NANAKULI HIGH SCHOOL GYMNASIUM
PRELIMINARY SOIL REPORT

D.A.G.S. JOB NO. 02-16-6717.2
NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

To:
DIVISION OF PUBLIC WORKS
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

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

MARCH 15, 1976

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

WALTER LUM
EDWARD WATANABE
EZRA KOIKE
WALLACE WAKAHIRO
3030 WAIALAE AVE., HONOLULU, HAWAII 96816 • TEL. 737-7931

March 15, 1976

DIVISION OF PUBLIC WORKS
Department of Accounting and General Services
State of Hawaii
P. O. Box 119
Honolulu, Hawaii 96810

Gentlemen:

Subject: Nanakuli High School Gymnasium
Preliminary Soil Report
(for foundation design purposes)
D.A.G.S. Job No. 02-16-6717.2
Nanakuli, Oahu, Hawaii
Tax Map Key: 8-9-07: Por. 3

Transmitted herewith is our soil exploration report for foundation design considerations for the proposed Nanakuli High School Gymnasium at Nanakuli, Oahu, Hawaii.

This report includes a Boring Location Sketch, boring logs, laboratory tests results, general foundation design guidelines and limitations.

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Edward K. Watanabe
Edward K. Watanabe

CR/EKW:vl

C O N T E N T S

NANAKULI HIGH SCHOOL GYMNASIUM
PRELIMINARY SOIL REPORT

D.A.G.S. JOB NO. 02-16-6717.2
NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate general soil conditions for foundation design considerations for the proposed Nanakuli High School Gymnasium at Nanakuli, Oahu, Hawaii.

This report includes field exploration, laboratory tests, general design guidelines for foundations and limitations.

FIELD EXPLORATION

Six borings were made at the site (B-1 thru B-6). The approximate locations of these borings are shown on the Boring Location Sketch.

The borings were located and made by MAS Drilling Co. and logged by Walter Lum Associates, Inc.

The borings were made with 4-in. diameter augers using a finger-type bit. A roller rock bit was used to drill thru rocky material. Soil samples were recovered with 2-1/2-in. o.d. thin-wall tubes and a 2-in. standard split spoon sampler driven with a 140-lb hammer falling 30 inches. Rock samples were recovered with an "NX" double tube core barrel using a diamond coring bit.

LABORATORY TESTS

Laboratory tests included: natural water content and density, laboratory vane shear, Atterberg limit, grain-size analysis and CBR.

A summary of the laboratory test results is given in Tables 1A thru 1C.

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."

GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS

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

Stearns, H. T. and U. S. Geological Survey, "Geologic and Topographic Map of Island of Oahu," 1938:

Pa - Consolidated noncalcareous material, chiefly older alluvium

U. S. Soil Conservation Service, "Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii," August 1972:

LPE - Lualualei extremely stony clay (3 to 35% slopes). High shrink-swell potential. Unified Soil Classification - CH

EaB - Ewa silty clay loam (3 to 6% slopes).

Moderate shrink-swell potential.

Unified Soil Classification - ML or CL

GENERAL SITE CONDITIONS

The proposed gymnasium site is located on the grounds of Nanakuli High School.

The site is an open, brushy and grassed area located between the existing General Kitchen, Industrial Arts and Music Buildings. Existing A.C. paved roadways and parking areas form the north, east and south boundaries.

A drainageway about 5 to 15 ft deep crosses the northerly portion of the site in an east-west direction. The drainageway was muddy during the field exploration. Some trees were noted; cobbles and boulders were exposed at the bottom of the drainageway.

Except for the drainageway, the rest of the site is on a gradual slope with gradients of about 5 to 10% down toward the west. The elevation at the site generally varies from about 132 to 154 ft.

INTERPRETATION OF SOIL CONDITIONS

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

A surface layer about 2 to 5 ft of stiff clay (CH) soils over cobbles and boulders with silty sand and gravel to about 20 to 25 ft, the depths drilled.

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

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

Variations to the above soil and water conditions are to be expected between borings and in localized areas.

DISCUSSION AND RECOMMENDATIONS

The proposed plan is to grade the site and construct a Gymnasium building and Parking Lots along the north, east and south sides of the structure.

For general grading of the site, fills of little to about 15 ft are planned.

The Gymnasium building will be about 110 ft by 150 ft in plan with a 2-story portion at the southerly end about 40 ft by 110 ft in plan. The building will consist of concrete masonry walls with wood decking on tapered steel girders for the roof structure.

The building loads may be about 50 to 80-kip column loads and 10 kips/ft wall loads.

The surface soils may be quite expansive; the ideal solution would be to strip and waste the expansive soils that are under the proposed building area.

Site grading with expansive soils will require considerable care. Most of the earthwork will be filling the site and borrow materials will have to be imported. Since stripping and wasting the expansive soils may not be economically practicable, an alternative solution would be to strip the surface expansive soils and use the material to construct the lower portions of fills at the site. The expansive soils should be capped with 3 ft of non-expansive material. Also, the outer slopes of expansive soils should be flattened to 3 horizontal to 1 vertical and capped with non-expansive soils. The existing drainageway will be filled over. Before the construction of the fill, after clearing and grubbing, subdrains should be provided at the bottom of the drainageway and daylighted beyond the toe of the fill. The fill should be placed as soon as practicable to allow the fill soils to settle and lessen future settlements.

The more granular soils from cuts and select non-expansive imported materials should be used for backfill under the proposed gymnasium.

If cesspools are encountered during grubbing work, they should be backfilled as recommended under "Cesspools."

Site Grading

In general, the borings indicated a surface layer of clay (CH) soils.

As much as practicable, the surface clay (CH) soils, particularly within the building area, should be stripped.

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

1. The area should be cleared and grubbed.

2. Surface vegetation and miscellaneous debris, boulder stockpiles, boulder clusters and rubbish should be cleared and removed prior to site filling.

3. Topsoil should be stripped to stiff natural ground and stockpiled for finish grading.

4. Soft pockets encountered during site preparations should be excavated and replaced with select soils compacted in thin lifts.

5. Hard surfaces such as along existing unpaved roads should be scarified down to stiff soils and recompacted to match the density of the surrounding soils.

6. Where fills are proposed on sidehill areas, gullies and natural drainageways, soft soils and loose material at the bottoms and sides should be stripped down to firm soils before the placement of fills.

Subdrains should be placed along the bottoms of natural drainageways with laterals in a herringbone pattern along the sides of the drainageways. Subdrains should be daylighted.

7. The materials used for filling the site should be controlled. In general, expansive clay soils should be kept below 3 ft of finish grade and away from the building. Cobbles larger than 3 in. but less than 6 in. should be kept below 3 ft of finish grade.

   Non-expansive soils (P.I. less than 20) should be used to finish the top 3 ft of fill, below the building and outer slopes of fills. Gravel size materials in the fill should not be greater than 3 inches.

   The on-site cobbles and boulders larger than 6 in. should be used to contruct the outer slopes of fills along the west boundary of the project site. See attached sketch, Figure 1.

8. Where clay (CH) soils are used for fills, the following guidelines may be considered:

   a. Where fills are to be placed over clay (CH) soils, the existing surface should be scarified and recompacted on the wet side of optimum.

b. Fills should be constructed in thin lifts on the wet side of optimum to lessen the swell potential of the clay.

c. Fills should be compacted to 90% of ASTM D 1557-70.

d. The clay soils should not be allowed to dry out before placing the next lift.

e. Use of clay (CH) soils in fills on sloping areas or the construction of slopes should be avoided. On-site clay soils should generally be placed in the deeper portions of fills in flat areas and away from the faces of slopes.

9. 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.

10. For construction of the fill at the lower end of the drainageway and perimeter slope, the surface clay soils should be stripped and replaced with select soils before the construction of the fill.

11. Boulders may be placed along the toe sections of fill slopes and outside of probable building sites. Before placing select fills or boulders, the clay (CH) soils should be stripped to stiff natural ground and shaped to drain. A filter layer of select granular material should be placed on the bottom. The void spaces between boulders should be filled with smaller granular material. A blanket of filter material should be placed against the boulders before any earth fills are placed against the boulders. See attached sketch, Figure 1.

12. 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.

13. Provisions to drain the site should be included during and after the completion of filling operations.

Slopes

The grading plan indicates slope heights generally less than 15 ft.

In silty and sandy soils, cut and fill slopes of 2 horizontal to 1 vertical or flatter may generally be considered. For expansive soils, 3 horizontal to 1 vertical or flatter slopes should be used.

Other general guidelines for slope design are as follows:

1. In general, for slope heights greater than 15 ft, 8-ft wide benches should be placed at height intervals of about 15 ft for the higher slopes. Where clay or adobe soils are used as fill materials, the height of the slopes or fills should be less than 8 ft

and the outer slopes capped with 3 ft of non-expansive materials. See attached sketch, Figure 2. For slopes in clay that may be higher than 8 ft, buttress fill should be used. See attached sketch, Figure 1.

2. To lessen erosion, the runoff from rainstorms should be diverted by berms or ditches away from slopes whenever practicable.

