Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix A

Table of Approved Plans.

(1 page)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

Table of Approved Plans

Permit,	Name of Plan	Submitted	Approved	Comments
Condition No.		(Report Year,	(Report Year,	(Report Year,
		Appendix)	Appendix)	Appendix)
SUP 1a	Site Plan (metes	2012, app B	2013, app D	
	& bounds)			
SUP 1b	Fire Protection	2010, app D	2010, app D	2012, app G
	& Control Plan			(firebreaks)
SUP 2	Renaturalization	2014, App J	2015, App C	See 2017 app E
	Plan			for history and
				update
SUP 4	Landscape Plan	2013, Арр Т	2014, app C	
	(Parcel 4)			
SUP 8	Drainage Plan	Planning		See 2017 app J
		Commission		for March 2008
		Record, Exh 21		Engineering
				Report
SUP 10	Beneficial	2014 <i>,</i> app L	2015, app C	See 2017 app H
	Re-use Plan			for history and
				update
CUP 2	Final Grading	2009 <i>,</i> app J	2010, app A	
	Plan (Grading			
	Closure Plan)			
CUP 3	Beneficial	2014 <i>,</i> app L	2015, app C	See 2017 app H
	Re-use Plan			for history and
				update
CUP 4a	Site Plan (LUO)	2012, app B		Request to
				update 2016,
				арр В
CUP 4b	Water Source &	2011, app G		
	Distribution Plan			
CUP 4c	Outdoor Lighting	2013, app D		2014, app D
	Plan	2013, app G		

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix B

Correspondence from State of Hawaii Clean Air Branch dated November 21, 2017.

(2 pages)

Re: Department of Health, Clean Air Branch (CAB) Request to Access a Government Record

Margaret DEntremont to: Wong, David Tien Lun Cc: Robert Creps, Joseph Shacat, Boyd Nobriga 11/21/2017 10:56 AM

Hi David,

Thank you for checking on this for us.

Appreciate it!

Regards,

Margaret D'Entremont Grace Pacific LLC Makakilo Quarry (808) 693-7104 Direct (808) 306-7998 Cell (808) 693-7107 Fax

"Wong, [David Tien Lun"	Hi Margaret, According to our records, CA	11/21/2017 10:52:18 AM
From:	"Wong, David	Fien Lun" <david.wong@doh.hawaii.gov></david.wong@doh.hawaii.gov>	
To:	"mdentremont	@gracepacific.com" <mdentremont@gracepacific.com></mdentremont@gracepacific.com>	
Date:	11/21/2017 10	52 AM	
Subject:	Department of	Health, Clean Air Branch (CAB) Request to Access a Go	vernment Record

Hi Margaret,

According to our records, CAB did not receive any complaints against your facility during the time frame identified in the attached request. If you have any questions, please feel free to contact me.

Thanks,

David

David Wong Environmental Health Specialist | Clean Air Branch State of Hawaii | Department of Health | P.O. Box 3378 |Honolulu, HI 96801-3378 p:808.586.4200 | f:808.586.4359

CAB Doc Request 171116.pdf

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: November 16, 2017

TO:

FROM:

Grace Pacific LLC, Makakilo Quarry

State of Hawaii Clean Air Branch

Name or Alias Margaret D'Entremont (808) 306-7998 Cell/ 693-7104 Direct Contact Information RE: Complaints filed against CSP No. 0045-01 CT

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD:

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or names of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Air quality complaints filed between 10-01-16 to 09-30-17 against Grace Pacific LLC, Makakilo Quarry CSP No. 0045-01 CT.

Please submit any findings to:

Margaret D'Entremont Email : mdentremont@gracepacific.com

Thank you! <u>I WOULD LIKE</u>: (please check one or more of the options below)

To inspect the government record.

A copy of the government record: (Please check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request. Note: Copying and transmission charges may also apply to certain options.

 Pick up at agency (date and time): Mail Fax (toll free and only if available) Other, if available (please specify): Email : mdentremont@gracepacific.com
If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.
Electronic Audio Other (please specify):
Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).
SEE BACK FOR IMPORTANT INFORMATION

OIP 1 (rev. 9/12/01)

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix C

Makakilo Quarry Hotline Phone Log October 1, 2016 through September 30, 2017.

(1 page)

	Grace Pacific Makakilo Quarry					
-	Community Hotline, Complaints, and Inquiries Log (Redacted) October 1, 2016 to September 30, 2017					
No	. Date	Communication Method	Complainant	Message / Description of Call	Investigation / Responsible Party	Investigation / Action Plan
1	11/22/2016	Phone Call	Resident A (Kahiwelo)	Complaint from a Kahiwelo resident asking why we were pushing dirt on the fire lane behind their house, and why we were pushing dirt on a day with 35 mph winds.	Quarry Manager	Quarry personnel were widening the fire break road to allow the landscapers to access the area, and cut additional vegetation/fuel for an improved fire break in the area adjacent to the complainant's property. A review of weather data for November 22, 2016 indicates that wind speeds were approximately 10-15 mph with gusts up to 25 mph.
2	1/19/2017	Phone Call	Resident B (vehicle on H-1 Freeway)	Resident was travelling eastbound on H-1 around 2:00 PM and the truck in front dropped some rock, which cracked the windshield. The resident did not get the truck's license plate number, or the trucking company's name, only a desciption of the truck as a grey or brown color.	Quarry Admin Assistant	The Quarry Admin Assistant explained to the complainant that there was nowhere to direct the complaint, since there was no specific information regarding the truck in question, and no way to track down the trucking company.

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix D

Index of attached DVD: Electronic Copies of 2017 Annual Report; Aerial Photos and Topographic Map dated September 14, 2017

Copies of Aerial Photos and Topographic Map

(5 pages)



MAKAKILO QUARRY TOPOGRAPHIC MAP UPDATED DECEMBER 11, 2017

DATE OF AERIAL SEPTEMBER 14, 2017









MAKAKILO QUARRY OVERALL AERIAL IMAGE

UPDATED DECEMBER 11, 2017 DATE OF AERIAL SEPTEMBER 14, 2017

RE





600 FT



MAKAKILO QUARRY UPPER AERIAL IMAGE

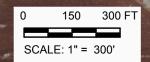
A. C.

