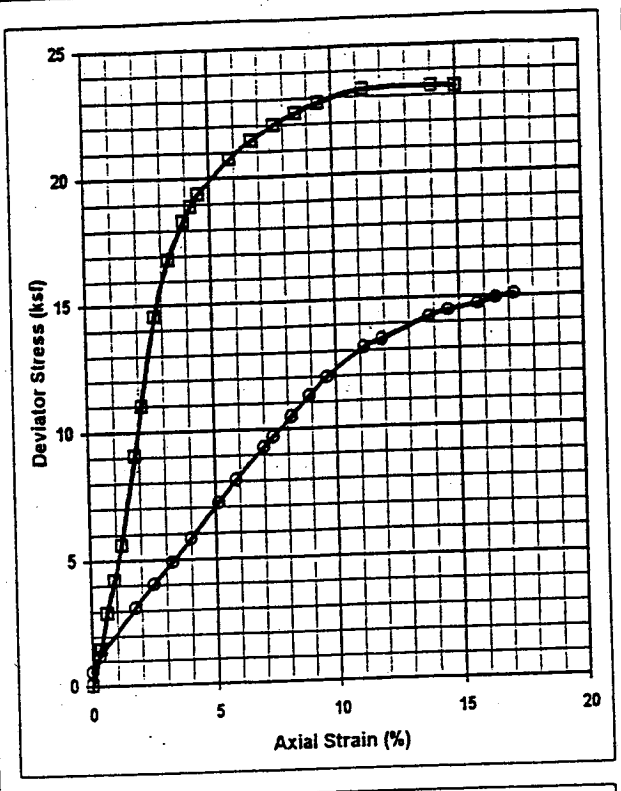
Direct Shear Test Results

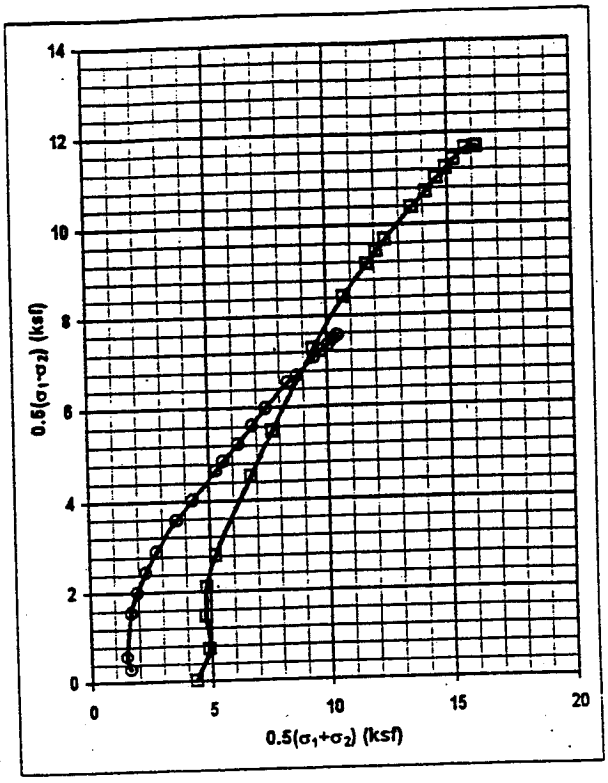
HNTB / Seatac Third Runway
Seatac, Washington

