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HAWAII KAI DRIVE EXTENSION
WAILUA STREET TO KALUANUI SUBDIVISION, UNIT I
PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAP KEY: 3-9-14

To:
KAISER HAWAII KAI DEVELOPMENT COMPANY

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS
NOVEMBER 4, 1970



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WALTER LUM
EDWARD WATANABE
EZRA KOIKE

TA 710.3
H3
H64
No 359

November 4, 1970

KAISER HAWAII KAI DEVELOPMENT CO.
P. O. Box 2997
Honolulu, Hawaii 96802

Gentlemen:

Subject: Hawaii Kai Drive Extension
Wailua Street to Kaluanui Subdivision, Unit I
Preliminary Soil Report
Maunaloa, Oahu, Hawaii
Tax Map Key: 3-9-14

Transmitted herewith is our preliminary soil report for design purposes for the Hawaii Kai Drive Extension - Wailua Street to Kaluanui Subdivision, Unit I.

The surface soils at the site may be generally described as stiff brown silty and clayey sands with gravel underlain by rock or boulders with clay pockets. Soft underlying materials and recent fills were encountered along the northern section of the route.

For the general pavement design, 2 in. of asphaltic concrete, 6 in. of base course and 6 in. of subbase are recommended.

Soft spots, clayey soils or unforeseen conditions may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Earthwork should be done in accordance with the requirements of Chapter 23, Revised Ordinances of Honolulu, 1961 As Amended and the recommendations contained herein.

The report includes a Boring Location Plan, boring logs, laboratory test results, recommendations and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

Ezra Koike

Ezra Koike
Professional Engineer
Hawaii No. 1450

EK:rmf

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HAWAII KAI DRIVE EXTENSION
WAILUA STREET TO KALUANUI SUBDIVISION, UNIT I
PRELIMINARY SOIL REPORT

MAUNALUA, OAHU, HAWAII
TAX MAP KEY: 3-9-14

SCOPE OF EXPLORATION

The purpose of this exploration was to determine general soil conditions for design purposes for the Hawaii Kai Drive Extension - Wailua Street to Kaluanui Subdivision Unit I.

This report includes field exploration, laboratory tests and general recommendations for general pavement design.

FIELD EXPLORATION AND LABORATORY TESTS

Two borings were made at the site. Also attached are the logs of 2 borings made previously for Kaluanui Unit 2 & Part of Unit 3, February 7, 1967; and one boring for Hawaii Kai Drive - Marina #10 Area, October 18, 1966. The locations of these borings are shown on Figure 1, Boring Location Plan.

Borings were made with 4-in. diameter augers. Soil samples were recovered with 2-in. standard split spoon samplers driven with a 140-lb hammer falling 30 inches.

Laboratory tests included: natural water content, Atterberg limits, sieve analysis, expansion and CBR.

SOIL CLASSIFICATION SYSTEM

Soil samples were visually observed and subjected to appropriate tests in the laboratory. Based on visual observations and laboratory tests, the soil descriptions in the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed roadway is an extension of Hawaii Kai Drive from Wailua Street to Kaluanui Subdivision, Unit I (approximately 580 ft). The alignment follows an existing construction road. There is a hydraulic fill stockpile at the northeast end of the roadway.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration, the soils at the site may be generally described as follows:

Stiff brown silty and clayey sands with gravel underlain by rock or boulders with clay pockets. Soft underlying materials and recent fills were encountered along the northern section of the route.

Water was encountered in the borings at about 5-ft depth during the field exploration.

For more detailed descriptions of soils encountered in the drill holes, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to extend Hawaii Kai Drive from Wailua Street northeastward about 580 ft.

The preliminary grading plan indicates low fills (less than about 3 ft).

In general, surface soils tested in the laboratory generally indicated expansion properties less than 3% and CBR values ranging from about 9 to 49.

Hard spots may occur along the existing construction road. Some settlement may occur where the underlying soils may be soft.

Site Grading

Guide lines regarding site grading are as follows:

1. In general, the on-site soils may be used for the construction of the proposed fill. If fill material is imported to the site, it should be select non-expansive material with less than 3-in. maximum size and a plasticity index of less than 15.
2. Miscellaneous debris should be cleared and removed prior to site filling.

3. Localized soft pockets should be excavated and backfilled with compacted select material.
4. Hard spots should be removed and the subgrade scarified and recompactd to match the density of the surrounding ground.
5. Fills should be constructed in approximately level layers starting at the lower end and working upward. Fills should be laid in 6-in. compacted layers. The fills below 2 ft from subgrade level should be compacted to a relative density of at least 90% of AASHO T-180-57 density. The fills within the top 2 ft of subgrade should be compacted to 95%.
6. The subgrade should be graded to prevent ponding of water.

Roadway Pavement Section

In general, the pavement thickness for the proposed roadway may be as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course.
3. Subbase course - 6-in. subbase course over a prepared subgrade.