GP

UPDATED DECEMBER 11, 2017 DATE OF AERIAL SEPTEMBER 14, 2017

-Fra







Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix E

Renaturalization History and Status Report. (SUP Condition #2)

(2 pages)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

Renaturalization Plan History and Update

<u>2009-2011</u>. A Renaturalization Plan (RP) was submitted by Belt Collins on November 6, 2009 for review and approval. (Appendix C to the 2009 Report). Modifications to the Renaturalization Plan were requested by DPP in a letter to Belt Collins dated August 24, 2010 (Appendix A to the 2010 Report). On March 28, 2011, Belt Collins wrote to DPP requesting a meeting with DPP to discuss the extent of the physical area that DPP wishes to include in the revised RP (Appendix C to the 2011 Report).

<u>2012</u>. In a letter dated February 2, 2012 (Appendix G to the 2012 Report) DPP identified the areas of concern and agreed on a two year trial period beginning January 2012 for an approach utilizing the broadcasting of seeds and reliance on natural rainfall. See also comments on SUP Condition No. 9.b in this Report.

<u>2013</u>. In a letter dated February 19, 2013 (Appendix D to the 2013 Report) DPP requested a status update of implementation of the two year trial. Grace Pacific responded on April 30, 2013 (Appendix G to the 2013 Report) with an aerial photo identifying the plot locations, plant propagation and the initial plantings (Attachments B, C and D respectively to the April 30th letter). Also attached to the 2013 Report as Appendix Q were September 2013 photos of the test plots.

2014. In an email dated December 20, 2013 (appendix A to the 2014 Report), DPP asked about earthwork outside of the approved excavation area. Grace Pacific responded on January 13, 2014 (Appendix B to this report) that area 1 was within the approved landscape grading area, and that area 2 reflected the placement of topsoil at former golf water features 9 and 10.

On May 5, 2014, DPP (Appendix C to the 2014 Report) wrote to Grace Pacific with guidance for revising the Renaturalization Plan and a request to have the revised plan submitted by June 1st. Grace Pacific, working with Belt Collins Hawaii, submitted a revised Renaturalization Plan on May 30, 2014 (Appendix J to the 2014 Report).

<u>2015.</u> In a letter dated August 27, 2015 (appendix C to this report) DPP approved the May 30, 2014 Renaturalization Plan and requested status reports in subsequent annual reports.

As of November 2015, the irrigation piping previously used to renaturalize the Lower Quarry site (Parcel 4) has been laid out on former golf Hole 9 and portions of former golf Hole 8 (sheets L-2.03, L-2.02 of the Renaturalization Plan, Appendix J of the 2014 report). See Appendix I to the 2015 report for photos of piping layout.

<u>2016.</u> Renaturalization of the area around former golf Hole 9 was completed in four phases during 2016. Photos of the grass in this area are provided in Appendix J to the 2016

Report. Additionally, grass was planted in three other areas, as shown in Appendix I of this report, in order to better control dust and improve the visual aesthetic of the site. The plantings were a mix of buffell grass, rye and bermuda.

The areas around former golf Hole 8 and the former driving range are scheduled for renaturalization in 2017. This will complete the May 30, 2014 Phase I Renaturalization Plan (Appendix J to the 2014 Report). Subsequently, Grace Pacific will prepare and submit the Phase II Renaturalization Plan.

<u>2017.</u> No new renaturalization projects were undertaken in the current reporting period.

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix F

VRP History and Status Report for Lower Quarry. Letter from ESI dated November 16, 2017. (SUP Condition #4)

(3 pages)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

Lower Quarry (Parcel 4) Voluntary Response Program (VRP) History and Update

2012. Based upon DPP's December 27, 2011 request (Appendix D to the 2012 Report) to be kept apprised of the Voluntary Response Plan (VRP) for the environmental remediation of the Lower Quarry site, Grace Pacific attached to the 2012 Report as Appendices N, O and P respectively, the VRP Agreement between Grace Pacific and the State of Hawaii Department of Health dated October 2011; an Amendment to the VRP Agreement dated September 20, 2012 amending the scope of the work; and the Schedule of Work dated October 8, 2012, prepared in accordance with Exhibit B, Attachment 1 of the VRP Agreement.

<u>2014.</u> Grace Pacific met with the SLUC staff on May 14th to discuss the VRP and the impact of the VRP on the November 6, 2014 deadline to return the Lower Quarry (Parcel 4) to landscaped open space. Grace Pacific decided to give priority to meeting the November 6th landscaped open space deadline. Grace discussed this change in priorities with the DOH, and agreed to address the DOH's concerns by documenting where soil was moved to within the Lower Quarry site and revising the site characterization work plan to reflect the changes in the site conditions.

In a letter dated May 30, 2014, (Appendix F to the 2014 Report), Grace notified DPP that it would begin landscaping as soon as possible to meet the November 6th deadline.

<u>2015.</u> A status report for the Voluntary Response Program (VRP), prepared by Environmental Science International, is attached to the 2015 Report as Appendix H.

<u>2016</u>. As previously noted, the site has been returned to landscaped open space as required by this condition. A status report for the Voluntary Response Program (VRP), prepared by Environmental Science International, is attached to the 2016 Report as Appendix H.

<u>2017.</u> A status report for the Voluntary Response Program (VRP), prepared by Environmental Sciences International, follows this page.



109131

November 16, 2017

Grace Pacific LLC P.O. Box 78 Honolulu, Hawaii 96810

Attention: Mr. Joseph Shacat

Subject: Annual Report for September 2016 to November 2017, Grace Pacific Lower Makakilo Facility, 91-920 Farrington Highway, Kapolei, Hawaii

References: Voluntary Response Program No. VRP-30

Dear Mr. Shacat,

Below is the Annual Report for the Grace Pacific LLC [Grace Pacific] Lower Makakilo Facility Voluntary Response Program [VRP]. This Annual Report documents work conducted from September 2016 to November 2017. Below is a summary of the work completed.

- The Site Characterization Report has been prepared and was submitted to Grace Pacific in January 2017. Grace Pacific is currently reviewing the Site Characterization Report. ESI is currently conducting the Environmental Hazard Evaluation [EHE] which assesses potential hazards to human health and the environment posed by contamination at the Site. The State of Hawaii Department of Health [DOH] Hazard Evaluation and Emergency Response [HEER] Office recently updated their Environmental Action Levels [EALs]. Sample results will be compared to the recently updated DOH EALs.
- Contaminants that exceed DOH EALs include Total Petroleum Hydrocarbons as oil [TPH-o], Total Petroleum Hydrocarbons as diesel fuel [TPH-d], benzo[a]pyrene, and polychlorinated biphenyls [PCBs].
- In April 2017, soil that contained PCBs at concentrations above the DOH EAL was excavated.