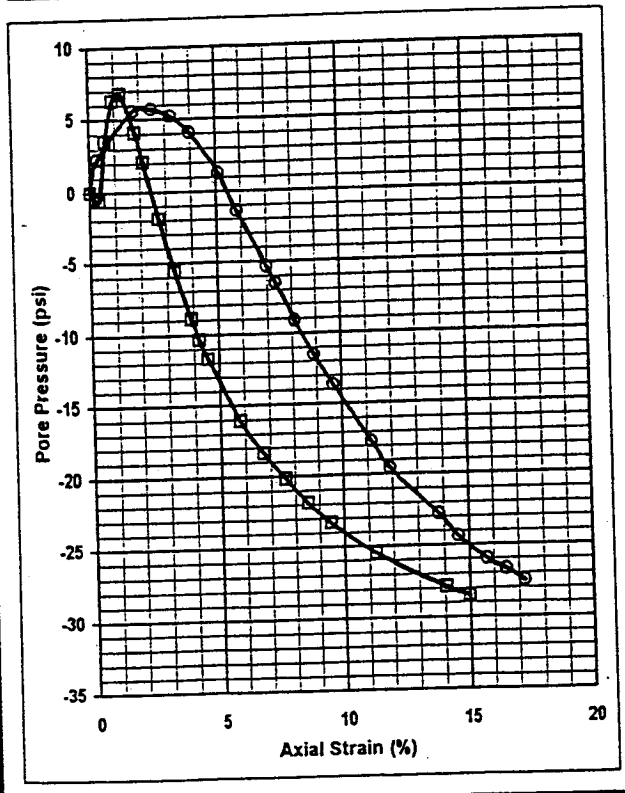
PLATE **B10**

PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	JMM	12/4/97			

b38@14ds.xls







PHYSICAL CONDITIONS	A ●	B ■	C ▲
Initial			
Diameter (in.)	2.41	2.41	NT
Height (in.)	5.09	5.63	NT
Water Content (%)	13.9	9.4	NT
Void Ratio	0.39	0.32	NT
Saturation (%)	97.2	78.2	NT
Dry Density (pcf)	121.6	127.2	NT
Specific Gravity	2.70	2.70	NT
Post Saturation / Pre-Consolidation			
Consolidation Pressure (psi)	10	30	NT
Backpressure (psi)	70	50	NT
Water Content (%)	14.3	12.0	NT
Post Consolidation			
Water Content (%)	14.3	11.5	NT
Dry Density (pcf)	121.6	128.5	NT
Void Ratio	0.39	0.31	NT
Saturation (%)	100	105	NT
Failure			
Major Principle Stress (ksf)	16.5	27.7	NT
Minor Principle Stress (ksf)	1.4	4.3	NT
Pore Pressure (ksf)	-4.0	-4.0	NT
Axial Strain at Failure (%)	17.24	14.05	NT
Time to Failure (min.) 39	17.54	15.82	NT
Sample A : Gray Sandy SILT; B[redacted]-97 @ 44 ft.; (SM-ML)			FILL
Sample B : Gray Sandy SILT; B12-97 @ 34 ft.; (SM-ML)			FILL
Sample C : NT			

