HILO COAST PROCESSING COMPANY
PEEPEEKEO, HAWAII

11.4 MM GPY MFG ALCOHOL PLANT
ENVIRONMENTAL IMPACT STUDY

VOLUME IX

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ENVIRONMENTAL IMPACT STUDY

PROPOSED ETHANOL FACILITY

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ENVIRONMENTAL IMPACT STUDY SUMMARY

Environmental Impact Statement For Proposed Motor Fuel Grade Ethanol Plant At Pepeekeo, Hawaii.

This summary will highlight the important elements of the EIS with particular reference to effluent disposal techniques.

The proposed plant will produce 35,000 gallons of absolute alcohol (199 proof) from 450 tons of final molasses per day. Steam, electric power, hot water and 25% of the molasses will be supplied from the parent raw sugar factory and power plant. Cold, fresh water will be furnished from two or more wells to be drilled above the plant and this water will again be used at the sugar mill.

The proposed process will be more efficient thermally and biochemically than are more conventional plants because of the use of a declining thermal gradient, a rigorous molasses clarification and a yeast recycling technique. The improved techniques reduce the quantities and types of materials in the waste stream, whch is a non-toxic aqueous effluent.

The placement of the plant as an adjunct to the existing facilities minimizes environmental effects while optimizing economic and social factors. The site would be immediately adjacent to the power plant in a vacated urban residential area of 11.3 acres which would be rezoned as urban industrial.
There would be no relocation of people required and no unique environmental conditions or species would be encountered because the area has been composed of residences and yards for decades.

The workforce and technological requirements will be fulfilled by the local community without dislocation of the existing infrastructure. Some specialized training would be supplied by the process engineering consultants upon plant completion.

The installation of the proposed facility as an integral part of the existing facility established the concept of containing the effluent loading of the ethanol operation within the environmental limits of the permits for the existing plant. This procedure improves the probability of the ethanol operation becoming feasible, saves energy and facilitates regulatory control by containing all the effluents within the present sampling and monitoring stations. A discussion of the logic and economic urgency of using the existing system for all factory effluents can be found in Appendix A and Section B of Part VII.

Adverse environmental conditions resulting from the proposed action would be transitory, occurring during construction, except that a minor and variable impact upon traffic on the main highway would occur. The degree of impact on any particular day would depend in large part upon the amount of cane hauling occurring at the same time on the same segment of highway.

PART I

INTRODUCTION

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INTRODUCTION

Industry and government began to show an interest in energy self-sufficiency for the State of Hawaii during the early 1970's and, in particular, after the 'oil shock' of 1973. The Hilo Coast Processing Company began installation of a power generation complex in 1971 to furnish firm electric power from sugar cane fiber for the local public utility. The installation was completed in 1974 and was well matured by 1977. In that year a study by the Stanford Research Institute and the Hawaii Natural Energy Institute, an arm of the University of Hawaii, entitled "Biomass Energy For Hawaii," stated that the Pepeekeo factory of HCPC would be a feasible location for an ethanol plant because of the availability of steam and electric power. A year or two later the sugar industry completed a review of the economic aspects of ethanol production which indicated that a single plant near Hilo on the Island of Hawaii had the best chance of survival.

In September, 1980, the Hilo Coast Processing Company (HCPC) was awarded a grant from the U.S. Department of Energy for a "Feasibility Study and Definitive Engineering For a Molasses Based Motor Fuel Grade Alcohol Facility," which was intended to provide the technical and economic bases for the installation of a plant of adequate capacity to furnish a substantial amount of high-grade alcohol to be used in place of the petroleum fuels now imported to Hawaii. The Hawaii County General Plan was revised by several ordinances in 1979 and 1980 which established the goals of energy self-sufficiency and development of the County as a demonstration community for the development and use of natural energy resources. The proposed ethanol plant would be an early step toward the achievement of those goals.

The assessment which follows has been prepared to provide the information needed by persons in both the public and the private sectors who must evaluate the proposal or who otherwise have an interest therein. The State of Hawaii has a comprehensive statutory background of environmental control which closely follows Federal standards and which mandates several County regulatory efforts in this regard. Therefore, in order to facilitate the review process, Appendix C has been prepared to illustrate applicable Federal statutes and the appropriate state and county rules and regulations.

PART II

DESCRIPTION OF PROPOSED PLANT

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DESCRIPTION OF PROPOSED PLANT

CONSTRUCTION OF AN ALCOHOL DISTILLERY FOR PRODUCTION OF MOTOR FUEL

Although the economic viability of the proposed plant has not yet been demonstrated, it is appropriate, and necessary, to evaluate the probable effects of the facility upon the community and its life-style.

The ethanol plant would be located within 150 yards of the existing sugar mill and power plant at Pepeekeo in a mauka-Hamakua direction and would all be mauka of the Special Management Area (SMA) except for a pipe-rack carrying steam, electric power and other materials (described later) between the existing plant and the new one. Nearly all of the existing factory facilities at HCPC were automatically included in the SMA when it was established, thus mandating SMA permits for all future changes or additions in the area.

The planned facility would produce a fuel-grade ethyl alcohol (ethanol) which would be 199 proof (99.5) absolute alcohol. The alcohol would be produced by fermentation of molasses from Hawaiian sugar mills, including that from HCPC. It is expected that the initial production rate would be about 11.5 million gallons per year, with the capability of future expansion of 23 million gallons per year.

A. Process Description

It is planned that molasses from the sugar mill would flow to a molasses storage tank at the ethanol plant which would also receive molasses by truck from other Hawaiian sugar factories. The molasses would be prepared for fermentation by dilution with hot water and treatment with sulfuric acid and ammonium sulfate, followed by a centrifugal separation to remove the solids formed (gypsum crystals) and any other solid impurities.

Fermentation would then take place in several steel tanks for about a day per batch, after which the fermented molasses, called "beer," would again be centrifuged to remove yeast cells before distillation. The separated yeast would then be returned to the fermentation tanks.

After centrifugation the "beer" would be pumped to vertical cylindrical towers where the alcohol would be distilled in three towers to remove all the water and produce absolute alcohol. The third tower would use cyclohexane to remove the final 5% of water from the alcohol and the cyclohexane will be continually recycled in the tower without loss.

The residual liquid remaining in the main tower, after the alcohol has been distilled from the "beer," is called "stillage." The "stillage" contains the organic molasses components which cannot be fermented, together with the soluble inorganic materials originally taken up by the sugar cane from fertilizer. The "stillage," being a molasses residue, is non-toxic and contains organic material, both carbohydrate and protein, in sufficient quantity that it is sometimes economically recoverable as a cattle food supplement. The study will evaluate this possibility, as well as the less favorable possibility that the "stillage" could be burned to produce a low-grade fertilizer. The other options to be considered are biological treatment for decomposition of this nutrient liquid or its discharge into the nutrient-deficient waters of the Pacific Ocean. These options are to be discussed in more detail in Parts IV and VII.

After the alcohol has been boiled off the distillation columns, it would be denatured (made unfit for human use) by the addition of unleaded gasoline at the rate of 2 gallons of gasoline per 100 gallons of alcohol, after which it would be stored in two 500,000 gallon tanks before shipment to Hilo for local use and for transport to the other islands, primarily Oahu.

B. Materials Usage

1. The primary source material would be final molasses, which is an end-product of the manufacture of raw sugar. At present (1981) most of this molasses is shipped to the mainland U.S.A. for sale as a cattle food supplement and a small percentage is used in Hawaii for the same purpose. The total annual production of Hawaiian molasses is about 300,000 tons per year, of which half, or about 150,000 tons, is expected to be used initially at the Pepeekeo plant. The tonnages of molasses produced vary somewhat from year to year, depending upon the quality of the sugar cane crop. The quantities mentioned here are necessarily approximate within the range of variation of normal agricultural yield and quality. It is expected that the amount of molasses from the HCPC sugar factory will be about 27,000 tons per year, which leaves about 123,000 tons to be obtained from other sources. An estimated 82,000 tons may be available from other sugar mills on the Island of Hawaii, with the remaining 41,000 tons being shipped in from the other islands.

Molasses shipped from off-island would be stored at the Port of Hilo for truck shipment to a 500,000 gallon storage tank at Pepeekeo which would receive all the incoming molasses at the ethanol plant. Port storage would occur in the existing molasses tanks near Pier I at Hilo.

2. Other materials used in quantity would be sulfuric acid and ammonium sulfate. Ammonium sulfate is a common fertilizer and is used in this case as a nutrient for the yeast in the fermentation process. Sulfuric acid, which would be used at the rate of about 6 tons per day, would be received in special shipping containers of about 2,600 gallon capacity, consisting of a standard tank permanently mounted in a box-framed standard open container which would meet all shipping and environmental standards. These containers would be in constant transit between the mainland supplier and the 25,000 gallon storage tank at the plant.

The ammonium sulfate would be used at the rate of about one-half ton per day and would be received either in bags or pellets as fertilizer is often shipped, or would be in bulk containers 1 or 2 tons in size. This material is not hazardous and presents no handling problems.

3. Other materials are used in smaller, not readily definable quantities, such as yeast, iodoform for cleaning fermenter tanks and cyclohexane for removing the last traces of water from ethanol.

a. The yeast used for fermentation of the molasses would be one of the commonly used varieties and would be grown from a small quantity of seed yeast kept under refrigeration at the laboratory of the ethanol plant.

b. Iodoform is a yellow crystalline sterilant slightly soluble in water and is used in place of chlorinated sterilants because it is effective and is more environmentally acceptable than chlorine compounds.

c. Cyclohexane is a colorless liquid about the density of ethanol at room temperature, insoluble in water but soluble in the presence of ethanol at distillation temperatures. The usage of cyclohexane should not exceed four gallons per day. The material is not toxic. It would be used for the production of absolute alcohol.

4. In terms of quantity, the largest volume of material usage would be water, both hot and cold. Hot water would be used for the dilution of molasses to the proper density prior to fermentation and for cleaning purposes. This water is to be obtained as a surplus material from the boiling processes at the sugar factory where water is boiled off the sugar juices to produce crystalline sugar. The usage would be about 300 gpm.

Cold water is to be used for cooling the fermentation tanks; for condensing the distillate from the distillation columns; for fire protection; for pump and equipment cooling water; and for general housekeeping. This water would be obtained from two to four wells drilled in the vicinity of the proposed facility, each well having a maximum capacity of 1750 gpm to permit a usage rate of 4000 to 5000 gpm. Adequate fire protection would be obtained by dedicating the lower 80% of a 500,000 gallon water storage tank to this purpose. The draw-off piping for other uses would be placed to permit use of the water in the upper 20% of the water in the storage tank only. Two or three of the wells would pump water into this tank continuously to replace water drawn off for ethanol production. Any surplus well-water would overflow to the nearby sugar factory reservoir.

C. Materials Output

1. The proposed facility would yield motor fuel grade alcohol as a primary useful product. Other materials would be either of lesser value or would be considered as a waste, depending upon the economic factors to be considered.
2. The fate of the sulfuric acid used is that much is converted to crystalline calcium sulfate in removing calcium salts from the molasses during pre-treatment. Calcium sulfate is the gypsum used in wallboard, but in this case the quantities involved are so small and variable that they are not economically recoverable. The remainder of the acid is consumed in the removal of gums and other organic complexes which would otherwise tend to reduce the molasses fermentation efficiency. The acid also maintains the necessary condition of acidity in the molasses to inhibit the contamination, by bacteria and wild yeasts, of the desired fermentation process.
3. The cooling water used by the ethanol plant would be collected and conveyed to the sugar mill for use in process operations there.

4. Fermentation tank wash water, containing about 0.002% iodoform sterilant would be commingled with other wash waters and pumped to ponds near the sugar factory waste water disposal facility.

5. Solids-bearing fluids from the molasses treatment would also be pumped to settling ponds near the sugar factory ponding system.

6. Carbon dioxide from the fermentation tanks would exhaust to atmosphere through scrubbers designed to prevent the loss of alcohol during fermentation. At present no market exists locally for this by-product.

7. Oxidation products of the distillation of alcohol, called 'light ends,' and consisting mostly of combustible liquids, primarily aldehydes, would be burned in the power plant boiler to avoid the possibility of nuisance odors from these materials.

8. Higher molecular weight alcohols and similar materials, commonly called 'fusel oils,' would be drawn off the distillation of colums and re-injected into the ethanol in very low quantity as a part of the motor fuel. The material would be present in such low concentration as to have no adverse effect upon the combustion of the fuel.

9. Stillage from the primary distillation column (tower) would follow one of several alternative routes. The alternatives were previously mentioned in Part II, A., above and will be discussed in Parts IV and V and Appendix A.

10. Domestic sewage, gray water and laboratory effluents would be conveyed by conventional drains to cesspools located at the project site.

PART III

PROJECT ENVIRONMENT

PART III

PROJECT ENVIRONMENT

A. Location and Geography

The proposed ethanol plant would occupy an area of about ten (10) acres immediately adjacent to the existing Pepeekeo Sugar factory and power plant complex. The existing facilities are just South of Pepeekeo point on the coastline approximately ten miles North of Hilo, Hawaii. At present (1981) the locality consists of about 75 acres zoned urban, consisting of heavy industrial, commercial and residential sub-zoning. The locality is bounded by the Pacific Ocean on the East and by agricultural zoning on all other boundaries.

The residential areas, on the northern and western segments of the locale, have been phased out over a period of several years, as a result of the Clean Water Act which in 1972 prohibited the discharge of untreated domestic sewage into the ocean. The phasing-out of these residential areas is scheduled to be completed by June, 1981. The residents of the area, mostly employees at the sugar factory and power plant, have relocated to the new Kulaimano subdivision at Pepeekeo or have moved elsewhere.

The proposed ethanol plant would be located on land now zoned (Jan. 1981) urban/residential immediately northwest of the Pepeekeo factory industrial area and adjoined thereto. The main access road to the sugar factory comprises the northern boundary of the proposed ethanol plant site and its eastern boundary would be about 600 feet inland of the coastline in order to avoid the 500 foot Special Management Area setback of the Coastal Zone. The southern and western boundaries would be constrained by the existing agricultural land use zoning designation. Work is in progress for the re-zoning of the proposed site from urban residential to urban industrial.

The site for the proposed plant and the contiguous areas have climatic and terrain common to the Hilo-Hamakua coast of the Island of Hawaii. This seacoast consists of rocky cliffs and rough coastline generally inaccessible except from steep trails and gulches, having no beaches, swimming or recreation other than occasional fishing spots frequently unuseable because of the heavy seas. The terrain has an average overall slope of about 8 percent toward the mountain (Mauna Kea) but is cut by numerous large and small gulches carrying the annual 10 foot to 25 foot rainfall to the sea. Most of the land, except for gulches, is under cultivation for sugarcane and other crops to an elevation of about 2,000 feet. The higher lands are in rain forest.

The proposed site is unremarkable when compared to terrain several miles up and down the coast. The soil is a volcanic ash (Appendix H) varying generally in depth from 2 to 15 feet and underlain by typical Hawaiian irregular layers of alternating ash, clay, decomposed rock, medium hard basalt, hard blue basalt and occasional voids due to lava tubes.

B. Land Use

Since the early 1900's the land from the seacoast up to the forest line at about 2000 feet elevation has been under continuous cultivation with sugarcane wherever practicable. In the days of hand labor, many of the gulches were cultivated but the practice has ceased since World War II with the advent of mechanical cultural techniques and harvesting. Along the Hilo coast several sugar mills were located at, or very near, sea level in order to transport cane by flume using water from watersheds near or in the rain forest. The Pepeekeo factory is located on the seacoast, as were adjacent factories to the north and south. These factories were about five miles apart along the coast and each was adjoined by a village which housed the factory management and operational employees and provided general stores, recreational facilities, and theaters. At Pepeekeo the site for the proposed ethanol plant was, until very recently, the location of housing for supervisory and top management personnel in an area of about ten acres adjacent to the factory. Some of the houses have been abandoned and all will soon be empty. The village adjoining this area on the northeast will most probably revert to sugarcane agriculture in part. The balance will probably remain commercial and industrial in nature. The U.S. Coast Guard will undoubtedly continue the use of a piece of land there for the Pepeekeo Light.

As a general statement, it can be said that the area of land along the Hilo coast which is now in sugarcane harvested by HCPC will continue in this use for at least the next ten years. This comment is based on the fact that the original financing for the HCPC sugar cooperative required the dedication of land to sugarcane agriculture for at least twenty years. Ten of those years have elapsed, and, as of 1981, the sugar cooperative remains a viable enterprise in spite of some very bad years for the domestic sugar industry in competition with low-cost foreign sugar. A significant element of land use by HCPC in recent years has been the shut down of three sugar factories within the last several years and the concentration of sugar processing and power generation at the Pepeekeo facility, an action which has reduced the obvious presence of heavy industry without reducing the production needed for the economic health of the community.

At the same time, the phasing-out of the old residential area adjoining the Pepeekeo industrial area has caused a shift of the population center to a new area about 1½ miles from the factory. The result is that the industrial complex is now isolated and out of sight of the residential community. Similarly, the proposed ethanol facility, as a part of the industrial complex, would not be readily apparent. All of these facilities would be visible from the sea and from the air but not easily discerned otherwise because of the surrounding sugar cane fields and hilly terrain. These fields would remain in sugarcane, insofar as can be predicted from present circumstances, and no change of land use out of agriculture can be foreseen as a result of the installation of the ethanol plant. Indeed, it is possible that the viability of agriculture will be improved thereby.