Mr. Joseph Shacat November 16, 2017 Page 2

- In June 2017, the excavated PCB contaminated soil and soil stockpiles that were generated during sampling of the ponds (and as a result of remedial excavation) were removed from the Site and properly disposed of at PVT Landfill.
- In July 2017, a notice of cessation was submitted to the DOH to close out the National Pollutant Discharge Elimination [NPDES] Permit for the Site.

The next phases of work includes the following:

- Revise Site Characterization Report based on Grace Pacific comments.
- Submit Site Characterization Report to the DOH and revise if necessary, based on their comments.
- Complete EHE.
- Prepare Remedial Alternatives Analysis.

If you have questions or need additional information, please give me a call at (808) 261-0740.

Mahalo,

Fanos

Robert Chong Executive Vice President

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix G

UXO History and Status Report. Email from Lori Lum dated November 29, 2017. (SUP Condition #6)

(2 pages)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

UXO History and Status Report for Open Space Buffer Area.

<u>2012</u>. On November 8, 2011, a brush fire occurred in the buffer zone to the south and west of the Upper Quarry pit. DPP notified Grace Pacific that the Honolulu Fire Department (HFD) discovered old military munitions (unexploded ordnance or UXO) in the area of the fire. (Appendix C to this Report). Grace Pacific contacted HFD to obtain the map of the location of the munitions (Appendix C to this Report). The UXO was removed by the US Army's 303rd Explosive Ordnance Battalion.

The US government is ultimately responsible for the disposition of munitions under the Military Munitions Rule, and that responsibility has been delegated to the US Army Corps of Engineers (USACE). The USACE did not have funding in FY 2013 to conduct a thorough evaluation of past military activities in the Makakilo area. Grace Pacific worked with the USACE and Senator Inouye's office to request "plus-up" funding for the USACE's Formerly Used Defense Sites (FUDS) program. If appropriated, the plus-up funding would allow the USACE to initiate a thorough evaluation of past military activities and mitigate any potential safety hazards as appropriate.

<u>2013</u>. DPP in a letter a letter dated February 19, 2013 (Appendix D to the 2013 Report), requested an update on progress of establishing fire break zones. Grace Pacific responded, in a letter dated April 30, 2013 (Appendix G to the 2013 report), that Grace was working with the Army Corps of Engineers and Senator Schatz's office to obtain funding for an investigation and cleanup. Grace had also posted warning signs on the property line fencing at the recommendation of the Army Corps.

<u>2014</u>. The Army Corps of Engineers has \$50 million in plus-up monies in the FY15 budget, however, it is difficult to get funding for new starts. On-going discussions continue with Army Corps of Engineers and Hawaii's Congressional Delegation for potential funding.

<u>2015.</u> In 2015, plus-up funding was received and used to conduct the Army Corps of Engineers research (via the ACOE's St. Louis office). The Army Corps still needs to determine eligibility and at this time the documents reviewed as to land leases or sub-leases are not conclusive. The St. Louis office is continuing their research and will put a report together for headquarters.

<u>2016.</u> Ongoing operations are in compliance with this condition. As of September 2016, the Army Corps of Engineers still has not determined eligibility for adding the site to the Formerly Used Defense Site (FUDS) program. They are continuing to search for historical leases or subleases.

<u>2017.</u> An email update from Lori Lum, Grace's consultant, follows this page.



RE: UXO update Makakilo Quarry Lori C. Lum to: 'RCreps@gracepacific.com' 11/29/2017 01:51 PM Cc: "BNobriga@gracepacific.com", "JShacat@gracepacific.com" Show Details

History: This message has been replied to.

Hi Bob!

Sorry for the delayed response. I needed to get an update from Jackie Conant and she just returned from Puerto Rico.

Jackie said Randy Curtis, Chief of Research and Technical Services for the Environmental & Munitions Branch, completed his work relating to the Findings and Determination of Eligibility (FDE) and it is being routed internally for review. It will then be submitted to the Division Commander.

Jackie apologized that this is taking so long!

Lori

Watanabe Ing LLP

From: RCreps@gracepacific.com [mailto:RCreps@gracepacific.com]
Sent: Thursday, November 16, 2017 9:33 AM
To: Lori C. Lum
Cc: BNobriga@gracepacific.com; JShacat@gracepacific.com
Subject: UXO update Makakilo Quarry

Lori, its annual report time again. Could you send a short update on the past year's efforts towards funding. Thank you, Bob Creps

Sent from my iPhone

This message, including any attachments, is intended for the use of the party to which it is addressed and may contain information that is privileged, confidential and exempt from disclosure. If you are not the intended recipient, any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please contact the sender immediately by reply e-mail, and delete the original and any copies of this message. It is the sole responsibility of the recipient to ensure that this message and any attachments are virus free.

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

APPENDIX H

Beneficial Re-use Plan History and Status Report. (SUP Condition #10 and CUP Condition #3)

(2 pages)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

Beneficial Re-use Plan History and Update

<u>2013</u>. The initial 2013 Makakilo Quarry Beneficial Re-Use Plan was delivered as an enclosure with the 2013 Annual Report.

<u>2014</u>. In a letter dated May 5, 2014, (Appendix C to the 2014 Report) DPP commented on the Beneficial Re-use Plan (filed November 14, 2013 with DPP and the SLUC), and asked that alternative scenarios be considered and that a revised Re-use Plan be filed by November 6, 2014. Grace Pacific, working with consultant R.M. Towill, revised the Re-use Plan, and filed the Plan with DPP on October 28, 2014 (Appendix L to the 2014 Report).

<u>2015.</u> In a letter dated August 27, 2015, (Appendix C to the 2015 Report) DPP approved the revised Beneficial Re-use Plan. DPP posed questions as to the scope of the Plan and funding strategies. Grace Pacific responded to these in a letter dated September 30, 2015 (Appendix D to the 2015 report).

In the August 27th letter, DPP asked about the integration of the required public access (Condition #10 above) and the various re-use scenarios. Grace Pacific notes that there are two required accesses: 1) the "feasible circulation patterns in and around the site" (arising from LUO Section 5.520) and 2) the "public access… across the project in which safe pedestrian/bicycling passage can be established." (such language being specific to this permit).

As to access 1), Figures 8 through 11 of the revised Re-use Plan show an orange arrow labelled "Site Access" approaching the pit from north. This access road will be used for each of the four Alternatives presented and will tie in to the future Makakilo Drive Extension. The Extension, in turn, will tie into the H-1 Freeway/Kualakai Parkway intersection.