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

4. Slope planting is recommended on cut and fill slopes to lessen erosion.

5. Slope adjustments or other precautions may be necessary if seepage zones or expansive clay pockets are encountered in localized areas.

Siting of Buildings

Buildings should not be located directly over the drainageway, if practicable, to lessen the possible differential settlement effects resulting from the consolidation of the fill over the drainageway.

To reduce the effects of slope creep, buildings should be kept 20 ft or more away from the tops of slopes.

Parking areas and other facilities that can tolerate settlements may be located over the drainageway.

Foundations

For the proposed Gymnasium building at the location indicated on the Boring Location Sketch, spread footing foundations bearing on the cobble-boulder natural ground, or on 3 ft of well-compacted non-expansive fill may be considered. Perimeter grade beams should be made as narrow as practicable.

Estimated allowable bearing values of 3,000 p.s.f. may be used on the cobble-boulder natural ground or on well-compacted fill extending thru the surface clay (CH) soils.

Footing excavations along utility trenches should be carried below the bottoms of trenches or the footings should be designed to bridge the trench.

Other general guidelines for foundation design are as follows:

1. Surface clay (CH) soils below and 5 ft beyond the perimeter of buildings should be removed and replaced with non-expansive soils compacted in thin lifts.

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 compacted in thin lifts.

3. Footing excavations should be tamped before pouring concrete.

4. Foundations should be well-tied together with deep grade beams, particularly around the perimeter of the structure.

5. Concrete masonry walls should be supported on deep well-reinforced continuous beam type foundations and the tops of walls should be well-reinforced to reduce the effects of differential settlements. Vertical joints or wall openings extending the full height of the walls may be provided to attempt to control possible cracking.

6. Good surface drainage away from the foundations of structures should be maintained and the site should be graded to prevent the ponding of water.

Concrete Slab on Ground

The surface layer of clay (CH) soils should be removed about 3 ft below finish grades where concrete slabs on ground are being considered. The clay soils should be scarified and recompacted on the wet side of optimum. The clay soils should not be allowed to dry out. Backfill under slabs should be select, non-expansive borrow or on-site material compacted in thin lifts.

If practicable, concrete slabs on ground should be placed after the superstructure is constructed and should be well separated from grade beams, walls and columns.

A capillary break under the slab should be provided. It may be constructed with 4 in. of well-graded gravel less than 3/4-in. and greater than 1/4-in. in size or some other form of capillary break may be used.

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 on the outside of buildings.

Joint and Connection Details

Some differential settlements are to be expected between the building elements. Joints and connections should be detailed to allow some movements or releveling and adjustments at a later date.

To reduce the wavy surface effects at the ground floor level due to differential settlements or heaving, non-bearing partitions, doors, cabinets, etc., should be designed with loose fits and other precautions taken to allow for some future adjustments or maintenance.

Driveways, sidewalks and entry slabs next to the buildings should be supported on hinged seats that would permit some rotation and maintain a smooth transition to the building.

Roadway and Parking Areas

The surface clay (CH) soils within 3 ft of the finish grades should be removed.

For light automobile traffic and drained subgrade conditions, the roadway pavement section for the general soil conditions may be as follows:

1. Wearing course - 2-in. asphaltic concrete.
2. Base course - 6-in. base course.
3. Select borrow subbase - 6-in. subbase course.
4. Borrow - 18-in. borrow over a prepared subgrade.

Provisions should be made in the contract documents to 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 lessen the ponding of water and softening of the subgrade, weep holes should be placed at subgrade levels thru the walls of the catch basins.

Cesspools

Cesspools may be encountered during the site preparation work. When encountered, cesspools should be flagged and located on the plans. Sludge should be removed from the bottom and the cesspool backfilled with fairly well-graded granular materials. The materials should be placed in thin layers and rammed into place or compacted with vibratory equipment. The top 4 ft of fill should be compacted in 6-in. compacted layers.

Building foundations should be designed to bridge the cesspool or extended to the bottoms of the cesspools.

Field Adjustments

Provisions should be made in the contract documents to allow for local adjustments in the field regarding overexcavation, select borrow, etc.

Utilities

Utilities should be placed after the fills are constructed. Utility lines should be designed with flexible joints, particularly where lines are connected to structures.

Utility line trenches should be daylighted with rock drains to drain water.

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 when encountered 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, new or existing utility trenches, underground structures, pipes, voids or cavities, cesspools, boulders, expansive soil pockets, rubbish or boulder disposal pits, 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.

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.

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION: NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

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

BORING NO. 1 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: FEB. 12, 1976
Field Party: HEW (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 138'±* Datum: —
Drill Bit: FINGER TYPE

Water Level	NOT NOTICED			
Time	—			
Date	2-12-76			

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
	ELEV.= 138'±*?	0								
(GH)	COBBLES & BOULDERS SOFT, REDDISH BROWN CLAY COBBLE			1-A	—	30	—	—	—	3 BLOWS/1.0' 20/0.1'
				1-B	NO RECOVERY					35/0.2'
		5		1-C	—	16	—	—	—	40/0.3'
	COBBLES & BOULDERS W/ POCKETS OF BROWN CLAYEY SILT	10		1-D	—	11	—	—	—	20/0.1'
		15		1-E	NO RECOVERY					44/0.4'
		20		1-F	NO RECOVERY					50/0.2'
	NOTE: INTERMITTENT ROUGH DRILLING TO 25'	25		1-G	NO RECOVERY					50/0.0' HAMMER BOUNCES
	END OF BORING @ 25' 2-12-76									

*ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

NANAKULI HIGH GYM

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

HAMMER:
Weight 140#
Drop 30"
SAMPLER: 2" SS - 2" STANDARD SPLIT SPOON
2½" S - 2½" O.D. THIN WALL TUBE
"NX" - NX DOUBLE TUBE CORE BARREL

BORING NO. 2 Sheet No. ____ of ____
Driller MAS DRILLING CO. Date FEB. 11 & 12, 1976
Field Party HEW (W. LUM ASSOC., INC.)
Type of Boring AUGER & CORING (B-40) Diam. 4" & "NX"
Elev. 142'±* Datum —
Drill Bit FINGER TYPE DIAMOND CORING & ROLLER ROCK

Water Level	NOT NOTICED			
Time	—			
Date	2-11-76			

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	PENETRATION DATA: 2½" O.D. THIN WALL TUBE
	ELEV. = 142'±*	0									
CH	MEDIUM, GRAY BROWN CLAY W/SOME GRAVEL		2½"S	2-A	26	36	80	–	1040 1480 1200		HYDRAULIC PRESSURE 700 PSI / 0.4'
CL-CH	HARD, REDDISH BROWN CLAY		2"SS	2-B	23	19	50	–	–		26/0.5' 25/0.2'
		5			NOTE: HARD DRILLING AT 4.5' MOVED HOLE 3'± NORTH						
			"NX"	RUN #1		CORED:	5.0'	RECOV.:	3.0'		
	COBBLES & BOULDERS W/GRAVEL & SOME SAND	10									
			"NX"	RUN #2		CORED:	4.0'	RECOV.:	2.0'		
		15									
			"NX"	RUN #3		CORED:	5.0'	RECOV.:	2.7'		
		20									
	END OF BORING @ 20' 2-12-76										

*ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

NANAKULI HIGH SCHOOL GYM

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION: NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON; 2½"S - 2½" O.D. THIN WALL TUBE

BORING NO. 3 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: FEB. 11, 1976
Field Party: HEW (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 146'+* Datum: —
Drill Bit: FINGER TYPE
Water Level: NOT NOTICED
Time: —
Date: 2-11-76

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 / 2½" O.D. THIN WALL TUBE
	ELEV. = 146'±*	0								
(CH)	MEDIUM, REDDISH BROWN CLAY		2½"S	3-A	—	34	—	—	400	HYDRAULIC PRESSURE 400 PSI / 1.5'
						34			800	
							γ_w = 122		1060	
			2"SS	3-B	—	34	γ_D = 91	—	—	50/0.3'
		5	2"SS	3-C	—	13	—	—	—	30/0.1' HAMMER BOUNCES
		10	2"SS	3-D	—	18	—	—	—	30/0.5' 30/0.4'
	COBBLES & BOULDERS W/ BROWN, SILTY SAND	15	2"SS	3-E	NO RECOVERY					40/0.2' HAMMER BOUNCES
		20	2"SS	3-F	NO RECOVERY					40/0.1' HAMMER BOUNCES
	NOTE: ROUGH AND HARD DRILLING TO 25'	25	2"SS	3-G	NO RECOVERY					40/0.1' HAMMER BOUNCES
	END OF BORING @ 25.1' 2-11-76									

*ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION: NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS - 2" STANDARD SPLIT SPOON
2½"S - 2½" O.D. THIN WALL TUBE

BORING NO. 4 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: FEB. 10, 1976
Field Party: HEW (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 149' ± * Datum: —
Drill Bit: FINGER TYPE

