PACIFIC CONCRETE AND ROCK COMPANY, LIMITED

Environmental Impact Statements

for

Quarry Relocation from Existing Puu Palailai Site to New Puu Makakilo Site — Section I

Restoration of Quarried Puu Palailai Site by Sanitary Landfill Methods — Section II

at

Makakilo, Oahu, Hawaii

INTRODUCTION

Pacific Concrete and Rock Company, Limited, has been in business on the island of Oahu for approximately 22 years. It is one of two major suppliers of concrete for Oahu and supplies approximately 40 percent of the island's concrete needs. The company is also a large producer of road and fill rock for Oahu. It also produces concrete block and other cast products. The company employs approximately 300 people and contributes approximately $207,000 in State taxes annually.

Pacific Concrete was founded to develop and utilize a known source of basalt rock on the slopes of Puu Palailai near the present Makakilo City. Pacific Concrete has been operating this quarry for the last 22 years. The deposit consisted of a limited but high quality lava flow which is now almost exhausted. Within a year and a half a new quarry site must be operating to furnish basalt rock for concrete production. Should a new quarry site be denied the company, it is quite likely that Pacific Concrete would cease to exist.

Approximately eight years ago, after exhaustive studies of Oahu's rock resources, a new source of rock was located on the slopes of Puu Makakilo. This is the only known source within economical distance of Honolulu. It is located adjacent to and above H-1, approximately a mile and a half from the nearest dwelling at Makakilo City (Tax Map Key 9-2-03) and approximately 17 miles from Honolulu. The land is presently zoned agricultural and is owned by Campbell Estate. It is presently used for limited grazing, with grazing capabilities during the wetter seasons of about one head of cattle per 10 acres.

Approximately 260 acres will be occupied, of which only 72 acres will be quarried over a 20 year period. The remaining 188 acres will remain untouched in grazing and will serve as a buffer zone. The geology of the area after drilling over 150 test holes indicates that the usable rock is well over 150 feet deep. Because of surrounding topography, the site is well hidden from all except far distant scrutiny or airplane overflight. The quarrying and processing of the quarried rock will be accomplished using the most modern methods for suppressing noise and dust.

The processing facilities will be located between H-1 and Farrington Highway immediately below the actual quarry site. Material will be conveyed from the upper site to the processing site via a tunnel under H-1, no part of which will be visible from either highway or any present or future residences. The

lower site will be shielded by a landscaped berm and extensive oleander plantings. The complete processing operation will also utilize the most modern pollution control methods.

At the existing quarry site at Puu Palailai there remains a 90 foot deep pit of approximately 29 acres. This area is Tax Map Key 9-1-16 and 9-2-03 and is owned by Campbell Estate. The site will be restored to a use compatible with the adjacent community. The pit will be filled to new contours eliminating the steep walls and leaving contours suitable for park or recreational use. It will take three and one half million cubic yards of suitable material to fill this hole to contours designed by Donald Wolbrink & Associates. The only economic and practical approach is to fill this hole with private and commercial refuse generated by the City and County of Honolulu and adjacent communities using modern sanitary landfill techniques. The landfill proposed will satisfy a pressing City need for a new ecologically sound disposal site. We are told that the Waipahu dump will have to be shut down shortly because of inability to meet State and Federal environmental standards. The Palailai site will have a life of four to ten years.

The landfill site is conveniently located at the end of the H-1 and adjacent to Farrington with easy access from Waianae, Campbell Industrial Park, Makakilo City, and Honolulu. Timewise, it is approximately five to ten minutes truck time beyond the turnoff to the Waipahu dump thus still remaining within economic distance of Honolulu.

Neither the entrance to the landfill nor the fill itself will be visible to Makakilo City residents. Its size and sheer surrounding walls serve to accommodate extensive quantities and yet encompass the operation within clearly defined, well protected limits. The geographic isolation of the area from any other mountain range or drainage area precludes surface water contamination or any water inflow from adjacent streams, etc.

The operation overlies water which, although brackish, might be used for human consumption at some future time. It is not programmed for use by the Board of Water Supply in its 50 year plan. However, to protect the potential source, Pacific Concrete has agreed to line the entire 29 acres with an impervious layer of well compacted and blended specification material approved by the Board of Water Supply. This lining will preclude seepage of rain water through the 100 feet of refuse and down through 87 feet of underlined strata into the brackish water lens. The sheer dense rock side walls of this operation prevent outflow of liquid or gas contaminants.

The landfill will be operated 10 hours a day, 6-1/2 days

a week. Each day's refuse will be covered with a minimum of six inches of earthen cover material. A small part of this cover material will be obtained from the site. The majority of the cover material and most of the lining material will be obtained from the new quarry site which has an adequate supply of decomposed volcanic cinder. The cover and lining material will be trucked from the new quarry site and stockpiled adjacent to the sanitary landfill site. Daily compaction and covering of refuse will be done with appropriate heavy equipment. A water-wagon will be in full daytime use watering the roads, the compacted refuse, and the cover material. Should leachates develop they will be pumped to the surface and disposed of as a road wetting agent. It is predicted by mainland experts consulted that there will be little or no leachate generated by a landfill in this particular rainfall belt.

The following are two environmental impact statements developed by Pacific Concrete in cooperation with its consultants. Development of the basic information for these environmental statements was initiated long before public awareness of the need for environmental safeguards. The final use plans for both the old quarry and new quarry were developed by Donald Wolbrink & Associates in 1968 and 1969 with consideration given to noise, dust, and visual pollution controls. The following environmental statements were developed by Pacific Concrete on a formal basis although to our knowledge they were not required for obtaining quarry and landfill permits. Pacific Concrete developed these statements to assure that all pollution control measures were considered and that all operations would remain within present or foreseeable laws developed to safeguard the ecology of Oahu.

The first item before the two environmental impact statements is a location map showing the existing Puu Palailai quarry which will be converted into the sanitary landfill and also the location of the new Puu Makakilo quarry site and illustrates both the new quarry limits and the surrounding extensive buffer zone.

PREFACE

All exhibits mentioned in the following environmental impact statements are on file with the Office of Environmental Quality Control and are available for review. A list and description of all exhibits is included at the end of Section II.

Please refer any questions concerning contents of this document to Harry R. Cerny of Pacific Concrete and Rock Company, Limited, telephone 845-6441.

PACIFIC CONCRETE AND ROCK COMPANY, LIMITED

Prepared By

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DRAFT

Environmental Impact Statement

Basalt Rock Quarry Operation

Puu Makakilo, Ewa, Oahu, Hawaii

7/31/72
DATE

ROBERT B. ROBINSON

A. A Description of the Proposed Action and Its Purpose

1. Introduction

Pacific Concrete and Rock Company, Limited, proposes to move its quarry operations from Puu Palailai to Puu Makakilo, Oahu, a distance of approximately two miles. The new site will encompass 72 acres of actual total quarry area and 188 acres of green belt buffer. Of the 72 acres of actual quarry area, only a maximum of 18 acres will be under active quarrying at any given time.

Immediately makai of the H-1 and the quarry site is an additional 35 acres where the shop, office, scale, processing site, and concrete batching plant will be located (the attached Exhibit I shows the location on Oahu, location of actual quarry site and processing site).

The exact location of the quarry and its ancillary operations on the slopes of Puu Makakilo were made during 1969 and 1970 after extensive test drilling and examination of the site from an ecological and geological standpoint.

An extensive deposit of rock on the south-western boundary was forsaken due to its open exposure to Makakilo City. The quarry and its primary and secondary crushing facilities were located between two shielding ridges and are recessed into the slope to preclude visibility from H-1. The finishing equipment was located below H-1 since there was no remaining terrain above H-1 that would sufficiently shield all the equipment.

All of Pacific Concrete's basalt aggregate for concrete production will be produced from the new site (500,000 tons per year). Approximately one-half of the road and fill rock sold by Pacific Concrete will also be produced at this site (approximately 250,000 tons per year).

The move is necessitated because there now remains only 1-1/2 years' deposit of usable concrete aggregate rock at Puu Palailai.

The Army initially quarried Puu Palailai during World War II and 22 years ago Pacific Concrete

began to extensively quarry the deposit. The limited remaining quantity of usable rock was recognized over eight years ago and, beginning in 1964, a series of exploratory methods were used by Pacific Concrete throughout the island of Oahu to determine sources of "A" rock for use as concrete aggregate. ("A" rock is a term used locally in the trade describing the high-quality hard, dense basalt used as a specification concrete aggregate.) Aerial reconnaissance and utilization of a magnetic survey to indicate densities of rock underlying various areas on Oahu were undertaken. Exploratory drilling was also done in various areas of Oahu.