As to access 2), it is important to note that pedestrian/bicycling passage, described as the "Suggested Public Access Road" in Figure 6, Zoning Map, on page 2-6 of the revised Re-use Plan, follows (approximately) the 700 foot elevation contour at the upper mauka boundary of the Landscape Grading Area of Figures 8-11, and is neither proximate nor relative to the beneficial re-uses depicted in Figures 8-11 of the revised Plan. The beneficial re-uses of Figures 8-11 take place on the quarry floor, at elevations ranging from 250 feet to 475 feet.

DPP also asked that the Quarry closure plan address contaminated soils, anticipating that, as with the Lower Quarry site, soils in and around the pit may require cleanup or containment. Grace Pacific adds the following new section 2.5.4 to the 2014

Revised Beneficial Re-use Plan. Future updates of the Plan will incorporate this new section.

2.5.4 Environmental Assessment

Ongoing compliance with Federal and State environmental regulations, such as the implementation of Best Management Practices, is expected to minimize the potential for contaminated soils arising from quarry operations.

During the final closure process in 2032, the site will be assessed to determine possible hazards to human health and the environment. The scope of the assessment will depend on the nature of the anticipated use of the property after quarry closure (i.e., commercial/industrial, residential, etc.), but will likely include subsurface sampling of the soil and groundwater for contaminants of potential concern. The environmental assessment, and any remedial activities (if required) will conform to all applicable Federal, State, and Local requirements.

<u>2016</u>. Grace Pacific is participating in DTS's planning activities related to the proposed extension of Makakilo Drive in order to ensure suitable egress for the required pedestrian/bicycle public access is incorporated in the design, as required by this SUP Condition.

<u>2017.</u> There was no correspondence or action taken on the Beneficial Re-use plan in the current reporting period.

Makakilo Quarry, Ewa, Oahu, Hawaii

2017

Appendix I

Sanitary Landfill Maintenance History and Status Report. (SUP Condition #16)

(1 page)

Grace Pacific LLC Makakilo Quarry 2017 Annual Compliance Report

Sanitary Landfill Maintenance History and Update.

<u>2016</u>. In 2016, Grace Pacific initiated the Palailai Landfill Cover Restoration Project in order to improve and repair the condition of the landfill cover. A description of the project was sent to the LUC and the DPP (Appendix A to the 2016 Report).

<u>2017</u>. The Palailai Landfill Cover Restoration project is ongoing. Completion of the project is anticipated during the first half of 2018. Notification will be sent to the State Land Use Commission and the Department of Planning and Permitting upon completion.

Makakilo Quarry, Ewa, Oahu, Hawaii

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Appendix J

Drainage Plan. May 2008 Engineering Report. (SUP Condition #8)

(16 pages)

MAKAKILO QUARRY (Tax Map Key 9-2-3: 82) CONDITIONAL USE PERMIT NO. 72/CUP-15 ENGINEERING REPORT AMENDMENT

Prepared for:

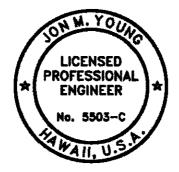
GRACE PACIFIC CORPORATION P.O. Box 78 Honolulu, Hawaii 96810

Prepared by:

BELT COLLINS HAWAII, LTD.

2153 North King Street, Suite 200 Honolulu, Hawaii 96819

> April 2007 and Amended May 2008



This work was prepared by me or under my supervision. <u>April 30, 2008</u> Expiration Date of the License

,

. .

ENGINEERING REPORT AMENDMENT

,

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2.3	Ben	ch Reclamation
3. DR.	AINA	GE PLAN
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APPENDICES

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Agra Earth & Environmental (from July 1998 Engineerin	ig Report)
Appendix B - Grading Figures, Plans and Sections	
Map of 100 Year Rainfall, Oahu, Hawaii	Figure 1
Existing Drainage	Figure 2
Developed Drainage	Figure 3
Overall Site Plan (Closure Grading Plan)	Figure 4
Closure Grading Plan with Index	Figure 5a
Cross Sections AA through II	Figures 5b1 - b9
Slope Ratio to Percentage	Figure 5c
Planting Slope Index	Figure 5d
Aerial Photo with Planting Slope Index	Figure 5e
Planting Slope Cross Sections AA through HH	Figure 5f
Excavation Phasing Map	Figure 6
	-

Appendix C - Storm Drainage Calculations

- C-1 Existing Runoff and Rainfall Storage Calculations
- C-2 Developed Runoff and Rainfall Storage Calculations
- C-3 Berm Surface Water Calculations
- C-4 Storage-Elevation Tables

Appendix D - Not Used

Appendix E - Revised Mitigation/Revegetation Plan

Existing VegetationExhibit 1Location of View PlanesExhibit 2-0Viewplane ExhibitsExhibits 2-1 - 2-9Recommended Plant PaletteExhibit 3Revegetation MatrixExhibit 4Revegetation PhasingExhibit 5

Appendix F - Not Used

1. INTRODUCTION

1.1 PURPOSE

This <u>Makakilo Quarry Engineering Report</u>, dated April 2007 and amended May 2008 (the "April 2007 Report"), is prepared to assist Grace Pacific Corporation in its application for a modification to use permits 72/CUP-15 and 73/SUP-147, to allow the relocation and continuation of quarrying activities at Pu'u Makakilo (the "Application").

The original Makakilo Quarry Engineering Report was approved by the City and County of Honolulu Department of Planning and Permitting on October 19, 1998 (the "1998 Report"). The 1998 Report was prepared to satisfy Condition no. 2 of City Council resolution 95. An amendment was made to the 1998 Report in March of 2004 (the "2004 Report"). The 2004 Report dealt largely with the retention of run-off within the property, visual mitigation and landscaping.

While this report is written to be a free-standing document, a review of the 1998 Report and the 2004 Report is of value in understanding the current operations. These reports are included as Exhibit J of the Application.

1.2 SITE DESCRIPTION

The James Campbell Company owns the land under the Makakilo Quarry (Tax Map Key 9-2-3:82), and licenses it to Grace Pacific Corporation for quarry operations. The license agreement expires in the year 2017. Subject to the approval of the Application, Grace Pacific has negotiated with Campbell for an extension of the license to 2032.

The quarry is situated on the slopes of Pu'u Makakilo. The west bound lanes of the H-1 Freeway front the southeast side of the property. The area makai of the H-1 Freeway is used as a processing site for quarry, but its operations are not included in this report.

