ADDENDUM RECOMMENDATIONS

KAOPA UNIT 3C

KAILUA, OAHU, HAWAII

for

LONE STAR HAWAII, INC.

W. O. 118-C

September 18, 1975

ERNEST K. HIRATA & ASSOCIATES, INC.

ERNEST K. HIRATA & ASSOCIATES, INC.
Soils and Foundation Engineering
1236 South King Street • Honolulu, Hawaii 96814 • Phone 531-5733

September 18, 1975

W. O. 118-C

Lone Star Hawaii, Inc.
Suite 1480
Pacific Trade Center
190 South King Street
Honolulu, Hawaii 96813

Attention: Mr. Gail Sims

Subject: Addendum Recommendations
Kaopa Unit 3C
Kailua, Oahu, Hawaii

Gentlemen:

Additional laboratory testing and engineering analyses were conducted on bag samples obtained from the field for the above referenced project. The purpose of the supplementary work was to provide recommendations for pavement design, lateral pressures for design of retaining walls, and coefficients of frictional resistance.

Laboratory testing procedures are described in the Appendix along with a summary of laboratory test results. Also enclosed is a Grading Utility Plan indicating the approximate location of bag samples.

RECOMMENDATIONS

Pavement Design

Based on the Grading Utility Plan, the following pavement recommendations are presented. These recommendations are for preliminary design purposes only and shall be verified in the field during grading.

Between Sections 2 thru 7
and 11 thru 12

2"	Asphaltic Concrete
6"	Base Course Material
6"	Select Borrow
12"	Borrow

Between Sections 6 thru 11

2"	Asphaltic Concrete
6"	Base Course Material
6"	Select Borrow

If concrete pavements are to be used, the 6" base course material may be omitted in both cases.

Lateral Pressures

Resistance to lateral loading may be provided by friction acting at the base of foundations and by passive earth pressure. An allowable coefficient of friction of 0.4 may be used with the dead load forces. Passive earth pressure may be computed as an equivalent fluid having a density of 200 pounds per cubic foot with a maximum earth pressure of 2000 pounds per square foot. When combining passive and friction for lateral resistance, the passive component should be reduced by one-third.

For active earth pressure considerations, an equivalent fluid pressure of 55 pounds per cubic foot per foot of depth may be used.

The design values given above may be used for design of retaining walls in both cut and fill areas.

Should you have any questions concerning our supplementary recommendations, please feel free to call on us.

Very truly yours,

Ernest K. Hirata & Associates, Inc.

Ernest K. Hirata P.E. 2732

EKH:yk

APPENDIX OF LABORATORY TESTING

Classification

The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification is determined by both visual examination and Atterburg Limit Tests according to ASTM D423 and D424. The final classification is shown on the Boring Logs.

Moisture-Density

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples. The information is useful in providing a gross picture of the soil consistency between borings and any local variations. The dry unit weight is determined in pounds per cubic foot while the moisture content is determined as a percentage of the dry unit weight. These samples are obtained from a 3" O.D. split tube sampler.

Consolidation

Settlement predictions of the soil's behavior under load are made on the basis of the consolidation tests. Loads are applied in several increments in a geometric progression, and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen having an inside diameter of 2.40 inches and a height of 1 inch to permit addition and release of pore fluid. Results of undisturbed and remolded samples are plotted on the Consolidation Test Report.

Compaction Tests

Compaction tests were performed on bag samples to determine the optimum moisture content at which each type of proposed fill material compacts to 100% density. The tests were performed according to ASTM D-1557-70.

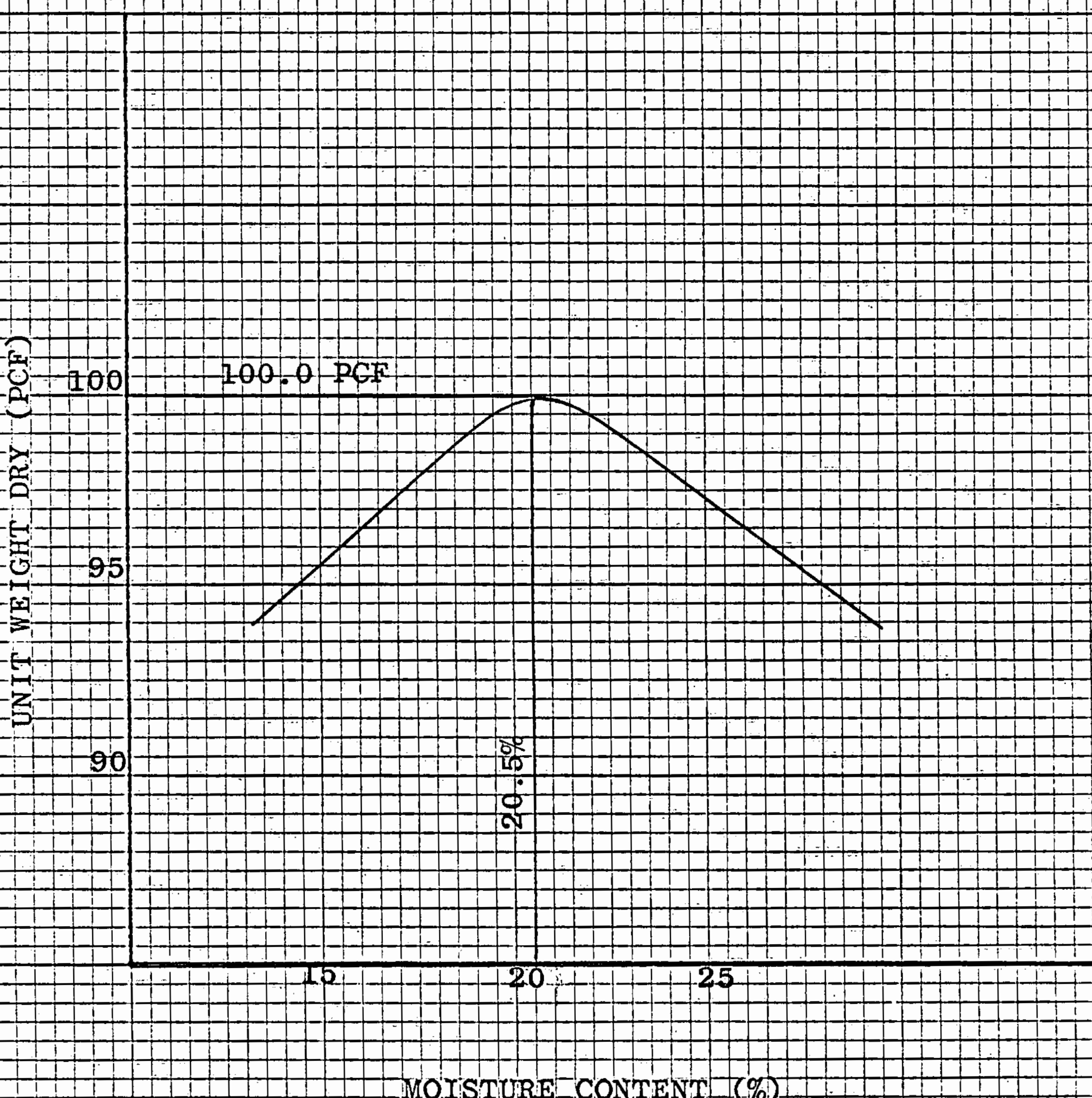
Swell Tests

Swell tests were performed to determine the expansiveness of the onsite surface soils. The tests were performed on undisturbed ring and remolded samples taking a one inch high specimen under different surcharge loads.

Shear Tests

Shear tests are performed in the Direct Shear Machine which is of the strain control type. The rate of deformation is approximately 0.02 inches per minute. Each sample is sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Eighty percent of the maximum value is taken to determine the shear strength parameters.

MAXIMUM DENSITY CURVE



Boring: Bag I near B12

Depth: surface

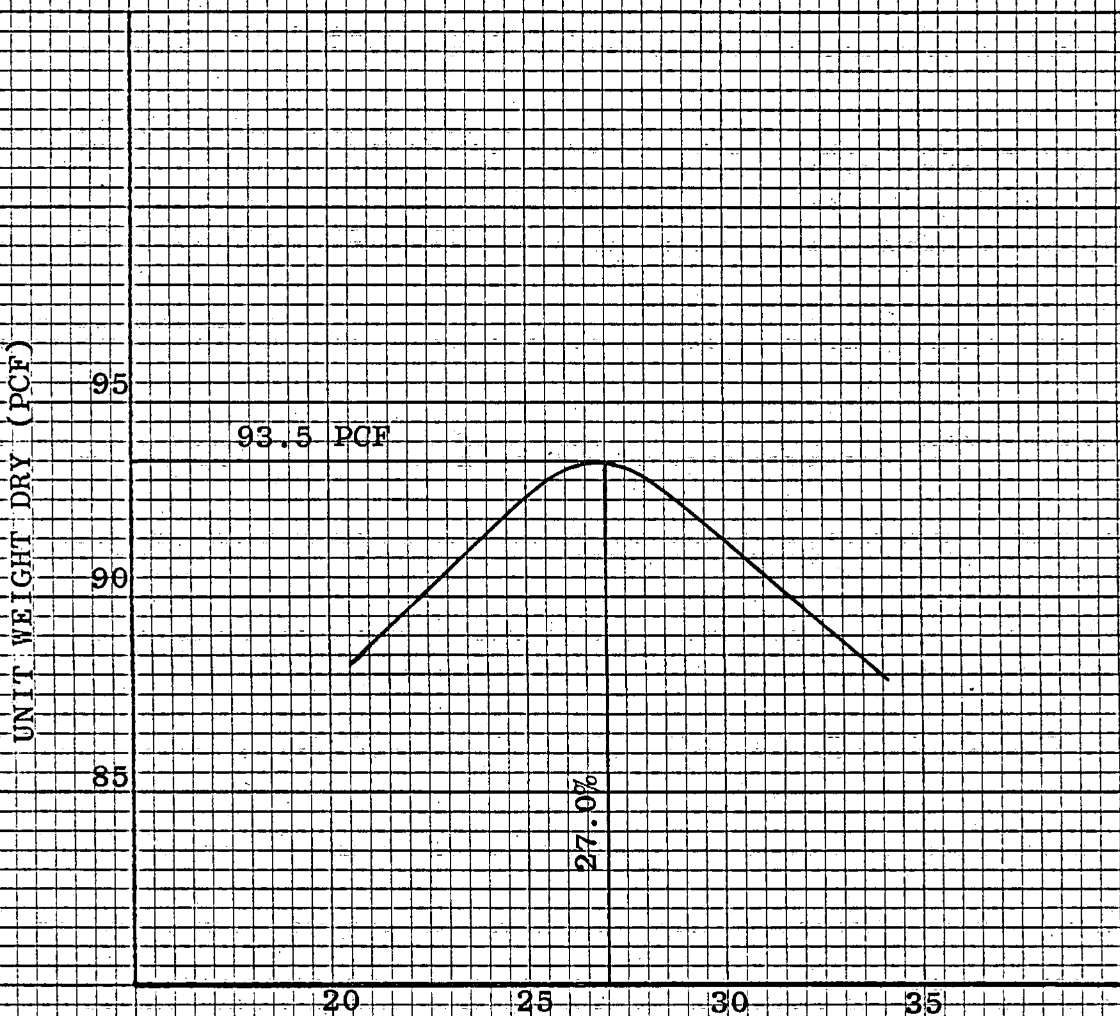
Classification: Brown Clayey Silt (ML)

W.O. 118-C

Plate A1

ERNEST K. HIRATA & ASSOCIATES, INC.

MAXIMUM DENSITY CURVE



MOISTURE CONTENT (%)

Boring: Bag 2 near B3

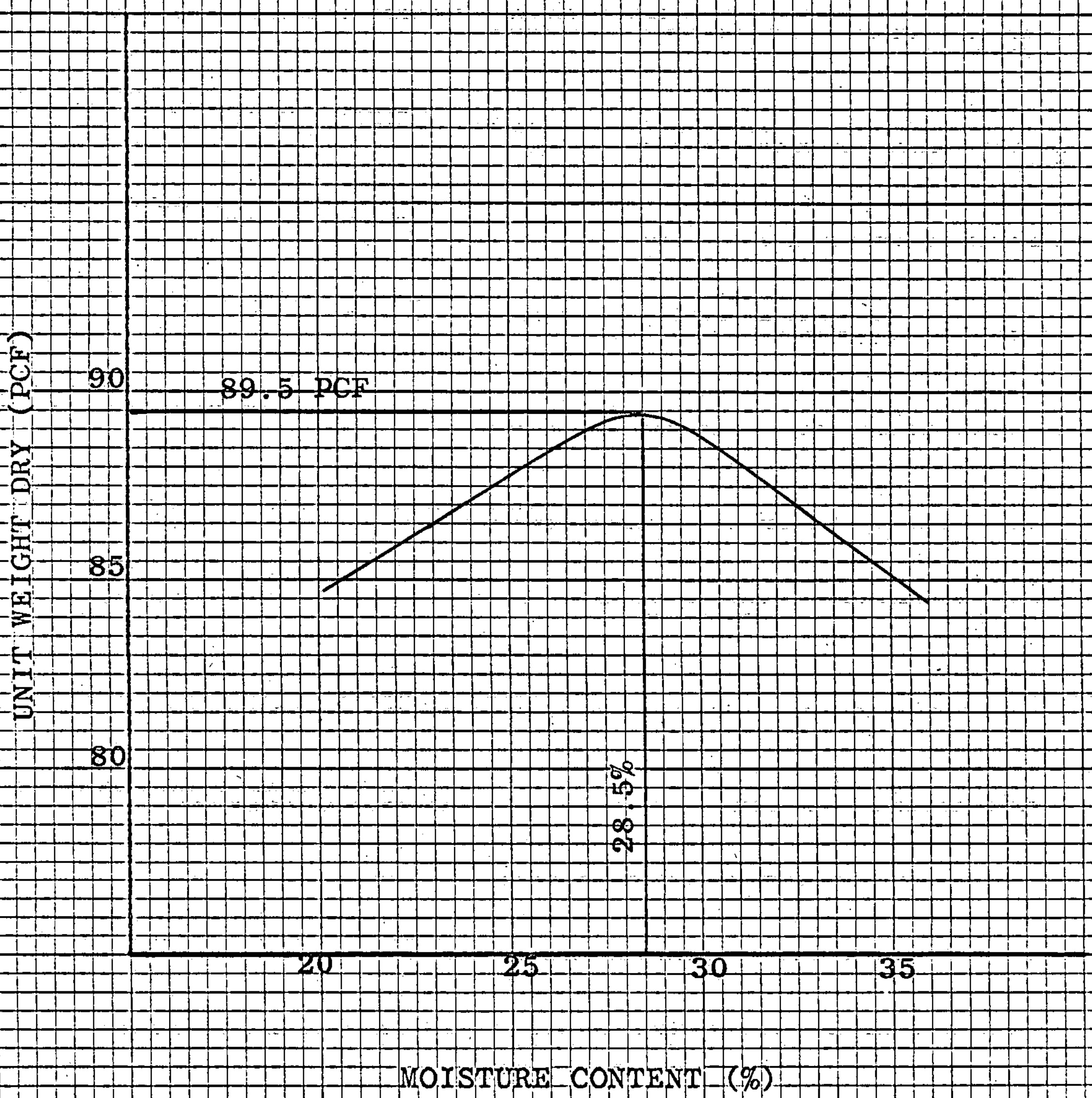
Depth: surface

Classification: Reddish brown Clayey Silt (ML-MH)

W.O. 118-C

Plate A2

MAXIMUM DENSITY CURVE



Boring: Bag 3 near B4

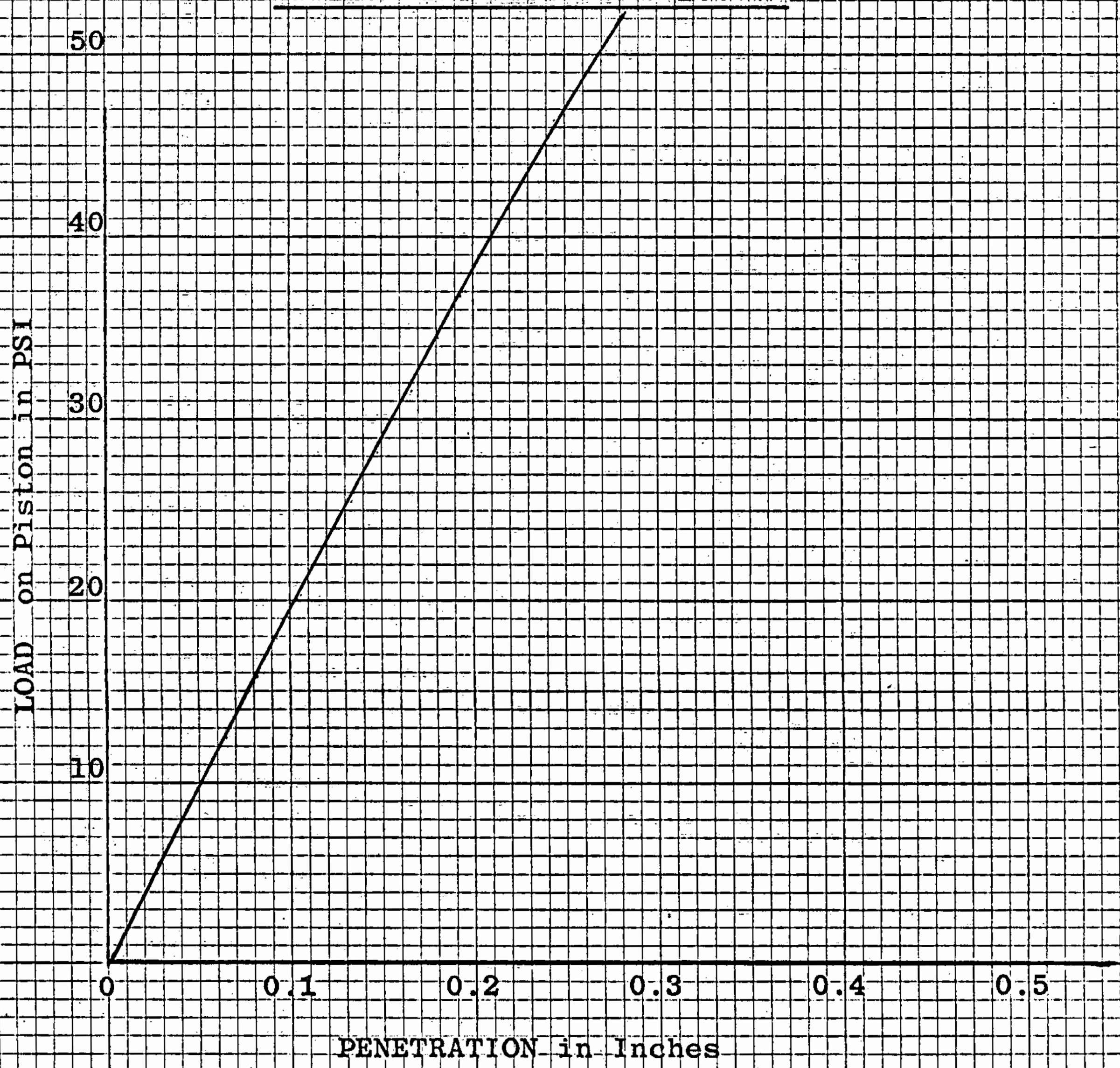
Depth: surface

Classification: Reddish brown
Clayey Silt (ML)