Provisions should be made in the contract documents to allow for local adjustments regarding subbase requirements in the field as ground conditions are exposed at subgrade levels. In general, the subbase thickness will depend upon the type of material within the top 2 ft of subgrade. Where pockets of clay (adobe) soils are exposed at subgrade, an 18-in. subbase layer should be used.

It is recommended that the subgrade be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, subdrains should be placed to drain water from subgrade levels. Where catch basins are placed in low areas, weep holes should be placed at the subgrade levels through the walls of the catch basins which are placed in these low areas.

Utilities

Because of some underlying soft deposits in localized areas, differential settlements are possible. Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures. Gravity flow lines should be made as steep as possible.

Because the invert of the proposed sewer line may extend into soft underlying soil, the excavations should be made in short sections and backfilled as soon as possible. The trenches

should be well braced. Soft spots at the bottom should be excavated and backfilled with select material compacted to match the density of the surrounding ground. A base course layer of filter material should be placed along the bottom of the trench. The material should be well graded from 3/4-in. maximum to dust sizes with less than 10% passing the No. 200 sieve. The thickness of the base course may vary from about 1 ft in firm soil to about 3 ft in soft material.

Unforeseen Conditions

Unforeseen or undetected conditions may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

BORING LOGS

Symbols

Symbols used generally are in accordance with the Unified Soil Classification System.

Where a parenthesis "(MH)" is used, the soil sample was classified by visual observation of the sample recovered.

Where no parenthesis "MH" is used, the soil sample was classified from either the Atterberg limits or sieve analysis test results.

Boring Log HAWAII KAI DRIVE EXTENSION
 PROJECT WAILUA ST. TO KALUANUI SUBD. UNIT 1
 LOCATION Maunaloa, Oahu, Hawaii
 Tax Map Key: 3-9-14

BORING NO. 1 Sheet No. _____ of _____
 Driller WALTER LUM ASOG Date OCT. 5, 1970
 Field Party MAKAULA, HASHIDA
 Type of Boring AUGER (MOBILE) Diam. 4"
 Elev. 6' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level 5.2'
 Time 3:55 PM
 Date 10-5-70

HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
SC	BROWN, MUDROCK W/ BROWN CLAYEY SAND & CORAL FRAGMENTS (FILL)	0		1-A	-	25	-	-	-					
(CH)	DARK BROWN, CLAY PUKA PUKA ROCK LAVA ROCK	5.2	WATER 10-5-70	1-B	-	36	-	-	-					42/5'
	END OF BORING @ 8'													

* ELEVATION ESTIMATED FROM GRADING PLAN

Boring Log

PROJECT HAWAII KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUBD. UNIT 1
 LOCATION Maunaulua, Oahu, Hawaii
 Tax Map Key: 3-9-14

BORING NO. 2 Sheet No. _____ of _____

Driller WALTER LUM ASSOC. Date OCT. 5, 1970

Field Party MAKAULA, HASHIDA

Type of Boring AUGER (MOBILE B-30) Diam. 4"

Elev. G.T. * Datum _____

Drill Bit T.C. DRAG

HAMMER:

Weight 140 #

Drop 30"

3" x 3" O.D. THIN WALL TUBE

SAMPLER: 2" x 2" STANDARD SPLIT SPOON

Water Level 5.5

Time 3:50 PM

Date 10-5-70

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Plastic Limit	Water Cont. %	Liquid Limit	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				3" O.D. THIN WALL TUBE	
										N (Blows per foot)					BLOWS / 0.5'
										0	10	20	30	40	
(MH)	STIFF, MOTTLED BROWN, SILTY CLAY W/SOME SAND GRAVEL & CORAL (FILL)	0 - 2.55	2"SS	2-A	-	34 17	-	-	-						
(SC)	STIFF, GRAY-BROWN, CLAYEY SAND W/ CORAL	2.55 - 5	2"SS	2-B	21	31	74	-	-						
	WATER														
CH	MEDIUM, DARK GRAY CLAY W/SOME SAND & GRAVEL	5 - 10	3"SS	2-C	-	66 88	-	-	-						ONE BLOW / 1.5'
(SC)	LOOSE, GRAY CLAYEY SAND W/ CORAL FRAGMENTS	10 - 15	2"SS	2-D	-	56	-	-	-						35 / 5'
(SM)	MOTTLED BROWN, SILTY SAND W/ DECOMPOSED ROCK	15 - 20	2"SS	2-E	-	42	-	-	-						65 / 5'
	CEMENTED BLACK SAND	20 - 20.5													
	END OF BORING @ 20.5'														

