SECTION 01010

STATEMENT OF WORK

1.0 General

This is a design-build contract consisting of two building replacement projects: 1) Billet Buildings (CLINs 0001, 0003-0006); and 2) Recreation Center (CLIN 0002). Accepted construction drawings dated 21 February 2003 and 15 July 2003, respectively, have been prepared and are provided with this contract. However, these drawings may be incomplete in some areas and may require additional design documentation.

The Contractor shall be responsible for reviewing the provided drawings for the two projects, as referenced above, identifying those areas requiring additional design documentation, and developing the drawings and specifications necessary to complete the design.

In addition, the Contractor shall review all provided drawings for overall conformance to applicable codes. Should the Contractor identify any portion of the provided drawings that do not meet code, the Contracting Officer shall be immediately notified. The Contractor shall revise the drawings as needed to correct the code violation at no additional cost to the contract.

The plans and specifications contained on the provided drawings may be considered acceptable to the Government, except as noted below. However, the Contractor shall prepare additional design documents to fulfill all of the requirements contained in this section; or to supplement the provided drawings covering any construction that cannot be constructed based on the information depicted in the provided drawings, or any construction, which the Contractor chooses to vary from the provided drawings. All variations shall be clearly identified and explained.

The Contractor shall not make any changes to the location or orientation of any of the buildings or major site features from that shown on the drawings provided by the Government. The exterior appearance of all buildings shall also remain unchanged.

2.0 Description of Projects

2.1 Billet Buildings

There are a total of eight (8) billet buildings constructed in one-, two-, and three-building modules. Four buildings have been identified as Base Bid, and the other four buildings are Options (see Title Sheet). The billets in the multi-building modules are connected by covered walkways. Sitework consists of site preparation, site grading and drainage, emergency vehicle access roads, an exterior fire protection system, a potable water supply system, and an underground electrical supply system.

2.2 Recreation Center

The Recreation Center construction consists of site preparation, site grading and drainage, a recreation center building, an exterior fire protection system, a potable water supply connection, a septic tank and leaching field, and site electrical.

3.0 Additional Design Required

3.1 Fire Protection for the Billet Buildings

The Contractor shall prepare and provide all necessary plans, specifications, and details necessary to construct the items described below.

a. On sht. C-3, the 200mm fire protection waterline shall be extended approximately 100m in a southwesterly direction following the existing road beyond the Command/Range Control parking lot driveway. The Contractor shall connect to the 200mm waterline feeding the Command/Range Control building and under construction by the Command/Range Control contractor. The Contractor shall coordinate the exact location, timing, and fittings required for this connection with the Command/Range Control contractor. See Attachment 1 for general layout. The Contractor shall also be responsible for completing the design necessary to ensure a complete and operating fire protection system for the Billets .

b. Provide 20'-wide, minimum, AC-paved access road for fire department and emergency vehicle access to each building in accordance with UFC 3-600-01, 2-10. The vehicle access road shall terminate no further than 10 meters from the building it serves. The layout of the access road(s) shall effectively accommodate construction of all eight (8) billet buildings, as sited, regardless of the number and location constructed under this contract. At the entrance from the existing road to each new access road(s), install two 4" diameter concrete-filled, steel pipe bollards (see Recreation Center drawings shts. C-2 and C-3 for details) with a barrier chain attached to each bollard suspended across the entrance and secured with a heavy-duty padlock. Each padlock shall have 6 keys. All padlocks shall be keyed alike.

c. Provide a fire alarm system complete with manual pull stations, audible/visual devices and smoke detection system in accordance with UFC 3-600-01, 6-1.3 and NFPA 101, 28.3.4. Electronic audible alarm is required. Include provisions for future electrical connections and wall space adjacent to the fire alarm panel for connection to a future transmitting unit.

d. Provide complete automatic sprinkler protection for all buildings in accordance with UFC 3-600-01, 6-1. This system shall be connected to the 200mm fire protection waterline. All fire protection distribution lines shall maintain the same minimum clearance from the potable waterlines as required for sewer lines. The sprinkler pipes inside the buildings shall be concealed. Pipes shall be Sched 40 steel. Sprinklers and escutcheons shall have chrome-plated finish. Multiple billets connected by covered walkways may be serviced by a single riser and alarm zone.

Risers shall be located inside the building and need not be concealed. Water motor gong shall be provided.

3.2 Fire Protection for the Recreation Center

The Contractor shall prepare and provide all necessary plans, specifications, and details necessary to construct the items described below.

a. On sht. C-2, delete the 75mm and 150mm fire protection water lines shown on the north side of the building; delete the 200mm fire protection waterline connection to the existing 365mm fire protection main shown in the Inset. The fire hydrant shall remain. The Contractor shall connect to the 200mm waterline feeding the Command/Range Control building and under construction by the Command/Range Control contractor on the east side of the building at the approximate location shown on Attachment 1. The Contractor shall coordinate the exact location, timing, and fittings required for this connection with the Command/Range Control contractor. The Contractor shall also be responsible for completing the design necessary to ensure a complete and workable fire protection system for this building.

b. Provide 20'-wide, minimum, AC-paved access road for fire department and emergency vehicle access to the building in accordance with UFC 3-600-01, 2-10. Locate the road north of the leaching field to accommodate dual-purpose use as a service road for the septic tank and leaching field also. The vehicle access road shall terminate no further than 10 meters from the building. At the entrance from the existing road to the new access road, install two 4" diameter concrete-filled, steel pipe bollards (see Recreation Center drawings shts. C-2 and C-3 for details) with a barrier chain attached to each bollard suspended across the entrance and secured with a heavy-duty padlock. The padlock shall have 6 keys. This padlock shall be keyed alike to the padlocks provided at the billet buildings.

3.3 Signage

a. Facility Identification Signs. Provide and install a facility identification sign at the main entrance to the Recreation Center and the Billets. The signs shall match existing base signage in materials and appearance. Text and location shall be coordinated with the DPW representative and the Contracting Officer.

b. Building Numbers. Provide and install a building number sign on each new building. The signs shall match existing building number signs in materials and appearance. The building numbers and the location of the signs shall be coordinated with the DPW representative and the Contracting Officer.

3.4 Use of Design Standards, Standard Details, Specifications, and UFGS

The Contractor shall base its design only on those design standards, standard details, specifications or UFGS that are referred to on the drawings, or as amended below. In its design submittals (see Section 01012), the Contractor shall clearly identify the source of its

basis of design. When a UFGS is used, a redline markup of the edited specification shall be included in the 90% submittal. A clean copy of the accepted 90% specification, without editing marks, shall be included in the 100% submittal.

3.5 Resolution of Conflicts

The drawings for the Billet Buildings and the Recreation Center were originally packaged as two separate contracts. Therefore, there may be instances of differences or inconsistencies in the details and/or requirements between the two sets of drawings. It is not the Government's intent to apply different standards to the two areas.

The Contractor is responsible for resolving all design conflicts and issues. Any details or specifications shown in one set of drawings and not shown on the other shall be of like effect as if shown on both. In case of differences between the two sets of drawings, the Contractor shall identify the differences and incorporate its proposed solution in the 90% design submittal (see Section 01012). In case neither set of drawings shows the required detail, the Contractor shall include the detail in its 90% design submittal.

3.6 Award of Billet Buildings Options

The drawings for the billet buildings reflect construction of all 8 buildings. The Contractor shall assume that the Government intends to eventually construct all billets. Utility layouts shall provide for future connections without requiring unnecessary tear out or rework. In its 90% design submittal, the Contractor shall indicate on the applicable plans, i.e. sht. C-3, Site Layout and Utility Plan, sht. C-4, Site Grading and Drainage Plan, sht. E-2, Site Electrical Plan, etc. the extent of the construction that will be performed under this contract and the end conditions of the utilities for future connection of the remaining buildings.

4.0 Amendments, Clarifications, Changes to the Drawings

4.1 The Billet Buildings drawings, dated 21 February 2003, shall be amended as follows:

a. Sheet T-1, GENERAL NOTES, ABBREVIATIONS, INDEX TO DRAWINGS.

At General Notes paragraph 1B, revise the 1st sentence to read, " Contractor shall verify all dimensions, elevations, and conditions to include toning of underground utilities prior to beginning any work and shall notify the Contracting Officer of any discrepancy and /or condition which will prevent fulfillment of the terms of the Contract.

b. Sheet T-2, ARCHITECTURAL SPECS

i) At Section 07610, STANDING SEAM METAL ROOFING, MATERIALS, add the following, "Gutter expansion joints shall conform to SMACNA standards Chapter 1 – Roof Drainage Systems and Figure 1-5 Allowances for Gutter Expansion".

ii) At Section 07715, FASCIAS, SOFFIT PANELS, AND PENTHOUSE ENCSOURES, add the following, "Dissimilar metals shall not come into contact with each other. Separate dissimilar metals with a heavy-coat of bitumastic paint or 30-pound building felt."

iii) At Section 08710, DOOR HARDWARE, add "Continuous Weather-stripping to exterior doors, PEMKO model #2892, 628 finish or equal, continuous along jamb and head."

iv) At Section 09250, GYPSUM BOARD / EFS, add the following to item #6 EFS FINISH, "Direct-applied cementitious finish, UNI-TEX System B-1 by United Coatings or Omega AKRO-GOLD Exterior Finish System, or equal. Achieve a stucco-like, light textured "Capri" or "Light Lace" finish".

v) At Section 09900, PAINTS AND COATINGS. Delete primer and finish coat specification. Replace with CMU primer and finish coat specification stated on Recreation Center drawing, sht. A-9.

vi) At Section 09900, PAINTS AND COATINGS, add "Concrete Stain / Sealer and Wax Finish. Acid-etch concrete floor, and wash clean. Apply 1-coat Acryl Pen concrete stain, and 1 coat Monocryl 100 clear-gloss sealer coat (or equal)(products available at United Coatings, ph: 487-3043)."

c. Sheet C-1, CIVIL NOTES

i) At Construction Notes, delete note #1.

ii) At Water Notes, revise note #1 to read, "All new water system work shall conform to 2002 version of Water System Standards or UFGS Spec Sections 02300 Earthwork and Section 02510a Water Distribution System, whichever is more stringent."

iii) At Water Notes, add to note #2, "Contractor shall provide cast iron meter box cover with the word "Water" cast onto the cover."

iv) At Water Notes, add to note #6, "Contractor shall furnish written certification that waterlines have been chlorinated." This note applies to potable water lines only and does not apply to the Fire Protection Waterline.

v) At Water Notes, add to Note #7, "Ten (10) feet lateral clearance is required between water and sewer lines (or 6 feet if waterline is at least 12" above sewer line), and 3 feet minimum cover for water mains under traffic, and minimum 2.5 feet cover under non-traffic areas."

vi) At Water Notes, add Note #14, "The design of the water distribution systems and all materials used in construction shall be conform with the seismic design criteria listed on sht. S0-1."

vii) At Grading Notes, revise Note #6, "Fills shall be compacted to 95% of maximum density per ASTM D-1557 test."

viii) At Grading Notes, add Note #8, "Contractor shall obtain Excavation Permit prior to start of excavation work."

d. Sheet C-3, SITE LAYOUT AND UTILITY PLAN

i) Provide traffic rated valve boxes (e.g. cast iron) for valves located within the travel way or shoulder area.

ii) At Detail #1 "Concrete Crossing at Swale", provide nonslip finish (i.e. broom finish concrete surface).

iii) Construct only those buildings and utility connections awarded in this contract. Provide stubouts and markers at the ends for future construction of the utilities for the remaining buildings.

iv) Install a crushed rock border around the perimeter of each building. See Attachment 2 for typical section. The border is not required where a concrete pad abuts the building.

v) The Contractor shall be responsible for maintaining the existing Physical Training Area in useable condition. Any relocation or damage repair needed shall be performed by the Contractor at no additional cost to the Government.

vi) The Contractor shall minimize disturbance to areas outside his immediate work zone. All disturbed areas shall be restored to original condition or better.

e. Sheet C-4, SITE GRADING AND DRAINAGE PLAN

i) Add the following note, "Provide positive drainage away from billet buildings. Provide 6-inch clearance between finish floor and finish grade, and slope at 5% away from billet building for the first 10 feet., Swales shall slope at minimum 1%."

ii) Fine grade the areas surrounding the buildings awarded in this contract. Adjacent areas shall be rough graded to ensure positive drainage away from the constructed buildings and towards existing drainage ways.

f. Sheets A-2 through A-5. Delete all references to gutters, roof drains, downspouts, and all related appurtenances. Install rain diverters over all exterior doors similar to Recreation Center drawings, sht. A-2, detail 1.

g. Sheet A-4, EXTERIOR ELEVATIONS, add note to stipulate that exterior color scheme shall match Range Command & Control Facility. Metal roofing: #815G79 Patina Green based on Ferro Union Hawaii.

h. Sheet A-6, MISCELLANEOUS DETAILS

i) At Detail 14 Chainlink Gate, revise note to read, “galvanized steel hinge by gate manufacturer, typ.”

ii) At Detail 4 & 5, clarify drawing to indicate that ¼” thick laminated glass shall occur on the interior-side of the thermal glazed window, and that exterior glass shall be ¼” thick float glass.

i. Sheet S0-1, STRUCTURAL NOTES

i) At CONCRETE MASONRY (CMU), revise note #3 to specify Type S mortar

ii) At STEEL, revise note #10 to add “Prepare Shop Drawings to meet the requirements of AISC “Code of Standard Practice.”

iii) DESIGN CRITERIA shall be replaced with the following:

(1) UFC 1-200-01 Design: General Building Requirements
(2) ASCE 7-98 Minimum Design Loads for Buildings and Other Structures
(3) IBC 2000 International Building Code 2000
(4) UFC 4-010-01 DoD Minimum Anti-Terrorism Standards for Buildings
(5) ACI-318 American Concrete Institute, Building Code Requirements for Reinforced Concrete
(6) AISC American Institute of Steel Construction-Manual of Steel Construction, Ninth Edition, 1989

j. Sheet S-1, FOUNDATION PLANS

i) Change section mark reference from Section 1/S-3 to Section 2/S-3.

ii) Provide CMU wall control joints as shown on Drawing A/S-1, typical for all billet buildings

k. Sheet S-2, ROOF PLAN, at Detail A/S-2, change section mark 1/S-3 to 2/S-3.

l. Sheet S-3, BUILDING SECTION, AND TYPICAL SECTION, at Section 2/S-3, add “vapor barrier” to note “101 thk cushion fill, ASTM C33 no. 67, typ.”

m. Sheet S-4, MISCELLANEOUS DETAILS, NOTES AND SECTION

i) At Detail 1 TYPICAL SECTION, provide 13mm premolded joint filler topped with joint filler plastic cap and continuous 13 wide x 13 deep finish sealant.

ii) At Detail D TYPICAL MASONRY WALL REINFORCING DETAILS & SCHEDULE, add note to clarify that these details are for any walls that are not detailed elsewhere in the Drawings. CMU wall reinforcing detailed with

different reinforcing notes supersede typical wall reinforcing notes of 3/S-3 as in the case of D/S-4.

n. Sheet S-5, MISCELLANEOUS ROOF DETAILS

i) At Section 1/S-5, add dimensions to thickened edge: 304 minimum below finish grade, finish slab 100 minimum above finish grade, and base of thickened slab as 304mm

ii) At Detail A/S-5, add note at fascia "1.5mm Bent PL continuous Channel Fascia".

iii) Change Detail 3/S-5 to B/S-5

o. Sheet M-1, LEGEND & ABBREVIATIONS, NOTES, AND EQUIPMENT SCHEDULE

i) Add the following to note #7, "Contractor shall provide air balance reports to the Contracting Officer for approval."

ii) Add the following to note #10, "Provide insulation around condensate drainpipes."

p. Sheet M-2, MECHANICAL PLAN, provide weatherproof pipe penetrations thru walls via sealant and escutcheon plates where appropriate.

q. Sheet E-1, LIGHTING FIXTURE SCHEDULE. Delete all references to specific manufacturers. This contract is not intended to require proprietary items. The Contractor shall select materials meeting the specifications.

r. Sheet E-2, SITE ELECTRICAL PLAN Construct only those utility connections servicing the buildings awarded in this contract. Provide stubouts and markers at the ends for future construction of the remaining utilities shown on the plan.

s. Sheet E-3, TYPICAL BILLETS BLDG-LIGHTING PLAN, POWER & TELECOM PLANS

i) Add to Note #1 that smoke detectors shall have integral 9-volt battery backup power supply.

ii) At TYP BILLETS POWER & TELECOM PLANS, extend the 53mm conduit stub out from each billet building to a new 2' x 4' hand hole, and provide two (2) 53mm new U.G. telephone conduits from the HH to stub-up at the new utility pole base.

iii) At TYP BILLETS BLDG LIGHTING PLAN, delete fire alarm conduit stub out and marker.

t. Sheet E-4, ONE LINE DIAGRAM

i) Construct only those transformer(s), distribution panel(s), and panels servicing the buildings awarded in this contract.

u. Sheet E-7, ELECTRICAL SPECIFICATIONS, at paragraph 1.04 RULES, REGULATIONS AND STANDARDS, add "Edition 2002" to N.E.C.

4.2 The Recreation Center drawings, dated 15 July 2003, shall be clarified as follows:

a. The disposal shall be a "gravity disposal unit".

b. Sheet C-2, SITE LAYOUT, UTILITY GRADING AND DRAINAGE PLAN. Install a crushed rock border along the south wall and southwest corner of the building. See Attachment 2 for typical section. The border is not required where a concrete pad or sidewalk abuts the building.

c. Sheet C-2, SITE LAYOUT, UTILITY GRADING AND DRAINAGE PLAN. Construct sidewalk ramps outside doors D1 and D6 to provide a smooth transition from the sidewalk to the adjacent ground surface. The sidewalk ramps shall be ADA-compliant.

d. Sheet M-6, AUTOMATIC FIRE SPRINKLER SPECIFICATIONS, Note 11. Revise nominal orifice size to ½" or 12.7mm.

e. Sheet E-1, LIGHTING FIXTURE SCHEDULE. Delete all references to specific manufacturers. This contract is not intended to require proprietary items. The Contractor shall select materials meeting the specifications.

f. Sheet E-2, SITE ELECTRICAL PLAN. Revise the location of new utility pole, P-238A. P-238A shall be located between existing poles, P-238 and P-237 and shall intercept the existing primary power line.

g. Sheet E-5, ONE LINE DIAGRAM. "Exst. Utility Pole P-52" shall be re-labeled "Exst Utility Pole, P-237".