AGI TECHNOLOGIES

CU Triaxial Shear Test Results

HNTB / Seatac Third Runway
Seatac, Washington

PLATE **B11**

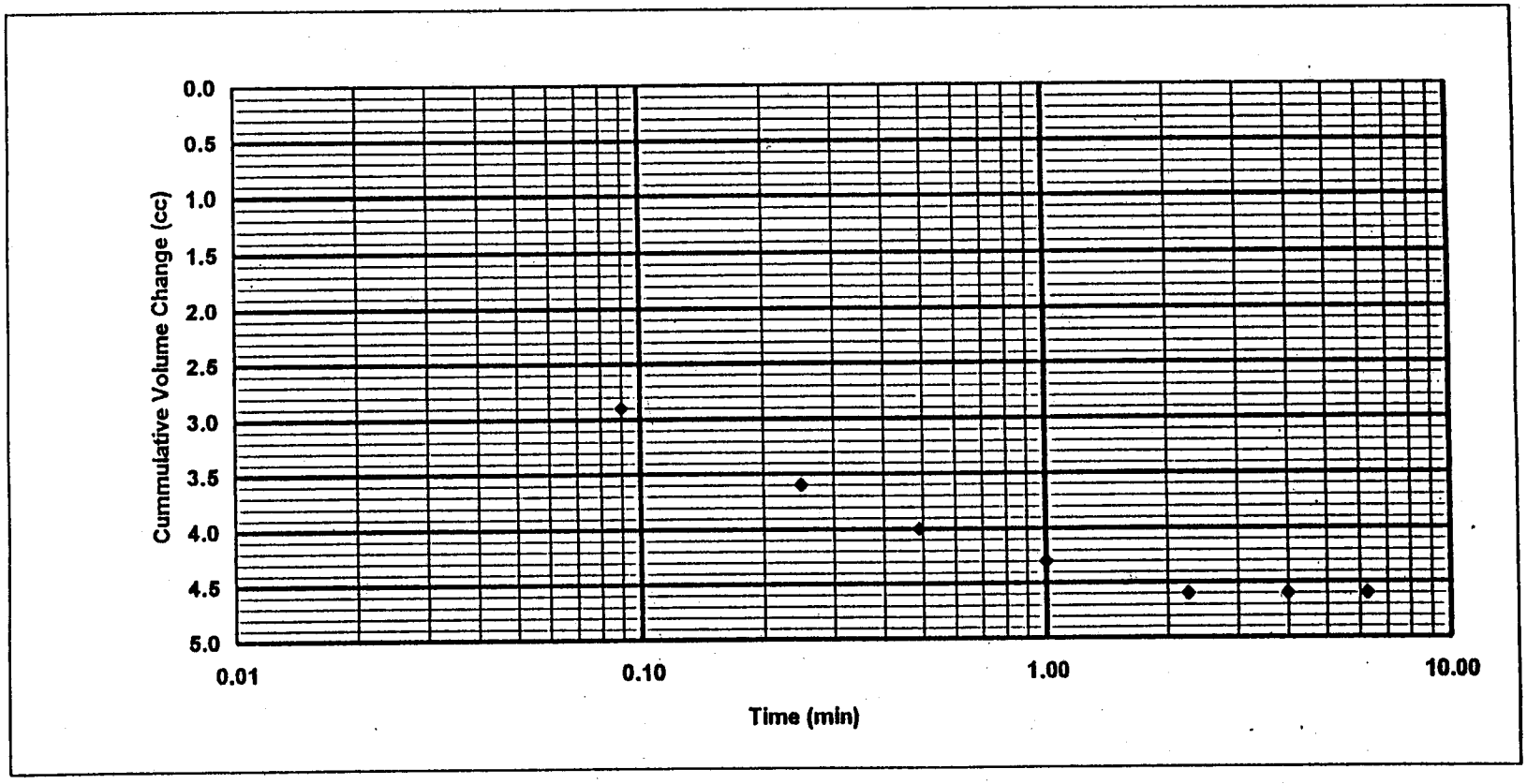
PROJECT NO.	DRAWN	DATE	APPROVED	REVISED	DATE
14,190.211	HHH	12/22/97			

b39&12tx.xls

AR 025983

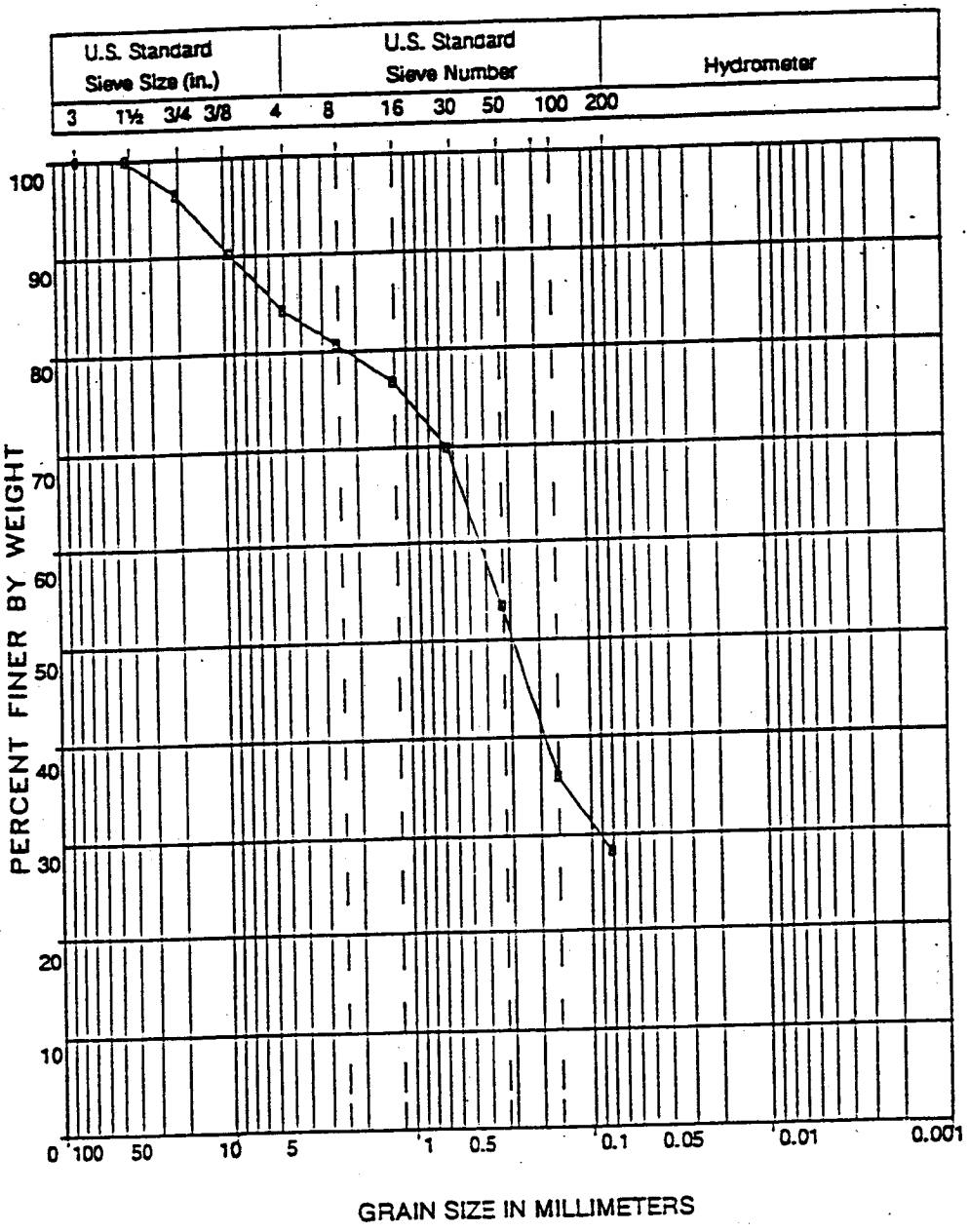
AGI Technologies

TRIAXIAL TEST
CONSOLIDATION PHASE
Log Time Method



HNTB / Seatac
14,190.211
Seatac, Washington

B12@34 ft
12/19/97



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	CRSE	MEDIUM	FINE	

Sample Source	Classification
AOA B5 @ 3.0 ft.	SILTY SAND (SM) with gravel

PLATE

Applied Geotechnology Inc.
Geotechnical Engineering
Geology & Hydrogeology

Particle Size Analysis

HNTB/Third Runway Preliminary Engineering Design
Sea-Tac, Washington

B2

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
14,190.203	JRS		01/06/94		