Exploratory geologic work by Pacific Concrete and various consultants finally indicated in 1966 that the best area for a new quarry site from an economic and geologic standpoint was the Puu Makakilo area (Exhibit IIA).

2. Description of Present Use, Value and Condition of Land

Lands are now used for seasonal grazing.

Soils are dark, reddish-brown, silty clay, stony to nonstony, very shallow to about four feet deep, and easily eroded.

Vegetations are of typical leeward, semi-arid varieties that are largely poor forage species. Major varieties in this area are listed as follows:

Algaroba (Prosopis chilensis)

Klu (Acacia farnensiana)

Sour grass (Trichachne insularis)

Wilder grass (Dichantium aristatum)

Guinea grass (Panicum maximum)

Uhaloa (Waltheria indica)

Feather fingergrass (Chloris radiata)

The animal population consists mainly of rats and mongooses.

The 260 acres are best suited for grazing of livestock due to an average slope of 30 percent

which is unsuitable for other agricultural or residential endeavors. These lands are estimated to be able to carry an animal unit yearlong on 20 to 30 acres of pasture.

Topography ranges from strongly sloping to steep (Exhibit IVB):

Slope 10 to 20 percent = 68 acres

Slope 21 to 35 percent = 82 acres

Slope 35 and over = 110 acres

The main drainage gulches at Makalapa and Hunehune fall within the buffer zone so will not be affected by the quarrying operations.

The total drainage area affected by quarry operations is 72 acres. Based on 6 inches of rainfall per hour (once in 20 year occurrence) and 90 percent runoff, expected runoff is 0.6 acre-feet per minute.

Mean annual rainfall is 22 inches with erratic distribution. Heavy rainstorms of Kona and cold frontal types can drop up to 6 inches of rain in an hour.

Highest temperature is 93°F and the lowest is 47°F. Mean daily temperature is 74.6°F. (Refer to the U. S. Department of Commerce National Weather Service Climatography of the U. S., No. 86-44.)

Trade winds occur 70 percent of the time. Winds in excess of 23 MPH occur 4 percent of the time. Winds between 13 to 23 MPH occur 23 percent of the time. Winds less than 13 MPH prevail 69 percent of the time.

3. Description and Plan of Operations

The following is a step-by-step explanation of the operation of a quarry including pollution and safety control measures.

a. An existing access road into the quarry site from the Palehua Road will be widened and straightened (note Exhibit V).

(1) This road will be oiled as necessary.

(2) This road will be over 1-1/4 miles away

from the nearest residence at its closest point. (H-1 is only 600 feet away from this same residential area).

(3) This road will also be the only access to the quarry site other than the tunnel under the H-1. It will be 15 feet wide and 5,300 feet long.

b. Opening the quarry.

(1) The boundaries of the quarry site will be surveyed and staked (see Exhibits V and VI).

(2) Berm (pollution barriers) locations for noise and visual pollution will be surveyed and staked (see Exhibit VII, locations outlined in red).

(3) Drainage swale locations for proper drainage of the quarry area will be surveyed and staked (see Exhibit VII, locations outlined in purple).

(4) The overburden (soil and decomposed rock) will be pushed aside by a D-9 tractor equipped with a bulldozer blade and ripper.

(5) The overburden will be pushed up into visual pollution barriers (berms) and drainage dikes will be developed along the periphery of the quarry site. All berms and dikes will be seeded with indigenous vegetation.

(6) Steel culverts similar to the type used under the H-1 will be inserted in natural drainage channels to allow continued natural drainage.

c. Operation of a quarry.

(1) A D-9 tractor is used to rip up and bulldoze usable rock on the surface. Only one unit is normally used for clearing overburden and ripping usable rock. The area is leveled to allow safe access by drills and compressors.

(2) Drilling holes into the very hard basaltic rock (blue rock) will then begin. The drilling pattern varies depending on the geological nature of the rock. The drill is composed of two units. The drilling unit has a vertical mast and air-driven hammer all mounted on tractor tracks (note Exhibit VIII). This unit is powered by compressed air furnished by a diesel-engined portable air compressor (note photo in Exhibit VIII). Two drills and two compressors are normally used.

(3) The drilled holes are then loaded with explosives and detonated. A typical shot consists of an average of 50 holes. All explosive storage, handling and shooting is controlled by the Division of Industrial Safety, State of Hawaii.

(4) This shot is calculated to reduce all rock to no larger than 4 foot pieces. A 4-1/2 c.y. diesel engine-powered shovel (one required) loads the shot rocks into diesel-powered quarry trucks which haul 35 or 50 tons (note Exhibit VIII). Two or three of these quarry trucks are used to haul the shot rock over a 60 foot wide, 1,000 foot plus long quarry haul road (all within the quarry itself) to the primary crusher. The quarry pit area and this haul road are oiled as necessary with a company-owned oil truck.

d. Crushing and stockpiling.

(1) The primary crusher system (note photo, Exhibit VIII) is composed of a totally housed steel rock box with a slat conveyor bottom into which the quarry trucks discharge their loads. This rock box is equipped with a negative pressure dust collector system. At this point, water mixed with a wetting agent is also sprayed on all of the rock for dust control. The conveyor is followed by a vibrating shaker mechanism which allows the small rock pieces to bypass the primary crusher. This bypass of small pieces permits the primary crusher to be devoted to crushing

only the large-sized rocks. This primary crusher is a 42 inch by 48 inch jaw crusher which crushes 4 foot or smaller rock into 10 inch or smaller sizes. The crushed and bypassed rock are then both conveyed to the secondary crushing system.

(2) The secondary crushing system (Exhibit VIII) composed of a screen and cone crusher, reduces the rock to a size of 3 inches and smaller.

(3) From the secondary crusher, the rock is conveyed by a radial stacker conveyor (Exhibit VIII) into one of two surge piles (Exhibit VIII). Buried under each of these surge piles is a conveyor which withdraws and conveys the 3 inch minus material into a 42 inch wide conveyor which conveys the rock under H-1 to the processing site.

(4) Water mixed with a wetting agent is sprayed onto the rock at all critical points throughout the entire system described in Items a, b, and c.

e. Conveying of 3 inch material under the H-1 to processing site.

(1) A tunnel will be built below the H-1 which will connect the stockpile of 3 inch and smaller material on the mauka side of the H-1 with the makai processing-finishing site.

(2) A 42 inch wide belt will run through this 10 foot square tunnel. The tunnel will run through solid rock and will surface over 100 feet away from the edges of the H-1. The belt conveyor will discharge onto a conveyor which will stack the rock into three surge piles - one pile for high-grade rock usable in concrete ("A" rock), and two piles for low-grade rock (road rock and fill rock).

(3) Exhibit V shows the location of the tunnel (purple line) and the three surge piles.

f. Processing-finishing.

(1) Thirty-five acres immediately makai of the quarry will be devoted to reducing rock to final sizes for use in road fill and concrete.

(2) Either "A" or "B" rock will be withdrawn by belt from beneath one of the surge piles and sized through a series of screens, conveyed, and thence either into finished stockpiles or into final reduction crushers for size reduction into sand size particles.

(3) Water mixed with a wetting agent is sprayed onto the rock at all critical points throughout the entire system described above.

(4) Primary crusher and screens will be totally housed to eliminate noise and stray dust.

(5) The entire screening and crushing system will be processed wet and the resulting wash water filtered and reused. Wash water will be drawn from the Board of Water Supply's 24 inch main along Farrington and all water not adhering to the rock or evaporating will be trapped and recycled. Approximately 200 gallons per minute will be required for make up water to compensate for adhering and evaporating water. Wet processing will virtually eliminate dust generation.

(6) This same 35 acre site will accommodate the shop, office, scale, and batch plant. The batch plant will be housed to eliminate dust. Exhibit V shows the location.

(7) A major-sized landscaped berm will be constructed to shield the entire operation from Farrington Highway. Note Exhibits V and VA.

(8) All buildings and structures will be painted to blend in with the surroundings.

(9) Access to processing site.

(a) All traffic relevant to a quarry

operation such as mixer trucks, dump trucks, pickups, etc. will use only one access-egress. This is noted on Exhibit V. This access is located on that portion of Farrington Highway which has the clearest visibility. A deceleration-acceleration lane will be created.