Water Level	NOT NOTICED				
Time	—				
Date	2-10-76				

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	PENETRATION DATA: 2½" O.D. THIN WALL TUBE
	ELEV. = 149' ± *2	0									
(CH)	MEDIUM, REDDISH BROWN CLAY		2"SS	4-A	–	32	–	–	–		
(CH)	MEDIUM TO STIFF MOTTLED REDDISH BROWN CLAY W/ SOME SAND & GRAVEL		2½"S	4-B	–	31	–	–	–		HYDRAULIC PRESSURE 750 PSI / 0.4'
		5	2"SS	4-C	NO RECOVERY						40/0.1'
	COBBLE OR BOULDER ?										HAMMER BOUNCES
(MH)	HARD, BROWN CLAYEY SILT & ROCK FRAGMENTS - COBBLE ?	10	2"SS	4-D	–	23	–	–	–	40	
	NOTE: INTERMITTENT ROUGH DRILLING TO 15'	15	2"SS	4-E	NO RECOVERY						40/0.1 HAMMER BOUNCES
	COBBLES, BOULDERS & POCKETS OF GRAY BROWN SANDY SILT	20	2"SS	4-F	–	11	–	–	–		50/0.5'
		25	2"SS	4-G	–	14	–	–	–		50/0.4'
	END OF BORING @ 25.4' 2-10-76										

*ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION: NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

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

BORING NO. 5 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: FEB. 10, 1976
Field Party: HEW (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 148'± * Datum: —
Drill Bit: FINGER TYPE

Water Level				
Time	—			
Date	2-10-76			

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
	ELEV. = 148'± *	0								
(CH)	MEDIUM, REDDISH BROWN CLAY			5-A	-	30	-	-	-	
CH	HARD, BROWN, CLAY W/COBBLES OR BOULDER			5-B	24	24	70	-	-	30/0.5'
		5		5-C	NO RECOVERY					40/0.0' HAMMER BOUNCES
		10		5-D	NO RECOVERY					50/0.1' HAMMER BOUNCES
	COBBLES & BOULDERS W/ POCKETS OF GRAY BROWN SANDY SILT	15		5-E	NO RECOVERY					50/0.3' HAMMER BOUNCES
		20		5-F	NO RECOVERY					50/0.4' HAMMER BOUNCES
	NOTE: ROUGH AND HARD DRILLING TO 25'	25		5-G	NO RECOVERY					50/0.2' HAMMER BOUNCES
	END OF BORING @ 25.2' 2-10-76									

*ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

NANAKULI HIGH GYM

WALTER LUM ASSOCIATES, INC. 3030 WAIALAE AVENUE • HONOLULU, HAWAII 96816 • PHONE 737-7931

Boring Log

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM
LOCATION: NANAKULI, OAHU, HAWAII
TAX MAP KEY: 8-9-07: POR. 3

HAMMER:
Weight: 140#
Drop: 30"
SAMPLER: 2"SS. 2" STANDARD SPLIT SPOON
2½"S. 2½" O.D. THIN WALL TUBE

BORING NO. 6 Sheet No. ____ of ____
Driller: MAS DRILLING CO. Date: FEB. 10, 1976
Field Party: HEW (W. LUM ASSOC., INC.)
Type of Boring: AUGER (B-40) Diam.: 4"
Elev.: 150'± * Datum: —
Drill Bit: FINGER TYPE

Water Level				
Time	—			
Date	2-10-76			

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	PENETRATION DATA: 2½" O.D. THIN WALL TUBE
	ELEV.: 150'± *	0									
CH	HARD, REDDISH BROWN CLAY W/ SOME GRAVEL		2"SS	G-A	–	24	–	–	–		
			2½"S	G-B	24	19	67	–	–		HYDRAULIC PRESSURE 750 PSI / 0.4'
		5	2"SS	G-C	–	11	–	–	–	30/0.2'	HAMMER BOUNCES
		10	2"SS	G-D	–	18	–	–	–	30/0.3	HAMMER BOUNCES
	COBBLES, BOULDERS W/MOTTLED GRAY BROWN CLAYEY SILT & DECOMPOSED ROCK	15	2"SS	G-E	–	13	–	–	–	40/0.2'	HAMMER BOUNCES
		20	2"SS	G-F	–	11	–	–	–	50/0.2'	HAMMER BOUNCES
	NOTE: ROUGH AND HARD DRILLING TO 25'	25	2"SS	G-G	NO RECOVERY					40/0.0'	HAMMER BOUNCES
	END OF BORING @ 25' 2-10-76										

* ELEVATION ESTIMATED FROM SITE PLAN DATED 1-12-76

NANAKULI HIGH SCHOOL GYMNASIUM

TABLE I A - SUMMARY OF LABORATORY TEST RESULTS

SURFACE				
SAMPLE NO.	1	2	3	
DEPTH BELOW SURFACE	—	—	—	
DESCRIPTION	GRAY CLAY	REDDISH-BROWN CLAY	GRAY-BROWN 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	
Liquid Limit	90	54	56	
Plastic Limit	28	25	24	
Plasticity Index	62	29	32	
Dilatancy	SLOW-NONE	SLOW-NONE	SLOW-NONE	
Toughness	VERY STIFF	MEDIUM-STIFF	VERY STIFF	
Dry Strength	VERY HIGH	HIGH	HIGH	
UNIFIED SOIL CLASSIFICATION	CH	CH	CH	
APPARENT SPECIFIC GRAVITY				
CBR TEST (Surcharge - 51 P.S.F.)				
Molding Moisture, %	25.4	25.6	21.6	
Molding Dry Density, P.C.F.	98.7	100.8	104.9	
Swell upon saturation, %	9.0	0.3	0.3	
CBR at 0.1" Penetration	2.3	6.7	6.2	
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 3-2-76 By BT

NANAKULI HIGH SCHOOL GYMNASIUM

TABLE I B - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	2	2		3
SAMPLE NO.	A	B		D
DEPTH BELOW SURFACE	1'-1.4'	3'-4.2'		10'-11.4'
DESCRIPTION	GRAY BROWN CLAY W/SOME GRAVEL	REDDISH BROWN CLAY		BROWN SILTY SAND
GRAIN-SIZE ANALYSIS (% Passing) Sieve				
1-1/2"				100.0
1"				100.0
1/2"				88.5
#4				68.2
#10				50.4
#20				39.2
#40				33.5
#100				28.0
#200				24.8
ATTERBERG LIMITS				
Air Dried or Natural	NATURAL	NATURAL		
Liquid Limit	80	50		
Plastic Limit	26	23		
Plasticity Index	54	27		
Dilatancy	SLOW	SLOW		
Toughness	VERY STIFF	MEDIUM STIFF		
Dry Strength	VERY HIGH	HIGH		
UNIFIED SOIL CLASSIFICATION	CH	CL-CH		SM*
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: * PORTION PASSING 1½" SIEVE

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

Date 3-2-76 By PT

NANAKULI HIGH SCHOOL GYMNASIUM

TABLE I C - SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	5		6	
SAMPLE NO.	B		B	
DEPTH BELOW SURFACE	3'-3.5'		3'-3.4'	
DESCRIPTION	BROWN, CLAY W/COBBLES OR BOULDER		REDDISH BROWN CLAY W/SOME GRAVEL	
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	70		67	
Plastic Limit	24		24	
Plasticity Index	46		43	
Dilatancy	NONE		SLOW-NONE	
Toughness	MEDIUM STIFF		MEDIUM STIFF	
Dry Strength	HIGH		HIGH	
UNIFIED SOIL CLASSIFICATION	CH		CH	
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 3-2-76 By RT

209.00' → 308.32'

EXIST. BLDG.

A.C. PAVEMENT

EXIST. CHAIN LINK FENCE & GATE

EXIST. CHAIN LINK FENCE

EXIST. INDUSTRIAL ARTS BLDG.

EXIST. CESSPOOL

EXIST. LATH HOUSE

EXIST. GAS TANK ENCL.

EXIST. AG. ARTS BLDG.

EXIST. PE LOCKER & SHOWER

FUTURE SWIMMING POOL SITE

TEST BORING NO. 1

TEST BORING NO. 2

140

142

144

146

148

PROPOSED PAR

SURFACE SAMPLE

GY

FIN. F

NG

FH

EXIST. C.B

BENCH MARK
+ CUT ON CURB
ELEV. · 140.48

EXIST. A.C.

D24

D12

D18

HTC BOX

HECO BOXES

ELEC. BOX

EXISTING CESSPOOL

EXIST. PE CLASSROOM

EXIST. MUSIC BLDG.

209.00 → 708.32

EXIST. BBSS rm.

EXIST. BLDG.

A.C. PAVEMENT

EXIST. CHAIN LINK FENCE & GATE

EXIST. CHAIN LINK FENCE

EXIST. INDUSTRIAL ARTS BLDG.

EXIST. BBSS rm.

EXIST. GAS TANK ENCLOS.

ARTS BLDG.