AR 025985

PARTICLE SIZE ANALYSIS

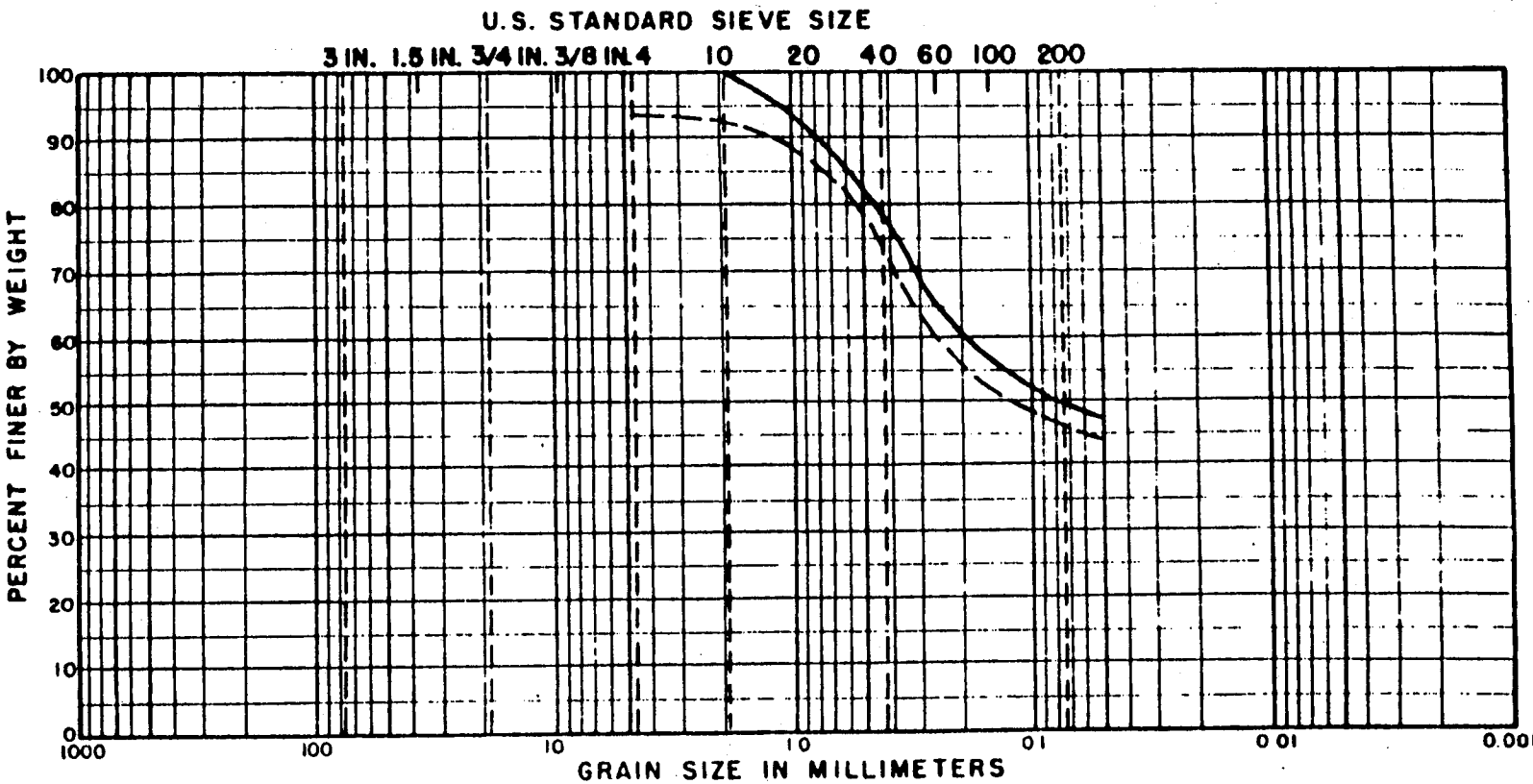
A detailed grain size analysis was conducted on several of the soil samples to determine the size distribution of the sampled soil. The information gained from this analysis allows us to provide a detailed description and classification of the in-place materials. In turn, this information helps us to understand how the in-place materials will react to conditions such as heavy seepage, traffic action, loading and so forth. The results are presented on Plates B1 and B2, and classification symbols are provided as part of the appropriate individual sample descriptions on the test pit or boring logs. We also performed minus No. 200 sieve washes on selected samples to determine the samples' fines content. The test results are tabulated below.