W.O. 118-C

Plate A3

CBR STRESS-PENETRATION CURVE



Soil Description: Brown Clayey Silt (ML)

Location: Bag 1 near B12

W.O. 118-C

Max. Density = 100.0 PCF

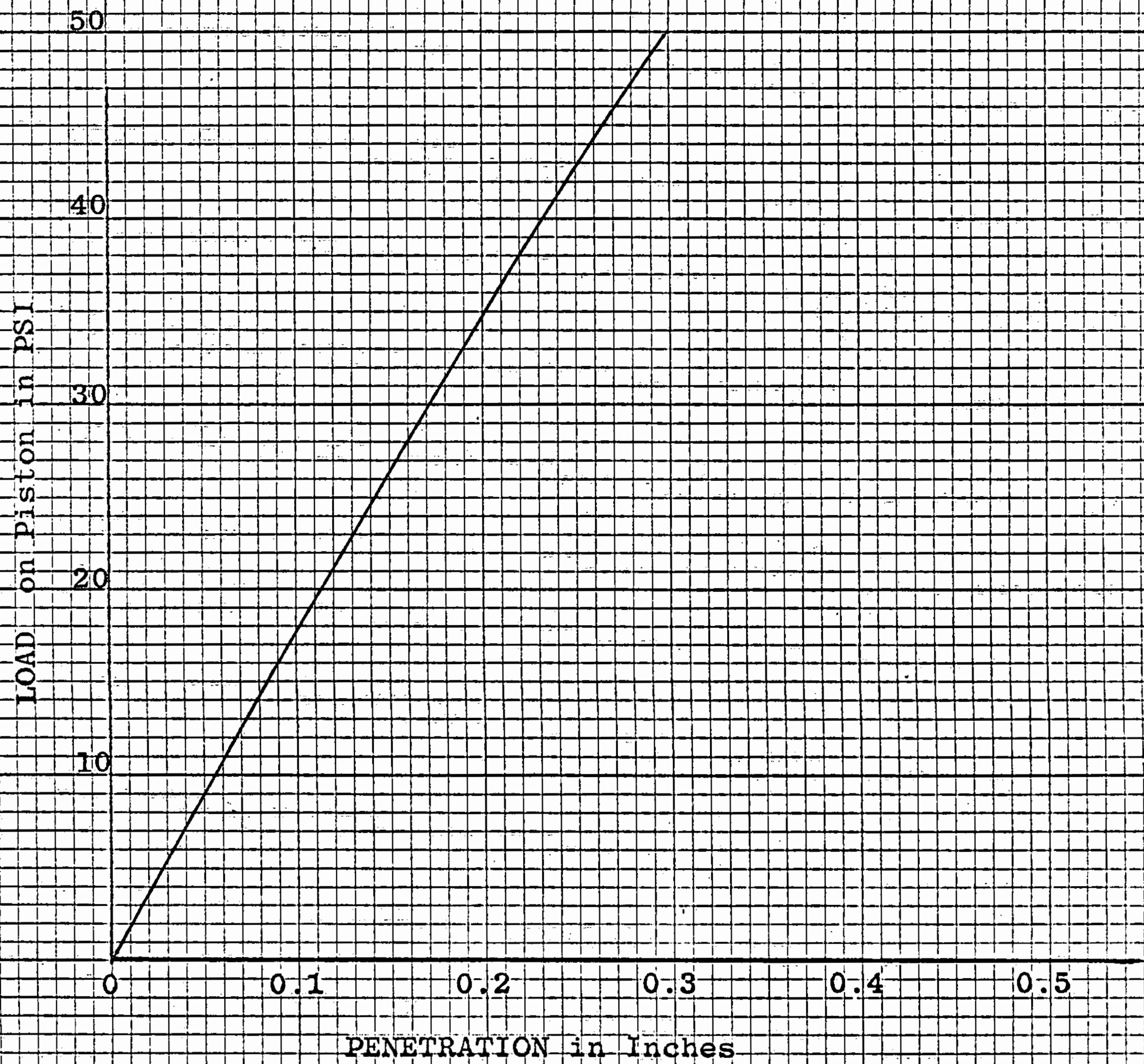
Opt. Moisture = 20.5%

Swell = 8.0%

CBR @ 0.1 = 2.0

Plate: B1

CBR STRESS-PENETRATION CURVE



Soil Description: Reddish brown Clayey Silt (ML-MH)

Location: Bag 2 near B3

W.O. 118-C

Max. Density = 93.5 PCF

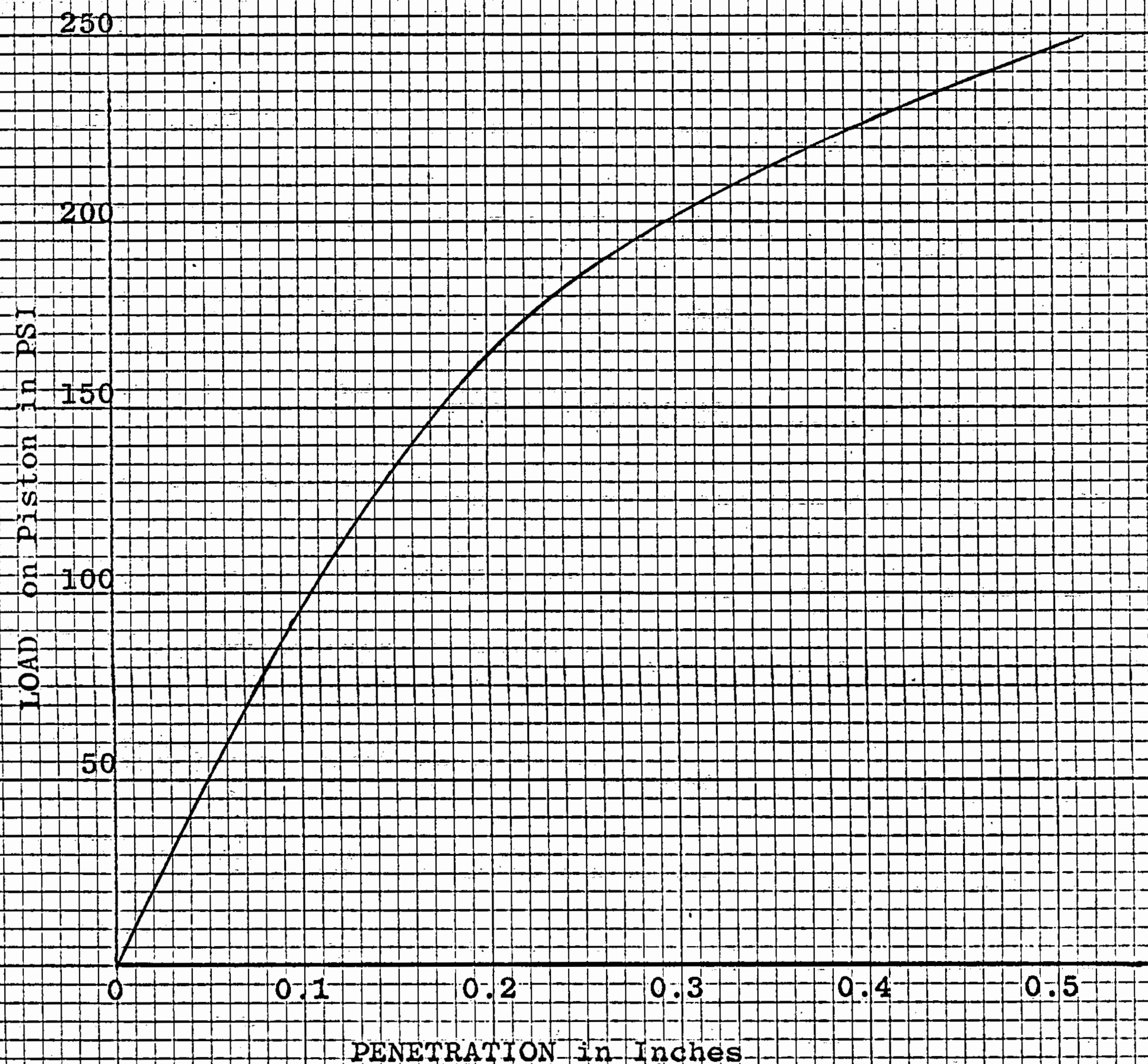
Opt. Moisture = 27.0%

Swell = 10.5%

CBR @ 0.1 = 1.8

Plate: B2

CBR STRESS-PENETRATION CURVE



Soil Description: Reddish brown Clayey Silt (ML)

Location: Bag 3 near B4

W.O. 118-C

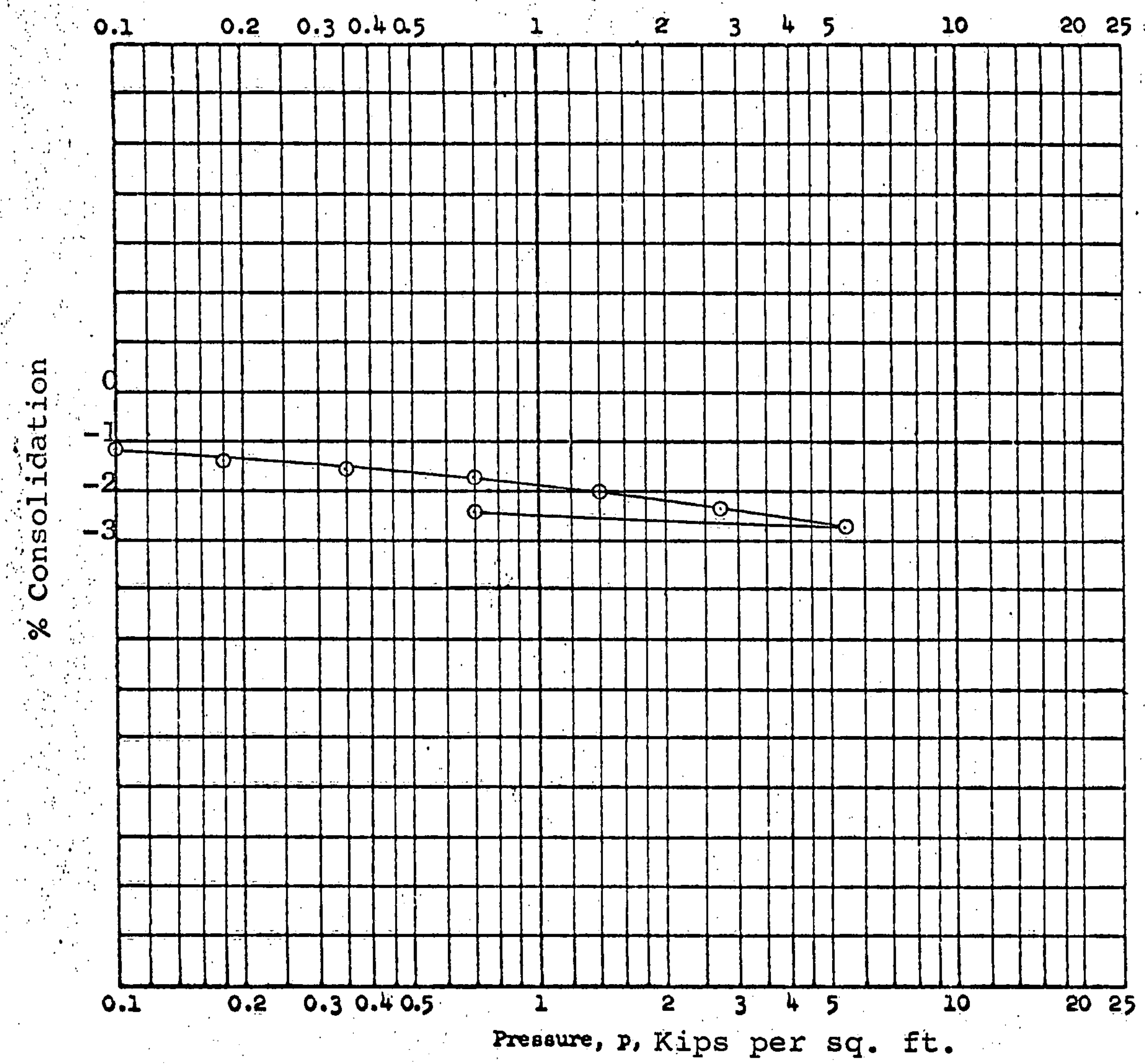
Max. Density = 89.5 PCF

Opt. Moisture = 28.5%

Swell = 3.42%

CBR @ 0.1 = 9.5

Plate: B3



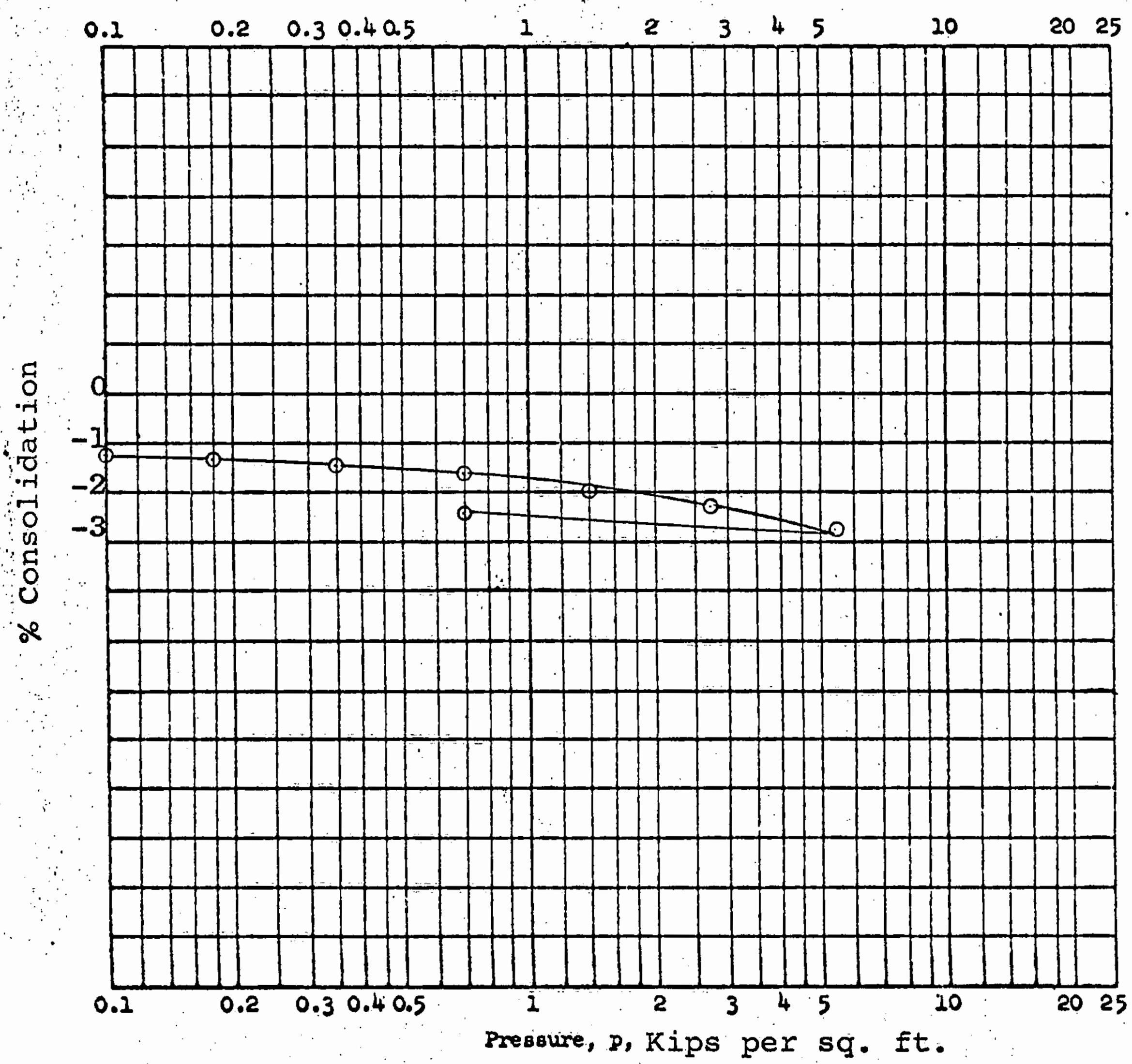
Type of Specimen Remolded		Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	%	w_f	%
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	lb/ft^3		
Classification ML					

LL 44.8	
PL 31.2	
Remarks Remolded to 90% relative compaction	

Project	Kaopa Unit 3C Lone Star Hawaii - Kailua
Area	W. O. 118-C
Boring No. Bag 1 near B12	Sample No.
Depth El surface	Date 8-19-75

CONSOLIDATION TEST REPORT

Plate C1



Type of Specimen	Remolded			Before Test		After Test	
Diam	2.40 in.	Ht	1.0 in.	Water Content, w_o	%	w_f	26.3 %
Overburden Pressure, p_o			T/sq ft	Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c			T/sq ft	Saturation, S_o	%	S_f	%
Compression Index, C_c				Dry Density, γ_d	lb/ft^3		
Classification	ML-MH						