PART IV

LAND USE CONTROL

PART IV

LAND USE CONTROL

The initiation of any sizeable enterprise which is planned to use one or more elements of the ecosphere requires consideration of a broad spectrum of environmental law at all levels of government. Typically, as a minimum, the regulations listed in Appendix C illustrate the scope of Federal environmental statutory requirements. In general, Hawaii State and County regulations are promulgated in concordance with Federal law in a manner intended to achieve satisfactory application of that law for administration at the local level. There are some of the laws of Hawaii which do not have a Federal basis and these usually refer to land use, water use and conservation areas as delineated in State and County General Plans.

The General Plan now in effect for the County of Hawaii was adopted as County Ordinance No. 439 on December 15, 1971, and was revised in 1979 and 1980 by several ordinances in order to provide certain adjustments and clarification to written policies and to develop a new policy element on Energy.

The major policy change which has occurred is the development, in accordance with State policy, of the Hawaii County Energy Policy, which has two goals:

1. to strive towards energy self-sufficiency for Hawaii County, and
2. to establish the Big Island as a demonstration community for the development and use of natural energy resources.

It is of particular interest to note that the conversion of biomass to ethyl alcohol for use as fuel is mentioned as one of the natural energy sources.

The amended General Plan lists eight policies for the achievement of these goals and establishes the rationale for these policies, as described in Appendix D.

One of the eight policies described calls for "a proper balance between the development of alternative energy resources and the preservation of environmental fitness." Two other policies encourage and promote energy conservation. It is evident that the proposed ethanol facility would fit into the framework of these policies and goals.

As a general statement it can be said that in Hawaii the environmental controls for air and water follow Federal guidelines, while those for land use are generally more rigorous than the Federal statutes.

The proposed plant would follow the Federal guidelines established for the effluents from the Hilo/Hamakua Coast sugar factories, as described and directed in the wastewater discharge permits issued by the State of Hawaii with EPA approval (Appendix G) and would be free of air pollutant emissions. Because the proposed ethanol facility would be an integral part of the existing sugar and power generation facility the proposal would be to hold within the existing effluent limits by discharging, monitoring and sampling at the same discharge point. These matters are to be described in detail in Part V. C.3. and Part V. C.4. and Appendix A.

Land use by the ethanol plant would follow existing State land use boundaries without change. There would be a change in the local zoning adjacent to the sugar factory from urban residential to urban industrial for an area of 11.3 acres, of which approximately 10 acres would be used for the ethanol plant and about 1.3 acres for an auxiliary fibrous fuel storage building for the existing power plant. There would be no change in the existing agricultural or urban boundaries.

In summary, the inclusion of the molasses-based ethanol plant at the location of the Pepeekeo sugar factory would blend smoothly with Hawaii State and County planning by moving toward a goal of energy self-sufficiency, concurrently maintaining and strengthening the role of agriculture in the economy of Hawaii. Similarly, as an adjunct to the existing facility, environmental controls would apply and be held within specific limits already established by State and Federal agencies.

Part V

PROBABLE IMPACTS

PART V

PROBABLE IMPACTS

Section A. Anticipated Social Effects

The installation of the ethanol operation can be expected to have beneficial social effects upon the community. Some new skills would be needed for operation of the plant and it is probable that these would be achieved by some of the younger people in the community through preliminary training and start-up instruction by the plant design group on a consulting basis until the plant matures. Once trained, the new personnel would become the permanent operational group.

It is estimated that approximately forty (40) people would be needed to operate the plant and perhaps ten percent of these would be permanent new additions to the community unless there are too few residents available to fill the other positions. It would appear, however, that the great majority of the new jobs could be filled locally because the work skills involved are no more complex than those required for the present sugar factory operation and, in fact, may be less complex. Thus present levels of education and training on the Island of Hawaii would provide the required work force and an influx of new people would not be needed.

The anticipated net social effect of the above, therefore, would be positive in that additional employment would be available without a noticeable strain upon the community's housing requirements or its supporting infrastructure of services. It is true that an influx of tradesmen will occur during the period of construction, but the scope of the project would be insufficient to cause a significant impact due to the presence of these transient personnel.

Section B. Economic Effect

The proposed ethanol plant would have a modest positive effect, i.e., favorable, for the County of Hawaii from the tax standpoint because of the slightly broader tax base for property taxes. The question of whether or not the State would have an overall economic benefit is not susceptible to a ready answer. On the one hand, less money for petroleum would leave the State. On the other hand, money formerly received from out-of-state for molasses would not be received. The question of whether or not the balance of trade would be favorable would depend upon the relative values of oil and molasses as well as a host of other factors. The money exchanged for molasses and ethanol would presumably circulate within the State with its value determined externally by the price of oil. The major advantage would be a step toward energy self-sufficiency. The economic impact of the State probably would be favorable if the cost ratio of gasoline to molasses remains at or near its present value.

Section C. Anticipated Environmental Impacts

1. Flora and Fauna

The countryside surrounding the area being considered for the ethanol plant has been under intensive cultivation and domestic use for nearly a century. About 1908 a "new mill" was begun at Pepeekeo to replace the existing mill whose origins are believed to have begun in the 1880's. There were at that time several small sugar mills within a five-mile radius of the Pepeekeo mill from Papaikou to Hakalau.

After this period of time of cultivation and domestic use the population of plants and animals stabilized so that in recent decades there has been little, if any, observable change in the local ecology. Most of the indigenous plants have been replaced by cultivated crops or by exotic species. Sparrows, mynah birds, ricebirds and others have replaced the native birds in these areas and the animal population consists largely of mongooses, dogs, cats, mice and rats, including the ubiquitous Hawaiian rat, which thrives on sugarcane.

There are no known endangered species of plant or animal in or near the site for the proposed ethanol plant. Indeed, a recent evaluation (Appendix F) of a forest area immediately above cane fields about seven miles from the Pepeekeo site found no endangered species and the researchers commented that the "area was found to be poor in resources for native birds, either for food, shelter or breeding."

This same evaluation considered flora in detail and states, in part, that "vegetation types encountered ..... are similar to other areas of highly disturbed vegetation at the same elevations along the Hamakua coast" and that "..... no rare or endangered species were found and the vegatation types within this 300 acre area are not unique."

The study is quoted to illustrate the fact that even the relatively remote areas at the upper edge of the sugarcane fields have become unsuitable for native species. Thus the mowed lawns, roadways and yards of the proposed plant site adjacent to the sugar factory are unlikely locations for native flora and fauna.

2. Historical Review

The proposed site has no historical significance, even with respect to early sugar industry operations. There are no signs of human activity other than the existing houses, adjoining structures and yards, all of which are unremarkable.

3. Ambient Air Effects and Noise

a. Air Effects

The ethanol plant will contain no internal or external combustion machinery except for a small diesel engine which will operate a fire pump in case of fire. The diesel pump is an insurance requirement for fire protection. Otherwise, no combustion products will be generated because plant energy is to be supplied by the sugar factory power plant.

Other possible sources of gaseous products would be:

(1) Fermenter Tanks.

The fermentation of molasses produces about one pound of carbon dioxide per pound of ethanol produced, thus the yield of CO_2 would be about five tons per hour. The gas would be pulled away from the closed fermenter tanks by means of a fan system which would blow the gas through a water-spray scrubber to remove alcohol vapors and any other soluble gases, which would thus be condensed and returned to the process to prevent loss of alcohol. The scrubbed carbon dioxide would vent to atmosphere. At present there is no local market for the amount of "dry ice" that could be made by compressing the CO_2.

No environmental hazard would be presented by this quantity of carbon dioxide, which would be less than one-tenth the amount formed by the combustion of sugarcane fiber at the Pepeekeo power plant.

(2) Process equipment and machinery.

There are several locations in the process where the fermentation and distillation vapors, if permitted to escape, would cause an unacceptable loss of ethanol as well as a possible odor nuisance. Therefore these vapors are either collected and scrubbed in the carbon dioxide scrubber or they are condensed and recovered as liquids which are then burned at the power plant or recycled.

The collected vapors, being molasses fermentation products, are non-toxic except for a small flow of about one-quarter gallon per minute recycling distillate containing about 10% acetaldehyde, an oxidation product of ethanol, which is an item on the EPA list of toxic materials. The acetaldehyde is contained in a solution of about 83% ethanol and 7% water which is pumped to the power plant and burned for its heating value and as an effective disposal technique. It is estimated that this flow of one quart per minute (equivalent to 360 gallons per day) will provide an energy equivalent of about 1400 barrels of fuel oil per year to the power plant, assuming a heating value of 78,600 BTU per gallon is assumed for the ethanol-aldehyde stream.

(3) Ethanol Storage Tanks.

The proposed facility would have a total of four (4) product tanks, consisting of two day tanks to receive alcohol as produced and two denatured alcohol storage tanks.

The shift tanks, each of 15,000 gallon capacity, would contain 199 proof ethanol and would be equipped with flame arrestors and dessicant-filled breather vents to accommodate the alternate filling and emptying procedures without evaporative loss of ethanol. Each shift tank has a capacity of 10% over the rated shift capacity in order to provide operational flexibility and to permit product testing before transfer to the storage tanks.

The denatured alcohol storage tanks, each 500,000 gallon capacity, provide a total of 30 days storage for the motor fuel grade alcohol to which unleaded gasoline has been as a denaturant. These two tanks would be equipped to avoid ethanol vapor loss.

(4) Gasoline Storage Tank.

This 25,000 gallon tank would be placed underground and equipped with the emission vent controls commonly in use with this type of tank, as required by safety codes and emission control regulations.

These four categories of possible emission sources would all be controlled as described above. In the event of spills or other emergencies the short-time emission of non-toxic vapors would constitute no environmental threat. Should an emergency occur in the distillation section, any possible release of the small aldehyde flow would be minimized by the shutdown of the system.

b. Noise.

The ethanol plant, being a fluids handling plant throughout, would generate minimal noise levels. The sources of noise in such a plant would be the pumps and associated electric motors. The two machines with potential for producing local short-radius noise are the air compressor and the occasionally operational diesel fire pump, neither of which would be noticeable away from the plant. The centrifugal separators to be used for molasses clarification would be designed to OSHA noise standards and would produce a moderate hum similar to centrifugal pump operation.

Because of its proximity to the sugar factory and power plant, the ethanol plant would not be perceptible as a noise source.

In-plant noise levels will also be negligible. It is anticipated that most of the noise will result from passing truck traffic and from the adjacent existing operations.

4. Water Usage and Wastewater Disposal.

This section of the environmental assessment is undoubtedly the most significant part of the analysis because water usage and disposal of fluid waste represent the only real modification of the natural resources of the area. Other changes caused by the proposed action, such as grading and construction, while real, nevertheless have little effect upon the existing industrial environment. Water usage, however, requires development of new sources and provisions for disposal, both of which are to be addressed in detail.

a) Process Water and Stillage.

The discussion on process water will cover existing sources, proposed new sources, usage and disposal procedures for fluid wastes including wash waters and stillage.

(1) Existing Process Water Supply.

As indicated in Part II. B.4. there exists a surplus of hot water from the sugar factory operation as a result of boiling down the sugar juice to yield crystalline sugar. Most of the water boiled off the sugar juice is available as condensate from the juice heaters and evaporators and part of this water is to be pumped to the ethanol plant for dilution of the molasses for fermentation and for tank and equipment washing. A necessary characteristic of this water is that it be sterile in order not to contaminate the fermentation process.

The supplies of fresh water for the sugar manufacturing facilities are primarily surface sources from waterheads on streams within two or three miles of the plant and the water is transported by ditch, flume and pipeline to the factory. This supply is highly variable as to both quantity and quality and is unsatisfactory for use at the ethanol plant. A small well about 2000 feet from the factory furnishes 500 gpm for power plant boiler and feed water and for bearing cooling water at the mill. This is supplemented by any excess from a nearby 300 gpm domestic water well but no surplus exists for other uses. The power plant has three 5500 gpm brackish water wells near the sea which normally supply 11,000 gpm for the power plant condenser and this water is then re-used for the sugar factory condensers and for cane cleaning in dry weather. Because of its salinity, which has exceeded 4000 ppm, this water was deemed unsuitable for cooling purposes at the proposed distillery.

(2) Proposed New Sources.

The most recent projection of cooling water requirements for the proposed facility calls for almost 4450 gpm at a temperature of 70° F., which in turn requires a design level of 5000 gpm.

The proposal would be to drill two or more wells above the ethanol plant site but within 200 to 600 feet of the periphery of the site in order to minimize piping and power costs. The exact location of the wells would depend upon a hydrologists' report (Appendix I) and the results of test drilling. There are no wells within five miles of the site except for those mentioned in 4. a. (1), above, and a Hawaii County well, not yet activated, about one mile uphill from the proposed well location, hence there would be no adverse effect upon any other wells.

The area in which the wells would be drilled is not a "designated area" as defined by the Hawaii State Department of Land and Natural Resources. There are, at the time of writing, no such areas on the Island of Hawaii, hence the special rules for water table control which apply to "designated areas" do not apply in this case.

It is nevertheless appropriate to consider the possible effect of the proposed wells. In very general terms, subsurface fresh water in Hawaii is usually found either as 'perched' water or in the Ghyben-Herzberg lens. 'Perched' water is that which is contained behind a subterranean dike of lava rock which crosses the sloping volcanic strata and prevents further downhill flow to the sea or to the lens. Water in the lens is fresh water floating upon salt water with the edge of the lens usually at or near the shoreline at sea level. The lens is formed by rain water percolation through the porous lava rock and ash until it is constrained by the heavier salt water which permeates the rock at and below sea level. In general, the lens will have 40 feet of fresh water below sea level for every foot of fresh water above sea level.

Typically, along the Hilo Coast, and elsewhere on the Island of Hawaii, fresh water in large amounts flows into the sea, at or below sea level, through the porous, layered rock of which the island is composed. Because the Hilo Coast is a high rainfall area (125 to 300 inches per year), the outflow of water along the shoreline is usually consistent, but a sustained period of low rainfall such as has recently occurred (October 1980 to date, March 1981) could reduce this flow by an indeterminate amount. This effect can be surmised by noting that the Pepeekeo power plant wells, which are about 50 feet from the coastal cliff, have increased in salinity somewhat as a result of salt water intrusion during this dry period. The pumping rate has not decreased below 11,000 gpm during this time and it appears that intrusion of seawater into the freshwater-seawater diffusion zone may have increased at low tide.

This brief discussion would indicate that most probably the amount of water needed for the proposed plant is indeed available at some depth, probably at 300 feet or more at a ground elevation of 150 feet. In addition, the high recharge rate of the aquifers in the area, due to the high rainfall, would indicate that the water supply should be relatively constant with no adverse effect upon any aspect of the environment. The fact that there is no water table, in the continental sense, other than a sea level to which water flows through sloping porous strata, contribute to the certainty of no adverse environmental effect if the proposed wells are drilled.

(3) Water Usage.

The major use of water in the new plant would be for cooling. The fermenters generate heat as a result of the yeast metabolism and the distillation equipment for alcohol recovery will use steam as the energy source, thus requiring cooling water to condense the alcohol vapors. The temperature of the cooling water would be raised from 70° F. to an average temperature of about 85° F., which is low enough to permit it to be reused at the sugar factory. The proposal would therefore be to collect the cooling water used at the ethanol plant and pipe it to the operating reservoir at the factory for use in cleaning cane or for other uses as needed.

The next largest use for water is for the dilution of molasses for fermentation. As mentioned earlier, this water will be obtained as surplus hot water from the process house at the sugar factory.

Smaller quantities of water are used for cleaning tanks and equipment and in the molasses treatment following the addition of sulfuric acid and ammonium sulfate. Other uses include seal water for pumps, bearing cooling water and plant clean-up. No machinery cooling is involved other than for the two air compressors.

(4) Disposal Procedures.

The proposed ethanol facility would be a fluids handling plant with no solid waste, as such, although one or more waste streams would contain dissolved solids or suspended solids or both. This section will describe each effluent stream resulting from the fluids handling activities and will describe the fate of that stream and its probable environmental impact.

The six effluent streams, within the plant, listed in ascending order of the quantity of process solids in each stream, would be steam condensate, cooling water, hydrocarbon stripper column bottoms, laboratory drains, tank and machinery drains (includes floor drains), and stillage. Some of these streams will be combined before leaving the plant, as will be described.

(4.1) Steam Condensate.

The condensate resulting from steam heating of the primary distillation column, known as the 'beer stripper/rectifier tower,' will be water of extremely high purity that must be returned directly to the power plant for re-use in steam generation. This condensate will return to the power plant in a 6" pipe mounted on the pipe rack connecting the sugar factory and power plant to the ethanol plant. It will have no environmental effect.

(4.2) Cooling Water.

As mentioned previously, this water which contains no added material except 15° F. of heat will be sent to the sugar factory. It will flow through a 16" pipe mounted in the pipe rack. At the sugar mill it will be collected in an existing concrete pond used as a reservoir for fire protection and process water pumps. The water will then be pumped to the cane cleaner and recycled several times therein before being pumped to the existing 150 acre ponding system see Appendix J).

If any of this cooling water becomes surplus to the needs of the sugar operation it will overflow at the reservoir and enter the sea through the authorized discharge outlet which continuously monitors the flows from the sugar factory and power plant. This outlet is registered as Station No. 001 on the Pepeekeo factory N.P.D.E.S. permit (see Appendix G). There would be no pollutants in this overflow and it would have no conceivable adverse environmental impact at Station #001.

(4.3) Hydro-carbon Stripper Column Bottoms.

This small flow of about 1.4 gpm containing over 99% water will be commingled with the effluent from the tank and machinery drains (see paragraph (4.5).

(4.4) Laboratory Drains.

The laboratory would be located in the fermentation house, together with administrative offices and facilities for personnel. It would be at ground level and designed for the required analyses of molasses, yeast and fermentation products. The drains for this analytical laboratory and administrative area would all lead to a cesspool to be installed below the plant. The cesspool would meet all the Hawaii State Department of Health standards and is not expected to have any environmental impact other than the temporary noise and excavated material disposal that would occur during construction.