Minus No. 200 Sieve Tests				
Exploration Number	Depth (feet)	Geologic Unit	Soil Classification Unit	Fines Content (%)
AOA TP2	3.0	Fill	SM	24.9
AOA TP4	5.0	Advance Outwash	SP	5.2
AOA TP16	3.0	Fill	SP-SM	12.5

ATTERBERG LIMITS

We performed several Atterberg Limit tests on the finer materials to determine the soil's plasticity characteristics as an aid in accurate classification. These tests include the liquid and plastic limits which were performed in accordance with ASTM Test Methods D-423-66(72) and D-424-59(71), respectively. The Plastic Index, the difference between the liquid and plastic limits, is then determined. The test results are tabulated below.

Atterberg Limit Test						
Exploration Number	Depth (Ft)	Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity Index	Soil Classification (USCS)
AOA TP7	3.0	30.2	36	27	9	ML
AOA TP8	2.0	31.4	44	31	13	ML
AOA TP13	7.0	34.6	45	27	18	ML



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

BORING	ELEVATION	CLASSIFICATION		NAT. WC	LL	PL	PI	
18	4 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	14	[illegible]	

— — — [illegible]

——— [illegible]

GRADATION CURVE

DAMES & MOORE

AR 025987

BORING	ELEVATION	SOIL TYPE	TYPE OF TEST	DRY DENSITY LBS./CU.FT.	MOISTURE CONTENT % OF DRY WEIGHT	NORMAL PRESSURE LBS./SQ.FT.	YIELD SHEAR STRENGTH LBS./SQ.FT.
10	403.3	SAND	DS	104	8.1	2000	1460
10	398.3	SAND	DS	100	5.9	2500	1600
11	411.6	SILTY SAND WITH GRAVEL	DS	134	8.3	1800	1650
14	405.8	SILTY SAND WITH GRAVEL	DS	129	9.1	400	430
14	401.3	SILTY SAND WITH GRAVEL	DS	131	8.0	650	580
15	405.1	SILTY SAND WITH GRAVEL	DS	145	5.0	400	660
15	400.1	SILTY SAND WITH GRAVEL	DS	138	7.9	700	1000
16	398.3	SILTY SAND WITH GRAVEL	DS	101	20.3	350	320
16	393.3	SILTY SAND WITH GRAVEL	DS	126	11.5	650	730
18	379.8	SAND	DS	105	6.8	850	600
19	370.7	SAND	DS	109	15.6	450	400
21	358.7	SILTY SAND WITH GRAVEL	DS	123	11.9	300	250

SUMMARY OF STRENGTH TEST DATA

KEY:
DS = DIRECT SHEAR TEST
TRI-X = TRIAXIAL COMPRESSION TE
UCC = UNCONFINED COMPRESSIO
TEST