FUTURE SWIMMING POOL SITE

TEST BORING NO. 1

TEST BORING NO. 2

PROPOSED GYMNASIUM

FIN. FLR. ELEV. = 140.50

TEST BORING NO. 3

TEST BORING NO. 4

2 STORY

HTC BOX

HECO BOXES

TEST BORING NO. 5

TEST BORING NO. 6

PROPOSED PARKING LOT

SURFACE SAMPLE # 3

140 142 144 146 148 150

WG FH EXIST. C.B

BENCH MARK
+ CUT ON CURB
ELEV. = 140.48

EXIST. A.C. ROADWAY

D-12 D-24 D-18

EXIST. C.B

HTC BOX
HECO BOXES
ELEC. BOX

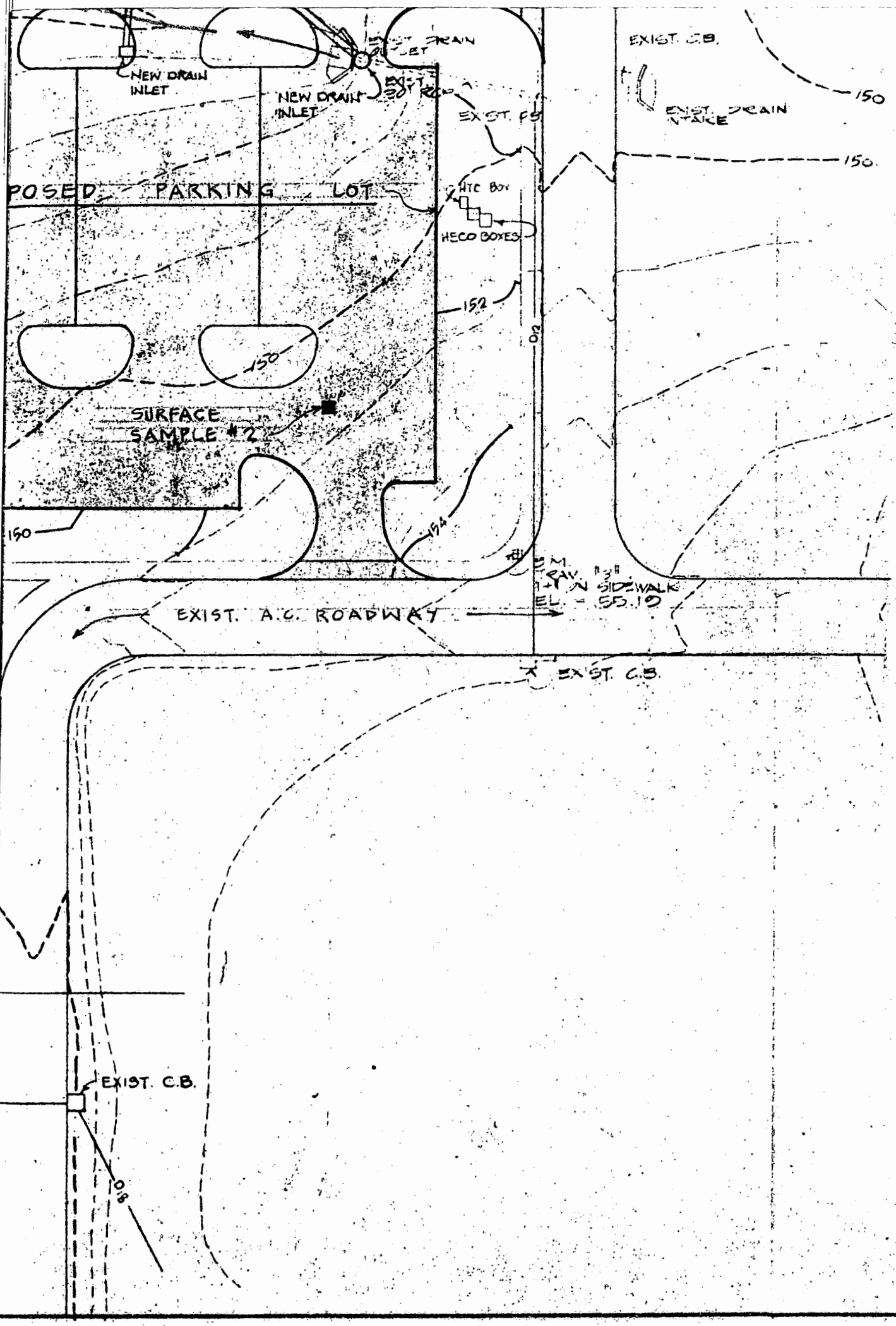
EXISTING CESSPOOL

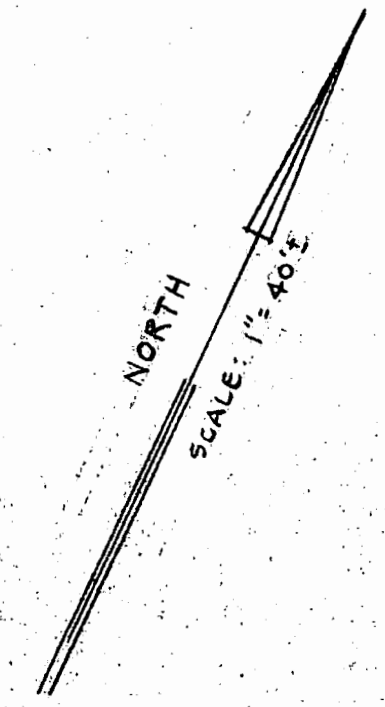
HECO BOXES

EXIST. PE LOCKER & SHOWER

EXIST. PE CLASSROOM

EXIST. MUSIC BLDG.