5.0 Permits and Clearances

The Contractor is responsible for identifying and obtaining all permits and clearances necessary to perform the work, including, but not limited to, excavation and trenching, hot work, and NPDES.

There are no anticipated environmental issues. The Government has completed coordination with the State Historic Preservation Office (SHPO) regarding Section 106 requirements and based on the current drawings all requirements have been met. The Government has also coordinated the design of the septic tank and leaching field with the State Department of Health (DOH). Providing no changes to the system as shown on the provided drawings are made, additional DOH approvals for this system are not required.

6.0 Phasing

The Contractor may work on the Billet Buildings and the Recreation Center concurrently.

7.0 Other Requirements

Onsite spoils are not permitted. The Contractor shall be responsible for removing all excess materials from Government property.

All disturbed areas shall be restored to existing condition or better.

The Contractor shall be responsible for his own site investigation, including toning for existing underground utilities, scheduling, and testing and acceptance of the completed work. Any damage to existing utilities shall be repaired at the Contractor's expense and at no additional cost to the Government.

8.0 Additional Information

8.1 Geotechnical Data

The Government has included a report prepared by Geolabs, Inc. for the Consolidated Command & Range Control Facility entitled, "Geotechnical Engineering Exploration, Consolidated Command and Range Control Facility, Pohakuloa Training Area, Island of Hawaii", dated March 5, 2003 (see Attachment 3). This project is currently under construction and is located adjacent to the site for the Billet Buildings. The subsurface data presented in this report may be considered indicative of the subsurface conditions found throughout PTA.

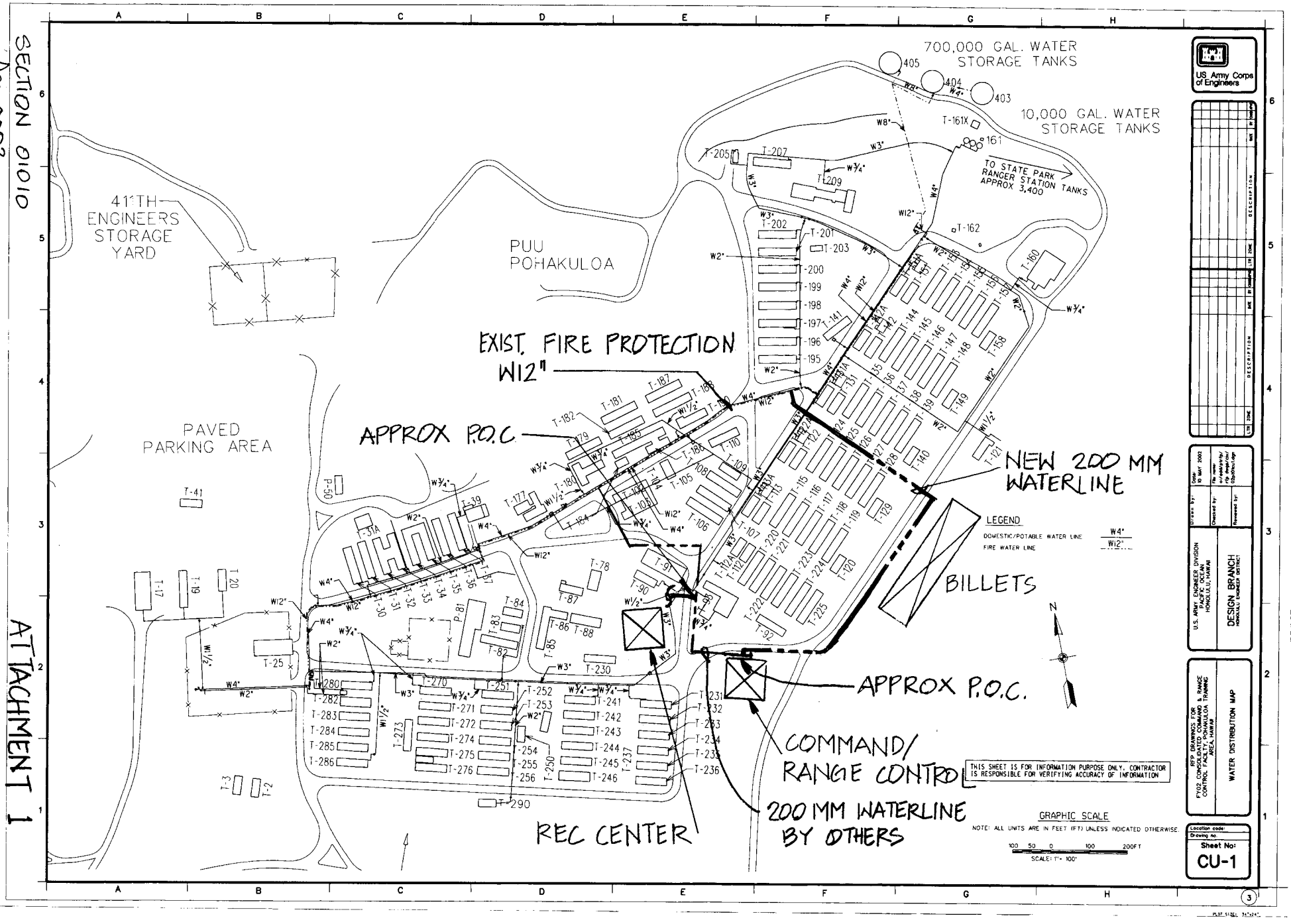
The Contractor shall dig trench pits at the Recreation Center site and at the Billets site to confirm soil layers. The pits shall be dug outside the footprints of the buildings. The Contractor's registered geologist or geotechnical engineer shall do soil layer logging. A one-page report comparing the on-site materials with the materials found at the Consolidated Facility and Range Control Facility shall be submitted.

8.2 Fire Flow Data

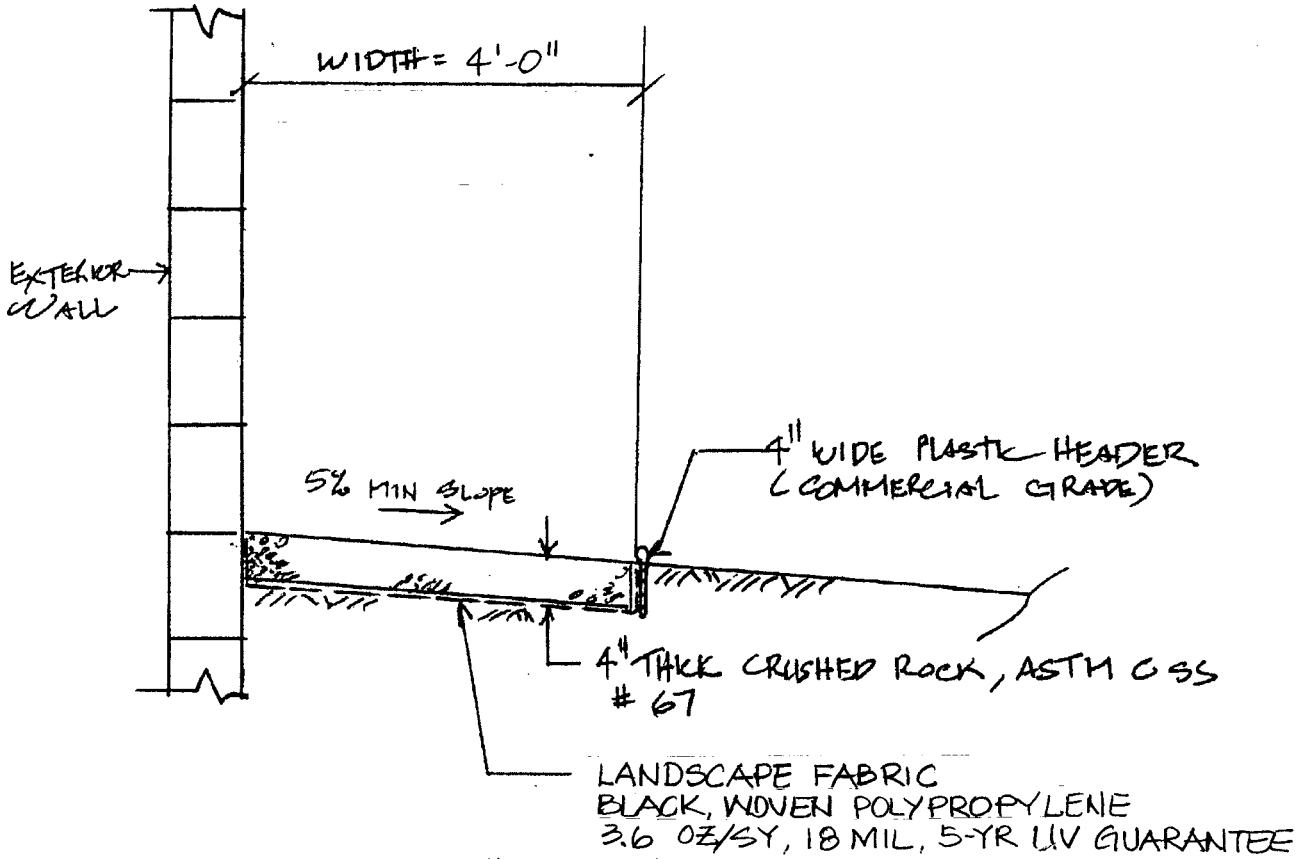
A copy of the Hydrant Flow Test Report conducted at PTA on 18 Oct 01 is also included for general information (see Attachment 4). This data is provided for information only. The Contractor is responsible for conducting his own hydrant flow tests as required in Section 01012, paragraph 11.2.5, Fire Protection.

SECTION 01010

Am-0003



ATTACHMENT 1



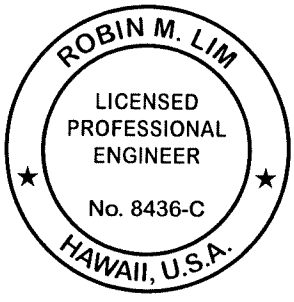
CRUSHED ROCK BORDER
TYPICAL SECTION
NTS

GEOTECHNICAL ENGINEERING EXPLORATION
CONSOLIDATED COMMAND AND RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

W.O. 4691-10(B) MARCH 5, 2003

Prepared for

NAKOA - PEMCO (JV)



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4-30-04
SIGNATURE EXPIRATION DATE
OF THE LICENSE

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
2006 Kalihi Street • Honolulu, HI 96819

Hawaii • California

Section 01010
AM-0003

Attachment 3

GEOLABS, INC.
Geotechnical Engineering and Drilling Services

March 5, 2003
W.O. 4691-10(B)

Mr. John Yamamoto
Nakoa – PEMCO (JV)
1632 S. King Street, Suite 100
Honolulu, HI 96826

Dear **Mr. Yamamoto:**

Geolabs, Inc. is pleased to submit our report entitled "Geotechnical Engineering Exploration, Consolidated Command and Range Control Facility, Pohakuloa Training Area, Island of Hawaii" prepared in support of the design of the Consolidated Command and Range Control Facility and associated appurtenances.

Our work was performed in general accordance with the scope of services outlined in our fee proposal of January 6, 2003.

Detailed discussion and specific recommendations for the design of the project are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

Robin M. Lim, P.E.
Vice President

RML:ST:as

(h:\4600 Series\4691-10B.st1-pg.2)

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Hawaii • California

GEOTECHNICAL ENGINEERING EXPLORATION
CONSOLIDATED COMMAND AND RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

W.O. 4691-10(B) MARCH 5, 2003

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CONSOLIDATED COMMAND AND RANGE CONTROL FACILITY

POHAKULOA TRAINING AREA, ISLAND OF HAWAII

W.O. 4691-10(B) MARCH 5, 2003

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Based on our field explorations conducted at the project site, the subsurface materials at the project site generally consist of surface fills, colluvium, and cinder sands over dense basalt formation. In general, the depths to the dense basalt formation are highly variable at the project site. In some areas, dense basalt formation is exposed at the ground surface. However, in several of the borings, colluvium and cinder sands were encountered from the ground surface extending to the maximum depths explored in those borings of about 6 to 20.8 feet below the ground surface. The colluvium and cinder sands encountered generally consisted of loose to medium dense silty sands and gravel. It should be noted that cobbles and boulders were encountered in the silty sand matrix of the colluvial deposits. The basalt formation encountered in our borings were generally slightly to closely fractured and medium hard to very hard. Groundwater was not encountered in the borings drilled at the time of our field exploration.

Based on our exploration at the project site, we believe that shallow spread and/or continuous footings may be used to support the new structures planned at the project site. As an alternative, the foundations for support of the structural loads planned at the site may also consist of thickened-edge slab footings. An allowable bearing pressure of up to 4,000 psf may be used in the design for footings bearing on compacted structural fill (or basalt formation). Due to the presence of loose colluvial materials near the ground surface in some areas, foundation subgrades should be over-excavated by a minimum of 2 feet and backfilled with compacted structural fills. Over-excavation may be omitted in areas where the dense basalt formation is exposed at the subgrade elevations. Because of the relatively dry condition of the on-site soils, earthwork for the project will require a substantial amount of water (and water trucks for transport of water) during construction to achieve the specified moisture content of the soils.

It should be noted that the average hydraulic conductivity obtained from the permeability tests conducted in the borings may be considered relatively low compared to other areas on the Island of Hawaii. In addition, the hydraulic conductivity of the near-surface colluvial materials and basalt rock formation at the site is highly variable. Therefore, special attention should be given to the recommendations for design of the individual wastewater systems of the project. The text of this report should be referred to for detailed discussion and specific recommendations for the design of this project.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1.0 - GENERAL

1.1 Introduction

This report presents the results of our geotechnical engineering exploration performed for the Consolidated Command and Range Control Facility project located in the Pohakuloa Training Area on the Island of Hawaii. The general location and vicinity of the project site are shown on the Project Location Map, Plate 1.

This report summarizes the findings from our field exploration and laboratory testing and presents our geotechnical recommendations derived from our analyses for the Consolidated Command and Range Control Facility project. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.2 Project Considerations

The project site is located within the Pohakuloa Training Area on the Island of Hawaii. We understand that a Consolidated Command and Range Control Facility is planned at the project site. The new facility will consist of a two-story building structure measuring approximately 50 by 100 feet in plan dimension. We understand that the new building will be used to house administrative offices, conference room, military police station, special rooms and related facilities for range control functions, central telecommunications switch room, male and female latrines, elevator, and storage space. In addition, supporting facilities including sanitary sewers, potable water lines, storm drainage and/or detention basins, access roadways, and parking lots will be provided to serve the new facility.

Based on the topographic map provided, the existing ground surface elevations at the project site vary from about +6,360 to +6,385 feet Mean Sea Level (MSL). In general, we anticipate that construction of the proposed structures for the project will involve site grading consisting of cuts and fills of less than about 3 to 5 feet in height in order to achieve the finished grades.

A preliminary geotechnical engineering study was conducted by Geolabs for the proposed project. The results of the preliminary study are contained in the report entitled "Geotechnical Engineering Exploration, Consolidated Command and Range Control Facility, Pohakuloa Training Area, Island of Hawaii" dated February 22, 2002. We understand that it was desired to conduct a design-level field exploration to confirm the recommendations for final design of the proposed project. Where applicable, the subsurface information from the preliminary exploration was used in conjunction with the recently drilled borings to evaluate the subsurface conditions at the project site.

1.3 Purpose and Scope

The purpose of our geotechnical exploration was to obtain an overview of the surface and subsurface conditions at the project site. The subsurface information obtained was used to develop a soil/rock data set for the formulation of geotechnical recommendations pertaining to the design of the proposed Consolidated Command and Range Control Facility project. In order to accomplish this, we conducted an exploration program consisting of the following tasks and work efforts:

1. Review of the preliminary study and available in-house soil and geologic information related to the project area.

2. Mobilization and demobilization of a truck-mounted drill rig, water truck, and two operators to the project site and back.

3. Drilling and sampling of four borings at the new building footprint extending to depths of about 5 to 20.8 feet below the existing ground surface.

4. Coordination of the field exploration and logging of the borings by a geologist from our firm.

5. Performance of two percolation tests in general accordance with the State of Hawaii, Department of Health's Administrative Rules, Chapter 11-62-31.2, "Wastewater Systems" and Chapter 10 of the Ten States Standards to evaluate the permeability of the subsurface soils for the disposal of wastewater effluent.

6. Laboratory testing of selected samples obtained during the field exploration as an aid in classifying the materials encountered and evaluating their engineering properties.

7. Analyses of the field and laboratory data for the formulation of geotechnical engineering recommendations pertaining to the design of foundations, slabs-on-grade, site preparation, and pavements for the proposed project.

8. Preparation of this formal report (8 copies) summarizing our work on the project and presenting our findings and recommendations.

9. Coordination of our overall work on the project by a project engineer from our firm.

10. Quality assurance of our work and client/design team consultation by a principal engineer from our firm.

11. Miscellaneous work efforts such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration and the Logs of Borings are presented in Appendix A of this report. Results of the laboratory tests performed on selected samples are presented in Appendix B. Results of the percolation tests performed in selected borings are presented in Appendix C.

END OF GENERAL

SECTION 2.0 – SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Hawaii, the largest in the Hawaiian Archipelago, covers an area of approximately 4,030 square miles. The island was formed by the activity of five shield volcanoes including the following: Kohala, which is long extinct; Mauna Kea, which has had activity during recent geologic times; Hualalai, which last erupted in 1801; and Mauna Loa and Kilauea, both of which are still active.

The Pohakuloa Training Area (PTA) is located on the western side of the Humuula Saddle, which forms the central upland portion of the Island of Hawaii, located between the Mauna Kea and Mauna Loa Volcanoes. The Humuula Saddle is a broad, relatively flat to gently sloping plateau situated between the Mauna Kea and Mauna Loa Volcanoes. The regional terrain rises from the east (Hilo side) and from the west (Waikoloa side) to crest at the Humuula Saddle, which is located just to the west of the intersection of the existing Saddle Road and the Mauna Kea Observatory access road. The Humuula Saddle formed as a result of the coalescence of lava flows erupted from the Mauna Kea and Mauna Loa Volcanoes.

In general, the project site is at the foot of the steeper south and southwest facing slopes comprising the upper mass of Mauna Kea Volcano. The south and southwest facing slopes of Mauna Kea rise abruptly from the surrounding flatter terrain of the Humuula Saddle. Several prominent cinder cone vents composed of bedded tephra deposits are located within and adjacent to the project site. The circular-shape cinder cones rise above the surrounding terrain and represent the volcanic vents from which the younger age volcanic ash and cinder (pyroclastic tephra) deposits were emitted. The cinder cone vents are typically oriented along the axes of the rift zones composing Mauna Kea Volcano.

