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**FOR REFERENCE**  
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FOUNDATION INVESTIGATION

0.2 M.G. RESERVOIR SITE

NIU VALLEY HIGHLANDS

TMK: 3-7-03-72

for

BUDGET REALTY

June 29, 1973

W.O. 198

ERNEST K. HIRATA & ASSOCIATES, INC.

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



ERNEST K. HIRATA & ASSOCIATES, INC.

Soils and Foundation Engineering

1157 South King Street • Honolulu, Hawaii 96814 • Phone 531-5733

June 29, 1973  
W.O. 198

Budget Realty  
1234 Kaumualii Street  
Honolulu, Hawaii 96817

Attention: Mr. Richard Mew

Gentlemen:

Our report, "Foundation Investigation, 0.2 M.G. Reservoir Site, Niu Valley Highlands, TMK: 3-7-03-72," dated June 29, 1973 is enclosed.

This is the report requested by you and planned in cooperation with Mr. Yasuo Arakaki, Civil Engineer.

The one exploratory boring indicates that the upper 21 feet of surface soil consists of gravelly silt with numerous cobbles and boulders. The gravelly silt is slightly clayey and dense. Underlying the gravelly silt was a reddish brown porous weathered rock.

The proposed site was found to be feasible for the reinforced concrete reservoir. The site should be grossly stable against any slope failure. Recommendations are included in this report for the development of the structure.

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

Very truly yours,

Ernest K. Hirata & Associates, Inc.

  
Ernest K. Hirata

EKH:ph

FOUNDATION INVESTIGATION

0.2 M.G. RESERVOIR SITE

NIU VALLEY HIGHLANDS

TMK: 3-7-03-72

INTRODUCTION

This report presents the results of our foundation investigation performed on the subject property. The purpose of this investigation was to determine the nature of the soils underlying the site, to ascertain their engineering properties, and to provide recommendations for foundation design and floor slabs.

This investigation included drilling one exploratory test boring, obtaining representative soil samples, laboratory testing and analysis, and the preparation of this report. The exploratory boring location is shown on the enclosed Grading Plan.

STRUCTURAL CONSIDERATIONS

The proposed reservoir will be constructed of reinforced concrete having a plan dimension of approximately 50 feet in diameter and 17 feet high. Four precast columns will be used to support the concrete roof loads.

The maximum load on the floor of the reservoir due to the weight of the water will be approximately 1000 PSF. The maximum column load will be on the order of 37 kips.

The proposed grading plan indicates a maximum cut of 25 feet with a variable height retaining wall along the uphill face of the slope. The maximum height of the retaining wall will be approximately 20 feet, with cut slope gradients of  $1\frac{1}{2}:1$  (horizontal to vertical).

#### SITE CONDITIONS

The proposed reservoir site is situated along the Ewa slope of Hawaiiiloa Ridge approximately 0.4 miles from the end of Anolani Street in Niu Valley. The site for the reservoir has an existing slope gradient of approximately 36 percent. The site is heavily covered with brush and trees, and numerous boulders were observed on the surface.

#### FIELD EXPLORATION

The site was explored on June 20, 1973 by drilling one exploratory test boring with a truck-mounted rotary drill rig. Prior to drilling, a bulldozer was used to provide access to the site.

The boring was drilled to a maximum depth of 40 feet. The boring location is shown on the Grading Plan, and the soils encountered are logged on Plates A1 and A2.

The soils were continuously logged by our field engineer and classified by visual examination in accordance with the Unified Soil Classification System.

Undisturbed and bag samples were recovered from the borings for laboratory testing. Undisturbed samples were obtained by driving a thin walled steel sampler with a 140 pound hammer from a height of 30 inches. The required blow count for each six inches of penetration is shown on the enclosed "Boring Logs".

#### SOIL CONDITIONS

The onsite surface soil can be classified as colluvium material deposited from the weathering of Hawaiiiloa Ridge.

The exploratory boring indicates that the upper 21 feet of surface soil consists of gravelly silt with numerous cobbles and boulders. The gravelly silt is slightly clayey and appears to be dense. Underlying the gravelly silt was a reddish brown porous weathered rock.

Groundwater was not encountered to the maximum depth drilled.