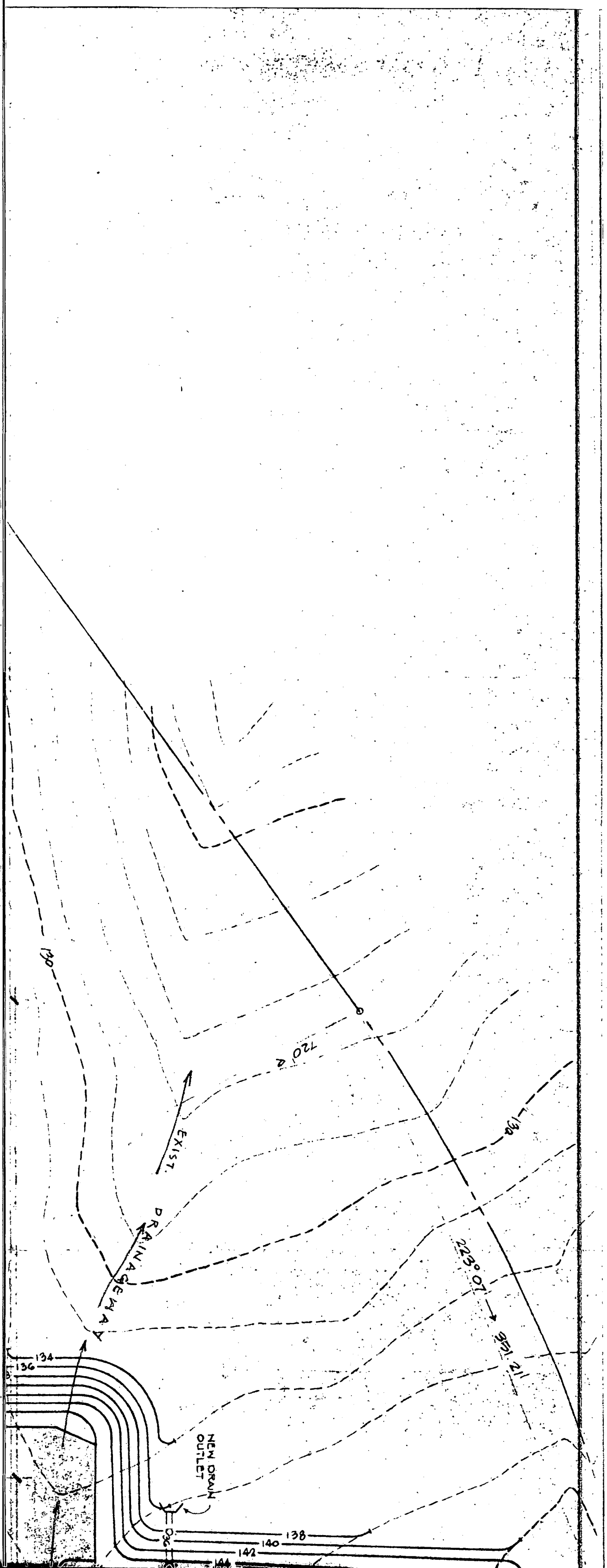


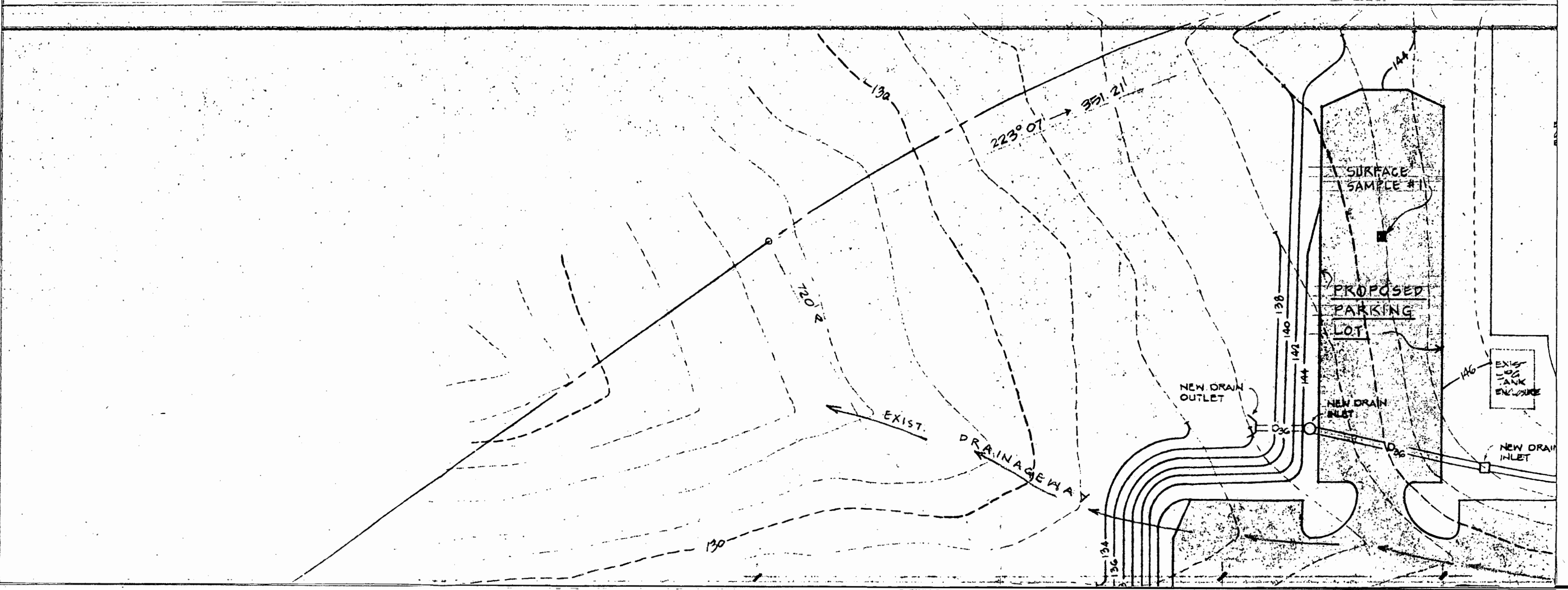
BORING LOCATION SKETCH
NANAKULI HIGH SCHOOL GYMNASIUM
NANAKULI , OAHU , HAWAII
TAX MAP KEY : 8-9-07 : POR. 3

Dr. ____
Date 2/76
Rev. ____

WALTER LUM ASSOCIATES, INC.
3030 WAIALAE AVE.
CIVIL ENGINEERS
PHONE 737-7931

Sheet
of


130
120°
EXIST.
DRAINAGE AREA A
130
223° 07'
351.21'
134
136
NEW DRAIN OUTLET
D36
138
140
142
144


223° 07'
351.21'
720'±
EXIST. DRAINAGEWAY
130
132
134
136
138
140
142
144
146
SURFACE SAMPLE #1
PROPOSED PARKING LOT
NEW DRAIN OUTLET
NEW DRAIN INLET
D36
EXIST. LPG TANK ENCLOSURE

EXIST. GAS VALVE ENCLOSURE

EXIST. AC

ARTS BLVD.

EXIST. GARBAGE ENCLOSURE

EXIST. GENERAL KITCHEN

EXIST. CESSPOOL

HECO BOXES

MTC BOX

EXIST. A.C. ROADWAY

150

148

146

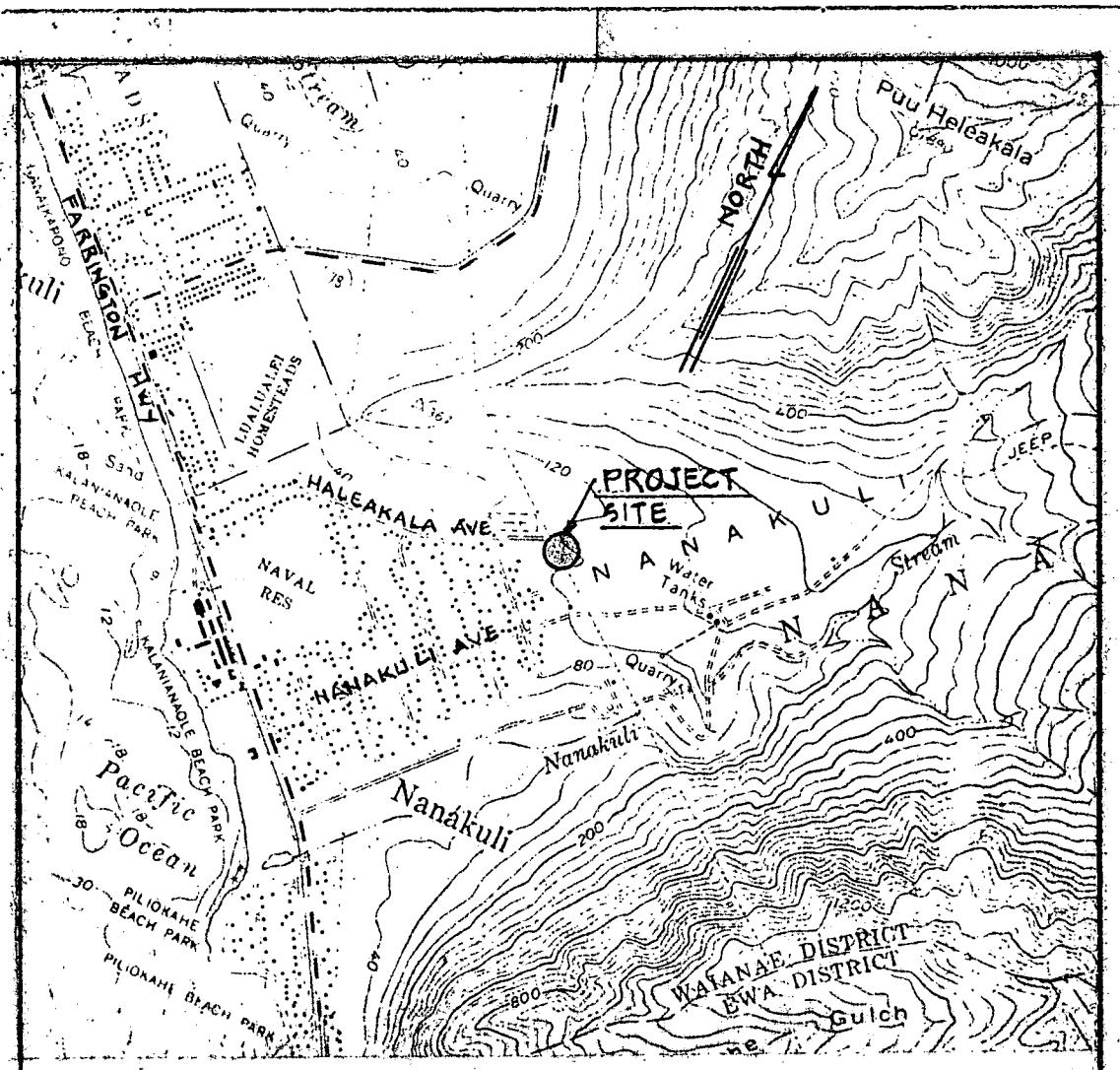
NEW DRAIN INLET

D36

D36

EXIST

AC



PROJECT LOCATION SKETCH

NOT TO SCALE

EX ST.
ARBAGE
NCLOSURE

EXIST
GENERAL
ITCHEN

EXIST
CESS DR.