Most of the geologic materials at the project site are derived from the late-stage eruption and erosion of the alkalic a'a lavas and cinder materials emitted from Mauna Kea Volcano. The cinder materials were observed to range in size from fine through coarse

sands and include gravel and cobble size pumice and scoria fragments existing in a semi-consolidated and weakly-cemented condition. Based on the available geologic information and our experience, the youngest lava flows comprising the surface flanks of Mauna Kea Volcano consist mainly of a'a type lavas.

The a'a lavas typically consist of a rubbly and irregular clinker surface consisting of loosely indurated basalt rock fragments with layer thickness on the order of about 3 to 15 feet. Below the rubble surface, very dense and often massive basalt rock termed "blue rock" may be encountered. The dense rock contains the core of the a'a lava flow, which may range to several tens of feet in thickness.

Most of the project site has accumulated a ground surface veneer of geologic materials that represent both pyroclastic air-fall deposits, such as volcanic ash and cinder sand emitted from the late-stage eruption of cinder cones, and alluvial materials derived from glaciation and erosion of the upper slopes of Mauna Kea Volcano. The surface veneer of pyroclastic and sedimentary materials generally overlies hard basalt rock. The mantling effect of the surface deposits has created a subdued surface topographic character, which masks the usually observed irregular and undulating topography of a'a lava flows. As a result, the depth from the ground surface to the top of the buried hard basalt rock surfaces varies considerably within relatively short distances.

2.2 Earthquakes and Seismicity

In general, earthquakes that occur throughout the world are caused solely by shifts in the tectonic plates. In contrast, earthquake activity in Hawaii is linked primarily to volcanic activity. Therefore, earthquake activity in Hawaii generally occurs before or during volcanic eruptions. In addition, earthquakes may result from the underground movement of magma that comes close to the surface but does not erupt. The Island of Hawaii experiences thousands of earthquakes each year, but most of the earthquakes are so small that they can only be detected by instruments. However, some of the earthquakes are strong enough to be felt, and a few cause minor to moderate damage.

In general, earthquakes (associated with volcanic activity) are most common on the Island of Hawaii. Earthquakes that are directly associated with the movement of magma

are concentrated beneath the active Kilauea and Mauna Loa Volcanoes on the Island of Hawaii. Because the majority of the earthquakes in Hawaii (over 90 percent of earthquakes) are related to volcanic activity, the risk of seismic activity and degree of ground shaking diminishes with increased distance from the southern portion of the Island of Hawaii. The Island of Hawaii has experienced numerous earthquakes greater than Magnitude 6 (M6+). Based on information obtained from the United States Geological Survey (USGS) Bulletin 2006, the following is a list of destructive earthquakes that occurred on the Island of Hawaii since 1868.

DATE	LOCATION	MAGNITUDE
March 28, 1868	South Hawaii	7.0
April 2, 1868	South Hawaii	7.9
October 5, 1929	Hualalai	6.5
August 21, 1951	Kona	6.9
April 26, 1973	North Hilo	6.2
November 29, 1975	Kalapana	7.2
November 16, 1983	Kaoiki	6.7
June 25, 1989	Kalapana	6.2

Due to the relative proximity of the project site to an active volcano, it may be concluded that the PTA site could experience moderate to severe earthquakes and associated ground shaking depending on the location of the earthquake origin.

2.3 Site Description

As mentioned previously, the project site is located within the existing Pohakuloa Training Area (PTA) at the Humuula Saddle on the Island of Hawaii. The project site is located at the southeastern corner of the existing PTA military installation and is bounded by paved roadways along the northern and western perimeters of the site as shown on the Site Plan, Plate 2.

Based on our site reconnaissance, the project site consists of relatively flat ground surfaces with some gentle slopes and small ditch and berm features. Based on the available topographic survey, the existing ground surface at the project site generally

ranges from about Elevation +6,360 feet to about +6,385 feet MSL. Some existing gravel roads and overhead power lines traverse the central portion of the site. The ground surface consists of widely scattered low relief outcroppings of basalt rock formation mixed with surficial sandy and gravelly soil with embedded cobbles and boulders. It appears that the basalt rock represents some older lava flows that were later covered by sandy and rocky alluvial/colluvial deposits representing glacial outwash and stream deposited alluvium.

2.4 Subsurface Conditions

The subsurface conditions at the project site were further explored by drilling and sampling four borings, designated as Boring Nos. 101 through 104, extending to depths of about 5 to 20.8 feet below the existing ground surface. The approximate locations of the borings drilled for the project are shown on the Site Plan, Plate 2. Subsurface information from the previous exploration was used in conjunction with the recently drilled borings to evaluate the subsurface conditions at the project site.

Based on our field exploration and the available information from the previous exploration, the project site is generally underlain by surface fills, colluvium, and cinder sands over basalt formation. In some portions of the project site, the basalt formation is exposed at the ground surface and extended down to the maximum depths explored of about 20 feet below the ground surface in those borings. In other areas, colluvium and cinder sands consisting of loose to medium dense silty sands and gravel was encountered from the ground surface extending down to the maximum depths explored of about 20.8 feet below the ground level in those borings. It should be noted that cobbles and boulders were encountered in the silty sand matrix in the colluvial deposits.

It should be noted that the surface soils at the site exist in a relatively dry state and are susceptible to erosion due to wind and/or surface water runoff. In addition, the relatively dry on-site soils will require a substantial amount of water (and water trucks for transport of water) during construction to achieve the specified moisture content of the soils for subgrade preparation and fill placement.

The basalt formation encountered in our borings were generally slightly to closely fractured and medium hard to very hard. It should be noted that lava tubes, blisters, and/or cavities are commonly encountered in the basalt formations. Therefore, the presence of lava tubes, blisters, and/or cavities should be anticipated at the project site.

Groundwater was not encountered in the borings drilled at the time of our field exploration. However, groundwater levels can fluctuate depending on factors such as seasonal rainfall, storm surge conditions, and other factors. Detailed descriptions of the materials encountered during our field exploration are presented on the Logs of Borings, Plates A-1 through A-4 of Appendix A.

END OF SITE CHARACTERIZATION

SECTION 3.0 - DISCUSSION AND RECOMMENDATIONS

Based on our field exploration and the preliminary field exploration conducted at the project site, the subsurface materials at the project site generally consist of surface fills, colluvium, and cinder sands over dense basalt formation. In general, the depths to the dense basalt formation are highly variable at the project site. In some areas, dense basalt formation is exposed at the ground surface. However, in several of our borings, colluvium and cinder sands were encountered from the ground surface extending to the maximum depths explored in those borings of about 6 to 20.8 feet below the ground surface. The colluvium and cinder sands encountered generally consisted of loose to medium dense silty sands and gravel. It should be noted that cobbles and boulders were encountered in the silty sand matrix of the colluvial deposits. The basalt formation encountered in our borings were generally slightly to closely fractured and medium hard to very hard. Groundwater was not encountered in the borings at the time of our field exploration.

It should be noted that the surface soils at the site exist in a relatively dry state and are susceptible to erosion due to wind and/or surface water runoff. In addition, the relatively dry on-site soils will require a substantial amount of water (and water trucks for transport of water) during construction to achieve the specified moisture content of the soils for subgrade preparation and fill placement.

Based on subsurface conditions encountered at the project site, we believe that shallow spread and/or continuous footings may be used to support the new structures planned at the project site. As an alternative, the foundations for support of the structural loads planned at the site may also consist of thickened-edge slab footings. Due to the presence of loose colluvial materials near the ground surface in some areas, foundation subgrades should be over-excavated by a minimum 2 feet and backfilled with compacted structural fills. Over-excavation may be omitted in areas where the dense basalt formation is exposed at the subgrade elevations of the slabs and/or foundations. Detailed discussion of these items and our geotechnical engineering recommendations for design are presented in the following sections of this report.

3.1 Seismic Design Considerations

We understand that this project will be designed in general accordance with the requirements of the 1997 Uniform Building Code (UBC). It should be noted that the Island of Hawaii is located within Seismic Zone 4 with an effective peak ground acceleration of 0.40g. Based on the subsurface materials anticipated at the site (colluvium and basalt rock formation) and the geologic setting of the area, the project site may be classified from a seismic analysis standpoint as a Very Dense Soil and Soft Rock Profile corresponding to a Soil Profile Type S_C. Based on our review of available geologic information, the project site does not appear to be located in the immediate proximity of mapped geologic fault structures. Therefore, the near-source factors (N_a and N_v) may be assumed to be 1.0 for this project site.

3.2 Foundations

Based on the subsurface conditions encountered at the project site, we recommend that shallow spread and/or continuous footings be used to support the new structures planned at the project site. As an alternative, the foundations for support of the relatively light structural loads planned at the site may also consist of thickened-edge slab footings. Due to the presence of loose colluvial materials near the ground surface in some areas, foundation subgrades should be over-excavated by a minimum 2 feet and backfilled with compacted structural fills. Over-excavation may be omitted in areas where the dense basalt formation is exposed at the subgrade elevations of the slabs and foundations. An allowable bearing pressure of up to 4,000 pounds per square foot (psf) may be used for the design of footings bearing on either compacted structural fill and/or the basalt formation underlying the site. This bearing value is for dead-plus-live loads and may be increased by 50 percent for transient loads, such as those caused by wind or seismic forces.

In general, footings should be embedded a minimum of 12 inches below the lowest adjacent exterior grade. For footings constructed near the tops of slopes or on slopes, the footings should be embedded deep enough such that the horizontal distance measured from the outside edge (at the base of the footing) to the face of the slope is not less than 6 feet.

Foundations located next to other foundations, utility trenches, or easements should be embedded below a 45-degree imaginary plane extending upward from the bottom edge of the utility trench. As an alternative, the footings may be extended to a depth as deep as the inverts of the utility lines. This requirement is necessary to avoid surcharging adjacent below-grade structures with additional structural loads and to reduce the potential for appreciable foundation settlement.

The bottom of footing excavations should be recompacted to obtain a dense and unyielding subgrade condition prior to the placement of reinforcing steel and concrete. If soft and/or loose materials are encountered at the footing subgrades, the soft and/or loose materials should be over-excavated until dense materials are exposed in the footing excavation. The over-excavation should be backfilled with structural fill materials moisture-conditioned to above the optimum moisture content and compacted to a minimum of 90 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D 1557 test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density. Alternatively, the bottom of the footing may be extended down to bear directly on the underlying competent material.

If foundations are designed and constructed in accordance with the recommendations presented herein, we estimate the total settlements of the foundations to be less than 1 inch. Differential settlements between adjacent footings supported on similar materials may be on the order of about 0.5 inches.

Lateral loads acting on the structure may be resisted by frictional resistance developed between the bottom of the foundation and the bearing soil and by passive earth pressure acting against the near-vertical faces of the foundation system. A coefficient of friction of 0.45 may be used for footings bearing on structural fill materials (or basalt formation). Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 450 pounds per square foot per foot of depth (pcf) assuming

that the soils around the footings are well compacted. The passive resistance in the upper 12 inches of the soil should be neglected unless covered by pavements or slabs.

We recommend that footing excavations be observed by a representative from Geolabs prior to the placement of reinforcing steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

3.3 Slabs-On-Grade

In general, we envision that concrete slabs-on-grade will be used for the interior building slabs for this project. For interior building slabs, which will not be subjected to vehicular traffic, we recommend that a minimum 4-inch thick layer of cushion fill be provided below the slabs for uniform support. The cushion fill should consist of open-graded gravel (ASTM C 33, No. 67 gradation) and also would serve as a capillary moisture break. To reduce the potential for future moisture infiltration and subsequent damage to floor coverings, an impervious moisture barrier is recommended on top of the gravel cushion layer. A 2-inch thick moist fine sand layer may be considered above the moisture barrier to aid in the curing of the concrete. Provision of the 2 inches of moist fine sand above the moisture barrier is optional and will be left up to the discretion of the project structural engineer. Flexible floor coverings should be considered above the floor slab since they can better mask minor slab cracking.

In addition, we envision that exterior concrete walkways and exterior flatwork will likely be required for the proposed project. In general, we recommend that a minimum 4-inch thick cushion layer of open-graded gravel (ASTM C 33, No. 67 gradation) be provided below the exterior concrete slab. To reduce the potential for substantial shrinkage cracks in the slabs, crack control joints should be provided at intervals equal to the width of the walkways (or slabs) with expansion joints at right-angle intersections.

In general, the gravel cushion fill layer may be placed directly on the proof-rolled building slab subgrade consisting of compacted structural fill. If the building slab subgrades are disturbed and/or appear to be loose, the slab subgrade should be scarified to a depth of about 8 inches, moisture-conditioned to above the optimum moisture content,

and compacted to a minimum of 95 percent relative compaction to provide a dense and unyielding subgrade.

3.4 Retaining Structures

Retaining walls, such as low site retaining walls and headwalls, may be required for the project. The following guidelines are for the design of retaining structures planned at the site. The recommendations provided should be limited to design of retaining structures that are less than 8 feet in vertical height.

3.4.1 Retaining Structure Foundations

In general, we believe that retaining structure foundations may be designed in general accordance with the recommendations and parameters presented in the "Foundations" section of this report. However, the retaining structure footings should have a minimum width of 18 inches. In addition, wall foundations located on relatively flat areas should be embedded a minimum depth of 24 inches below the lowest adjacent finished grade. For footings bearing directly on basalt rock formation, the minimum embedment depth may be reduced to 12 inches. For sloping ground conditions, the footing should be extended deeper to obtain a minimum 6-foot setback distance measured horizontally from the outside edge of the footing to the face of the slope. Wall footings oriented parallel to the direction of the slope should be constructed in stepped footings.

3.4.2 Static Lateral Earth Pressures

Retaining structures should be designed to resist the lateral earth pressures due to the adjacent soils and surcharge effects. The recommended lateral earth pressures for design of retaining structures, expressed in equivalent fluid pressures of pounds per square foot per foot of depth (pcf), are presented in the following table.

LATERAL EARTH PRESSURES FOR DESIGN OF RETAINING STRUCTURES			
Backfill Condition	**Earth Pressure Component**	**Active** (pcf)	**At-Rest** (pcf)
Level Backfill	Horizontal	35	55
	Vertical	None	None

The values provided above assume that granular soils less than 6 inches in maximum dimension will be used to backfill behind the retaining structures. In addition, the backfill immediately behind the retaining structures (within 3 feet of the backside of the wall) should be limited to a maximum particle size of 3 inches to facilitate compaction of the backfill using smaller-sized equipment. It is also assumed that the backfill behind retaining structures will be compacted to between 90 and 95 percent relative compaction. Over-compaction of the retaining structure backfill should be avoided.

In general, an active condition may be used for gravity retaining walls and retaining structures that are free to deflect laterally by as much as 0.5 percent of the wall height. If the tops of the structures are not free to deflect beyond this degree, or are restrained, the retaining structures should be designed for the at-rest condition. These lateral earth pressures do not include hydrostatic pressures that might be caused by groundwater trapped behind the structures.

Surcharge stresses due to areal surcharges, line loads, and point loads within a horizontal distance equal to the depth of the retaining structures should be considered in the design. For uniform surcharge stresses imposed on the loaded side of the structure, a rectangular distribution with uniform pressure equal to 24 percent of the vertical surcharge pressure acting on the entire height of the structure, which is free to deflect (cantilever), may be used in design. For retaining structures that are restrained, a rectangular distribution equal to 40 percent of the vertical surcharge pressure acting over the entire height of the structures may be

used for design. Additional analyses during design may be needed to evaluate the surcharge effects of point loads and line loads.

3.4.3 Dynamic Lateral Earth Forces

Because the project site is located on the seismically active Island of Hawaii, forces due to dynamic lateral earth pressures will need to be considered in the design of retaining structures. The force due to dynamic lateral earth pressures (a_{max}= 0.40g) may be estimated by using $16H^2$ pounds per lineal foot of wall length for level backfill conditions, where H is the height of the wall in feet. It should be noted that the force due to dynamic lateral earth pressures provided assumes that the retaining structure will be allowed to move laterally by up to about 2 to 4 inches in the event of an earthquake. If this amount of lateral movement is not acceptable, the retaining structure should be designed with higher dynamic lateral forces for a semi-restrained wall condition. For a semi-restrained wall condition, the force due to dynamic lateral earth pressures may be estimated using $28H^2$ pounds per lineal foot of wall for level backfill conditions.

The force due to dynamic lateral earth pressures would generally act at the mid-height of the wall. The force due to dynamic lateral earth pressures presented above is in addition to the static lateral earth pressures. An appropriately reduced factor of safety may be used when forces due to dynamic lateral earth pressures are accounted for in the design of the retaining structure.

3.4.4 Drainage

Retaining structures should be well drained to reduce the build-up of hydrostatic pressures. A typical drainage system would consist of a 1-foot wide zone of permeable material, such as open-graded gravel (ASTM C 33, No. 67 gradation), placed immediately around a perforated pipe (perforations down) at the base of the retaining structures discharging to an appropriate outlet or weepholes. As an alternative, a prefabricated drainage product, such as MiraDrain or EnkaDrain, may be used instead of the drainage material. The prefabricated drainage product

should also be hydraulically connected to a perforated pipe at the base of the retaining structure.

Backfill behind the permeable drainage zone should consist of granular fill materials with a maximum particle size of 3 inches or less. Unless covered by concrete slabs, the upper 12 inches of the backfill should consist of relatively impervious material (well-graded materials) to reduce the potential for significant water infiltration behind the retaining structure.

3.5 Site Grading

Based on the anticipated finished floor elevation and the existing grades at the Consolidated Command and Range Control Facility site, we anticipate that grading work for the project construction will consist of cuts and fills of up to about 3 to 5 feet in thickness in order to achieve the finished grades.

In general, site grading operations should be observed by a representative from Geolabs. It is important that a qualified geotechnical engineer observe the site grading operations to evaluate whether undesirable materials are encountered during excavation and whether the exposed soil/rock conditions are similar to those encountered in this and subsequent explorations.

At the on-set of earthwork, areas within the contract grading limits should be thoroughly cleared and grubbed. Vegetation, debris, rubbish, and other unsuitable materials should be removed and disposed of properly off-site. After clearing and grubbing, areas within the proposed grading limits should be excavated, where necessary, to the design finished subgrades. In general, the excavated materials may be re-used as a source of fill materials provided that the materials meet the gradation (and maximum particle size) requirements described in this section of the report and are free of deleterious materials.

After clearing and grubbing, finished subgrades in cut areas and areas designated to receive fills should generally be scarified to a minimum depth of 8 inches, where possible, moisture-conditioned to above the optimum moisture, and compacted to a

minimum of 90 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D 1557 test procedures. Optimum moisture is the water content (percentage by dry weight) corresponding to the maximum dry density.