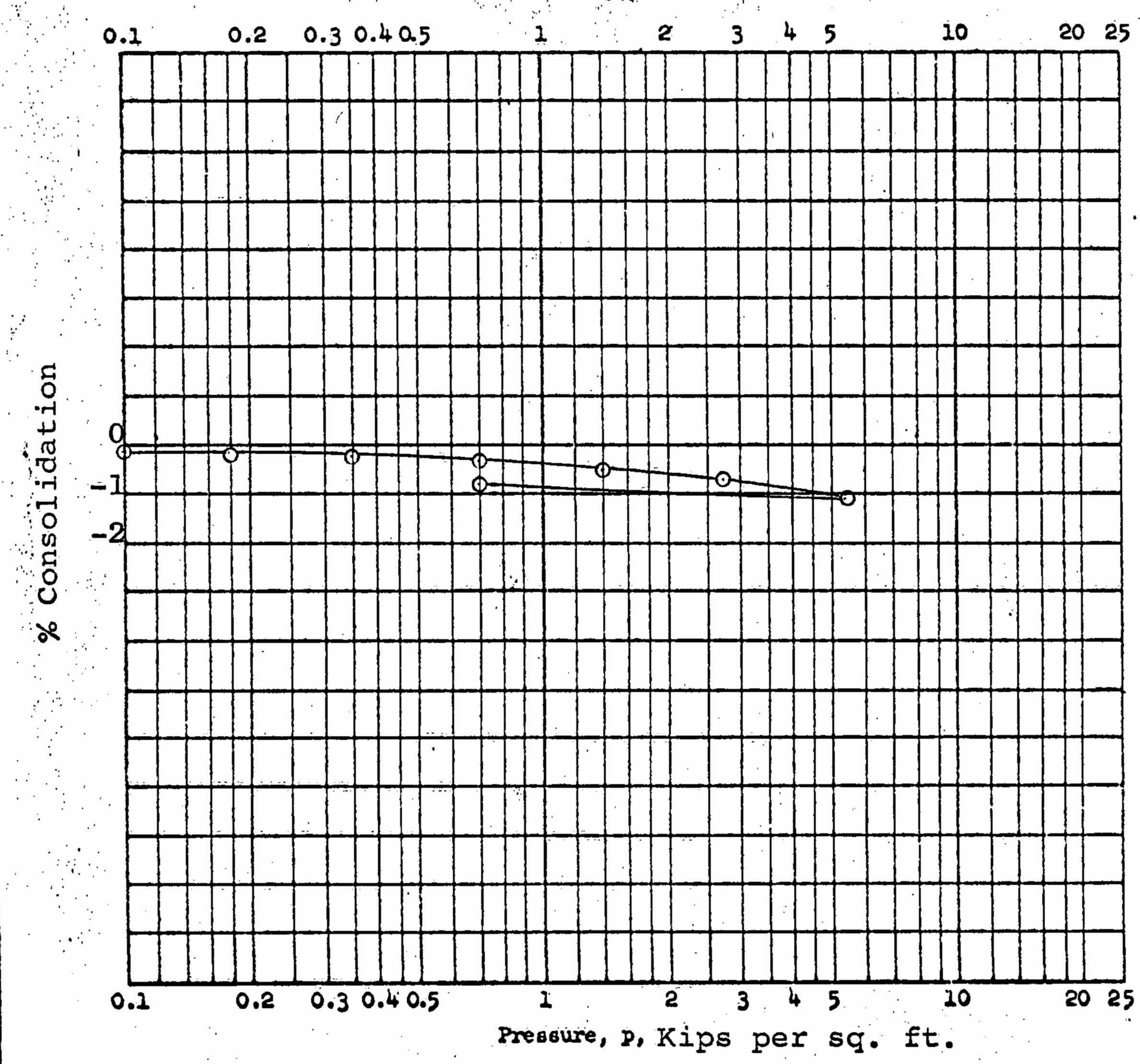
LL	51.4	
PL	36.7	

Remarks Remolded to 90% relative compaction

Project	Kaopa Unit 3C Lone Star Hawaii - Kailua		
Area	W. O. 118-C		
Boring No.	Bag 2 near B3	Sample No.	
Depth El	surface	Date	8-20-75

CONSOLIDATION TEST REPORT

Plate C2



Type of Specimen Remolded		Before Test		After Test	
Diam 2.40 in.	Ht 1.0 in.	Water Content, w_o	%	w_f	26.3 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	lb/ft^3		
Classification ML					

LL 48.7	
PL 36.8	
Remarks Remolded to 90% relative compaction	

Project	Kaopa Unit 3C Lone Star Hawaii - Kailua
Area	W. O. 118-C
Boring No.	Bag 3 near B4
Sample No.	
Depth El	surface
Date	8-20-75

CONSOLIDATION TEST REPORT

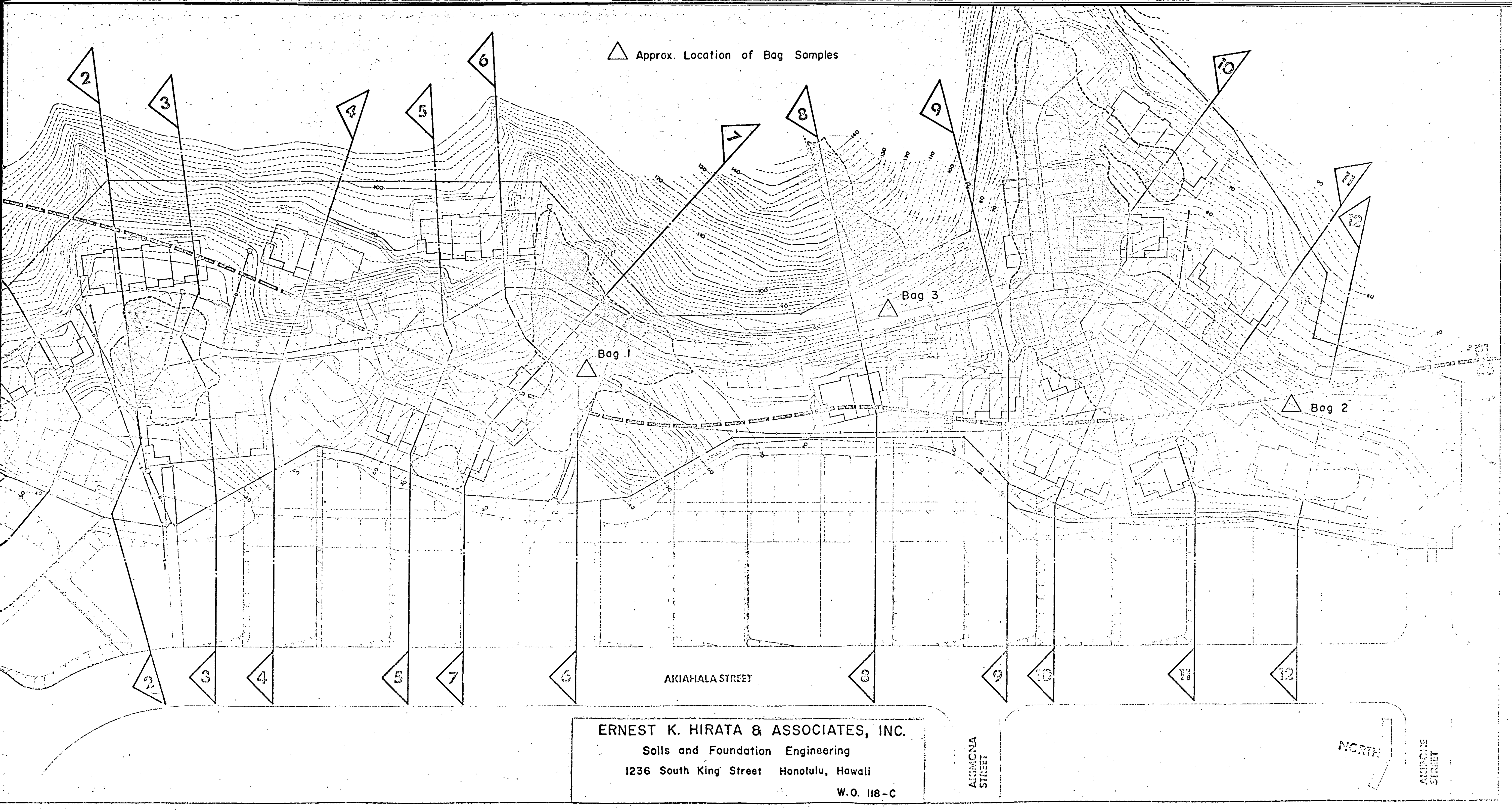
Plate C3

LABORATORY TEST RESULTS

Project: Kaopa Unit 3C W. O. 118-C

Bag		1	2	3		
Depth (ft.)		Surface	Surface	Surface		
Atterburg Limit Tests						
Liquid Limit		44.8	51.4	48.7		
Plastic Limit		31.2	36.7	36.8		
Plastic Index		13.6	14.7	11.9		
Soil Classification		ML	ML-MH	ML		
Expansion @ PSF						
Natural						
Remolded		14.2%	11.5%	4.9%		
Expansion @ PSF						
Natural						
Remolded		6.5%	5.7%	1.3%		
Unconfine Stress (PSF)						
Proctor						
Max. Dry Unit Wt. (PCF)		100.0	93.5	89.5		
Optimum Water (%)		20.5	27.0	28.5		
CBR @ 0.1		1.9	1.8	9.5		
CBR Swell		8.0%	10.5%	3.4%		
Remolded Shear	ø	45.5°	41.0°	37.0°		
	c	2.0 KSF	1.9 KSF	1.7 KSF		

Plate D



ERNEST K. HIRATA & ASSOCIATES, INC.
Soils and Foundation Engineering
1236 South King Street Honolulu, Hawaii
W.O. 118-C

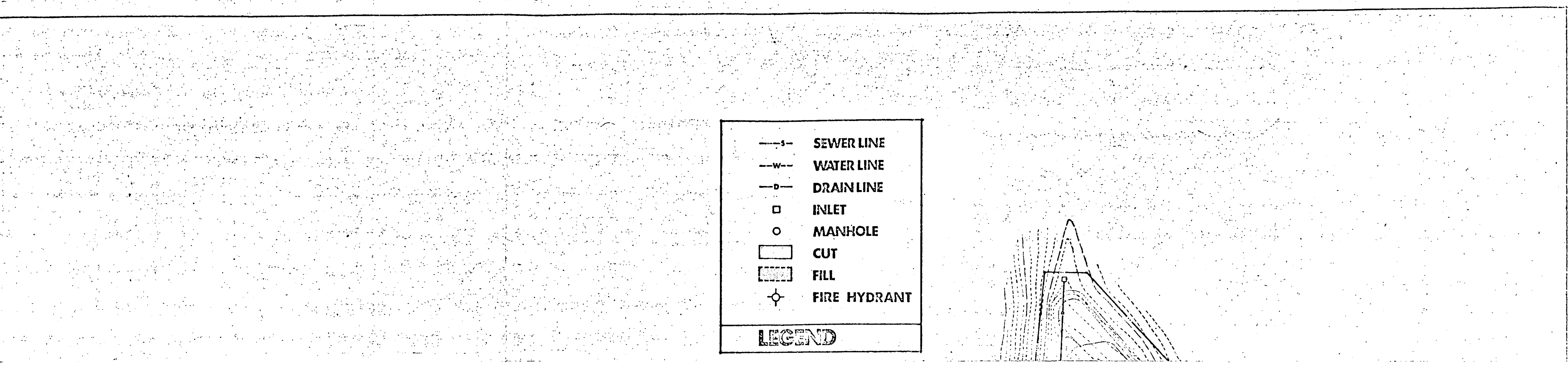
NESTAR HAWAII INC

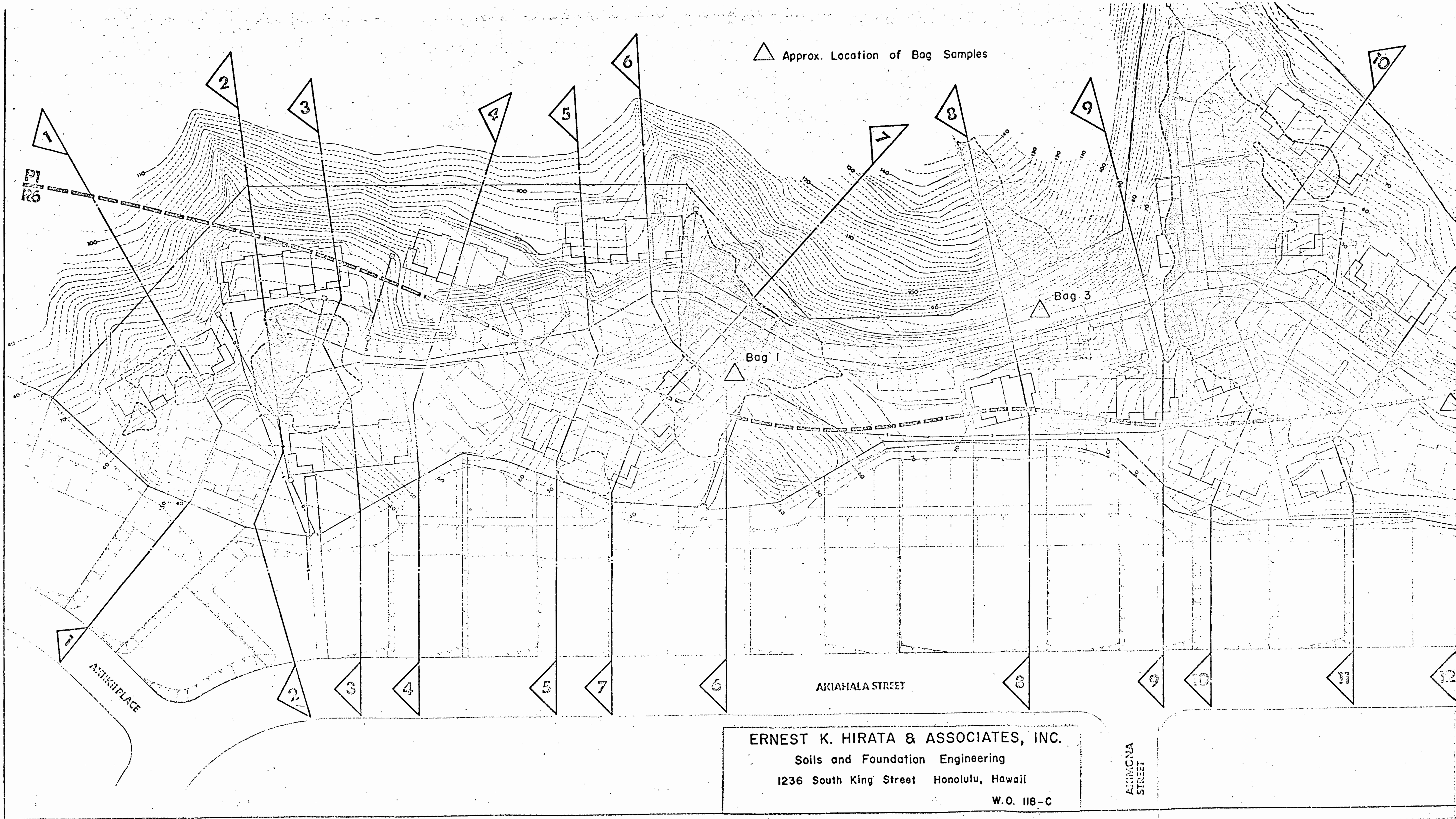
KAOPA UNIT 3C

HOGAN 1210 AUAHI ST.
CHAPMAN HONOLULU
COBEEN WEITZ HI 96814
& ASSOC INC. 524-4200
ARCHITECTS PLANNERS

GRADING UTILITY PLAN

5


SEWER LINE
WATER LINE
DRAIN LINE
INLET
MANHOLE
CUT
FILL
FIRE HYDRANT
LEGEND



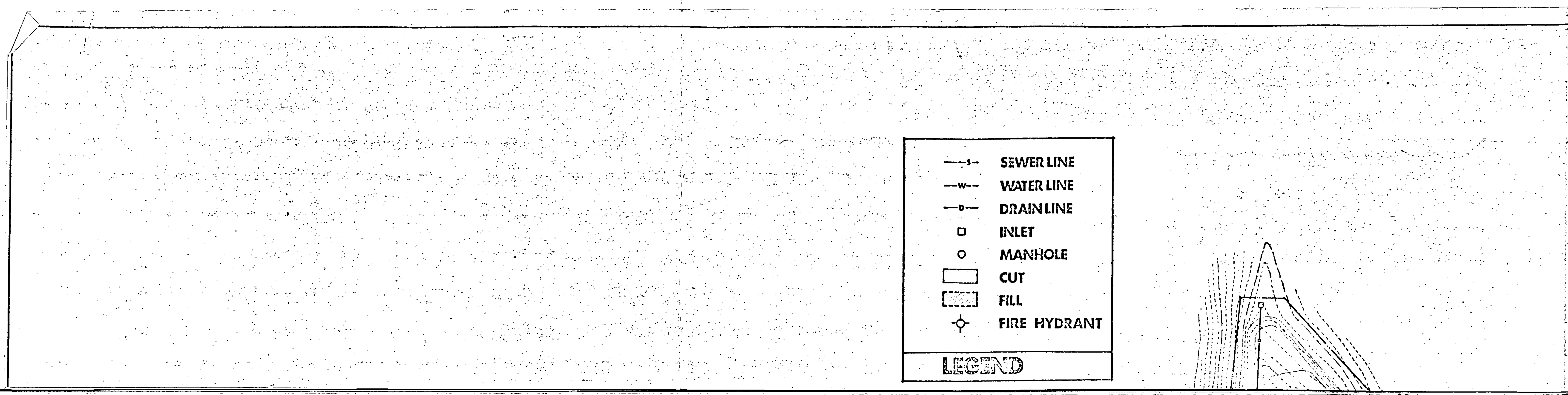
PDH FOR LONESTAR HAWAII INC

KAOPA UNIT 3C

HOGAN CHAPMAN COBEEN WELTZ & ASSOC INC ARCHITECTS, PLANNERS

1210 AUAHI ST HONOLULU HI 96814 524-4200

GRADING UTILITY PLAN


SEWER LINE
WATER LINE
DRAIN LINE
INLET
MANHOLE
CUT
FILL
FIRE HYDRANT
LEGEND

ERNEST K. HIRATA & ASSOCIATES, INC.

Soils and Foundation Engineering

1236 South King Street • Honolulu, Hawaii 96814 • Phone 531-5733

October 9, 1975

W. O. 118-C

Lone Star Hawaii, Inc.
Suite 1480
Pacific Trade Center
190 South King Street
Honolulu, Hawaii 96813

Attention: Mr. Gail Sims

Subject: Additional Soils Recommendations
Kaopa Unit 3C
Kailua, Oahu, Hawaii

Gentlemen:

Soils recommendations were requested by the Architect and Civil Engineer for various foundation conditions that might be encountered during construction at a meeting held at the Architect's office on October 3, 1975.

Upon reviewing the preliminary Grading Plan and Foundation sheets, the following soils recommendations are presented. These recommendations are for the general soils conditions, and we may wish to revise these recommendations at specific locations once final plans have been completed.

1. We recommend that benches be provided for all slopes in

excess of 15 feet in height. Where the total vertical height is less than 20 feet, we may allow the omission of the bench. We will wish to review these specific slope conditions.

2. We do not recommend that sliver fills be placed on existing slopes greater than 2:1 (horizontal to vertical).

3. A cross section presenting recommendations for slope gradients and minimum embedment of footings located adjacent to slopes can be found on Plate 1.