## RECOMMENDATIONS

### General

The site was found to be feasible for the proposed 0.2 M.G. reinforced concrete reservoir. Conventional shallow foundations may be used to support the structure.

### Foundations

Conventional spread footings may be used to support the structure. An allowable bearing value of 3000 PSF may be used for the design of the footings.

### Lateral Design

The bearing value indicated above is for the total of dead and frequently applied live loads, and may be increased by one-third for short duration loading which includes the effect of wind or seismic forces. Resistance to lateral loading may be provided by friction acting at the base of foundations. An allowable coefficient of friction of 0.4 may be used with the dead load forces.

### Floor Slabs

A six inch layer of crushed rock should be placed under all concrete slabs.

### Site Grading

Cut slopes should be stable at slope gradients of  $1\frac{1}{2}$ :1 (horizontal to vertical). Fill slopes should be stable at slope gradients of 2:1. All slopes should be planted as soon as possible upon completion of grading.

Since approximately 25 feet of the upper material will be removed, the reinforced concrete reservoir will be founded on the weathered rock. The site should be grossly stable against mass slope failure since the weight of the soil removed will be nearly equal to the total weight of the proposed reservoir.

### Inspection

It is recommended that all footings be inspected by a qualified soils engineer prior to placing concrete or steel. Any fill which is placed should be inspected and tested. Any import of fill material should be inspected by us to ascertain that the engineering properties meet our recommendations for foundation design.

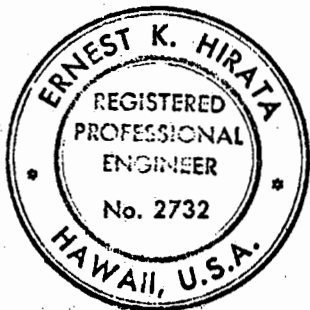
### Limitations

The boring log indicates the approximate subsurface soil conditions encountered only at the location where the boring

was made and may not represent conditions at other locations.

During construction, should subsurface conditions differ from those encountered in the boring, we should be advised immediately in order to review and to revise our recommendations.

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



Respectfully submitted,

Ernest K. Hirata & Associates, Inc.

*Ernest K. Hirata*  
Ernest K. Hirata P.E. 2732

Enc: Log of Borings  
Consolidation Test Report  
Maximum Density Curve  
Grading Plan

Plates A1 and A2  
Plate B1

EKH:ph





# ERNEST K. HIRATA & ASSOC.

## BORING LOG

BORING NO. B1 (cont.)

DRIVING WT. 140 lb.