In areas where dense basalt formation is exposed at the subgrade elevations, the finished subgrades in cut areas and areas designated to receive fills should be proof-rolled with a vibratory drum roller to assist in detecting and collapsing potential near-surface cavities. The proof-rolling operations should be conducted using a vibratory drum roller (minimum 10-ton static weight). The vibratory drum roller should pass over the proof-rolling areas at least eight passes to assist in detecting and collapsing potential near-surface cavities.

The scarification and proof-rolling operations should be performed in the presence of a representative from Geolabs. Yielding areas, loose areas, or cavities disclosed during clearing, scarification, and proof-rolling operations should be backfilled with structural fill materials compacted to a minimum of 95 percent relative compaction. Due to the potential for presence of cavities and/or voids, contract documents should include additive and deductive unit prices for over-excavation and compacted fill placement to account for variations in the over-excavation and backfill quantities.

General and structural fill materials should consist of well-graded granular materials generally less than 6 inches in maximum dimension with sufficient fines to prevent the occurrence of voids in the compacted mass. In general, the excavated basalt rock materials may be re-used as a source of structural fill materials, provided that the materials are processed to meet the maximum size and gradation requirements presented above and that the materials are free of deleterious materials. Imported materials, if required, should be well graded from coarse to fine with no particles greater than 6 inches in largest dimension. Imported material should be observed and/or tested by a qualified geotechnical engineer for its suitability prior to being transported to the project site for the intended use.

The maximum particle size of fills and backfills should be limited to a maximum of 3 inches for fills and backfills to be placed in confined locations. Confined locations are defined as areas where the compaction equipment is limited in size to less than 10 tons in static weight.

In general, structural and general fills should be placed in level lifts not exceeding 12 inches in loose thickness, moisture-conditioned, and compacted to a minimum of 95 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM Test Designation D 1557. Compaction should be accomplished by sheepsfoot rollers, vibratory rollers, or other types of acceptable compaction equipment. It should be noted that the surface soils at the site exist in a relatively dry state and will require a substantial amount of water (and water trucks for transport of water) during construction to achieve the specified moisture content of the soils for subgrade preparation and fill placement.

Where fills are composed of rock and/or cobbles, conventional compaction testing would not be practicable. Therefore, a testing program to evaluate the number of passes by a compactor needed to achieve the desired level of compaction should be conducted at the start of the grading phase of the project under the observation of a representative from Geolabs. On the basis of this testing program, the number of passes may then be used as the field criterion for adequate compaction. For preliminary estimating purposes, compaction may be accomplished by using a vibratory drum roller having a static weight of at least 10 tons traveling at a speed of about 300 feet per minute. The roller should pass over the fill surface at least eight times for 95 percent relative compaction and a minimum of six times for 90 percent relative compaction.

In general, we believe that cut and fill slopes may be designed with a slope inclination of two horizontal to one vertical (2H:1V) or flatter. Fills to be placed on slopes with inclinations steeper than 5H:1V should be keyed and benched into the existing slope to provide stability of the new fill against sliding.

The filling operations should start at the lowest point and continue up in level horizontal compacted layers in accordance with the above fill placement recommendations. Fill slopes should be constructed by overfilling and cutting back to the design slope ratio to obtain a well-compacted slope face. Surface water should be diverted away from the tops of slopes, and slope planting should be provided as soon as possible to reduce the potential for significant erosion of the finished slopes. It should be noted that the relatively dry surface soils at the site are highly susceptible to erosion due to wind and/or surface water runoff.

It is generally difficult to provide a smooth cut slope face when excavating in basalt formations. If over-cutting of the cut slopes occurs, consideration should be given to leaving the slope as-is. Patching of the over-cut areas with sliver fills is not recommended due to the potential for erosion of the fill materials in the patched areas.

3.6 Excavation

Our field exploration disclosed that the project site is generally underlain by loose to medium dense colluvium and medium hard to very hard volcanic rock near the existing ground surface. In general, the colluvium and volcanic rock at the site may be excavated with normal heavy excavation equipment, such as ripping with large bulldozers. However, deeper excavations and the very hard basalt formation in localized areas may require the use of hoe rams or chipping.

The above discussions regarding the rippability of the surface materials are based on our visual observation of the existing rock formations and field data from the borings drilled at the site. We recommend that subcontractors proposing to bid on this project be encouraged to examine the site conditions and the boring data to make their own interpretation.

3.7 Pavement Design

Based on the information provided, we anticipate that flexible pavements will be constructed for the roadways and parking lots at the Consolidated Command and Range Control Facility site. In general, we anticipate that the vehicle loading for this project would consist primarily of passenger vehicles and light trucks. Therefore, we have

assumed generally light to medium traffic loading conditions for pavement design purposes. On this basis, we recommend that the following pavement sections be used for this project.

Flexible Pavement Section

2.0-Inch Asphaltic Concrete
6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
8.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

The subgrade soils under the pavement areas should be scarified to a minimum depth of 8 inches (where possible), moisture-conditioned to above the optimum moisture, and compacted to at least 95 percent relative compaction. In areas where dense basalt rock formation is exposed at the subgrade level, the subgrade should be proof-rolled with a minimum 10-ton vibratory drum roller a minimum of eight passes in-lieu of scarification and compaction. CBR tests and/or field observations should be performed on the actual subgrade soils during construction to confirm that the above design section is adequate. The aggregate base and subbase course should consist of crushed basalt aggregate compacted to a minimum of 95 percent relative compaction.

In general, paved areas should be sloped, and drainage gradients should be maintained to carry surface water off the pavements. Surface water ponding should not be allowed on the site during or after construction. Where concrete curbs are used to isolate landscaping in or adjacent to the pavement areas, we recommend that the curbs extend a minimum of 2 inches into the subgrade soil to reduce the potential for migration of excessive landscape water into the pavement section.

3.8 Individual Wastewater System

We understand that on-site disposal of wastewater effluent using a shallow leaching field and/or seepage pits will likely be required for this project. Therefore, we have conducted two field percolation tests to obtain data pertaining to the preliminary design of the individual wastewater disposal system.

Two percolation tests were performed in Boring Nos. 103 and 104 in general accordance with the procedures outlined by the Department of Health for the design of

individual wastewater systems (IWS). The approximate locations of the borings are shown on the Site Plan, Plate 2. The percolation tests were performed near the proposed leach field locations for the IWS. Percolation rates of 2 and 25 minutes per inch of drop was achieved in the two tests. The results of our percolation tests are presented on Plates C-1 and C-2 of Appendix C.

Based on our test results, the percolation rates may vary considerably across the site depending on the subsurface materials encountered. Higher percolation rates (on the order of about 2 minutes per inch of drop) may be considered in the design provided that provisions are made to increase the size of the leaching fields in the event that the design percolation rates are not achieved in the field due to variation in the subsurface materials. Therefore, we recommend that percolation tests be conducted in the leaching fields during construction to confirm the higher design percolation rates used in sizing the leach fields.

3.9 Underground Utility Lines

We envision that some underground utility lines will be required for the development of this project. It is anticipated that most of the trenches for the utility lines will be excavated in the loose to medium dense colluvium and medium hard to very hard basalt formation encountered at the site. For support of the utility lines planned at the project site, we recommend that granular bedding consisting of 6 inches of open-graded gravel (ASTM C 33, No. 67 gradation) or 1-inch minus, well-graded materials be used below the pipes.

Free-draining granular materials, such as the open-graded gravel (ASTM C 33, No. 67 gradation) or 1-inch minus, well-graded materials, should be used for the initial trench backfill up to about 12 inches above the pipes. It is critical to use this free-draining material to reduce the potential for formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. Improper backfill material around the pipes and improper placement could result in settlement of the backfill and damage to the pipes. Where the 1-inch minus, well-graded materials are used for the granular bedding

and/or the initial trench backfill, the 1-inch minus, well-graded materials should be moisture-conditioned and compacted to not less than 90 percent relative compaction.

The upper portion of the trench backfill from the level 12 inches above the pipes to the top of the subgrade or finished grade should consist of well-graded granular materials less than 6 inches in maximum size. The backfill should be moisture-conditioned to above the optimum moisture, placed in about 8-inch loose lifts, and mechanically compacted to at least 90 percent relative compaction. Where trenches are located in paved areas, the upper 3 feet of the trench backfill below the pavement grade should be compacted to not less than 95 percent relative compaction.

Because basalt formation was encountered near the ground surface, trench work for utility installation will likely involve excavation in the basalt formation and may require hard ripping or the use of hoe rams. Care must be exercised by the contractor to avoid over-ripping of the basalt formation, which would disrupt the structure of the rock formation resulting in a potential loss of bearing strength for foundations in its vicinity.

3.10 Drainage

The finished grades outside the new structures should be sloped to shed water away from the foundations and slabs to reduce the potential for ponding. It is also advised that gutter systems be installed around the buildings and that the discharge be diverted away from the foundations and pavement areas. Excessive landscape watering near the foundations and pavement areas should also be avoided. Planters next to shallow foundations should be avoided or have concrete bottoms and drains to reduce the potential for significant water infiltration into the subsurface.

These drainage requirements are essential for the proper performance of the above shallow foundation recommendations since ponded water could cause subsurface soil saturation and subsequent heaving or loss of strength. The foundation excavations should be properly backfilled against the walls or slab edges immediately after setting of the concrete to reduce the potential for significant water infiltration into the subsurface. In addition, drainage swales should be provided as soon as possible and should be maintained to drain surface water runoff away from the foundations and pavement areas.

3.11 Design Review

Final drawings and specifications for the Consolidated Command and Range Control Facility should be forwarded to Geolabs for review and written comments prior to construction. This review is necessary to evaluate conformance of the plans and specifications with the intent of the geotechnical engineering recommendations provided herein. If this review is not made, Geolabs cannot be responsible for misinterpretation of our recommendations.

3.12 Construction Monitoring

It is recommended that Geolabs be retained to provide geotechnical services during construction of the Consolidated Command and Range Control Facility project. The items of construction monitoring that are critical requiring "Special Inspection" include observation of site preparation, fill placement and compaction, and foundation construction. Other aspects of earthwork construction should also be observed by a representative from Geolabs. This is to observe compliance with the intent of the design concepts, specifications, or recommendations and to expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared.

If the actual exposed subsurface conditions encountered during construction are different from those assumed or considered in this report, then appropriate modifications to the design should be made.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4.0 - LIMITATIONS

The analyses and recommendations submitted in this report are based, in part, upon information obtained from field borings. Variations of subsurface conditions between and beyond the borings may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations provided in this report.

The locations of the field borings indicated in this report are approximate, having been taped from features shown on the Demolition, Site Layout and Utility Plan transmitted by Imata & Associates, Inc. on January 23, 2003. Elevations of the borings were estimated based on interpolation between the contour lines shown on the same plan. The physical locations and elevations of the borings should be considered accurate only to the degree implied by the methods used.

The stratification lines shown on the graphic representations of the borings depict the approximate boundaries between soil/rock types and, as such, may denote a gradual transition. Water level data from the borings were measured at the times shown on the graphic representations and/or presented in the text of this report. These data have been reviewed and interpretations made in the formulation of this report. Groundwater was not encountered in our borings. However, it must be noted that fluctuation may occur due to variation in rainfall, temperature, and other factors.

This report has been prepared for the exclusive use of Nakoa - PEMCO (JV) and their project consultants, for specific application to the Consolidated Command and Range Control Facility planned in the Pohakuloa Training Area on the Island of Hawaii (as described in this report) in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the architect and engineer in the design of the proposed project. Therefore, this report may not contain sufficient data, or the proper information, for use in construction cost estimates, or other uses. A subcontractor wishing to bid on this project is urged to retain a competent

geotechnical engineer to assist in the interpretation of this report and/or in the performance of additional site-specific exploration for detailed design and bid estimating purposes.

The owner/client should be aware that unanticipated soil/rock conditions are commonly encountered. Unforeseen soil conditions, such as perched groundwater, soft deposits, hard layers, or cavities, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

Plate 1	-	Project Location Map
Plate 2	-	Site Plan
Appendix A	-	Field Exploration
Plate A	-	Boring Log Legend
Plates A-1 thru A-4	-	Logs of Borings
Appendix B	-	Laboratory Testing
Plates B-1 thru B-3	-	Laboratory Test Data
Appendix C	-	Percolation Testing
Plates C-1 and C-2	-	Percolation Test Data

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Respectfully submitted,

GEOLABS, INC.

By _____
Robin M. Lim, P.E.
Vice President

RML:ST:as

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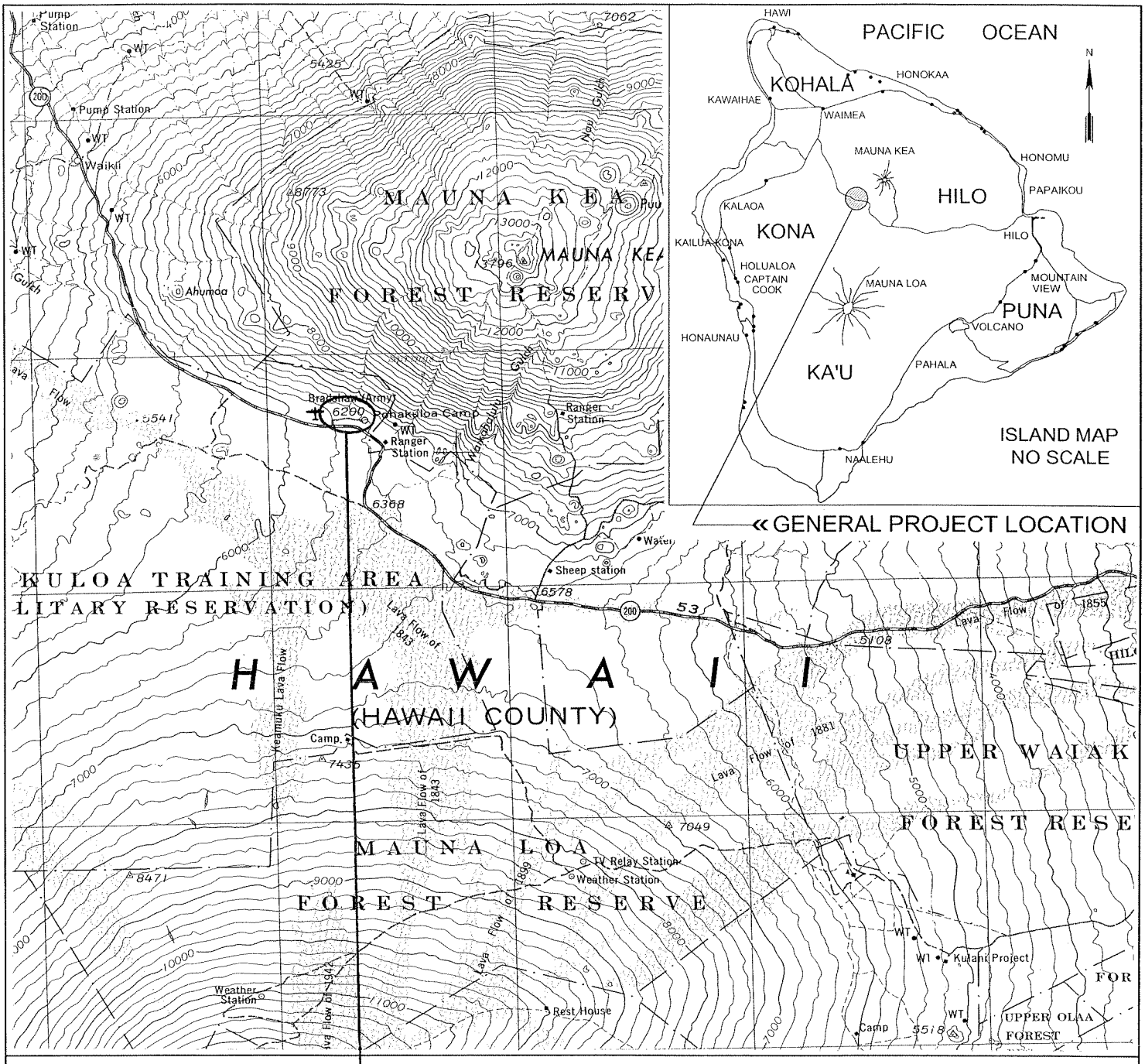
PLATES



PROJECT LOCATION MAP

CONSOLIDATED COMMAND & RANGE CONTROL FACILITY POHAKULOA TRAINING AREA, ISLAND OF HAWAII

4 2 0 4 MILES

GRAPHIC SCALE

N

REFERENCE: U.S.G.S. QUADRANGLE MAP
ISLAND OF HAWAII (1975).