(4.5) Tank and Machinery Drains

The plant would be designed such that all drains and process effluent streams containing, or having the potential to contain, suspended solids during the course of normal operation would be collected and pumped to specially constructed settling ponds separated from the sugar factory settling ponds. There are three reasons for the separation. First, the suspended solids from the ethanol plant would be a small quantity compared to the cane cleaner washwater loading (18 to 20 dry tons per day vs. 400 to 1600 dry tons per day) and this small quantity of calcium sulfate may have some future value for soil pH adjustment. Second, the ethanol plant solids would contain yeast which might upset the clarification process in the land containment (settling pond) system and cause HCPC to be in violation of its NPDES permit. Third, the existing system has never had an odor problem and if one should develop with the alcohol plant settlings it would be easier to control at the low 50 to 200 gpm alcohol plant effluent flow rate than at the 5000 gpm cane washwater flow rate. The clarified effluent from the separate ponds would be commingled with the stillage before discharge.

The answer to the question of environmental impact of this disposal technique for the suspended solids from the plant is uncertain. Although a few acres of good agricultural land must be diverted for the purpose of land containment of this material, it is possible that the gypsum (calcium sulfate) which constitutes most of the tonnage may be useful for the addition of calcium to the sugarcane fields. Current practice is to adjust soil acidity with calcium by spreading ground coral on the fields. If indeed the gypsum can be used it may be that the total environmental effect will be favorable.

The fate of the residual alcohol or other organics in solution in the clarified overflow will be described in the next paragraph.

(4.6) Stillage

Stillage is the residue of dissolved organic and inorganic materials originally present in the molasses. In the case of the proposed ethanol plant the stillage will consist of 208 gpm of a solution of 88.40% water, 0.02% alcohol and 11.58% dissolved solids. There are no suspended solids in the stillage from the proposed process because of the rigorous molasses pre-treatment to remove solids and because of the yeast recycling technique which removes the yeast cells commonly found in stillage from rum distilleries and others which do not recycle yeast.

The precise composition of the stillage to be obtained from the ethanol plant is necessarily conjectural because of the variability of the composition of the molasses feed stock which the plant will encounter and the as yet unknown effect of the molasses pretreatment process upon these various feed stocks. It is expected, however, that the combination of the rigorous pre-treatment of molasses and the recycling of yeast will produce a stillage of lower nutrient level than that produced from older facilities. The effect of a lower nutrient level is to reduce the possible by-product value of the stillage and, at the same time, to reduce the oxygen demand of the material if it is handled as a waste stream.

The volume of stillage from the ethanol plant would approximate 4% of the flow from the cane cleaning operation. The proposal is to insert the stillage stream into the effluent stream from the land containment system immediately prior to the continuous monitoring instruments at the HCPC NPDES discharge station No. 003. The HCPC permit has a suspended solids limit which requires a clarification efficiency between 96% and 99.5%, depending upon the influent loading to the land containment system by the cane washing operation. Hence no suspended solids could be tolerated in the stillage. On the other hand, the EPA, in establishing Federal guidelines for the Hilo/Hamakua Coast, determined that, even though suspended solids deposits were environmentally undesirable on the ocean bottom, there was no environmental requirement for a BOD (Biochemical Oxygen Demand) limit on the cane washwater treatment facilities.

It must be emphasized that this determination by the EPA applies only to this special case of a rich nutrient-bearing effluent discharging to a nutrient-deficient, rough, open ocean with an inaccessible coastline.

Because the proposed motor fuel grade alcohol plant is an extension of the sugar factory operation physically and technologically, the concept would be to constrain the ethanol facility within the NPDES permit limitations issued to the basic sugar operation. This procedure would have the advantage of facilitating Federal and State regulatory action concurrently with improving the economics for the proposed plant, eliminating the need for additional operations and minimizing the requirements for additional use of energy.

The subject of stillage disposal for the plant is complex and a special section, Appendix A, has been prepared in order to reduce the length of this segment of the statement.

b) Domestic Water and Sewage.

The potable water for the proposed plant would be furnished through an existing system that supplies the Pepeekeo factory industrial area and the residential area which is being phased out. The system, operated by Mauna Kea Sugar Company, obtains its water, which is of high quality, from a well previously mentioned which was installed many years ago. The cessation of use of potable water in the former residential area assures an adequate supply for the new plant.

The sewage and gray water from the lavatories, showers and drains of the administrative area would flow to the cesspool described in the previous paragraphs concerning laboratory drains.

c) Rainfall Run-off.

The run-off from the total acreage at and around the ethanol plant is to be considered in two categories, the first of which is that run-off which comes from pavements, buildings and operating areas, and the second is the run-off from undisturbed areas and storage areas.

The present practice at the Pepeekeo industrial area is to direct the run-off from the roadways, buildings and operational areas to the authorized NPDES discharge station Nos. 001 and 002 so that the run-off is monitored and sampled concurrently with normal effluent. This procedure provides a permanent record and an opportunity for spot-checking if it seems appropriate to do so.

Similarly, for the proposed plant the plan is to collect such run-off and direct it to station No. 001 via a 24" diameter pipe carried on the pipe rack. The area involved would be about five acres and, with a rainfall of one inch per hour, the run-off would be about 2250 gpm. No adverse environmental effect is anticipated because the ethanol plant would have no materials that could be entrained with the rainwater. All materials would be enclosed in equipment, buildings or enclosed storage tanks.

The second category of run-off, which can be called 'natural' run-off, would be handled in the same manner as the surrounding cane fields and grassy areas by collecting the water as appropriate and directing it by grass-lined swales to adjoining gulches. The growth of vegetation is so heavy in the area that the prevention of erosion is uncomplicated.

These methods of control of run-off are practical, inexpensive and over a period of years have shown no adverse environmental effect.

Section D. Technological Changes Expected.

This section is included to indicate the type of technology required for the ethanol plant as compared to the raw sugar factories with which the community is familiar.

In general terms, the sugar factory is more complex technologically because it involves several solids-handling techniques as well as fluids handling and steam -- electric power generation. Raw sugar factory industrial areas are, because of the bulky raw material received, cleaned and processed, normally quite noisy and often dusty.

Many raw sugar factories have an alcohol production unit as part of the complex because the availability of molasses, heat and electric power provides a convenient supplementary process. Indeed, alcohol production is so commonly integral with sugar production all over the world that it is considered a normal part of sugar operations. This is the approach that would be taken by HCPC, with integral management, personnel, energy, production, maintenance and environmental control functions held common to both sugar and alcohol operations.

The ethanol plant would be a fluids-handling system with pumps, piping, tanks, and process equipment and these would be operations with a familiar technology. The new operations would be fermentation and distillation, much of which would be under automatic control, and these procedures would have to be learned. However, the technology would not be 'new' in the sense that mining or steel-making would be 'new' to the community. It could be expected that persons living in the Hilo-Pepeekeo area would be capable of meeting the ethanol production operating requirements without undue difficulty and thus the technological impact would be minimal.

PART VI

UNAVOIDABLE ADVERSE IMPACTS

PART VI

UNAVOIDABLE ADVERSE IMPACTS

Section A. Traffic Patterns Affected

The proposed facility at Pepeekeo would cause some additional truck traffic between Pepeekeo and the Port of Hilo and between Pepeekeo and the sugar factories at Ookala and Haina if all the molasses on Hawaii comes to Pepeekeo and is supplemented by off-island shipments to Hilo. Ethanol would move from Pepeekeo to the Port of Hilo.

Assuming a worst-case situation where the trucks were loaded one-way only, the heaviest increase of traffic would be about ten truck-trains of molasses and seven truck loads of alcohol, for a total of seventeen round trips per day between Hilo and Pepeekeo. This assumes that all the sugar factories except Pepeekeo are shut down for offseason, a condition which brings maximum molasses hauling from Hilo.

This hauling, if done on one shift, might be noticeable in that it would represent about two trucks per hour each way. The probability is, however, that two or three shifts would be used, in which case the additional traffic would be negligible because the truck tractors would be highway-type units with adequate speed capability.

If the other sugar factories are sending molasses to Pepeekeo the traffic loading would be slightly heavier towards Volcano and Honokaa but might only be noticeable if cane truck traffic were concentrated in a particular area along the coastal highway.

The major traffic effect will be felt on the private road between the main highway and the sugar factory where cane trucks haul as much as 8000 tons per day. In this area it is probable that an additional five percent loading of truck traffic might be disadvantageous but it could be adjusted by HCPC if necessary by re-routing some vehicles.

There would be some additional wear and tear on the main highway because of the added annual tonnage to and from Pepeekeo. This additional wear would be difficult to estimate because it would be over-shadowed by climatic and harvesting conditions which greatly affect highway maintenance requirements.

In this case the added traffic burden cannot be eliminated but may not be noticed by the community except under unusual traffic conditions.

Section B. Construction Effects

The effects of construction will not be apparent to the populace at large except for the transportation of construction materials, steel, concrete and machinery along the highway from Hilo. This will be an intermittent and transitory occurrence but it is unavoidable because there is only one highway and bridge route that is capable of carrying the weights involved.

There will, however, be the usual disturbances of terrain and vegetation that occur at construction sites. These will be minimized, as described in

Part IX, but the civil works and excavation for foundations, pipelines and roadways are unavoidable. It is not anticipated that dust would be a problem in this area because of the normally moist or wet soil and rock.

There will be an increase in noise levels at the construction site itself during the use of heavy machinery but the noise will not be noticeable elsewhere and it will be temporary.

The area would be cleared, graded, excavated in places, and filled as needed. It can be expected that heavy rains and storm run-off will occur. Run-off would be controlled as noted later but is probably not completely avoidable.

PART VII

POSSIBLE ALTERNATIVES

PART VII

POSSIBLE ALTERNATIVES

Section A. Discussion Of Site Selection.

As the study began it became obvious that the steam and power needs of the proposed motor fuel grade alcohol plant were such that the plant should be as close to the Pepeekeo power plant as was feasible.

HCPC management directed that the plant should have minimal adverse environmental effect and, specifically, should not be within the 500-foot shoreline set-back established as a Special Management Area under the Coastal Zone Management Act.

These two somewhat mutually exclusive constraints resulted in selection of the site now contemplated. This site meets the above criteria and, at the same time, neither encroaches upon agricultural land nor requires massive civil works to accommodate the plant. Other sites in the vicinity of the existing industrial complex were considered but discarded as failing to meet the necessary conditions.

Section B. Short-term Versus Long-term Considerations.

A necessary objective of a proposed action is to meet an immediate need of the community without sacrificing its long range productivity potential. This requires that a favorable environmental and economic balance be achieved without putting either element at risk to the detriment of the community, particularly in consideration of future decades.

The proposed action, if found to be economically feasible as a result of this study, should have a beneficial short-term effect in terms of added job opportunity and reduced dependence upon imported fuels. From the economic standpoint it should also improve the stability of the HCPC agricultural cooperative for the long term. The cooperative would be somewhat less vulnerable to the vagaries of the world sugar market.

The construction phase of the project would have a short-term adverse environmental effect with no permanent effects other than the terrain changes and close-range visual changes due to the installation of machinery. The technical specifications and descriptions by the design engineers indicate that no air pollution would result from the proposed plant and that nuisance odors would not occur.

As previously described, the only factors having possible long-term environmental effects are those involving the proposed new water supply and the disposal of process water and stillage. The previous discussion regarding the proposed wells asserted that no long-range change in the aquifer supplying the water was probable and there are no known foreseeable circumstances that would challenge the validity of that assertion. In this case, then, the long-range effects would be neutral, having no effect either way.

In the case of the disposal of stillage to the sea the presumed long range effect, if any, would be beneficial. The logic involved would state that the addition of nutrients to a nutrient-deficient environment should be beneficial as long as the deficiency exists, assuming that the nutrients contain no toxicity which could have an impact upon the organisms utilizing the nutrients.

If this logic is valid, then the addition of stillage, which contains inorganic nutrients and organic biodegradable components, which are by definition nutrient materials, and which contains no toxic components, should have a beneficial effect. The other constraint in the logic is that the deficiency must continue unabated and the coastline conditions at Pepeekeo are such that this condition would be met.

Section C. Alternative Actions.

Some of the alternative actions available relate to site location in Pepeekeo area and to methods of waste disposal are discussed in this Part VII and in Appendix A. They have been considered from the standpoint of a proposed installation at Pepeekeo. Other options can be mentioned, such as location elsewhere in Hawaii, or complete rejection of the ethanol production concept, or manufacture of other products.

The first option, major relocation, would not be available to HCPC elsewhere on the properties of the sugar cooperative because there is no energy source available, other than the sugar factory, which could be used without defeating the economic viability of the project. Similarly, location elsewhere than at the HCPC production facilities would be of no interest to HCPC and is beyond the scope of this investigation.

The second option, abandonment of the project, is a real alternative that may well occur if the results of the economic analysis of this feasibility study are negative. If the project is rejected the effect on the existing environment would be nil except for the loss of time and money expended for the study itself.

The third option, manufacturer of other products from molasses, such as yeast, citric acid, glycerine, other alcohols, animal feed, aconitic acid and other organics are all technically possible but appear not to be feasible in Hawaii because of marketing difficulties. The existing use of molasses is as a cattle food supplement in the western U.S. and Canada with a very small similar usage in Hawaii.

PART VIII

IRREVERSIBLE RESOURCE COMMITMENTS

PART VIII

IRREVERSIBLE RESOURCE COMMITMENTS

Consideration of Commitment of Resources

The proposed action would commit land, water, labor and materials. If the plant were to be abandoned the permanent loss of resources would be mostly the labor and materials which would be used in the construction of the plant. These items are normally expressed in terms of money and if the plant failed to make money and recover the investment before abandonment, then the loss would be permanent and irretrievable except for equipment salvage.

The land would be re-useable in some other way and its proposed conversion to industrial use would have no effect upon foreseeable agricultural activities nor the economy of the community. The grading and levelling activities during construction would probably not be economically reversible.

The water to be used at the proposed plant represents a committed resource probably irretrievable economically during the operation of the plant. If the plant were to be closed the resource would still be available.

The isolated location for the proposed plant is such that no adverse effect upon esthetics would occur except at the immediate location of the facility and even there the impact would be minimal.

PART IX

MITIGATION MEASURES

PART IX

MITIGATION MEASURES

Proposed Mitigation Measures

A normal weather pattern at Pepeekeo during the course of construction would cause run-off from the site. In order to reduce the possible erosion effects, it is proposed that temporary fences of a closely woven plastic fabric would be set up at appropriate locations to contain the suspended soil solids. The product commonly used for this purpose is Mirafi fabric, produced by Celanese Chemical Company.

The applicable County, State and Federal codes and regulations would be applicable for the control of dust (if any) and for minimizing construction machinery noise.

It is proposed that the existing palm tree hedge along the edge of the area be retained for esthetic purposes, together with other trees or vegetation that need not be destroyed.

PART X

ESTIMATED PROJECT COSTS

PART X

ESTIMATED PROJECT COSTS

Preliminary Estimated Costs

At the time of preparation of the environmental assessment the cost of the plant is still indeterminate. In fact, a primary purpose of the feasibility study is to determine within about 10% what the probable cost of a molasses-based motor fuel grade ethanol plant would be in Hawaii.

However, on a preliminary basis, the cost of the 11-million gallon per year plant is indicated by Table 1 and Table 2 which follow. These data are tentative and may vary as much as .25% from the final figures.

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HILO COAST PROCESSING COMPANY
Pepeekeo, Hawaii

TABLE 1

ESTIMATED CAPITAL COSTS
(1981 Dollars)

FOR

11.4 MILLION GALLON PER YEAR

MFG ALCOHOL PLANT

Item			$MM
Equipment			
Molasses Pretreatment	1.2		
Fermentation	1.6		
Distillation	2.3		$ 4.8
Site Work			1.4
Buildings			1.3
Concrete			.5
Structural Steel			.8
Fire Proofing			4.7
Piping & Insulation			3.0
Electrical & Instrumentation			.5
Painting			
		Subtotal	17.0
Spare Parts, Lab and Shop, Equipment			.5
Construction Management and Fee			1.6
		Subtotal	19.1
Engineering Design			1.9
		Subtotal	21.0
Contingency			1.0
		TOTAL	$ 22.0
Escalation through 1983			2.2
		TOTAL	$ 24.2

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Pepeekeo, Hawaii

TABLE 2

ESTIMATED OPERATING COSTS
11.4 MM U.S. GALLON/YEAR MFG ALCOHOL
1981 Cost

	Unit	Usage/Yr	Base Cost	Operating Cost (1981) $MM/Yr	Operating Cost (1981) $/Gallon		
Fixed Charges							
Depreciation	10%	TFI[1]	$ 22.0 MM	2.20	0.129		
Maintenance	3%	TFI[1]	$ 22.0 MM	0.66	0.058		
Taxes and Insurance	2%	TFI[1]	$ 22.0 MM	0.44	0.039		
						Subtotal	0.226
Feedstock							
Final Molasses	tons	150,000	$ 100.00	15.0	1.333		
						Subtotal	1.333
Raw Materials							
Sulfuric Acid	tons	1,952	$ 173.00	0.338	0.030		
Ammonium Sulfate	tons	166	$ 220.00	0.037	0.003		
Bi-Ammonium Phosphate	tons	0	---	0.000	0.000		
Yeast	lbs	15,000	$ 1.40	0.021	0.002		
Sterilant	lbs	5,300	$ 8.00	0.042	0.004		
Gasoline	gallons	223,200	$ 1.10	0.246	0.022		
Caustic	tons	166 (50%)	$ 438.00	.0727	0.007		
						Subtotal	0.068
Utilities							
Steam (from mill)	MM lbs	245.5	$ 0.0[2]	0.00	0.00		
Electricity (from generator)	MM kwh	6.4	0.0[2]	0.00	0.00		
Process Water (condensate)	MM gallons	119.6	0.0[2]	0.00	0.00		
Cooling Water (new well)	MM gallons	2,070.4	0.0[2]	0.00	0.00		
						Subtotal	.000
Labor							
Management	Persons	2	50,000	0.100	0.009		
Technical	Persons	1	30,000	0.030	0.003		
Operators	Persons	8	30,000	0.240	0.021		
Laborers	Persons	22	25,000	0.550	0.048		
Office	Persons	3	25,000	0.075	0.006		
General and Administrative	0.5% Revenue	--	114,000	0.114	0.010		
						Subtotal	0.097
Total Operating Cost	---	--	---	20.056	1.759		
						TOTAL	1.724

1 TFI = Total fixed Investment estimate is based on 1981 current dollars, fifteen-year life

2 Electricity, steam, process and well water are incorporated into investment and operating cost of alcohol plant.

APPENDICES

APPENDIX A

STILLAGE DISPOSAL

I. Introduction

The original proposal in April, 1980, for the feasibility study for an ethanol plant at Pepeekeo considered an examination of alternatives for stillage disposal by the production of an animal feed or fertilizer, or both, from the stillage.