4. Spread footings should be tied in both directions at those locations where footings are founded on slopes exceeding 5:1 (horizontal to vertical).

5. Active Lateral Pressures

Case I - Level Backfill

a)	In cut	- 30 PCF
b)	In fill	- 35 PCF
c)	Fill over cut	- 35 PCF

Case II - Sloping Backfill

a)	In cut	- 45 PCF
b)	In fill	- 55 PCF
c)	Fill over cut	- 55 PCF

Case III - Reduction in Pressure

Reduction in active pressures will only be allowed in cases where compacted fill is retained. Walls may be designed for an equivalent fluid pressure of 35 PCF provided the cross section on Plate 2 is followed.

6. Also enclosed are details for grading for conditions where a fill slope is placed on natural ground, Plate 3, and a fill slope placed over a cut slope, Plate 4.

Should you have any further questions, please feel free to call on us.

Very truly yours,

Ernest K. Hirata & Associates, Inc.

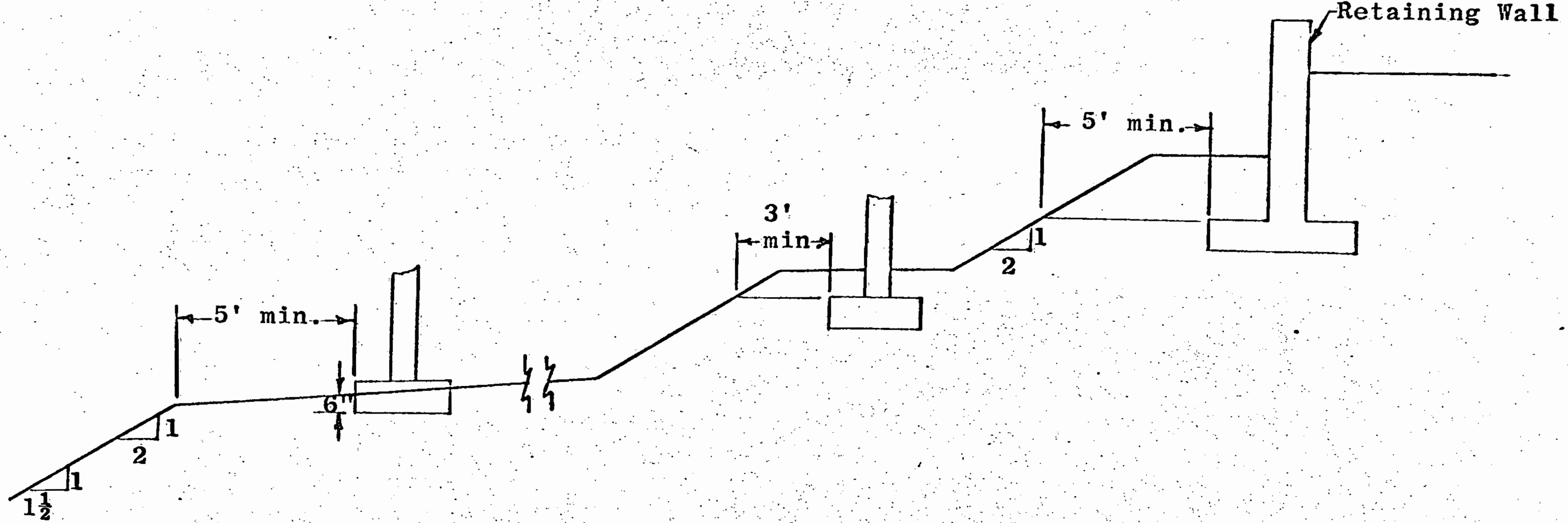
Ernest K. Hirata P.E. 2732

EKH:yk

cc: Hogan, Chapman, Cobeen, Weitz & Associates, Inc.
VTN-Pacific

Encl: Plates 1 through 4

CROSS SECTION OF FOUNDATIONS



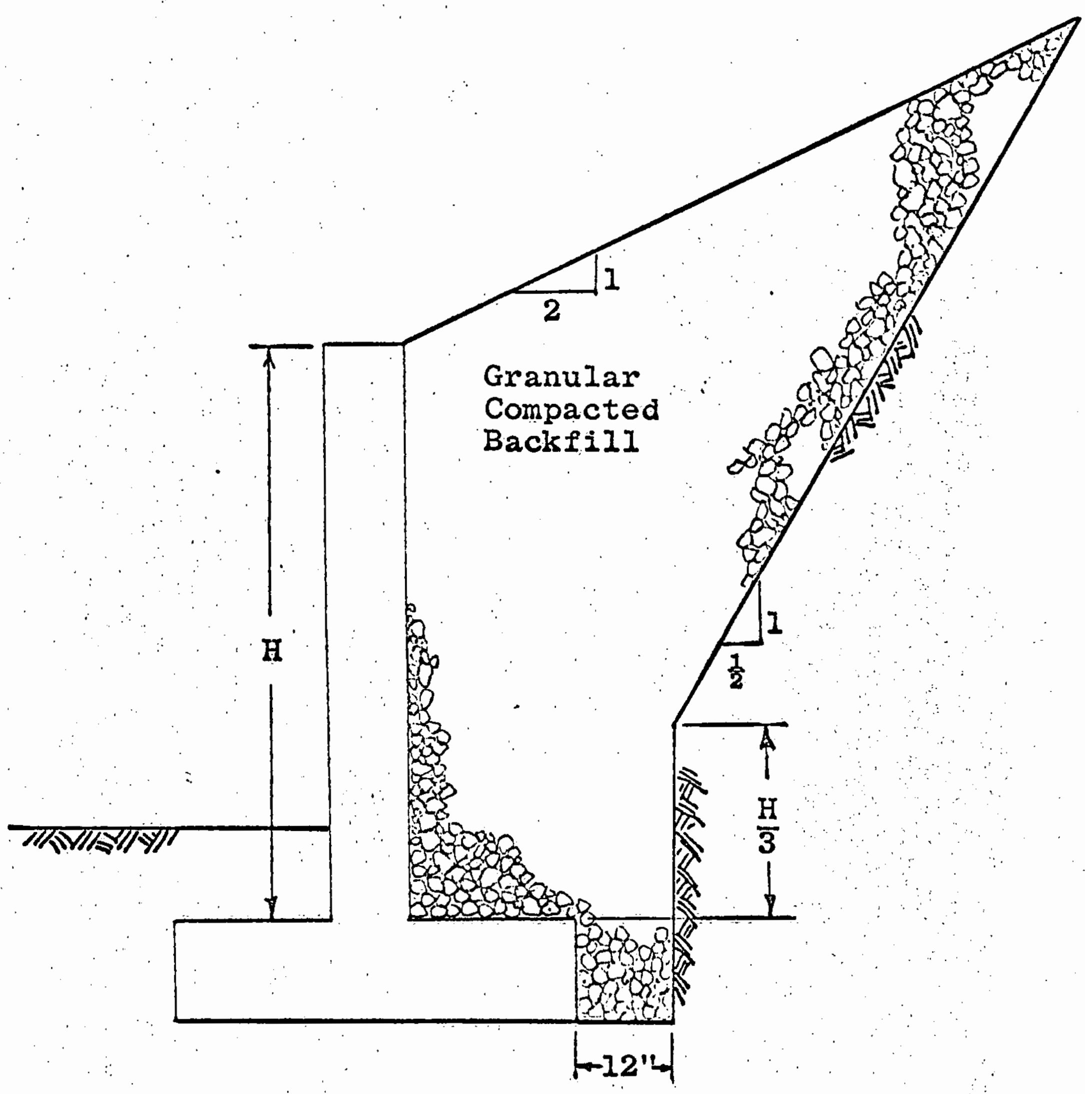
No Scale

W. O. 118-C

Plate 1

ERNEST K. HIRATA & ASSOCIATES, INC.

BACKFILL RECOMMENDATION FOR REDUCTION OF LATERAL PRESSURE



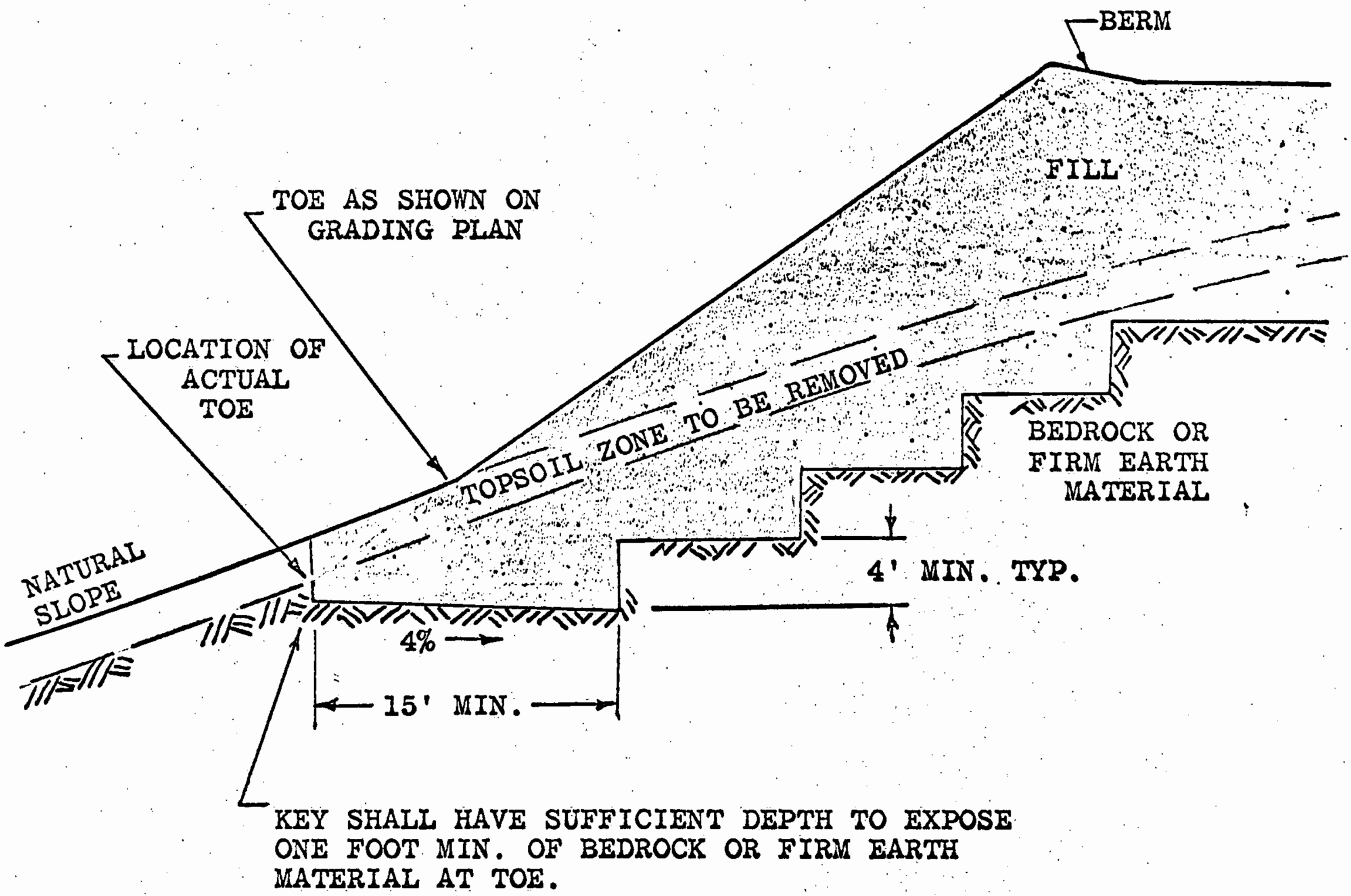
No Scale

W. O. 118-C

Plate 2

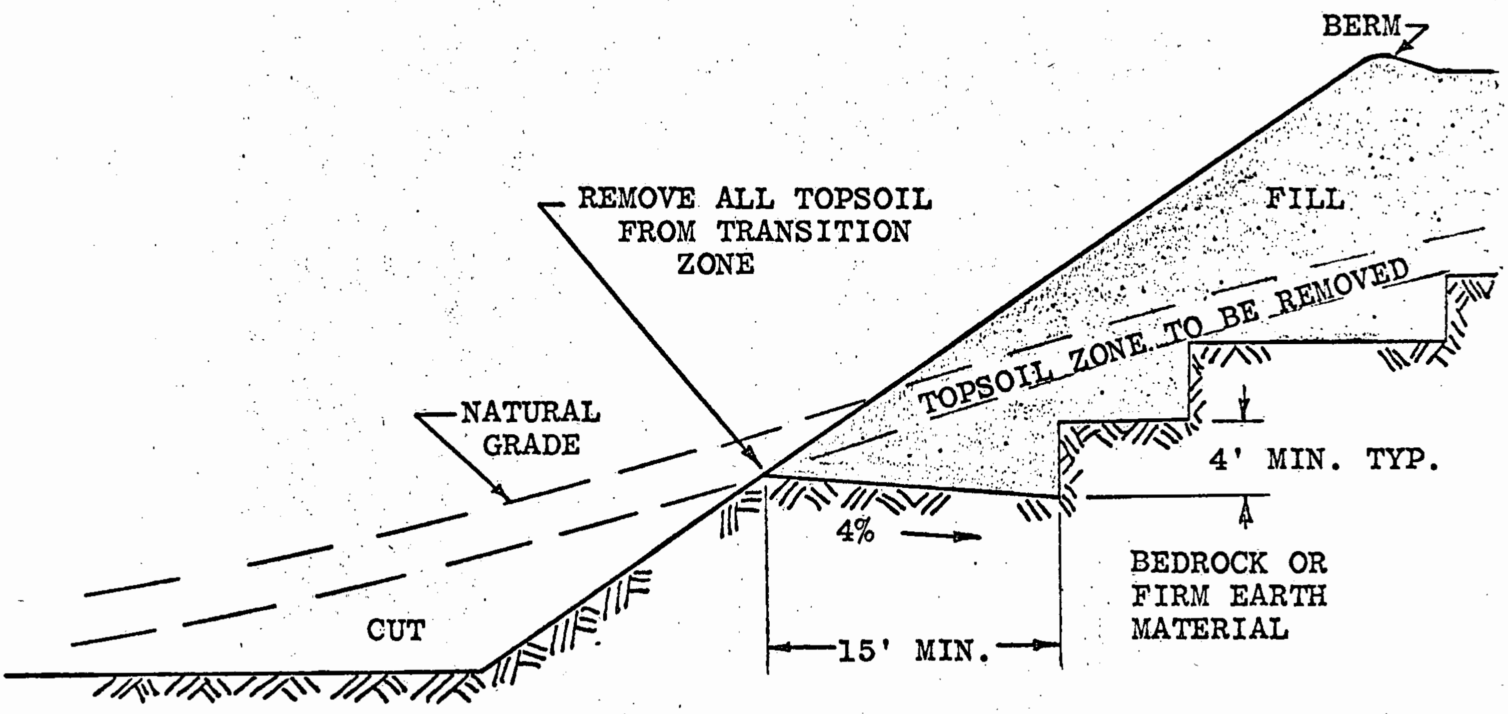
TYPICAL FILL OVER NATURAL SLOPE DETAIL

No Scale



TYPICAL FILL OVER CUT SLOPE DETAIL

No Scale



W. O. 118-C

Plate 4

PRELIMINARY SOILS INVESTIGATION

PHASE III - KAOPA SUBDIVISION UNIT 3

KAILUA, OAHU, HAWAII

for

HAWAIIAN PACIFIC INDUSTRIES

W.O. 118-C

February 7, 1972

EH

ERNEST K. HIRATA & ASSOCIATES, INC.

ERNEST K. HIRATA & ASSOCIATES, INC.
Soils and Foundation Engineering
1157 South King Street • Honolulu, Hawaii 96814 • Phone 533-6529

February 7, 1972
W.O. 118-C

Hawaiian Pacific Industries, Inc.
1020-E Keolu Drive
Kailua, Oahu, Hawaii 96734

Attention: Mr. William Rus

Gentlemen:

The following report titled "Preliminary Soils Investigation, Phase III - Kaopa Subdivision Unit 3, Kailua, Oahu, Hawaii," dated February 7, 1972 our work order 118-C is enclosed.

This investigation was authorized to determine the subsurface soil conditions at the site and to determine if any unusual or adverse condition might exist which would affect the proposed development.

We found that the surface soils consisted primarily of both silty clay and clayey silt underlain by yellowish brown decomposed rock. Dark gray to blue basaltic rock was encountered at depths ranging from 5 to 19 feet below present grade.

The site is feasible for the proposed development provided the recommendations in this report are followed.

We appreciate the opportunity to be of service. Should you have any questions concerning this report, please call on us.

Very truly yours,

Ernest K. Hirata & Associates, Inc.

Ernest K. Hirata

Ernest K. Hirata

TABLE OF CONTENTS

APPENDIX

PLATES

PRELIMINARY SOILS INVESTIGATION
PHASE III - KAOPA SUBDIVISION UNIT 3
KAILUA, OAHU, HAWAII

INTRODUCTION

The following report presents the results of a soils investigation conducted on the subject property. A preliminary site plan showing the area covered by this investigation is enclosed in the Appendix. This investigation was authorized to determine the subsurface soil conditions at the site and to provide recommendations for the proposed development.

SITE DESCRIPTION

The subject area is located along the western portion of Enchanted Lakes along the hills and ridges below Kalanianaole Highway. The area designated as Phase III is bounded on the north by the Kaopa #2 subdivision. The eastern portion is bounded by Phase II of Kaopa subdivision Unit 3, and the southern portion is bounded by Kaopa #1. The western boundary is delineated very close to the top of the ridgeline designated as the City Urban Boundary.

The Phase III area is comprised primarily of the hills and ridge areas as well as the draws between the hills. The hills and ridges are covered with a moderate to thick growth of grass and bushes.

PROPOSED GRADING

Grading plans for the site have not been completed at the time of this report. Grading techniques of cutting and filling will be utilized to create level pad areas and proper drainage.

FIELD EXPLORATION

Field exploration was performed on October 22 through 26, 1971 by drilling 13 exploratory borings. The exploratory borings ranged in depth from 10 to 20 feet.

The soils were logged by our field engineer and classified by both visual examination and laboratory testing in accordance with the Unified Soil Classification System. The Log of Borings can be found on Plates A1 through A13 in the Appendix. The approximate location of the borings are shown on the site plan enclosed in the Appendix.

Undisturbed and bag samples were recovered from the borings for laboratory testing. Undisturbed samples were obtained by driving a 3" O.D. split tube sampler with a 140 pound hammer from a height of 30 inches. The required blow count for each 6 inches of penetration is shown on the enclosed Boring Logs.