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2003	KJD	1
SCALE	W.O.	
1" = 4 MILES	4691-10(B)	

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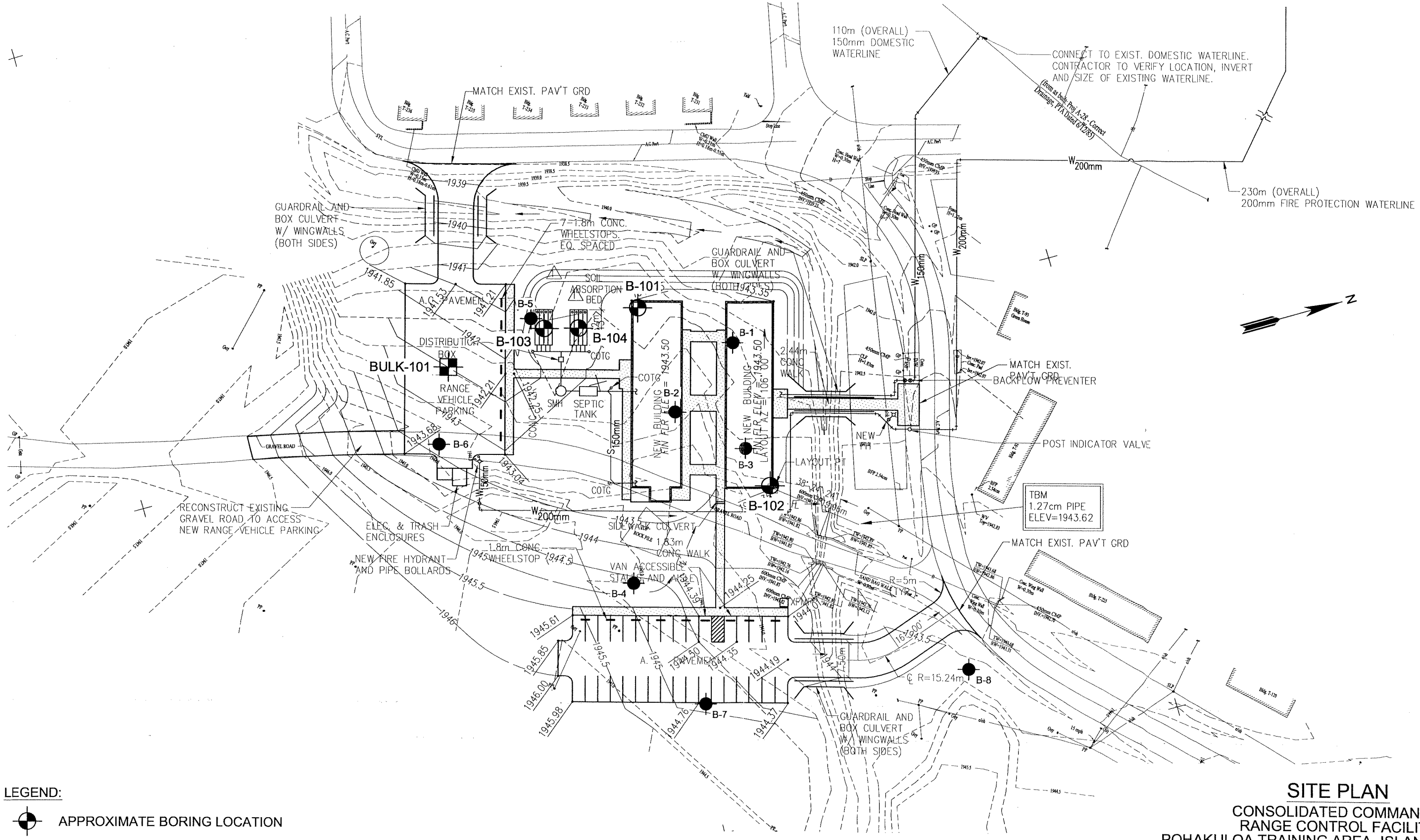

LEGEND:

- APPROXIMATE BORING LOCATION
- APPROXIMATE BULK SAMPLE LOCATION
- APPROXIMATE BORING LOCATION (FROM REPORT DATED FEB. 22, 2002)

REFERENCE: DEMOLITION, SITE LAYOUT AND UTILITY PLAN TRANSMITTED BY IMATA & ASSOCIATES, INC. ON JANUARY 23, 2003.

25 10 5 0 25 50

GRAPHIC SCALE: 1:800

SITE PLAN

CONSOLIDATED COMMAND &
RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
FEBRUARY 2003	KJD	2
SCALE	W.O.	
1 : 800	4691-10(B)	

File: 4691-10(B)SitePlan.dwg Mar 04, 2003 - 3:25pm

APPENDIX A

Field Exploration

APPENDIX A

Field Exploration

The subsurface conditions at the project site were explored by drilling and sampling four additional borings, designated as Boring Nos. 101 through 104, extending to depths of about 5 to 20.8 feet below the existing ground surface. The borings were drilled using a truck-mounted drill rig equipped with continuous flight augers and rotary coring tools. The approximate locations of the borings drilled are shown on the Site Plan, Plate 2.

The materials encountered in the borings were classified by visual and textural examination in the field by our geologist, who monitored the drilling operations on a near-continuous basis. Soils were classified in general conformance with the Unified Soil Classification System, as shown on Plate A. Graphic representations of the materials encountered are presented on the Logs of Borings, Plates A-1 through A-4.

Relatively "undisturbed" soil samples were obtained from the borings drilled in general accordance with ASTM Test Designation D 3550, Ring-Lined Barrel Sampling of Soils, by driving a 3-inch OD Modified California sampler with a 140-pound hammer falling 30 inches. In addition, some samples were obtained from the drilled borings in general accordance with ASTM Test Designation D 1586, Penetration Test and Split-Barrel Sampling of Soils, by driving a 2-inch OD standard penetration sampler using the same hammer and drop. The blow counts needed to drive the sampler the second and third 6 inches of an 18-inch drive are shown as the "Penetration Resistance" on the Logs of Borings at the appropriate sample depths.

Core samples of the rock materials encountered at the site were obtained by using diamond core drilling techniques in general accordance with ASTM Standard Practice D 2113, Diamond Core Drilling for Site Investigation. Core drilling is a rotary drilling method that uses a hollow bit to cut into the rock formation. The rock material left in the hollow core of the bit is mechanically recovered for examination and description.

Recovery (REC) is used as a subjective guide to the interpretation of the relative quality of rock masses. Recovery is defined as the actual length of material recovered from a coring attempt versus the length of the core attempt. For example, if 3.7 feet of material is recovered from a 5.0-foot core run, the recovery would be 74 percent and would be shown on the Logs of Borings as REC = 74%.

The Rock Quality Designation (RQD) is also a subjective guide to the relative quality of rock masses. RQD is defined as the percentage of the core run that is sound material in excess of 4 inches in length without any discontinuities, discounting any drilling induced fractures or breaks. If 2.5 feet of sound material is recovered from a 5.0-foot core run, the RQD would be 50 percent and would be shown on the Logs of Borings as RQD = 50%. Generally, the following is used to describe the relative quality of the rock, based on the "Practical Handbook of Physical Properties of Rocks and Minerals."

Rock Quality	**RQD** (%)
Very Poor	0 – 25
Poor	25 – 50
Fair	50 – 75
Good	75 – 90
Excellent	90 – 100

The rippability of a rock mass is a function of the relative hardness of the rock, its relative quality, brittleness, and fissile characteristics. Dense basalt formations with high RQD values would be very difficult to rip and would probably require more arduous methods of excavation.

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Geotechnical Engineering

Boring Log Legend

UNIFIED SOIL CLASSIFICATION SYSTEM (USCS)

MAJOR DIVISIONS			USCS	TYPICAL DESCRIPTIONS
COARSE-GRAINED SOILS (MORE THAN 50% OF MATERIAL RETAINED ON NO. 200 SIEVE)	GRAVELS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LESS THAN 5% FINES)	GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
			GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (MORE THAN 12% FINES)	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SANDS (50% OR MORE OF COARSE FRACTION PASSING THROUGH NO. 4 SIEVE)	CLEAN SANDS (LESS THAN 5% FINES)	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINES (MORE THAN 12% FINES)	SM	SILTY SANDS, SAND-SILT MIXTURES
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE-GRAINED SOILS (50% OR MORE OF MATERIAL PASSING THROUGH NO. 200 SIEVE)	SILTS AND CLAYS (LIQUID LIMIT LESS THAN 50)		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (LIQUID LIMIT 50 OR MORE)		MH	INORGANIC SILT, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			CH	INORGANIC CLAYS OF HIGH PLASTICITY
			OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

LEGEND

	(2-INCH) O.D. STANDARD PENETRATION TEST	LL	LIQUID LIMIT
	(3-INCH) O.D. MODIFIED CALIFORNIA SAMPLE	PI	PLASTICITY INDEX
S	SHELBY TUBE SAMPLE	TV	TORVANE SHEAR (tsf)
G	GRAB SAMPLE	PEN	POCKET PENETROMETER (tsf)
	CORE SAMPLE	UC	UNCONFINED COMPRESSION (psi)
		▽	WATER LEVEL OBSERVED IN BORING

Plate

A

GEOLABS, INC.	CONSOLIDATED COMMAND & RANGE CONTROL FACILITY	Log of Boring
Geotechnical Engineering	POHAKULOA TRAINING AREA, ISLAND OF HAWAII	101

Laboratory			Field							
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS
			87	61	20/.0' Ref.		0			ML
			90	70			5			
			100	80			10			
			100	100			15			
							20			
							25			

Approximate Ground Surface Elevation (feet MSL): 6373 *

Description

Brown **SILT,** loose, dry (volcanic ash)

Gray vugular **BASALT,** moderately fractured, unweathered to slightly weathered, very hard (basalt formation)

Brownish gray vesicular **BASALT,** moderately fractured, slightly weathered, hard to very hard (basalt formation)

grades to slightly fractured

grades to massive

Boring terminated at 20 feet

* Elevations estimated from Demolition, Site Layout and Utility Plan transmitted by Imata & Associates, Inc. on January 23, 2003.

Date Started:	January 27, 2003	Water Level: ▽ Not Encountered	Plate
Date Completed:	January 27, 2003		
Logged By:	S. Latronic	Drill Rig: CME-55	A - 1
Total Depth:	20 feet	Drilling Method: 4" Auger & HQ Coring	
Work Order:	4691-10(B)	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG 4691-10B.GPJ GEOLABS.GDT 3/4/03

GEOLABS, INC.	CONSOLIDATED COMMAND & RANGE CONTROL FACILITY	Log of Boring
Geotechnical Engineering	POHAKULOA TRAINING AREA, ISLAND OF HAWAII	102

Approximate Ground Surface Elevation (feet MSL): 6372 *

Laboratory			Field							
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
	5	105			28					SM	Brown **SILTY SAND** with gravel, loose, dry (fill)
										SM	Light brown **SILTY SAND,** stiff, dry to damp (volcanic ash)
	18				6						
	14	96			29		5			SM	Gray and brown **SILTY SAND** with some gravel and cobbles, medium dense, dry to damp (cinder)
			31	0							
	10				40		10				
			52	0							
			15	0			15				**COBBLE**
	6				28/.5' +50/.3' Ref.		20				
											Boring terminated at 20.8 feet
							25				

Date Started:	January 27, 2003	Water Level: ▽ Not Encountered	Plate
Date Completed:	January 27, 2003		
Logged By:	S. Latronic	Drill Rig: CME-55	
Total Depth:	20.8 feet	Drilling Method: 4" Auger & HQ Coring	A - 2
Work Order:	4691-10(B)	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG 4691-10B.GPJ GEOLABS.GDT 3/4/03

GEOLABS, INC.	CONSOLIDATED COMMAND & RANGE CONTROL FACILITY	Log of Boring
Geotechnical Engineering	POHAKULOA TRAINING AREA, ISLAND OF HAWAII	103

Laboratory			Field							Approximate Ground Surface Elevation (feet MSL): 6371 *
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			70	60						ML	Brown **SILT,** loose, dry (ash)
											Brownish gray **BASALT,** severely fractured, moderately weathered, soft to medium hard (clinker)
											Gray vugular **BASALT,** slightly fractured, unweathered to slightly weathered, very hard (basalt formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				

Date Started:	January 27, 2003	Water Level: ▽ Not Encountered		Plate
Date Completed:	January 27, 2003			
Logged By:	S. Latronic	Drill Rig:	CME-55	
Total Depth:	5 feet	Drilling Method:	HQ Coring	A - 3
Work Order:	4691-10(B)	Driving Energy:	140 lb. wt., 30 in. drop	

BORING_LOG 4691-10B.GPJ GEOLABS.GDT 3/4/03

GEOLABS, INC.	CONSOLIDATED COMMAND & RANGE CONTROL FACILITY	Log of Boring
Geotechnical Engineering	POHAKULOA TRAINING AREA, ISLAND OF HAWAII	104

Laboratory			Field							Approximate Ground Surface Elevation (feet MSL): 6373 *
Other Tests	Moisture Content (%)	Dry Density (pcf)	Core Recovery (%)	RQD (%)	Penetration Resistance (blows/foot)	Pocket Pen. (tsf)	Depth (feet)	Sample	Graphic	USCS	Description
			85	33			0			ML	Brown **SILT,** loose, dry (ash)
											Gray **BASALTIC COBBLES AND GRAVEL** with some silt, dense, dry (clinker)
											Gray vugular **BASALT,** severely fractured, unweathered to slightly weathered, hard to very hard (basalt formation)
							5				Boring terminated at 5 feet
							10				
							15				
							20				
							25				

Date Started:	January 27, 2003	Water Level: ▽ Not Encountered	Plate
Date Completed:	January 27, 2003		
Logged By:	S. Latronic	Drill Rig: CME-55	A - 4
Total Depth:	5 feet	Drilling Method: HQ Coring	
Work Order:	4691-10(B)	Driving Energy: 140 lb. wt., 30 in. drop	

BORING_LOG 4691-10B.GPJ GEOLABS.GDT 3/4/03

APPENDIX B

Laboratory Testing

APPENDIX B

Laboratory Testing

Moisture content (ASTM D 2216) and unit weight (ASTM D 2937) determinations were performed on selected soil samples as an aid in the classification and evaluation of soil properties. The results of these tests are presented on the Logs of Borings at the appropriate sample depths.

One sieve analysis test (ASTM C 117 & C 136) was performed on a selected sample of the soils to evaluate the gradation characteristics of the soils and to aid in soil classification. Graphic presentation of the grain size distribution of the sample is provided on Plate B-1.

One laboratory California Bearing Ratio (CBR) test (ASTM D 1883) was performed on a bulk sample of the near-surface soils to evaluate the pavement support characteristics of the soils. Results of the test are presented on Plate B-2.

One Modified Proctor compaction test (ASTM D 1557) was performed on a bulk sample of the near-surface soils to evaluate the dry density and moisture content relationship. The results of the test are presented on Plate B-3.

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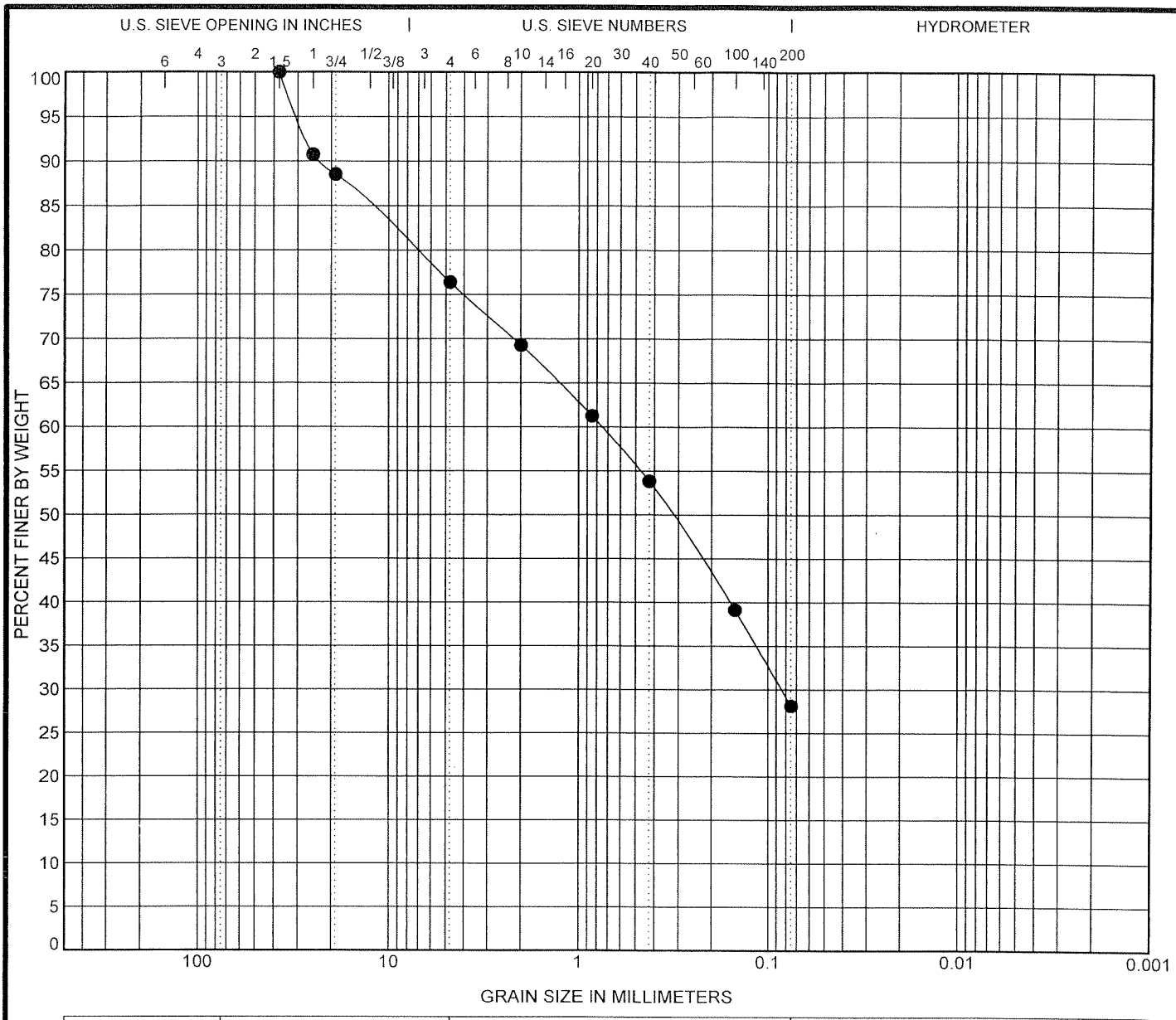


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	B-102	5.0 - 6.5	Gray and brown SILTY SAND with gravel(SM)					

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	B-102	5.0 - 6.5	37.5	0.756	0.084		23.6	48.3	28.1

GEOLABS, INC.