* ELEVATION ESTIMATED FROM GRADING PLAN

HAWAII-KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUB'D UNIT 1

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	BAG SAMPLE	BAG SAMPLE	BAG SAMPLE	
SAMPLE NO.	"A"	"B"	"C"	
DEPTH BELOW SURFACE	SURFACE	SURFACE	SURFACE	
DESCRIPTION	GRAY CLAYEY SAND W/GRAVEL	GRAY-BROWN CLAYEY SAND W/GRAVEL	REDDISH-BROWN SILTY SAND W/GRAVEL	
GRAIN-SIZE ANALYSIS				
(% Passing)				
Sieve 1/2"	91.0	100	100	
1"	89.4	96.9	92.4	
1/2"	82.6	91.1	78.4	
#4	76.0	84.4	67.3	
#10	71.1	78.6	60.9	
#20	64.9	72.5	54.0	
#40	59.0	66.3	47.4	
#100	46.4	47.4	33.2	
#200	41.1	39.9	28.4	
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	
Liquid Limit	36	34	67	
Plastic Limit	18	16	34	
Plasticity Index	18	18	33	
Dilatancy	MEDIUM	QUICK	SLOW	
Toughness	SLIGHT-MED.	SLIGHT	MEDIUM	
Dry Strength	MED.-HIGH	MEDIUM	SLIGHT-MED.	
UNIFIED SOIL CLASSIFICATION				
	SC	SC	SM	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS				
(Surcharge-51 P.S.F.)				
Molding Moisture, %	16.6	13.6	16.7	
Molding Dry Density, P.C.F.	108.2	116.1	107.4	
Swell upon saturation, %	2.6	1.2	NIL	
CBR at 0.1" Penetration	8.9	49.0	30.0	
MOISTURE-DENSITY RELATIONS OF SOILS				
(AASHTO T-180-57 Method)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 10-16-70 By BT

HAWAII-KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUBD. UNIT 1

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

	1		2	
BORING NO.				
SAMPLE NO.	A		B	
DEPTH BELOW SURFACE	1'-2.5'		5'-6.5'	
DESCRIPTION	BROWN CLAYEY SAND & CORAL FRAG.		DARK GRAY CLAY w/ SAND & GRAVEL	
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1"	100			
1/2"	94.9			
#4	83.7			
#10	75.7			
#20	65.9			
#40	57.5			
#100	41.7			
#200	35.8			
ATTERBERG LIMITS				
Air Dried or Natural			NATURAL	
Liquid Limit			74	
Plastic Limit			27	
Plasticity Index			47	
Dilatancy			NONE	
Toughness			HIGH	
Dry Strength			HIGH	
UNIFIED SOIL CLASSIFICATION	SC		CH	
APPARENT SPECIFIC GRAVITY				
EXPANSION AND CBR TESTS (Surcharge-51 P.S.F.)				
Molding Moisture, %				
Molding Dry Density, P.C.F.				
Swell upon saturation, %				
CBR at 0.1" Penetration				
MOISTURE-DENSITY RELATIONS OF SOILS (AASHTO T-180-57 Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

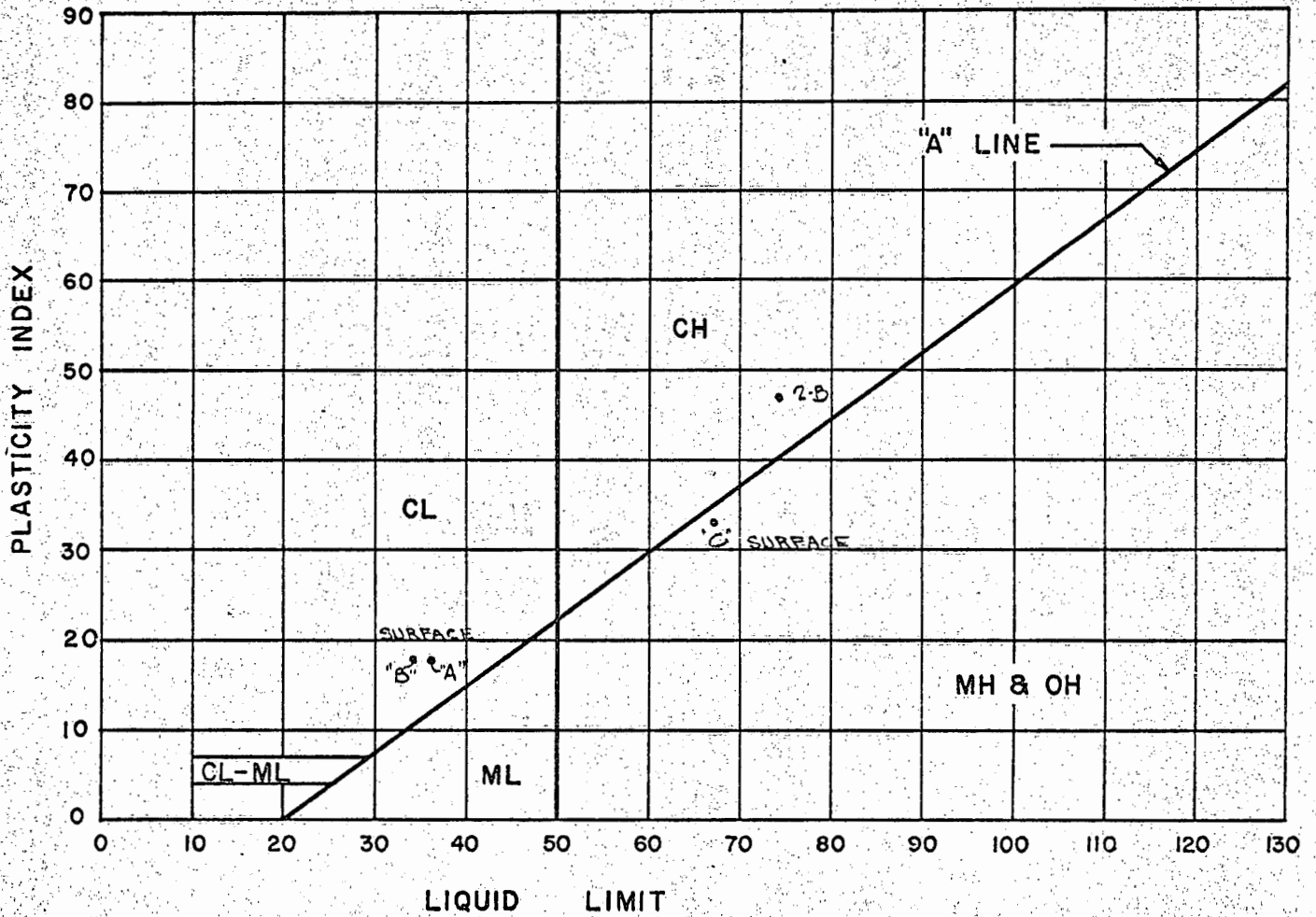
REMARKS:

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 10-16-70 By BT

PLASTICITY CHART

PROJECT: HAWAII-KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUBD. - UNIT 1
LOCATION: MAUNALUA, OAHU, HAWAII



WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

DATE 10-15-70 BY BT

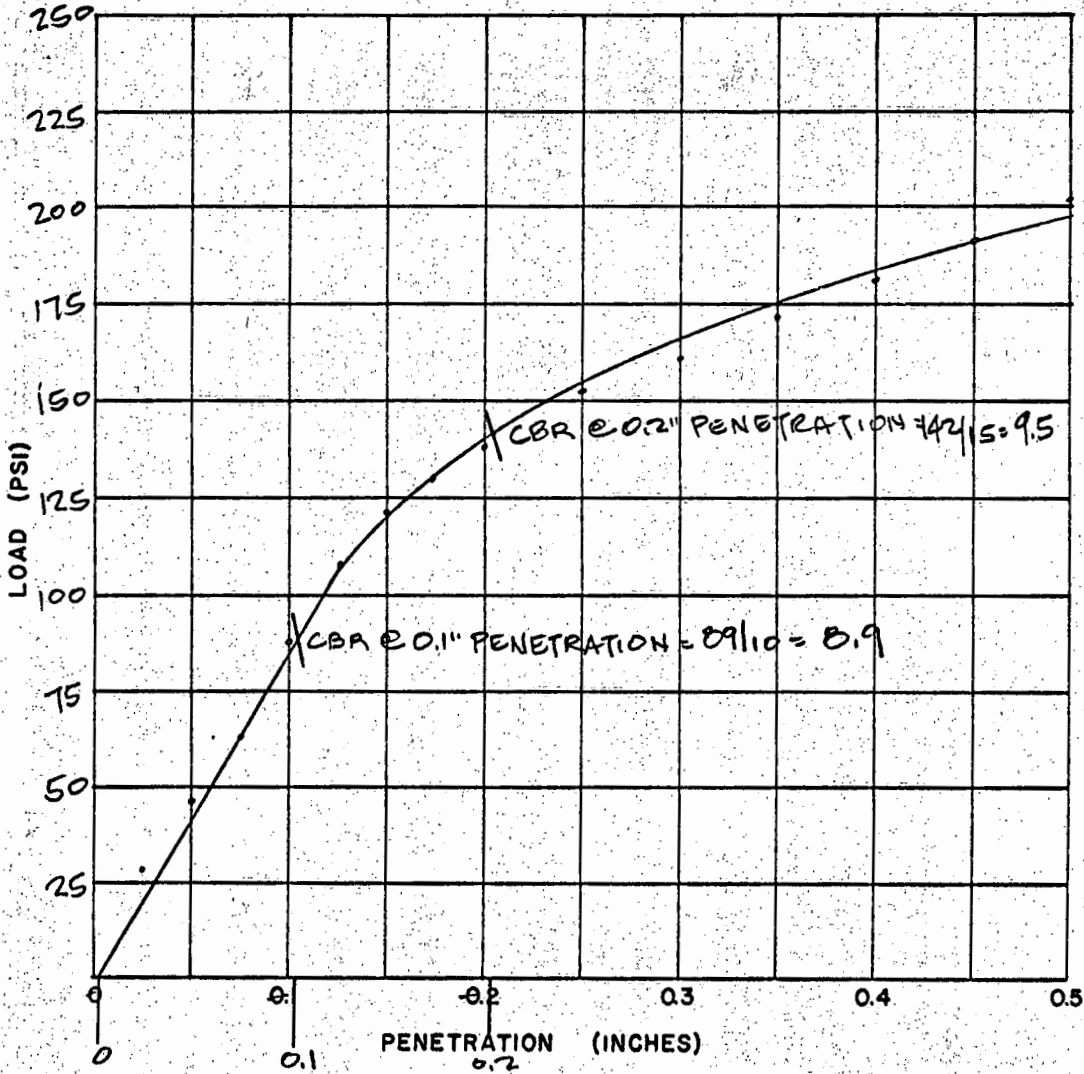
CBR TEST

PROJECT: HAWAII KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUBD. - UNIT 1

