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MILILANI TOWN UNIT 33
PRELIMINARY SOIL REPORT

FOR REFERENCE
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No. 673

WAIPIO, EWA, OAHU, HAWAII
TAX MAP KEY: 9-4-05: POR. 1

To:
MILILANI TOWN, INC.

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

JANUARY 14, 1976

MUNICIPAL REFERENCE & RECORDS CENTER
City & County of Honolulu
City Hall Annex, 558 S. King Street
Honolulu, Hawaii 96813

WITHDRAWN

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS

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January 14, 1976

MR. GENE FERGUSON
Mililani Town, Inc.
P. O. Box 2780
Honolulu, Hawaii 96803

Dear Mr. Ferguson:

Subject: Mililani Town Unit 33
Preliminary Soil Report
(for site grading design considerations
for residential development)
Waipio, Ewa, Oahu, Hawaii
Tax Map Key: 9-4-05: Por. 1

Transmitted herewith is our preliminary soil report for site grading design considerations for single-family residential development at the proposed site for Mililani Town Unit 33 at Waipio, Ewa, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory test results, general site grading design guidelines and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Ezra Koike
Ezra Koike

CR/EK:sa

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MILILANI TOWN UNIT 33
PRELIMINARY SOIL REPORT

WAIPIO, EWA, OAHU, HAWAII
TAX MAP KEY: 9-4-05: POR. 1

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for site grading design considerations for single-family residential development for the proposed Mililani Town Unit 33 at Waipio, Ewa, Oahu, Hawaii.

This report includes field explorations, laboratory tests, general site grading design guidelines and limitations.

FIELD EXPLORATION

Ten exploratory borings were made at the site. The approximate locations of these borings are shown on the Boring Location Sketch. Descriptions of the underlying soils encountered are shown on Boring Logs Nos. 1 thru 10.

Borings were made with 4-in. diameter augers using carbide drag and finger-type bits. Soil samples were recovered with 2 and 3-in. o.d. thin-wall tube samplers and a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

Logs of 4 borings from "Mililani Town Unit 29B," October 29, 1974, are attached for reference.

LABORATORY TESTS

Laboratory tests included: natural water content and density, unconfined compression, laboratory vane shear, grain-size analysis, Atterberg limit, specific gravity, ASTM D 1557-70 density and CBR.

A summary of the laboratory test results is given in Tables IA thru ID.

SOIL DESCRIPTION BY OTHERS

From a review of the U. S. Soil Conservation Service maps of the area, the soils are generally described by others as follows:

U. S. Soil Conservation Service, "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii,"

August 1972:

Eastern 1/2 of site

WaA - Wahiawa silty clay, 0 to 3% slopes,

Unified Soil Classification - MH

Western 1/2 of site

FL - Fill land, mixed

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 given on the boring logs are generally made in accordance with the "Unified Soil Classification System."

GENERAL SITE CONDITIONS

The proposed site is located about 1/2 mile west of Kamehameha Highway and 1/2 mile north of Kipapa Gulch Bridge.

The average annual rainfall at the proposed site may range around 30 to 40 inches.

The existing ground slopes down toward the south at gradients of about 2 to 5% with localized variations.

The eastern portion of the site was formerly a pineapple field and the western portion was formerly a cane field. The western portion may be located over part of the old Kipapa Airfield. At the time of the field exploration, the site was overgrown with weeds and brush and crossed by haul roads.

An A.C. paved access road crosses the site in a north-south direction in the central portion of the site. Several small stockpiles of boulders were located along the edge of the access road.

An existing underground concrete structure was noted along the southern boundary of the site (near Boring No. 5).

Along the eastern boundary, Mililani Town Unit 29B was under construction at the time of the field exploration.

INTERPRETATION OF SOIL CONDITIONS

From the field exploration and laboratory test results, the soils encountered in the borings may be approximated as follows:

Stiff to hard, reddish-brown to brown clayey silts (MH) and some silty clays (MH-CH soils) to about 21 ft, the maximum depths drilled.

Water was not noted in the borings during the field explorations.

Variations to the above soil and water conditions are to be expected between borings and in localized areas. For more detailed descriptions of soils encountered in the borings, refer to the boring logs.

DISCUSSION AND RECOMMENDATIONS

The present plan is to clear and grade the site for a single-family residential development.

Although the preliminary grading design has not been done, it is our understanding from discussions that the cuts and fills will generally be less than about 10 ft in height.

Since the western portion of the site may have been part of the old Kipapa Airfield, abandoned structures and utilities may be encountered within the project site; the grading will have to be adjusted and corrected in the field as underground structures and soft areas are detected.

The underground concrete structure located in the vicinity of the proposed roadway along the southern boundary of the site should be removed to

stiff natural ground and the excavation backfilled with selected on-site soils compacted in thin lifts.

Site Grading

Vegetation, rubbish, loose fills and miscellaneous debris should be cleared and removed prior to site filling. Localized hard and soft pockets encountered during the site preparations should be excavated and replaced with selected soils compacted in thin lifts.

In general, selected on-site soils may be used for the construction of the proposed fills.

Grading work should be done in accordance with the Revised Ordinances of Honolulu, 1969 As Amended and as recommended below:

1. The site should be cleared and grubbed.
2. Topsoil, rubbish and stockpiled soils should be stripped to stiff natural ground before placement of fills.

Thin layers of loose surface soils near finish or existing grade should be scarified and recompactd.

3. Hard surfaces along existing access roadways and haul roads should be scarified and recompacted to match the density of the surrounding soil.
4. If drainage or old irrigation ditches are encountered, the bottoms and sides of the existing drainage ditches should be stripped down to stiff natural ground or scarified and recompacted before the placement of fills.
5. Fills should be constructed in approximately level layers starting at the lower end and working upward. Where fills are made on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill should be benched to a generally level condition. As the fill is brought up, it should continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

6. If boulders are proposed to be used in the construction of fills, they generally should be placed along the toe sections of fill slopes and outside of probable building sites. Before placement of boulders, the subgrade should be stripped to stiff natural ground and shaped to drain. A transition layer of select granular material (6 in. to dust sizes) should be placed on the subgrade and the boulders should be placed on the select material. Earth fill may be used in the void spaces between boulders. A transition layer of select granular material should also be placed against the boulders before earth fills are placed against the boulders. See attached sketch, Figure 1.
7. In general, fills should be laid in 6-in. compacted layers to 90% of the maximum density determined by the ASTM D 1557-70 test method. In roadway areas, the top 2 ft of fill should be compacted to 95% of the maximum density.
8. Provisions to drain the site during and after the completion of filling operations should be included.

Slopes

Generally, cut and fill slopes of 2 horizontal to 1 vertical or flatter should be used.

If slope heights (top to toe) of greater than 15 ft are considered, 8-ft-wide benches should be placed at height intervals of about 15 ft. Slopes should be limited to 30 ft in height, wherever practicable.

To lessen erosion, the runoff from rainstorms should be diverted away from slopes by berms or ditches wherever practicable. Slope planting is recommended on cut and fill slopes.

The surface of fill slopes should be compacted by cat-tracking or with a sheepsfoot roller.

Slope adjustments or other precautions may be necessary if seepage zones, expansive clay pockets or soft spots are encountered in localized areas. In general, when clay pockets are encountered in cut slopes, the slopes should be adjusted by flattening the slope or by removing the clay "CH" soils and reconstructing the slopes with select granular material compacted in thin lifts.

Regrading of slopes, cutting and removing the toes of slopes, constructing walls and structures on slopes, placing utility trenches on slopes or along the toes of slopes, etc., can cause slope instability problems. These conditions will require special attention, otherwise, field adjustments may be required when they are detected.

Foundations

In general, single-family, light, wood-frame residential structures are contemplated.

On fairly level lots, where the buildings are situated 15 ft from the tops of slopes, conventional house foundations such as beam-on-post type or slab-on-ground type foundations may be considered for the general area.

Where the topography is not level, or at locations where existing structures are encountered, or the structures contemplated are relatively large or odd-shaped units, the design of foundations should be done on an individual lot basis.

Other general guidelines for foundation design considerations are as follows:

1. Footings should be placed on existing stiff ground or on well-compacted fill.
2. Soft spots or pockets of loose material encountered in footing excavations or below the building area should be excavated and replaced with well-graded granular material.
3. Bearing values for a given soil usually vary with the size and depths of footings. For light residential structures, bearing values of about 2000 p.s.f. may be used for footings on stiff natural ground or on compacted fill.

4. Where slab on ground construction will be over the deeper fills, house construction should be delayed as long as practicable to allow the fill and subsoils to adjust to the new load conditions.
5. Where slab on ground is considered over clayey silts, the subgrade should be scarified and recompacted at water contents above the plastic limit. This will lessen up and down movements or expansive effect of the natural soils in areas where the moisture content may be below the optimum moisture content.
6. Concrete slabs on ground should be placed over a base course of 4 in. of well-graded gravel less than 3/4-in. in size and greater than 1/4-in. in size or some other form of capillary break should be provided. The subgrade should be compacted and shaped to a level surface or to drain, if practicable, and generally should be kept slightly higher than the finish grade of the outside of the houses.
7. A few units may be partly on cut and partly on fill. For slab-on-ground construction, to lessen differential settlements that may

occur, the cut area below the unit should be excavated to a depth of about 2 ft and recompacted to match the density of the fill area.

8. For slab on ground construction over clayey soils, the surface clay (CH soil) should be removed and replaced with 3 ft of select non-expansive soil below the slabs and foundations. Prior to placing and compacting the selected soil, the moisture content of the clay soils at the bottom of the excavation should be on the wet side of optimum moisture and not allowed to dry-out.
9. If practicable, particularly where clay or expansive soils are detected, the houses should be designed with flexible super-structures to accomodate some up and down movements of the ground surface resulting from environmental or weather changes.
10. Foundations located over or adjacent to a utility trench should be designed to span over the trench or the footings should extend below the bottom of the trench.

11. Construction of retaining walls on slopes should generally be avoided.
12. Good surface drainage away from the foundations of structures should be maintained and the site should be graded to prevent the ponding of water.

Joint Details

To lessen the heave or wavy surface effects at the ground floor level, nonbearing partitions, doors, cabinets, etc., should be designed with loose fits and other precautions to allow for some future adjustments or maintenance.

Roadways

In general, for light automobile traffic and drained subgrade conditions, an estimate of the roadway pavement thickness for the general soil conditions may be as follows:

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

Provisions in the contract documents should allow for local adjustments regarding select borrow subbase and borrow requirements in the field in accordance with the design standards of the City and County of Honolulu. In fill areas, the use of select soils within the top 2 to 3 ft of the subgrade may reduce the thickness of or eliminate the need for the select borrow subbase or borrow courses.

The subgrade should be compacted and shaped to drain. To avoid the ponding of water and softening of the subgrade at low points, weep holes should be placed at subgrade levels thru the walls of the catch basins placed in these low areas.

Utilities

Utilities should be placed after the fills are constructed. The bottoms of utility trenches should be daylighted at low points and graded to drain water, particularly near the tops and toes of slopes. The backfill of trenches should be well-compacted, particularly at the toes of slopes.

Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Unforeseen Conditions

Because of the variability of soil deposits, site improvements, designs and construction techniques, existing or changed conditions may be encountered that cannot be foreseen with even the most exhaustive studies of site and project conditions. These unforeseen conditions should be recognized and then evaluated so that the designs or the construction methods may be modified accordingly, if necessary.

Unforeseen or changed or undetected conditions such as soft spots, existing utility trenches, underground structures, pipes, voids or cavities, old tunnels, boulders, expansive soil pockets, seepage water, or water level changes with weather, etc., may occur in localized areas and will have to be adjusted and corrected in the field as they are detected.

Site Regrading

After mass grading work is done and cuts and fills are made according to the grading plans, regrading at some future date should be avoided unless done under the guidance of a soils engineer.

PROPOSED SPECIFICATION FOR EARTHWORK

MILILANI TOWN UNIT 33

I. GENERAL GRADING REQUIREMENTS

Grading work shall conform to Chapter 23 of Revised Ordinances of Honolulu, 1969 as amended.