Pu'u Makakilo Inc., a subsidiary of Grace Pacific Corporation, owns the property surrounding the existing quarry. The land is characterized as dry-range land with poor, scrub-type vegetation on greater than 10 percent slopes.

2. GRADING PLAN

2.1 GRADING

The attached grading plan (Figure 4, Appendix B) shows the proposed final grades prior to reclamation of the quarry in the year 2032. The plan maximizes the excavation of the known basalt reserve while minimizing visual and environmental impacts to the surrounding community.

The southeast boundary of the quarry, which consists of undisturbed ridges and gullies, parallels the H-1 freeway. This area serves as a buffer and will remain undisturbed,

1

providing a noise and visual barrier from the freeway. The quarry sides and mauka face will utilize slopes averaging flatter than 1.5 (horizontal) to 1 (vertical) and undulating faces to minimize the appearance of a man-made landform. The existing quarry floor will gently slope from the back and sides to the front at approximately a 2% grade. The floor of the proposed mauka quarry area will be steeper, at 15% to 25%, matching the gradients of the existing Pu'u formation.

Restoration grading recommendations prepared by a geotechnical engineer are attached as Appendix A. Several key methods are recommended to provide an adequate foundation for access roads, residential and light loaded commercial development. Excess stockpile material, 1 inch minus, may be used for landscape restoration provided the material contains or is amended with proper portions of organics, sand and silts.

The proposed relocation of the quarry extends up the Pu'u from existing lower elevations between 500 feet to 550 feet to an upper elevation of 700 feet. An access road running across the 350 foot elevation of Parcel 82 will be constructed to allow vehicle access from the southwest portion of the 312 acre parcel (TMK 9-2-3-74) to the northeast portion of the parcel.

As part of this proposal, two drainage basins will be constructed within the lower active pit for runoff retention. There is only minimal additional run-on arising from this proposal, representing runoff from the southwestern portion of the berm that is to be constructed on the northeast boundary. Today, approximately one-half of the runoff in the vicinity of the proposed berm finds its way into the Kaloi Gulch watershed.

Two new landforms will be created from the 475 foot to 700 foot elevations in conjunction with the relocation of quarrying activities. On the southwest boundary, the ridgeline of the Puu will be cut and graded by up to 50 feet to reduce the visual impact of the quarrying, as seen from the H-1 freeway on the approach to Kapolei. For the same reason, Grace Pacific will construct a ridge-like berm extending from the northeastern ridge of the Puu. This berm will range in height from 15 feet to 100 feet above the existing ground. The berm will be constructed with flatter than 2:1 horizontal to vertical slopes. In addition, the bowl of the Puu, in the 700 foot to 800 foot elevation, will be restored to its pre-golf, gullied appearance.

The quarry sides and mauka face will consist of slopes of averaging greater than a 1.5 to 1 horizontal to vertical proportion to reach the desired depths of approximately 200 feet below the existing ground surface. Quarrying to such slopes arguably leaves good material in the ground, but success in achieving visual mitigation in the land forming and revegetation processes is deemed a greater benefit. Over-excavation on the quarry floor will be necessary in some areas to follow rock deposits. Such over-excavation will be filled and compacted to achieve the desired final grades. See Figures 4, 5a and 5b of Appendix B for a detailed look at the slopes along the sides and mauka face of the proposed quarry area.

2.2 ALTERNATIVE FLOOR RECLAMATION

If post-closure development plans deem it desirable, the quarry can be indirectly reclaimed to increase infiltration. After the quarry has been shaped to match the grading plan, the pit floor can be regraded to produce a rough, irregular surface. This method will increase water infiltration and slow erosion by keying the replaced soil into the substrate. This can be achieved by either blasting or ripping the pit floor. Since this quarry is hard rock quarry, blasting is the appropriate method to fracture the pit floor so that water can drain slowly and roots can penetrate. A good technique is to blast an extra 10 feet during the last production round and leave some of the fractured material in place.

2.3 BENCH RECLAMATION

Under the May 2008 Revised Grading Plan several areas of the existing quarry will be left with traditional 25 foot wide benches and 50 foot high faces. In these cases, the benches will be sloped toward the high wall to help trap moisture and soil. Topsoil will be placed on the benches and planted. Other methods may be used to break up the linear features including performing post-production blasting to form staggered benches. Strategic blasting can create chutes, spurs, and rough vertical cliff faces can be created. The desired effect depends on the rock type, structural geology, and blasting agent from a choice of blast patterns, delays, and stemming depths. The appropriate methods will be chosen only when final quarry grades are achieved and rock faces can be evaluated. Appendix E presents the current revegetation plan for screening and restoration of the quarry.

3. DRAINAGE PLAN

3.1 DRAINAGE PLAN

3.1.1 METHOD

The intent of the Makakilo Quarry drainage plan is to reduce the amount of stormwater run-on and minimize the impacts of run-off on the quarry as well as downstream. Elements of the drainage plan are detailed in Appendix C.

The method used in this report to calculate required storage uses the total rainfall depth from the design storm. This number is multiplied by the drainage area to yield the total required storage. See Appendices C-1 through C-4 for rainfall storage calculations.

The depth of recorded rainfall for a 100-year storm with a 24-hour duration was extracted from the State Hawaii Department of Land and Natural Resources, Division of Water Land Development, "Rainfall Frequency Study for Oahu, Report R-73", 1984. The applicable page from this reference is included in Appendix B, as figure 1.

3.1.2 EXISTING DRAINAGE

The existing upper quarry covers 94 acres of the Makakilo Pu'u. The slopes of Pu'u Makakilo generate approximately 148 acres of rainfall into the existing quarry area. Figure 2 of Appendix B shows the extent of the existing drainage area.

Twoe existing drainage basins located near the bottom elevation of the quarry create the necessary storage capacity for a design 100-year 24-hour storm. They are DB#1 and DB#2. The required storage was calculated to be 151.9 ac-ft. See Appendix C-1 for required storage calculations. The volume capacity of the three drain basins is 175 ac-ft.

3.1.3 QUARRY DRAINAGE WITH RELOCATION OF QUARRY

The relocated quarry extends mauka within the northeast and southwest trending ridges of Pu'u Makakilo. See Figure 4 of Appendix B for the proposed relocation of quarrying activities. The total proposed area plus the offsite area contribution totals 170.0 acres. This includes the rainfall from the southwestern face of the new berm. See Figure 3 of Appendix B for the developed drainage arising from the proposed relocation of the quarry. On-site storage capacity of 174.3 ac-ft is needed for the increased runoff surface. Free board at this rainfall capacity will be 2 feet. See Appendix C-2 for calculations.