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: "A" SURFACE

SAMPLE DESCRIPTION: GRAY CLAYEY SAND W/GRAVEL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	85	28
0.050	140	47
0.075	205	68
0.100	265	88
0.125	325	108
0.150	365	122
0.175	390	130
0.200	415	138
0.250	460	153
0.300	485	162
0.350	515	172
0.400	545	182
0.450	575	192
0.500	605	202

AGGREGATE 3/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18"
No. OF BLOWS 54
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 16.6
MOLDING DRY DENSITY, P.C.F. 108.2
CBR @ 0.1" PENETRATION 8.9

DATE 10-6-70 BY MM
DATE 10-13-70 BY ST

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

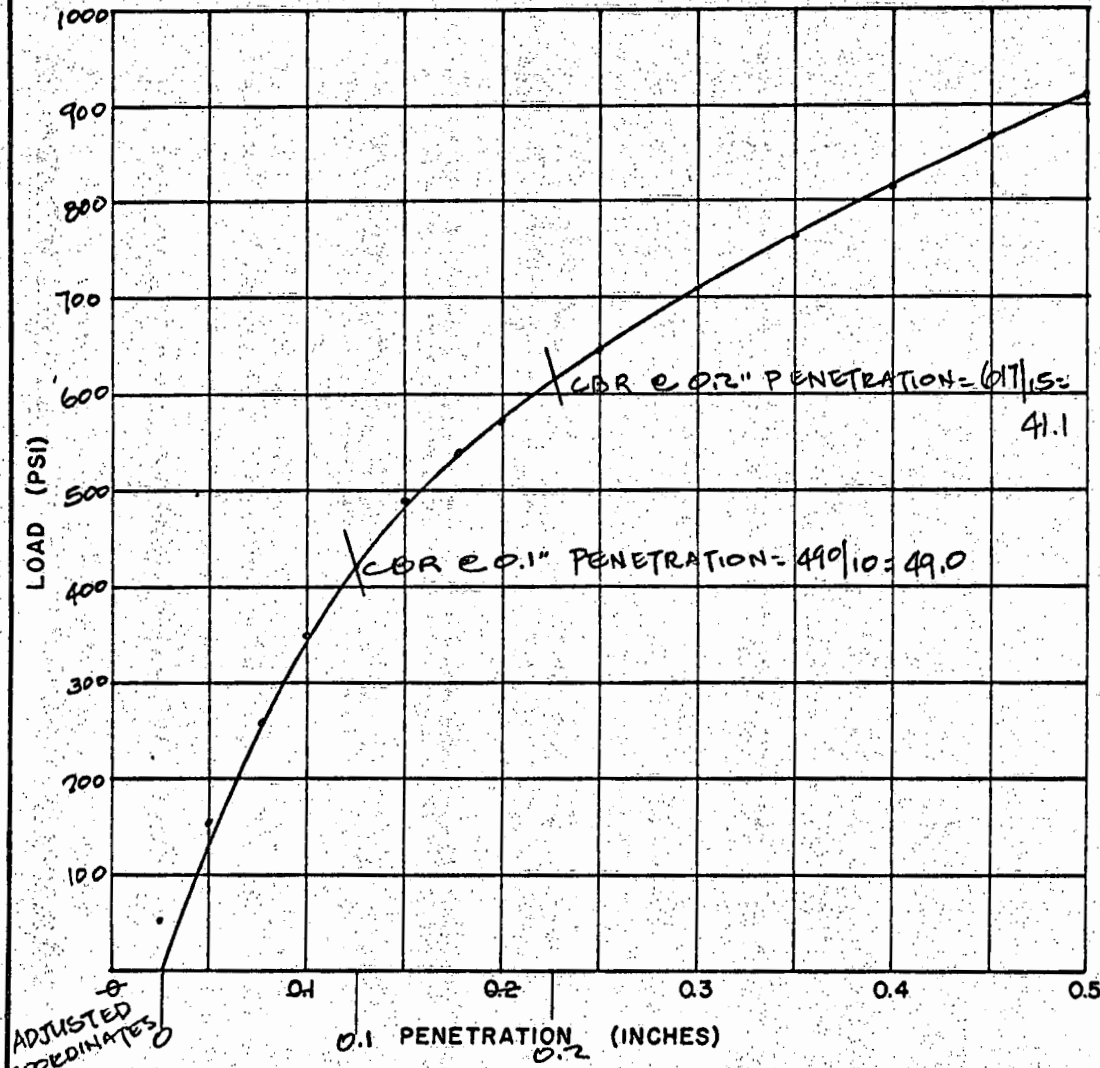
CBR TEST

PROJECT: HAWAII KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUB'D. - UNIT 1