HECO BOXES

NTC BOX

EXIST A.C. ROADWAY

150

148

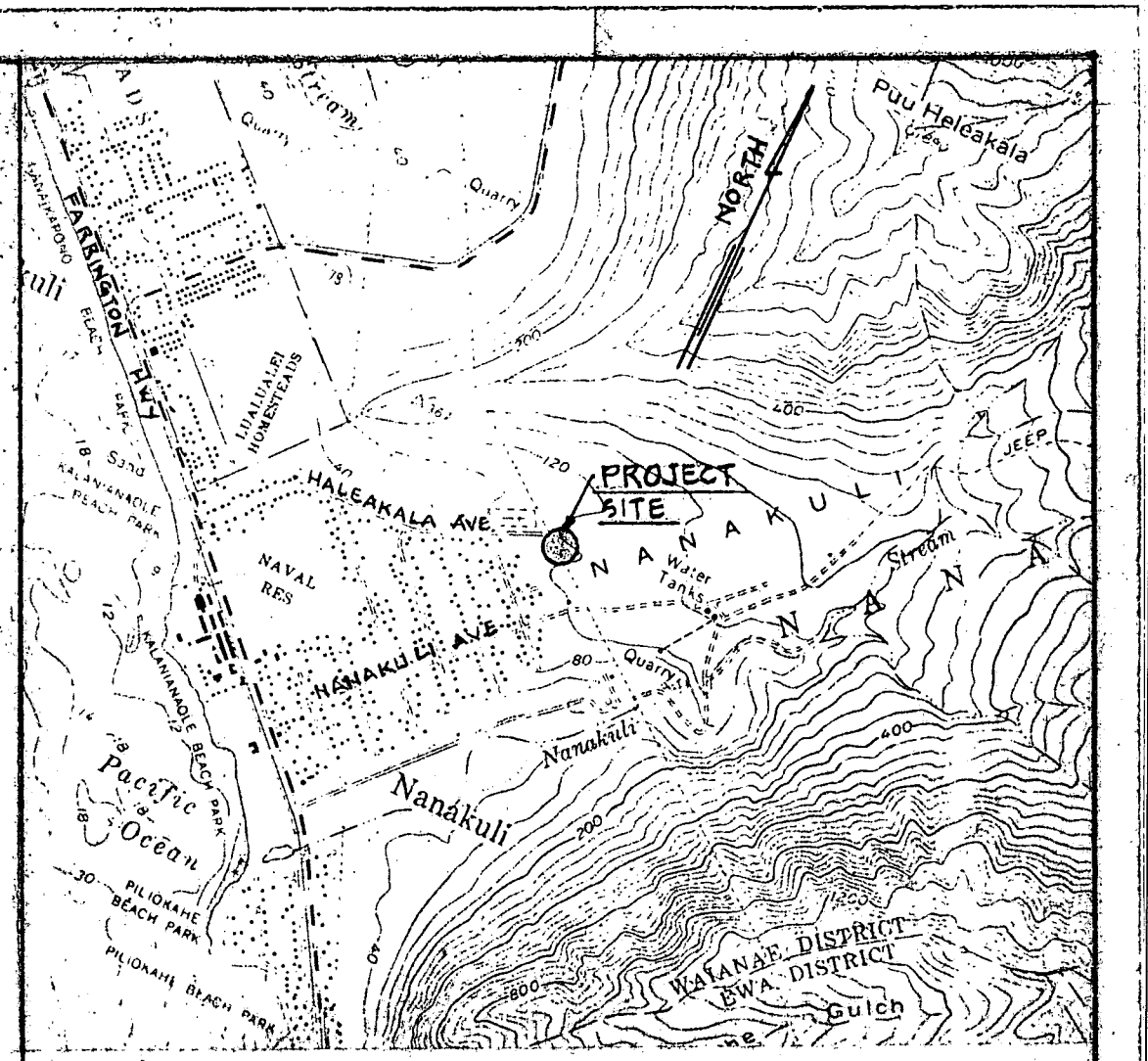
146

NEW DRAIN
INLET

D36

D18

D36



PROJECT LOCATION SKETCH

NOT TO SCALE

EXIST. PE

ARTS BLVD.