The limit of grading runs along the outer ridge of the Pu'u on the southwest side of the quarry. Runoff generated outside the limit of grade will fall away naturally from the quarry. On the northeast, a new berm will be constructed. As a result, no measures are necessary to divert offsite runoff from the northeast and southwest limits of the relocated quarry. Subsequently, run-on generated from the northwestern edge of the relocated quarry will be handled by the three drainage basins.

The flow off of the northeastern berm face is 18.33 cfs and will continue to flow along the existing flow patterns.

3.1.4 CONCLUSION

The intent of the Makakilo quarry drainage plan is to reduce the amount of storm water entering the site and fully retain all the storm water runoff within the upper quarry.

The two existing basins (DB#1 and DB#2) with capacity of 175 ac-ft sufficiently store the 174.3 ac-ft (100-yr storm) of required by the expansion. A 100-yr storm at 174.3 ac-ft of rainfall will reach hydrological water levels of 253 ft. The surrounding berm height at the 96" culvert is at elevation 255 ft. This results in 2' of freeboard. The existing slopes along the southwestern edge of the quarry will convey runoff away along its natural existing flow pattern preventing offsite runoff from entering the site.

The berm on the northeastern edge of the proposed quarry will serve as an offsite runoff diversion. The southwestern face of the berm will produce approximately 18.33 cfs of runoff and will follow existing flow patterns. The existing area (under the site of the proposed berm) generates approximately 18.33 cfs, therefore there is no net increase in runoff generated by the construction of the berm. The direction of flow of this 18.33 cfs of runoff will continue along the same direction as the existing flows.

Overall, no additional flows will be added to outside drainage patterns. Runoff will be contained within the quarry limits. The quarry relocation project will have no adverse impact on adjacent properties or existing downstream drainage systems.

3.2. EROSION CONTROL PLAN

Minimizing or eliminating water-quality problems by mechanical or operational means is generally described as a *best management practice* (BMP). BMPs can be classified as either short- or long-term with considerable overlap existing between the two. Also, erosion controls at a site will likely change over time as the configuration of the site changes. The best strategy for stormwater control is to divert stormwater around the quarry and into an existing drainage. However, in the absence of such diversion, once stormwater has entered a quarry, a very effective control technique during ongoing operations is to develop numerous sumps or low areas to disperse stormwater. These low areas collect sediments and allow stormwater to infiltrate into the ground.

The runoff created within the Makakilo quarry expansion will be retained, therefore no soil loss is expected within the quarry expansion.

Proper erosion control measures will be implemented during the construction of the new berm. The northeastern face of the berm measures to be approximately 5.7 acres. Flow generated during a 10-year storm for this area would be 18.33 cfs.

Silt fences will be installed along the toe of the berm slope down stream of drainage pattern flow. Geotextile fabrics will be installed along the berm slopes, in order to stabilize the bare slopes while the grassing is being established. Other methods include mulching, straw bales, silt fences, jute matting, and plastic coverings. Mulching, matting, and plastic covering are good methods to reduce rain drop erosion especially on slopes; while straw bales and silt fences are designed to prevent fully or rill erosion of long overland areas such as swales.

The quarry is exempted from complying with the City and County of Honolulu, Soil Erosion Standards and Guidelines, November 1975. (Chapter 23. Grading, Soil Erosion and Sediment Control). However, Grace Pacific. will use the guidelines, as appropriate, in its erosion control activities at the site.

3.3. WATER QUALITY

No discharge is expected from the quarry. The site has been designed to fully contain runoff for a 100-year storm event.

The newly constructed berm will produce runoff that will flow towards Kaloi Gulch but the quantity of flow will not be in excess of what was already conveyed in the same area. Industrial activity will not take place within the berm area.

4. 2007 REVEGETATION PLAN

4.1 PURPOSE OF THE PLAN

The purpose of the Plan is to address the visual mitigation and revegetation of the areas affected by the proposed relocated quarry while operating (2007-2032), and the post-closure revegetation efforts beginning in 2032.

The Plan assumes the final landforms described in the Grading Plan section of this report. See Figures 4, 5a, 5b, and 6 of Appendix B.

The tools of the Plan are landforms and re-naturalization (or "revegetation"). The key elements of the Plan are:

1) the use of the existing ridges and man-made berms as effective visual screens of quarry activities and quarry faces;

2) for quarried faces not able to be screened, minimizing the man-made appearance of the final contours is preferable from a visual standpoint; and

3) the re-naturalization of man-made berms and quarried faces with drought tolerant vegetation, mixed and placed to blend with that existing on the Puu, is the most water-efficient and effective approach to long term landscape management.

The Proposed Use affords an opportunity an opportunity to improve upon several aspects of the 2004 Revegetation Plan. The existing excavation area is completely screened from view from the Kapolei Regional Park towards Ko Olina by a ridge on the southwest boundary. This aspect will be retained. A ridge and berm along the H-1 freeway at the 275 foot elevation screens the close-in views from Farrington Highway in the vicinity of Kapolei Knolls around to Palehua Road. This aspect will also be retained.

The intermediate and distant views from the Villages of Kapolei and Kalaeloa (formerly BPNAS) presently are that of a 2,400 foot wide active quarry face with a visible height of 250 feet (from elevation at 275 feet to 525 feet). The proposed excavation activity will quarry upslope through this quarry face and leave a bowl-shaped landform 700 feet further mauka, complementing the existing bowl of the Puu. The exposed face of the bowl (prior to revegetation) will be 200 feet in height (from elevation at 500 feet to 700 feet). The top of the Pu⁴u is at an elevation of 980 feet. What is presently the quarry face will become the quarry floor (from elevation at 275 feet to 500 feet), which as a landform, will be readily revegetated.

The intermediate and distant views from Ewa and Waipahu, while not viewing the existing active face head-on, will benefit from the move mauka and the bowl-shaped final landform.

The weak ridge on the northeast boundary of the proposed excavation area will expose the southwest quarry face on the approach to Kapolei on the H-1 Freeway from Kunia Road to the vicinity of the proposed North South Road Interchange. To mitigate this visual impact, Grace Pacific is proposing to lower the southwest ridgeline by approximately 50 feet

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in elevation and to build a berm on the northeast ridgeline of approximately 75 feet in height. The net effect of these actions will be to leave no more than 100 feet of the southwest face unscreened. Further, it is planned to grade the unscreened face with slopes averaging flatter than 1.5 to 1 (horizontal to vertical slope) to facilitate the revegetation effort.