The surface soils consisted primarily of both silty clay and clayey silt underlain by yellowish brown decomposed rock.

The exception to this was at boring 6 where silty gravel was encountered to a depth of 11 feet. Dark gray to blue basaltic rock was encountered in borings 4, 6, 10, 11, and 12 at depths ranging from 5 to 19 feet below present existing grade.

Groundwater was not encountered in any of the exploratory borings, however boring 12 indicated the possibility of some water seepage due to the high moisture contents encountered.

LABORATORY TESTS

Laboratory testing was performed on the undisturbed and bag samples. Laboratory tests included Atterburg Limits, moisture density relationships, shears, consolidations, compactions, swells, and unconfine compression tests. Test results and sampling procedures are described in the attached Appendix.

ENGINEERING ANALYSES

I. Slope Stability

A. Cut Slopes

Laboratory test results indicate that slopes comprised of decomposed rocks will be stable using slope gradients of $1\frac{1}{2}$:1 (horizontal to vertical) with proper benching. Exploratory borings B4 and B10 indicate that for slopes proposed in the upper ridge areas will encounter basaltic rock where slope gradients of 1:1 may be used. The final determination of 1:1 slope gradients will need to be determined in the field during grading operations.

B. Fill Slopes

Fill slopes may be constructed using a slope gradient of 2:1 (horizontal to vertical). Both cut and fill slopes should be planted as soon as practical upon completion of grading to prevent soil erosion and surficial slope failures.

II. Groundwater

Groundwater was not encountered in any of the exploratory borings. However boring B12 indicated a very high moisture content in the soil and if any slopes are planned in this area, some seepage from the slope face can be anticipated. In that event, subdrains would be required.

III. Bearing Capacity

An allowable bearing pressure of 2000 PSF may be used for footings having a minimum width of 12 inches and a minimum embedment of 12 inches below adjacent finished grade for both cut and fill lots.

IV. Settlement of Fills and Foundations

If all vegetation and brush is removed prior to placement of fills, the maximum settlement of the underlying strata as a result of fill placement is expected to be ½ inch. Most of the settlement is expected to occur during fill construction.

V. Expansive Soil

The onsite soils exhibit moderate to high volume change potential with changes in moisture content in an undisturbed state. Soils that were remolded exhibited both non expansive and moderately expansive characteristics. Therefore, we recommend that for cut lots, one number 4 bar be placed in both the top and bottom of footings. For fill lots, determination of the expansive soil properties will be made upon completion of grading.

VI. Grading

A. Rippability: The major portion of onsite soils encountered during our investigation indicate that excavations can be made with conventional earth moving equipment. However in the upper ridges in the areas of borings 4 and 10, blasting may be required when the hard basaltic rock is encountered.

B. Insitu Moisture Content: The insitu moisture content varies considerably from ridge to ridge. Generally the insitu moisture content is above the optimum moisture as determined from the maximum density curves. We anticipate that air drying will be necessary to achieve compaction of the soils.

C. Embankment Shrinkage: Approximatley the upper 2 inches of soil can be expected to be lost during grubbing operations. The relative densities of the undisturbed soils are approximately 75% and approximately 15% shrinkage of borrow material due to compaction can be anticipated.

CONCLUSIONS AND RECOMMENDATIONS

1. The site is feasible for the proposed development.

2. Cut slopes in the weathered rock should be grossly stable against rotational failure at slope gradients of $1\frac{1}{2}$:1 (horizontal to vertical). Slopes proposed in the upper ridge areas in the vicinity of B4 and B10 encountering the basaltic rock should be grossly stable using a slope gradient of 1:1. The final determination of 1:1 slope gradients will need to be determined in the field during grading operations.

3. Fill slopes should be grossly stable at slope gradients of 2:1 (horizontal to vertical).

4. In order to minimize surficial instability of compacted fill and cut slopes, we recommend that all slopes be planted as soon as practical upon completion of grading.

5. Although groundwater was not encountered, boring B12 indicated a very high moisture content in the soil. If slopes are planned in this area, some seepage from the slope face can be anticipated. In that event, subdrains will be required.

6. An allowable bearing pressure of 2000 PSF may be used for footings having a minimum width of 12 inches and a minimum embedment of 12 inches below adjacent finished

grade for both cut and fill lots.

7. The maximum settlement of the underlying strata as a result of fill placement is expected to be ½ inch. Most of the settlement is expected to occur during fill construction.

8. The onsite soils exhibit moderate to high volume change potential in an undisturbed state. We recommend that for cut lots, one number 4 bar be placed in both the top and bottom of footings. For fill lots the expansiveness varies with the material used, and therefore recommendations will be made upon completion of grading.

9. The major portions of onsite soils can be excavated with conventional earth moving equipment. However in the upper ridges in the areas of borings 4 and 10, blasting may be required when the hard basaltic rock is encountered.

10. Generally the insitu moisture content is considerably above the optimum moisture and air drying will be necessary to achieve compaction of the soils.

11. Approximately the upper 2 inches of soil can be expected to be lost during grubbing operations. Approximately 15% shrinkage of borrow soil due to compaction can be anticipated.

12. Onsite soils are suitable for fill material.

13. All trees, roots, brush and other deleterious materials shall be removed and wasted from the site.

14. Oversize material shall not be placed within 10 feet of finish pad grade nor placed within 10 feet of any slope face.

15. Areas to receive fill which are 5:1 or flatter shall be scarified, watered as required, mixed, blended, and compacted to at least 90% relative compaction to a depth of 12 inches prior to placing of fill.

16. Fill placed on surfaces which slope steeper than 5:1 shall be keyed and benched.

17. We recommend that any building pad which is in both cut and fill material be overcut a thickness equal to the maximum thickness of fill on the pad up to a maximum of three feet and replaced with a uniformly thick blanket of compacted fill.

18. All fill shall be compacted to a minimum of 90% relative compaction as determined by ASTM D 1557-58T.

19. Pavement design recommendations will be submitted in an addendum report.

Respectfully submitted,

Ernest K. Hirata & Associates, Inc.

Ernest K. Hirata P.E. 2732

ERNEST K. HIRATA
REGISTERED PROFESSIONAL ENGINEER
No. 2732
HAWAII, U.S.A.

APPENDIX OF LABORATORY TESTING

Classification

The field classification is verified in the laboratory, also in accordance with the Unified Soil Classification System. Laboratory classification is determined by both visual examination and Atterburg Limit Tests according to ASTM D423 and D424. The final classification is shown on the "Boring Logs."

Moisture-Density

The field moisture content and dry unit weight are determined for each of the undisturbed soil samples. The information is useful in providing a gross picture of the soil consistency between borings and any local variations. The dry unit weight is determined in pounds per cubic foot while the moisture content is determined as a percentage of the dry unit weight. These samples are obtained from a 3" O.D. split tube sampler.

Consolidation

Settlement predictions of the soil's behavior under load are made on the basis of the consolidation tests. Loads are applied in several increments in a geometric progression, and the resulting deformations are recorded at selected time intervals. Porous stones are placed in contact with the top and bottom of each specimen having an inside diameter of 2.41 inches and a height of 1 inch to permit addition and release of pore fluid. Results of undisturbed samples are plotted on the "Consolidation-Pressure Curves."

Compaction Tests

Compaction tests were performed on bag samples to determine the optimum moisture content at which each type of proposed fill material compacts to 100% dry density. The tests were performed according to AASHO T 180-57.

Swell Tests

Swell tests were performed to determine the expansiveness of the onsite surface soils. The tests were performed on undisturbed ring samples taking a one inch high specimen under different surcharge loads.

Unconfined Compression Test

The unconfined compression test of a soil is a uniaxial compression test in which the test specimen is provided with no lateral support while undergoing vertical compression. The minimum height of the test specimen is at least 2.5 times the diameter of the ring. The rate of deformation varied between 1 and 2 percent. The test measures the unconfined compressive strength of a soil and, indirectly, the shearing strength.

Remolded Swell Tests

In order to determine the expansiveness of the compacted fill, bag samples were remolded into one inch high rings, tested under different surcharge loads, and inundated for a period of 24 hours.

Samples were compacted to 90% of the maximum laboratory density at the optimum moisture content. Total swell is indicated as a percentage of the original height.

Shear Tests

Shear tests are performed in the Direct Shear Machine which is of the strain control type. The rate of deformation is approximately 0.03 inches per minute. Each sample is sheared under varying confining loads in order to determine the Coulomb shear strength parameters, cohesion and angle of internal friction. Undisturbed samples are tested at their natural moisture content.

ERNEST K. HIRATA & ASSOCIATES INC.

STANDARD GRADING SPECIFICATIONS

These specifications present the usual and minimum requirements for grading operations performed under the control of Ernest K. Hirata & Associates Inc.

No deviation from these specifications will be allowed, except where specifically superseded in the preliminary soils report, or in other written communication signed by the Soils Engineer.

I. GENERAL

A. The Soils Engineer is the Owner's or Builder's representative on the project. For the purpose of these specifications, supervision by the Soils Engineer includes that inspection performed by any person or persons employed by, and responsible to, the licensed Civil Engineer signing the soils report.

B. All clearing, site preparation or earthwork performed on the project shall be conducted by the Contractor under the supervision of the Soils Engineer.

C. It is the Contractor's responsibility to prepare the ground surface to receive the fills to the satisfaction of the Soils Engineer and to place, spread, mix, water and compact the fill in accordance with the specifications of the Soils Engineer. The Contractor shall also remove all material considered unsatisfactory by the Soils Engineer.

D. It is also the Contractor's responsibility to have suitable and sufficient compaction equipment on the job site to handle the amount of fill being placed. If necessary, excavation equipment will be shut down to permit completion of compaction. Sufficient watering apparatus will also be provided by the Contractor, with due consideration for the fill material, rate of placement and time of year.

E. A final report shall be issued by the Soils Engineer attesting to the Contractor's conformance with these specifications.

II. SITE PREPARATION

A. All vegetation and deleterious material such as rubbish shall be disposed of offsite. This removal must be concluded prior to placing fill.

B. Soil, alluvium or rock materials determined by the Soils Engineer as being unsuitable for placement in compacted fills shall be removed and wasted from the site. Any material incorporated as a part of a compacted fill must be approved by the Soils Engineer.

C. After the ground surface to receive fill has been cleared, it shall be scarified, disced or bladed by the Contractor until it is uniform and free from ruts, hollows, hummocks or other uneven features which may prevent uniform compaction.

The scarified ground surface shall then be brought to optimum moisture, mixed as required, and compacted as specified. If the scarified zone is greater than twelve inches in depth, the excess shall be removed and placed in lifts restricted to six inches.

Prior to placing fill, the ground surface to receive fill shall be inspected, tested and approved by the Soils Engineer.

D. Any underground structures such as cesspools, cisterns, tunnels, septic tanks, wells, pipelines or others not located prior to grading are to be removed or treated in a manner prescribed by the Soils Engineer.

III. COMPACTED FILLS

A. Any material imported or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable by the Soils Engineer. Roots, tree branches and other matter missed during clearing shall be removed from the fill as directed by the Soils Engineer.

B. Rock fragments less than six inches in diameter may be utilized in the fill, provided:

1. They are not placed in concentrated pockets.

2. There is a sufficient percentage of fine-grained material to surround the rocks.

3. The distribution of the rocks is supervised by the Soils Engineer.

C. Rocks greater than six inches in diameter shall be taken offsite, or placed in accordance with the recommendations of the Soils Engineer in areas designated as suitable for rock disposal.

D. Material that is spongy, subject to decay, or otherwise considered unsuitable shall not be used in the compacted fill.

E. Representative samples of materials to be utilized as compacted fill shall be analyzed in the laboratory by the Soils Engineer to determine their physical properties. If any material other than that previously tested is encountered during grading, the appropriate analysis of this material shall be conducted by the Soils Engineer as soon as possible.

F. Material used in the compacting process shall be evenly spread, watered, processed and compacted in thin lifts not to exceed six inches in thickness to obtain a uniformly dense layer. The fill shall be placed and compacted on a horizontal plane, unless otherwise approved by the Soils Engineer.

G. If the moisture content or relative density varies from that required by the Soils Engineer, the Contractor shall rework the fill until it is approved by the Soils Engineer.

H. Each layer shall be compacted to 90 percent of the maximum density in compliance with the testing method specified by the controlling governmental agency.

If compaction to a lesser percentage is authorized by the controlling governmental agency because of a specific land use or expansive soil conditions, the area to receive fill compacted to less than 90 percent shall either be delineated on the grading plan or appropriate reference made to the area in the soil report.

I. All fills shall be keyed and benched through all topsoil, colluvium, alluvium or creep material, into sound bedrock or firm material where the slope receiving fill exceeds a ratio of five horizontal to one vertical, in accordance with the recommendations of the Soils Engineer.

J. The key for side hill fills shall be a minimum of 15 feet within bedrock or firm materials, unless otherwise specified in the soils report.

K. Drainage terraces and subdrainage devices shall be constructed in compliance with the ordinances of the controlling governmental agency, or with the recommendations of the Soils Engineer.

L. The Contractor will be required to obtain a minimum relative compaction of 90 percent out to the finish slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment, or by any other procedure which produces the required compaction.

If a method other than overbuilding and cutting back to the compacted core is to be employed, slope tests will be made by the Soils Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified of such conditions by written communication from the Soils Engineer in the form of a conference memorandum, to avoid any misunderstanding arising from oral communication.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no additional cost to the Owner or Soils Engineer.

M. All fill slopes should be planted or protected from erosion by methods specified in the soils report.

N. Fill-over-cut slopes shall be properly keyed through topsoil, colluvium or creep material into rock or firm materials; and the transition shall be stripped of all soil prior to placing fill.

IV. CUT SLOPES

A. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature are encountered during grading, these conditions shall be analyzed by the Soils Engineer; and recommendations shall be made to treat these problems.

B. Unless otherwise specified in the soils report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of controlling governmental agencies.

C. Drainage terraces shall be constructed in compliance with the ordinances of controlling governmental agencies, or with the recommendations of the Soils Engineer.

V. GRADING CONTROL

A. Inspection of the fill placement shall be provided by the Soils Engineer during the progress of grading.

B. In general, density tests shall be made at intervals not exceeding two feet of fill height of every 500 cubic yards of fill placed. This criteria will vary depending on soil conditions and the size of the job. In any event, an adequate number of field density tests shall be made to verify that the required compaction is being achieved.

C. Density tests shall also be made on the surface material to receive fill as required by the Soils Engineer.

D. All cleanout, processed ground to receive fill, key excavations, subdrains and rock disposal must be inspected and approved by the Soils Engineer prior to placing any fill. It shall be the Contractor's responsibility to notify the Soils Engineer when such areas are ready for inspection.

VI. CONSTRUCTION CONSIDERATIONS

A. Erosion control measures, when necessary, shall be provided by the Contractor during grading and prior to the completion and construction of permanent drainage controls.

B. Upon completion of grading and termination of inspections by the Soils Engineer, no further filling or excavating, including that necessary for footings, foundations, large tree wells, retaining walls, or other features shall be performed without the approval of the Soils Engineer.

C. Care shall be taken by the Contractor during final grading to preserve any berms, drainage terraces, interceptor swales, or other devices of a permanent nature on or adjacent to the property.

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B1 — DRIVING WT. 140 lb. — DATE OF DRILLING 10-22-71

SURFACE ELEV. 60 + — DROP 30 in. — W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS Ø	C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (CL) - Reddish brown, moist
5	x		15		20.0				Decomposed Rock - Yellowish brown, hard.
	x		18 15/2"	93.7	13.0				grading to gray silty clay from 8 feet. dry, hard.
10									
12									End boring at 12 feet
15									
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B2 DRIVING WT. 140 lb. DATE OF DRILLING 10-22-71

SURFACE ELEV. 60 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Clayey SILT (ML) - Brown, dry
5	x		6 12 13	92.2	26.4		Unconfine Strength 9732 PSF		Decomposed Rock - Mottled dark brown silty clay. grading to yellow brown sandy silt from 8.5 feet., hard
10	x		6/1"						
15									End boring at 14.5 feet.
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B3 DRIVING WT. 140 lb. DATE OF DRILLING 10-25-71

SURFACE ELEV. 35 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0–5	x		14 29 27	90.3	25.0				Silty CLAY (CL) - Dark brown, moist, stiff.
5–15	x		10 14 16	76.2	34.2		Unconfine Strength 3727 PSF		Decomposed Rock - Yellow brown sandy silt, moist, medium dense.
	x		10 20 22	76.9	39.4				very moist at 12 feet.
15									End boring at 15 feet

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B4 | DRIVING WT. 140 lb. | DATE OF DRILLING 10-25-71

SURFACE ELEV. 80 ± | DROP 30 in. | W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS Ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0–5									Decomposed Rock - Orange brown clayey silt, rocky.
5–10.5									Bedrock - blue gray basalt, hard.
10.5									End boring at 10.5 feet.