II. SPECIFICATIONS FOR ON-SITE EARTHWORK

A. Scope of Work

The work to be performed under these specifications includes the furnishing of labor, materials, tools and equipment for the earthwork at Mililani Town Unit 33. The work includes the preparation of the site, the excavation of materials and the placement of fill materials in accordance with the specifications and applicable plans, together with guidelines included in the preliminary soil report for this project.

B. Soil Engineer

The services of a soil testing firm shall be used. A soil technician shall be present at the site on an intermittent basis to observe grading progress and to take density tests.

A reasonable time shall be allotted to perform field and laboratory tests prior to the placement of additional fill.

The density test results shall be transmitted to the Contractor and to Mililani Town, Inc. Where low density test results are noted, the area shall be rerolled by the Contractor and retested by the Soils Engineer if, in his opinion, a test is necessary.

If the field observations and test results, in the opinion of the Soils Engineer, indicate that the earthwork is not in general conformance to the intent of the plans and soil report, the discrepancy shall be reported to the Contractor and the project representative from Mililani Town, Inc. for corrective action.

C. Clearing, Grubbing and Preparing Areas to be Filled

Vegetation, rubbish and miscellaneous material shall be removed and disposed of, leaving the disturbed area with a neat, debris-free appearance.

Topsoil, stockpiled soils and localized soft pockets shall be stripped to stiff natural ground before the placement of fills. Loose surface soils encountered at finish grade shall be scarified and recompacted.

Hard surfaces such as access roadways, haul roads, etc., shall be scarified to a depth of about 12 in. and recompacted to approximately match the density of the surrounding soils.

Loose material at the bottoms and sides of drainage ditches and natural drainageways shall be stripped down to stiff natural ground before the placement of fills.

Silting basins shall be drained and loose and soft soils shall be stripped down to stiff ground and the backfill shall be compacted in accordance with Section II-E, "Placing, Spreading and Compacting Fill Material."

Where fills are constructed on sloping areas steeper than about 5 horizontal to 1 vertical, the ground at the toe of the fill shall be benched to a generally level condition. As the fill is constructed in approximately level layers, it shall continually be keyed into the stiff natural ground by cutting steps into the slopes and compacting the fill into these steps.

Known abandoned utility lines and abandoned lines encountered during construction shall be removed and the trench recompacted to approximately match the density of the surrounding area but generally not less than 90% of ASTM D 1557-70 maximum density. Field adjustments may be considered where deep utility lines are encountered.

D. Materials

Fill material shall consist of on-site soils or approved borrow soils. The soils shall contain no more than a trace of organic and deleterious matter.

Borrow soils shall be selected soils generally less than 6-in. maximum size, with more than about 30% fines.

Fill material placed in the top 2 ft of fills shall generally be less than about 3-in. maximum size with more than about 30% fines.

E. Placing, Spreading and Compacting Fill Material

The selected fill material shall be placed in level layers which, when compacted, shall not exceed 6 inches. Each layer shall be spread evenly and blade-mixed during the spreading to attain uniformity of material and water content within each layer.

Rocks or cobbles shall not be allowed to nest and voids between rocks shall be filled and compacted with small stones or earth.

When the water content of the fill material is well below the optimum for compacting purposes, water shall be added until the water content is near the optimum.

When the water content of the material is well above the optimum for compacting purposes, the fill material shall be aerated by blading or by other satisfactory methods until the water content is near the optimum.

After each layer has been placed, mixed and spread evenly, it shall be compacted to 90% of maximum density in accordance with ASTM D 1557-70 or other comparable density tests. For fills in roadway areas, the top 2 ft of fill shall be compacted to 95% of the maximum density.

Compaction shall be with sheepsfoot rollers, multiple-wheel pneumatic-tired or other acceptable rollers which shall be able to compact the fill to the specified density. Rolling shall be accomplished while the fill material is at the specified water content. The rolling of each layer shall be continuous over its entire area and the roller shall make sufficient passes to obtain the desired density.

Field density tests shall be made to get an indication of the compaction of the fill. Where sheepsfoot rollers are used, the soils may be disturbed to a depth of several inches. Density readings shall be taken in the compacted material below the disturbed surface. When these readings indicate that the density of any layer of fill or portion thereof is below the required density, that layer or portion shall be reworked until the required density has been obtained.

The fill operation shall be continued in 6-in. compacted layers, as specified above, until the fill has been brought to the finished slopes and grades as shown on the accepted plans.

F. Slope Adjustments

If clay soils are encountered in cut slopes, the slopes shall be adjusted by use of flatter slopes or by removal of the clay "CH" soils and reconstruction of the slopes with select granular materials. The actual remedial measures will depend upon field conditions.

G. Boulder Fills

If boulders are used for the construction of fills, they shall be generally placed along the toe sections of slopes and outside of probable building sites. The subgrade shall be stripped to stiff natural ground, shaped to drain and a transition layer of select granular material (maximum 6-in. to dust sizes) shall be placed on it. Smaller granular materials shall be used in the void spaces between boulders. A transition layer of select granular material shall be placed against the boulder fill before construction of fills.

H. Excess Boulders

Excess boulders not used for construction shall be removed from the project site by the Contractor.

I. Excavation

Suitable material from excavation shall be used in the fill and unsuitable material from excavation shall be disposed of.

J. Unforeseen Conditions

If unforeseen or undetected soil conditions such as soft spots, new and existing utility trenches, structure foundations, voids or cavities, boulders, seepage water or expansive soil pockets, etc., are encountered, corrective measures shall be made in the field as they are detected.

K. Rainy Weather

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rain, fill operations shall not be resumed until field tests indicate that the water content and density are as previously specified.

BORING LOGS

The stratification lines shown on each of the boring logs represent the approximate boundary between soil types and the transition may be gradual.

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 limit or grain-size analysis test results.

Boring Log

PROJECT MILILANI TOWN UNIT 33

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-05: Por. 1

HAMMER:

Weight 140#

Drop 30"

2'SS - 2" STANDARD SPLIT SPOON

SAMPLER: 3'S - 3" O.D. THIN WALL TUBE

BORING NO. 1 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 4, 1975

Field Party MEYER, KALI, ASATO

Type of Boring AUGER (MOBILE B-40) Diam. 4"

Elev. 558' ± * Datum _____

Drill Bit T.C. DRAG

Water Level NOT NOTICED

Time _____

Date 12-4-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	STIFF, REDDISH BROWN SILTY CLAY	0	2'SS	1-A	-	36	-	-	-					
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT W/TRACES OF DECOMPOSED ROCK	2.5	2'SS	1-B	-	28	-	-	-					
	COBBLES	5	3'S	1-C	-	27	-	-	-					7/0.5 TUBE SMASHED
MH-CH	STIFF DARK REDDISH BROWN SILTY CLAY	7.5	2'SS	1-D	-	25	LL= 56 PL= 30	-	-					
MH	HARD, REDDISH BROWN SILTY CLAY	10	2'SS	1-E	-	27	LL= 71 PL= 35	-	-					40/0.5
MH	HARD, MOTTLED BROWN SILTY CLAY	15	2'SS	1-F	-	31	LL= 79 PL= 37	-	-					50/0.5
	COBBLES OR BOULDERS?	20	2'SS	1-G	-	NO RECOVERY	-	-	-					50/0.5 HAMMER BOUNCES
	END OF BORING @ 20' 12-4-75													

NOTE:

LL= LIQUID LIMIT
PL= PLASTIC LIMIT

*ELEVATION ESTIMATED FROM TOPD MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1

BORING NO. 2 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 4, 1975
 Field Party MEYER, KAU, ASATO
 Type of Boring AUGER (MOBILE P-40L) Diam. 4"
 Elev. 558' ± * Datum _____
 Drill Bit T.C. DRAG

HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
3" S - 3" O.D. THIN WALL TUBE

Water Level	NOT NOTICED			
Time				
Date	12-4-75			

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				3" O.D. THIN WALL TUBE Blows/0.5'	
										N (Blows per foot)	0	10	20		30
(MH)	STIFF, BROWN SILTY CLAY w/TRACES OF CORAL (FILL?)	0	2"SS	2-A	-	34	-	-	-						
(MH)	STIFF, BROWN SILTY CLAY w/CORAL (FILL?)	5	3" S	2-B	125	20	104	3,450	-						7/0.5 17/0.5
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	5	2"SS	2-C	-	30	-	-	-						
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	7	2"SS	2-D	-	31	-	-	-						
(MH)	HARD, MOTTLED BROWN CLAYEY SILT	10	2"SS	2-E	-	27	-	-	-						67
(MH)	HARD, REDDISH BROWN SILTY CLAY	15	3" S	2-F	106	29	83	12,400	-						20/0.5
(MH)	HARD, REDDISH BROWN SILTY CLAY	20	2"SS	2-G	-	30	-	-	-						72

END OF BORING @ 21.5'
12-4-75

* ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1

BORING NO. 3 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 5, 1975
 Field Party MEYER, KAU, ASATO
 Type of Boring Auger (MOBILE P-40) Diam. 4"
 Elev. 561' ± * Datum _____
 Drill Bit FINGER TYPE

HAMMER:
 Weight 140*
 Drop 30"
 2" SS - 2" STANDARD SPLIT STON
 2" S - 2" O.D. THIN WALL TUBE
 SAMPLER:
 3" S - 3"

Water Level	NOT NOTICED			
Time				
Date	12-5-75			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA													
										Standard Penetration Test					2" & 3" O.D. THIN WALL TUBES								
										N (Blows per foot)													
										0	10	20	30	40	BLOWE/0.5'								
(MH)	STIFF MOTTLED BROWN CLAYEY SILT w/ TRACES OF ROOTS & CORAL	0	2" SS	3-A	-	33	-	-	-														
(MH)	STIFF, BROWN SILTY CLAY	5	2" S	3-B	120	33	90	5280	-												4/0.5 5/0.5 9/0.5		
(MH)	STIFF, MOTTLED BROWN SILTY CLAY	5	2" SS	3-C	-	34	-	-	-														
			3" S	3-D	114	37	84	3,610	1,600													7/0.5 11/0.5 15/0.5	
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	10	2" SS	3-E	-	32	-	-	-													42	
(MH)	STIFF, TAN CLAYEY SILT	15	2" SS	3-F	-	32	-	-	-														
(MH)	STIFF, BROWN CLAYEY SILT	20	2" SS	3-G	-	30	-	-	-														46
	END OF BORING @ 21.5'																						
	12-5-75																						

*ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-05: Por. 1

BORING NO. 4 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date DEC. 5, 1975

Field Party MEYER, KAU, AGATO

Type of Boring AUGER (MOBILE B-40) Diam. 4"

Elev. 564' ± * Datum _____

Drill Bit FINGER TYPE

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON

2" S - 2" O.D. THIN WALL TUBE

3" S - 3"

Water Level NOT NOTICED

Time _____

Date 12-5-75

PENETRATION DATA

Standard Penetration Test	2" & 3" O.D. THIN WALL TUBES
N (Blows per foot)	0 10 20 30 40
	BLOWS/0.5'

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
(MH)	STIFF, BROWN CLAYEY SILT	0	2"SS	4-A	-	35	-	-	-					
			2"SS	4-B	120	31	92	5,790	2,000+					6/0.5 9/0.5 8/0.5
MH-GH	STIFF TO MEDIUM REDDISH BROWN SILTY CLAY	5	2"SS	4-C	-	32	-	-	-					
			3"SS	4-D	110	41	78	-	2,050 2,250 1,900					4/0.5 6/0.5 10/0.5
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	10												
MH	STIFF, REDDISH BROWN CLAYEY SILT		2"SS	4-E	-	35	-	-	-				45	
							LL= 53 PL= 34							
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	15	3"SS	4-F	111	33 35	83	3,260	-					6/0.5 14/0.5
MH	STIFF, REDDISH TAN CLAYEY SILT	20	2"SS	4-G	-	37	-	-	-					
							LL= 58 PL= 36							
	END OF BORING @ 21.5'													
	12-5-75													

NOTE:
LL= LIQUID LIMIT
PL= PLASTIC LIMIT

* ELEVATION ESTIMATED FROM TOPO MAP REC'D. 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33