4.2 GOALS AND OBJECTIVES

<u>Minimize or eliminate the visual recognition of the quarry from off-site</u> <u>locations.</u> Through the re-establishment of plant material and careful excavation of exposed rock areas, it is the intent of this Plan to either screen or "visually blend" wherever possible exposed areas of the site. "Visual blending" is based on the use of appropriate plant material and grow-in procedures.

Screen the quarry machinery and equipment from public view. Placing the quarry machinery and equipment on the Quarry floor effectively screens it from the public view. The quarry floor will be at a 245-foot elevation, which will be at least 70 feet below the quarry rim.

<u>Minimize the long-term use of irrigation water.</u> Although all plant materials require water for establishment and to survive, this plan recommends a minimum of water consumption through the use of drought-tolerant species and growth in procedures that are designed to acclimate plants to dry conditions.

<u>Minimize long-term maintenance in the re-naturalized areas.</u> On the same basis in which irrigation water use is being minimized, recommendations are geared towards the long term, low maintenance requirements of the quarry environment. Plant materials will be selected based on ability to survive with minimal maintenance for the twoyear establishment period. These plants ultimately will naturalize into the existing vegetation and survive without regular maintenance. See Exhibits 3 of Appendix E for the Recommended Plant Palette. See Exhibits 4 and 5 of Appendix E for the Revegetation Matrix and Revegetation Phasing Plan arising from the Proposed Use.

<u>Avoid an "engineered appearance" to the completed project.</u> In regards to the arrangement and appearance of the plant materials and rock walls, it is the intent of this plan to convey the importance of using irregular forms wherever possible. No straight row plantings will occur anywhere within the site or at the site boundary, including the benches. Clusters of plant materials and benches of varying shapes, orientation and dimension will be used to create a more natural appearance.

<u>Quickly establish a re-naturalized appearance.</u> Plant materials that are currently surviving on the site without irrigation provide a guide to those plants that will survive in the hot, windy and dry climate of the site and should be considered for use. Plant materials with a fast growth rate and hardy nature will be used so that screening and slope stabilization can occur as quickly and effectively as possible. Plant materials that have strong colors and textures and would not visually blend in with the naturally occurring grasses and lightly textured and colored trees found in neighboring areas will not be used. See Exhibit 3 of Appendix E for recommended Plant Palette.

Activities will not disturb protected areas of the site. All areas, which are not intended for quarry development, will be left undisturbed. These areas will serve as the benchmark and guide for the appearance of the quarry re-naturalized areas when that work is done. See Exhibit 1 of Appendix E for photos of undisturbed lands on the surrounding Puu Makakilo slopes.

<u>Minimize costs associated with the re-naturalization efforts.</u> The plan strives to minimize short and long-term costs associated with the re-naturalization. Seed or seedlings of many of the plant materials recommended can be propagated directly on-site and most are considered easy to grow. Many of the plant materials used will reseed themselves and spread on their own eliminating the potential need for periodic follow-up plantings. Typically smaller container size trees will be planted because they more readily adapt to site conditions and because they are available at a relatively low cost. The irrigation system contemplated for use will require an initial cost and some on-going costs for maintenance but will lower the potential long-term costs of replanting during extremely dry periods. Test plots will be used on-site to test varying seed mixes and maintenance practices to improve the chances of success and to fine tune a cost effective planting and low maintenance approach.

4.3 SITE OPPORTUNITIES AND CONSTRAINTS

Site opportunities and constraints are summarized below:

<u>Natural ridgelines screen views.</u> The ridge on the Makakilo side of the quarry completely screens distant, intermediate and close-up views of the quarry from the Makakilo residential neighborhood (Exhibits 2-1 and 2-2 of Appendix E) to the Kapolei Regional Park; The ridge on the Waipahu side of the quarry screens intermediate and close-up views of the quarry face, as seen from the intersection of Farrington Hwy and the old Palehua Road (Exhibit 2-3 of Appendix E). The western quarry face is visible from the distant view at the H-1/Kunia intersection (Exhibit 2-4 of Appendix E). The lowering of the elevation of the southwest ridge and construction of a berm on the northeast ridge will mitigate the effects of the proposed excavation area on this distant view. See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

Berm above H-1 freeway screens views into Upper Quarry. The existing H-1 freeway cut faces and the intervening gullies of Puu Makakilo serve to screen close-up views of the quarry from the H-1 and Farrington Hwy (Exhibit 2-5 of Appendix E). The quarry face is visible from intermediate views such as Kapolei Golf Course (Exhibit 2-6 of Appendix E) and the Villages of Kapolei (Exhibit 2-7 of Appendix E) and from distant views, such as the Ewa Golf Course (Exhibit 2-8 of Appendix E). See Exhibit 2-0 of Appendix E for a map of screening zones and photograph vantage points.

<u>Puu Makakilo screens views from Upper Makakilo.</u> Puu Makakilo completely screens views of the quarry from the residents of upper Makakilo (Exhibit 2-9 of Appendix E).

<u>The variation of colors of the quarry face rock and surrounding natural</u> <u>vegetation.</u> Distant views of the quarry are indistinct due to moving cloud shadows and the mottled appearance of the quarry rock and cinder. Much of the existing quarry face rock and surrounding vegetation has an uneven gray-brown to blue color from a distance. This unevenness helps to break up the line of the quarry faces and benches.

<u>Color/Texture</u>. During the dry season, the surrounding area vegetation is brown to yellow in color. During the rainy season, the plants are grayish-green with occasion splashes of yellow. Textures vary among the vegetation found on site, but generally smaller, finer textured plants appear to predominate visually rather than broadleafed ones. Brightly colored plants, such as Bougainvillea, should be avoided, as they attract attention, rather than diffuse it.

<u>Types of plants.</u> The plants existing on site have volunteered naturally. These plants include a wide variety of shrubs, groundcovers, and grasses. None of the established plants on site receive any permanent irrigation. Therefore, only the hardiest and drought tolerant plants tend to survive. All proposed plants should be extremely drought-tolerant, and require minimal water after establishment. See Plant Palette, Exhibit 3 of Appendix E.

<u>Volunteer/Natives.</u> Many volunteered or native plants are very drought tolerant and hardy. Many are considered "weeds" in ornamental landscapes, but on this site they cover the ground and minimize erosion. However, there are a few noxious weeds and toxic plants that should be eliminated. An example of this is the Tree Tobacco (Nicotiana glauca), which is poisonous to man and to livestock.