GEOTECHNICAL ENGINEERING

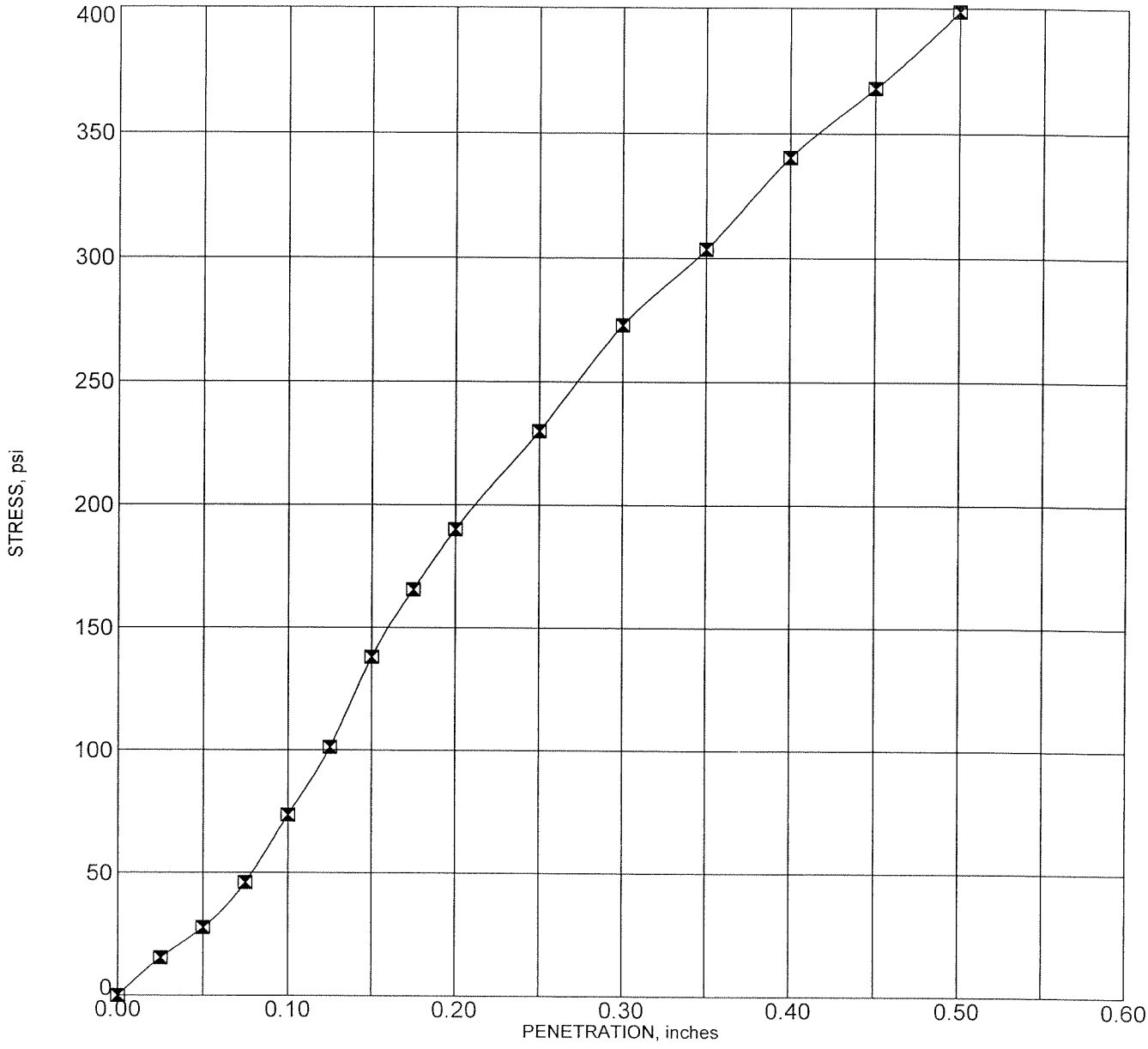
W.O. 4691-10(B)

GRAIN SIZE DISTRIBUTION - ASTM C 136

CONSOLIDATED COMMAND &
RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

Plate
B - 1

G GRAIN_SIZE 4691-10B.GPJ GEOLABS.GDT 3/4/03



Corr. CBR @ 0.1"	14.5
Swell (%)	0.00

Sample: Bulk-101
Depth: surface
Description: Grayish brown SILTY SAND

Molding Dry Density (pcf)	86.9	Hammer Wt. (lbs)	10
Molding Moisture (%)	20.2	Hammer Drop (inches)	18
Days Soaked	2	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

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GEOTECHNICAL ENGINEERING
W.O. 4691-10(B)

CALIFORNIA BEARING RATIO - ASTM D 1883

CONSOLIDATED COMMAND &
RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

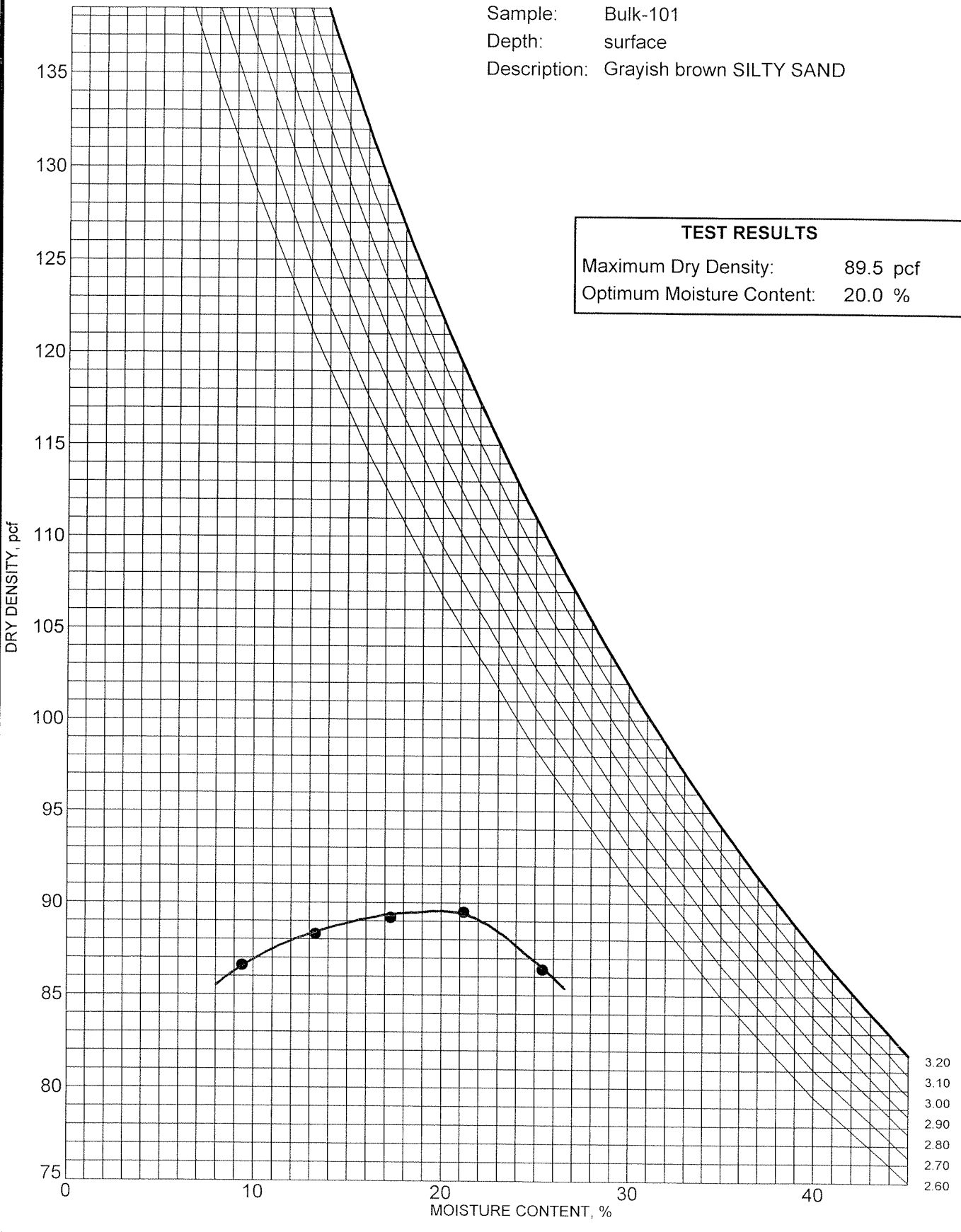
Plate
B - 2

G_CBR 4691-10B.GPJ GEOLABS.GDT 3/4/03

Sample: Bulk-101
Depth: surface
Description: Grayish brown SILTY SAND

TEST RESULTS

Maximum Dry Density:	89.5 pcf
Optimum Moisture Content:	20.0 %



GEOLABS, INC.
GEOTECHNICAL ENGINEERING

W.O. 4691-10(B)

MOISTURE-DENSITY RELATIONSHIP - ASTM D 1557 A

CONSOLIDATED COMMAND &
RANGE CONTROL FACILITY
POHAKULOA TRAINING AREA, ISLAND OF HAWAII

Plate
B - 3

G_COMPACTION 4691-10B.GPJ GEOLABS.GDT 2/26/03

APPENDIX C

Percolation Testing

APPENDIX C

Percolation Testing

Two field percolation tests were performed in general accordance with the State of Hawaii, Department of Health's Administrative Rules, Chapter 11-62-31.2, "Wastewater Systems" and Chapter 10 of the Ten States Standards to evaluate the permeability of the subsurface soils for disposal of wastewater effluent. The test results and the "Site Evaluation/Percolation Test" forms are presented as Plates C-1 and C-2.

In general, the percolation tests were performed by drilling 4-inch diameter boreholes extending to depths of about 5 feet below the existing ground surface at the time of the tests. Approximately one inch of sand and gravel was then placed at the bottoms of the boreholes to protect the bottoms of the holes from scouring and sediments when filling the boreholes with water.

The boreholes were prepared by filling the boreholes with about 12 inches of water to saturate the materials at the bottoms of the boreholes. The time needed for the 12 inches of water to seep away was recorded. Then, the actual percolation tests in the boreholes commenced. During the tests, the holes were carefully filled with water to a depth of 6 inches over the sand and gravel layer. The time intervals and water drops were then recorded to provide data upon which to base calculation of the percolation rates.

(h:\4600 Series\4691-10B.st1-pg38)

SITE EVALUATION/PERCOLATION TEST

Date/Time: January 28, 2003

Test performed by: Steve Latronic

Owner: The United States Armed Forces

Tax Map Key:

Elevation: +6,371 ft MSL
Depth to Groundwater Table: N/A ft below grade
Depth to Bedrock (if observed): 2.0 ft below grade
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5.0 ft below grade

Depth below grade (inches)	Soil Profile (color, texture, other)
0 - 6	Brown SILT, soft, dry to damp (volcanic ash)
6 - 24	Reddish brown A'A BASALT, severely fractured
24 - 60	Gray BASALT, slightly fractured, very hard (basalt formation)

PERCOLATION READINGS

Time 12 in of water to seep away: 52.5 min (first trial reading)
Time 12 in of water to seep away: 54.0 min (second trial reading)

For percolation tests in sandy soils, record time intervals and water drops at least every 10 minutes for at least 1 hour.

For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time Interval (min)	Drop in Inches	Time Interval (min)	Drop in Inches
10	2.0	10	6.0
10	1.4	10	3.0
10	2.4	10	1.5
10	2.1	10	0.4
10	1.6	10	0.4
10	0.4	10	0.4

Percolation Rate (time/final water level drop): 25.0 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.

ROBIN M. LIM
LICENSED PROFESSIONAL ENGINEER
No. 8436-C
HAWAII, U.S.A.

Engineer's Signature/Stamp

revised 5/92

SITE EVALUATION/PERCOLATION TEST

Date/Time: January 28, 2003

Test performed by: Steve Latronic

Owner: The United States Armed Forces

Tax Map Key:

Elevation: +6,373 ft MSL
Depth to Groundwater Table: N/A ft below grade
Depth to Bedrock (if observed): 2.0 ft below grade
Diameter of Hole: 4 in.
Depth to Hole Bottom: 5.0 ft below grade

Soil Profile

Depth below grade (inches)	(color, texture, other)
0 - 6	Brown SILT, soft, dry to damp (volcanic ash)
6 - 24	Gray Basalt COBBLES & GRAVEL, dense, damp
24 - 60	Gray BASALT, severely fractured, very hard (basalt formation)

PERCOLATION READINGS

Time 12 in of water to seep away: 24.0 min (first trial reading)
Time 12 in of water to seep away: 22.5 min (second trial reading)

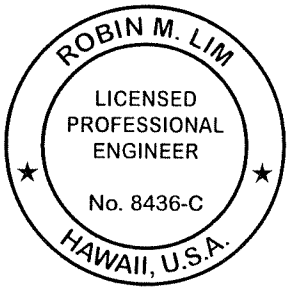
For percolation tests in sandy soils, record time intervals and water drops at least every 10 minutes for at least 1 hour.

For percolation tests in non-sandy soils, presoak the test hole for at least 4 hours. Record time intervals and water drops at least every 10 minutes for 1 hour; or if the time for the first 6 inches to seep away is greater than 30 minutes, record time intervals and water drops at least every 30 minutes for 4 hours or until 2 successive drops do not vary by more than 1/16 inch.

Time Interval (min)	Drop in Inches	Time Interval (min)	Drop in Inches
1	4.0	1	1.0
1	2.0	1	0.9
1	1.0	1	1.1
1	1.0	1	0.5
1	0.5	1	0.5
1	0.5	1	0.5

Percolation Rate (time/final water level drop): 2.0 min/in

As the engineer responsible for gathering and providing site information and percolation test results, I attest to the fact that above site information is accurate and that the site evaluation was conducted in accordance with the provisions of Chapter 11-62, "Wastewater Systems" and the results were acceptable.



Engineer's Signature/Stamp

revised 5/92

Flow Test (10-18-01).xls

S. S. DANNAWAY ASSOCIATES, INC.

Fire Protection Engineers/Building Code Consultants

Test # 1 of 1

HYDRANT FLOW TEST REPORT

DATE: 18-Oct-01

LOCATION: Pohakuloa Training Area
Big Island

TIME: 11:05 AM

TEST MADE BY: John Lopes, S.S. Dannaway Associates

REPRESENTATIVE OF: S. S. DANNAWAY ASSOCIATES, INC.

WITNESS: Ricky Okamoto, S.S. Dannaway Associates

STATE PURPOSES OF TEST: To determine the available water supply for the new command center

PRESSURE HYDRANT (TEST HYDRANT): Hydrant located near building T-37

FLOW HYDRANT: Hydrant located adjacent to building T-280

FLOW HYDRANT DATA:

	Flow 1		Flow 2		
No. & SIZE NOZZLE (in.)	1	2 1/2	2	2 1/2	Nozzle coefficients:
					flowtubes = 0.90 - 0.95
PITOT READING(S)	60		35	20	hydrant butts:
	r. edge		r. edge	r. edge	rounded edge = 0.90
DISCHARGE COEFF.	0.90		0.90	0.90	sharp edge = 0.80
					inset edge = 0.70
GPM	1,300		1,743		smooth nozzle = 0.95

PRESSURE (TEST) HYDRANT DATA

STATIC PRESSURE: 75 psi

RESIDUAL PRESSURE(S): Flow 1 70 psi Flow 2 61 psi

PROJECTED AVAILABLE WATER SUPPLIES

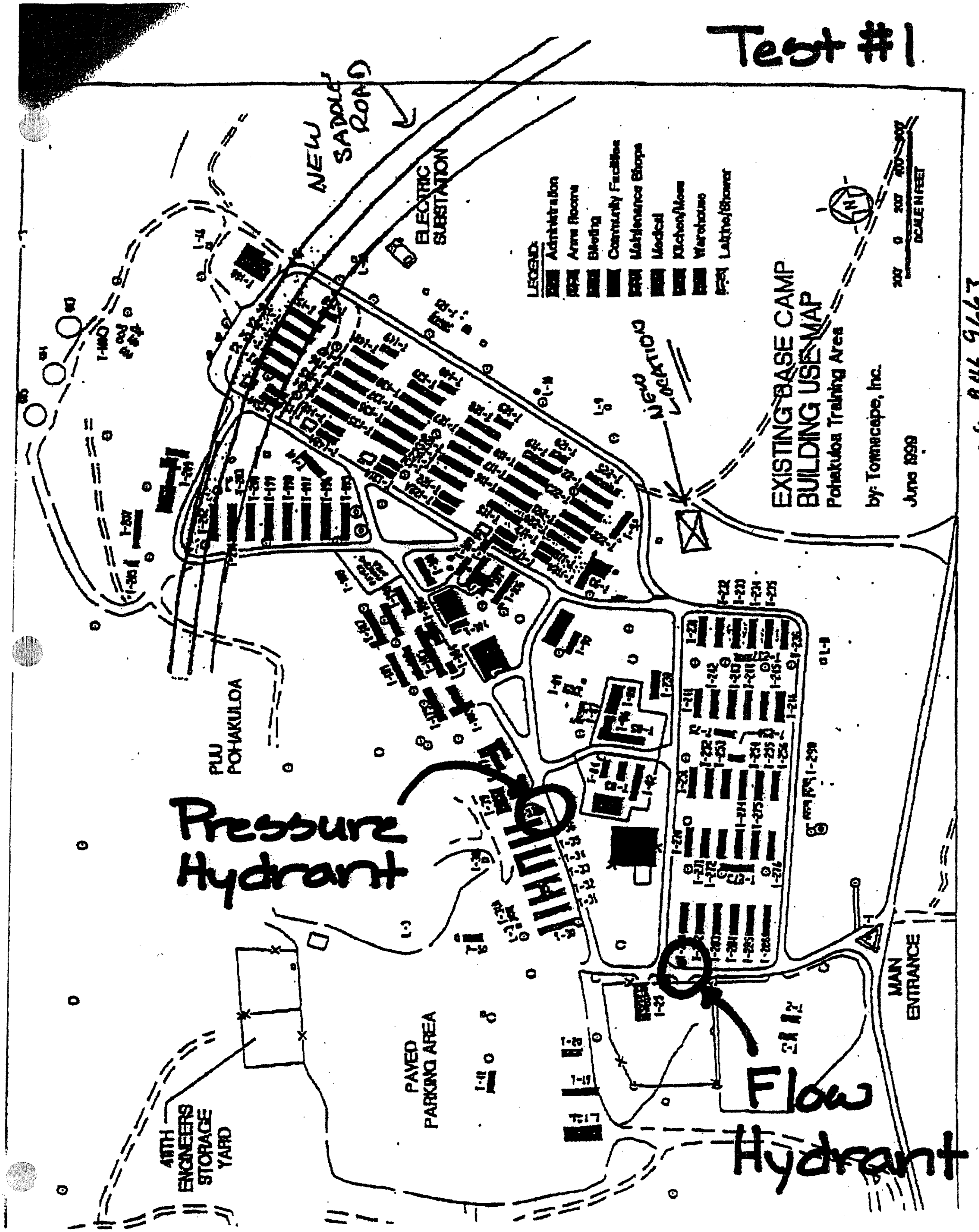
@ 20 psi Residual: 3,649 gpm or @ 40 psi Residual: 2,859 gpm

REMARKS:

FH: Clow, wet barrel, 1997, two 2 1/2", one 4"

PH: Clow, wet barrel, 1998, two 2 1/2", one 4"