Plate A4

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B5 DRIVING WT. 140 lb. DATE OF DRILLING 10-25-71

SURFACE ELEV. 55± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Clayey SILT (ML) - Brown, dry.
5	x		16 25 32	100.5	18.7				Decomposed Rock - Yellow brown, damp, hard.
10	x		10 20 37	105.1	17.0				
15									End boring at 15 feet.
20									
25									
30									

Plate A5

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B6 DRIVING WT. 140 lb. DATE OF DRILLING 10-25-71

SURFACE ELEV. 100 + DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty GRAVEL (GM) - Brown, dry, some cobbles, hard.
10	x		14/3"		11.7				
									Bedrock - hard.
15									End boring at 15 feet.
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B7 DRIVING WT. 140 lb. DATE OF DRILLING 10-25-71

SURFACE ELEV. 175 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS Ø	C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Clayey SILT (ML) - Brown, dry.
	x		12 22 25	85.3	21.8				Decomposed Rock - Gray, hard.
5									
	x		12 18 38	86.9	19.4				
10									grading brown color at 12 feet.
	x		35 45	92.8	15.3		27°	0.63 KSF	mottled yellow brown 14 feet.
15									
	x		16/1" Refusal		14.8				
20									End boring at 19 feet.
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B8 DRIVING WT. 140 lb. DATE OF DRILLING 10-26-71

SURFACE ELEV. 100± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Decomposed Rock - Orange brown, dry, hard.
5	x		12 21 30	87.8	23.8		66°	1.7 KSF	
10	x		7 15 20	80.2	27.6		68.5°	0.95 KSF	
15	x		10 17 16	86.6	25.4				
									End boring at 16.5 feet.
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B9 DRIVING WT. 140 lb. DATE OF DRILLING 10-26-71

SURFACE ELEV. 75± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Clayey SILT (ML) - Reddish orange.
5	x		50	75.3	16.3				Decomposed Rock - Yellow brown, hard.
10									rocky below 9 feet.
15									
20									End boring at 20 feet.
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B10 | DRIVING WT. 140 lb. | DATE OF DRILLING 10-26-71

SURFACE ELEV. 130 ± | DROP 30 in. | W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	DIRECT SHEAR STRENGTH PARAMETERS C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Decomposed Rock - Yellowish orange clayey silt, dry, hard.
5	x		37 50/3"	80.8	20.1				
									Bedrock - Gray Basalt
10									End boring at 10 feet.
15									
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B11 DRIVING WT. 140 lb. DATE OF DRILLING 10-26-71

SURFACE ELEV. 70 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	c	CLASSIFICATION (% Sand, % Silt, % Clay)
0	x		13 19 27	84.4	29.4		Unconfine strength 26,358 PSF		Clayey SILT (ML) - Red, dry.
5	x		20/4½"	71.3	23.5				Decomposed Rock - mottled yellow. grading to gray color with rock at 9 feet.
10									
									Bedrock - Gray basalt.
15									End boring at 15 feet.
20									
25									
30									

ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B12 DRIVING WT. 140 lb. DATE OF DRILLING 10-26-71

SURFACE ELEV. 75 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS Ø	C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Silty CLAY (CL) - Red, medium stiff.
	x		8 8 10	68.2	44.9				Decomposed Rock - mottled orange clayey silt.
5									
	x		7 7 8	68.4	52.4		20.5°	0.5 KSF	
10									
	x		6 7 9	70.9	45.4		31.5°	.535 KSF	very moist at 13 feet
15									
	x		7 14/4"	83.1	29.0				Bedrock - hard.
20									End boring at 19.5 feet.
25									
30									

Plate A12

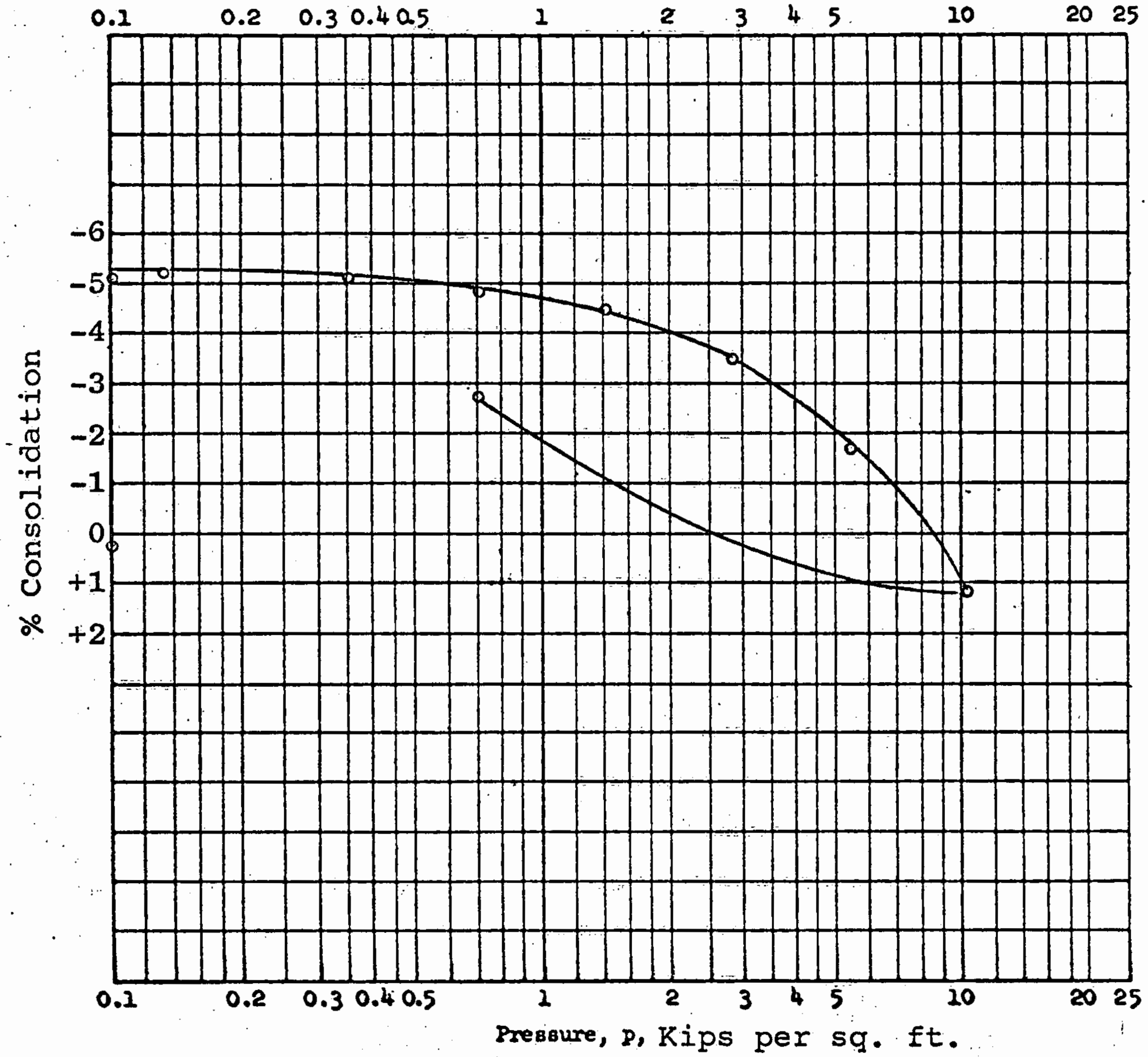
ERNEST K. HIRATA & ASSOC.

BORING LOG

BORING NO. B13 DRIVING WT. 140 lb. DATE OF DRILLING 10-26-71

SURFACE ELEV. 60 ± DROP 30 in. W.O. 118-C

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/FOOT	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS ø	C	CLASSIFICATION (% Sand, % Silt, % Clay)
0									Clayey SILT (ML) - Brown, dry, some gravel.
	x		16 22 16	111.1	10.8				Decomposed Rock - Yellowish brown silty clay, gravelly, hard.
5									
	x		8 23 30/4"	87.1	22.8				
10									
									End boring at 12 feet.
15									
20									
25									
30									



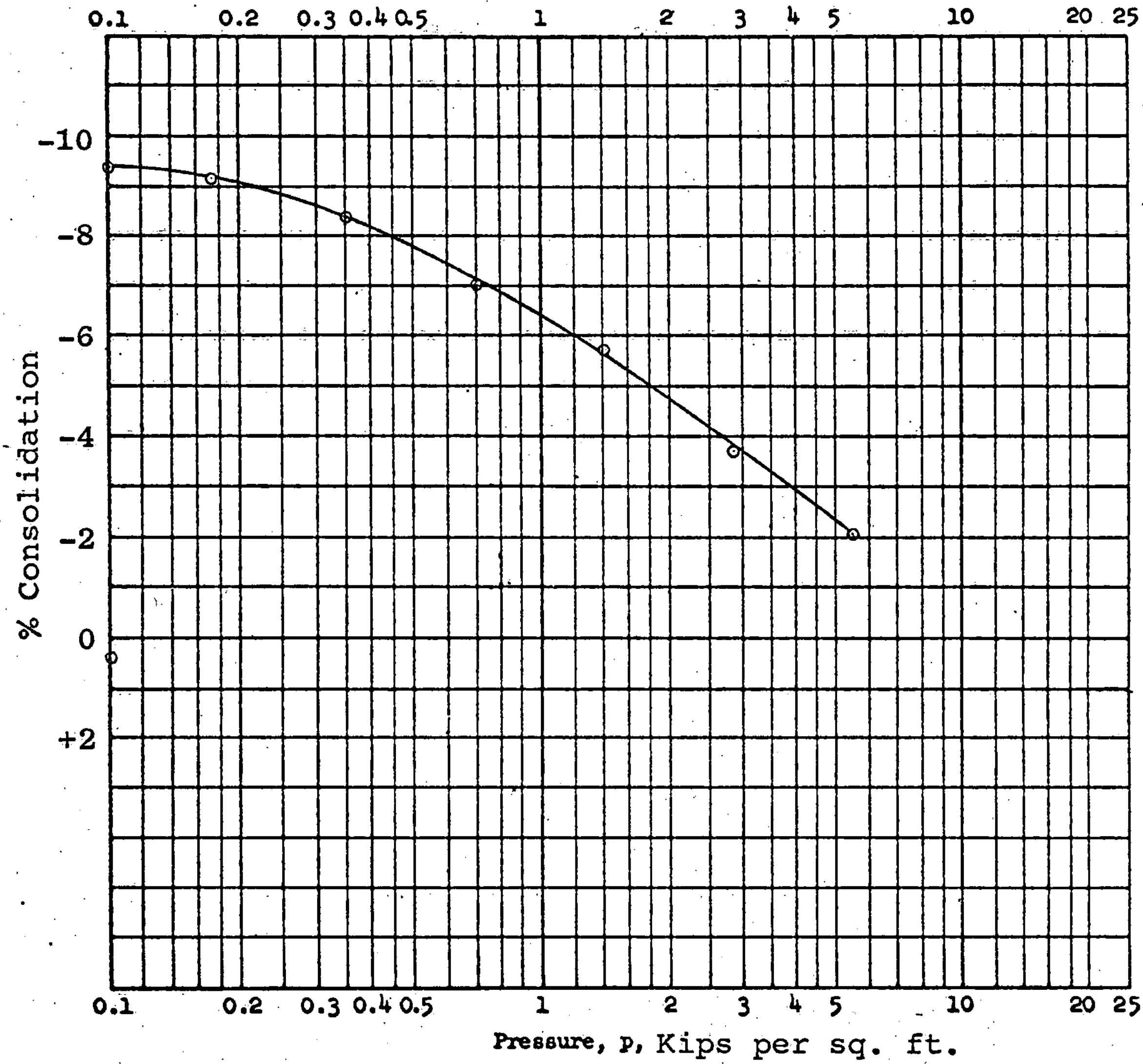
Type of Specimen Undisturbed		Before Test		After Test		
Diam 2.42 in.	Ht 1.0 in.	Water Content, w_o	25.0 %	w_f	%	
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f		
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%	
Compression Index, C_c		Dry Density, γ_d	90.3 lb/ft^3			
Classification CL		k_{20} at e_o = × 10⁻ cm/sec				

LL	G_s	Project Kaopa #3 - Phase III	
PL	D_{10}	W.O. 118-C	
Remarks		Area	
		Boring No. B3	Sample No.
		Depth 3' El	Date 1-6-72
		CONSOLIDATION TEST REPORT	

ENG FORM 1 MAY 63 2090

0 3424

Plate B1



Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.42 in.	Ht 1.0 in.	Water Content, w_o	18.7 %	w_f	%
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	100.5 lb/ft^3		
Classification Decomposed Rock		k_{20} at e_o = × 10$^-$ cm/sec			

LL	G_s
PL	D_{10}

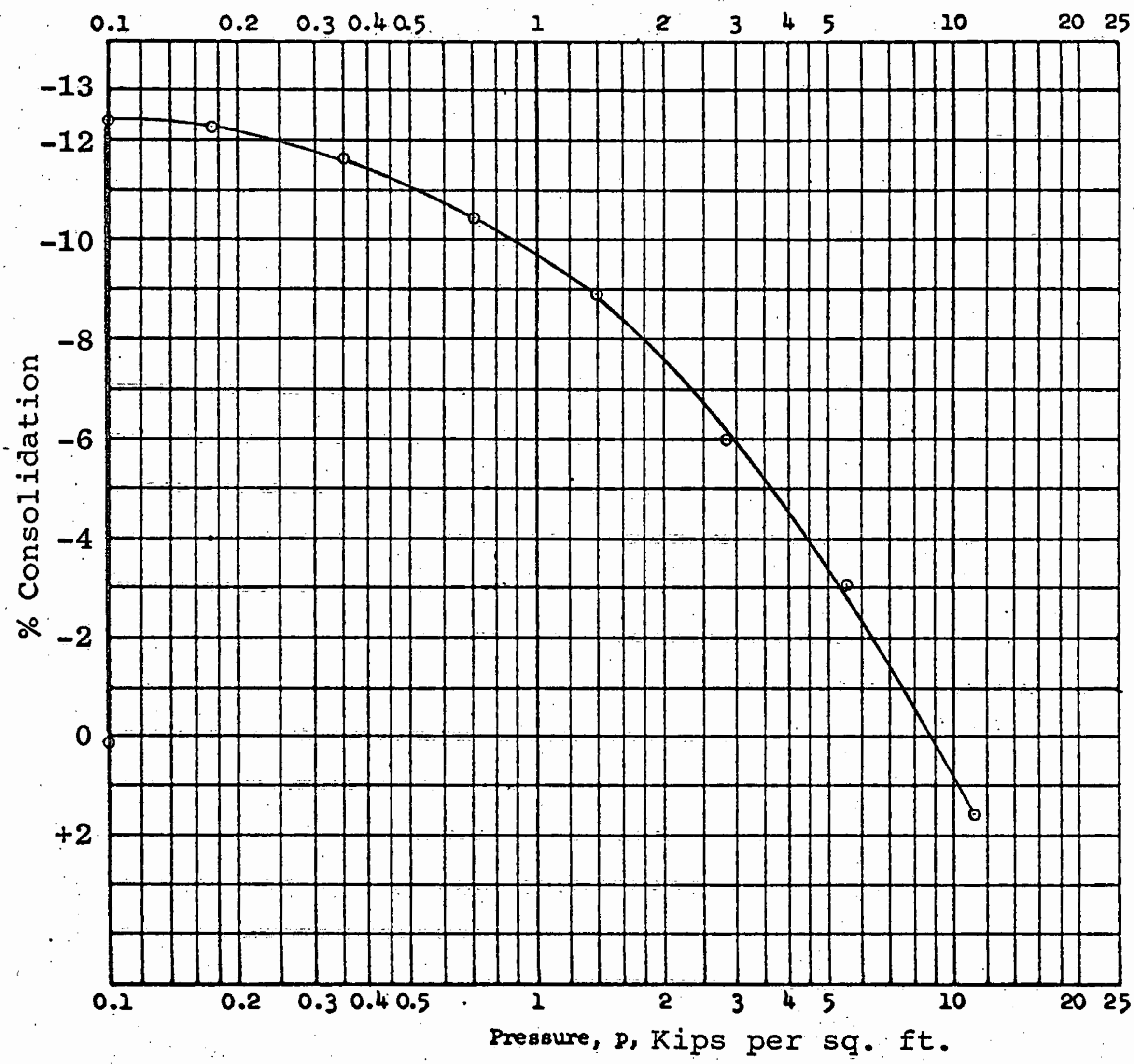
Remarks

Project Kaopa #3 Phase III	
W.O. 118-C	
Area	
Boring No. B5	Sample No.
Depth 4' El	Date 11-9-71

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090

0 3424



Type of Specimen Undisturbed		Before Test		After Test	
Diam 2.42 in.	Ht 1.0 in.	Water Content, w_o	10.8 %	w_f	%
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	lb/ft^3		
Classification Decomposed Rock		k_{20} at e_o = × 10^- cm/sec			

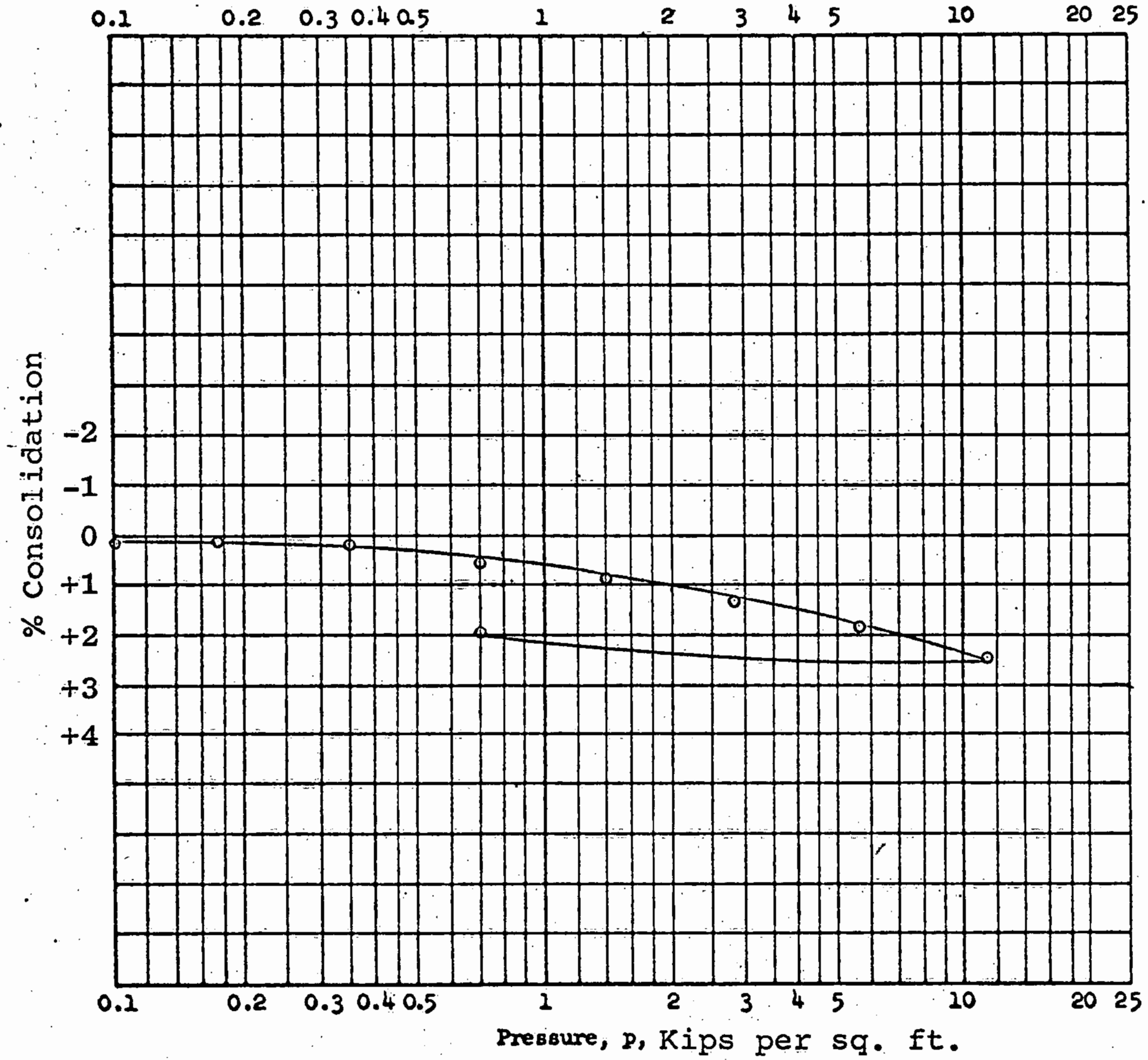
LL	G_s
PL	D_{10}
Remarks	

Project Kaopa #3 Phase III	
W.O. 118-C	
Area	
Boring No. B13	Sample No.
Depth 3' El	Date 11-9-71