<u>Source of irrigation water.</u> Grace Pacific Corporation has a well at its Processing Site with an allocation of 168,000 GPD. Water from this well is pumped to the Upper Quarry and stored in tanks near the primary crusher. Portable water tanks may be located on the upper benches and supplied by water wagons.

The Revegetation Matrix and Revegetation Phasing Plan (Exhibits 4 and 5 of Appendix E) assume the availability of approximately .200 mgd of water for all quarry purposes (Processing Site well plus Board of Water Farrington Hwy meters). Of this amount, the Revegetation Plan targets .050 mgd or less for revegetation purposes. This limitation on supply serves as a constraint on the speed by which quarried land and land graded for visual mitigation purposes may be revegetated.

<u>Climate.</u> Rainfall is historically less than 20 inches per year, and usually occurs between the months of December and February. Prevailing trade winds are from the northeast and can be quite strong. Temperatures are very high, with summer

average highs in the mid to high 90's and winter average highs in the lower 80's. The average annual humidity ranges from 65% in the summer to 75% in the winter.

<u>Agricultural soils analysis.</u> Soil tests on quarry benches and the slopes surrounding the quarry suggest that existing site soils are high in sodium and magnesium, and low in calcium, phosphorous, iron and zinc. With proper amendments re-naturalization can occur readily given the soils present on-site. Toxic concentrations of boron and magnesium have been found in certain areas of the site. These areas will require the addition of Gypsum to bind the toxic materials in the soil.

4.4 LANDSCAPE DEVELOPMENT PLAN

Quarry Floor. The quarry floor will encompass an area of approximately 107 acres. This area makes up the lower ground plane or base of the quarry. It is understood that this base area of the quarry may be developed in the future, however until the specific development plan has been determined, the area will be planted with grasses and ground covers to control dust and erosion. The floor of the quarry with elevations below 300 feet will be hidden from view and will have no visual impact from off-site locations.

Upon removal of Grace Pacific's plant and equipment in 2032, the first priority will be to establish a natural appearing grass/ground cover mix. The species already growing on site provide a good indication of species that will tolerate the harsh site conditions occurring in Makakilo. A carefully selected combination of grass/ground cover species that are fast growing, drought tolerant and will reseed or otherwise spread is recommended. Species will be combined to ensure that plants will establish within all of varying microclimates present on-site. The quarry floor soil materials may also need to be amended to provide nutrients and drainage. The ultimate planting plan for the quarry floor will depend upon the final land use determined by the James Campbell Company and Grace Pacific. For this reason no large landscape materials will be introduced within the quarry floor area.

Irrigation will be required to establish grasses and ground covers in the quarry floor area. Rotary impact heads will be used to establish the plantings for a period of approximately two years. Irrigation lines will be buried in shallow 4" trenches to protect then from UV and other damage and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards.

<u>Mauka Quarry Faces.</u> The most visible aspect of the quarry at its completion will be the faces above the 400 foot elevation up to the mauka perimeter. To mitigate the appearance of these faces, an undulating landform and a slope averaging flatter than 1.5 to 1 but allowing for significant variation will be created to render a more natural appearance than straight benches and slopes..

Because of the high exposed elevations that will be exposed, it not the intent of the revegetation plan to screen the entire face with trees but rather to soften the exposed surfaces with grasses and shrubs. This treatment will create the illusion that these faces are naturally formed and aged. The excavation pattern for the quarry will emphasize the uppermost benches first. It will be very important to complete landscape work in conjunction with the quarrying process to ensure the landscape installation is not hindered due to conflicts with mining procedures. Soil and amendments will be added to the surfaces immediately after completion, as it may be difficult to add any soil later. Soils used in the work will come from on-site stockpiles where possible. If imported soils are used, they will be matched with the structure and characteristics of on-site soils and will be inspected to prevent the introduction of noxious weeds and insects.

The plant materials used would be fast growing, drought tolerant and selfspreading varieties. Random placement of tree and shrub groupings will be under the direction of a Landscape Architect to select appropriate variation and density of clusters. Clusters of larger plants such as Kiawe and Opiuma will be planted in specific areas. Large tree or shrub plantings will not be planted along the entire length of benches to avoid reinforcing unnatural horizontal lines.

Irrigation is required to establish plant material on the faces. It will be particularly critical that a sturdy system is in place (even though considered of temporary quality) because of the potential future access problems. A PVC line system is recommended with lower trajectory and narrower coverage area impact heads due to the strong prevailing winds. Where adjacent benches occur within 25' of elevation change of each other, it is possible that one row on the upper bench could irrigate both levels. This would be determined on a case-by-case analysis in the field. Irrigation will be implemented for a two-year grow-in period. Irrigation mainlines will be buried in shallow 4" trenches to protect from UV and lengthen the usable life of the system. The irrigation system will be turned on periodically in times of drought to minimize potential fire hazards. As field stock materials will be used on the benches, no drip irrigation will be required. See Exhibits 4 and 5 of Appendix E for the re-naturalization schedule.

Access Road. From the existing Quarry, the access road skirts the lower edge of the adjacent Puu Makakilo property, and then turns into Old Palehua Road, crossing under the H-1 and terminating at Farrington Highway. The visibility of the access road varies depending on where it is being viewed from and the particular segment of the road being viewed. Wherever possible undulating re-naturalized berms of 6 feet in height planted with grasses, groundcovers, trees and shrubs will be maintained to screen the access road from view. Earth mounds and rock material laid in natural patterns should be used in certain areas where highest visibility exists. A continuous landscape treatment along the road is not desirable (such as a row of trees or a long berm) and would serve to draw more attention to the roadway. A limited number of field stock trees are recommended to soften the most critical areas immediately. The irrigation system provided will consist of a rotor head system, which will remain in place for the duration of the use of the access road use to revitalize plant materials, which are affected, by heavy vehicle use. A temporary drip irrigation system will be used to establish the field stock materials for an approximate 12month period. Existing Buffer at H-1, the "Adjacent Area". The portions of the existing Quarry parcel flanking the quarry, but not used for quarrying, are termed the "Adjacent Area" in the license agreement with the James Campbell Company. The Adjacent Area for the most part is untouched and has a natural appearance with kiawe, hauole koa and naturally occurring grasses. It is the intent of this Plan to maintain this area in its entirety as it currently exists and to a substantial degree emulate this "look" as much as possible in the surrounding areas to be naturalized.