As this study began in October, 1980, a survey of molasses fermentation processes for the production of ethanol and stillage by-products had recently been published as a report (1) to the Department of Energy by the Research Corporation of the University of Hawaii (RCUH). The survey concluded (page 4) that, "Producing an animal feed directly from the stillage is the preferred process for handling stillage providing the amount produced and its value are confirmed by pilot-plant production and animal feeding trials." (emphasis added). The RCUH report also commented (page 187) that "An economical process is needed for the removal of potassium from molasses or stillage." The RCUH study group had inspected several sites and processes in Europe and the United States in order to provide a valid basis for its recommendations. Its economic analysis of alternatives provided a useful reference for the Pepeekeo study.

At the October, 1980, organizational meeting for the present study it was evident that the time limit for the work would preclude implementation of the RCUH recommendations.

A further constraint was introduced by the fact that the installation of a boiler for incineration of stillage and production of a potassium-base fertilizer would be subject to recently-enacted Federal air pollution regulations. These regulations for New Source Performance Standards (NSPS) for Prevention of Significant Deterioration (PSD) of air quality in National Ambient Air Quality Standards (NAAQS) attainment areas would introduce other time losses.

As a result of these time constraints and a preliminary indication that the cost of by-product facilities would adversely affect the economics of plant installation, the decision was made to investigate the feasibility of stillage disposal to the sugar factory wastewater disposal system. Concurrently, studies would be made to re-examine the feasibility and cost of the animal feed and fertilizer alternatives.

II. Background - Hilo Coast Processing Company (HCPC) Wastewater Disposal System

There have been a number of investigations since 1967 of the impact of the Hilo Coast sugar mill discharges on the marine environment. All of these were conducted prior to the installation of the pollution control facilities now in use. Investigations have been performed by Kennedy Engineers (1967), EPA (1971), Grigg (1972), Chan and Chase (1972), Grigg (1975) and Harrison, etc. al. (1975), all of whom found that the sugar mill discharges had minimal effect upon the dissolved oxygen, temperature, salinity and pH of the turbulent, well-mixed waters of the Hilo Coast.

The studies by Grigg (2) and Harrison (3) were made following detailed discussions with the EPA and the Hawaii State Department of Health which resulted in National Pollutant Discharge Elimination System (NPDES) permit requirements that the studies be made. The objective of the investigations was to make a field study (Grigg) of the actual marine environment at HCPC followed by a laboratory investigation (Harrison) of the ecological effects of oxygen concentration upon the numerically dominant species of the shallow water ecosystems along the Hilo Hamakua Coast.

Grigg concluded that the processes of re-aeration associated with the mixing due to wind and waves are sufficient to offset the biochemical oxygen demand (BOD) caused by organic matter, and Harrison concluded that it was unlikely that the degree of oxygen depletion caused by sugar mill effluents could be deleterious to the intertidal or subtidal species.

Since 1975, HCPC has taken ocean water samples by helicopter at least annually at four locations, one at the discharge area, one near the shoreline a mile South, one near the shoreline a mile North of the discharge, and one in the open sea as a control. These samples are analyzed for dissolved oxygen, phosphorous, nitrogen and temperature and all have substantiated the prior studies.

As a result of these investigations, and others, the U.S. Environmental Protection Agency, after careful analysis of the situation, promulgated NPDES guidelines for the Hilo/Hamakua Coast sugar factories which mandate control limits for suspended solids but <u>not</u> for biochemical oxygen demand. The State of Hawaii has followed these guidelines in issuing the NPDES permit to HCPC. It is apparent to the EPA, the State of Hawaii, expert marine biologists, and to the casual observer, that biochemical oxygen demand is not an environmental threat to the waters of the Hilo Coast.

As a result, HCPC has developed a wastewater pollution control system which can remove as much as 1600 dry weight tons (3,200,000 lbs.) per day of suspended solids from cane washwater with efficiencies of 99% or better. The BOD with this loading may be as high as 120,000 lbs. per day, some of which is removed by the system.

The HCPC pollution control system consists of a series of inter-connected lagoons, spread over 200 acres of former cane land, to which approximately 6 million gallons per day (4200 gpm) of wastewater is pumped. The solids are settled out as the water flows from pond to pond. Several pieces of heavy earth-moving machinery constantly excavate the ponds as they fill with solids. The pond effluent, after passing through the final 'polishing' ponds is passed through a continuous automatic monitoring and sampling station and is discharged to the sea by cascading over an 80 foot cliff at the shoreline (see Appendix J).

III. Proposed Stillage and Wastewater Disposal System

The stillage from the distillation of ethanol will consist of 208 gallons per minute of a brown liquor containing about 12% dissolved solids but without suspended or undissolved solids. The biochemical oxygen demand of this liquor is estimated at 8,000-10,000 mg/l (milligrams per liter or parts per million) and its approximate composition would be 88% water; 1% to 2% potassium salts; 1% to 2% other inorganic soluble salts; 3/4% to 1¼% residual sugars; 1% to 1½% amino acid based organics; 7% to 8% other organics including 2% ethanol, some glycerol and unidentified plant materials.

At a BOD of 10,000 ppm the daily loading of BOD from the plant at 200 gpm would be approximately 24,000 lbs. This would represent about half of the existing daily variation in normal loading from the sugar factory. It is characteristic of the sugar processing operation that its wastewater solids load peaks in rainy weather at the same time that adjacent streams run full with high solids and BOD loading. Thus the stillage BOD would not be expected to have an effect when the sugar wastewater load peaked.

As noted earlier, the clarification requirements on the treatment system are rigorous, therefore no suspended solids from the ethanol plant would be permitted in the stillage stream.

The proposal for the stillage flow would be to introduce the 208 gpm of stillage into the 4200 to 5000 gpm of clarified sugar factory wastewater at a point below the ponding system and far enough ahead of the sampling station to permit thorough mixing before sampling. The additional 4% to 5% hydraulic loading on the system would be far less than the normal additional loading at this station due to rainfall runoff from the ponding area.

The ethanol plant wastewater, other than stillage, would consist of solids separated in the molasses clarification process together with washwater from these solids, the washwater from the fermentation tanks, from the stillage cleaning equipment and from floor washing or other plant cleanup. This wastewater, containing solids, would be pumped to separate ponding facilities at the top of the factory ponding system. The clarified effluent would be permitted to join the main flow of other clarified effluent at a point where no system upsets could occur. It would then be commingled prior to the introduction of the stillage to the main effluent stream. The separate ponds for the ethanol plant wastewater would be excavated as necessary in the same manner as the primary system.

In evaluating this approach to stillage disposal it is appropriate to recall that generations of civil engineers and others have been taught that Biochemical Oxygen Demand - B.O.D. - is inherently unfavorable. This teaching arises from the original 5-day B.O.D. determinations on the Thames River in England which showed that the indiscriminate dumping of sewage (hence nutrients) into the river caused it to become stagnant and fetid. From this beginning B.O.D. has been used for pollution control and automatically carries unfavorable connotations, which is in most cases appropriate because it is a common occurrence to overcharge waters with nutrients.

However, in those exceptional cases where the nutrient deficiency cannot be overcome and the dissolved oxygen concentration remains at or near saturation, the Biochemical Oxygen Demand loses its significance as a control parameter. This is the situation that has been shown to exist along the Hilo/Hamakua Coast.

IV. Alternate Disposal Systems

The first section of this Appendix briefly discussed other possible methods of disposal such as the production of animal feed and/or fertilizer. Stillage has also been applied directly as a liquid fertilizer in Hawaii and elsewhere. At the former rum distillery at the Puunene sugar factory on Maui the stillage was introduced into the factory wastewater which was used for irrigation. This is a convenient and effective procedure where an irrigation system is present and the stillage is a small percentage of the total flow so that the high dilution forestalls problems with odors, flies or other insects. It would appear not to be feasible to attempt such a procedure at Pepeekeo because of the lack of an irrigation system and the problems associated with attempting to use mechanical means as a disposal method in a high rainfall area. Thus, further discussion of the alternatives mentioned earlier is appropriate.

Both of these alternative processes require additional energy, higher installation costs and higher operating costs. These costs could be offset by an adequate return for the by-product, which in turn would require a successful commercial process and an available market for the product. At the time of the preparation of this document neither of these criteria could be met for either the animal feed or the fertilizer. It seemed imprudent to imperil the economic feasibility of the ethanol plant with multimillion dollar auxiliaries having negative potential.

Other alternatives for disposing of the BOD of the stillage are available, such as anaerobic/aerobic biological treatment system. These systems are usually moderately complex and operationally sensitive. All of these systems require energy, some more than others, and some have shown some energy recovery on a laboratory or pilot-plant scale. A number of these processes may be commercially acceptable where the stillage would otherwise become an environmental insult.

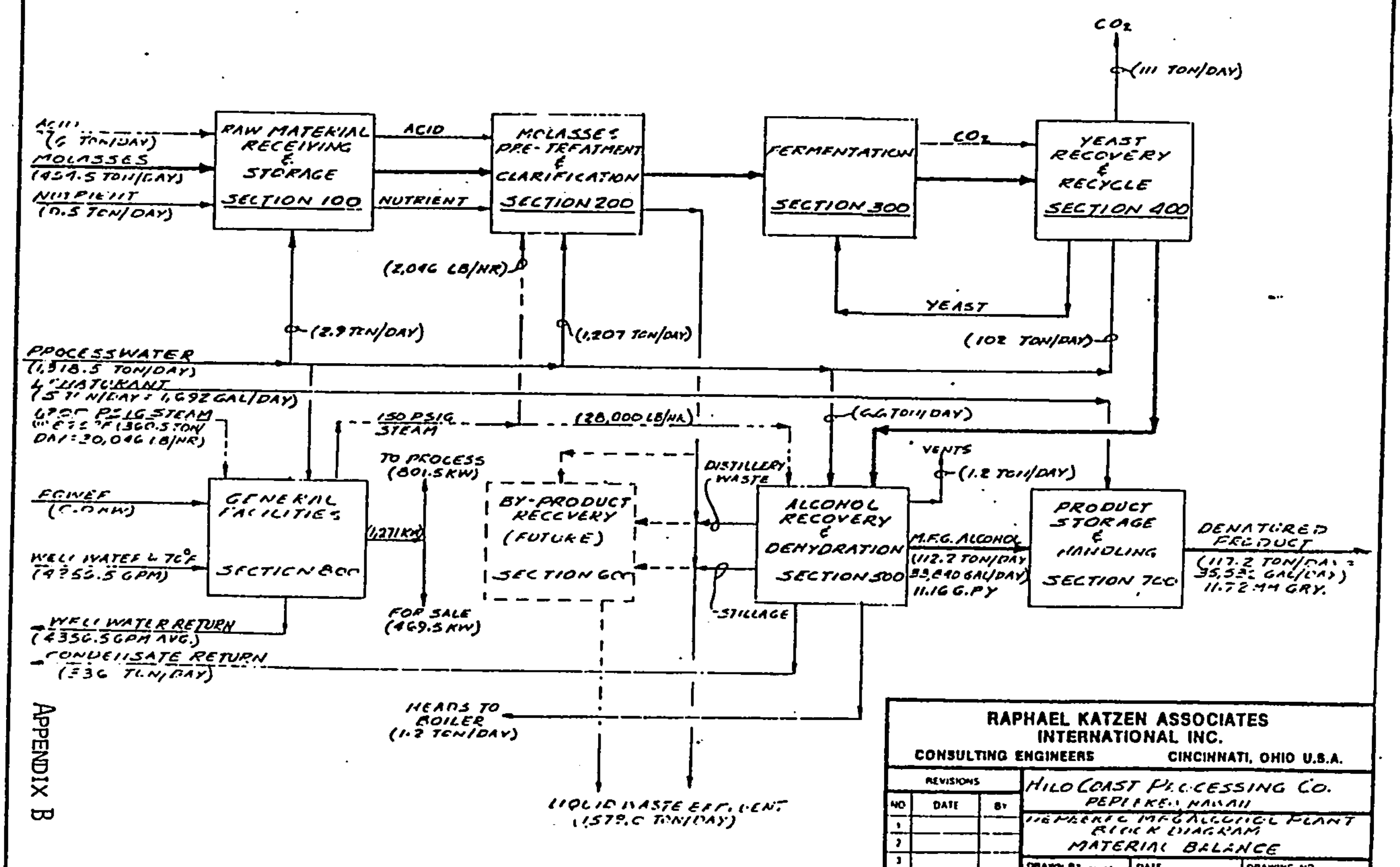
The available data for the Pepeekeo site show that biochemical oxygen demand is not an environmental insult in this site-specific case and it would therefore be very poor judgment to risk the economic viability of the plant by spending money and energy to solve a non-existent problem. For this reason, the decision has been made that the most reasonable procedure, from the cost-benefit standpoint and from the overall environmental-benefit standpoint, would be to commingle the clarified effluent from the factory wastewater ponding system with the stillage prior to discharge into the nutrient-deficient Central Pacific.

References:

1. Hawaii Natural Energy Institute, University of Hawaii at Manoa, Hawaii Ethanol From Molasses Project, Phase I, Final Report, April 1, 1980.

2. Grigg, Richard W., Environmental Impact of Thermal Loading and Biological Oxygen Demand of Sugar Mill Wastes Off the Eastern Coast of Hawaii, July, 1975.

3. Harrison, H.T., Jokiel, P.L., Hiller, C.P., Effects of Lowered Oxygen Tension On Coral Reef Organisms, Hawaii Institute of Marine Biology, October, 1975.



Appendix B

Material Flow

APPENDIX C

Part I. Federal Statutes Applicable To Environmental Controls for Proposed Ethanol Plant.

1. Natural Environmental Policy Act of 1969, PL 94-52 Rev. 1975.
2. Clean Air Act, PL 92-157, Rev. 1977.
3. Clean Water Act, PL 92-500, Rev. 1978.
4. State Drinking Water Act, Pl 93-523, Rev. 1974.
5. Marine Protection, Research & Santuaries Act, PL 92-532, Rev. 1980.
6. Coastal Zone Management Act, PL 92-532, Rev. 1975.
7. Environmental Quality Improvement Act, PL 93-36, Rev. 1975.
8. Endangered Species Act of 1973, PL 93-205, Revised.
9. Noise Control Act of 1972, PL 92-574, Revised.
10. Occupational Safety and Health Act of 1970, PL 93-237, Revised.
11. Oil Pollution Act Amendments of 1973, PL 93-119, Rev. 1980.
12. Solid Waste Disposal Act, Pl 93-14, Rev. 1975.

Part II. Permit Requirements - 1981.

Type of Permit	Source
Special Management Area	County Planning Department
NPDES	State (Use HCPC)
Grading	County (Ord. 168) DPW
Building	County DPW
Electrical	County DPW
Plumbing & Cesspool	County DPW
Outdoor Lighting	County (Ord. 38)
Well Drilling (registration Only)	State
Occupancy	County DPW
Fire Dept. Approval	County Fire Marshal

COUNTY OF HAWAII

GENERAL PLAN REVISIONS

Ordinance 456	July 16, 1979	(Pages 7-11 Only)
Ordinance 475	Oct. 3, 1979	
Ordinance 484	Oct. 25, 1979	
Ordinance 538	Feb. 27, 1980	

APPENDIX D

COUNTY OF HAWAII
HILO, HAWAII 96720

PLANNING DEPARTMENT
25 AUPUNI STREET

evaluation of the General Plan policies and the LUPAG Map would be made. Here, if it is concluded that the proposed use would not have the effect of altering long-range land use pattern reflected on the LUPAG Map, then the rezoning request or other permit action could be taken without an amendment to the LUPAG Map. Again, a careful review of available planning documents like the Community Development Plan and evaluation by other government agencies must be made before final action is taken.

The system described above emphasizes the policy orientation of the General Plan and gives decision-makers some measure of flexibility. Yet there are broad land use patterns provided in the LUPAG Maps to provide some general direction in orderly and rational fashion.

In the formulation of the various components of the planning program, such as the General Plan, Development Plans, etc., the public is involved. Then, too, in the process of reviewing requests in accordance with that program such as rezoning proposals, opportunities for public input are available.