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090

0 3424



Type of Specimen Remolded		Before Test		After Test	
Diam 2.42 in.	Ht 1.0 in.	Water Content, w_o	9.5 %	w_f	13.5 %
Overburden Pressure, p_o T/sq ft		Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c T/sq ft		Saturation, S_o	%	S_f	%
Compression Index, C_c		Dry Density, γ_d	124.6 lb/ft^3		
Classification CL-ML		k_{20} at e_o = × 10⁻ cm/sec			

LL 22.4	G_s
PL 17.3	D_{10}
Remarks	

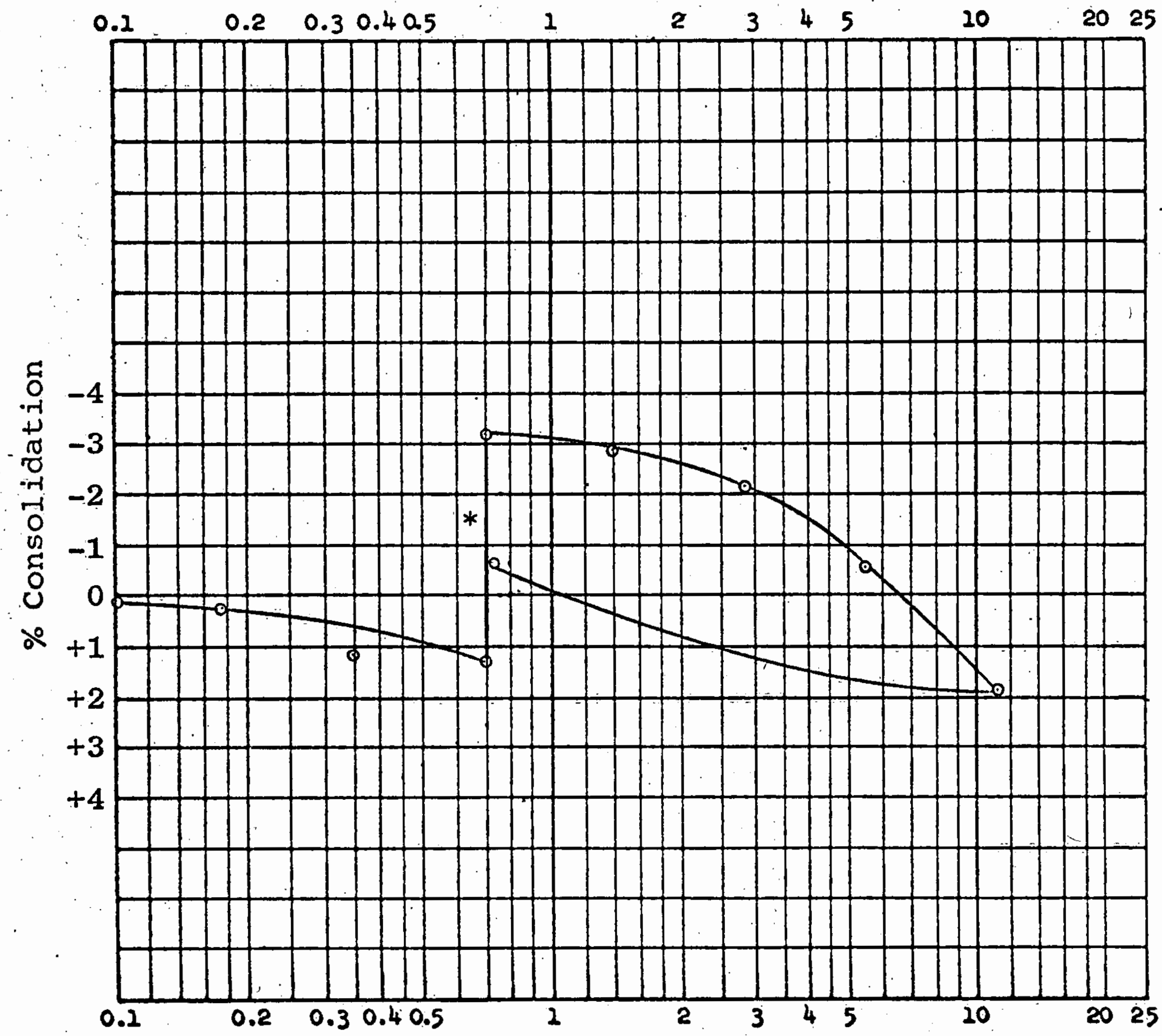
Project Kaopa #3 Phase III	
W.O. 118-C	
Area	
Boring No. B4	Sample No.
Depth 5'-10' El	Date 1-21-72

CONSOLIDATION TEST REPORT

ENG FORM 1 MAY 63 2090

0 3424

Plate B4



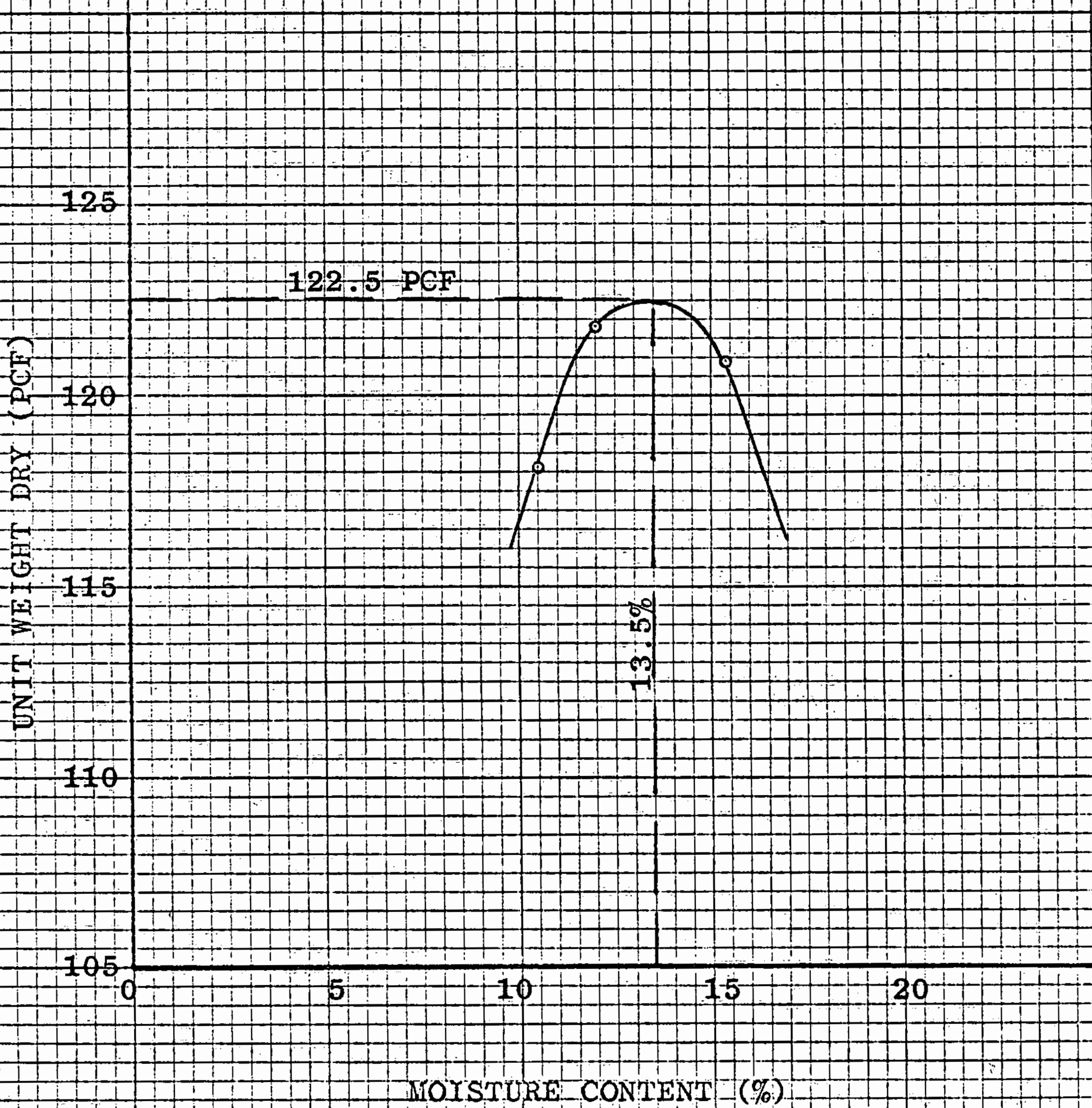
Type of Specimen	Remolded			Before Test		After Test	
Diam 2.42 in.		Ht 1.0 in.		Water Content, w_o	20.0 %	w_f	30.6 %
Overburden Pressure, p_o			T/sq ft	Void Ratio, e_o		e_f	
Preconsol. Pressure, p_c			T/sq ft	Saturation, S_o	%	S_f	%
Compression Index, C_c				Dry Density, γ_d	94.5 lb/ft^3		
Classification	ML			k_{20} at e_o = × 10⁻ cm/sec			
LL	35.0	G_s		Project	Kaopa #3 Phase III		
PL	27.1	D_{10}			W.O. 118-C		
Remarks * Water added at				Area			
700 PSF surcharge				Boring No.	B9	Sample No.	
				Depth El	0-9'	Date	1-22-72
				CONSOLIDATION TEST REPORT			

ENG FORM 2090
1 MAY 63

0 3424

Plate B5

MAXIMUM DENSITY CURVE



Boring: B1

Depth: 8'-12'

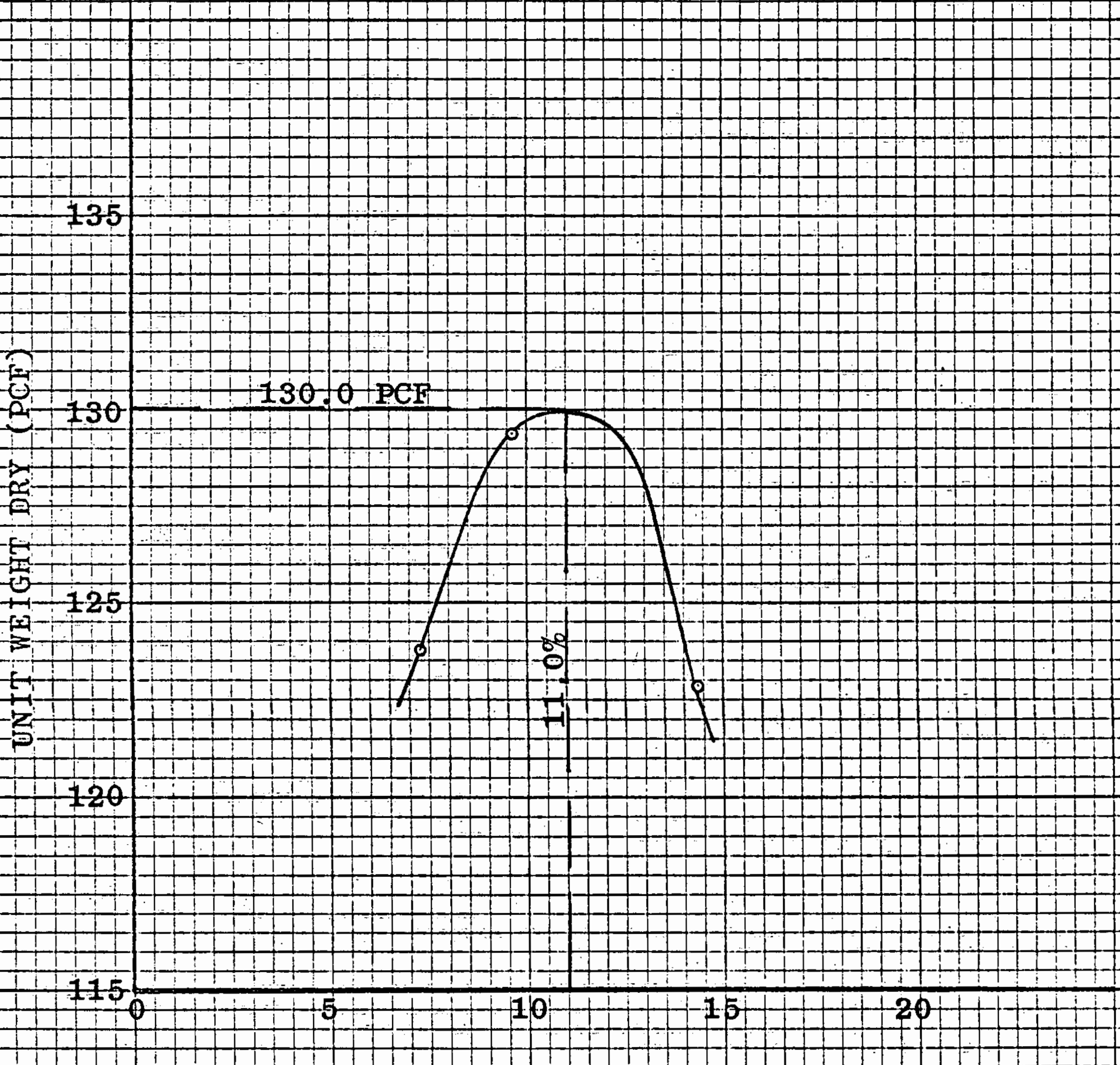
Classification: CL
Decomposed Rock
Gray Silty Clay

W.O. 118-C

L.L.=29.0
P.L.=19.5
P.I.= 9.5

Plate C1

MAXIMUM DENSITY CURVE



Boring: B2

Depth: 10'-14'