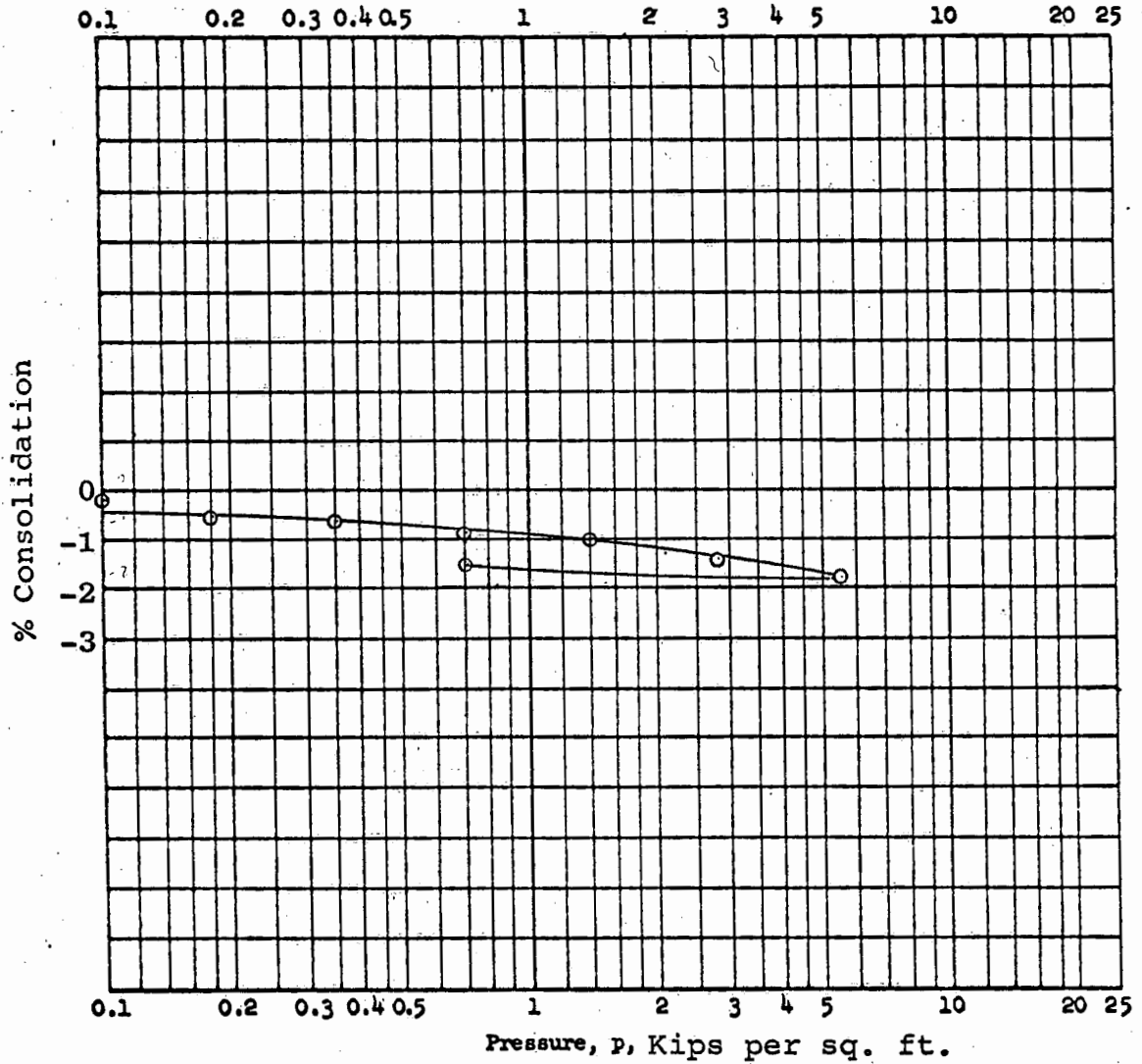
DATE OF DRILLING 6-20-73

SURFACE ELEV. 295 +

DROP 30 in.

W.O. 198

DEPTH FEET	CORE	BAG	PENE. RESIST. BLOWS/6 in.	DRY DENSITY PCF	MOISTURE CONTENT %	RELATIVE COMPACTION %	DIRECT SHEAR STRENGTH PARAMETERS		CLASSIFICATION (% Sand, % Silt, % Clay)
							$\phi$	c	
30									
	x		38 63 100	91.6 2.5"	18.9				
35									
	x		50 100	87.9 3"	19.2				
40									End boring at 40 feet.



Type of Specimen		Undisturbed		Before Test		After Test	
Diam	2.40 in.	Ht	1.0 in.	Water Content, $w_o$	18.9 %	$w_f$	%
Overburden Pressure, $p_o$ T/sq ft				Void Ratio, $e_o$		$e_f$	
Preconsol. Pressure, $p_c$ T/sq ft				Saturation, $S_o$		% $S_f$ %	
Compression Index, $C_c$				Dry Density, $\gamma_d$		91.6 lb/ft <sup>3</sup>	
Classification Decomposed Rock				$k_{20}$ at $e_o =$		$\times 10^{-7}$ cm/sec	
LL	$C_u$	Project 0.2 M.G. Reservoir Site					
PL	$D_{10}$	Budget Realty					
Remarks				Area W.O. 198			
				Boring No. B1		Sample No.	
				Depth 33'		Date 6-28-73	
				<b>CONSOLIDATION TEST REPORT</b>			

MAXIMUM DENSITY CURVE

UNIT WEIGHT DRY (PCF)

100  
95  
90

98.5 PCF

24.5%

20 25 30

MOISTURE CONTENT (%)