POLICY CHANGES

A. Energy Element

Nationally, for the remainder of the 20th Century, most of the energy demand will be met with fossil fuels and nuclear fission. In turn, fossil fuels are fast becoming a scarce world commodity due to the increasing demand. Hawaii is currently most vulnerable to dislocation in the global oil market, but is also endowed with a variety of natural energy resource alternatives which are renewable or inexhaustable and potentially low polluting. Hawaii's near total dependence on imported petroleum provides the incentive for the promotion of energy conservation and the development of technology to harness local natural (solar, hydrologic, and geothermal) energy resources, and to convert solid waste into an alternate fuel resource.

Energy Self-Sufficiency for the Big Island

The County of Hawaii must strive to attain energy self-sufficeincy in order to minimize the dependence on imported fossil fuels. A commitment must be made by both the government and the public for research, planning, and development to attain the goal of energy self-sufficiency for the County of Hawaii.

As a result of the 1974 oil crisis, there has been concern over Hawaii's dependence on imported petroleum. In 1974 and 1976, the State Legislature enacted several significant bills which were designed to promote the research and development of natural energy resources, and the conservation of energy in order to foster a greater independence from imported fossil fuels.

The State Legislature adopted Act 237 (Chapter 196, H.R.S.) in 1974, which among other things, created the position of a State

Energy Resources Coordinator to review and formulate existing and proposed energy resource programs.

Also in 1974, the State Legislature established the Hawaii Natural Energy Institute (HNEI, Act 235) to foster development of local natural energy resources in Hawaii, and to serve as a focal point for energy research at the University of Hawaii. The HNEI maintains cooperation and coordination between all levels of government and private organizations involved with energy related research in Hawaii. HNEI also stimulates the formulation of energy projects with potential for Federal funding, and serves as the central source of information on natural energy policies and programs.

Act 236, adopted by the State Legislature in 1974, established the Natural Energy Laboratory of Hawaii (NELH) at Ke-ahole (North Kona, Hawaii) to provide essential support facilities for future energy research programs. The legislature selected Ke-ahole Point through the criteria for development of three of the proposed natural energy programs (OTEC, Biomass conversion, and direct solar energy utilization systems).

In 1976, the State Legislature adopted Act 189 which complemented the development half for energy self-sufficiency by the creation of tax incentives for the installation and use of "solar energy devices" and "alternate energy improvements" to promote energy conservation. These devices and improvements increase the level of efficiency, and decrease the utilization of electrical power which accounts for 42% of the total energy demand in the County of Hawaii.

The County of Hawaii must combine the efforts of energy conservation and the development of natural energy alternatives to minimize dependence on imported fossil fuels in order to attain energy self-sufficiency.

In addition, the development of naturally occurring energy resources will become a valuable planning tool allowing for selectivity in kind and location of future industrial activity on the Island of Hawaii.

1. Geothermal Energy:

Geothermal Energy is natural heat energy from the earth that can be harnessed for direct thermal use and for electrical power generation. These are four basic ways in which this type of natural heat energy may be found: 1) steam; 2) hot water; 3) magma; 4) hot, dry rock. The construction of electrical power plants using hot water, brines, or steam separated from hot water or brine deposits is the most probable development of geothermal energy resources.

Geothermal drilling on the Big Island started in the early 1960's. Initial wells were either found to be unsuccessful or once drilled were not further developed.

In 1972, the Hawaii Geothermal Project (HGP) was organized to investigate the development of geothermal energy in Hawaii, and is a cooperative project involving Federal, State, County, and private funds. In April 1976, a successful well was completed near Kapoho in the Puna District, and HGP has proposed the installation of a research power plant to demonstrate that geothermal energy is an economically viable natural energy alternative for the Big Island.

2. Hydroelectric Power:

Hydroelectric power is one of the oldest sources of electrical energy. On the Big Island, hydroelectric power fulfills only a very small portion (approximately 4%) of the County's electrical energy demand.

On the Big Island, the percent of total demand supplied by hydroelectricity will probably remain significant due to the reliance on normal stream flows and the lack of impoundment required to store enough water for continuous or increased energy output.

3. Solar Energy:

Solar energy is the basis of many natural energy alternatives in Hawaii. Solar energy generates the global winds; stores energy in biomass through photosynthetic activity; warms the oceans, can produce electrical power directly via photovoltaic cells; and can be used directly for heating through solar heat collection devices.

Wind Energy: The University of Hawaii, Department of Meteorology, initiated a five-year program in 1977 for Solar Energy Meteorological Research for the purpose of continuing wind surveys to establish the relationship between weather conditions and wind strengths, speeds, and distribution. Wind energy can be used directly to generate electricity through windmill electrical generators or by pumping water into storage for use in hydroelectric power systems. Wind energy technology has been advancing, but as yet is not competitive enough to be a serious natural energy alternative. Once the technology is developed, Hawaii will be in an advantageous position due to favorable wind regimes in many areas of the island.

Biomass Conversion/Solid Waste-Alcohol Conversion: Biomass is defined as "the total mass or amount of living organisms in a particular area or volume." Solar energy is converted into plant biomass through photosynthesis. Biomass can be used by direct combustion to produce thermal energy, then steam to generate electrical power.

On the Big Island, biomass conversion generates about 34% of the County's electrical energy. Locally, bagasse, the fibrous waste of sugar can processing, is the only source of biomass in use.

Biomass conversion is one of the projects of the NELH program at Ke-ahole point, and involves the cultivation and harvest of plant and animal life forms as a natural energy alternative.

Biomass can also be considered solid waste, since it is the basis for most of mankind's organic refuse, and can be processed into ethyl alcohol. Alcohol fuel is adaptable for use in hydro-carbon combustion systems which account for about 58% of the total energy demand of Hawaii County. Through combustion, alcohol can generate electrical power (via heat and steam) which represents the remaining 42% of the County's total energy demand.

Ocean Thermal Energy Conversion (OTEC): Ocean Thermal Energy Conversion (OTEC) is a form of solar energy where the ocean acts as a solar heat collector. This process uses the thermal differences between the warm surface waters and the cold deep waters to power a turbine/generator for electrical power generation.

The NELH program at Ke'ahole point has proposed the installation of a study OTEC project plant to research the potential of this natural energy alternative.

Solar Devices/Improvements: There are two direct forms of solar energy applicable to households: 1) solar heat collection and 2) solar light energy to electrical power via photovoltaic cells.

Solar heat collection is adaptable to domestic water heating which accounts for a major portion of the electrical power demand per household.

Advances in the use of photovoltaic cells to generate electrical power is also applicable on a public utility scale as well as on a domestic basis.

These solar energy devices and improvements can be considered energy conservation technologies since their domestic use will possibly decrease the total energy demand in Hawaii County.

GOALS:

to strive towards energy self-sufficiency for Hawaii County.

to establish the Big Island as a demonstration community for the development and use of natural energy resources.

POLICIES:

The County shall encourage the development of alternative energy resources.

The County shall encourage the expansion of energy research industry.

The County shall strive to educate the public on new energy technologies and foster attitudes and activities conducive to energy conservation.

The County shall ensure a proper balance between the development of alternative energy resources and the preservation of environmental fitness.

The County shall strive to assure a sufficient supply of energy to support present and future demands.

The County shall provide incentives which will encourage the use of new energy sources and promote energy conservation.

The County shall seek funding from both government and private sources for research and development of alternative energy resources.

The County shall coordinate energy research and development efforts of both the government and private sectors.

OTHER CHANGES TO DOCUMENT

The emphasis of this updating effort was directed at the Land Use Pattern Allocation Guide (LUPAG) Maps. However, during the course of our review, it was found that some of the policies needed re-examining. The following are the changes:

1. Urban Center - Low Density (p. 78): To include the concept of allowing very limited neighborhood-type of commercial uses within the Low Density category and expanding the concept of residential uses. That portion would read "Low Density Residential, Neighborhood Commercial, and Ancillary Community and public uses, [(singel-family) residential-no more than 4 units per acre]." Parenthetical ( ) material to be deleted and underscored ______ to be added.

Additionally, the definition of residential uses was liberalized by deleting the reference to single-family. It was felt that density is the governing land use tool and not so much the kinds (duplex, triplex, etc.) of residential structure. This change

BILL NO. 146 (AMENDED)

COUNTY OF HAWAII - STATE OF HAWAII

ORDINANCE NO. 168

AN ORDINANCE AMENDING THE HAWAII COUNTY CODE BY ADDING CHAPTER 18 THEREOF, RELATING TO EXCAVATION, FILLS, GRADING, GRUBBING, STOCKPILING AND EROSION AND SEDIMENTATION CONTROL.

BE IT ORDAINED BY THE COUNCIL OF THE COUNTY OF HAWAII:

ARTICLE 1.

SECTION 1. GENERAL PROVISIONS.

Sec. 1.1. Purpose.

The purpose of this Ordinance is to provide standards to safeguard property, control erosion and sedimentation and to promote the public welfare by regulating and controlling excavations, fills, grading, grubbing and stockpiling operations within the County of Hawaii.

Sec. 1.2. Definitions.

Wherever used in this Ordinance, the following words shall have the meaning indicated:

(a) "Chief Engineer" shall mean the Chief Engineer, Department of Public Works, County of Hawaii, or his duly authorized representative.

(b) "Designated historic and archaeological sites" shall mean those sites listed within the County General Plan or the Hawaii Register of Historic Places.

(c) "Engineer" shall mean a professional engineer (civil or structural) registered in the State of Hawaii.

(d) "Engineer's soils report" shall mean a report on soils conditions prepared by an engineer experienced in the practice of soils mechanics and foundations engineering.

(e) "Erosion" shall mean the wearing away of the ground surface as a result of action by wind and/or water.

APPENDIX E

(f) "Excavation," "cut" or "borrow" shall mean any act by which soil, sand, gravel, rock or any similar material is cut into, dug, uncovered, removed, displaced, relocated or bulldozed. State Land Use Commission and County Zoning and other agencies' regulations on shoreline improvements are made a part hereof by reference.

(g) "Fill" shall mean any act by which soil, sand, gravel, rock or any other material is deposited, placed, pushed, dumped, pulled, transported, or moved to a new location. State Land Use Commission and County Zoning and other agencies' regulations on shoreline improvements are made a part hereof by reference.

(h) "Grading" shall mean any excavation or fill or any combination thereof.

(i) "Grubbing" shall mean any act by which vegetation, including trees, timber, shrubbery and plants, is removed, dislodged, uprooted or cleared from the surface of the ground.

(j) "Overburden" shall mean a soil material overlaying another geologic formation.

(k) "Permittee" shall mean the person or party to whom the permit is issued and shall include but not be limited to the property owner, his lessee, developer, agent, or attorney in fact.

(l) "Plasticity" shall mean the property of a soil which allows it to be deformed beyond the point of recovery without cracking or appreciable volume change.

(m) "Sedimentation" shall mean the deposition of erosional debris-soil sediment displaced by erosion and transported by water from a high elevation to an area of lower gradient where sediments are deposited as a result of slack water.

(n) "Soil and Water Conservation Districts" shall mean the legal subdivisions of the State of Hawaii authorized under Chapter 180, Hawaii Revised Statutes.

Whenever the Chief Engineer determines that any existing excavation, fill, grubbing or stockpiling has become a hazard to property, or adversely affects the safety, use, or stability of a public way or drainage channel, the owner of the property upon which the excavation, fill, grubbing or stockpiling is located, or other person or agent in control of said property, upon receipt of notice in writing from the Chief Engineer shall within the period specified therein repair or eliminate the hazard and be in conformanc with the requirements of this Ordinance. The Chief Engineer or his authorized representatives are hereby authorized to enter any property to determine or to enforce the provisions stated herein.

Sec. 1.4. Exclusions.

(a) All work in this section must conform to the provisions of Sec. 3.4 to be considered for exclusion.

(b) This Ordinance shall not apply to the following:

(1) Mining or quarrying operations regulated by other County Ordinances or governmental agencies.

(2) Grading within the building lines for basements and footings of a building, retaining wall, or other structure, authorized by a valid building permit.

(3) Grading and grubbing on individual cemetery plots.

(4) Sanitary filling and operation of rubbish dumps.

(5) Agricultural operations, including ranching incidental to or in conjunction with crop or livestock production

and all other operations that are in conformance with soil conservation practices acceptable to the applicable soil and water conservation district directors and are in accordance with an actively pursued comprehensive conservation program, providing:

a) Such operations do not alter the general and localized drainage patterns with respect to abutting properties.

b) A conservation program for the affected properties acceptable to and approved by the applicable soil and water conservation district directors is filed with the Soil Conservation District.

c) The conservation program, with appropriat modifications is reviewed and re-approved by the soil and water conservation district directors periodically but not less than once every five years.

(6) Excavation which does not alter the general drainage pattern with respect to abutting properties, which does not exceed 100 cubic yards of material on any one site, and does not exceed 5 feet in vertical height at its highest point; provided that the cut meets the cut slopes and the distance from property lines requirements in Section 3.1.

(7) Fill which does not alter the general draina pattern with respect to abutting properties, which does not exceed 100 cubic yards of material on any one site and does not exceed 5 feet in vertical depth at its deepest point, provided that the fill meets the fill slopes and distance from property lines requirements in Section 3.1.

(8) Grubbing which does not alter the general an localized drainage pattern with respect to abutting properties and does not exceed a total area of one acre.

(9) Exploratory excavations not to exceed 50 cubic yards under the direction of an engineer for the purpose of subsurface required by the Chief Engineer and provided that the Chief Engineer has been advised in writing prior to the start of such excavation.

(10) Clearing, excavation and filling required in conjunction with the installation of pole lines by electric, telephone and public utilities.

SECTION 2. PERMITS; INSPECTION.

Sec. 2.1. Permits.

Except as excluded in Section 1.4 of this Ordinance:

(a) No grading work shall be commenced or performed without a grading permit.

(b) No grubbing work shall be commenced or performed without a grubbing permit except where grubbing concerns land for which a grading permit has been issued.

(c) No stockpiling work shall be commenced or performed without a stockpiling permit.

(d) No grading, grubbing or stockpiling permit shall be issued without the Chief Engineer's review of the applicant's compliance with the County General Plan or with Chapters 6, 205 and 343, Hawaii Revised Statutes.

Sec. 2.2. Application for Permits.

(a) An applicant for a grading, grubbing, or stockpiling permit shall first file an application on a form furnished by th Department of Public Works, County of Hawaii. Each application shall:

(1) Describe by tax key or street address the land on which the proposed work is to be done.

(2) State the estimated dates for the starting and completion of the proposed work.

(3) Show the name of the permittee and/or owner including engineer, if applicable, who shall be responsible for the

work to be performed by himself, his contractors and/or employees and for requesting the inspections required herein.

(b) Each application for a grading permit shall also be accompanied by two sets of plans and specifications, including:

(1) For all areas

a) A vicinity sketch or other data adequately indicating the site location.

b) Boundary lines of the property on which the work is to be performed.

c) Location of any buildings, structures, or designated historic and archaeological sites, on the property where the work is to be performed and location of any building or structure on land of adjacent property which is within 15 feet of the property to be graded when the grading may affect the buildings, structures,or designated historic and archaeological sites.

d) Contours showing the topography of the existing ground and extending 5 feet into adjacent property when required by the Chief Engineer. The scale and contour are to be appropriate to the work in question.

e) Elevations, dimensions, location, extent and the slopes of all proposed grading shown by contours and other means.

f) The area in square feet of the land to be graded and the quantities of excavation and fill involved. Show separately quantities for excavation within and outside of building lines.

g) Any additional plans, drawings, or calculations required by the Chief Engineer.

(2) For grading of areas of more than 15,000 square feet, a contour map prepared by an engineer or land surveyor

and approved by the Chief Engineer and showing the contours and elevations of the land before and after the completion of the proposed grading. This map shall include location of existing large trees, designated historic and archaeological sites, and definable rock outcroppings, lava tubes, detailed plans and specifications of all drainage devices and utilities, including bank protection, walls, cribbing, dams, silting or sediment basins, landscaping, screen planting, erosion control planting or other protective devices to be constructed in connection with, or as a part of the proposed work, together with a map showing the drainage area and estimated runoff of the area served by any drains.

(3) Where a proposed cut or fill is greater than 15 feet in height; or on land with slopes exceeding 15 per cent in an area with high plasticity soils; or when any fill is to be placed over a swamp, pond, gully or lake; the permittee shall submit an engineer's soils report which shall include data regarding the nature, distribution and strength of existing soils and substantiating data from an engineer regarding the safety of the proposed grading, the fill and the material to be used, and describing the cut sections by showing the height, cut slope, benches, and material composing the cut bank.

(c) An applicant for a grubbing permit shall furnish two sets of plot plans showing the location, the property boundaries, and any other pertinent information as may be required by the Chief Engineer. Grubbing or land clearing by bulldozer for the purpose of making topographic survey shall not be permitted without an authorized grubbing permit. No permit will be required for cutting or bulldozing of trails for survey lines and access for soil exploration equipment.

(d) An applicant for a stockpiling permit shall furnish two sets of plot plans showing the property lines and the location of the proposed stockpile, quantities, height of stockpile, duration of stockpile, source and type of the material to be stockpiled and furnish any other pertinent information as may be required by the Chief Engineer to control the creation of dust, drainage or sedimentation problems. The plot plan for stockpiling shall be approved by the Chief Engineer.

(e) If no action (approval, disapproval, deferral or modification) is taken by the Chief Engineer within 30 days after submittal of the initial request the permit shall be deemed approved.

Sec. 2.3. Permit Limitations.

(a) The issuance of a grading permit shall constitute an authorization to do only that work which is described on the permit and on the plans and specifications approved by the Chief Engineer.

(b) Jurisdiction of Other Agencies. Permits issued under the requirements of this Ordinance shall not relieve the owner of responsibility for securing required permits for work to be done which is regulated by any other code, department or division of the governing agency.