LOCATION: MAUNALUA OAHU, HAWAII

SAMPLE NO: "B" SURFACE

SAMPLE DESCRIPTION: GRAY-BROWN CLAYEY SAND W/ GRAVEL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	160	53
0.050	410	157
0.075	780	260
0.100	1050	350
0.125	1270	423
0.150	1470	490
0.175	1620	540
0.200	1720	573
0.250	1940	647
0.300	2125	708
0.350	2300	767
0.400	2450	817
0.450	2600	867
0.500	2740	913

AGGREGATE 3/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18"
No. OF BLOWS 56
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 13.6
MOLDING DRY DENSITY, P.C.F. 116.1
CBR @ 0.1" PENETRATION 49.0

DATE 10-6-70 BY CM
DATE 10-13-70 BY ST

WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

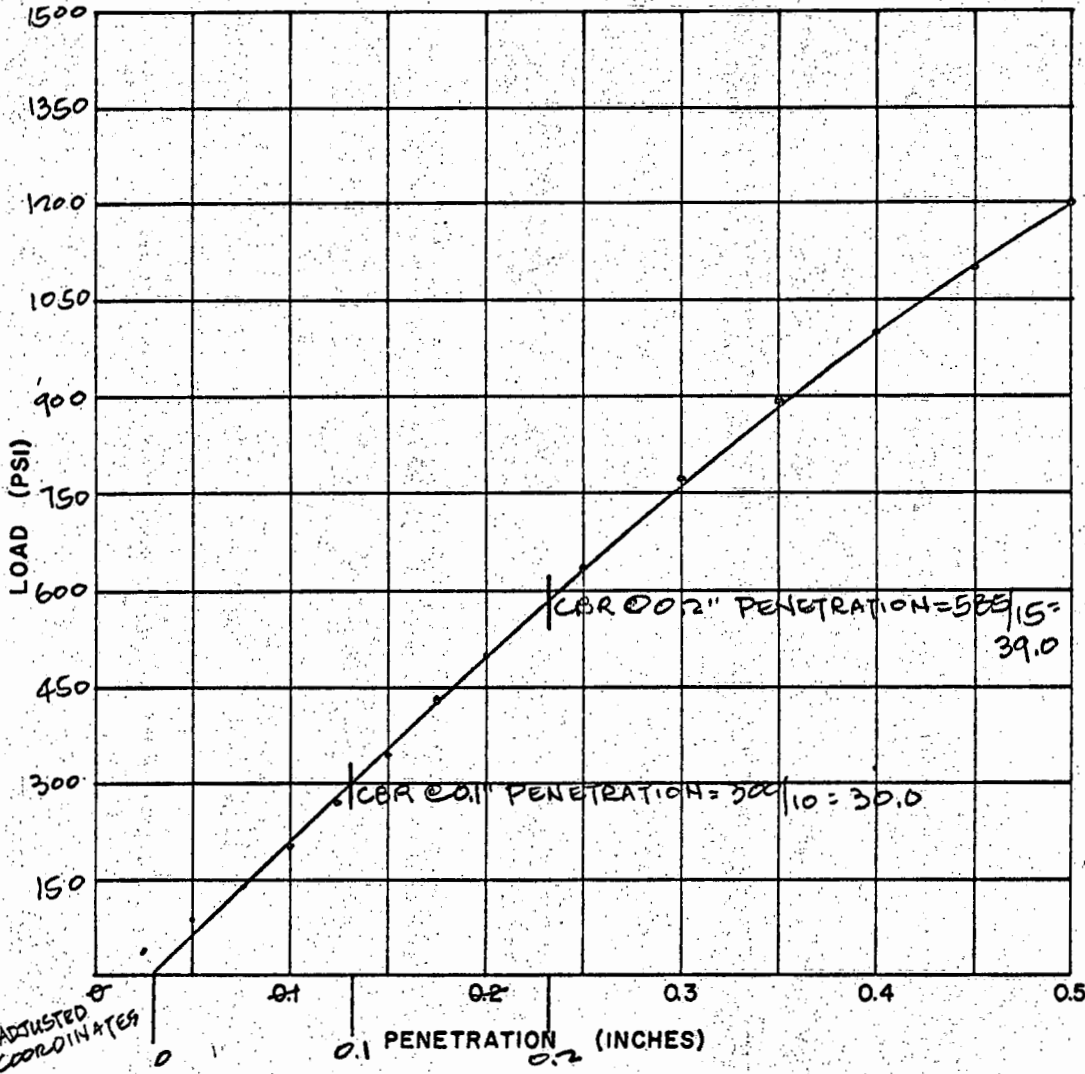
CBR TEST

PROJECT: HAWAII-KAI DRIVE EXTENSION
WAILUA ST. TO KALUANUI SUB'D. - UNIT 1

LOCATION: MAUNALUA, OAHU, HAWAII

SAMPLE NO: "C" SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN SILTY SAND W/ GRAVEL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	110	57
0.050	250	83
0.075	420	140
0.100	600	200
0.125	810	270
0.150	1040	347
0.175	1290	430
0.200	1500	500
0.250	1900	633
0.300	2320	773
0.350	2680	893
0.400	3000	1000
0.450	3300	1100
0.500	3600	1200