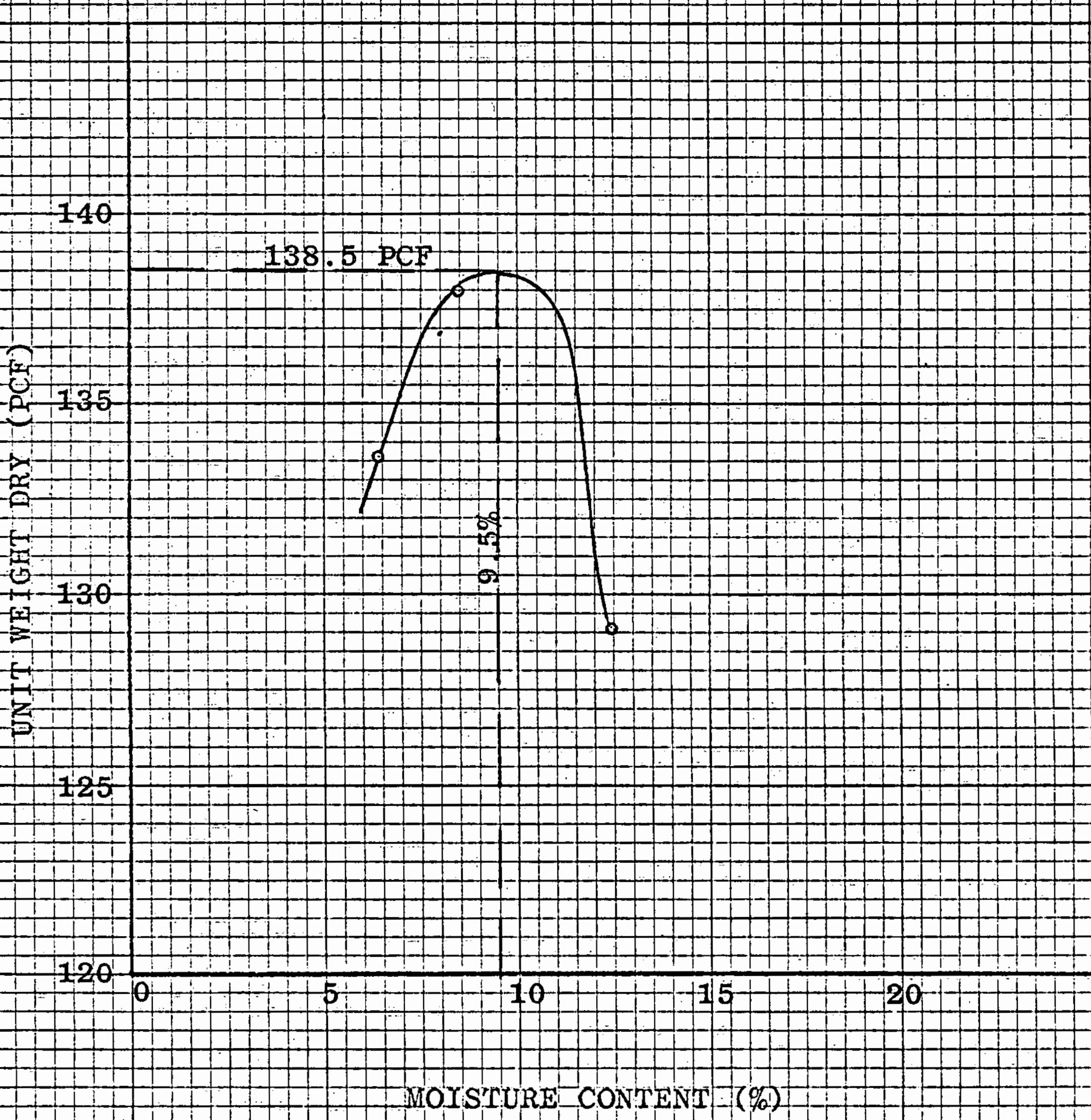
Classification: CL-ML W.O. 118-C

Decomposed Rock

Yellow Brown Sandy Silt

L.L.=23.8
P.L.=17.6
P.I.= 6.2

MAXIMUM DENSITY CURVE



Boring: B4

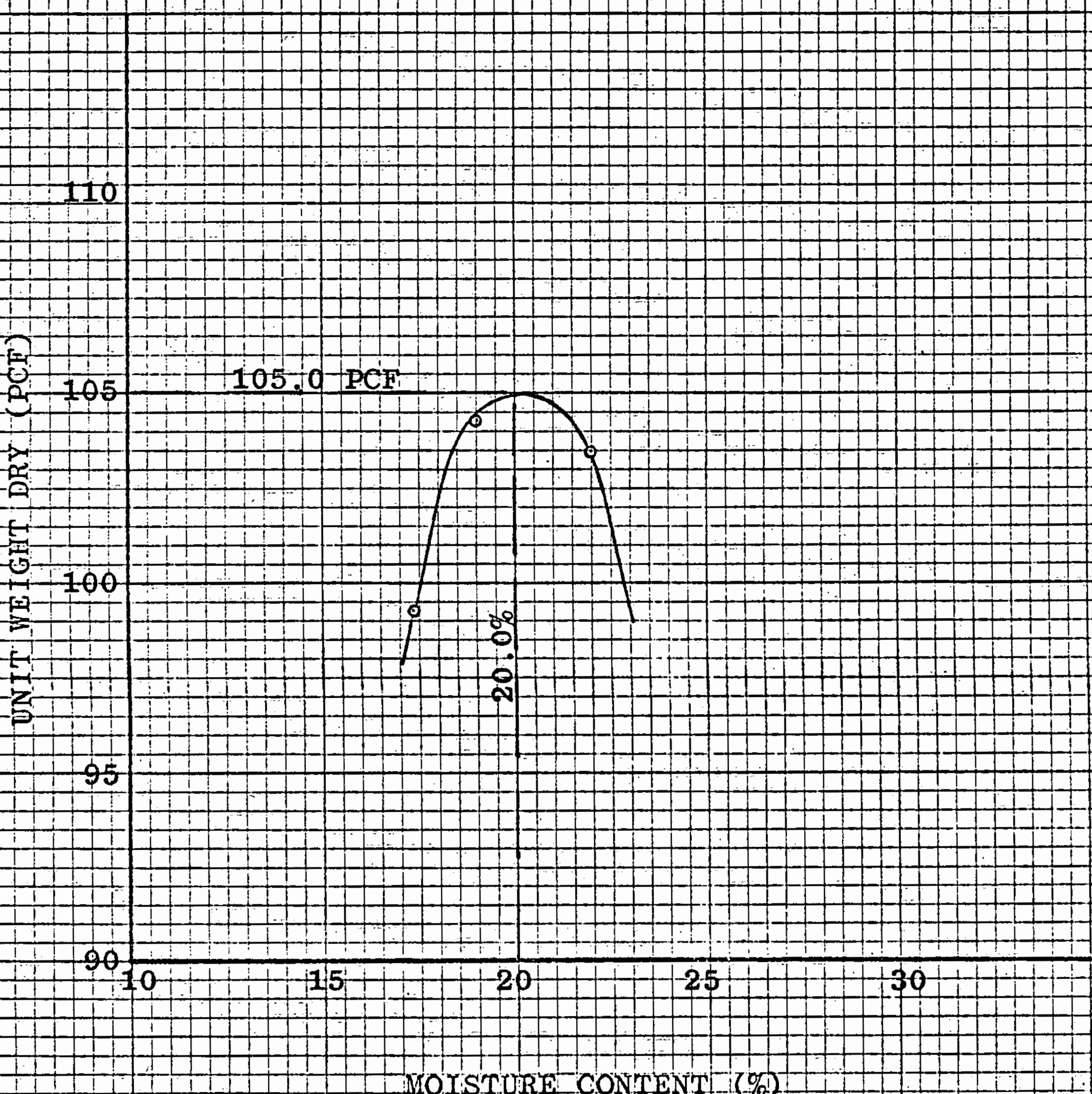
Depth: 5'-10'

Classification: CL-ML W.O. 118-C

Bedrock, Gray & Rocky

L.L.=22.4
P.L.=17.3
P.I.= 5.1

MAXIMUM DENSITY CURVE



Boring: B9

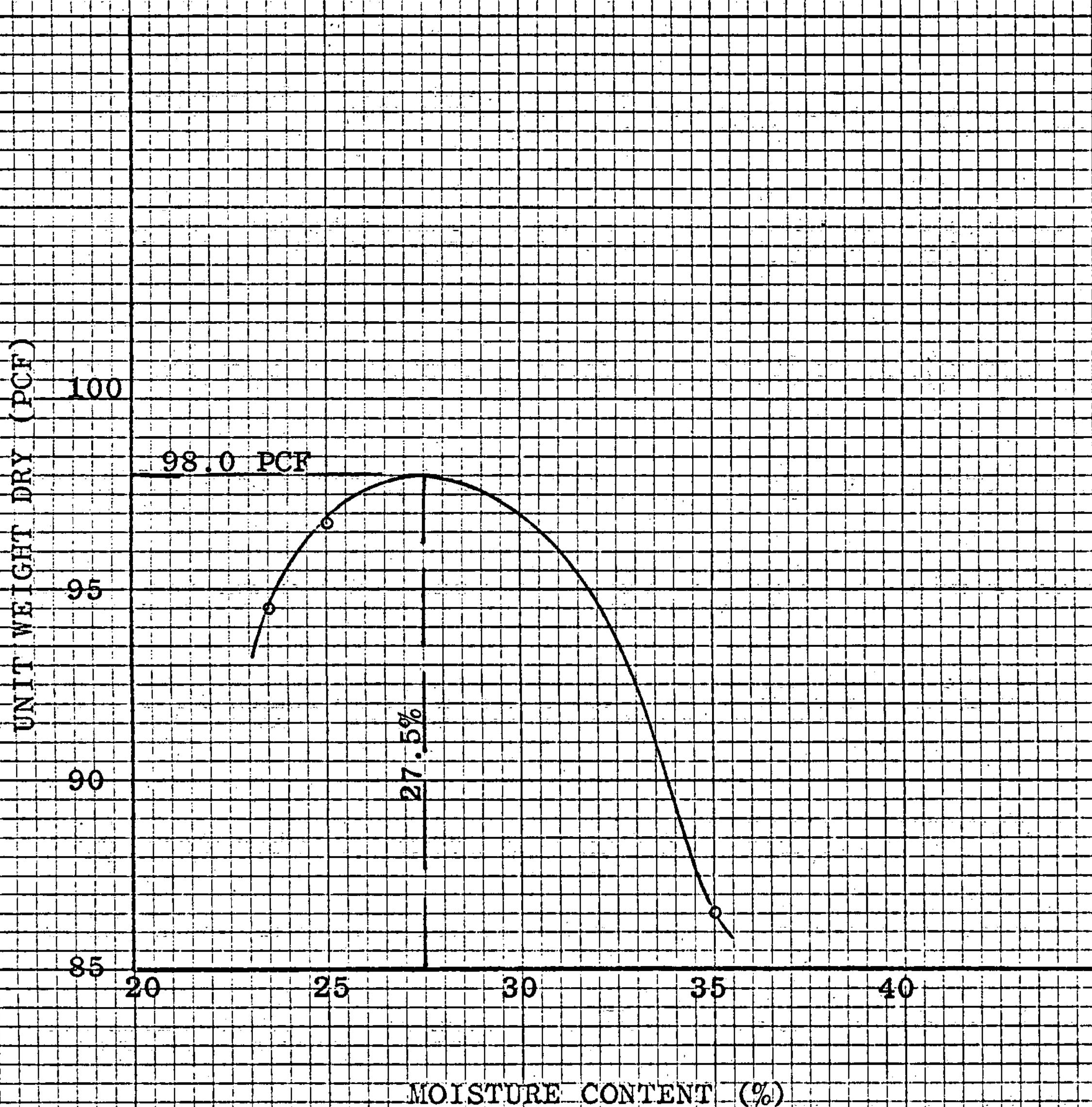
Depth: 0'-9'

Classification: ML — W.O. 118-C

Reddish Orange Clayey Silt

L.L.=35.0
P.L.=27.1
P.I.= 7.9

MAXIMUM DENSITY CURVE



Boring: B12

Depth: 3'-8'

Classification: MH
Decomposed Rock
Red clayey silt

W.O. 118-C

L.L.=71.2
P.L.=40.7
P.I.=30.5

LABORATORY TEST RESULTS

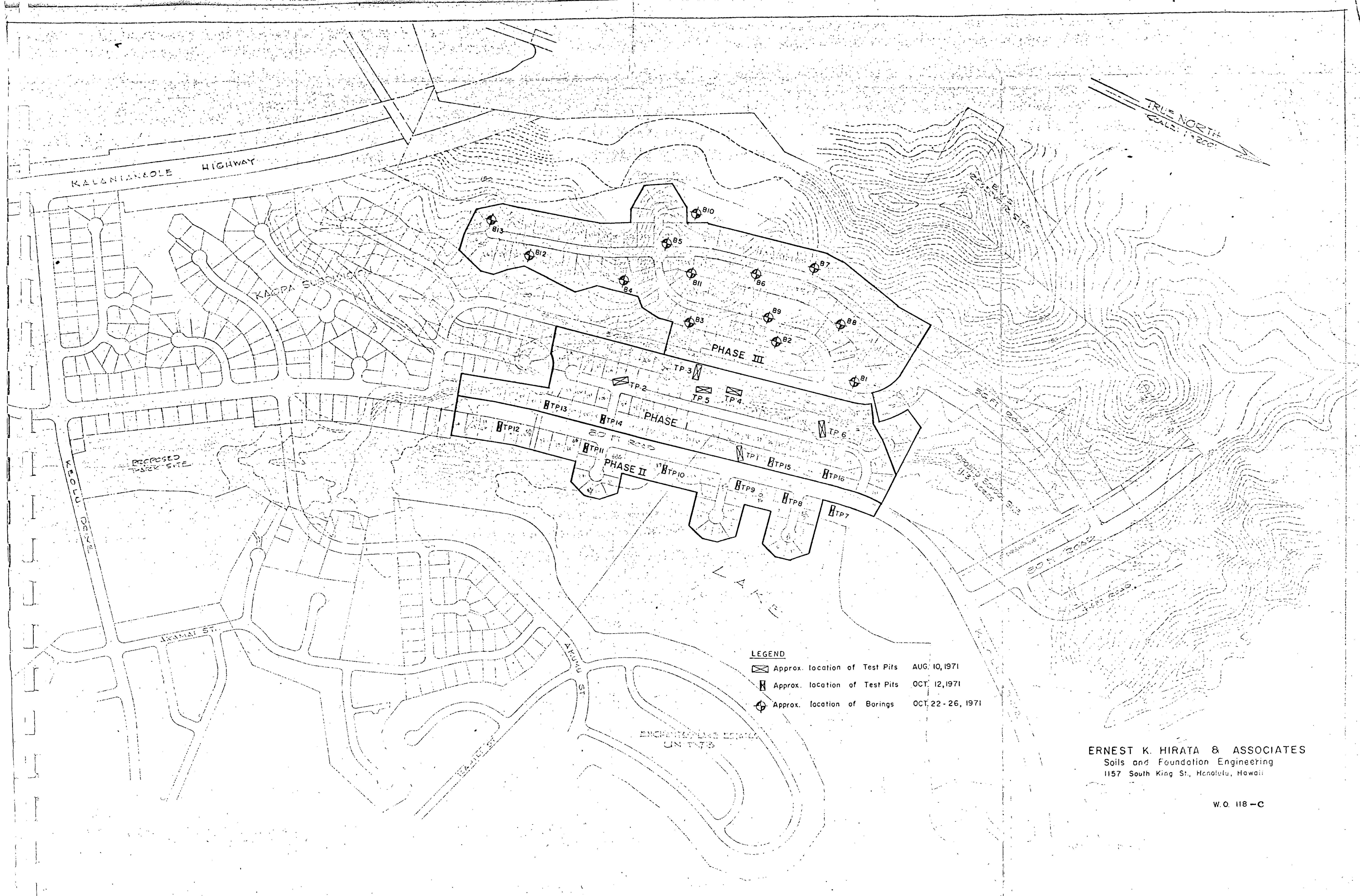
Project: Kaopa #3 - Phase III W.O. 118-C

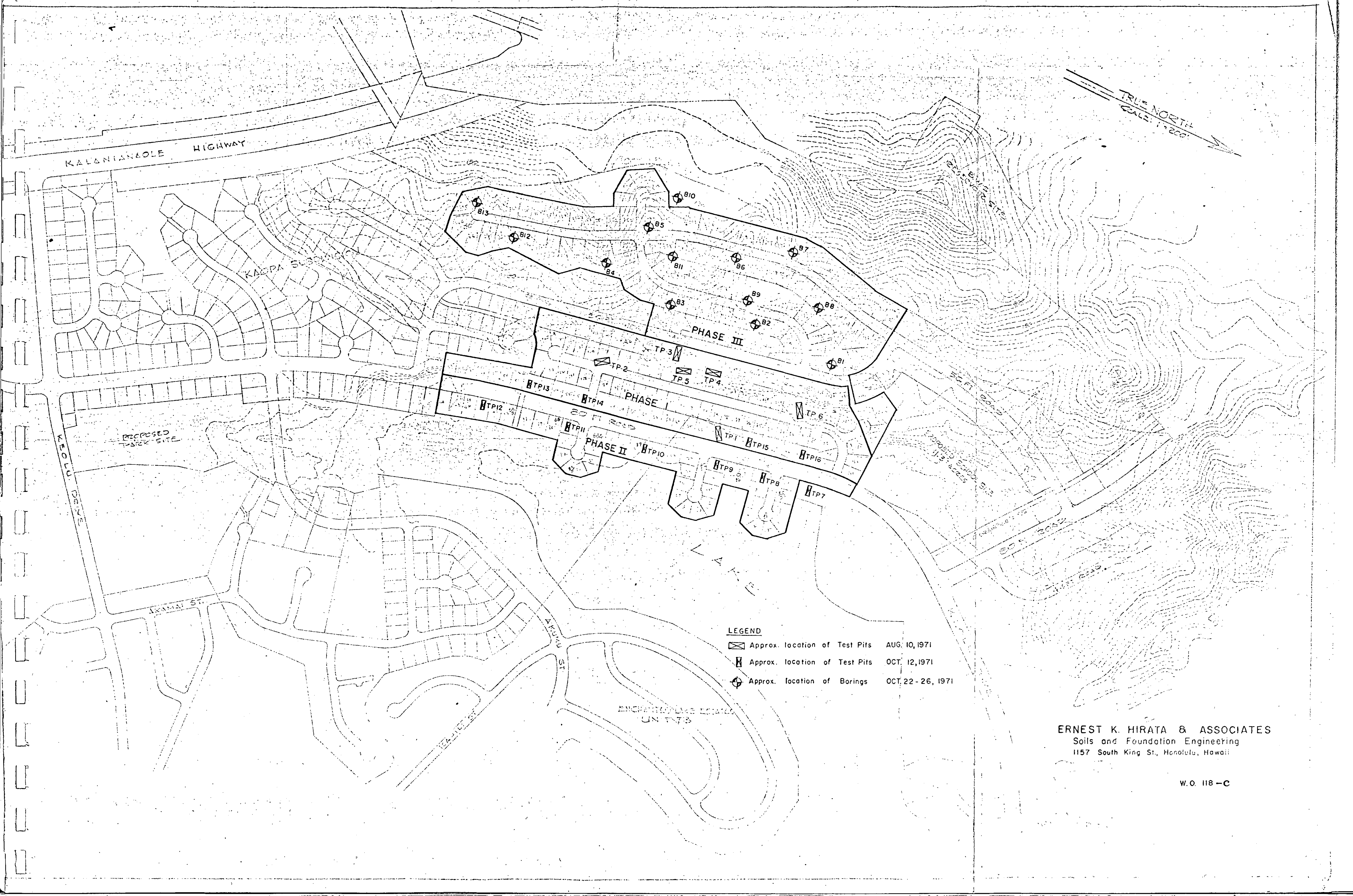
Boring or Test Pit No.	B1	B2	B2	B3	B3
Depth (ft.)	8'-12'	10'-14'	5'	3'	8'
Atterburg Limit Tests					
Liquid Limit	29.0	23.8			
Plastic Limit	19.5	17.6			
Plastic Index	9.5	6.2			
Soil Classification	CL	CL-ML			
Expansion @ 90 PSF					
Natural				5.2	
Remolded					
Expansion @ PSF					
Natural					
Remolded					
Unconfine Stress (PSF)			9732		3727
Proctor					
Max. Dry Unit Wt. (PCF)	122.5	130.0			
Optimum Water (%)	13.5	11.0			
Wet Density In-Place (PCF)			116.5	112.9	102.3
Moisture In-Place (%)			26.4	25.0	34.2
Dry Unit Wt. In-Place (PCF)			92.2	90.3	76.2

LABORATORY TEST RESULTS

Project: Kaopa #3 - Phase III **W.O.** 118-C

Boring or Test Pit No.	B4	B5	B9	B12	B13
Depth (ft.)	5'-10'	4'	0'-9'	3'-8'	3'
Atterburg Limit Tests					
Liquid Limit	22.4		35.0	71.2	
Plastic Limit	17.3		27.1	40.7	
Plastic Index	5.1		7.9	30.5	
Soil Classification	CL-ML		ML	MH	
Expansion @ 90 PSF					
Natural		9.7			12.5
Remolded	0.1				
Expansion @ 700 PSF					
Natural					
Remolded			4.5		
Unconfine Stress (PSF)					
Proctor					
Max. Dry Unit Wt. (PCF)	138.5		105.0	98.0	
Optimum Water (%)	9.5		20.0	27.0	
Wet Density In-Place (PCF)		119.3			123.1
Moisture In-Place (%)		18.7			10.8
Dry Unit Wt. In-Place (PCF)		100.5			111.1


TRUE NORTH
SCALE: 1"=200'
KALANIANAOLE HIGHWAY
KAOPA SUBDIVISION
PHASE III
PHASE I
PHASE II
80 FT. ROAD
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
TP 1
TP 2
TP 3
TP 4
TP 5
TP 6
TP 7
TP 8
TP 9
TP 10
TP 11
TP 12
TP 13
TP 14
TP 15
TP 16
PROPOSED PARK SITE
KEOLU DRIVE
AKUMU ST
LAKE
LEGEND
Approx. location of Test Pits AUG. 10, 1971
Approx. location of Test Pits OCT. 12, 1971
Approx. location of Borings OCT. 22-26, 1971
ERNEST K. HIRATA & ASSOCIATES
Soils and Foundation Engineering
1157 South King St., Honolulu, Hawaii
W.O. 118-C



KALANIANAOLE HIGHWAY
KEOLU DRIVE
PROPOSED PARK SITE
KAAPA SUBDIVISION
AKAMAI ST.
AKUMU ST.
LAKE
80 FT ROAD
PHASE I
PHASE II
PHASE III
TP 1
TP-2
TP 3
TP 4
TP 5
TP 6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
TP15
TP16
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
TRUE NORTH
LEGEND
Approx. location of Test Pits AUG. 10, 1971
Approx. location of Test Pits OCT. 12, 1971
Approx. location of Borings OCT. 22 - 26, 1971
ERNEST K. HIRATA & ASSOCIATES
Soils and Foundation Engineering
1157 South King St., Honolulu, Hawaii
W.O. 118 — C