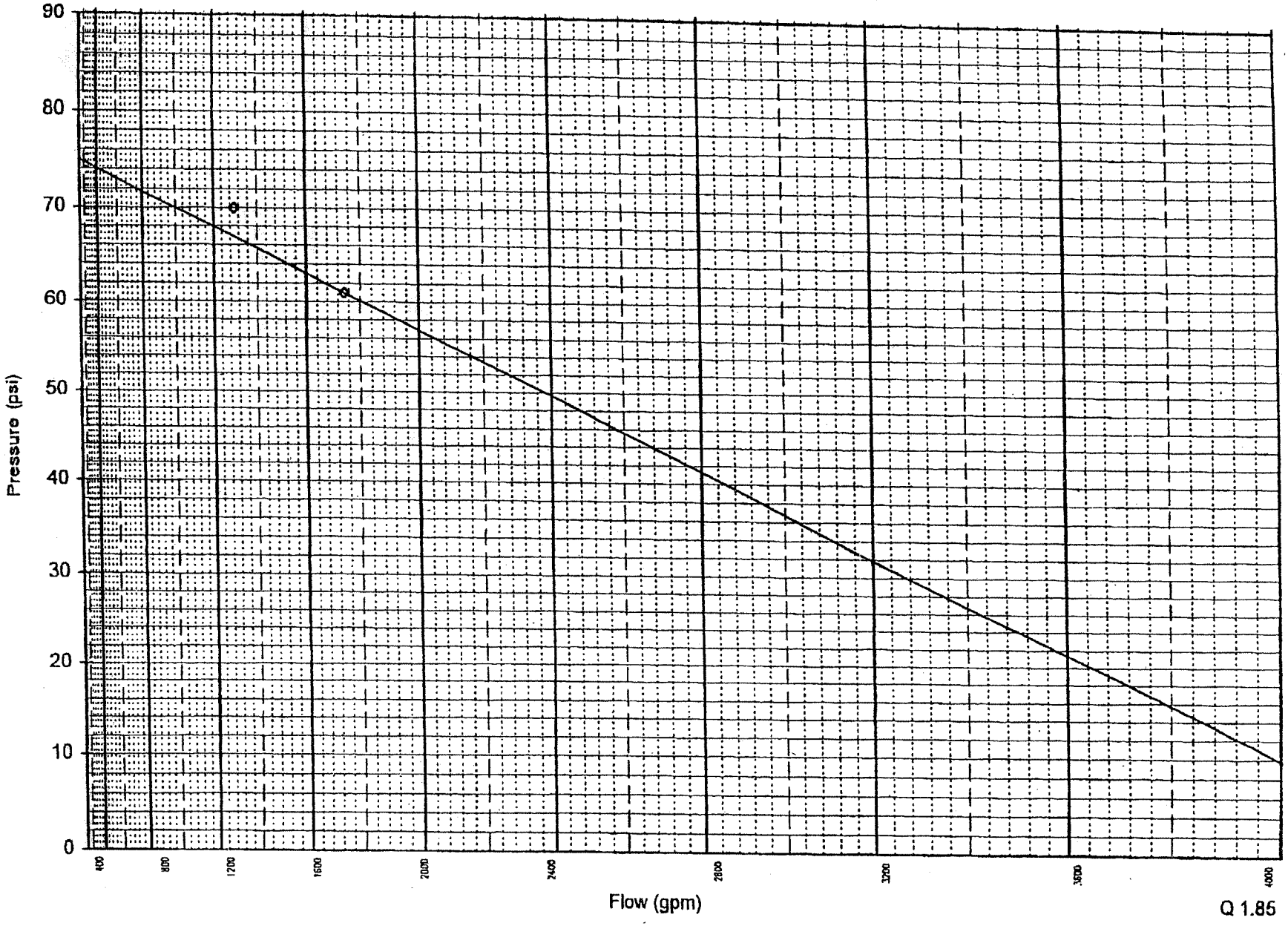
Pressure at PH after test: fluctuated between 70 to 80 psi


Test #1
NEW SADDLE ROAD
ELECTRIC SUBSTATION
LEGEND:
Administration
Arms Room
Billeting
Community Facilities
Maintenance Shops
Medical
Kitchen/Mess
Warehouse
Latrine/Shower
SCALE IN FEET
NEW LOCATION
EXISTING BASE CAMP
BUILDING USE MAP
Pohakuloa Training Area
by: Townscape, Inc.
808 946 9663
PUU POHAKULOA
Pressure Hydrant
PAVED PARKING AREA
411TH ENGINEERS STORAGE YARD
MAIN ENTRANCE
Flow Hydrant

S. S. DANNAWAY ASSOCIATES

Pohakuloa Training Facility
Test #1

10/18/01



Q 1.85

Attachment 4,
Page 3 of 3

Section 01010
AM-0003

SECTION 01012

DESIGN AFTER AWARD

1.0 GENERAL

1.1 The Government is providing drawings for the “Billet Buildings” and the “Recreation Center”, prepared, signed and stamped by licensed architects and engineers. Except as noted in Section 01010, the construction represented on these drawings has been reviewed and found acceptable by the Government.

1.2 The requirements of this section apply only to those design elements that the Contractor is required to prepare, as outlined in Section 01010, or has elected to change from the provided drawings.

1.3 After contract award and Notice to Proceed, the Contractor will be provided a CD containing the CADD files for the provided drawings.

1.4 The Contractor shall include in his Project Schedule (Section 01320), his schedule for submittal and review of the required design stages, pre-final (90%) and final (100%).

1.5 “Fast-tracking” will be allowed. The Contractor will be allowed to proceed with the sitework providing the design of the site elements is complete and the Contracting Officer has approved the Final (100%) sitework design.

2.0 DESIGNER OF RECORD

2.1 The Contractor shall identify a Designer of Record ("DOR") for each area of design. All design disciplines shall be accounted for by listed, registered Designer(s) of Record. Each DOR shall be responsible for ensuring integrity of his design and design integration of all construction submittals and extensions to design developed by others, such as the constructor, subcontractors or suppliers. The DOR shall review and approve all construction submittals and extensions to design in accordance with the procedures described in Section 01330, SUBMITTAL PROCEDURES. Each DOR shall be responsible for the responses to "Requests for Information" (RFI's) applicable to his area of design responsibility. Each DOR shall stamp, sign, and date all design drawings under his responsible discipline at each review/design submittal stage (see Contract clause - "REGISTRATION OF DESIGNERS") and all submittals under his responsible discipline, in accordance with the submittal review procedures. The DOR shall sign-off on all applicable RFI responses.

2.2 The Contractor may at his own discretion identify for approval the AE designer of the Government furnished work plans for the “Billet Buildings” and the “Recreation Center” or identify another AE designer.

3.0 DEFINITION OF DESIGN SUBMITTALS

3.1 **PRE-FINAL (90%) DESIGN SUBMITTAL**. The Pre-Final (90%) Design submittal shall include all documentation necessary to insure that the design is complete and in accordance with the Statement of Work (Section 01010). . The following documents shall be included in this submittal:

3.1.1 Design Analysis. The Design Analysis shall be complete and in its final form. It shall include all backup material and data to support the design documents prepared in response to the Statement of Work (Section 01010). All design calculations shall be included. The Design Analysis shall contain all material explaining the design rationale for any design decisions that would not be obvious to an engineer reviewing the Pre-Final Drawings and Specifications.

3.1.2 Drawings. The Drawings shall be complete, including all of the drawings provided by the Government, whether or not revised by the Contractor. The Contractor is expected to have completed all of his coordination. The drawings shall contain all of the details necessary to ensure a clear understanding of the work throughout construction. Shop drawings shall not be submitted with the design drawings. If the Contractor is planning to prepare shop drawings in lieu of design drawings for specific areas of construction, these shop drawings shall be identified and included in the submittal register.

3.1.3 Specifications. The Specifications for all items of work submitted for the Pre-Final Design shall consist of legible marked-up specification sections.

3.1.4 Submittal Register. A complete Submittal Register, including all shop drawings, shall be generated by the Specsintact software or shall be prepared using the Microsoft Excel © template developed by the Government specifically for this purpose. The template may be obtained from the Contracting Officer if needed.

3.1.5 Permits. Provide a list of all permits that are required to complete the construction, including the status of each, i.e. approved, or in process with estimated approval date.

3.2 **FINAL (100%) DESIGN SUBMITTAL.** The Final (100%) Design submittal shall incorporate all of the Government's comments received in response to the Pre-Final Design submittal and shall represent complete design documents for construction of the buildings and facilities included in this contract. If the Contractor fails to gain approval of its Final Design submittal, he shall repeat this Final Design submittal process until Government approval is achieved. The following documents shall be included in this submittal, and each of its resubmittals if required:

3.2.1 Design Analysis. The Design Analysis shall be complete.

3.2.2 Drawings. The Drawings shall be complete, including all of the drawings provided by the Government, whether or not revised by the Contractor.

3.2.3 Specifications. The Specifications shall be typed in final form, with no editing marks.

3.2.4 Submittal Register. The final complete submittal register shall be submitted in printed copy and electronic file, either Specsintact or Excel.

3.2.5 Permits. A copy of all required permits shall be submitted. Construction shall not start until all required permits are obtained.

3.2.6 Pre-final (90%) Design Submittal review comments and responses. Provide a printed copy of all government-issued review comments and corresponding Contractor responses. For all review comments with which the Contractor did not concur, responses shall thoroughly explain the reason for non-concurrence. If more than one Final Design submittal is made, review comments and responses from the previous submittal shall be included.

3.3 **COMPREHENSIVE INTERIOR DESIGN**

3.3.1 General. A Comprehensive Interior Design (CID) is required for the Recreation Center only. A CID is not required for the Billets, however, all finishes for the Billets shall be submitted for Government approval prior to ordering affected materials. Adequate time for the approval process of the finishes for both buildings shall be included in the Contractor's Project Schedule.

3.3.2 Definition. The Comprehensive Interior Design (CID) shall involve the selection and sampling of all applied finishes including material, color, texture and patterns necessary to complete the building's interior architectural features. The CID shall meet all requirements addressed in the

Statement of Work and the drawings provided by the Government

3.3.3 Samples. Present architectural finish samples in orderly arrangements according to like rooms/areas receiving like finish. Each like room receiving like finishes will be noted as a Color Scheme. Each Color Scheme shall have a written description of material used. This written description shall use the same material abbreviations and notes that appear on the Room Finish Schedule and Legend in the government-provided drawings.

3.3.4 Preliminary Submittals. The Contractor shall submit three complete sets of the initial CID package. The design philosophy shall use a warm neutral background color with appropriate accent colors. All CID proposals shall be reviewed and approved by the Government. The Interior Designer shall revise the CID binders after each review and update the CID to satisfy review comments. Each submittal will follow this method of review until the Government approves the completed CID package.

3.3.5 Government Approval. Government approval will be sought from the Honolulu Engineer District, which is the District Authority Having Jurisdiction (DAHJ). The DAHJ will be consulted through the Contracting Officer for all interpretations of Comprehensive Interior Design (CID) to be used in this project. The Contractor shall direct all questions, interpretations and clarifications to the Contracting Officer. All requests for information by the Contractor shall be submitted to the Contracting Officer in writing with the appropriate sketches, basis for waiver, specific question and any other information deemed necessary by the DAHJ. In general, a minimum of seven (7) calendar days is required by the DAHJ to respond to all inquiries. The seven days will start from the day of receipt by the Contracting Officer. In the event interpretation or approval is required from HQUSACE, an additional seven (7) calendar days will normally be required.

3.3.6 Final Submittal. After approval of the Preliminary Submittal, the Contractor shall submit three (3) complete sets of the approved and final Comprehensive Interior Design package. Once the Contractor has submitted the CID and the Government has approved the submittal, all materials, finishes, colors, textures and pattern submitted and approved for this project are then considered part of the contract and the Contractor shall furnish all approved CID finishes. No deviations will be considered.

3.3.7 Format. Submit all CID information and samples on 8 1/2"x 11" modules. Place the project title, base, architectural firm, page number and date on the bottom of each page or module.

3.3.6.1 The module shall support and anchor all samples. Anchor large or heavy samples with mechanical fasteners, Velcro, double-sided foam tape or contact cement. Rubber cement or glue will not be acceptable.

3.3.6.2 Assemble the 8 1/2" x 11" pages and modules in a 3" D-ring binder. Holes for placement of the modules in the binder shall be 3/8" in diameter. Each binder shall be identified on the outside spine and front cover by title, project number, percentage phase and date.

3.3.6.3 Material and finish samples shall indicate true pattern, color and texture.

3.3.6.4 Where paint manufacturers color names and numbers are used indicated the finish of the paint such as gloss, semi-gloss, flat and so on.

3.3.6.5 Signage may include emblems, striping, letters, numbers and logos. The interior designer shall consider visual appearance, organization, location, structural supports (if required) and relation to other base graphics. Indicate on a separate signage sheet the location and message for all signage. Submit a sample of the signage material finish and color with the structural finishes.

3.3.6.6 No photographs or colored photocopies of materials will be accepted or approved.

3.3.8 CID Binder. The CID Binder shall include the following information at each design submittal in this order:

==========

SEQUENCE OF CID CONTENTS

1. Title page

2. Table of contents

3. Design objectives - A statement of design objectives explaining the interior design philosophy of the facility shall be provided in the CID. Design objectives and the proposed method of accomplishing the objectives shall cover, when applicable, energy efficiency, safety, health, maintenance, image, personal performance of occupants and functional flexibility.

4. Interior floor plan

5. Interior sample finish boards

   Scheme A
   Scheme B
   Scheme C

   Example: All restrooms could be noted as color scheme "A", all general open office finishes could be noted as color scheme "B" and the main lobby could be noted as color scheme "C".

6. Room finish schedule

7. Signage

8. Signage plan

9 Plan must show suitability of proposed space to suit the furniture to be provided.

==========

4.0 QUANTITY OF DESIGN SUBMITTALS

4.1 General. The indicated number of copies shall be provided to each of the addressees at each submittal stage.

Activity and Address	Drawing Size <Full>	Drawing Size <Half>	Specifications	Color Boards**
U.S. Army Corps of Engineers Honolulu Engineering District Bldg. 230, Room 318 Ft. Shafter, HI 96858 Attn: CEPOH-PP-A / Jerry M. Matsuda	0	1	1	1
U.S. Army Corps of Engineers Honolulu Engineering District Bldg. 230, Room 112 Ft. Shafter, HI 96858 Attn: CEPOH-EC-Q	2	1	2	1
U.S. Army Corps of Engineers Honolulu Engineering District Fort Shafter Resident Office Bldg. 230 Ft. Shafter, HI 96858 Attn: CEPOH-EC-CF	2	2	2	2
LTC Fred S. Clarke Commander Pohakuloa Training Area P.O. Box 4607 Hilo, HI 96702-0607	1	1	1	1
Wayne Carey DPW PTA P O BOX 4607 Hilo, Hawaii 96720	1	1	1	
Director of Public Works U.S. Army Garrison, Hawaii Attn: Ed Uchida WAAF, Schofield Barracks, HI 96857-5013	1	1	1	1

** Color boards shall be submitted with the 100% building submittal only.

5.0 MAILING OF DESIGN SUBMITTALS

5.1 General. Mail all design submittals to the Government during design and construction, using an overnight mailing service. The submittals shall be mailed to the addresses listed in Paragraph 4.0, Quantity of Design Submittals.

5.2 Transmittal Letter. Each design submittal shall have a transmittal letter accompanying it indicating the date, design percentage, type of submittal, list of items submitted, transmittal number and point of contact with telephone number.

6.0 COORDINATION

6.1 Written Records. The Contractor shall prepare a written record of each design site visit, meeting, or conference, either telephonic or personal, and furnish within five (5) working days copies to the Contracting Officer and each of the three Corps of Engineers offices listed in Paragraph 4.0, Quantity of Design Submittals. The written record shall include subject, names of participants, outline of discussion, and recommendation or conclusions. Number each written record in consecutive order.

6.2 Design Needs List. Throughout the life of his contract the Contractor shall furnish the COR a monthly "needs" list for design related items. This list shall itemize in an orderly fashion design data required by the Contractor to advance the design in a timely manner. Each list shall include a sequence number, description of action item, name of the individual or agency responsible for satisfying the action item and remarks. The list will be maintained on a continuous basis with completed action items checked off and new action items added as required. Once a request for information is initiated, that item shall remain on the list until the requested information has been furnished or otherwise resolved. Copies of the list will be furnished to both the Administrative Contracting Officer and the agencies tasked with supplying the information on a weekly basis.

7.0 DESIGN SUBMITTAL REVIEWS

7.1 All Government review comments and Contractor responses shall be recorded and tracked using DrChecks, a database developed and maintained by the Government. After award of the contract, the Contractor shall contact Resource Center Enterprises (1-800-428-4357) to register its firm and all of its design consultants in DrChecks. Each firm will receive a registration key. Once the key is received, any individual from that firm will able to register in DrChecks. The Contractor will be responsible for accessing DrChecks at www.projnet.org to obtain government review comments and to provide responses to all comments for this project.

7.2 Design Schedule. The Contractor shall prepare and submit its Project Schedule in accordance with Section 01320, Project Schedule. The Preliminary Project Schedule, and all subsequent schedule submittals, shall include a complete design schedule showing all design submittals and government review periods, indicated in calendar dates. The Government will not review any design submittals that are incomplete and the Project Schedule has been received and accepted.

7.3 Government Review. The Government will review all documents submitted. The Government shall be allowed a minimum of 30 calendar days, exclusive of mailing time, for review at each design stage. The Government will review for conformance with the technical requirements of the solicitation.

7.3.1 The Government's review comments will indicate changes or other action required on the submitted items. All changes shall be incorporated as required by the review comments unless adequate justification is provided indicating the reason that such actions or changes constitute a change to the Statement of Work of this contract.

7.3.2 The Contractor shall respond to all comments using DrChecks. All review comments must be resolved and annotated with the Contractor's intended action(s). If the Government finds that the Contractor has not satisfactorily complied with its comment(s) or comment(s) are left unresolved, the design submittal will not be approved. The Contractor shall repeat the submittal and review process until the design submittal is approved.

7.3.3 If the Contractor disagrees with any of the Government's comments and does not intend to comply with a comment, he must clearly describe and justify the reason(s) for noncompliance within seven (7) calendar days after receipt of the comments. If the Contractor believes that an action taken in response to a comment may exceed the requirements of this contract, he shall immediately notify the COR in writing and shall await direction before proceeding with any further action on that comment.

7.4 Review conferences shall be held after each design submittal at a location to be furnished by the Contractor. These conferences shall be scheduled to take place within one week of the Contractor's receipt of the Government's comments. The Contractor shall ensure that all of the personnel involved with the development of the design submittal attend the review conference.

7.4.1 The Contractor is responsible for documenting the discussions and actions resulting from the review conference. Copies of all comments, annotated with the agreed upon comment action, shall be distributed to all conference attendees before the conference adjourns. Any issues that are not resolved during the conference shall be resolved by immediate follow-on action at the end of conference. All valid comments shall be incorporated into the next stage of construction documents.

7.5 If no changes are made to the government-provided sitework drawings, the Contractor may proceed with sitework activities without additional design approvals. However, the Contractor shall not begin construction on the portions of the sitework or buildings included in either the Pre-Final Design or Final Design submittals prior to approval of the Final Design submittal. Furthermore, the Government, reserves the right to disapprove a design submittal if in the opinion of the Government, the submittal does not comply with the contract requirements, is incomplete, or the design is not at the level expected for a particular submittal stage, i.e. 90% or 100%, as applicable.