AGGREGATE 3/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18"
 No. OF BLOWS 50
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 16.7
 MOLDING DRY DENSITY, P.C.F. 107.4
 CBR @ 0.1" PENETRATION 30.0

DATE 10-6-70 BY CM
 DATE 10-13-70 BY ST

WALTER LUM ASSOCIATES, INC.
 CIVIL, STRUCTURAL, SOILS ENGINEERS

LOGS OF BORINGS

FROM

"KALUANUI UNIT 2 & PART OF UNIT 3"

DATED FEBRUARY 7, 1967

Boring Log

PROJECT KALUANUI UNIT 2 & PART OF UNIT 3

LOCATION HAWAIIKAI, MAUNALUA, OAHU, HAWAII

BORING NO. 11 Sheet No. _____ of _____

Driller WALTER LUM ASSOC. Date 12-2-66

Field Party MAESHIRO, MAKAULA, MAKISHI

Type of Boring ALIGER (McCULLOCH) Diam. 3"

Elev. 5' ± * Datum _____

HAMMER:

Weight _____

Drop _____

SAMPLER: _____

Water Level NOT ENCOUNTERED

Time _____

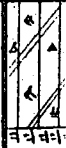
Date 12-2-66

PENETRATION DATA

DESCRIPTION	Depth (Ft.)	Elev.	Sample No.	Wet Dens. P.C.F.	Moist. Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Split Spoon Sampler		2" o.d. thin Wall Tube Sampler		
									Blows Per Foot		Blows/0.5'		
									0	10	20	30	40

EL = 5' ± *

STIFF BROWN
SILTY CLAY w/ GRAVEL
ROCK OR BOULDER



* ELEVATION ESTIMATED FROM GRADING PLAN

LOGS OF BORINGS

FROM

"HAWAII KAI DRIVE - MARINA #10 AREA"

DATED OCTOBER 18, 1966

Boring Log

PROJECT HAWAII KAI DRIVE - MARINA #10 AREA
 LOCATION HAWAII KAI, MAUNALUA, OAHU, HAWAII

BORING NO. 13 Sheet No. _____ of _____

Driller WALTER LUM ASSOC. INC. Date AUG. 15, 1966

Field Party GLORY, TSUKAZAKI, LEE

Type of Boring MOBILE Diam. 3" AUGER

Elev. * 3' ± Datum M.S.L.

HAMMER:

Weight 10 LB. SLEDGE HAMMER

Drop _____

SAMPLER:

2" O.D. SHELBY TUBE

Water Level 5.2'

Time 12:20 PM.

Date 8-15-66

DESCRIPTION	Depth (Ft.)	Elev.	Sample No.	Wet Dens. P.C.F.	Moist. Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Blows Per Foot					SAMPLER PENETRATION			
									0	10	20	30	40	BLOWS/5'			
* EL. = 3' ± STIFF BROWN SILTY CLAY W/ GRAVEL	1		13-A	121.5	36.7	88.9	7800	71900								4/5	8/5
SOFT TO MEDIUM GRAYISH BROWN SILTY CLAY W/ DECOMPOSED ROCK	2																
BOULDER	3																
LOOSE TO MEDIUM BLACK SILTY SAND	4																
	5		13-B	-	34.6 219.9	-	-	-	940	600						4/5	2/5
BROWN PEAT	6																
	7																
	8																
	9																
	10																
	11		13-C	109.0	65.5	65.9	-	-								6/5	4/5 5/5
VERY SOFT TO SOFT WHITE SANDY SILT & CORAL FRAGMENTS W/ TRACE OF SHELL FRAGMENTS	12																
	13																
	14																
LOOSE TO MEDIUM BLACK COARSE SAND W/ CORAL FRAG- MENTS	15		13-D	120.6	23.7	97.5	-	-								100/4	
	16																

*ELEVATION ESTIMATED
FROM TOPOGRAPHIC MAP

LIMITATIONS

In general, soil formations are commonly erratic and rarely uniform or regular. The boring logs indicate the approximate subsurface soil conditions encountered only at the drill holes where the borings were made at the times designated on the logs and may not represent conditions at other locations or at other dates. Soil conditions and water levels may change with the passage of time and construction methods or improvements at the site.

During construction, should subsurface conditions much different from those in the borings be observed, encountered, or otherwise indicated, we should be advised immediately to review or reconsider our recommendations in light of the new developments.