Boring: BI

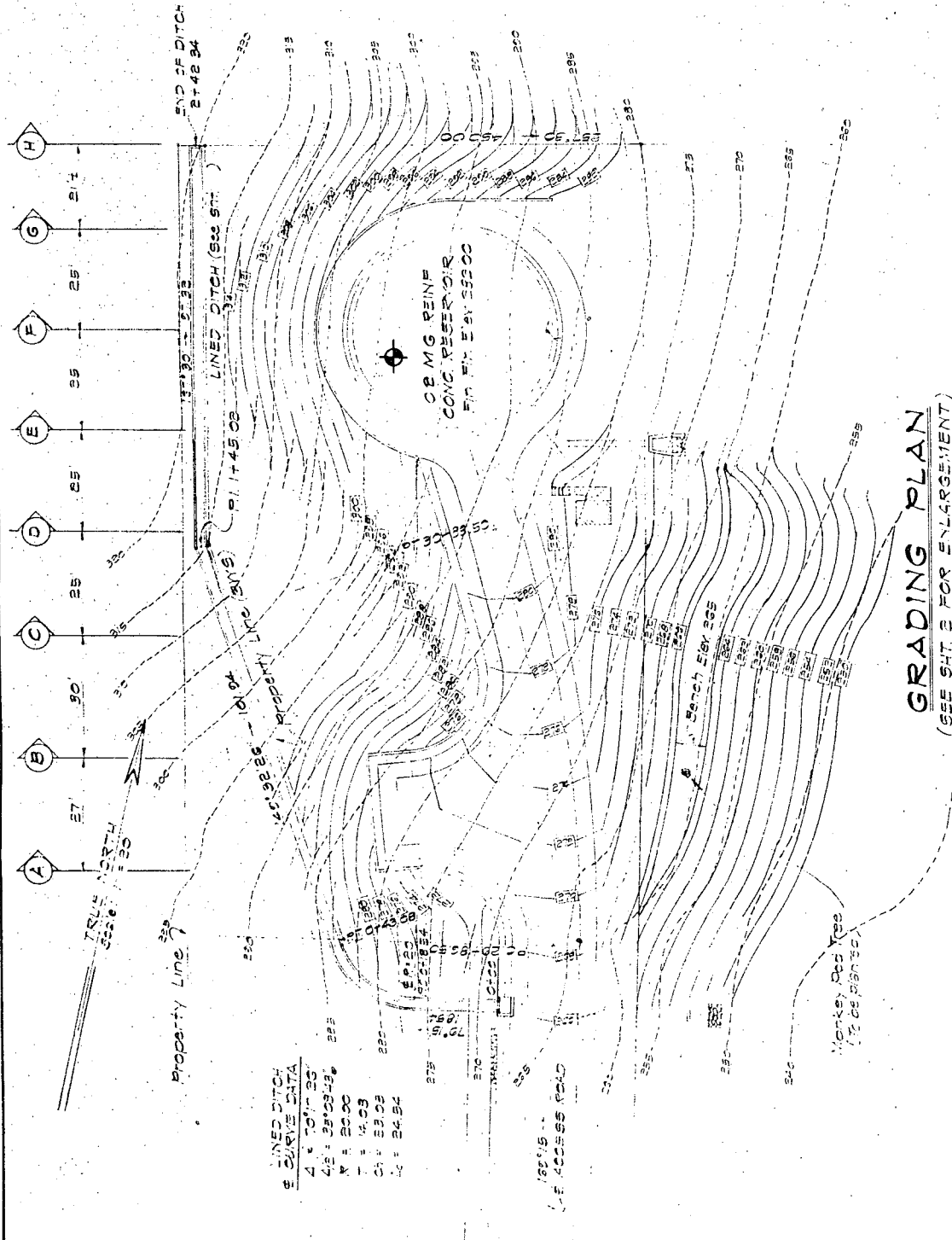
Depth: 3'-5'

Classification: Gravelly Silt

W.O. 198

Plate C

No. 910-9, 10 x 10 to 1"  
The A. Lynch Co., San Francisco  
Made in U. S. A.