BORING NO. 5 Sheet No. _____ of _____

LOCATION Waipio, Ewa, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date DEC. 4, 1975

Tax Map Key: 9-4-05: Por. 1

Field Party METER, KAU, ASATO

Type of Boring AUGER (MOBILE E-4D) Diam. 4"

HAMMER: Weight 140#

Elev. 555' ± * Datum _____

Drop 30"

Drill Bit FINGER TYPE

SAMPLER: 2" S - 2" STANDARD SPLIT SPOON
3" S - 3" O.D. THIN WALL TUBE

Water Level NOT NOTICED

Time _____

Date 12-4-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										3" O.D. THIN WALL TUBE					
	ELEV. = 555' ± *									N (Blows per foot)					
										0	10	20	30	40	BLOWS/D.F.
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY w/ SOME GRAVEL & CORAL (FILL?)	0 - 2'	2"SS	5-A	-	30	-	-	-						
(MH-GH)	HARD, REDDISH BROWN SILTY CLAY	2' - 10'	2"SS	5-B	-	27	-	-	-						40/0.5
		10 - 15'	3" S	5-C	110	28	86	-	-						20/0.5
(MH)	HARD MOTTLED BROWN-RED CLAYEY SILT	15' - 20'	2"SS	5-D	-	31	-	-	-						53
(MH)	STIFF, MOTTLED BROWN, RED & GRAY CLAYEY SILT (DECOMPOSED ROCK)	20' - 21.5'	2"SS	5-E	-	30	-	-	-						
	END OF BORING @ 21.5' 12-4-75														

*ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-12-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-05: Por. 1

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPUN

BORING NO. 6 Sheet No. _____ of _____

Driller W. LUM ASSOC. INC. Date DEC. 8, 1975

Field Party MEYER, KAKU, AGATO

Type of Boring AUGER (MOBILE P-20) Diam. 4"

Elev. 556' ± X Datum _____

Drill Bit FINGER TYPE

Water Level NOT NOTICED

Time _____

Date 12-8-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
	ELEV. = 556' ± 3*	0								0	10	20	30	40
(MH)	STIFF TO HARD DARK REDDISH BROWN CLAYEY SILT	0 - 3		6-A	-	32	-	-	-					
(MH)	HARD DARK REDDISH BROWN SILTY CLAY	3 - 5		6-B	-	32	-	-	-					42
(MH)	HARD, REDDISH BROWN CLAYEY SILT	5 - 10		6-C	-	32	-	-	-					48
(MH)	HARD, REDDISH BROWN CLAYEY SILT	10 - 15		6-D	-	32	-	-	-					50
(MH)	HARD, TAN BROWN CLAYEY SILT	15 - 20		6-E	-	33	-	-	-					32/0.5' 15/0.1'
(MH)	HARD, BROWNISH RED SILTY CLAY	20 - 21.1		6-F	-	40	-	-	-					59
(MH)	HARD, BROWNISH RED SILTY CLAY	21.1 - 22.1		6-G	-	36	-	-	-					35/0.5' 15/0.1'
	END OF BORING @ 21.1 12-8-75													

*ELEVATION ESTIMATED FROM TOPO MAP REC'D. 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33

BORING NO. 7 Sheet No. _____ of _____

LOCATION Waipio, Ewa, Oahu, Hawaii

Driller W. LUM ASSOC., INC. Date DEC. 4, 1975

Tax Map Key: 9-4-05: Por. 1

Field Party MEYER, KAU, ASATO

Type of Boring AUGER (MOBILE P-40) Diam. 4"

HAMMER:

Elev. 559 ± * Datum _____

Weight 140#

Drill Bit T.C. DRAG

Drop 30"

Water Level NOT NOTICED

SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
2" S - 2" O.D. THIN WALL TUBE

Time _____

Date 12-4-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" O.D. THIN WALL TUBE FLOWS/D.5'
										N (Blows per foot)					
										0	10	20	30	40	
(MH)	STIFF, BROWN CLAYEY SILT W/ TRACES OF CORAL	0	2"SS	7-A	-	32	-	-	-						
			2" S	7-B	-	32 33 31	-	-	-						4/0.5 5/0.5 5/0.5
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	5	2"SS	7-C	-	35	-	-	-						
			2" S	7-D	122	31 30	93	10,150 10,500	-						6/0.5 8/0.5 8/0.5
(MH)	STIFF, REDDISH BROWN CLAYEY SILT	10	2"SS	7-E	-	33	-	-	-						
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT	15	2"SS	7-F	-	39	-	-	-						
(MH)	HARD, BROWN CLAYEY SILT	20	2"SS	7-G	-	33	-	-	-						42
	END OF BORING @ 21.5 12-4-75														

* ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1
 HAMMER:
 Weight 140#
 Drop 30"
2'SS - 2" STANDARD SPLIT SPDN
 SAMPLER: 2'S - 2" O.D. THIN WALL TUBE

BORING NO. B Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 8, 1975
 Field Party MEYER, KAKU, ASATO
 Type of Boring AUGER (MOBILE 8-4-2) Diam. 4"
 Elev. 554' ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 12-8-75

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA					
										Standard Penetration Test				2" O.D. THIN WALL TUBE	
	ELEV. = 554' ± *									N (Blows per foot)					
										0	10	20	30	40	BLOWS/0.5'
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY W/ TRACES OF ROOTS	0 - 2	2"SS	B-A	-	32	-	-	-						
(MH-CH)	HARD, REDDISH BROWN SILTY CLAY	2 - 5	2"SS	B-B	114	29	89	6,430	-						8/0.5' 14/0.5'
		5 - 7	2"SS	B-C	-	31	-	-	-						52
		7 - 9	2"SS	B-D	-	33	-	-	-						67
(MH)	HARD, DARK BROWN SILTY CLAY	9 - 11	2"SS	B-E	-	34	-	-	-						69
		11 - 13	2"SS	B-F	-	37	-	-	-						43
(MH)	HARD, MOTTLED BROWN CLAYEY SILT	13 - 21.5	2"SS	B-G	-	38	-	-	-						50
	END OF BORING @ 21.5 12-8-75														

* ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER:
2"SS - 2" STANDARD SPLIT SPION
2"S - 2" O.D. THIN WALL TUBE
3"S - 3"

BORING NO. 9 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 5 1975
 Field Party MEYER, KAU, ASATO
 Type of Boring ALGER (MIDDLE B-42) Diam. 4"
 Elev. 558 ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 12-5-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					2" & 3" O.D. THIN WALL TUBES
										N (Blows per foot)					
										0	10	20	30	40	BLOWS/0.5'
(MH)	STIFF DARK REDDISH BROWN SILTY CLAY W/ TRACES OF ROOTS & SAND	0	2"SS	9-A	-	31	-	-	-						
(MH)	STIFF, REDDISH BROWN SILTY CLAY	5	2"S	9-B	121	31	92	7,480	-						9/0.5' 11/0.3'
(MH)	STIFF DARK MOTTLED BROWN CLAYEY SILT	10	2"SS	9-C	-	31	-	-	-						
(MH)	STIFF, REDDISH BROWN CLAYEY SILT	15	2"SS	9-D	-	32	-	-	-						
(MH)	STIFF, REDDISH BROWN CLAYEY SILT	20	2"SS	9-E	-	36	-	-	-						
(MH)	COBBLE? STIFF, MOTTLED BROWN CLAYEY SILT (DECOMPOSED ROCK)	20.9	3"S	9-F	-	34	-	-	-						
(MH)	STIFF, MOTTLED BROWN CLAYEY SILT (DECOMPOSED ROCK)	20.9	3"S	9-G	110	39	79	-	-						9/0.5' 12/0.4' HAMMER BOUNCES
	END OF BORING @ 20.9'														
	12-5-75														

* ELEVATION ESTIMATED FROM TOPO MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

Boring Log

PROJECT MILILANI TOWN UNIT 33
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1
 HAMMER: Weight 140#
Drop 30"
 SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON
2" S - 2" O.D. THIN WALL TUBE
3" C. 3"

BORING NO. 10 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date DEC. 5, 1975
 Field Party MEYER, KAU, ASATO
 Type of Boring Auger (MOBILE B-20) Diam. 4"
 Elev. 556' ± * Datum _____
 Drill Bit FINGER TYPE
 Water Level NOT NOTICED
 Time _____
 Date 12-5-75

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										2" & 3" O.D. THIN WALL TUBES					
	ELEV.: 556' ± *	0								N (Blows per foot)					
										0	10	20	30	40	Blows/0.5'

(MH)	STIFF DARK REDDISH BROWN SILTY CLAY	0-5	2" S	10-A	105	31	80	-	2,000+						2/0.5 4/0.5 5/0.5
MH	STIFF REDDISH BROWN CLAYEY SILT	5-7	2" SS	10-B	-	30	-	-	-						
		7-8	3" S	10-C	109	33	82	-	-						10/0.5 20/0.5
MH-GH	STIFF, REDDISH BROWN SILTY CLAY	8-10	2" SS	10-D	-	33	-	-	-						
		10-11	2" SS	10-E	-	33	-	-	-						45
(MH)	STIFF TO HARD BROWN, SILTY CLAY	11-15	2" SS	10-F	-	37	-	-	-						
MH	STIFF MOTTLED GRAY BROWN CLAYEY SILT	15-20	2" SS												
	COBBLES OR BOULDER?	20													
	END OF BORING @ 20'														
	12-5-75														

NOTE:
 LL: LIQUID LIMIT
 PL: PLASTIC LIMIT

*ELEVATION ESTIMATED FROM TOPD MAP REC'D 12-2-75 FROM BELT, COLLINS & ASSOC., LTD.

MILILANI TOWN - UNIT 33

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	I	D	E	F
	SURFACE	6'-7.5'	10'-11'	15'-16'
DESCRIPTION	REDDISH-BROWN SILTY CLAY	DARK REDDISH-BROWN SILTY CLAY	REDDISH-BROWN SILTY CLAY	MOTTLED BROWN SILTY CLAY
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1-1/2"				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	70	56	71	79
Plastic Limit	37	30	35	37
Plasticity Index	33	26	36	42
Dilatancy	SLOW	RAPID-SLOW	SLOW	RAPID-SLOW
Toughness	MED. STIFF	MED. STIFF	MED. STIFF	MED. STIFF
Dry Strength	MEDIUM	MEDIUM	MEDIUM	MEDIUM
UNIFIED SOIL CLASSIFICATION	MH	MH-CH	MH	MH
APPARENT SPECIFIC GRAVITY	2.93			
CBR TEST (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 (ASTM D-1557-70, 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 1-9-76 By RST

MILILANI TOWN - UNIT 33

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	4 SURFACE	4 B 2'-3.5'	4 E 10'-11.5'	4 G 20'-21.5'
DESCRIPTION	BROWN CLAYEY SILT	REDDISH - BROWN SILTY CLAY	REDDISH - BROWN CLAYEY SILT	REDDISH - TAN CLAYEY SILT
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1-1/2"	100			
1"	100			
1/2"	97.1			
#4	95.4			
#10	93.2			
#20	92.5			
#40	92.1			
#100	91.4			
#200	90.9			
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL	NATURAL	NATURAL
Liquid Limit	56	53	53	58
Plastic Limit	35	30	34	36
Plasticity Index	21	23	19	22
Dilatancy	SLOW	RAPID-SLOW	SLOW-RAPID	SLOW-RAPID
Toughness	MED. STIFF	MED. STIFF	MED. STIFF	MED. STIFF
Dry Strength	LOW-MED.	MEDIUM	LOW-MED.	LOW-MED.
UNIFIED SOIL CLASSIFICATION	MH	MH-CH	MH	MH
APPARENT SPECIFIC GRAVITY	2.91			
CBR TEST				
(Surcharge - 51 P.S.F.)				
Molding Moisture, %	30.2			
Molding Dry Density, P.C.F.	94.4			
Swell upon saturation, %	0.5			
CBR at 0.1" Penetration	20.0			
MOISTURE-DENSITY RELATIONS OF SOILS (ASTM D-1557-70, Method <u> </u>)				
Dry to Wet or Wet to Dry	A WET TO DRY			
Max. Dry Density (P.C.F.)	96			
Optimum Moisture (%)	23			

REMARKS:

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

Date 1-9-76 By BT

MILILANI TOWN - UNIT 33

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO. SAMPLE NO. DEPTH BELOW SURFACE	7	10	10
DESCRIPTION	SURFACE BROWN CLAYEY SILT W/ TRACES OF CORAL		SURFACE DARK REDDISH- BROWN SILTY CLAY
GRAIN-SIZE ANALYSIS (% Passing)			
Sieve			
1-1/2"		100	
1"		100	
1/2"		100	
#4		100	
#10		99.4	
#20		98.2	
#40		97.7	
#100		96.4	
#200		95.3	
ATTERBERG LIMITS			
Air Dried or Natural	NATURAL	NATURAL	NATURAL
Liquid Limit	55	58	65
Plastic Limit	33	32	40
Plasticity Index	22	26	25
Dilatancy	SLOW	RAPID	SLOW-RAPID
Toughness	MED. STIFF	MED. STIFF	MED. STIFF
Dry Strength	MEDIUM	MEDIUM	MEDIUM
UNIFIED SOIL CLASSIFICATION	MH	MH	MH
APPARENT SPECIFIC GRAVITY	2.91	2.83	
CBR TEST			
(Surcharge - 51 P.S.F.)			
Molding Moisture, %	28.7	26.6	
Molding Dry Density, P.C.F.	97.4	96.1	
Swell upon saturation, %	0.2	0.7	
CBR at 0.1" Penetration	12.0	24.7	
MOISTURE-DENSITY RELATIONS OF SOILS (ASTM D-1557-70, Method <u> </u>)			
Dry to Wet or Wet to Dry	A DRY TO WET	A WET TO DRY	
Max. Dry Density (P.C.F.)	95	98	
Optimum Moisture (%)	29	27	

REMARKS:

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

Date 1-9-76 By BT

MILILANI TOWN - UNIT 33

TABLE I D - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	10	10		
SAMPLE NO.	D	F		
DEPTH BELOW SURFACE	6'-7.5'	15'-16.5'		
DESCRIPTION	REDDISH-BROWN SILTY CLAY	MOTTLED GRAY-BROWN CLAYEY SILT		
GRAIN-SIZE ANALYSIS (% Passing)				
Sieve				
1-1/2"				
1"				
1/2"				
#4				
#10				
#20				
#40				
#100				
#200				
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	74	74		
Plastic Limit	34	41		
Plasticity Index	40	33		
Dilatancy	SLOW	SLOW		
Toughness	MED. STIFF	MED. STIFF		
Dry Strength	MEDIUM	MEDIUM		
UNIFIED SOIL CLASSIFICATION	MH-CH	MH		
APPARENT SPECIFIC GRAVITY				
CBR TEST				
(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 (ASTM D-1557-70, Method ___)				
Dry to Wet or Wet to Dry				
Max. Dry Density (P.C.F.)				
Optimum Moisture (%)				

REMARKS:

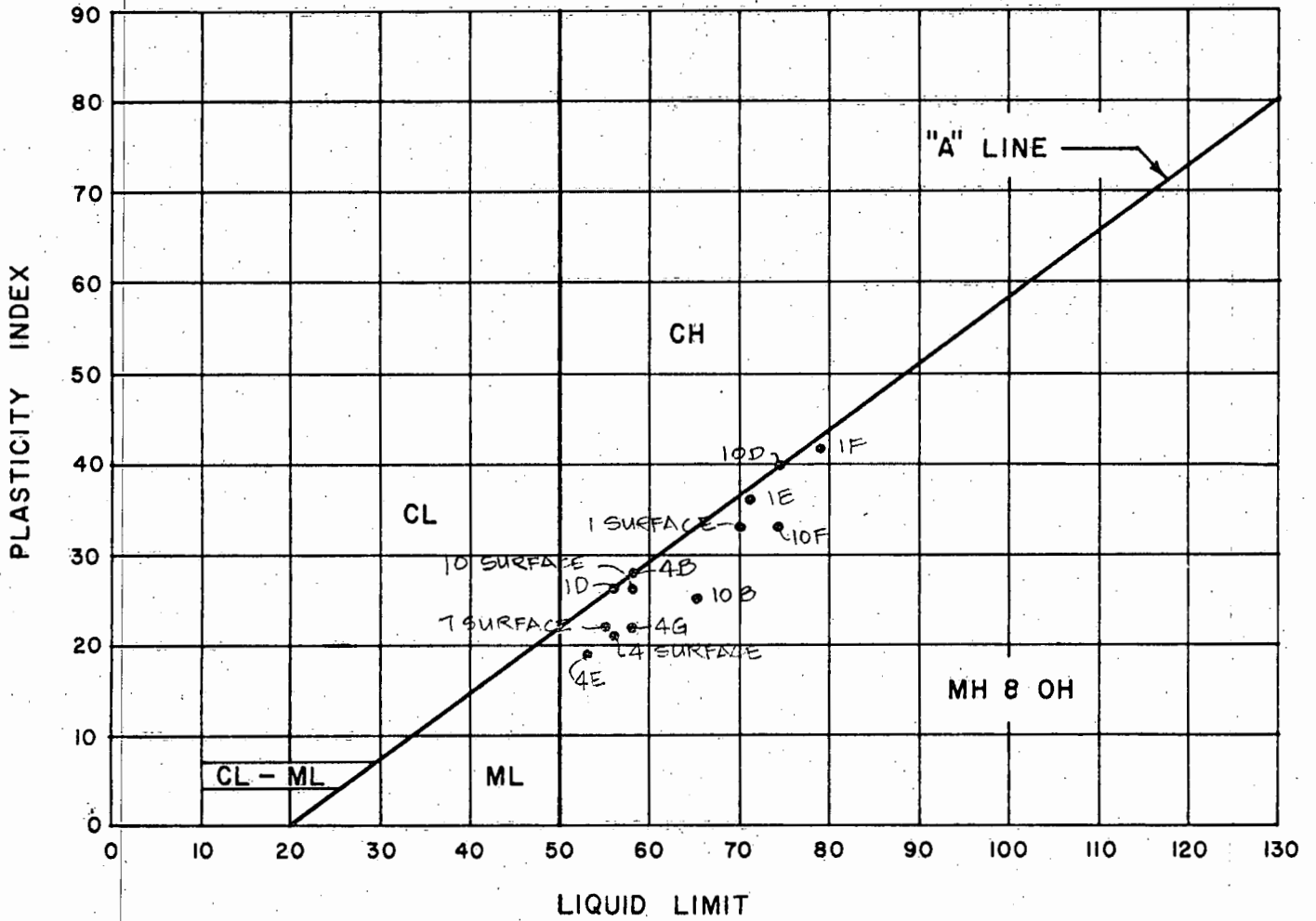
WALTER LUM ASSOCIATES, INC.
CIVIL, STRUCTURAL, SOILS ENGINEERS

Date 1-9-76 By BT

PLASTICITY CHART

PROJECT: MILILANI TOWN - UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII



DATE 1-9-76 BY DT

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

MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

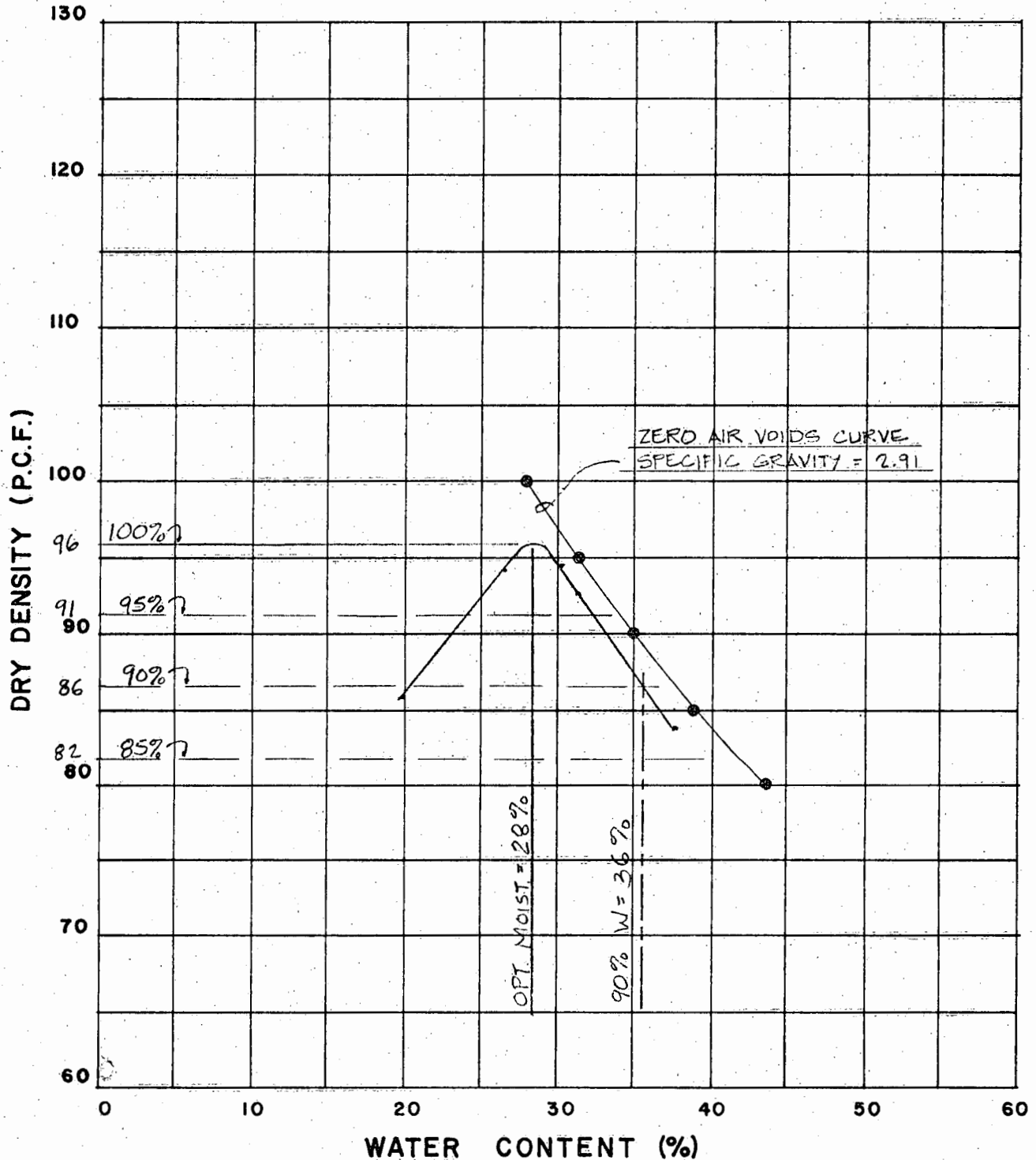
PROJECT: MILILANI TOWN UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO.: 4 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" Ø X 4.583" HIGH
HAMMER: 10 LBS. 18" DROP
LAYERS: 5
BLOWS: 25 / LAYER



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

DATE 12-16-75 BY R.H.

MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

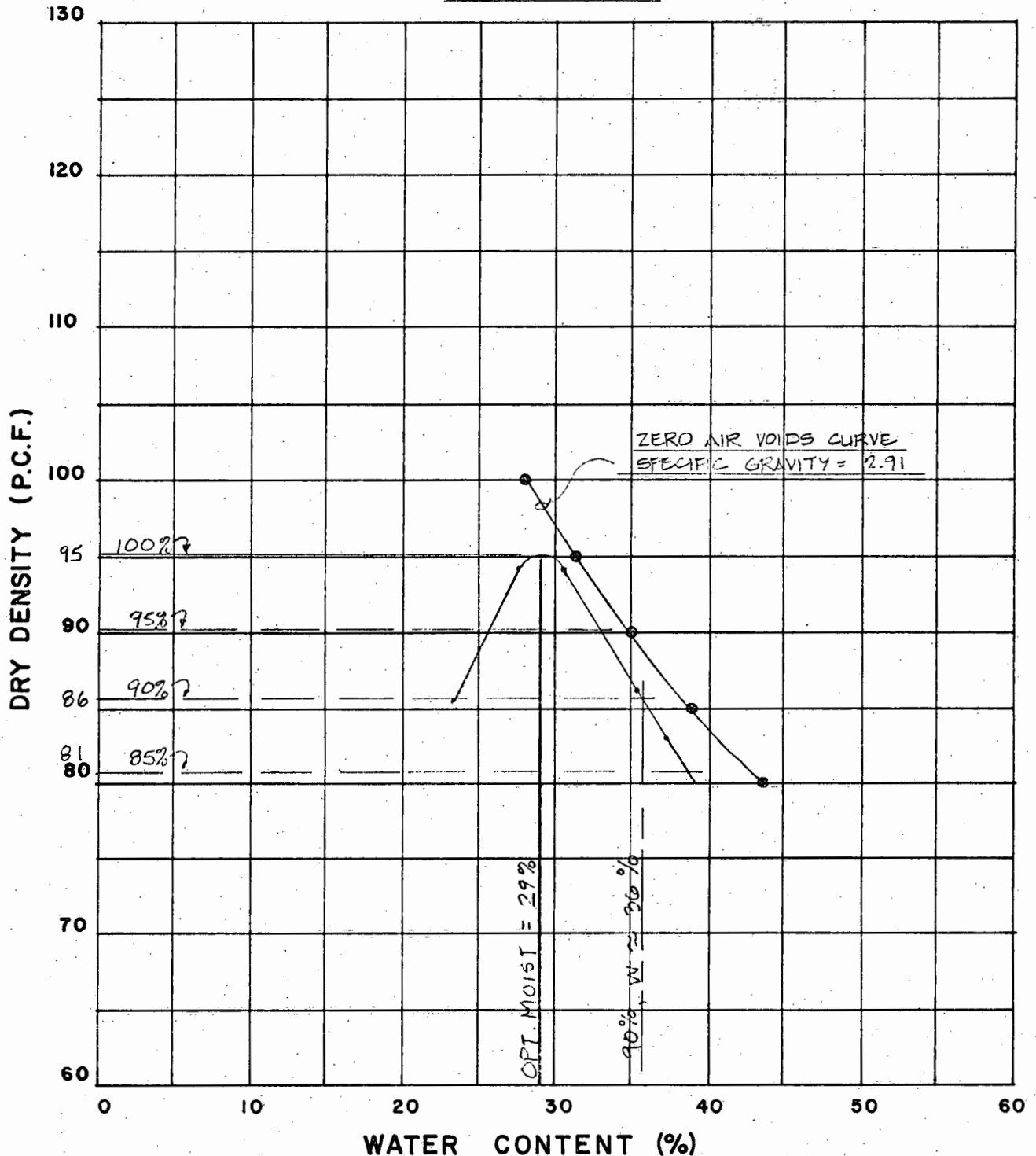
PROJECT: MILILANI TOWN UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO.: 7 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT
W/ TRACES OF CORAL

AGGREGATE: 1/4" MINUS
MOLD SIZE: 1" x 4.584" HIGH
HAMMER: 10 LBS, 18" DROP
LAYERS: 5
BLOWS: 25 / LAYER



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

DATE 12-15-75 BY R.H

MOISTURE-DENSITY CURVE (ASTM D-1557-70, METHOD A)

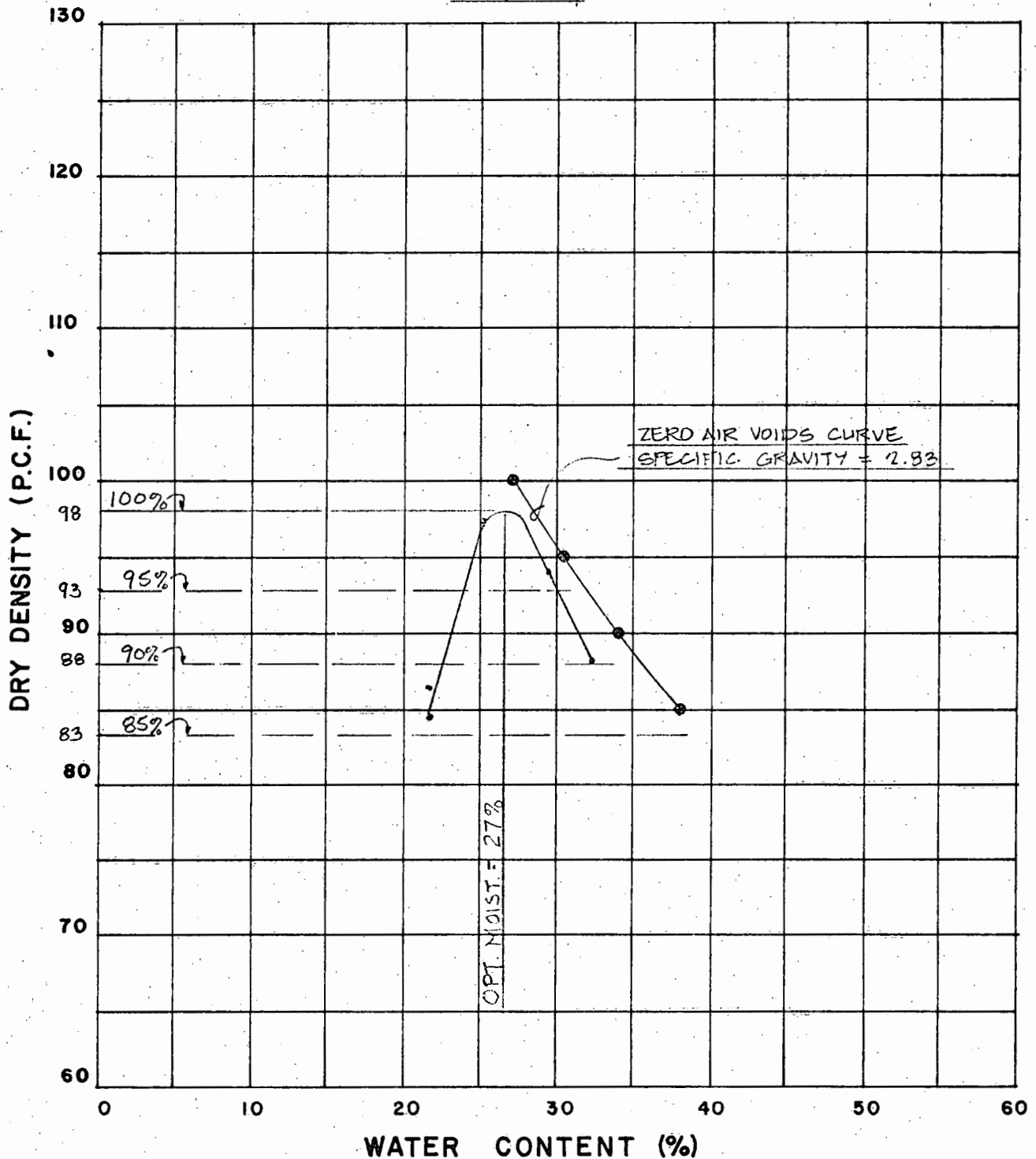
PROJECT: MILILANI TOWN UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO.: 10 SURFACE

SAMPLE DESCRIPTION: DARK REDDISH-BROWN SILTY CLAY

AGGREGATE: 1/4" MINUS
MOLD SIZE: 4" DIA X 4.584" HIGH
HAMMER: 10 LBS, 18" DROP
LAYERS: 5
BLOWS: 25 / LAYER



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

DATE 12-12-75 BY RH.

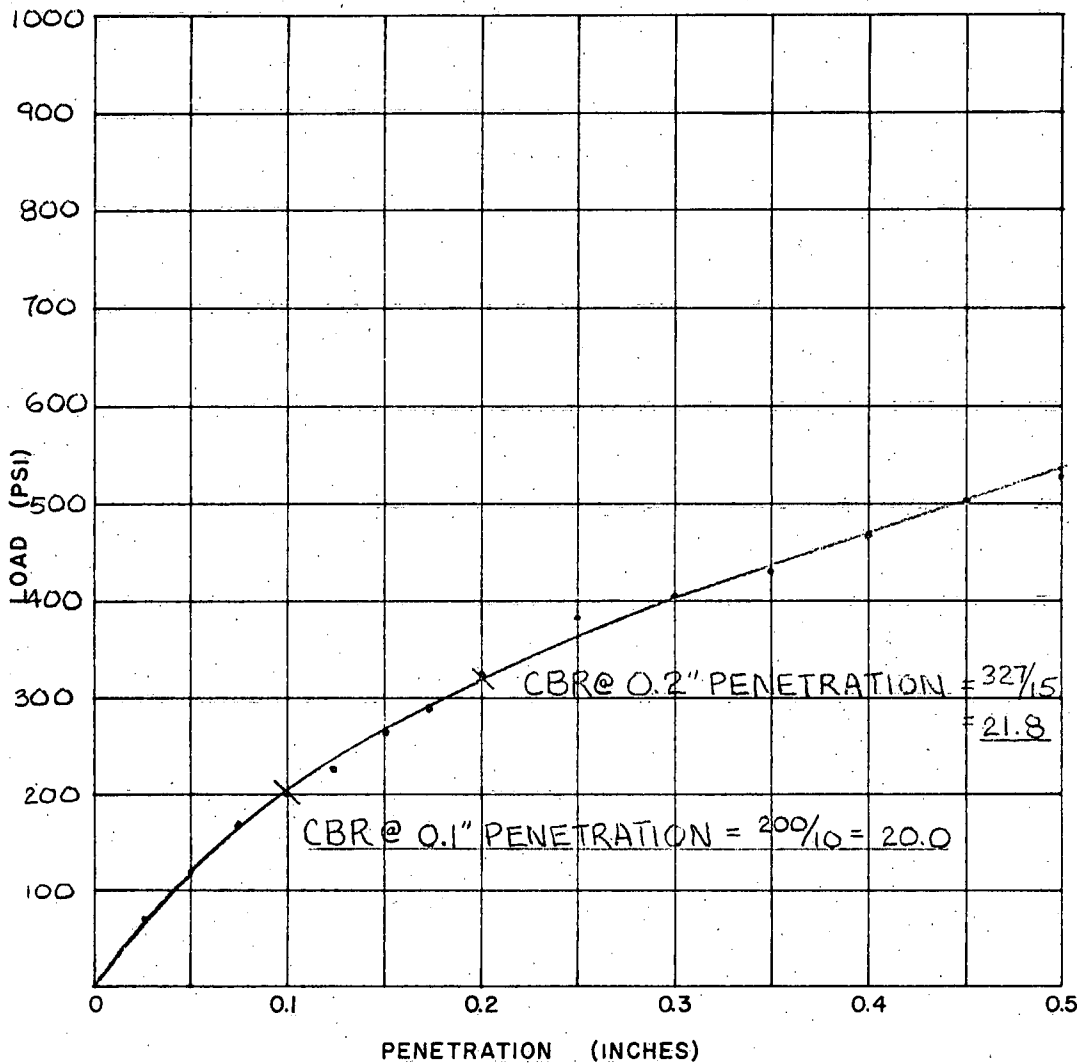
CBR TEST

PROJECT: MILILANI TOWN - UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO: 4 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	210	70
0.050	360	120
0.075	490	163
0.100	600	200
0.125	700	233
0.150	790	263
0.175	890	297
0.200	980	327
0.250	1150	383
0.300	1230	410
0.350	1310	437
0.400	1410	470
0.450	1510	503
0.500	1610	537

AGGREGATE 1/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18 INS.
 No. OF BLOWS 56/LAYER
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 30.2

MOLDING DRY DENSITY, P.C.F. 94.4

CBR @ 0.1" PENETRATION 20.0

DAYS SOAKED 4

DATE 12-15-75 BY G.O.

DATE 12-16-75 BY G.S.