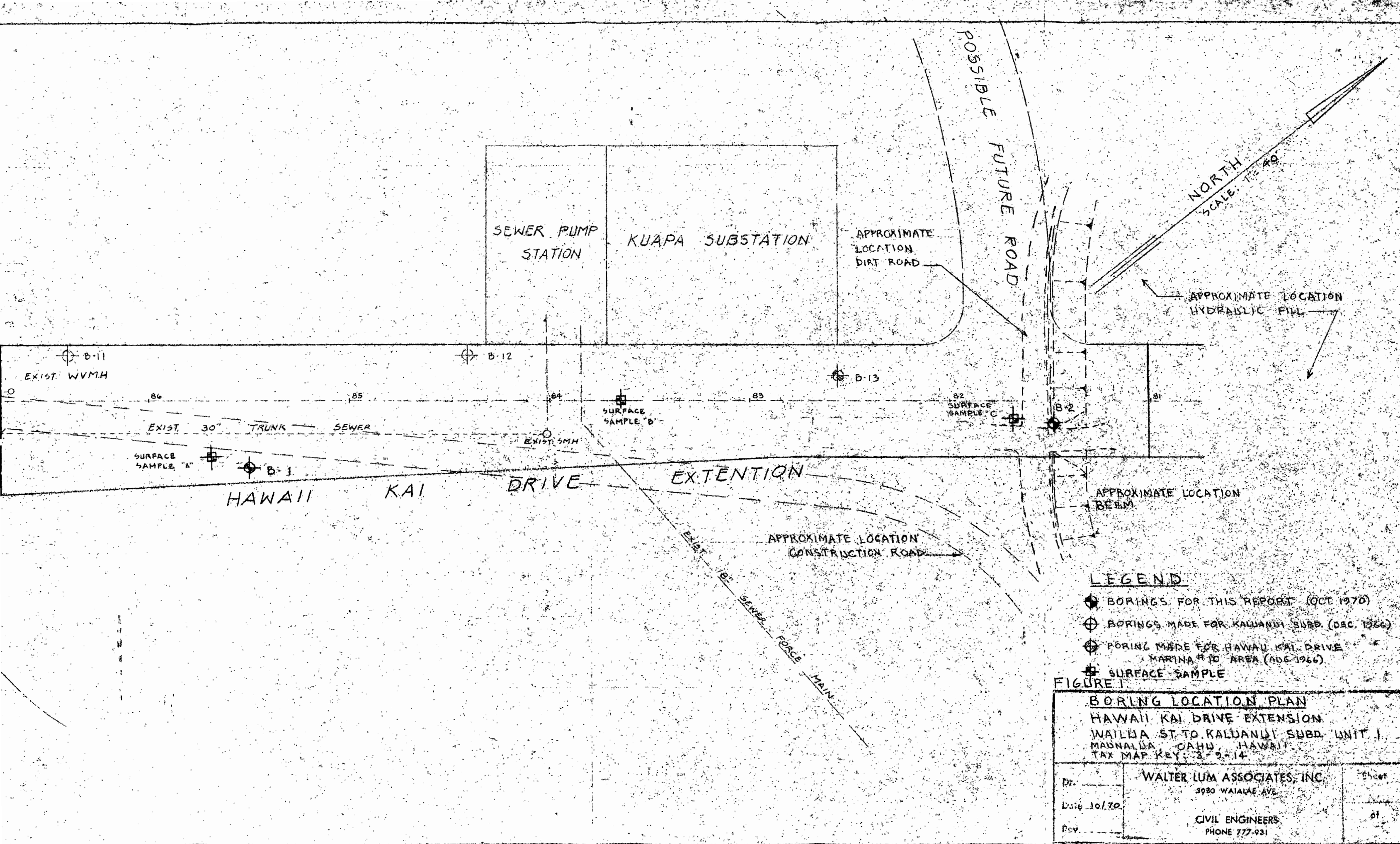
Our professional services were performed, findings obtained and recommendations prepared in accordance with generally accepted engineering practices. This warranty is in lieu of all other warranties expressed or implied.



PROJECT SITE

FIGURE 2
 PROJECT VICINITY MAP
 HAWAII KAI DRIVE EXTENSION
 WAIALUA ST. TO KALUANUI SUBD. UNIT I

MAUNALUA BAY



LEGEND

- BORINGS FOR THIS REPORT (OCT 1970)
- ⊕ BORINGS MADE FOR KALUANUI SUBD. (DEC. 1966)
- ⊕ BORING MADE FOR HAWAII KAI DRIVE MARINA #10 AREA (AUG. 1966)
- ⊕ SURFACE SAMPLE

<p>FIGURE 1 BORING LOCATION PLAN HAWAII KAI DRIVE EXTENSION WAILUA ST. TO KALUANUI SUBD. UNIT 1 MAUNALOA, OAHU, HAWAII TAX MAP KEY: 3-2-14</p>		
<p>Dr. _____</p> <p>Date 10/70</p> <p>Rev. _____</p>	<p>WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVE. CIVIL ENGINEERS PHONE 777-931</p>	<p>Sheet of</p>