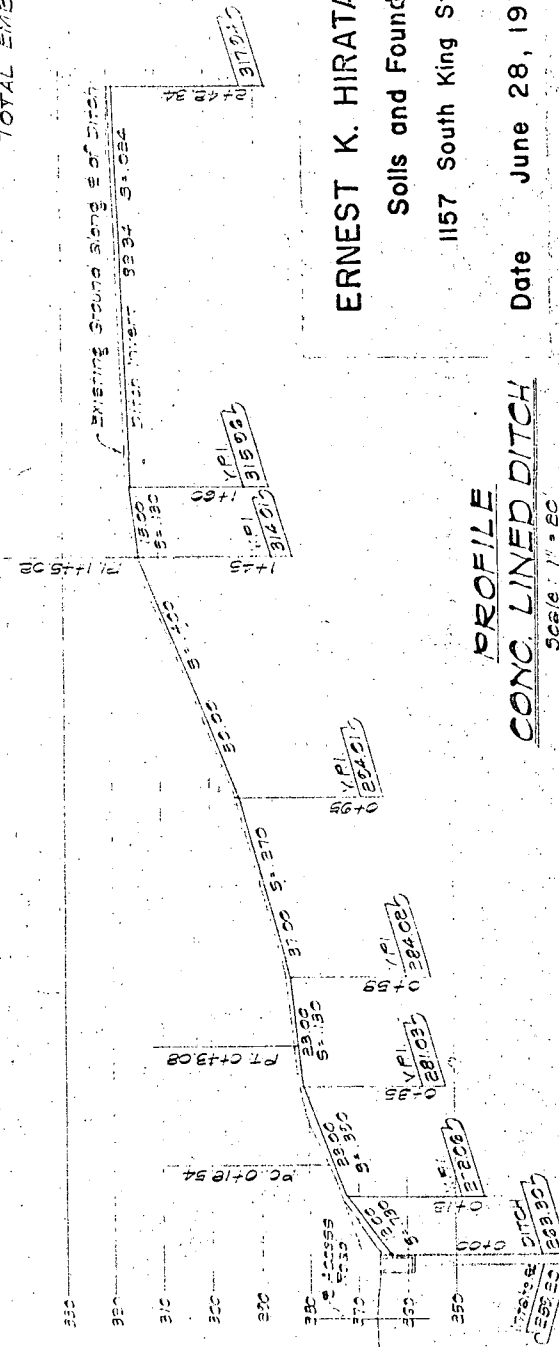


**GRADING PLAN**  
(SEE SHEET FOR ENLARGEMENT)

**GRADING NOTES:**

1. All grading work shall conform to Chapter 25, Revised Ordinances of Honolulu, 1967, as amended, Ordinance No. 3128.
2. The Contractor shall remove all dirt and debris resulting from his work and deposit it in a designated facility, roadway and other areas. The logs incurred for any necessary remedial action by the Chief Engineer shall be borne by the Contractor.
3. The Contractor, at his own expense, shall keep the road, areas and surrounding area, the storm drain, sidewalks, fire hydrants, etc. clear and unobstructed. This work shall be done in accordance with the standards and regulations of the State Department of Health.
4. All grading operations shall be performed in accordance with the standards of the Water Pollution Control and Water Quality Standards contained in the Public Health Regulations, State Department of Health, on Water Pollution Control and Water Quality Standards.
5. All slopes and exposed areas shall be sodded or planted immediately after the grading work has been completed.
6. Fills on slopes steeper than 5:1 shall be keyed.
7. The City shall be informed of the location of the disposal site for the excess material from the project when the application for a grading permit is made. The disposal site must also fulfill the requirements of the Grading Ordinance.
8. Prior to the issuance of a grading permit, the permittee shall obtain a certification by the State Department of Health on the acceptability of the proposed erosion control.
9. No grading work shall be done on Saturdays, Sundays and holidays or any time without prior notice to the Chief Engineer.