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

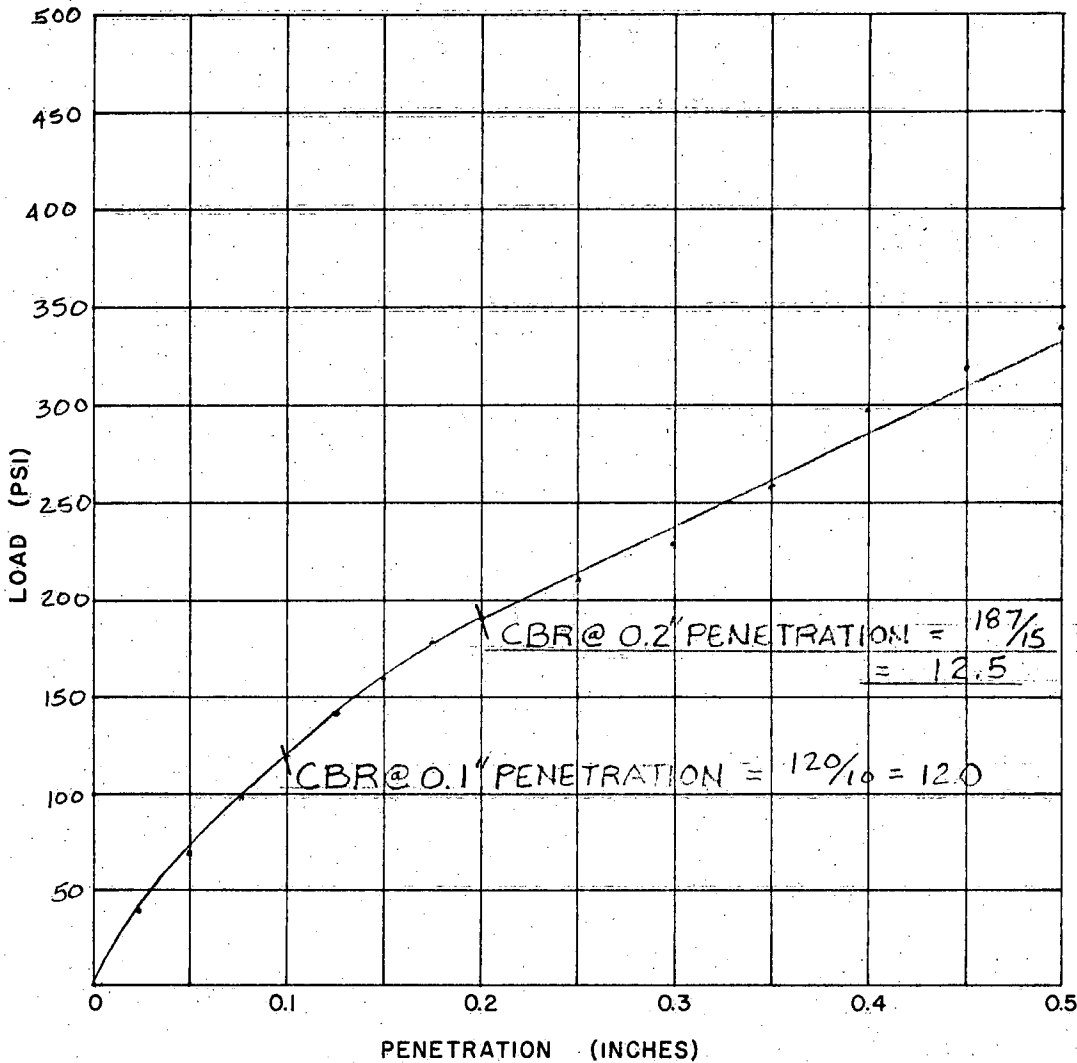
CBR TEST

PROJECT: MILILANI TOWN UNIT 33

LOCATION: WAIPID, EWA, OAHU, HAWAII

SAMPLE NO: 7 SURFACE

SAMPLE DESCRIPTION: BROWN CLAYEY SILT
W/ TRACES OF CORAL



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	110	37
0.050	200	67
0.075	290	97
0.100	360	120
0.125	430	143
0.150	490	163
0.175	530	177
0.200	560	187
0.250	630	210
0.300	700	233
0.350	780	260
0.400	890	297
0.450	970	323
0.500	1030	343

AGGREGATE 1/4" MINUS
HAMMER WEIGHT 10 LBS.
HAMMER DROP 18 IN.
No. OF BLOWS 56/LAYER
No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 28.7
MOLDING DRY DENSITY, P.C.F. 97.4
CBR @ 0.1" PENETRATION 12.0
DAYS SOAKED 4

DATE 12-15-75 BY GO

DATE 12-15-75 BY RH.

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

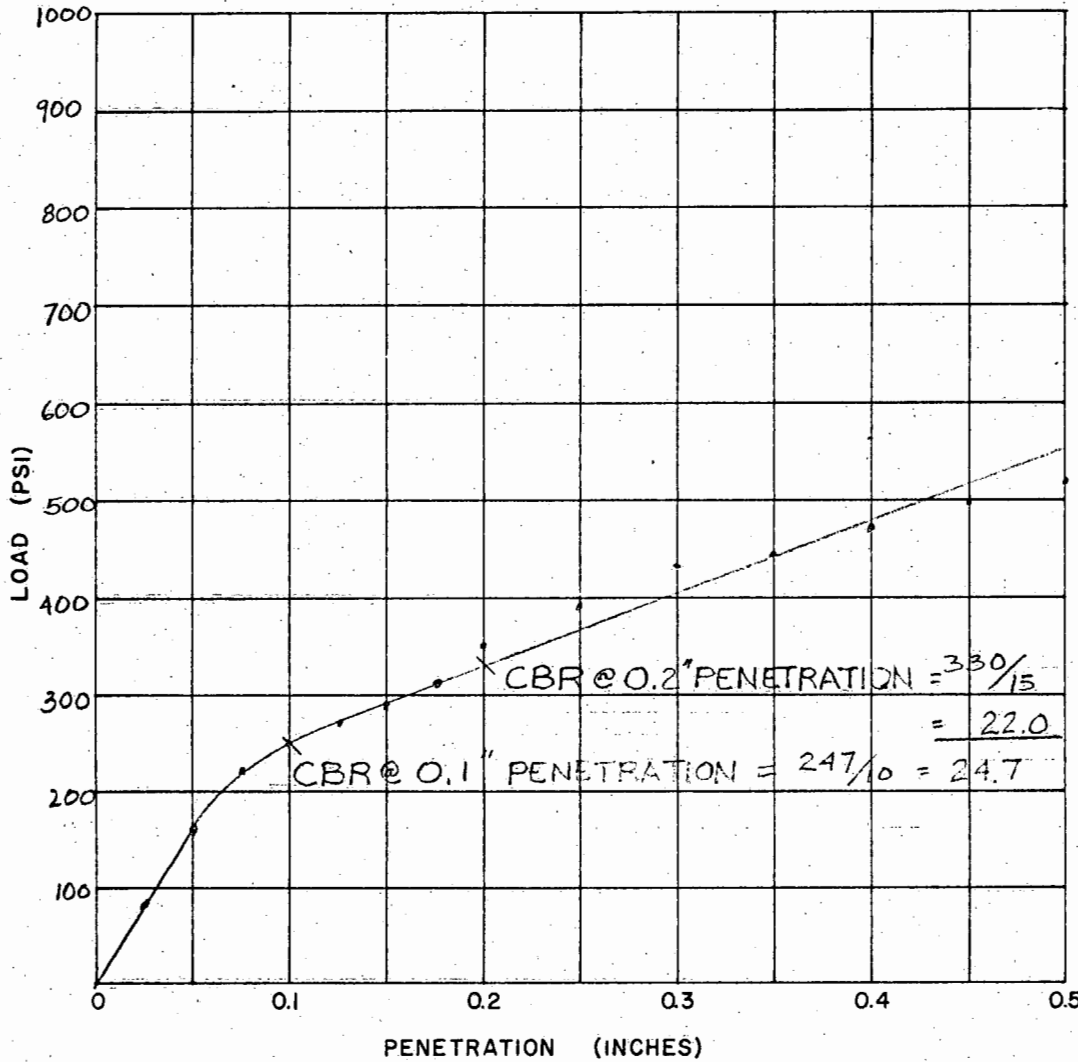
CBR TEST

PROJECT: MILILANI TOWN UNIT 33

LOCATION: WAIPIO, EWA, OAHU, HAWAII

SAMPLE NO: 10 SURFACE

SAMPLE DESCRIPTION: DARK REDDISH-BROWN SILTY CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS)	LOAD (PSI)
0.025	240	80
0.050	490	163
0.075	640	213
0.100	740	247
0.125	820	273
0.150	880	293
0.175	950	317
0.200	1040	347
0.250	1170	390
0.300	1280	427
0.350	1330	443
0.400	1400	467
0.450	1490	497
0.500	1570	523

AGGREGATE 1/4" MINUS
 HAMMER WEIGHT 10 LBS.
 HAMMER DROP 18 IN.
 No. OF BLOWS 56/LAYER
 No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, % 26.6
 MOLDING DRY DENSITY, P.C.F. 96.1
 CBR @ 0.1" PENETRATION 24.7
 DAYS SOAKED 5

DATE 12-15-75 BY G.O.
 DATE 12-16-75 BY R.H.

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

SELECTED

LOGS OF BORINGS

FROM

MILILANI TOWN UNIT 29B

(DATED OCTOBER 29, 1974)

Boring Log

PROJECT MILILANI TOWN UNIT 29B
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1

BORING NO. 1 Sheet No. _____ of _____

Driller W. LUM ASSOC. INC. Date SEPT. 12, 1974

Field Party ASATO, KAU

Type of Boring AUGER (MOBILE B-50) Diam. 4"

Elev. 555' ± * Datum _____

Drill Bit T.C. DRAG

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

Water Level	<u>NOT NOTICED</u>			
Time				
Date	<u>9-12-74</u>			

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	PENETRATION DATA				
										Standard Penetration Test				
	ELEV. = 555' ± * ₀									N (Blows per foot)				
										0	10	20	30	40
MH	STIFF TO HARD DARK REDDISH BROWN SILTY CLAY	5		1-A	-	36	-	-	-					
						LL: 62								
						PL: 32								
(MH)	HARD DARK BROWN & TAN SILTY CLAY	10		1-B	-	33	-	-	-					47
GH	HARD, MOTTLED BROWN CLAY	15		1-C	-	30	-	-	-					27/0.5
(MH)	HARD MOTTLED GRAY BROWN CLAYEY SILT	20		1-D	-	32	-	-	-					27/0.5
						LL: 86								15/0.1
						PL: 37								
(MH)	END OF BORING @ 21.5' 9-12-74			1-E	-	40	-	-	-					55

NOTE
 LL = LIQUID LIMIT
 PL = PLASTIC LIMIT

*Elevation Estimated from Grading Plan By Belt Collins & Associates, Ltd.

MILILANI UNIT 29B

Boring Log

PROJECT MILILANI TOWN UNIT 29B

LOCATION Waipio, Ewa, Oahu, Hawaii

Tax Map Key: 9-4-05: Por. 1

BORING NO. 2 Sheet No. _____ of _____

Driller W. LUM ASSOC., INC. Date SEPT. 12, 1974

Field Party ASATO KAU

Type of Boring AUGER (MOBILE B-50) Diam. 4"

Elev. 558' ± * Datum _____

Drill Bit T.C. DRAG

HAMMER:

Weight 140#

Drop 30"

SAMPLER: 2" STANDARD SPLIT SPOON

Water Level NOT NOTICED

Time _____

Date 9-12-74

PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test				
										N (Blows per foot)				
										0	10	20	30	40
(MH)	STIFF TO HARD DARK REDDISH BROWN SILTY CLAY	5		2-A	-	31	-	-	-					
				2-B	-	31	-	-	-				44	
(MH)	HARD, BROWN CLAYEY SILT	10		2-C	-	33	-	-	-					39/0.5'
(MH)	HARD REDDISH BROWN CLAYEY SILT	15		2-D	-	31	-	-	-					54
(MH)	HARD MOTTLED GRAY BROWN CLAYEY SILT	20		2-E	-	39	-	-	-					41
	END OF BORING @ 21.5 9-12-74													

*Elevation Estimated from Grading Plan By Belt Collins & Associates, Ltd.