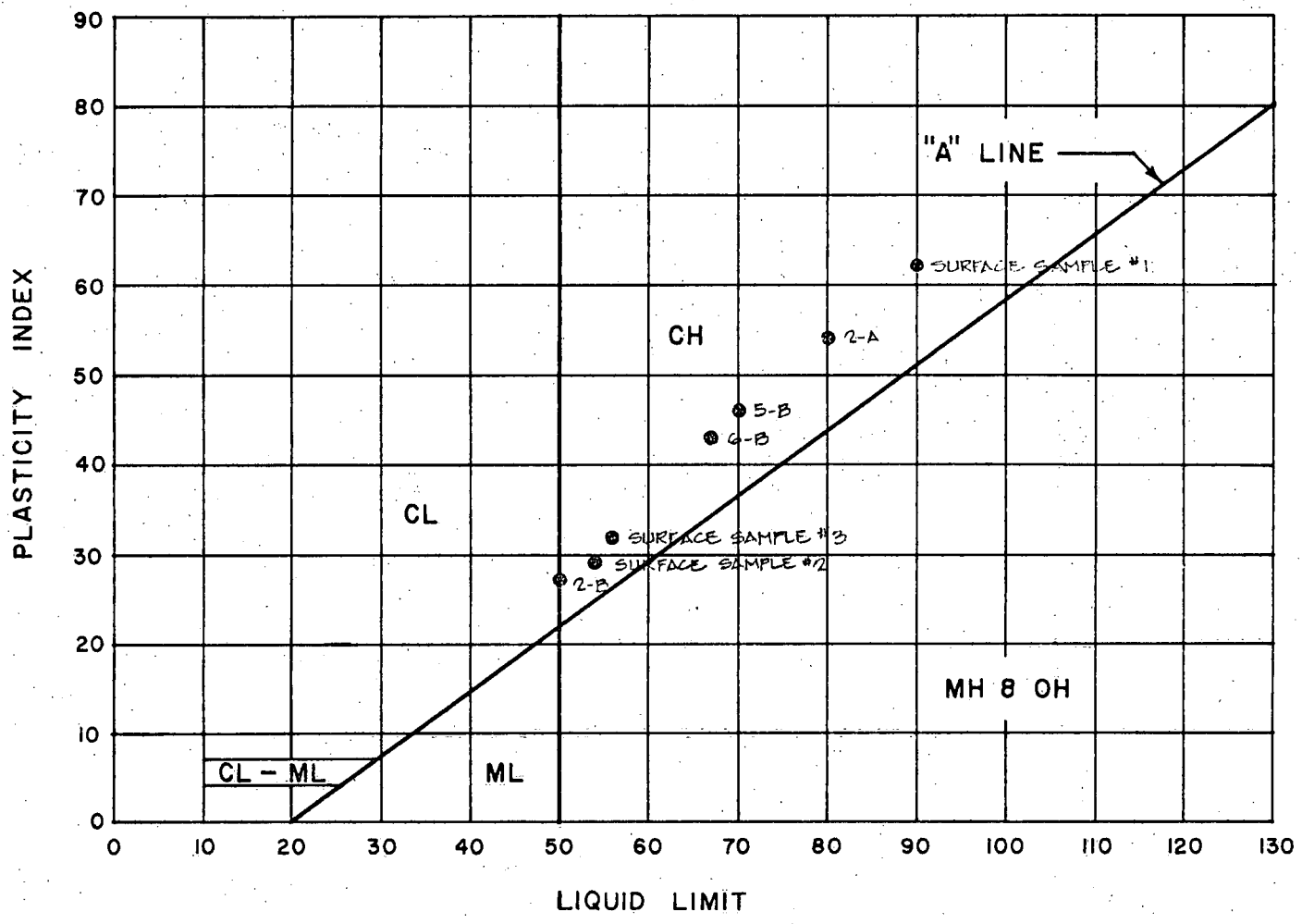
EXIST GAS
VAULT ENCLOSURE

EXIST

PLASTICITY CHART

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM

LOCATION: NANAKULI, OAHU, HAWAII



DATE 2-25-76 BY C. RACUYA

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

8-872

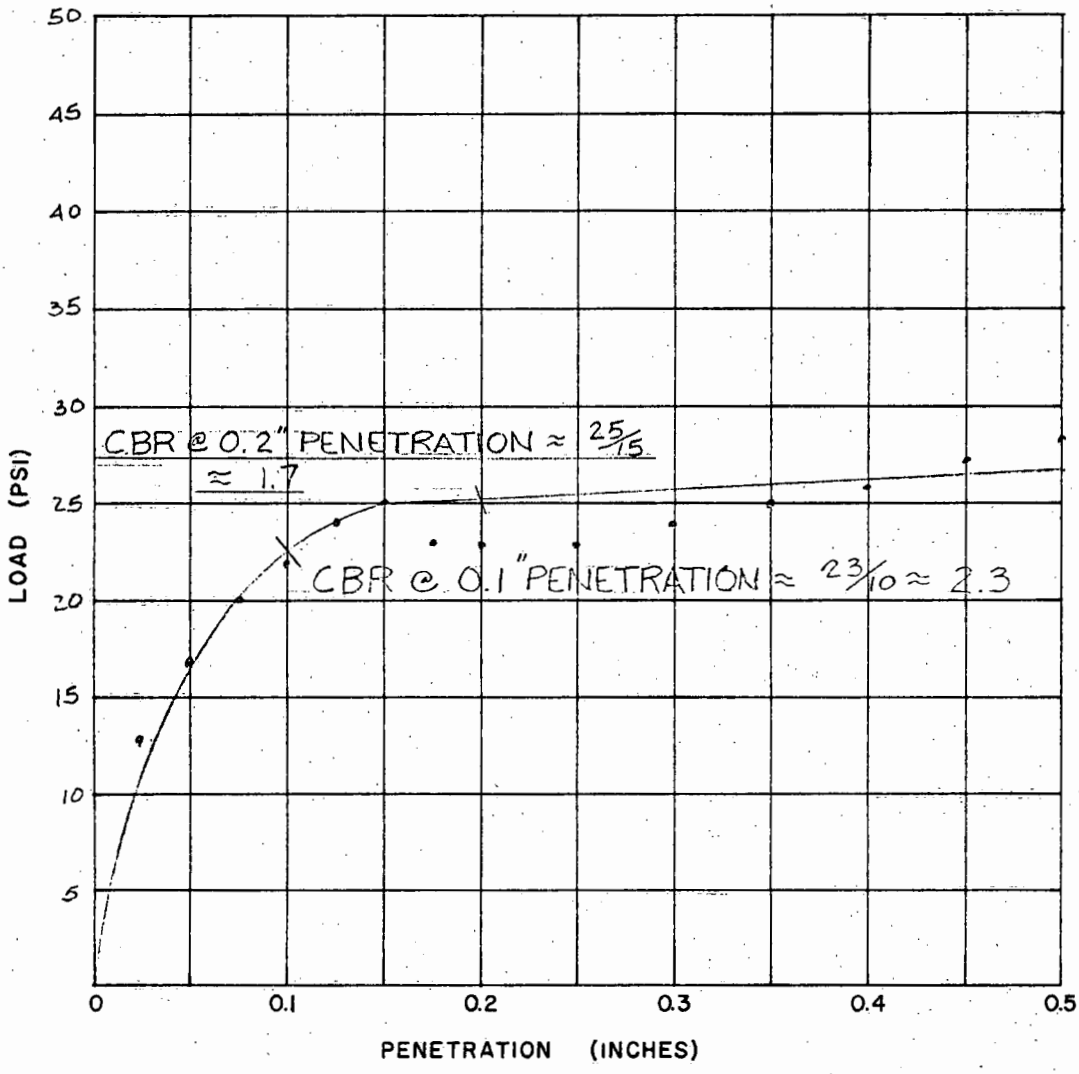
CBR TEST

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO: 1 SURFACE

SAMPLE DESCRIPTION: GRAY CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	39	13
0.050	51	17
0.075	60	20
0.100	66	22
0.125	71	24
0.150	74	25
0.175	70	23
0.200	68	23
0.250	70	23
0.300	73	24
0.350	76	25
0.400	79	26
0.450	81	27
0.500	84	28

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10 LB.

HAMMER DROP 18 IN.

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 25.4

MOLDING DRY DENSITY, P.C.F. 98.7

CBR @ 0.1" PENETRATION 2.3

DAYS SOAKED 4

DATE 2-23-76 BY R.H.

DATE 2-24-76 BY R.H.

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

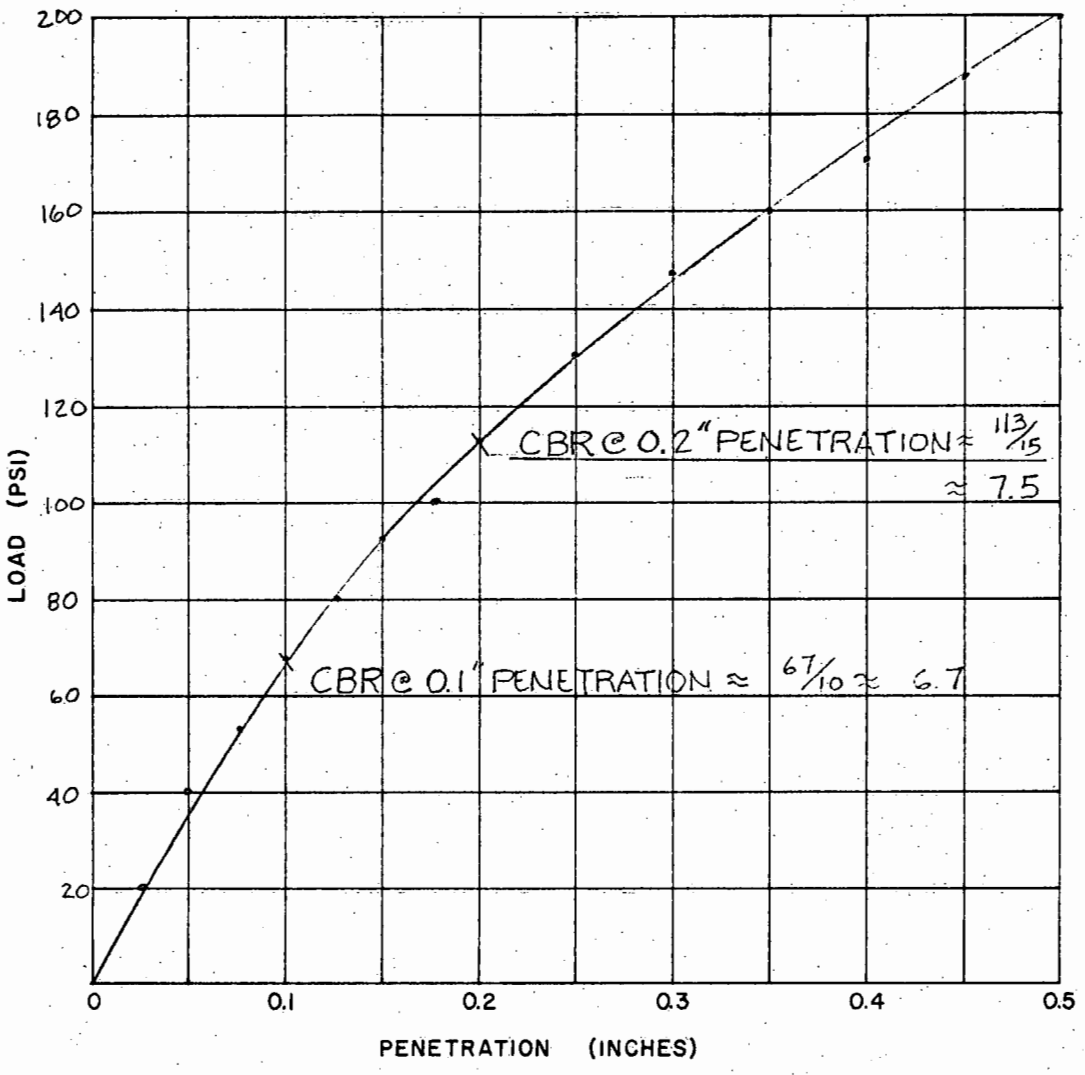
CBR TEST

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO: 2 SURFACE

SAMPLE DESCRIPTION: REDDISH-BROWN CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	60	20
0.050	120	40
0.075	160	53
0.100	200	67
0.125	240	80
0.150	280	93
0.175	300	100
0.200	340	113
0.250	390	130
0.300	440	147
0.350	480	160
0.400	510	170
0.450	560	187
0.500	590	197

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, %. 25.6

MOLDING DRY DENSITY, P.C.F. 100.8

CBR @ 0.1" PENETRATION 6.7

DAYS SOAKED 4

DATE 2-24-76 BY R.H.

DATE 2-25-76 BY R.H.