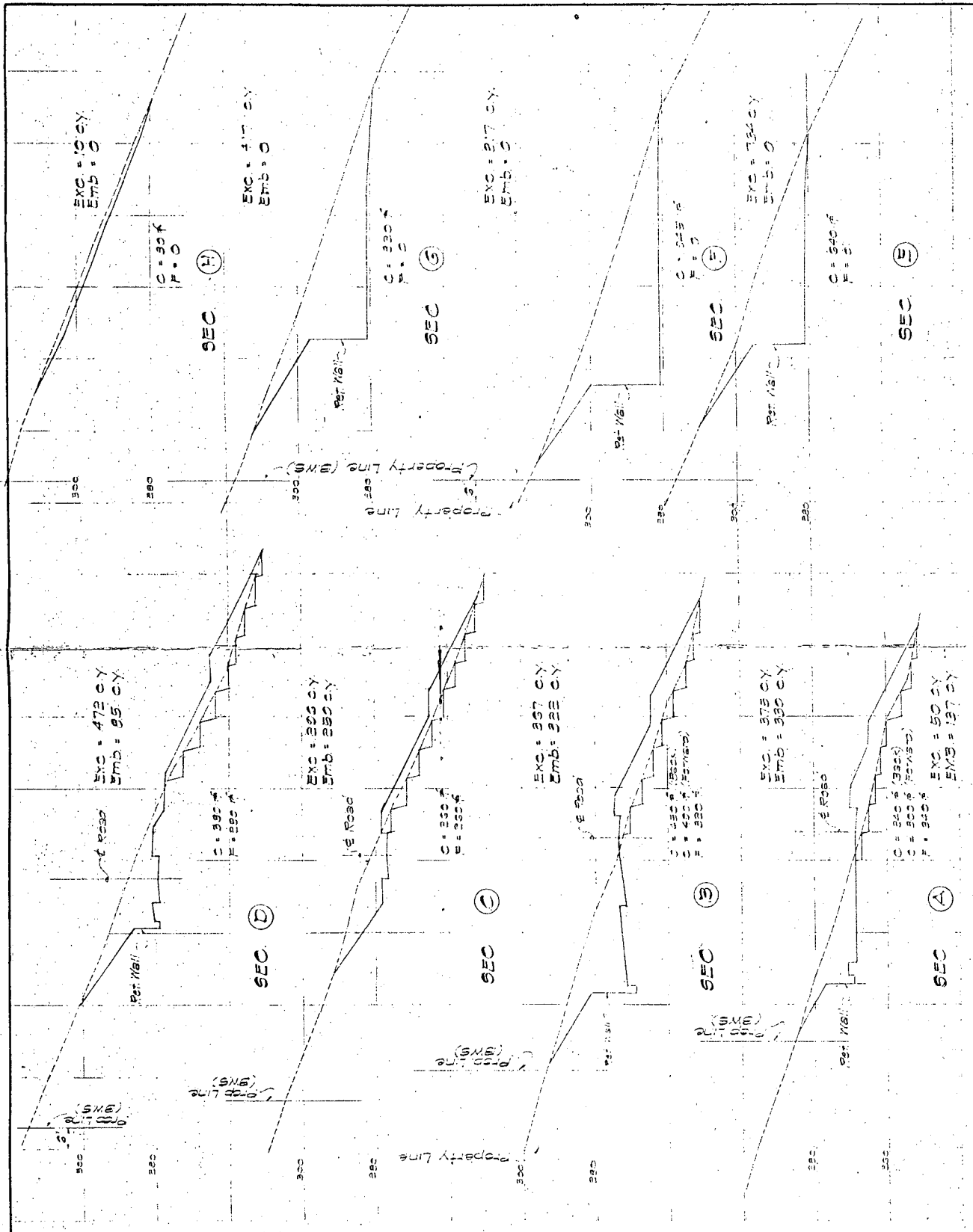
**Approx. Location of Boring**



**PROFILE**  
**CONC LINED DITCH**  
Scale: 1" = 60'

**CROSS SECTIONS**  
Scale: 1" = 20'

**ESTIMATED EARTHWORK QUANTITIES**  
TOTAL EXCAVATION = 9998 cu yds.  
TOTAL EMBANKMENT = 1124 cu yds.



**NIU VALLEY HIGHLANDS**  
NIU, WAIKIKI, HONOLULU, HAWAII

**0.2 M.G. RESERVOIR SITE**  
**GRADING PLAN**

DATE: \_\_\_\_\_  
ENGINEER: \_\_\_\_\_  
ASSISTANT ENGINEER: \_\_\_\_\_

**ERNEST K. HIRATA & ASSOCIATES, INC.**  
Soils and Foundation Engineering  
1157 South King Street Honolulu, Hawaii

Date **June 28, 1973**  
W.O. 198