MILILANI TOWN UNIT 29B

Boring Log

PROJECT MILILANI TOWN UNIT 29B
 LOCATION Waipio, Ewa, Oahu, Hawaii
 Tax Map Key: 9-4-05: Por. 1
 HAMMER:
 Weight 140#
 Drop 30"
 SAMPLER: 2" STANDARD SPLIT SPOON

BORING NO. 4 Sheet No. _____ of _____
 Driller W. LUM ASSOC., INC. Date SEPT. 12, 1974
 Field Party ASATO, KAU
 Type of Boring AUGER (MOBILE P-50) Diam. 4"
 Elev. 560' ± * Datum _____
 Drill Bit T.C. DRAG
 Water Level NOT NOTICED
 Time _____
 Date 9-12-74

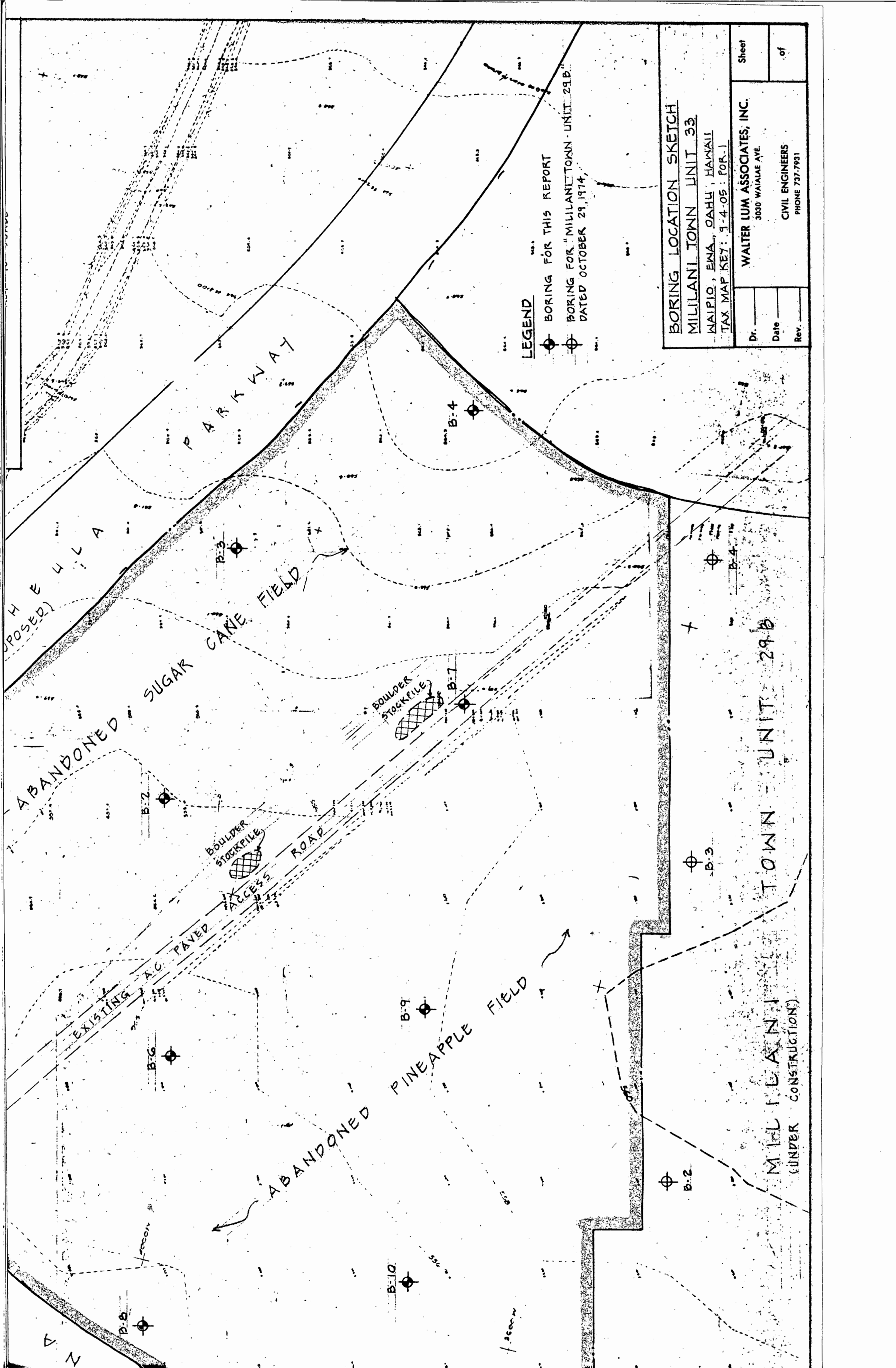
PENETRATION DATA

Unified Soil Classification	DESCRIPTION	Depth (Ft.)	Sampler	Sample No.	Wet Dens. P.C.F.	Water Cont. %	Dry Dens. P.C.F.	Unconf. Comp. P.S.F.	Vane Shear P.S.F.	Standard Penetration Test					
										N (Blows per foot)					
										0	10	20	30	40	
GH	STIFF DARK REDDISH BROWN SILTY CLAY			4-A	-	30	-	-	-						
(MH)	HARD REDDISH BROWN SILTY CLAY	5		4-B	-	29	-	-	-						61
(MH)	HARD, BROWN CLAYEY SILT.	10		4-C	-	33	-	-	-						39/0.5'
MH	HARD, MOTTLED BROWN CLAYEY SILT.	15		4-D	-	32	56	38	-						50
(MH)	HARD, DARK BROWN SILTY CLAY														
(MH)	HARD, BROWN CLAYEY SILT.	20		4-E	-	32	-	-	-						54
	END OF BORING @ 21.5'														
	9-12-74														

NOTE:
 LL= LIQUID LIMIT
 PL= PLASTIC LIMIT

*Elevation Estimated from Grading Plan By Belt Collins & Associates, Ltd.