(b) Traffic into and out of processing. The total daily traffic will be identical to the traffic presently generated at the existing quarry (which also uses Farrington as an access to H-1). The general route will be Farrington to H-1 via either Makakilo Drive or via Kunia Road. The total daily traffic is 36 mixer truck round trips from 6 a.m. to 4 p.m. and 91 dump trucks round trips from 7 a.m. to 12 p.m.

(c) Two drainage ditches run through the site. One ditch will be left untouched and the other ditch will be rerouted (Exhibit XIXB). Water runoff from the site will not increase since the average slope of the area will be reduced from 20 percent to approximately 10 percent.

B. Impact of Proposed Quarry and Processing Site on the Environment

1. General Impact

The existing terrain in and near the actual quarry site will be altered during the next 20 years.

An existing 5,300 feet long access road mauka of the H-1 into the site from Palehua Road will be developed. The road will be oiled as necessary. The road will be a relatively narrow one (15 feet wide) with a minimum of cut and fill (no cut more than 8 feet high and no fill more than 10 feet deep). All cuts will be on a one-half grade and all fills will be one-third. All fills will be grassed as necessary to control erosion (see attached list of indigenous vegetation, Section A.2)

and culverts will be sized to match existing culverts under the H-1. The road will be developed in approximately two weeks.

A green buffer zone of indigenous plants will be preserved to an average width of 600 feet around the actual quarry site. Note Exhibit I for protective zone limits.

At no time will more than 18 acres be stripped for quarrying. The overburden stripped from the 18 acres will be used to line the sanitary landfill at Palailai and stockpiled. In the event it is stockpiled, it will be seeded with indigenous vegetation and irrigated until full cover is achieved. The 18 acres exposed will be basalt rock which will not cause any runoff problems. It has been established at all the existing quarries on Oahu that all rainfall percolates down through the fractured rock rather than running off.

Runoff from directly above the open pit will be diverted by a drain swale 10 feet wide, 3 feet deep with a 2-3 percent slope. The swale will be seeded to grass. The attached sketch, Exhibit VII, shows the location of the swales. The runoff will be diverted around the pit and into the original gulches (Exhibit XIXB).

The existing terrain (Exhibit I) will be quarried to final contours as shown in Exhibit XX.

A total landscaping plan developed by Wolbrink & Associates (Exhibit V, VA, VB, VC) along with the berms across the two small gulches mauka of H-1 will provide a continuing program to shield all present and future operations with vegetation and artifically created terrain.

Over the subsequent 20 years, the existing indigenous vegetation described previously will be eliminated on a total of 72 acres and replaced by the same species of grass as present. Over 500 trees of various species will be planted and grown on the benches (Exhibit VD).

2. Short Term Impact on the Environment (less than two years)

During the initial clearing phase for the opening of 18 acres of quarry area, the overburden

will be stockpiled and watered daily. Some minor amounts of dust will escape but the clearing operation will be of short duration (10 weeks to clear the first 12-year quarry area).

The site preparation for the primary and secondary berm building will require 16 weeks and will require sprinkling daily to hold airborne dust to a minimum. This area will not be altered further for the subsequent 20 years.

A tunnel under the H-1 will be constructed - which will have minimal effect on the environment since all activities including excavation will be through solid rock. Construction will take approximately 14 weeks.

The lower processing site of 35 acres between the H-1 and Farrington will be leveled. A 1,200 foot long berm adjacent to Farrington will be built and planted (note previous Exhibit V). Soil from the leveling of the site will be used for the berm. The active areas will be watered daily during the 20 weeks of leveling and berm building.

This 35 acre area will be shielded from public view by the planted berms adjacent to Farrington noted on Exhibit VB and the oleander hedge planted adjacent to the H-1 also shown in the same exhibit.

This lower site of 35 acres will be taken out of cane for 20 years but an equivalent acreage will be released for cane growing by 1976 at the original Palailai quarry site.

3. Long-Term Impact on the Environment (next 20 years)

The major types of environmental impacts of a quarry operation are visual, dust, noise, and water runoff.

As previously noted, the visual problem has been extensively studied and carefully planned for with a series of landscape drawings and specifications (Exhibits VA, VB, VC, IX, X). These landscaping and buffer specifications are time sequenced to actually eliminate the visual pollution normally associated with a quarry.

The dust and noise of the on-going operations is covered in Section III of the conditional use

permit request which is attached.

The water runoff will be reduced since the development of a quarry by its very nature alters steep slopes into a series of level benches which are fractured and allow better percolation of rain water. This is proven by the 29 acre pit at the present site which has never been observed to have standing water (in the 4 acre deepest pit site) more than a few inches deep and longer than one day after the heaviest rains. A settling basin will be installed in adequate size to handle the heaviest runoff as shown in Exhibits XIX and XIXB.

C. Unavoidable Adverse Effects

The operation of a quarry will result in the generation of some dust and noise. The total quarry processing noise will be below all City, State, and Federal laws at the edge of the buffer zone.

A minor amount of dust will escape from the four areas of operations, namely at the shot rock face; at the dump into the primary; at the stockpiles; and at the screening rooms. The working area at the face and all stockpiles will be watered daily, the dump area and screening room will be housed and the rock water sprinkled. Some dust will still escape but the quantity will be below the City, State, and Federal laws at the boundaries.

D. Alternatives

Note Exhibits IIA and IIB which is a geological report of the Waianae Range by Dr. Leonard Palmer, a consulting geologist formerly with the Geoscience Department, University of Hawaii. Of the two mountain ranges on Oahu, the Waianae Range is the one less subject to urban encroachment. This report (page ICI 10) substantiates the soundness of the Puu Makakilo basalt flow over other known flows in the Waianae Range.

Urban encroachment and zoning and conservation zoning have made unavailable the majority of the flows in the Honolulu-Kailua area (Exhibit IIC). With the exception of the Puu Makakilo flow, the remaining known flows are economically far too distant from the Honolulu market -

80 percent of Pacific Concrete's sales are made in the corridor from Salt Lake-Airport to Hawaii Kai. The majority of the concrete produced by Pacific Concrete (80 percent) uses 1.33 tons of basalt per cubic yard of concrete. The list f.o.b. price of 3,000 p.s.i. concrete is $20.35 per cubic yard. The cost of hauling rock to Honolulu is approximately 6 cents per ton per mile of haul one way. Thus every five miles of additional haul adds 40 cents to the cost of every yard of concrete for bidding purposes. The majority of competitive concrete bids in Honolulu have a range of between 10 cents to 50 cents. Pacific Concrete is already located more than five miles farther from the heart of Honolulu than its other major competitor. A location any farther would eliminate Pacific Concrete from competition and leave our major competitor a virtual monopoly since they have the only economically viable source of high-quality basalt rock suitable for concrete.

E. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term (20 years) use of the area will be the quarrying of rock. Quarrying will create a series of level terraces ultimately suitable for houses or apartments. The majority of the existing terrain is too steep for housing (over 30 percent slope) even though the preliminary detailed land-use map for the area shows single family residences and a school. The present use for cattle grazing is economically marginal due to the large acreage (20) needed to support one head.

One of the short-term impacts will be the generation of a minor amount of dust at the site for the next 20 years which will have a minimal effect on the environment. Similarly, noise will be generated but will be within City comprehensive zoning code limitations. Both noise and dust will be below all applicable City, State, and Federal limits at the buffer zone boundaries. All final elevations will be landscaped as the quarrying is completed. The quarry and all equipment are located to make full use of the shielding effects of the terrain.

The long-term productivity of the area will definitely be enhanced by virtue of the creation of economically feasible residential lots from land presently too steep and arid for good grazing land. In the event that nothing is built on this site, the irrigated landscaping and

natural grass coverage will generate more vegetation per acre than the present sparse kiawe and under growth. The present property taxes are approximately $1 per acre per year. The residential property taxes after quarrying would be a minimum of $1,000 per acre per year.

In overview, a given amount of rock will be quarried on Oahu to meet the market needs. With the large amount of energy it takes to move this product, the shorter the haul distance to the end user the less contamination of the overall environment. This is true within the quarry, at the finishing plant, and in truck hauling. It can be expressed in fossil fuel used as well as potential for dust and noise generation.

F. Irreversible and Irretrievable Commitment of Resources

The entire 24 million tons of solid basalt rock underlying approximately 5 feet of soil, cinder, and decomposed rock will be conserved for use by man and committed to use in concrete throughout all of Oahu. The removal of this rock irreversibly commits this rock to use elsewhere and this area to a change in topography from a rough, steep, rocky terrain to wide, level terraces dimensioned to accommodate any form of housing for a minimum of 140 families.