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

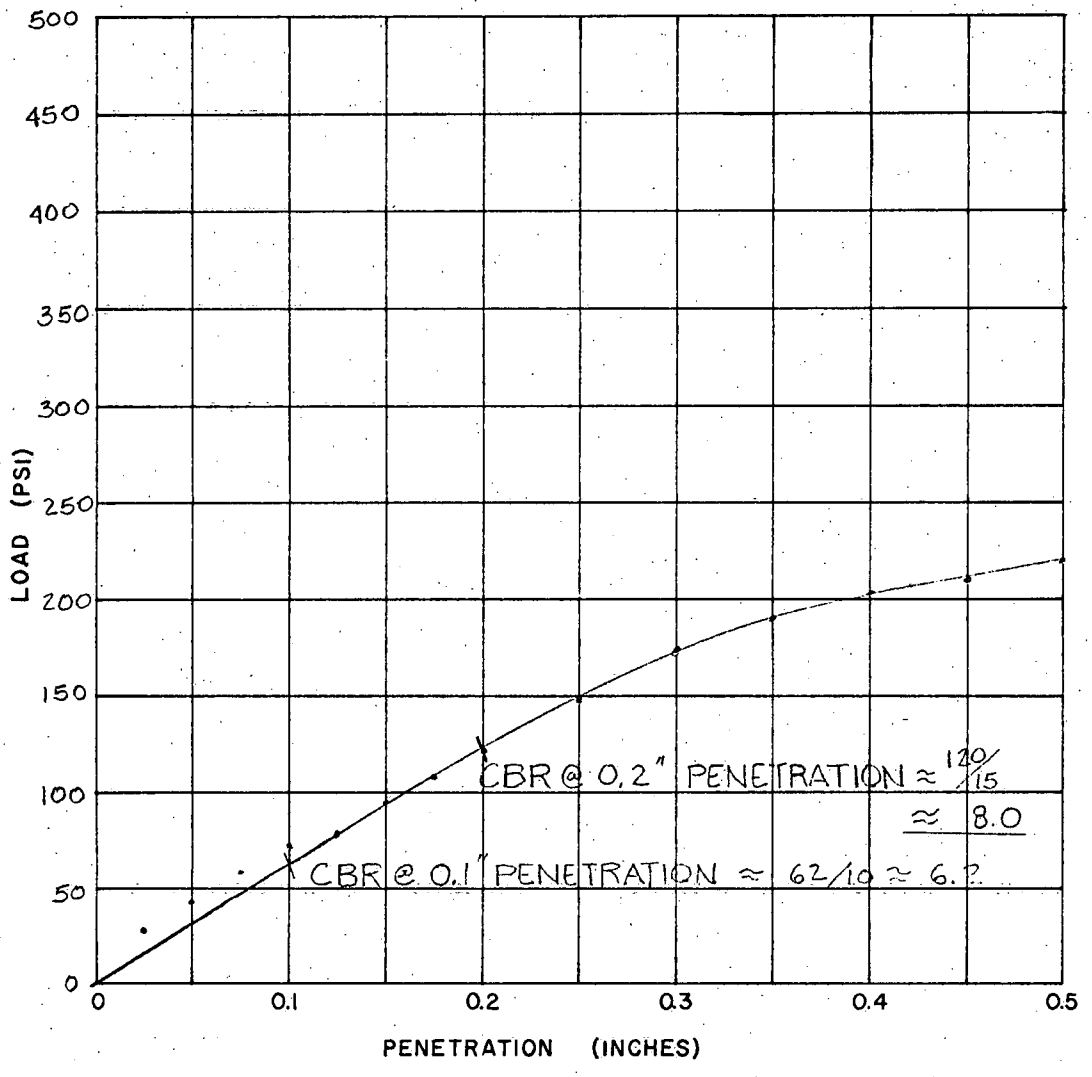
CBR TEST

PROJECT: NANAKULI HIGH SCHOOL GYMNASIUM

LOCATION: NANAKULI, OAHU, HAWAII

SAMPLE NO: 3 SURFACE

SAMPLE DESCRIPTION: GRAY-BROWN CLAY



CBR PENETRATION DATA

PENETRATION (INCHES)	LOAD (LBS.)	LOAD (PSI)
0.025	80	27
0.050	130	43
0.075	170	57
0.100	215	72
0.125	235	78
0.150	285	95
0.175	320	107
0.200	360	120
0.250	440	147
0.300	515	172
0.350	570	190
0.400	605	202
0.450	630	210
0.500	660	220

AGGREGATE 1/4" MINUS

HAMMER WEIGHT 10LBS

HAMMER DROP 18 INS.

No. OF BLOWS 56/LAYER

No. OF LAYERS 5

TEST RESULTS:

MOLDING MOISTURE, %. 21.6

MOLDING DRY DENSITY, P.C.F. 104.9

CBR @ 0.1" PENETRATION 6.2

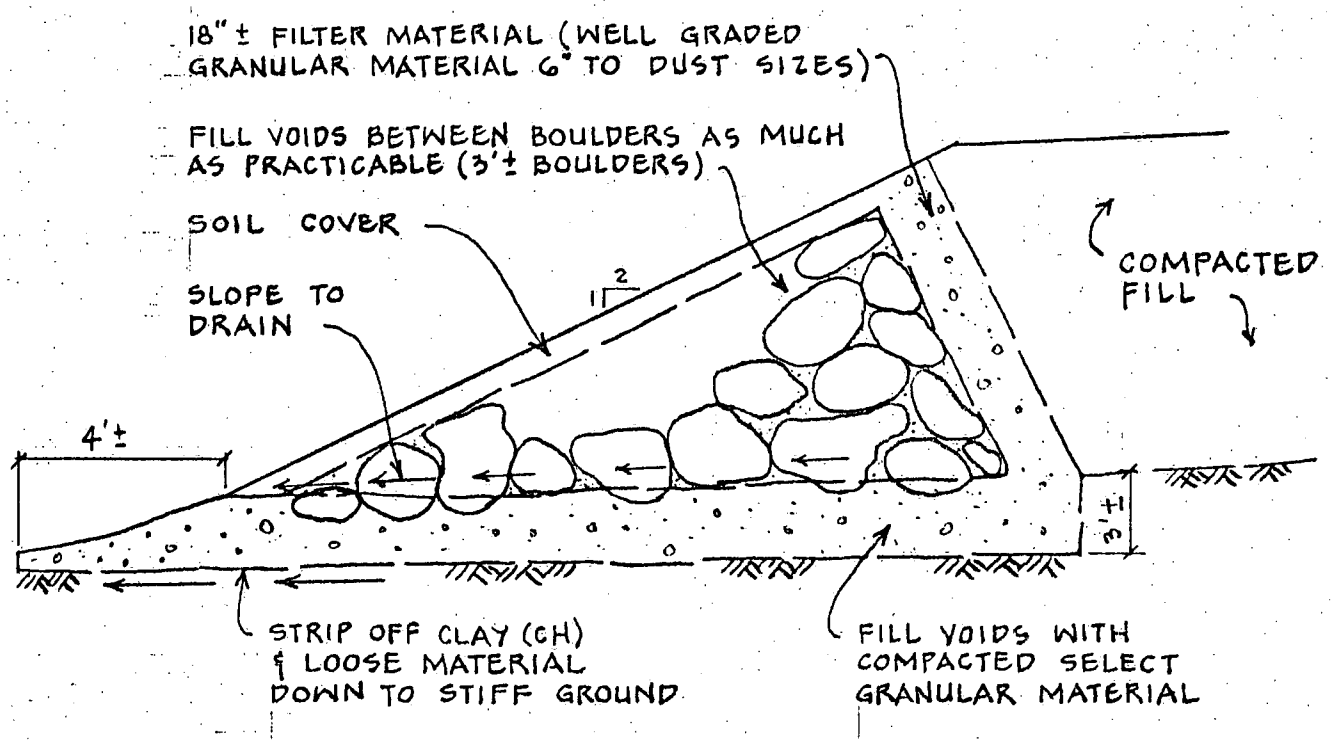
DAYS SOAKED 4

DATE 2-24-76 BY R.M.

DATE 2-25-76 BY R.H.

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

10-470



SECTION

NOT TO SCALE

FIGURE 1

SUGGESTED BUTTRESS FILL

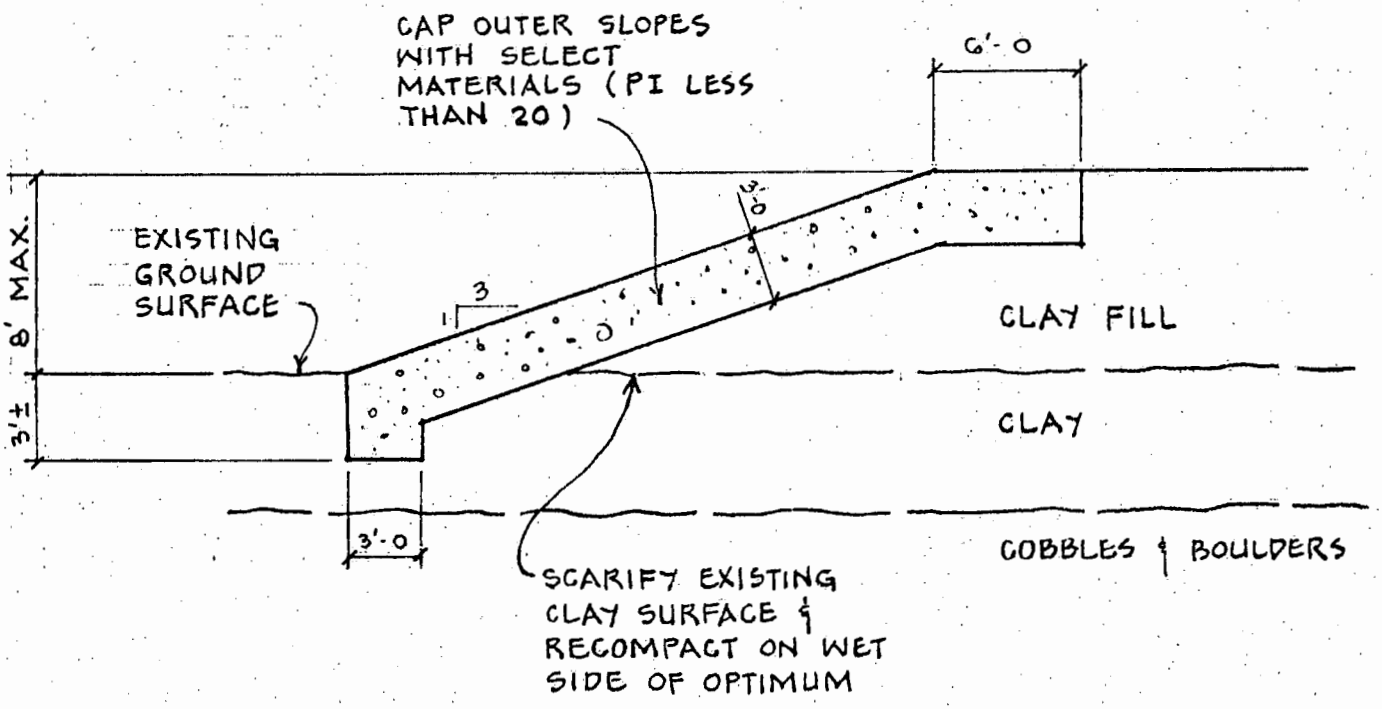
NANAKULI HIGH SCHOOL GYMNASIUM

NANAKULI, OAHU, HAWAII

TAX MAP KEY: 8-9-07: POR. 3

WALTER LUM ASSOCIATES, INC.

CIVIL, STRUCTURAL, SOILS ENGINEERS



SECTION

NOT TO SCALE

FIGURE 2

SUGGESTED CLAY SLOPES

NANAKULI HIGH SCHOOL GYMNASIUM

NANAKULI, OAHU, HAWAII

TAX MAP KEY: 8-9-07: POR. 3

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

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.