(c) Conditions of Approval. In granting any permit under this Ordinance, the Chief Engineer may attach such conditions as may be reasonably necessary to prevent creation of a nuisance or hazard to public or private property. Such conditions may include, but shall not be limited to:

(1) Improvement of any existing grading to bring it up to the standards of this Ordinance.

(2) Requirements for fencing of excavations or fills which otherwise would be hazardous.

(3) Screen planting, landscaping, erosion control planting, or other treatments to maintain good appearance of graded area and reduce the detrimental impact on adjacent properties of the community.

(4) Cleaning up the area.

(5) Days and hours of operation.

Sec. 2.4. Permit Fees.

(a) Before issuing a grading permit, the Chief Engineer shall collect a permit fee for grading on the same site based on the volume of excavation or fill, whichever is greater, according to the following schedule:

Volume of Material	Permit Fee
0 - 100 cubic yards	$2.00
101 - 1,000 cubic yards	$2.00 for the first 100 cubic yards plus $2.00 for each additional 100 cubic yards or fraction thereof.
1,001 - 10,000 cubic yards	$20.00 for the first 1,000 cubic yards plus $2.00 for each additional 1,000 cubic yards or fraction thereof.
10,001 cubic yards or more	$38.00 for the first 10,000 cubic yards plus $1.00 per 1,000 cubic yards or fraction thereof.

(b) Before issuing a grubbing permit, the Chief Engineer shall collect a permit fee of $2.00 for grubbing in excess of one acre, plus $1.00 for each additional 5 acres or fraction thereof.

(c) Before issuing a stockpiling permit the Chief Engineer shall collect a permit fee of $2.00 for stockpiling in excess of the first 500 cubic yards plus $1.00 for each additional 1,000 cubic yards or fraction thereof.

(d) Where work for which a permit is required by this Ordinance is started or proceeded prior to obtaining said permit, the fees above specified shall be doubled, but the payment of such double fee shall not relieve any person from fully complying with the requirements of this Ordinance in the execution of the work nor from any other penalties prescribed herein.

(e) When grading, grubbing or stockpiling is performed by or on behalf of the County, State or Federal Government, the Chief Engineer shall waive the collection of any permit fee required in subsections (a), (b), and (c) above.

(f) All permit fees shall be deposited in the General Fund.

Sec. 2.5. <u>Expiration of Permits</u>.

(a) Every grading or grubbing permit shall expire and become null and void unless the work permitted herein is started within 90 days after the date of issuance or within 90 days after the completi[illegible] date specified thereon but not later than one year after the date of issuance. Extension of time may be granted if, in the judgment of the Chief Engineer, the work authorized under the permit would not be exceeded. In such cases, no additional fee will be imposed.

(b) Every stockpiling permit shall expire and become null and void one year after the date of issuance and all stockpiled material temporarily stored on the premises shall be removed from the premises or used on the premises as fill material under a grading permi[illegible] for fill prior to the expiration date. Extension of time may be grante[illegible] if, in the judgment of the Chief Engineer, the work authorized under the permit would not be exceeded. In such cases, no additional fee will be imposed.

Sec. 2.6. <u>Denial of Permit</u>.

(a) If the Chief Engineer finds that the work as proposed by the applicant is likely to endanger any property or public way or structure or endanger the public health or welfare, he shall deny the grading, grubbing or stockpiling permit. Factors to be considered in determining probability of hazardous conditions shall include, but not be limited to, possible saturation of the ground by rains, earth movements, geological or flood hazards, undesirable surface water runoff, sub-surface conditions such as the stratification and faulting of rock, nature and type of soil or rock. Failure of the Chief Engineer to observe or recognize hazardous conditions or his failure to deny the grading, grubbing or stockpiling permit shall not relieve the permittee or his agent from being responsible, or cause the County, its officers or agents, to be held responsible for the conditions or damages resulting therefrom.

Sec. 2.7. Suspension or Revocation of Permit.

(a) The Chief Engineer may, in writing, suspend or revoke a permit issued under the provisions of this Ordinance whenever the permit has been issued on the basis of incorrect or insufficient information supplied by the permittee; whenever the grading, grubbing or stockpiling is not being performed in accordance with the terms and provisions of the permit; or whenever the grading, grubbing or stockpiling discloses objectionable or unsafe conditions.

(b) When a permit has been suspended or revoked, the permittee may submit detailed plans and proposals for compliance with the provisions of this Ordinance and for correcting the objectionable or unsafe conditions. Upon approval of such plans and proposals by the Chief Engineer, he may authorize the permittee in writing, to proceed with the work.

Sec. 2.8. Right of County to Perform Work and to Recover Costs Thereof.

(a) In the event that the permittee shall fail (1) to comply with all the terms and conditions of the permit to the satisfaction of the Chief Engineer; or (2) to complete all of the work authorized under the permit within the time limit specified in the permit; or (3) to comply with all special precautions enumerated in Section 3.2 and with all the requirements of the Chief Engineer pursuant to Section 3.2; or (4) fail to proceed under Section 2.7(b); within 30 days after a permittee has been served with written notice thereof, either by mail or personal service, the County Council may order the permittee to be prosecuted as a violator of the provisions of this Ordinance and may order the Chief Engineer to proceed with the work specified in such notice. A statement of the cost of such work shall be transmitted to the County Council who shall cause the same to be paid. Such cost shall be charged to the permittee or owner or both of the premises involved. The County of Hawaii may enforce payment of such cost in any manner provided by law, including proceedings under Chapter 507, Part II, Hawaii Revised Statutes. For the purposes of the operation of Part II of Chapter 507 of the Hawaii Revised Statutes, the permittee shall be deemed to come within the definition of "owner" as defined in said chapter; the County of Hawaii shall be deemed to come within the definition of "general contractor" as defined in said section and the execution of work specified in the notice shall be deemed a contract between the permittee and the County of Hawaii.

Sec. 2.9. Construction Prohibited Prior to Completion of Grading Work.

No construction of any structure upon the premises involved shall be permitted until the Chief Engineer has received the notice of completion that the grading, grubbing, or stockpile work has been completed in accordance with the grading permit.

Sec. 2.10. Inspection.

(a) Each permit issued under this Ordinance shall be deemed to include the right of the Chief Engineer or his authorized representatives to enter upon and to inspect the grading, grubbing or stockpiling operations.

(b) The permittee shall notify the Chief Engineer at least two days before the permittee or his agent begins any grading, grubbing or stockpiling. A copy of the permit, approved plans and specifications for grading, grubbing or stockpiling shall be maintained at the site during the progress of any work. Where it is found by inspection that the soil or other conditions are not the same as stated or shown in the application for grading, grubbing or stockpiling permit, the Chief Engineer may stop the grading, grubbing or stockpiling until revised plans, based upon the existing conditions, are submitted by the permittee and approved by the Chief Engineer. Approval or disapproval of applicant's revised plan shall be made within 14 days from date of receipt by the Chief Engineer.

(c) If the Chief Engineer or his representative finds that the work is not being done in conformance with this Ordinance; or the plans and specifications approved by the Chief Engineer, he shall immediately notify the person in charge of the grading work of the non-conformity and immediately notify the responsible party the need for corrective measures to be taken. Grading operations shall cease until corrective measures satisfactory to the Chief Engineer have been taken.

(d) When a permittee has been served with a written notice, either by mail or personal service for failure to comply with any provision of this Ordinance, or when a permittee has had his permit suspended or revoked by the Chief Engineer, the permittee and any person or party connected with execution of the work authorized by the permit shall be denied a grading, grubbing or stockpiling permit for such work until the permittee has complied and initiated action satisfactory to the Chief Engineer to comply with the provisions of this Ordinance.

SECTION 3. EXCAVATION, FILLS, GRADING, GRUBBING AND STRIPPING.

Sec. 3.1. Conditions of Permit.

The requirements of paragraphs (a), (b) or (c) herein may be waived by the Chief Engineer after the permittee submits an engineer's soils report substantiating data regarding the stability of the cut or fill slopes without complying with any of the requirements therein.

(a) Height. Where a cut or fill is greater than 15 feet in height, terraces or benches shall be constructed at vertical intervals of 15 feet except that where only one bench is required, it shall be at the midpoint. The minimum width of such terraces or benches shall be 8 feet or as determined by the Chief Engineer, based upon the type of material encountered and shall have suitable drainage provisions to control erosion on the slope face.

(b) Cut Slopes. Under the following soil conditions, no cut may be steeper in slope than the ratio of its horizontal to its vertical distance as shown below:

1/2 horizontal to 1 vertical in unweathered rock;

1-1/2 horizontal to 1 vertical in decomposed rocks or rock and soil mixture;

2 horizontal to 1 vertical in low plasticity soils.

3 horizontal to 1 vertical in high plasticity soils for cuts up to 5 feet in vertical depths. Slopes for cuts exceeding this depth shall be as recommended in the engineer's soils report.

(c) Fill Slopes. Under the following soil conditions, no fill may be steeper in slope than the ratio of its horizontal to its vertical distance as shown below:

1-1/2 horizontal to 1 vertical in rock and soil mixture.

2 horizontal to 1 vertical in low plasticity soils.

3 horizontal to 1 vertical in high plasticity soils for fills up to 5 feet in vertical height. Slopes for fills exceeding this height shall be as recommended in the engineer's soils report.

(d) Distance from Property Line. The horizontal distance from the top of a cut slope or the bottom of a fill slope to the adjoining property line shall be as follows:

Height of Cut or Fill	Distance from Property Line (in feet)
Zero feet to 4 feet	2
More than 4 feet to 8 feet	4
More than 8 feet to 15 feet	6
More than 15 feet	8

These requirements may be modified by the Chief Engineer when cuts or fills are supported by retaining walls, approved by the Building Department, or when the permittee submits an engineer's soils report stating that the soil conditions will permit a lesser horizontal distance without causing damage or danger to the adjoining property. Retaining wall of 6 feet and over shall be designed by a professional engineer when deemed necessary by the Chief Engineer. Setback requirements of the County Zoning Ordinance is referenced herewith. State

Land Use Commission and County Zoning Ordinance and other agencies' requirements on shoreline improvements are referenced herewith.

(e) Area Cleared. The maximum area of land that may be cleared for grading or grubbing is 20 acres. The area of land that may be cleared may be increased or reduced by the Chief Engineer to control pollution and minimize storm damage. Additional area shall not be cleared for grading or grubbing until measures to prevent dust or erosion problems in the area already graded or grubbed have been completed.

(f) Fill Materials. The fill material may consist of rock, gravel, sand, or soil or a mixture thereof. *Except for* slopes, the fill shall be compacted to 90 percent of maximum density as determined by the ASTM Soil Compaction Test D1557, as amended. The Chief Engineer shall inspect the work and may require adequate inspection and compaction control substantiated by test results by an engineer qualified to prepare an engineer's soils report. These requirements may be modified by the Chief Engineer if the permittee submits an engineer's soils report substantiating with appropriate investigation and analysis that the required 90% compaction density may be lowered without causing excessive settlement, creep or stability problems.

(g) Preparation of Ground Surface Before Placing Fill or Stockpiling. The natural ground surface shall be prepared by removing the vegetation and, if required by the Chief Engineer, shall be keyed by a series of benches. No fill shall be placed over any water spring, marsh, refuse dump, nor upon a soggy or springy foundation, provided that this requirement may be waived by the Chief Engineer if the permittee submits an engineer's soils report substantiating data regarding the safety of the fill.

(h) Vegetation. Whenever feasible natural vegetation should be retained. If removed, trees, timber, plants, shrubbery and other vegetation, after being uprooted, displaced, or dislodged from the ground by excavation, clearing or grubbing, shall not be stored or deposited along the banks of any stream, river, or natural water course. After being uprooted, displaced or dislodged, such vegetation shall be disposed of and removed from the site within a reasonable time, but not to exceed three (3) months. Exceptions providing for burial in open areas may be allowed as determined by the Chief Engineer.

(i) Report after Grading. When drading involves cuts or fills for which an engineer's soils report is required, the permittee shall submit a report summarizing the construction technique and inspection data as well as a statement regarding conformaty to this Ordinance and the project specifications.

(j) Notification of Completion. The permittee or his agent shall notify the Chief Engineer or his representative when the grading operation is ready for final inspection. Final approval shall not be given until all work including installation of all drainage structures and their protective devices have been completed and the required reports have been submitted.

Sec. 3.2. Special Requirements.

(a) Any person performing or causing to be performed an excavation or fill shall, at his own expense, provide the necessary means to prevent the movement of earth of the adjoining properties, to protect the improvements thereon, and to maintain the existing natural grade of adjoining properties.

(b) Any person performing or causing to be performed, any excavation or fill shall be responsible for the maintenance or restoration of street pavements, sidewalks and curbs, and improvements of public utilities which may be affected. The maintenance or restoration of street pavements, sidewalks and curbs shall be performed in accordance with the requirements of the County of Hawaii and the maintenance and restoration of improvements of public utilities shall be in conformity with the standards of the public utilities companies affected.

(c) Any person depositing or causing to be deposited, any silt or other debris in ditches, water courses, drainage facilities, and public roadways, shall remove such silt or other debris. In case such person shall fail, neglect or refuse to comply with the provisions of this section within 48 hours after written notice, served upon him, either by mail or by personal service, the Chief Engineer may proceed to remove the silt and other debris or to take any other action he deems appropriate. The costs incurred for any action taken by the Chief Engineer shall be payable by such person.

(d) At any stage of the grading, grubbing or stockpiling work, if the Chief Engineer finds that further work as authorized by an existing permit is likely to create soil erosion problems or to endanger any life, limb, or property, he may require safety precautions, which may include but shall not be limited to the construction of more gradual slopes, the construction of more gradual slopes, the construction of additional silting or sediment basins, drainage facilities or benches, the removal of rocks, boulders, debris and other dangerous objects which, if dislodged, are likely to cause injury or damage, the construction of fences or other suitable protective barriers, the planting and sodding of slopes and bare areas and the performance of additional soil compaction. All planted or sodded areas shall be maintained. An irrigation system or watering facilities may be required by the Chief Engineer.

(e) At any stage of the grading, grubbing or stockpiling operations, if the Chief Engineer finds that further work as authorized by an existing permit is likely to create dust problems which may jeopardize health, property or the public welfare, the Chief Engineer may require additional dust control precautions and, if these additional precautions are not effective in controlling dust, may stop all operations. These additional dust control measures may include such items as sprinkling water, applying mulch treated with bituminous material, or applying hydro mulch.

Sec. 3.3. Drainage Provisions.

(a) Adequate provisions shall be made to prevent surface waters from damaging the cut face of an excavation or the sloping surfaces of a fill. All drainage provisions shall be designed to carry surface waters to a street, storm drain, natural water course or other area, approved by the Chief Engineer as a safe place to deposit and receive such waters. The Chief Engineer may require such drainage structures and pipes to be constructed or installed, which in his opinion, are necessary to prevent erosions damage and to satisfactorily carry off surface waters.

(b) Whenever the surface of a lot is excavated or filled, positive drainage shall be provided to prevent the accumulation or retention of surface water in pits, gullies, holes, or similar depression which may create a hazard or nuisance.

(c) The flow of any existing and known natural underground drainage shall not be impeded or changed so as to cause damage to adjoining property.

Sec. 3.4. Erosion and Sedimentation

(a) All grading, grubbing and stockpiling permits and operations shall conform to the erosion and sedimentation control standards and guidelines established by the Department of Public Works in conformity with Act 249, SLH 1974.

SECTION 4. VIOLATIONS AND PENALTIES: OTHER LIABILITIES.

Sec. 4.1. Penalties.

(a) Violations. It shall be unlawful for any person to do any act forbidden, or to fail to perform any act required, by the provisions of this Ordinance.

(b) Continuing Violation. The failure to comply with the requirements set forth under the provisions of this Ordinance shall be deemed a new offense for each day of such non-compliance.

(c) Penalty. Any person violating any of the provisions of this Ordinance shall, upon conviction, be punished by a fine not exceeding $500, or by imprisonment not exceeding 50 days, or by both for each offense.

Sec. 4.2. Liability.

The provisions of this Ordinance shall not be construed to relieve or alleviate the liability of any person for damages resulting from performing, or causing to be performed, any grading, grubbing or stockpiling operation. The Chief Engineer or any employee charged with the enforcement of this Ordinance, acting in good faith and without malice for the County in the discharge of his duties, shall not thereby render himself liable personally and he is hereby relieved from all personal liability for any damage that may accrue to persons or property as a result of any required act or omission in the discharge of his duties.

SECTION 5. WAIVER.

Sec. 5.1. Waiver.

In all applicable cases, if a permittee, supported by accompanied engineer's report, finds that strict adherence to the provisions of this Ordinance causes undue hardship or practical difficulty, he may seek waivers from the provisions and the Chief Engineer may grant a waiver with conditions if he finds that the request will not likely create any problems to the adjoining properties nor endanger any life or limb nor be in conflict with existing ordinances and statutes.

SECTION 6. BOARD OF APPEALS.

Sec. 6.1. Appeals.

There shall be a board of appeals, to be known as the Grading Board of Appeals, which shall consist of five members two of whom shall be from the soil conservation district, who shall be appointed by the Mayor with the approval of the Council in the manner prescribed in Section 13-4 of the Hawaii County Charter. The Grading Board of Appeals shall be administratively connected with the Department of Public Works. The Grading Board of Appeals shall hear and determine appeals from the actions of the Chief Engineer in the administration of this Ordinance. An appeal shall be sustained only if the Board finds that the action of the Chief Engineer was based on an erroneous finding of a material fact or that the Chief Engineer had acted in an arbitrary or capricious manner or had manifestly abused his discretion.

SECTION 7. SEVERABILITY. If any portion of this chapter, or its application to any person or circumstance, shall be held unconstitutional or invalid, the remainder of the chapter and the application of such portion to other persons or circumstances shall not be affected thereby.