The sparse vegetation will be removed and upon completion of the quarry, option areas will be landscaped and maintained. Five hundred plus trees and over 1,000 shrubs will be planted (Exhibit VD).

Approximately one-half of the five foot of soil, cinder, and decomposed rock will be committed to lining the sanitary landfill at Puu Palailai (the original quarry) to preclude leachate seepage into the ground-water table. The other half will be used to restore the quarried areas for landscaping.

G. Environmental Monitoring

Dust and noise will be monitored once every six months by a qualified private consultant.

The landscaping will be monitored by Campbell Estate, owners of the land.

H. Short-Term Cost/Benefit Analysis

The operation of a quarry and processing site on the slopes of Puu Makakilo as a private enterprise involves the usual short-term (20 years) benefits to the Oahu community. These are obvious and can be itemized as follows.

1. Number of people employed by Pacific Concrete = 300.

2. Number of families dependent on Pacific Concrete = 255.

3. Total number of people dependent on Pacific Concrete = 1,200.

4. Total annual wages paid by Pacific Concrete, most of which revert back to the community in one way or another = $3.5 million.

5. The annual income to the remainder of the Hawaii residents from Pacific Concrete wages paid = income multiplier* of 50 percent x $3.5 million = $1.75 million.

6. Annual State taxes withheld on wages paid all Pacific Concrete employees = $200,000.

7. Total annual State taxes paid by Pacific Concrete exclusive of taxes withheld on wages paid Pacific Concrete employees.

Gross Income	$120,000
Net Income	26,000
Fuel (diesel)	41,000
Property	20,000
	$207,000

8. Annual amount of purchases made by Pacific Concrete within the State, such as cement; parts; steel; fuel; etc. = $5 million.

9. The annual payments to Hawaiian Homes for limestone sand and other materials - 1971 = $125,000.

*Note the letter from Fred Bennion of the Tax Foundation of Hawaii (Exhibit III).

10. State-wide effect.

    a. The only concrete operation on Molokai and employer of four people who support 14 people.

    b. One of two concrete operations on the Kona Coast. Employer of 23 people who support 101 people.

Another major short-term benefit is a less obvious one but of considerable potential, economic impact on the community. As mentioned earlier, there are three suppliers of concrete on Oahu. They are HC&D, Halawa Quarry, and Pacific Concrete. Pacific Concrete and HC&D each supply about 40 percent of the total island needs while Halawa supplies about 20 percent. Due to its central Honolulu location, Halawa Quarry has a powerful transportation savings advantage over HC&D and Pacific Concrete. The Halawa Quarry deposit is of limited quantity of concrete quality "A" rock, thus reducing their impact on the Honolulu market. HC&D has an "A" rock deposit which is of very high quality and in extensive quantities. Their transportation cost of hauling "A" rock to Honolulu is about the same as Pacific Concrete's even though they are located five miles closer. This is due to terrain and traffic factors.

In the event that Pacific Concrete is not able to economically compete with the other major competitor and Halawa Quarry 1-1/2 years from now, the reason for loss of competitiveness would be due to the only uncontrollable factor - increased transportation costs. The market would then revert to the other major supplier and Halawa Quarry with the other major supplier undoubtedly picking up all of Pacific Concrete's market share. The ratio of market control would be 75-80 percent for the remaining major supplier and 25-20 percent for Halawa Quarry. Since Halawa would be limited in available quantities of "A" rock, the remaining major supplier could increase the price of concrete possibly by as much as 20 percent (providing Federal wage price controls were not in effect). There are many examples of what can happen to pricing under a monopolistic situation.

The short-term (20 years) cost to the environment would be defined in terms of dust, noise, visual pollution, and loss of 72 acres of marginal grazing land. Due to the

intensive pollution control measures to be installed and implemented, the net effect will be a substantially improved environment. The new site will generate less than half the amount of dust generated at the existing site. All quarrying and processing functions will be continually wetted. Noise will be controlled by housing all stationary equipment (which also eliminates the equipment as a source point of dust) and the installation of the best available mufflers on all mobile equipment. Quarry and processing noises at the buffer boundaries will be within the strict CZC limits as well as State and Federal regulations.

Some portion of the activities will be in view in spite of an extensive berm and landscape system and, of course, total operation will obviously be visible from the air and from certain far ground vantage points. All stationary equipment will be painted a soft green to blend in with the landscape. All finished quarry benches will be planted with trees and shrubs within two months after completion. No more than 18 acres at a time will be exposed.

The loss of 72 acres of grazing land will preclude grazing a maximum of seven cattle at an estimated annual income to the rancher of $350.

The costs for the above pollution control measures are as follows:

Housing all stationary equipment	$80,000
Wet processing (not including annual operation costs)	75,000
Muffling mobile equipment	15,000
Constructing three berms, two drain swales and one stilling basin	200,000
Landscaping (not including annual maintenance)	195,000
Grand Total	$565,000

I. Long-Term Cost/Benefit Analysis

After 20 years, the quarry will have ceased all operations and removed all installations. All exposed soil areas will have been landscaped with trees and shrubs. The

area will have been leveled to a predetermined plan for residential construction in concert with the City's detailed land use map.

The benefit of quarrying the area to final usable grades should accrue to the home buyer since the developer's site preparation costs will be nil. All the final quarry grades are designed for homes and school buildings.

The benefit to the City of residential construction on land presently too steep and expensive will be property taxes of approximately $133 per lot (assuming a $10,000 value for each lot) for a total of $18,500 per year.

PACIFIC CONCRETE AND ROCK COMPANY, LIMITED

Prepared By

Harry R. Cerny
Chief Engineer

&

Dr. P. H. McGauhey*

DRAFT

Environmental Impact Statement

Sanitary Landfill Operation

Puu Palailai, Ewa, Oahu, Hawaii

7/31/72
Date

ROBERT B. ROBINSON

*Dr. P. H. McGauhey, Director Emeritus, Sanitary Engineering Research Laboratory, University of California

A. A Description of the Proposed Action and Its Purpose

1. Background Information

Pacific Concrete presently operates a quarry adjacent to Farrington Highway and the H-1, within one-quarter mile of Kalaeloa Boulevard on the slopes of Puu Palailai near Makakilo City on Oahu. Exhibit I is a location map. This quarry was operated by the Army during World War II and has been operated continuously for the last 22 years by Pacific Concrete. The primary use of the quarry has been to generate rock for concrete and rock for fill in lesser quantities. There now remains only 1-1/2 years' deposit of usable concrete rock at Puu Palailai. Another site for a quarry has been located on the eastern slope of Puu Makakilo. Exhibit I also shows the new location.

In the process of 22 years of quarrying, a 29-acre, 90 foot deep pit with vertical walls has been created. Exhibit II is a photo of the pit. The volume of the pit is 3,300,000 cubic yards and quarrying will cease by the end of 1975.

A number of uses for this pit were studied by a planning consultant - Donald Wolbrink & Associates, Honolulu, Hawaii.

Wolbrink concluded that the several acceptable ultimate uses for the pit would each require filling it up to carefully planned contours. These contours would provide the optimum in agricultural or recreational use. Solid ground area surrounding the contoured filled site could be devoted to residential use. However, to purchase and transport material to fill this pit would not only be economically impossible but would require 20-30 years to complete.

A sanitary landfill is an appropriate method for filling the site since it fills a known city-wide need and would be completed within ten years after beginning operations. Exhibit III is a map of the final fill contour lines overlaid on existing contours.

The summary of "Solid Waste Management Plan for City and County of Honolulu - Supplement to Hawaii State Solid Waste Management Plan" submitted to

Dr. Walter B. Quisenberry, director, State Department of Health, in July, 1971, was compiled by Metcalf & Eddy Consultants.* Pages 16, 17, and 18 (Exhibit IV) of this report are submitted as justification for the use of the pit at Puu Palailai as a landfill site. The original site recommended in this report for location in the Ewa-Waianae area was a site in Nanakuli. This site has been found to be unavailable due to commitment to the Model Cities' program for low-income housing. The capacity of the Nanakuli site was estimated to be 7,700,000 cubic yards on 300 acres. The Puu Palailai site has a capacity of 3,300,000 cubic yards or 43 percent of the Nanakuli site but the Palailai site encompasses only 29 acres or 9.3 percent of the size of the Nanakuli site. The Palailai landfill operation will therefore occupy a relatively small area.

Although the pit is presently unsuitable for optimum use, a landfill at Palailai will create a site suitable for agricultural or recreational use. The surrounding area will then become suitable for residential use. Present technology does not allow for economic residential construction on a landfill due to the expense of driving piles or prestressing concrete slabs to preclude settling problems.