MILILANI TOWN UNIT 29B

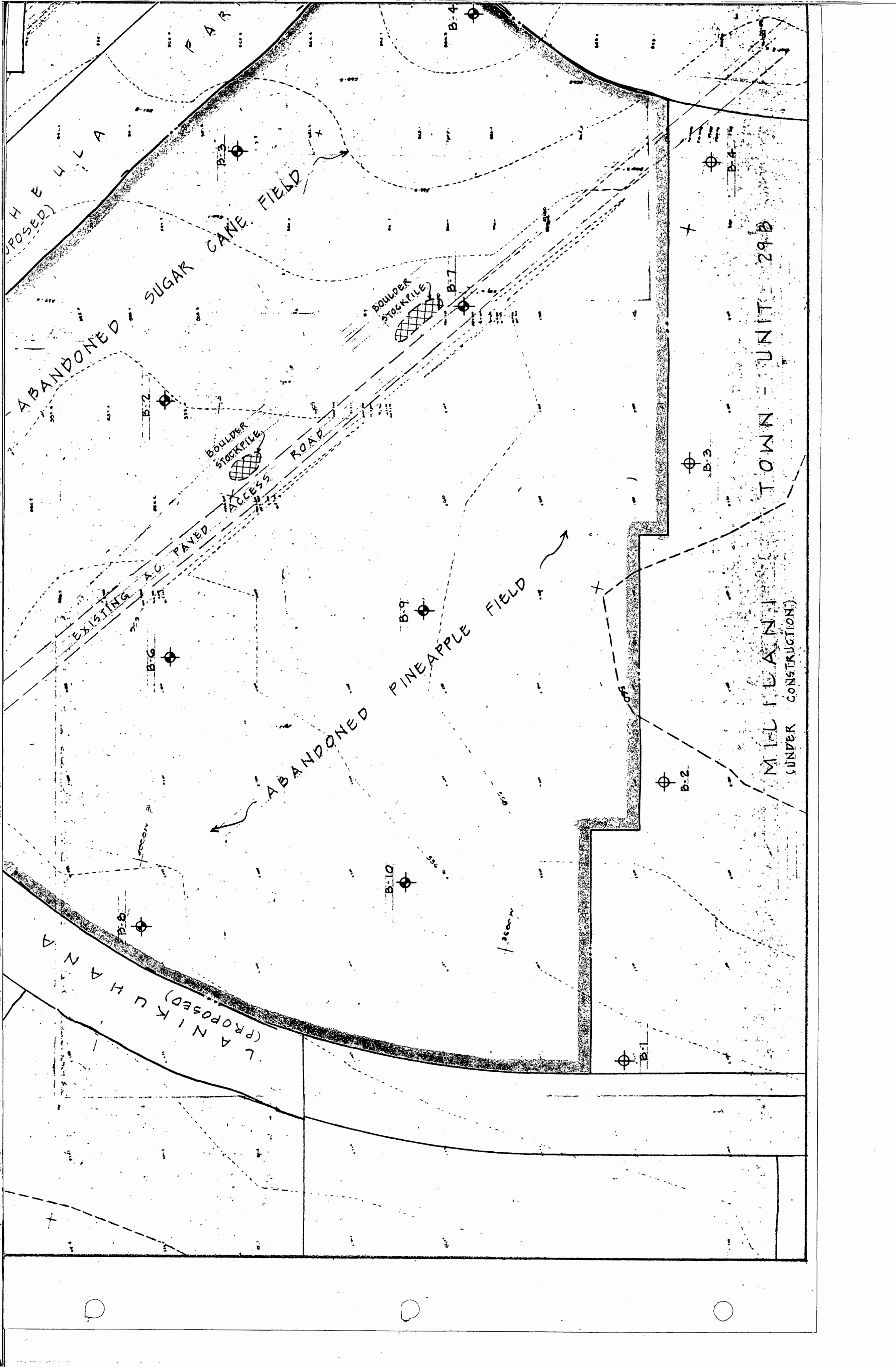


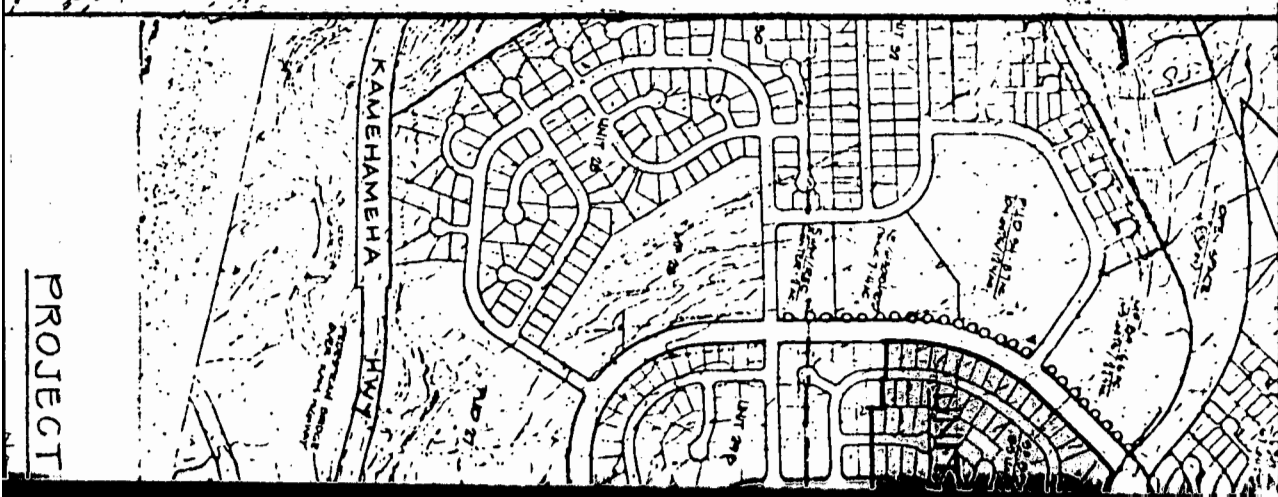
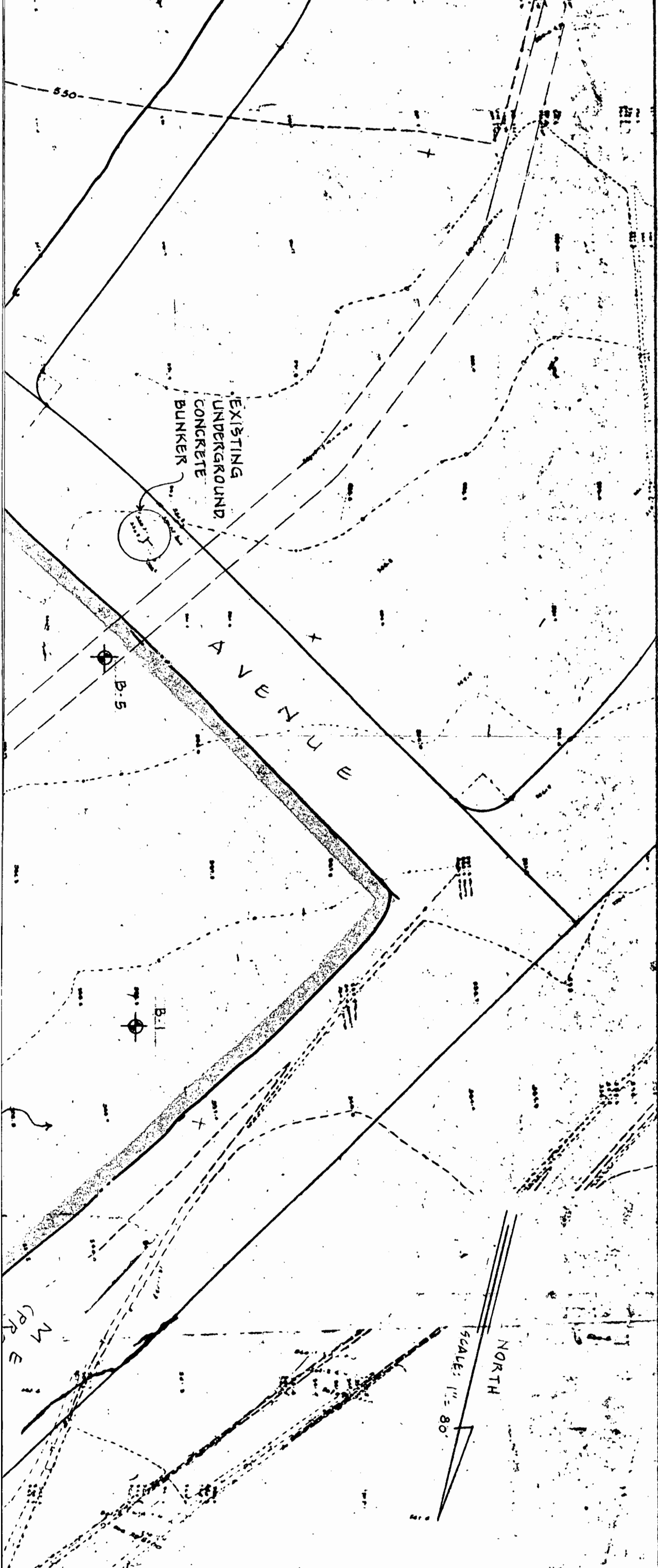
BORING LOCATION SKETCH		Sheet
MILILANI TOWN UNIT 33		of
WAIPIO, EWA, OAHU, HAWAII		
TAX MAP KEY: 9-4-05: POR.1		
Dr.	WALTER LUM ASSOCIATES, INC.	
Date	3030 WAIALAE AVE.	
Rev.	CIVIL ENGINEERS	
	PHONE 737-7931	

LEGEND

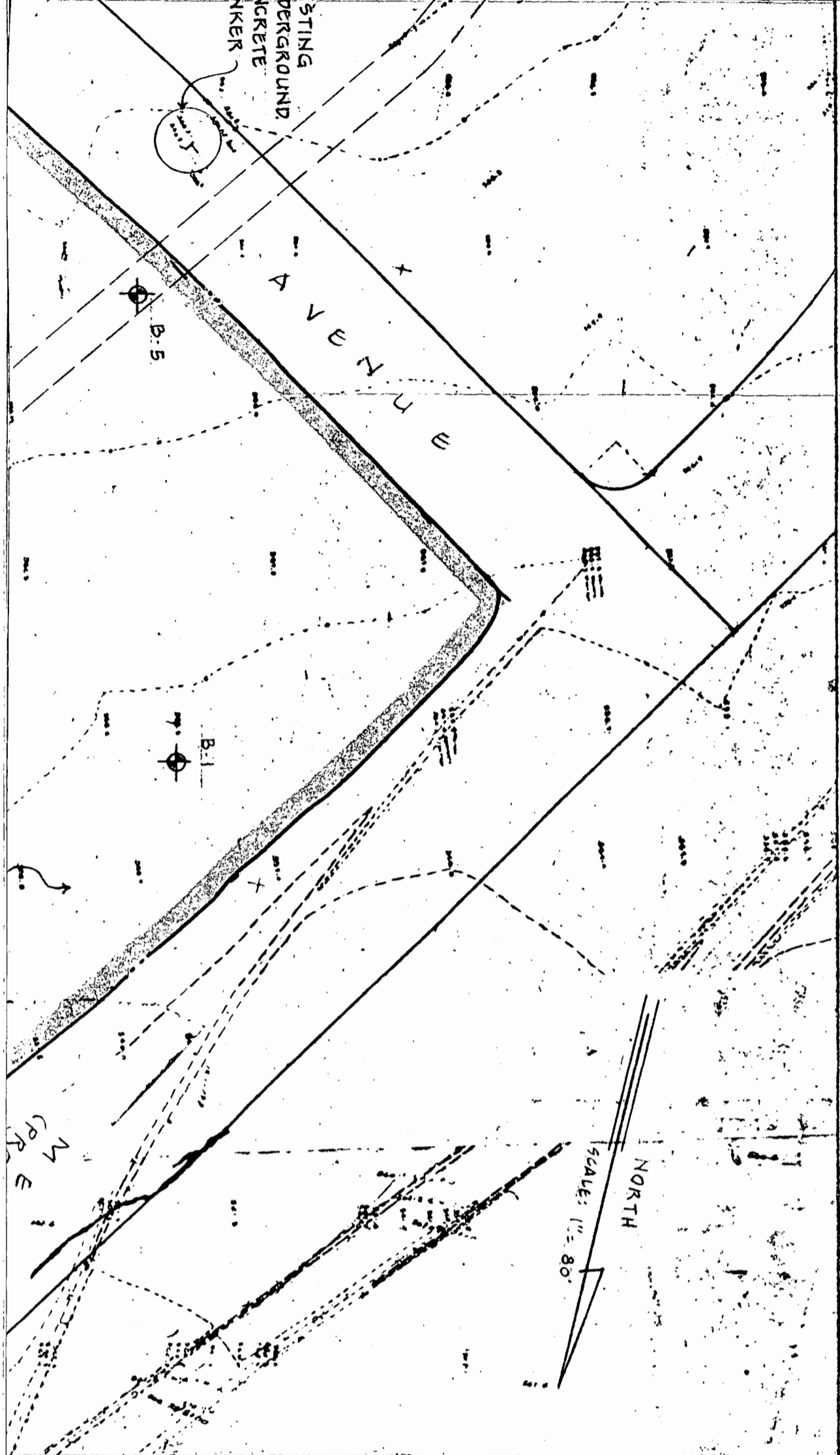
- ⊕ BORING FOR THIS REPORT
- ⊕ BORING FOR "MILILANI TOWN UNIT 29B" DATED OCTOBER 29, 1974

MILILANI TOWN UNIT 29B
(UNDER CONSTRUCTION)

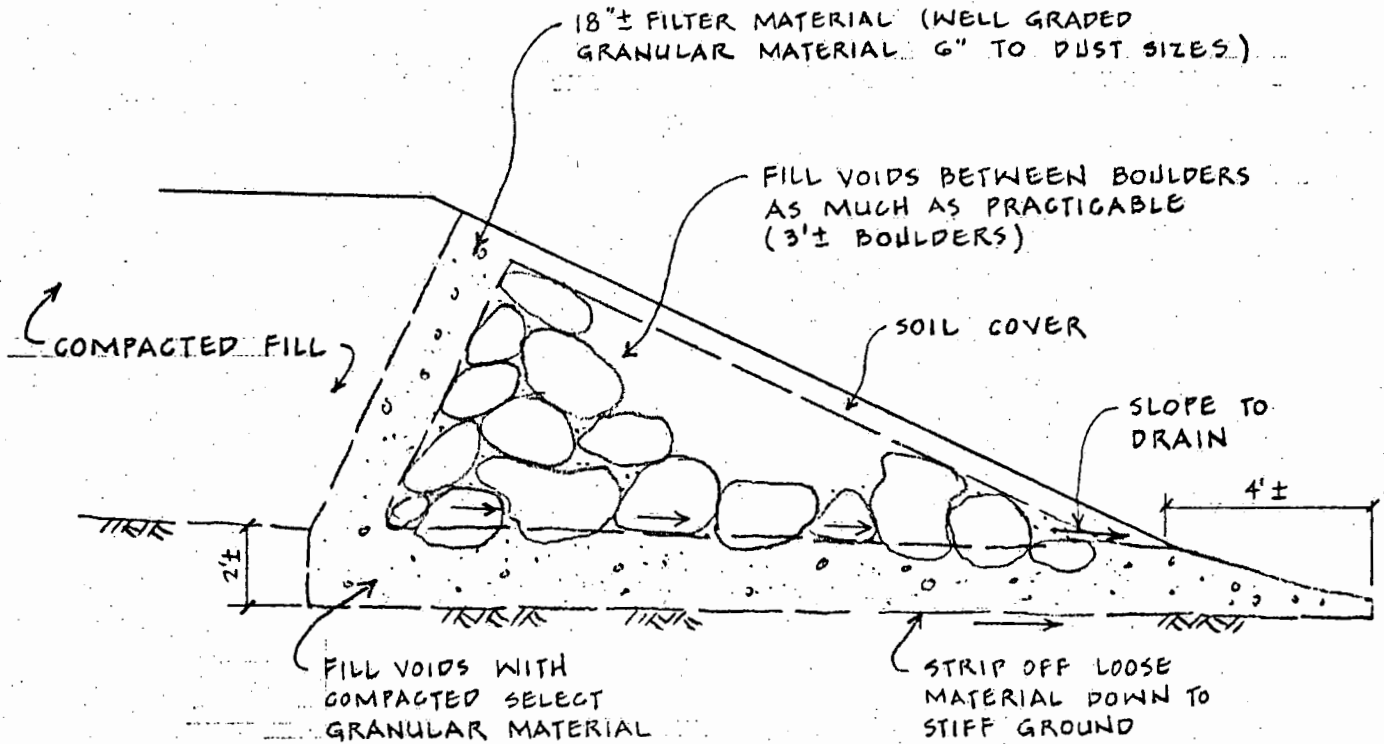




PROJECT



PROJECT LOCATION SKETCH



SECTION
NOT TO SCALE

FIGURE 1
SUGGESTED BOULDER FILL
MILILANI TOWN UNIT 33
WAIPIO, EWA, OAHU, HAWAII
TAX MAP KEY: 9-4-05: POR. 1

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 between borings, at other locations, or at other dates. Soil conditions and water levels may change with the passage of time, 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.

This report was prepared only for the indicated use of the site. If there is a substantial lapse of time between the submission of this report and the start of work at the site, or if conditions have changed due to natural causes, plan changes, or construction operations at or adjacent to the site, it is recommended that this report be reviewed to determine the applicability of the recommendations considering the time lapse, changed conditions, and changes in the state of the art of soil engineering.

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

LIMITATIONS (cont'd.)

Contract documents and specifications often prescribe supervision by the soil engineer. It should be understood by all parties that the soil engineer's actual scope of work is very limited. We as the soil engineer do not assume the day to day physical direction of the works, nor minute examination of the elements, nor do we assume the responsibility for the safety of the contractor's workmen. Supervision, inspection, control, etc., by the soil engineer generally mean taking of soil tests and making visual observations, sometimes on only an intermittent basis relating to earthwork or foundations for the project. The soil engineer does not guarantee the contractors' performance, but rather looks for general conformance to the intent of the plans and soil report. Any discrepancy noted by the soil engineer regarding earthwork or foundations will be referred to the project engineer or architect or contractor for action.

Although the soil report may comment or discuss construction techniques or procedures for the design engineer's guidance, the report should not be interpreted to prescribe or dictate construction procedures or to relieve the contractor in anyway of his responsibility for the construction.