SECTION 8. This Ordinance shall take effect 45 days after its adoption.

INTRODUCED BY:

Josephine R. Yadao
Councilman, County of Hawaii

Hilo, Hawaii

Date of Introduction: July 23, 1975

Date of Adoption: November 5, 1975

Effective Date: December 20, 1975

AVIAN ASSESSMENT SURVEY

for

BioEnergy Development Corporation

By Matthew D. Hess
Bachelor of Science in Zoology

Avian Disease Laboratory
Hawaii Volcanoes National Park

University of Hawaii Research Corporation

1980 Earthwatch Teams Assistant

APPENDIX F

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INTRODUCTION

A biomass energy organization is proposing the clear cut logging of an area involving 341 acres which is in an area known to have endermic Hawaiian birds. At the request of BioEnergy Development Corporation, the author, Matthew Hess was contracted to undertake an avian assessment survey. The primary objective in this Avian survey of a small geographic area of 341 acres, called Puueo, in the Hilo district on the island of Hawaii, was to establish the presence of any endangered bird species. In addition, quantitative data on all the bird species present was found collected, to give a view of the species diversity and density. In this 54 man-hour study beginning September 29, 1980 and ending November 9, 1980, attention was directed toward the detection of endemic and endangered bird species.

HISTORICAL REVIEW

HABITAT

A number of factors have led to the degeneration of this area's native forest, which now has a direct bearing on the resources available for the native and endangered bird species. The native trees found were widely scattered Koa, Hapuu, and Ohia in largely the same abundance as the scattered exotic Eucalyptus. The succession of the thick guava tree stands results in mostly older Ohia and Koa trees with little apparent regeneration. The geographic elevation is between 1600 ft. and 2400 ft., where at the highest elevation the guava is still consistently dense. In the elevations above, a vegetation gradient begins that gradually becomes more continuous with the predominently native forest at approximately 3000 ft.(1) The rainfall is variable throughout the year, but this is considered a wet, low elevation forest with from 250 to 300 in. average rainfall annually.(2)

In this low elevation the night biting mosquito, Culex, is known to thrive, therefore this is now a habitat with vectors for such avian diseases as malaria and fowl pox. The native bird species and many of the endangered birds have little genetic resistance to these exotic diseases and this is believed to be another factor why many endemic species, with former ranges here, now are found in higher elevations.(3)

Experimental evidence has demonstrated the high susceptability of existing endemic species to avian malaria, an exotic disease. (Charles Van Riper III, personal communication) In a preliminary study to determine this drepanid distribution near Hilo, an abrupt lower edge of population density occurred at about the 2000 ft. level, the approximate upper level of the Culex mosquitos' breeding belt.(4) However, this avian malaria vector has now been known to breed in localized areas as high as 6000 ft.(5)

An endangered species presently known to occur in these elevations is the Hawaiian Hawk. (Curtis Griffin, personal communication) The other endemic Hawaiian drepanids found on Hawaii are believed to occur only in the forest elevations above 600 - 900 m, approximately 2000 ft. as a lower edge.(6) The Hawaiian Owl and the Elepaio are other endemic species known to occur in these elevations.(7)

Endangered species, as any endemic species, may, frequent the area by day if their elevational ranges are close enough. They may also use these elevations at different months of the year, migrating vertically or laterally. Therefore, practically all endangered species are treated as possibly occurring in the area, even though most are not proable to be found here.

The U. S. Fish and Wildlife Service investigation of the Hilo districts has not yet been published for reference. Refer to Table 1 for the individual endangered species accounts of the known elevational ranges and habitat descriptions, derived largely from Berger(8) and Munro(9).

STUDY METHODS

Census Method

Selection of a particular census method took many hours of consideration. The first method chosen not only gives a fair accuracy of the species diversity at the time of this survey, but also a more thorough view of the species density and relative abundances in this area. The variable circular-plot technique used by Dr. Michael Scott of the Hawaii Fish and Wildlife Service and the U. S. Forest Service Ornithologists was selected to generate the data.(10) Several line transects, parallel to the contour were set with flagging tape. This technique was used on four mornings, from dawn till about 10:30 a.m., during the period of maximum bird activity and singing in order that observations at later stations were not biased as activity gradually decreased.

The starting and ending stations on each of the 4 days were different, and the transects ran in opposite directions, and from different elevations each day so that any bias was eliminated. Since a large influence in bird activity and singing was the weather, each morning the survey was conducted, was consistent in being calm and sunny.

A second method used in the field each day was a random search for incidental sightings of endangered species. In conjunction with the first method this should determine whatever populations of endangered birds were present. A total of 34 hours were spent in random searching and this was important since direct attention could be given to watching and listening for the several possible, endangered species. (Table 1)

A tape recorder was carried at all times to attempt to record any of these vocalizations, but its use was empahsized in this incidental sightings method. In addition, 3 hours from 6:30 p.m. to 9:30 p.m. on 2 nights were spent listening for diurnal and nocturnal species that may be present; the Hawaiian Owl, the threatened Newell's Shearwater and the endangered Hawaiian Hoary Bat.

STUDY METHODS

Transect Selection

In selecting the transects on a topographic map the distances between the transects had to be as close as possible for the required thoroughness, yet remain statistically independent of the other transects' detection distance. A distance of 400 m. between transects was selected since the detection distance of the most conspicuous species is usually not more than 125 m. This habitat is fairly uniform in vegetation, therefore the transect lines were decided to run parallel to the contour of the gradual slope. The magnetic North-South axis happened to approximate the transect direction therefore was utilized to place the primary transect at the lower boundary and placed the following transects parallel and 400 m apart. Placement of the transects in some areas had to be irregular to accommodate the barriers of thick guava stands and steep ravines.

STUDY METHODS

Placement of Stations

A decision to survey just 100 m beyond all borders of the 341 acre parcel was accomplished by first placing stations at the ends of all transects near the boundaries. With the first transect placed at the lower border, stations were selected at least 200 m. apart and farther in a few instances. This is to insure the statistical independence of each station and still be as precise in locating the rarer or less obvious endangered species.

The field forms used were the standard U. S. Fish and Wildlife forms for use with the Variable Circular Plot Method for estimation of species density.

LIMITATIONS

In such an avian survey there are limitations to the desired accuracy which must be considered and stated in the report. The 54 man-hours spent in the methods of this survey's fieldwork would be sufficient to detect whatever populations of endangered or threatened species are present, but may not determine those species that occur in the area in other seasons of the year. Following is a number of factors that may contribute to scattered individuals escaping detection, as would be the case with endangered species whose abundance is scarce:

A. The accessibility of this area was limited in a few places due to the thick guava tree stands and steep ravines.

B. Near the higher elevations in the 341 acres the area is narrow and may be utilized by endangered species in adjacent areas at this elevation. Effort was taken to survey outside the higher area by the addition of 10 stations placed at the upper boundaries.

C. A number of the endangered species in Hawaii have extensive foraging ranges that would make detection difficult.

D. Again, this survey, conducted largely in the month of October was but one month of the year, and the species found in the area may fluctuate seasonally.

These limitations therefore allow the author only to state what was encountered during the 54 man-hours in the fieldwork. Also, the author can suggest which endangered species possibly utilize this area that were not detected for any of the above stated factors. This survey was not intended as a representation of this elevation or any other adjacent area, but the 341 acres called Puueo, in Amauulu, Hawaii.

SUMMARY

During the entire 54 man-hours in the fieldwork, no endangered species were detected. This area does not resemble in any context what could be viewed as a prime habitat for endemic or endangered bird species. Indeed, this area was found to be poor in resources for native birds, either for food, shelter, or breeding. However, this does not infer that there are no endangered species utilizing this 341 acres now, or at other times of the year. All that can be said is that during this survey, none were detected. The Variable Circular Plot method generated useful data that gives a fair estimate of the species diversity and density.

Again it is known that the Endangered Hawaiian Hawk does utilize the elevation and area of the Hilo district, as might be found the threatened Newell's Shearwater at other times of the year.(11) The Consultant Botanist reported sighting the Hawaiian Hawk near the lower boundary of the survey area.

Other endemic species also known to inhabit these elevations is the Hawaiian Owl and the Elepaio according to Munro.(12) It would be fairly accurate to state that no populations of endangered avian species exist here with the exception of the Hawaiian Hawk. If an endangered species is residing, or foraging in this 341 acres, called Puueo, it would have to be as isolated individuals or pairs.

ACKNOWLEDGMENTS

The author would like to thank Dr. Michael Scott of the U. S. Fish and Wildlife Service at Volcano National Park for his help in compiling the data collected in the field with the use of his computer program for the Variable Circular Plot Method and for his suggestions in the selection of the methods for this Avian Assessment Survey.

Also, thanks to Howard Sakai of the Forestry Service for his aide with the designing of the study methods and transects for this survey.

Thanks to Mark Collins with the U. S. Forestry Service for his suggestions about the format and his guidance in preparation.

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APPENDIX

In this section is included all the data compiled during the 100 count periods, generated by the Variable Circular Plot method.

Table 1 is a comparison of Habitat descriptions and elevational ranges of the endangered birds of Hawaii according to the publishings of A. J. Berger and G. C. Berger. These species accounts of the endangered species of Hawaii is to review of some of the published information on their distributions and abundance.

Table 2 shows the species actually observed during the count periods, and those species estimated densities in number of birds/100 acres, number of birds/341 acres and the 95% confidence levels of the latter, as computed from the data generated. The estimation of species densities and related computations were made by the Variable Circular Plot computer program as used by ornithologists with the U. S. Fish and Wildlife Service and the U. S. Forestry Service. Where minute numbers of a species are encountered density estimation may appear unusual.

Table 3 is the calculated species frequency, the species incidence, and relative abundance of those species located during the count periods to give three additional indicators relating to abundance.

Figure 1 is a map of the 341 acres called Puueo with the transect and station positions selected for this survey.

FIG. 1

TRANSECT AND STATION POSITIONS

TABLE 1

ENDANGERED SPECIES HABITAT ACCOUNTS ON HAWAII

	Berger (8)	Munro (9)
HAWAIIAN HAWK *Buteo solitarius*	Primarily occurs in wet, native forest from sea level to 8500'.	Widely distributed, generally from 2000' to 5000' prefers open forest rather than a wet dense one.
HAWAIIAN CROW *Corvus tropicus*	Sighted Baldwin as being above 3700' rough AA lava with undisturbed native vegetation. Only on Hualalai at present. Tomich sighted a nest at 2300' near Puuwaawaa Ranch.	Seems confined to Hualalai and Kona. Formerly ranged from 1000' to 8000' in the 1890's. Now habitat is degraded and population is almost extinct.
HAWAIIAN CREEPER *Loxops maculatas mana*	Uncommon on Hawaii. Perkins stated that distribution was puzzling. Could be found above 3500' in South Kona. Food sources of insects primarily from large Koa trees.	No apparent reasons why numerous in some locations and scarce in others.
HAWAIIAN COOT *Fulica americana alai*	Prefer more open water, but often found in brackish marshes in low land areas.	Seen in fresh and brackish water, but prefers areas of open water, particularly shore lagoons.
HAWAIIAN STILT *Himantopus himantopus knudseni*	Prefers marsh areas and ponds. Generally abundant where reseding tides leave exposed marine animals in the mud. Can occur short distances from the sea, but keeps to open plains.	Found in marshy areas and swamps, but mostly in tidal mud flats. Munro states that there seems to be no record of it on Hawaii.
HAWAIIAN DUCK *Anas wyvilliana*	In recent years found only on Kauai, more recently reintroduced on Hawaii.	Originally common in coastal lagoons, marshes and mountain streams. Perkins reports it in small pools on mountain streams on the main islands.
HAWAIIAN GOOSE *Branta sandvicensis*	Found in open lava flows with suitable vegetation. Breeding habitat here also at elevations about 5000'.	Accustomed to semiarid waterless high country acquiring moisture from the berries. Thought to winter in low land lava flows. Some collected at 2000' in early 1900's.

	Berger (8)	Munro (9)
AKIAPOLAAU *Hemiganthus wilsoni*	Recently only found in Mamane-Naio forests and some koa from 3500' and above. Perkins in 1903 reports commonly sighted in Koa trees from 1500' and above in the Hilo forests.	Generally found above 3500' however reported in Kilauea and Olaa For. .t Reserves.
AKEPA *Loxops coccinea coccinea*	Perkins notes that it is widely distributed on Hawaii occurring in Koa, Ohia, and Naio trees for food sources. Specimens found between 3000' and 5000'. Baldwin reports in 1950 observing them in South Hilo districts.	Note on Hawaii and can be found above 4000'. On Mauna Kea above 5000'.
OU ?sittirostra psittacea	At low elevations certain diseases may have caused destruction there. The OU on Hawaii is seldom seen. Richards reports several in the upper Olaa forest at 4000'.	Did formerly forage in low elevations but, diseases carried it to near extinction. High Flier, migrates over large areas of forest, now predominately native.
PALILA *Psittirostra bailleui*	In the past the Palila had a wide distribution. Now they are common from 7000' upwards to treeline. Only rarely are they found below 6500' and only in the Mamane forest which is their main food source on Mauna Kea.	Formerly in 1890 found at 4000'. At present, reported only high on Mauna Kea slopes in Mamane-Naio forest above 6000'.
.RK RUMPED PETREL *Pterodroma phaeopygia sandwichensis*	One reported at Kilauea Crater in 1948 and 5 dead birds found above 9000' on Mauna Loa from feral cats. Munro reports nests from 1500' to 5000'. The mongoose has caused its demise on Hawaii.	Endemic to main islands formerly from 1500' to 5000'. Now on Hawaii thought to be restricted to volcanic slopes above 7000'.
.EWELL'S SHEARWATER *Puffinus newelli*	(Threatened) Population reduced on Hawaii also by mongoose. Known to frequent island of Hawaii. Nesting colony on Kauai is located about 1500'. Munro reports nesting from 500' to 1000'.	Nests found in burrows near the sea from 500' to 1000' in forested areas.
HAWAIIAN HOARY BAT *Lasiurus linereus semotus*	Only endemic land mammal.	Observed this mammal at sea level, and at 9000' on Haleakala, Maui. Steven Sabo U.S. Fish and Wildlife Service (per. communication)

TABLE 2

Species	Actual # Sighted.	Estimated Density: Birds/ 100 Acres	Estimated Density: Birds/ 341 Acres	95% Confidence Levels For Population Densi In Total Area (341 Ac: Lower	Upper
House Sparrow	23	4.90	16.71	10.57	24.22
N. American Cardinal	53	4.33	14.77	11.06	19.00
Japanese White Eye	232	67.01	228.51	200.05	258.86
Elepaio	40	12.89	43.94	31.38	58.62
Spotted Munia	13	4.03	13.73	7.28	22.21
Red-billed Leiothrix	7	.45	1.54	.61	2.89
House Finch	5	.66	2.24	.70	4.64
Melodious Laughing Thrush	2	.16	.55	.05	1.55
Kalij Pheasant	1	.03	.09	.000037	.36
Helmeted Guinea Fowl	2	5.73	19.53	1.84	55.98

TABLE 3

Species	Species Frequency	Species Incidence	Species Abundance
House Sparrow	8/100 = .08	23/8 = 2.875	23/232 = .099
N. American Cardinal	37/100 = .37	53/37 = 1.432	53/232 = .228
Japanese White Eye	89/100 = .89	232/89 = 2.607	232/232 = 1.00
Elepaio	32/100 = .32	40/32 = 1.25	40/232 = .172
Spotted Munia	5/100 = .05	13/5 = 2.60	13/232 = .056
Red-billed Leiothrix	5/100 = .05	7/5 = 1.40	7/232 = .030
House Finch	3/100 = .03	5/3 = 1.67	5/232 = .021
Melodious Laughing Thrush	2/100 = .02	2/2 = 1.00	2/232 = .009
Kalij Pheasant	1/100 = .01	1/1 = 1.00	1/232 = .004
Helmeted Buinea Fowl	1/100 = .01	2/1 = 2.00	2/232 = .0[illegible]

Species Frequency - Number of count periods species is recorded <u>divided by</u> Total number of count periods.

Species Incidence - Number of a species recorded <u>divided by</u> Number of count periods species is recorded.

Species Abundance - Number of a species recorded <u>divided by</u> Number of most abundant species.

RECOMMENDATIONS

Considerations must be made for the adjacent areas to this 341 acres. The higher elevations of this area is approximately 500 ft. below the predominantly native forest where endemic birds are thought to occur. Effort must be taken to ensure that the degradation of adjacent areas by additional exotic vegetation does not occur. The native forest above, utilized by endemic bird species hopefully will not be affected by the clear cut logging of this 341 acres.

FLORISTIC ASSESSMENT
IN THE
PUUEO FOREST RESERVE

November, 1980

Winona Char
Layne Yoshida

TABLE OF CONTENTS

INTRODUCTION

An environmental assessment of the vegetation of the study area was conducted during November 1980. The major portion of the field work was conducted from November 6 to November 9 by Winona Char and Layne Yoshida.

The study site consists of approximately 300 acres in the Puueo Forest Reserve and is bounded on the south by 'Awehi' Stream and on the north by 'Pukihae' Stream. The elevation of the study site is between 1600 and 2400 ft. A trail that parallels 'Awehi' Stream was used to gain access to the southern boundary of the study site, while two minor unnamed streams were used as access trails to the central portion of the study area. There were no recognizable trails to be found on the eastern boundary and access was gained by cutting a trail paralleling 'Pukihae' Stream.

Since the main objective of this study was to provide an assessment of the vegetation in the area, notes were only made on the dominant vegetation types and species present. No attempt was made to estimate the percentage cover of each species within the study site.