Exhibit V is a letter from the Director and Chief Engineer, City and County of Honolulu, indicating the Department of Public Works approval of this landfill.

The entire fill operation, including access to the fill site, has been evaluated from an environmental impact standpoint and is in conformance with the laws of the City and County of Honolulu and the State of Hawaii.

2. Operation of the Landfill

   a. Traffic access to the site entrance is directly off Farrington Highway, 1,200 feet from the H-1 and 1,200 feet from Kalaeloa Boulevard.

   b. Traffic volume into the site will be approximately 144 trucks per day varying in size from

*The complete Metcalf & Eddy study for the City and County of Honolulu may be obtained from the office of the Chief Engineer and Director, City and County of Honolulu; or from the office of the Director, State Department of Health.

5,000 pounds GVW to 80,000 pounds GVW. This will be an increase of approximately 17 percent over present traffic but substantially less than that of several prior years.

c. All trucks will be weighed across the existing Pacific Concrete scale as shown on Exhibit III. One scaleman will be on duty from 6:00 a.m. to 5:00 p.m., Monday through Friday, and on Saturday from 7:00 a.m. to 3:00 p.m.

d. Trucks will use only one road from the scale to the fill area. This road is shown in purple on Exhibit III. Note that it is located at the farthest possible distance from Makakilo City. This landfill access road will be 25 feet wide and approximately 1,700 feet long. The road will be oiled as necessary. A combination oil-water truck will be used six days per week for road and landfill dust suppression.

e. The landfill will progress from the lowest elevation in lift I shown on Exhibit III through lifts II, III, and IV. The operation will never be visible from any Makakilo residence. Note Exhibit VI.

f. Approximately 500-600 tons of refuse will be compacted daily.

g. None of the landfill traffic goes through or near any residential area. Exhibit II shows the access and distance from residential areas.

h. No chemicals, radioactive wastes, or whole animal carcasses will be accepted.

i. Refuse from the commercial and City haulers will be discharged in a confined area.

j. One Cat. D-8 tractor will spread refuse into layers not more than 2 feet thick and compact the refuse by repeated passes on each layer as shown in Exhibit VII. At the close of each day's work, the working face will be covered with a minimum of 6 inches of cover material composed of dirt, cinder, and rocks no bigger than 2 inches in diameter. The top will be closed with a minimum of 6 inches of compacted cover material. The D-8 will continually run

back and forth over refuse from 6:30 a.m. to 5:00 p.m. compacting it from an uncompacted density of 400 or 500 pounds per cubic yard to approximately 1,100 pounds per cubic yard. From 5:00 p.m. to 6:30 p.m. the D-8 will spread and compact the cover material, thus completely encasing all of that day's refuse in a dirt and rock shell. This dense shell excludes flies, insects, rats, and virtually eliminates odors and unsightliness.

k. The cover material during the first two years will be generated from the present quarry area. During the remaining years of fill life the material will be hauled from the new quarry site at Makakilo.

l. All of the area within the fill that is traversed daily by refuse trucks will be watered as necessary to control dust.

m. When near final elevations above the existing quarry walls are reached, lath-mesh fences will be installed to control any possible blow-about of papers.

n. No refuse truck shall remain in the fill area after its load of refuse has been dumped.

o. The operation will be fully supervised and will be periodically monitored by the City, the Campbell Estate, and the Department of Health.

Exhibit VIII is a copy of the pertinent sections of the lease agreement between Campbell Estate and Pacific Concrete and Rock Company, Limited. Note the specific operating instructions.

B. Impact of Proposed Sanitary Landfill on the Environment

1. Dust and Noise

Operation of a sanitary landfill at Puu Palailai will reduce the dust generated in the quarry area as compared to what it has been during the past 22 years of quarrying.

Potential dust-generating areas include the access road into the fill site, refuse as it is

spread and compacted, cover material as it is spread and compacted, and the cover material on final elevations. Controlling methods to be used to suppress the dust will be water, oil, and the planting of vegetation to trap dust and also to prevent dust from becoming airborne. The 1,700 foot long, 25 foot wide road into the fill site will be oiled as necessary. It will be watered once a day. A photograph of the oil-water truck is attached (Exhibit IXA). Refuse as it is spread and compacted, will need no treatment. Sixty-six percent of Honolulu's refuse is composed of paper, wood, and trimmings. Cover material, as it is spread and compacted, will require a wetting after the last compaction pass. This wetting will help to cement the surface. The cover material on the final elevations will be planted to grass within two weeks after the final layer of cover material is in place.

The dust concentrations that can be expected to be generated by landfill operations are not presently known but estimates based on post sampling results of quarry operations indicate that State Department of Health Air Pollution Regulations can be met. Chapter 43 of the Public Health Regulations allows concentrations of 150 micrograms per cubic meter above ambient levels. Trade winds, which blow 70 percent of the time, carry fugitive dust toward Farrington Highway, the H-1, and into sugar cane fields on agriculturally-zoned lands. The maximum concentration of 150 micrograms per cubic meter above ambient has been established by the Department of Health as non-injurious to plant and animal life.

The effect of landfilling operations with attendant dust control measures will be to reduce the dust at the site boundary from the present values noted in Exhibit IXB (under normal quarry operating conditions) by at least 50 percent and probably closer to 75 percent. State Department of Health Air Pollution Regulations should thus easily be met.

Operation of a sanitary landfill at Puu Palailai will also reduce the noise in the quarry area as compared to what it has been during the past 22 years of quarrying.

Noise can be expected to be generated by the refuse trucks, the D-8 tractor, the oil-water truck, and the dump trucks hauling cover material. The maximum noise level that can be expected during the landfill

operation will be approximately 70 dBA at the nearest boundaries of the buffer zones. The operation can be expected to produce a sound pressure level of approximately 65 dBA at the nearest residence when all noise sources are at their closest approach to the property boundaries. Ambient is approximately 50 dBA when no operations are in progress. The City Comprehensive Zoning Code allows a varying noise level for each of a series of frequencies as noted in Exhibit IXB. The estimated sanitary landfill noise levels are shown to be essentially within levels permitted by the CZC since the values calculated above are maximum values and will not normally exist for prolonged periods of time during the year.

The attached dust and noise analyses by Mr. Fred Hertlein III, Exhibit IXB, detail the studies establishing the estimated noise and dust values. To assure that these dust concentrations and noise levels comply with State and City and County regulations, a local firm of environmental consultants will be retained to monitor these critical parameters on a semi-annual basis.

2. Contamination of Groundwater Due to Leachate

Rainfall at the Puu Palailai quarry site averages 21 inches per year, representing about 16.6 million gallons of water annually on the 29 acres involved. At present, there is no surface runoff from the quarry, hence infiltration and evaporation account for the entire water yield. The groundwater surface (piezometric height) is located at approximately 87 feet below the deepest portion of the quarry. Existing groundwater is brackish. Samples from an existing well at the quarry site show 650 mg/l of chlorides.

Hydrologic data from the Board of Water Supply show the Puu Palailai site to be isolated on either side by basalt rock intrusions or sedimentary layers. These data also indicate the presence of a water pressure barrier on the northeast (mauka) side which limits leachate travel. Exhibit X is a copy of the Board of Water Supply year 2020 Plan Map of these hydrologic barriers. Water entering underlying strata at the quarry site is excluded from all but the southeast area (makai) - the area shown in red in Exhibit X. Possible contamination of groundwater by leachate therefore depends upon water entering the landfill during its construction or after completion of the fill, and percolating downward through the

fill and through the existing quarry bottom and underlying 87 foot thick geological formation. Plans for grading and maintaining the finished landfill will insure a maximum of surface runoff from the site to an existing irrigation ditch and a million gallon irrigation reservoir. With an annual rainfall of only 21 inches (established by the Board of Water Supply) there should be a relatively small amount of water movement downward through the compacted refuse. To intercept any percolating water which may occur, together with liquids which may result from the decomposition of organic matter, the fill site is to be sealed with an impermeable engineered soil stratum approved by the Board of Water Supply and overlain by a pervious drainage stratum leading to a sump and a well. This sump and well will allow for inspection or removal of leachate for treatment should such a need ever arise. To further minimize the quantity and maximize the quality of any leachate which develops, no chemicals, radioactive wastes or whole animal carcasses will be allowed in the landfill. Every load of refuse will be observed by the D-8 operator who will hold the person who dumped a questionable load and isolate the load for examination by the fill supervisor. If the materials are not acceptable, the hauler must pick up the items and see the Department of Health for disposal instructions. An appropriate sign will be posted at the entrance explaining forbidden refuse.