7.6 If the Pre-Final and/or Final submittals are incomplete or deficient requiring resubmittal, the Government will charge the Contractor $4,650.00 for each additional review beyond the one Pre-Final Design and one Final Design submittal, regardless of the content of the additional submittals.

8.0 DESIGN ANALYSIS

8.1 Media and Format. The design analysis shall be prepared on 8-1/2-inch by 11-inch paper except that larger sheets may be used when required for graphs or other special calculation forms. All sheets shall be in reproducible form. The material may be typewritten, hand lettered, handwritten, or a combination thereof, provided it is legible. Side margins shall be 1-inch minimum. Bottom margins shall be 1-1/4-inches, with page numbers centered 1 inch from the bottom. Each volume shall be bound in a 3-ring binder.

8.2 Organization. The design analysis for the Recreation Center shall be separately bound from the design analysis for the Billets. The title page shall identify the submittal being made, i.e. Pre-Final or Final, and the name of the facility, i.e. Recreation Center or Billets. Each section shall be separately tabbed. Number each page.

8.3 Design Calculations. Design calculations shall be included in the design analysis. When calculations are voluminous, they shall be bound separately from the narrative part of the design analysis. Present the design calculations in a clean and legible form incorporating a title page and table of contents for each volume. Identify the source of loading conditions, supplementary sketches,

graphs, formulae, and references. Explain all assumptions and conclusions. Calculation sheets shall carry the names or initials of the author and the checker and the dates of calculations and checking. No portion of the calculations shall be computed and checked by the same person.

8.4 Automatic Data Processing Systems (ADPS). When ADPS are used to perform design calculations, the design analysis shall include descriptions of the computer programs used and copies of the ADPS input data and output summaries. When the computer output is large, it may be divided into volumes at logical division points. Precede each set of computer printouts by a table of contents and a description of the computation performed. If several sets of computations are submitted, a general table of contents in addition to the individual tables of contents shall accompany them. Preparation of the description, which must accompany each set of ADPS printouts, shall include the following:

a. Explain the design method, including assumptions, theories, and formulae.
b. Include applicable diagrams, adequately identified.
c. State exactly the computation performed by the computer.
d. Provide all necessary explanations of the computer printout format, symbols, and abbreviations.
e. Use adequate and consistent notation.
f. Provide sufficient information to permit manual checks of the results.

9.0 **DRAWINGS**

9.1 General. Prepare all drawings using Computer-Aided Design and Drafting (CADD). Drawings shall be well-arranged and cross-referenced, presenting complete information. The Contractor shall prepare the drawings to the level of detail necessary for the Government to contract the construction to a third party without any additional assistance from the Contractor. Drawings shall be complete. Do not include unnecessary work such as duplicate views, notes and lettering, and repetition of details. Do not include standard details not applicable to the project, or details of standard products or items, which are adequately covered by specifications on the drawings. Each Design Discipline shall include a complete list of abbreviations and symbols used in their respective drawings. Detail the drawings such that conformance with the RFP can be checked and to the extent that shop drawings can be checked. Do not use shop drawings as design drawings. Drawings shall be prepared on 24” x 36” sheets with standard Corps of Engineers title blocks and borders. An index of drawings shall be included with each submittal. The COR will furnish the Contractor with the drawing numbers for inclusion in the title blocks of the drawings.

9.2 Methods and Format. Create and edit all drawings in MicroStation. Save all Final Design CADD files as MicroStation 8.0 or latest available version. The Contractor shall use EM 1110-1-1807 Standards Manual for U.S. Army Corps of Engineers Computer-Aided Design and Drafting (CADD) Systems as guidance to for standard details, cell libraries, title blocks, and layer/level assignments. Drawing features not addressed in EM 1110-1-1807 shall conform to drafting standards.

9.3 Use of Standard Fonts. Only standard fonts provided by MicroStation shall be used in the creation of CADD files. No fonts created by third parties or the designers are permitted.

9.4 Use of Reference Files. The uses of Reference files and Xrefs during the design stage are at the discretion of the designers. All CADD files at the Final (100%) Design submittal shall be free standing, independent files, and not supported by reference files. All Reference files (MicroStation) shall be removed at the Final (100%) Design submittal.

9.5 Submittal Media. All CADD files shall be submitted on CD-RW discs.

10.0 SPECIFICATIONS

10.1 General. The Unified Facilities Guide Specifications (UFGS) shall be used by the Contractor in the development of the specifications for this contract, unless an alternate source has been identified on the government-provided drawings as allowable. As much as practicable, use only one source for the contract. If the design is based on a specific product, the specification shall consist of the important features of the product. The specification shall be in sufficient detail to allow identification of alternate product(s) that could be readily substituted without adversely impacting the project. By the same token, specifications shall not be so restrictive as to unnecessarily preclude substitution of equivalent product(s).

10.2 For the Pre-Final Design submittal, the specifications shall be marked-up or redlined versions of the UFGS or other guide specification. For the Final Design submittal, all marked-out, redlined, and inserted text shall be replaced with the final typed version of the specifications.

10.3 Submittal Register. The submittal register shall be prepared using Specsintact or on an Excel spreadsheet. The Contractor shall be responsible for listing all submittals necessary to ensure compliance with the contract requirements. The Register shall identify submittal items such as shop drawings, manufacturer's literature, certificates of compliance, material samples, guarantees, test results, etc that the Contractor will be submitting for review and/or approval action during construction. The Contractor shall place all the Submittal Register pages in an appendix of the specifications.

11.0 CONTENTS OF PRE-FINAL (90%) DESIGN SUBMITTAL

11.1 General: The Pre-Final (90%) design submittal shall supplement the drawings provided by the Government.

11.1.1 Design Analysis. The Fire Protection and Life Safety Analysis shall be included in the Design Analysis. The design analysis shall support and verify that the design complies with the requirements of the project.

11.1.2 Drawings. The pre-final drawings shall incorporate all changes and additions described in the Statement of Work, Section 01010, as well as any additional design performed by the Contractor. The pre-final drawings shall represent completed construction drawings suitable for construction without any additional assistance from the Contractor. All changes to the government-provided drawings, regardless of reason, shall be clearly identified using clouding and revision letter marks. All revisions shall be listed in the revision block. The applicable Designer of Record shall sign and stamp all drawing sheets that have been revised.

11.1.3 Specifications. The pre-final (90%) marked up specifications shall consist of all specification sections to be used, clearly indicating the products and execution to be used in the final design.

11.2 The site/utility portion of the 90% design submittal shall contain as a minimum, the following:

11.2.1 General Narratives:

11.2.1.1 Site/Layout: Explanation of objectives and factors influencing siting decisions: Rationale for locating site elements, e.g. Emergency vehicle access roads; Set back requirements or specific clearance requirement. Locations of borrow and spoil areas.

11.2.2 All drawings included in the required technical data for the proposal submission (see SECTION 01010: STATEMENT OF WORK), shall be developed to 90 percent completion.

11.2.2.1 General Site Layout: Label and tie down locations of new site elements (emergency

vehicle access roads) Scale shall be included.

11.2.2.2 Site Grading and Drainage Plans: Show locations of all sediment basins, diversion ditches, and other erosion control structures. Indicate the approximate drainage areas each will service. Indicate the materials, construction and capacity of each structure.

11.2.2.3 Road Alignment Plans: Add any new roads to the government-provided drawings. Include typical road cross sections. The materials to be used shall be indicated.

11.2.2.4 Traffic Control Plan: Traffic routing and signage shall be in accordance with The Manual on Uniform Traffic Control Devices for Streets and Highways, U.S. Department of Transportation, Federal Highways Administration.

11.2.2.5 Sanitary Sewer and Water Systems Plan: Add any new water lines to the government-provided drawings. Include profiles of all water lines showing location and elevation of pipe, thrust blocks, manholes, valves connections, etc. Materials and construction of pipes, valves, valve boxes, sewage treatment systems and appurtenances shall be indicated. Specifications shall be provided.

11.2.2.6 Electrical Plan Requirements:

11.2.2.6.1 Required diagrams and details on Site Electrical Drawings.

a. On-Site One Line Diagrams
b. On-Site Distribution Transformer Schedule: Provide with the following headings:
- Transformer Designation. Transformer Size (KVA). Building(s) Served.
- Primary Phase(s) and Circuit to which connected.

c. Details shall include but not limited to poles, manholes, handholes, duct banks, site lighting poles, trenching, pad-mounted transformers and switches, etc.

11.2.2.6.2 All electrical work shall comply with the current editions of the Hawaii Electric Light Company (HELCO) Electric Service Installation Manual, HELCO Standards and Specifications for materials, installation details, and application requirements, and applicable Army Technical Manuals, except where noted.

11.2.2.7 Specifications: Provide pre-final marked-up specifications, which include all sections that apply to site/utility work.

11.2.2.8 Design Analysis: Design analysis shall include design calculations fully developed to support the design of the site and utility systems included in this submittal.

11.2.2.9 Geotechnical: Provide all calculations used to obtain soil and pavement design parameters.

11.2.3 Architectural

11.2.3.1 The architectural specifications shall be complete with all edits incorporated in the specification text as required.

11.2.3.2 Details: Complete construction details, sections, interior elevations, exterior elevations, etc., shall be provided to describe the methods and materials of design.

11.2.3.3 Comprehensive Interior Design package

11.2.4 Mechanical Systems

11.2.4.1 List all references used in the design including Government design documents and industry standards.

11.2.5 Fire Protection

11.2.5.1 Design documents: All Fire Protection Design documents shall be in accordance with ER 1110-345-700 and are required to be submitted for approval prior to start of construction. Fire protection symbols in NFPA 170 shall be used.

11.2.5.1.1 A Fire Protection Analysis shall be submitted in accordance with UFC-3-600-01. The Analysis shall identify what is being provided in the project to meet this requirement. Include the following: Hydraulic analysis and node sketch for all sprinkler systems to be installed in all buildings in accordance with FSC and UFC 3-600-01. Calculations confirming the adequacy of the existing water supply shall be provided. Hydrant flow test is required and flow data shall be submitted. Calculations for any fire pump and/or tank shall be provided if the existing water system is not adequate. Locations of all fire pumps/tanks shall be shown. All IBC allowable area, allowable height, construction type to be used and location on property requirements shall be submitted. Fire alarm system type (addressable) to be discussed. Discussion of all the life safety requirements of LSC shall be included.

11.2.5.1.2 Fire Protection Drawings:

a. General: Minimum of 1:100 scale shall be used on all plan drawings, and building sections. Drawings shall show fire alarm systems, sprinkler system and life safety requirements (fire barriers, exists, etc.). Detail drawings shall be minimum 1:50 scale. Minimum drawing requirements are as follows:

b. Automatic fire sprinkler system: Sprinkler head plans, attic plans, building sections, sprinkler riser with shutoff valve and tamper switch, alarm check valve, preaction/deluge valve, local alarm gong, flow/pressure switch, wall penetrations, fire rated wall penetrations, fire department connection locations, and sprinkler design parameters (occupancy hazard for each room, minimum sprinkler density to be used for each occupancy hazard, minimum design area, most hydraulically remote area, sprinklered areas). Detail fire pump plans, sections, isometric diagram of the fire pump system, tank plans, tank sections, tank details and piping layout and details.

c. Fire alarm system: Plans showing location of all initiation devices (manual pull stations, duct smoke detectors, sprinkler flow switches, smoke detectors, magnetic door holders), visible/audible notification appliances, supervisory devices (tamper switches, low pressure switches), fire alarm panel, fire alarm exterior annunciator, and fire alarm diagram.

d. Life Safety: All fire rated walls shall be shown where they begin and where they end. All fire rated shafts, stairs, vertical opening, seismic joints shall be shown. Fire rated doors, fire rated door frames, fire rated windows and window frames, door hardware, fire dampers, and smoke dampers are to shown with the appropriate fire rating in hours.

e. IBC requirements: Site plan showing the location of the project buildings in relation to other existing buildings, roads, parking lots, fuel tanks, water tanks, electric poles, exterior power lines.

f. Means of egress lighting and LED type exit signs meeting LSC shall be shown on the plans.

11.2.5.1.3 Specifications.

a. General requirements: The fire protection work for the project shall be constructed in accordance with Unified Facilities Guide Specifications (UFGS) Sections 13920 Pumps, 13930 Wet Pipe Sprinkler System, Fire Protection, 13945 Preaction/Deluge Sprinkler System, Fire Protection, 13851 Fire Detection and Alarm System Addressable, and 7840 Firestopping. Edited UFGS specification sections shall be used and revised in accordance with the restrictions in ER 1110-345-700, Appendix D and the following:

b. Sprinkler systems: Plastic pipe, plastic fittings, and "T drill method" are not allowed. Sprinkler system design area, density and hydrant demand in UFC 3-600-01 shall be followed. Sway bracing and branch restraints are required. Government Shop submittal approval and preparer approval is required.

c. Fire alarm systems: Class A looped fire alarm system is required. "T taps" are prohibited. Fire Protection Engineer qualification approval, Fire Protection Engineer shop drawing approval and fire alarm shop drawing submittal approval by the Government are required.

d. Firestopping, fire dampers, fire rated doors/door frames, smoke dampers, and exit signs, must be submitted for Government approval.

12.0 CONTENTS OF FINAL (100%) DESIGN SUBMITTAL

12.1 General: The Final (100%) Design submittal shall consist of a complete set of construction documents plans and specifications at the same level of detail as if the project were to be bid including a complete list of equipment, fixtures and materials to be used. The final (100%) drawings are an extension of the reviewed 90% drawings and are to include the 90% comments and responses. All details shall be shown on the drawings.

12.1.1 Complete design analysis for all design disciplines. The final Fire Protection and Life Safety Analysis shall be included in the Design Analysis. The design analysis is an extension of the reviewed 90% design analysis and supports and verifies that the final design complies with the requirements of the project.

12.1.2 The Final (100%) drawings are an extension of the reviewed 90% drawings and shall include all revisions incorporated from the 90% review comments. Drawings shall be 100% complete, signed and sealed by the designer of record.

12.1.3 Provide Final (100%) specifications. The Contractor shall make final identification of all materials at this stage.

12.1.4 Comment Response Package: Complete package showing all comments from all previous reviews and the respective response and disposition.

12.1.5 Additional Requirements.

12.1.5.1 Compliance Certification

12.1.5.1.1 The Contractor shall certify that the features and standards offered in its submittals meet or exceed the corresponding mandatory features and standards stated in the Statement of Work. A certification to this effect shall be included on the title sheet of each submittal made under this section. The certification shall be signed by the person(s) authorized to bind the Contractor, or by persons who have been delegated such authorization, in writing.

12.1.5.1.2 The parties understand that, deviations from the mandatory requirements of this contract, may be approved by the Contracting Officer upon written application by the Contractor and agreement as to good and sufficient consideration by the parties, reflected in an equitable adjustment to the contract price.

12.1.5.2 Field Inspection. The Contractor shall verify field conditions, which are significant to design, by field inspection, researching and obtaining all necessary as-built drawings and reproducing them for his own use as necessary, and discussing status with knowledgeable personnel. The information shall be reflected in the design documents.

12.1.5.3 Topographic Information. The topographic information shown on the government-provided drawings is the extent of the topographic data the Government has. Any additional topographic information required by the Contractor for design after award of the contract shall be procured and paid for by the Contractor.

12.1.5.4 Soil and Foundation Report. The Contractor shall investigate the existing soil conditions at the building sites to confirm that the conditions at these sites are similar to the conditions described in the Geolabs, Inc. report for the Consolidated Command & Range Control Facility (Section 01010, Attachment 3). A one-page report comparing the materials shall be submitted. If the conditions encountered are materially different from those described in the Geolabs report, the Contractor shall also submit additional documentation describing the drawing revisions needed as a result of the conditions encountered.

12.2 The building design portion of the 100% design submittal shall contain, as a minimum, the following items for all submittals:

12.2.1 Architectural

12.2.1.1 The architectural analysis, drawings and specifications shall include the 90% submittal incorporating all corrections, including the annotated comments from the 90% submittal. Architectural specifications must be complete with all edits incorporated in the specification text.

12.2.1.2 All architectural drawings shall be coordinated with the other engineering disciplines. Ensure that the plans are in compliance with the applicable codes. It will be the Contractor's responsibility to implement the comments generated from any design review submittal as well as verify the consistency between plans and specification. The evaluation of the Contractor's submittals shall be based on degree to which the submittal meets the requirements set forth in this document and the specifications.

12.2.1.3 The Comprehensive Interior Design package shall include the 90% submittal incorporating all corrections, including the annotated comments from the 90% submittal.

12.2.2 Specific Mechanical and Plumbing Requirements:

12.2.2.1 The mechanical and plumbing analysis, drawings and specifications shall include the 90% submittal incorporating all corrections, including the annotated comments from the 90% submittal. Mechanical and plumbing specifications must be complete with all edits incorporated in the specification text.

12.2.2.2 Details: Construction details, sections, elevations, etc., shall be provided where required for clarification of methods and materials of design. All roof and exterior wall penetrations shall be detailed on the drawings.

12.2.3 Fire Protection: The Fire protection analysis, drawings and specifications shall include 90% submittal incorporating all corrections, including the annotated comments from the 90%

submittal. Fire protection specifications must be complete with all edits incorporated in the specification text.

12.2.4 Specific Electrical Requirements:

12.2.4.1 The Electrical system design analysis, drawings, and specifications shall include the 90% submittal incorporating all corrections, including the annotated comments from the 90% submittal. All requirements specified in the 90% submittal must be developed and completed.

12.2.5 Specifications: Provide final specifications. The Contractor shall make final identification of all materials and finishes.

13.0 **DESIGN RELATED PRODUCTS**

13.1 DD Form 1354: Three (3) sets of DD Form 1354, Transfer and Acceptance of Military Real Property shall be prepared in accordance with ER 415-345-38 and submitted to the Contracting Officer.

13.2 Submittal Register, ENG FORM 4288: The Contractor shall complete and submit the Submittal Register in accordance with Section 01330, Submittal Procedures.

13.3 Reproduction of Construction Documents: The Contractor will be responsible for his own reproduction as well as reproduction for Government use. The Government will require the same number of copies of the plans and specifications as were required for the review stages; no color boards will be required. The originals will be retained by the Contractor for recording of as-built conditions. Upon completion of the project, the original design documents corrected to reflect as-built conditions will be supplied to the Government, in accordance with Section 01780, Closeout Submittals.