The Environmental Protection Agency's manual on "Sanitary Landfill Design and Operation (1971)," cites the impermeable liner as a practical method. See Exhibit XI, page 54. The feasibility of constructing such an impermeable liner from materials available at the site is attested to by the engineering specifications of Dames and Moore, Consulting Engineers (Exhibit XII attached).

Construction of the landfill is to begin at the deepest (sump) end of the quarry. Any rain water which might flow from higher elevations of the quarry floor will be excluded from the filling site by a small earthen-ridge dam and permitted to percolate downward in the normal manner (Exhibit XIII). Rainfall directly on the filled area during construction may produce a leachate. This will be withdrawn via the sump, diluted with brackish water and used for dust control on the cap rock areas makai of the H-1 and Farrington. The Board of Water

Supply has approved this method of leachate disposal.

3. Indigenous Botanical and Zoological Species

There are no botanically or zoologically endangered species in this 29-acre, actively quarried man-made pit.

C. Probable Adverse Environmental Effects Which Cannot Be Avoided

1. Dust

The introduction of dust into the air during landfilling operations, if no dust control measures were taken, might have an adverse effect on a part of the leeward (dust affected) ecosystem. According to particle size estimates provided by Fred Hertlein, dust generated by the landfill operation and airborne beyond the landfill buffer boundary will probably be in the range of 10 microns and smaller. The ecosystems which might be affected could be botanical or zoological. There are no residences in the leeward area and the introduction of homes in the next 10 years in the very small area not in cane or being quarried is highly unlikely because this terrain is rocky with an average slope of over 35 percent. The majority of the leeward terrain is planted in sugar cane and it is the major leeward botanical species and will not be removed from culture until 1995. According to the Oahu Sugar plantation manager, the cane growth adjacent to the existing quarry operation is affected to such a minor extent by dust from the existing quarry operations that he cannot warrant any attempt to analyze the dust's effect on the growth rate. Therefore, there should be even lesser effects on the leeward cane resulting from the landfill operation, which can be expected to generate only about 25 percent as much dust as the present quarry operations. The effect of dust on the leeward animal population is considerably more difficult to establish. The two major types of animals known to exist in the leeward area are rats and mongooses. Since these are burrowing animals, it is suspected that they are more tolerant to dust than human beings are but this cannot be established with absolute certainty. It is nevertheless felt that dust generated should have minimal adverse effect on the leeward ecosystems. Dust

levels will be monitored semi-annually to assure compliance with local regulations.

2. Noise

During the filling phase, the noise generated by the D-8 tractor, the oil-water truck, and the dump and refuse trucks will be minor since the steep quarry walls will attenuate much of the noise. All equipment will be outfitted with mufflers to reduce noise to the greatest degree possible. It has been shown that when all operating equipment is at the property boundary closest to Makakilo, noise levels of about 70 dBA can be expected at the property boundary while levels of 65 dBA can be expected at the nearest residences. Since the equipment is not located this close to the property boundary at Makakilo for very long periods of time throughout a normal year, these levels, which are slightly in excess of ambient, should be barely noticeable. In summary, adverse environmental effects outside the buffer boundaries due to noise should be minimal. Noise levels will be monitored semi-annually to assure compliance with the noise code in the CZC.

3. Insects and Rodents

The Los Angeles County Sanitation Districts, in their sanitary landfills adjacent to high-value residential areas, have demonstrated that any problems of insects and rodents are negligible in their sanitary landfills. Similarly the EPA (Exhibit XIV) reports that rats and flies are seldom troublesome at properly constructed landfills and that the use of insecticides is normally precluded by the use of cover materials. Inasmuch as the Los Angeles methods are to be used, the landfill will not cause any appreciable increase in fly or rodent populations over present levels. If necessary, an insect and rodent control program could be instituted.

4. Leaching

Management of any leachates during the period of construction of the landfill requires that they be diluted and used for dust control in cap rock areas. This procedure has been approved by the Board of Water Supply. On occasion, the smell of these leachates may be detectable to the site operators and undetectable to humans at the buffer boundary due to the dilution with water.

The Board of Water Supply has agreed to a Class II (all wastes except chemicals, radioactive wastes, and whole animal carcasses) landfill provided an impermeable liner is installed to entrap the leachates. Refer to their letter of agreement, Exhibit XV.

D. Alternates to the Proposed Action

There are many alternatives (both mechanical and geographical) to a sanitary landfill at Palailai. The most obvious ones are contained in the Metcalf & Eddy report. See Exhibit XVI.

The majority of the Metcalf & Eddy refuse disposal alternatives fall into two categories. The first is a set of mechanical treatments of refuse primarily to reduce bulk. One of these (incineration) is presently in use by the City but the cost per refuse ton is high and the pollution of air still occurs in varying degrees. Incineration still leaves a residue of 20-30 percent which must be disposed of on land. Another mechanical technique is baling, which is also more costly than conventional landfill and is still experimental. Any of the alternatives continue to (except ocean dumping of baled refuse) require an on-land disposal site.

The second set of alternatives is a series of landfill sites to serve the present and near future needs (10-20 years) for uncompacted, incinerated or compacted refuse. A committee of private citizens headed by Col. H. Wells (Ret.) assisted in evaluation and selection of many sites around Oahu. The landfill sites with the least ecological and economical problems were selected and shown on page 110 and itemized on page 111 of the Metcalf & Eddy report.

The recommended Central Oahu site of Wahiawa has been rejected by the Board of Water Supply as being adjacent to active wells pumping potable water not presently requiring treatment. The Nanakuli site has since been rejected due to prior commitment for a Model Cities' project.

The Pacific Concrete Palailai quarry site was not chosen as a site because the committee and consultants were not aware that the quarry was within 1-1/2 years' of exhaustion.

From an ecological and economical standpoint, this Palailai site is the preferable one for the Pearl City, Waipahu, Ewa, Nanakuli, and Waianae area.

It will be the first sanitary landfill in the State of Hawaii which is open to the public. The operation of a public sanitary landfill will be a definite step up in the technology of solid waste management in Hawaii.

E. The Relationship Between Local Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The local short-term (4-10 years) use of the 90 foot deep pit, as mentioned previously, is to place a series of layers of refuse and dirt cover with the cover occupying approximately 20 percent of the total volume of the fill. One of the short-term impacts will be to continue generation of cinder and soil dust at the site for the next 10 years but in a decreased amount than has been generated for the past 22 years. Similarly, noise generation will continue but in a considerably reduced amount over the past 22 years.

The short-term use of this pit as a true sanitary landfill allows the City to relegate the Waipahu dump to a lesser role, primarily that of receiving incinerated materials from the three City incinerators. This could result in a lessening pollution of the waters of Pearl Harbor and an improved atmosphere due to a reduction in fires which presently occur in the dump due to the absence of layers of cover material.

An unknown quantity and quality of leachate will be generated, possibly for many years at the Palailai landfill site. A typical chemical analysis of leachates from the Public Health Service sanitary landfill experimentation test well gives some indication of the quality of the leachates that may be expected (Exhibit XVII). The Board of Water Supply has stated that the existing groundwater beneath the site is brackish and will require treatment to render it potable. But, the Board of Water Supply also requires an impermeable layer at the bottom of the landfill to trap all leachates.

The disposal of City and County of Honolulu refuse in an ecologically and economically sound sanitary landfill site for 4-10 years allows the City Public Works time to develop a long-term solution to the City's refuse disposal problem. A minimum of four years for engineering experimentation and development of alternatives such as baling, recycling, etc. could result in a refuse solution which could allow full long-term economical productivity of refuse disposal and simultaneously upgrade the environment.

The restoration of the 29-acre pit to near original contours will allow agricultural or recreational use which will enhance long-term productivity of the area. A 29-acre recreational site surrounded by residences could serve all of the people who live at Makakilo City (presently 1,500 homes).

F. Irreversible and Irretrievable Commitment of Resources

The sanitary landfill will overlie the brackish water table under the site with a possible source of leachate for many years. Since the quantity and quality of leachates are relatively unknown, the site will be lined with an impervious lining which will trap and pond the leachate. The leachate will then be pumped to the surface as it accumulates, diluted with water and sprayed on the surface of the ground for dust control in cap rock areas.

The placing of refuse into this fill area does in all likelihood irretrievably commit the refuse (if refuse can be considered a resource) to this site. The refuse cannot be reclaimed at a future date because the site will serve as a recreational area for Makakilo residents.

The dirt cover material used for daily cover of the refuse is also irretrievably committed to the site. This material will be relatively coarse and normally suitable only as fill material.

G. Environmental Monitoring

A joint program could be established with the City and the University of Hawaii to monitor leachates. This would be a unique situation in that the site is not now used for refuse fill, the walls of the site are vertical, the depth of refuse is great, the runoff from adjacent areas into the site is nil, and there will be no other extraneous sources of water except rainfall and that used for dust control.

The installation of the first public sanitary landfill in Hawaii could allow the use of this operation as a model for any future landfills. Physical monitoring of various aspects of this fill could assist in establishing firm criteria for other future landfills particularly ones which might be situated further inland over potable water sources.

H. Short-Term Cost/Benefit Analysis

The Palailai crater quarry is a unique site for a sanitary landfill. Favorable geologic and geographic features serve to keep short-term capital expenditures and short-term environmental degradation to a minimum.

The site is geologically isolated from the Waianae Range. This isolation precludes requirements for extensive and expensive surface water diversionary ditches. Its location also precludes expensive or impossible to control major subsurface percolation into the fill from adjacent areas (no apparent water seepage has ever occurred through existing vertical walls even during months of heavy rainfall).

The site's relative distance from the nearest housing and the geographical crater-ridge characteristics all serve to isolate the fill visually, thus obviating expensive berm construction.

While the site is not visible from any residences, its location near the fast-growing Pearl City, Waipahu, Ewa, and Nanakuli areas will result in haul savings to the City and commercial refuse haulers of $500 per day total over a haul to the originally proposed Nanakuli site (now unavailable). This would have been an annual savings of $225,000 and is due to a reduced haul distance of five miles at 20¢ per ton mile (note Section II, page 33).

The possible problem of leachate contamination of groundwater (although not proven to contaminate groundwater beyond potability when separated from fill by many feet of rock and cinder strata) will be solved by installation of an impervious lining in the bottom of the entire landfill area (29 acres). This involves an expenditure of $200,000 to $250,000. The Board of Water Supply has stated that phenols in the leachates might contaminate the groundwater. The lining is an insurance against the possible future discovery that contaminants in the leachates are truly harmful or expensive to remove from groundwater.

A study is presently being conducted by the University of Hawaii on the leachates generated by the Waipahu dump. The result of this study should establish the contamination potential of leachates.

The site's closeness and direct ease of access to the H-1 precludes extensive access road construction.

The short-term economic cost of implementing environmental quality control programs will be as follows:

Dust control - oil-water truck, including operator	$30,000/yr.
Noise control - noise suppressing mufflers on D-8, and oil truck	*500/yr.
Leachate control - line approximately five acres annually and dispose of leachate	50,000/yr.
Rodent and fly control - infrequent or semi-annual spraying and poisoning may be required	1,000/yr.
Monitoring of dust and noise by a private consultant - two times/yr.	2,000/yr.
Total	$83,500/yr.

The short-term cost to the environment of minor amounts of dust and noise generated by the landfill operation have been proven to be minimal as shown by Exhibit IXB.

The short-term economic benefits of the landfill are the inexpensive disposal versus $8-$12 for incineration, Exhibit XVI, page 75, Metcalf & Eddy Report illustrates costs/ton) of City and commercial refuse. The City's incinerators are only adequate to handle a total of 1,000 tons (Exhibit XVI, page 111) a day of which 250 tons (Metcalf & Eddy Report) continue to remain after incineration and must be landfilled (Exhibit XVI, page 105). The unincinerated 1,200 tons per day must also be landfilled or two new incinerators must be built to handle this amount. A landfill operation at Palailai (500-600 tons per day) will therefore save the City the cost of one new incinerator ($5 million) during the life of the landfill.

The cost difference between incineration and landfill is approximately $5/ton. The landfill site will accept 600 tons per day or a daily savings to the City and commercial haulers of $3,000. A per year savings of approximately $900,000 will be generated during the life of the landfill.

*replaced every other year

I. Long-Term Cost/Benefit Analysis

Except for leachate disposal, the long-term environmental degradation will be minor since the site will become quiescent from a landfill standpoint at the end of 10 years. Experimental disposal of leachate might be accomplished by jet injection wells piping leachate 100 feet below the brackish water level and similar in principle to the wells used at Waimanalo to dispose of sewage. The leachate could also be disposed of into a sewer system. This leachate disposal may continue indefinitely.

The long-term major benefits will accrue from the landscaping of the site into a park-recreational area. The grass, shrubs, and trees will renew the atmosphere through the O_2-CO_2 cycle. This botanical addition will contribute considerably more to the improvement of the environment. The creation of a 29-acre park-recreation site will benefit the adjacent Makakilo residents both physically and physiologically in perpetuity versus the present 90 foot deep pit which could have limited if any benefits.

The creation of a large park-recreation area will result in increased property values for all lands surrounding the park. The largest increase in value will accrue to the closest property which is undeveloped. But, the houses presently located along the periphery of the undeveloped area may also experience some increase due to the elimination of the quarry site as an "attractive nuisance" and creation of a usable recreation area.

The generation of refuse by the public is increasing nation-wide at an annual rate of 50 percent more than the population increases. The 4-10 years of the Palailai landfill life will allow time for development of efficient hardware for refuse collecting, recycling, volume reducing, and disposing. For example, this increase in time span allows for economic evaluation of the baling of refuse. Baling has dual advantages of bulk reduction (reducing hauling and disposal costs) and creating as nearly inert a package from refuse as is presently technically and economically available. Four additional years of engineering development and economic study should allow integration of baling into the City of Honolulu's refuse handling program if baling proves feasible.

PUU MAKAKILO QUARRY OPERATION EXHIBITS

1. Exhibit I: Map--Topography and location of quarry and access road.

   U.S.G.S. contour map. Ewa quadrangle, Oahu. Map showing topography and location of quarry, buffer zone, access road and finishing site.

2. Exhibit II (A): Report--"Geological Reconnaissance of the Waianae Range," by Leonard Palmer.

   A report for Pacific Concrete by Leonard Palmer assessing the Waianae Range for high-quality, quarriable rock suitable for use in concrete.

3. Exhibit II (B): Report--"Geological Reconnaissance of Puu Makakilo," by Leonard Palmer.

   A report for Pacific Concrete by Leonard Palmer assessing Puu Makakilo for high-quality, quarriable rock suitable for use in concrete.

4. II (C): Map--State Zoning Map of Oahu.

   State zoning map indicating urban, agricultural and conservation zone districts of the island of Oahu.

5. Exhibit III: Letter--Fred Bennion, Tax Foundation of Hawaii.

   A letter from Fred Bennion (Tax Foundation of Hawaii) illustrating the company's contribution from a tax standpoint to the support of the State government and economy.

6. Exhibit IV (A): Photos--Existing vegetation and topography of Puu Makakilo.

   Photos illustrating typical vegetation on the quarry site. The vegetation consists primarily of grasses and kiawe bushes.

7. Exhibit IV (B): Print--Existing and proposed finish slope plan.

   A graphic description of the existing slopes overlain by the ultimate-level-benches generated after quarrying.

8. V (A): Print--Plant site, access road map.

   A contour map of the quarry and processing site schematically

depicting the access road and various quarry facilities.

9. Exhibit V (B): Print--Profile and line of sight from Farrington Highway.

   A schematic to scale drawing depicting the shielding of stockpiles from drivers view using oleander plantings and landscaped earthen berms.

10. Exhibit V (C): Profile and line of sight from Farrington Highway.

    A schematic to scale drawing depicting the shielding of the processing plant from drivers view using oleander plantings and landscaped earthen berms.

11. Exhibit V (D): Report, Sketches--Detailed landscape plan.

    A set of landscaping specifications and sketches developed by Donald Wolbrink & Associates to hide the entire operation from view and to preclude any erosion problems.

12. Exhibit VI: Print--Incremental development (in acres and time phase) map.

    A map to scale of the actual to be quarried areas showing areas to be quarried by year and to scale location and size.

13. Exhibit VII: Print--Location of berms and drainage swales.

    A map to scale showing location of berms to shield the upper site from view and drainage swales to preclude erosion.

14. Exhibit VIII: Photos--Quarry equipment.

    A series of photos showing both mobile and stationary quarry equipment which will be installed and used on the quarry and processing plant.

15. Exhibit IX (A): Print--Honolulu end profile plan.

    A map to scale of the actual quarry site illustrating line of sight from a typical position on H-1 Honolulu side of the quarry site.

16. Exhibit IX (B): Print--Profile and line of sight from Honolulu end.

    A sketch to scale showing a cross section taken down through the three previously mentioned lines of sight.

17. Exhibit X (A): Print--Makai end profile plan.

    A map to scale of the actual quarry site illustrating line of sight from a typical position immediately below (makai) the quarry site.

18. Exhibit X (B, C, D): Prints--Profile and line of sight from makai end.

    Sketches to scale showing a cross section taken down through the previously mentioned lines of sight.

19. Exhibit XI: Report--Muffler specifications.

    A list of most mobile equipment to be used in the quarry and the types of mufflers to be used to maintain quiet equipment.

20. Exhibit XII: Report--Department of Health: Public Health Regulations, "Air Pollution Control," Chap. 43, pp. 11-12.

    A publication by the Department of Health itemizing the regulations for air pollution control of fugitive dust.

21. Exhibit XIII: Report--Dust collection principles.

    An excerpt illustrating the reasons for dust collection, equipment selection criteria and dust sizes generated.

22. Exhibit XIV: Sketch--Dust control at primary crusher.

    A sketch illustrating the points at the primary or initial crushing area where water and a surfactant will be sprayed on the rock to keep dust to a minimum.

23. Exhibit XV: Sketch--Dust control for crushers, surge piles, conveyors.

    A sketch illustrating the points at the surge pile, crusher and conveyors where water and a surfactant will be sprayed on the rock to keep dust to a minimum.

24. Exhibit XVI: Report--Air cleaning equipment.

    A brief analysis of dust control using air filtering techniques.

25. Exhibit XVII: Report--Protection of storage piles.

    Additional information on application of water and a

surfactant to large stockpiles to maintain wet and therefore dustless stockpiles.

26. Exhibit XVIII: Report--Halawa dust study, Board of Health regulations on air pollution, Chap. 31.

    A study by the Director of Health on Halawa Quarry's dust generation over a period of approximately 10 days during 1970.

27. Exhibit XIX (A): Map--Stilling basin location.

    A map to scale showing stilling basin locations and dimensions. This stilling basin will settle particles during heavy rainfall periods.

28. Exhibit XIX (B): Map--Water runoff patterns.

    Water runoff patterns, swale and basin locations superimposed upon a U.S.G.S. map, Ewa quadrangle.

29. Exhibit XX: Print--Master grading plan.

    A sketch showing final grades of the quarry area when the quarrying has been completed.

30. Exhibit XXI: Print--Residential end-use map.

    A map by Donald Wolbrink conforming to the City's Detailed Land Use Map for the area showing residential and school locations on the final elevations after quarrying has been completed.

PUU PALAILAI SANITARY LANDFILL EXHIBITS

1. Exhibit I: Map--Topography of landfill and option areas.

   U.S.G.S. contour map. Ewa quadrangle, Oahu. Map showing topography and location of sanitary landfill and new quarry area where cover material will be obtained for landfill.

2. Exhibit II: Photo--Aerial view of landfill site and access roads.

   An aerial photo showing the landfill site, wind direction, access to the landfill from H-1 and Farrington and the nearest residences.

3. Exhibit III: Print--Landfill and borrow (excavation) area boundaries.

   A map to scale showing actual landfill and borrow area boundaries.

4. Exhibit IV: Report--Metcalf & Eddy, pp. 16-18.

   An excerpt from Metcalf & Eddy study for the Department of Health and the City on refuse disposal. This study illustrates the need for a new sanitary landfill site in the west end of Oahu.

5. Exhibit V: Letter--Department of Public Works approval.

   A letter from the City and County of Honolulu's Public Works signed by the Director and Chief Engineer indicating that department's approval for a sanitary landfill at Puu Palailai.

6. Exhibit VI: Print--Profile and line of sight from nearest Makakilo residence.

   A map to scale showing a line of sight from the nearest Makakilo residence demonstrating that the landfill operations will never be visible from Makakilo City.

7. Exhibit VII: Sketch--Vertical section of landfill technique.

   A vertical cross section showing the various components which will comprise the sanitary landfill at Puu Palailai.

8. Exhibit VIII: Contract--Campbell Estate Lease Agreement.

A contract between Pacific Concrete (operators) and Campbell Estate (landowners) to operate a sanitary landfill using the most modern known engineering techniques.

9. Exhibit IX (A): Photo--Oil and water truck.

   A photo of the oil and water truck which will be used daily on the road and sanitary landfill at Puu Palailai.

10. Exhibit IX (B): Report--Hertlein noise and dust study.

    Not available.

11. Exhibit X: Map--Board of Water Supply: Hydrology and leachate travel on Oahu.

    A map developed by the Board of Water Supply (Honolulu) showing groundwater extent and quality underlying the landfill area.

12. Exhibit XI: Report--U.S. Environmental Protection Agency: "Sanitary Landfill Design and Operation," pp. 53-54.

    Excerpts from the U.S. Environmental Protection Agency booklet on sanitary landfill design and operation indicating one method of lining the bottom of a sanitary landfill to preclude leachate travel.

13. Exhibit XII: Report--Dames and Moore statement on impervious quarry lining.

    To be completed.

14. Exhibit XIII: Sketch--Cross-section of landfill design with earthen-ridge dam.

    A sketch illustrating a temporary earthen dam above the sanitary landfill site to exclude any possibility of rainfall runoff onto the already filled site.

15. Exhibit XIV: Report--U.S. Environmental Protection Agency: "Sanitary Landfill Design and Operation," pp. 90-94.

    Excerpts from the U.S. Environmental Protection Agency booklet on sanitary landfill design and operation illustrating the minimal problems with rats, flies and birds and also control thereof if necessary.

16. Exhibit XV: Letter--Board of Water Supply approval.

A letter from George Yuen, Manager and Chief Engineer, Board of Water Supply (Honolulu) approving the sanitary landfill providing leachate is trapped with an impervious liner.

17. Exhibit XVI: Report--Metcalf & Eddy, pp. 73-75, 100, 103-121.

Excerpts from Metcalf & Eddy's study for the State and City illustrating the alternatives for the handling and disposing of refuse on Oahu and the economic and practical desirability of a sanitary landfill on the west end of Oahu.

18. Exhibit XVII: Report--Board of Health: "Pollution of Subsurface Water by Sanitary Landfills," pp.9-15.

Excerpts from a study of a mainland sanitary landfill indicating the composition of leachates and giving a general idea of leachate travel in the subsurface.

19. Exhibit XVIII: Report--P. H. McGauhey, with correction letter.

An analysis by Dr. P. H. McGauhey, Director Emeritus, Sanitary Engineering Research Laboratory, University of California, indicating the practicability of installing and operating a sanitary landfill at Puu Palailai.

20. Exhibit XIX: Photos-Los Angeles sanitary landfill.

Photos of a former sanitary landfill in the Palos Verdes area of Southern California which is now a botanical garden and park. Also, photos of a recently completed unlandscaped sanitary landfill north of Westwood California showing $150,000 homes which have been adjacent to the landfill while it was active.

21. Exhibit XX: Photo-Contour map of landfill area.

A map to scale showing the contours (elevation) of the existing Puu Palailai quarry site which will be filled with refuse.

22. Exhibit XXI: Print--Cross-section with existing and restoration grades.

A sketch to scale showing typical cross section views of the quarried out hole as it exists now and the final contours after the sanitary landfill is completed. These cross

sections are made Honolulu-Ewa direction.

23. Exhibit XXII: Print--Longitudinal section (Mauka-Makai) of existing and proposed finish grades.

    A sketch to scale showing typical cross section views of the quarried out hole as it exists now and the final contours after the sanitary landfill is completed. These cross sections are made mauka-makai direction.

24. Exhibit XXIII: Print--Landscaping, access roads, and water diversion ditches map.

    A map to scale showing landscaping, access roads, water diversion ditches and an alternate access road which could be incorporated at a later date.

25. Exhibit XXIV: Print--Agricultural re-use.

    A map to scale showing in light green the final flat areas and in darker green the terraces all depicting the total area for possible agricultural re-use.

26. Exhibit XXV: Print--Single-family residential re-use.

    A sketch to scale showing the total area zoned for single family residential use but excluding all construction from the landfill proper with only park and recreational areas on the landfill itself.

27. Exhibit XXVI: Print--High-rise re-use.

    A sketch showing another alternate use incorporating medium and high-rise structures surrounding the landfill with the landfill proper being devoted to park and recreational use only.