METHODOLOGY

Prior to fieldwork, topographic maps were examined for possible access routes and trails. A walk-through survey method covering the most acreage was employed. Notes were made on the vegetation types and on the different species (taxa) encountered. Any vegetative associations appearing to be different were searched for unique or rare taxa.

Collections were made of plants which could not be positively identified in the field and were later determined in the laboratory at the University of Hawaii Herbarium. Voucher specimens of some of the plants collected have been deposited at the U. H. Herbarium.

DISCUSSION

The vegetation in the study area is highly disturbed (adjoining areas were once used for grazing cattle) and the dominant taxa throughout much of the area are waiawi (Psidium cattleianum), an exotic, and uluhe (Dicranopteris emarginata), a native fern. The vegetation types encountered during this survey are similar to other areas of highly disturbed vegetation at the same elevations along the Hamakua coast.

A matrix of closed waiawi scrub and uluhe patches form the major vegetation types within the study area. In these types of vegetation only a few other species are able to establish themselves. Larger trees such as 'ohi'a (Metrosideros collina ssp polymorpha), Eucalyptus (planted) can be found scattered throughout the area, along with some koa (Acacia koa). Several minor vegetation types in the area include small patches of California grass (Brachiaria mutica) and stands of Eucalyptus (mostly Eucalyptus robusta). Besides 'ohi'a and koa other native species found throughout the study area are hapu'u 'i'i (Cibotium chamissoi) hame or mehame (Antidesma platyphyllum) and kopiko (Psychotria hawaiiensis). Papa'a hekili (Clermontia parviflora), a native member of the Lobelia family, becomes occasional at elevations above 2000 ft.

Several taxa encountered during the survey could not be identified to the species level because they were either immature or without flowers. The only one which has a high probability of being on the Proposed Federal Register of Endangered Species is the Cyanea sp., Several individuals of this taxon were located along the small stream that passes through the central portion of the study site. The plant appears to grow only in dense shade along the steep stream bank.

SUMMARY

Only the 'Awehi' Stream area appears to have been botanized in the past and in searching the herbaria at the University of Hawaii, Manoa and Bishop Museum no rare or endangered taxa from the study area were located.

During the course of this survey no rare or endangered species were found and the vegetation types within this 300 acre area are not unique. The planned development of this area will not cause any significant damage to the total island population of any of the species involved.

CHECKLIST OF VASCULAR PLANTS
'AWEHI, HAWAI'I

As the primary objective of this survey was to prepare an environmental assessment of the study area, rather than to make an exhaustive search solely for plant species, the list is not considered to be complete.

Plant families are listed alphabetically within each of three groups: Pteridophyta (ferns) and fern allies, Monocotyledonae, and Dicotyledonae. For each species the following information is provided:

1. Scientific name with the author of that name
2. Common name or Hawaiian name, when known
3. Status of the species

    E = endemic to the Hawaiian Islands, i.e. occurring naturally nowhere else in the world

    I = indigenous, i.e. native to the Hawaiian Islands but also occurring naturally (without the aid of man) elsewhere

    X = exotic, i.e. plants of accidental or deliberate introduction after the Western discovery of the Hawaiian Islands

    P = Polynesian introduction; it includes those plants brought by the Polynesian immigrants prior to Captain Cook's discovery of the Hawaiian Islands.

Taxonomy and nomenclature of the pteridophytes follows Wagner's unpublished "Checklist of Hawaiian Pteridophytes" except where more commonly accepted names or more recently published names are listed. Taxonomy and nomenclature of the flowering plants (Monocotyledonae and Dicotyledonae) follows St. John (1973) except where more commonly accepted names are listed. Hawaiian names used in the checklist are in accordance with Porter (1972) or with St. John (1973).

PTERIDOPHYTA AND FERN ALLIES

ADIANTACEAE		
Adiantum capillus-veneris L.	'Iwa'iwa	I
ASPIDIACEAE		
Athyrium sandwichianum Presl	Ho'i'o	E
Elaphoglossum alatum var. parvisquameum (Skottsb.) Anderson & Crosby	'Ekaha	E
Elaphoglossum hirtum (Swartz) Christensen	'Ekaha	E
ASPLENIACEAE		
Asplenium contiguum Kaulf.		E
Asplenium lobulatum Mett.		E
BLECHNACEAE		
Blechnum orientale L.	Blechnum	X
DAVALLIACEAE		
Nephrolepis cordifolia (L.) Presl	Ni'ani'au, 'okupukupu, narrow sword fern	I
Nephrolepis exaltata (L.) Schott	Pamoho	I
DICKSONIACEAE		
Cibotium chamissoi Kaulf.	Hapu'u 'i'i	E
Cibotium splendens (Gaud.) Krajina	Hapu'u pulu, pepe'e	E
GLECHENIACEAE		
Dicranopteris emarginata (Brack.) Robinson	Uluhe	I
Hicriopteris pinnata (Kunzé) Ching	Uluhe-lau-nui	I
GRAMMITIDACEAE		
Adenophorus hymenophylloides (Kaulf.) H. & G.	Pai, palai-la'au	E
Adenophorus sarmentosus (Brack.) Wilson		E
Adenophorus tamariscinus (Kaulf.) H. &. G.	Wahine-noho-mauna	E
Grammitis hookerii (Kaulf.) Copel.	Maku'e-lau-li'i	I
Grammitis tenella Kaulf.	Kolokolo, mahinalua	E
HYMENOPHYLLACEAE		
Callistopteris baldwinii (D. C. Eaton) Copel.		E
Mecodium recurvum (Gaud.) Copel.	'Ohi'a ku	E
Sphaerocionium obtusum (H. & A) Copel.	Palai-lau-li'i	E

LINDSAEACEAE		
Sphenomeris chusana (L.) Copel.	Pala'a, pala-pala'a	I
LYCOPODIACEAE		
Lycopodium cernuum L.	Wawae-iole	I
Lycopodium phyllantum H. & A.	Wawae-iole	I
OPHIOGLOSSACEAE		
Ophioglossum pendulum L.	Laukahi, puapua-moa	I
POLYPODIACEAE		
Pleopeltis thunbergiana Kaulf.	'Ekaha-akolea, pakahakaha	I
PSILOTACEAE		
Psilotum complanatum Swartz	Moa, pipi	E
Psilotum nudum (L.) Beauv.	Moa	I
SELAGINELLACEAE		
Selaginella arbuscula (Kaulf.) Spring	Lepelepe-a-moa	E
THELYPTERIDACEAE		
Christella dentata (Forssk.) Brownsey & Jermy	Downy woodfern	X
MONOCOTYLEDONAE		
ARACEAE		
Colocasia esculenta var. antiquorum (Schott) Hubb. & Rhed.	Taro, kalo	P
COMMELINACEAE		
Commelina diffusa Burm. f.	Honohono	X
CYPERACEAE		
Cyperus haspan L.		X
Cyperus polystachyus Rottb.		X
Eleocharis obtusa var. gigantea (Clarke) Fern.	Kohekohe, pipi-wai	I
GRAMINEAE		
Axonopus compressus (Sw.) Beauv.	Broad-leaved carpetgrass	X
Brachiaria mutica (Forsk.) Stapf	Californiagrass, paragrass	X
Coix lachryma-jobi L.	Job's tears, kukae-kolea	X
Oplismenus hirtellus (L.) Beauv.	Basketgrass, hono-hono-kukui	X

GRAMINEAE (continued)		
Panicum repens L.	Quackgrass	X
Paspalum conjugatum Berg.	Hilo grass, mau'u-Hilo	X
Paspalum orbiculare Forst. f.	Ricegrass, mau'u-laiki	X
Sacciolepis indica (L.) Chase	Glenwoodgrass	X
Setaria glauca (L.) Beauv.	Yellow foxtail	X
Setaria palmifolia (Koen.) Stapf	Palmgrass	X
LILIACEAE		
Astelia menziesiana Sm.	Pa'iniu	E
Smilax sandwicensis Kunth	Hoi-kuahiwi, aka-'awa	E
MUSACEAE		
Musa X paradisiaca L.	Mai'a, banana	P
ORCHIDACEAE		
Arundina bambusaefolia (Roxb.) Lindl.	Bamboo orchid	X
Epidendrum sp.	Epidendrum	X
PANDANACEAE		
Freycinetia arborea Gaud.	'Ie'ie	E
ZINGIBERACEAE		
Hedychium flavescens Carey	Yellow ginger, 'awapuhi melemele	X
DICOTYLEDONAE		
AQUIFOLIACEAE		
Ilex anomala H. & A.	Kawa'u	E
ARALIACEAE		
Cheirodendron trigynum (Gaud.) Heller	'Olapa	E
BIGNONIACEAE		
Spathodea campanulata Beauv.	African tulip	X
CARYOPHYLLACEAE		
Drymaria cordata (L.) Willd.	Drymaria, pipili	X
COMPOSITAE		
Ageratum conyzoides L.	Ageratum, maile-hohono	X
Erechtites valerianaefolia (Wolf) DC.		X
Eupatorium riparium Regel	Pamakani	X
Pluchea odorata (L.) Cass.	Plúchea	X

ERICACEAE		
Vaccinium calycinum Sm.	'Ohelo-kau-la'au	E
Vaccinium sp.	'Ohelo	E
EUPHORBIACEAE		
Antidesma platyphyllum Mann var. platyphyllum	Hame, mehame	E
LEGUMINOSAE		
Acacia koa Gray	Koa	E
LOBELIACEAE		
Clermontia parviflora Gaud.	Papa'a-hekili	E
Cyanea sp.	'Oha	E
LYTHRACEAE		
Cuphea carthagenensis (Jacq.) MacBride	Cuphea, puakamoli	X
MELASTOMATACEAE		
Melastoma malabathricum L.	Malabar melastome	X
MELIACEAE		
Toona ciliata M. Roem.	Toon	X
MYRTACEAE		
Eucalyptus citriodora Hook.	Lemon-scented gum	X
Eucalyptus robusta Sm.	Swamp mahogany	X
Metrosideros collina ssp. polymorpha (Gaud.) Rock	'Ohi'a-lehua, lehua	E
Psidium cattleianum Sabine	Strawberry guava	X
Psidium cattleianum f. lucidum Deg.	Waiawi, yellow strawberry guava	X
ONAGRACEAE		
Ludwigia octivalvis (Jacq.) Raven	Primrose willow, kamole	X
Ludwigia palustris (L.) Ell.	Water purslane	X
PASSIFLORACEAE		
Passiflora edulis f. flavicarpa Deg.	Yellow lilikoi	X
PIPERACEAE		
Peperomia tetraphylla (Forst. f.) H. & A.	'Ala'ala-wai-nui kane	I
Peperomia sp.	'Ala'ala-wai-nui kane	E
ROSACEAE		
Rubus rosaefolius Sm.	Thimbleberry, 'ola'a	X

RUBIACEAE		
Coprosma sp.	Pilo	E
Psychotria hawaiiensis (Gray) Fosberg var. hawaiiensis	Kopiko	E
RUTACEAE		
Pelea volcanica Gray var. volcanica	'Alani	E
TILIACEAE		
Heliocarpus popayaensis HBK.	White moho	X
UMBRELLIFERAE		
Centella asiatica (L.) Urban	Asiatic pennywort, pohekula	X
VERBENACEAE		
Stachytarpheta jamaicensis (L.) Vahl	Jamaica vervain, owi, oi	X

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Porter, J. R. 1972. Hawaiian names for vascular plants. College of Tropical Agriculture, Hawaii Agricultural Experiment Station, University of Hawaii, Departmental Paper No. 1.

St. John, H. 1973. List and summary of the flowering plants in the Hawaiian Islands. Pacific Tropical Botanical Garden Memoir 1.

Wagner, W. H. Checklist of Hawaiian Pteridophytes. MS. Unpublished.

NEW PERMIT
1980-85

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. BOX 3378
HONOLULU, HAWAII 96801

GEORGE A. L. YUEN
DIRECTOR OF HEALTH

VERNE C. WAITE, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

JAMES S. KUMAGAI, PH.D., P.E.
DEPUTY DIRECTOR OF HEALTH

TADAO BEPPU
DEPUTY DIRECTOR OF HEALTH

Hilo Coast Processing Company
RECEIVED
FEB 11 1980

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

FEB 11 1980

In reply, please refer to:
File: EPHSD-PTR

Mr. Terris H. Inglett
Executive Vice President
Hilo Coast Processing Company
P. O. Box 18
Pepeekeo, Hawaii 96783

Dear Mr. Inglett:

In accordance with the provisions of the Federal Water Pollution Control Act (33 USC 1251 et. seq.), Chapter 342, Hawaii Revised Statutes and Chapter 37 of Public Health Regulations, Department of Health, the Hawaii State Department of Health has reviewed the following application for National Pollutant Discharge Elimination System (NPDES) permit to discharge wastewaters:

Discharger	NPDES Permit No.
Hilo Coast Processing Co. Pepeekeo Mill	HI 0000191

This agency has published a public notice of our proposed action regarding the above application.

After consideration of the expressed views of all interested persons and agencies, pertinent Federal and State statutes and regulations regarding the discharge, the Department of Health has issued the enclosed National Pollutant Discharge Elimination System permit for the discharge referred to above. This action does not constitute a significant change from the tentative determination set forth in the public notice.

The permit shall take effect on the date of this notice.

The permit applicant will have the opportunity to appeal to the Director of Health to any of the conditions of an issued permit. The applicant will have twenty (20) days after receipt of notification of issuance of a permit to appear before the Director or submit a written letter of appeal to the Director. The applicant may further appeal to a circuit court from any of the Director's decision in the manner provided in Chapter 91, Hawaii Revised Statutes.

Very truly yours,

[signature]

SHINJI SONEDA, CHIEF
Environmental Protection and
Health Services Division

KT:lt
Enclosures
cc: EPA, Region IX, Permits Branch (w/2 sets of encl.)
U.S. Fish & Wildlife Service, Hawaii Area Office (w/encl.)
OEQC (w/o encl.)

APPENDIX G

Permit No. HI 0000191
Application No. HI 0000191

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq; "Act"), and Chapter 342, Hawaii Revised Statutes, as amended, and Chapters 37 and 37-A of Public Health Regulations, Department of Health, State of Hawaii

HILO COAST PROCESSING COMPANY
Pepeekeo Mill
Pepeekeo, Hawaii

is authorized to discharge from a facility located at the Pepeekeo Mill, located approximately 1/4 mile south of Pepeekeo Point (Discharge Serial Nos. 001, 002, 003),

to receiving waters named the Pacific Ocean at coordinates: Latitude 19°50'44"N, Longitude 155°05'15"W,

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III hereof.

This permit shall become effective upon issuance.

This permit and the authorization to discharge shall expire at midnight, March 1, 1985.

Signed this 11th day of February, 1980

Hilo Coast Processing Company
RECEIVED
FEB 11 1980

(for) Director of Health

PERMIT ISSUED
Date FEB 11 1980

NPDES Form 2 2

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning the effective date of this permit and lasting through March 1, 1985, the permittee is authorized to discharge from outfall(s) serial number(s) 001, 002, 003.

1. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristic	Discharge Limitations kg/day (lbs/day)		Discharge Limitations Other Units (Specify)		Monitoring Requirements	
	Daily Average	Daily Maximum	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
low m^3/day (MGD)	---	---	---	---	Continuous	Continuous
otal Suspended Solids	---	---	3.6 lb. / 1000 lb. gross cane	9.9 lb. / 1000 lb. gross cane	Once/Week	Composite
ppearance of Discharge Plume (same day as suspended solids monitored).*					Once/6 mos.	Color Photograph

See Part III.D.1.

2. The discharge shall not cause objectionable odors at the surface of the receiving waters.
3. There shall be no discharge of floating solids, visible foam, sugar cane trash and bagasse, filter cake, boiler ash, clinker, soot, and rock.
4. Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): Discharge Serial Nos. 001, 002, 003 effluent samples shall be taken prior to mixing with the receiving waters.

PERMIT ISSUED
Date FEB 11 1980

Hilo Coast Processing Company
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FEB 11 1980

B. SCHEDULE OF COMPLIANCE

1. The permittee shall achieve compliance with the effluent limitations specified for discharges in accordance with the following schedule:

   Not Applicable

2. No later than 14 calendar days following a date identified in the above schedule of compliance, the permittee shall submit either a report of progress or, in the case of specific actions being required by identified dates, a written notice of compliance or noncompliance. In the latter case, the notice shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirement.

C. MONITORING AND REPORTING

1. *Representative Sampling*

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. *Reporting*

Monitoring results obtained during the previous three (3) months shall be summarized for each month and submitted on forms to be supplied by the Director, to the extent that the information reported may be entered on the forms. The results of all monitoring required by this permit shall be submitted in such a format as to allow direct comparison with the limitations and requirements of this permit. Unless otherwise specified, discharge flows shall be reported in terms of the average flow over each 30-day period and the maximum daily flow over that 30-day period. Monitoring reports shall be postmarked no later than the 28th day of the month following the completed reporting period. The first report is due on April 28, 1980. Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Director and the Regional Administrator at the following addresses:

Director State Department of Health
Attn: Environmental Protection & Health Services Division
1250 Punchbowl Street
Honolulu, HI 96813

Regional Administrator
Environmental Protection Agency
Region IX, Attn: ENCMR
215 Fremont Street
San Francisco, CA 94105

Hilo Coast Processing Company
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FEB 11 1980

3. *Definitions*

a. The "daily average" discharge means the total discharge by weight during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges by weight divided by the number of days during the calendar month when the measurements were made.

b. The "daily maximum" discharge means the total discharge by weight during any calendar day.

4. *Test Procedures*

Test procedures for the analysis of pollutants shall conform to regulations published pursuant to Section 304(g) of the Act, under which such procedures may be required.

5. *Recording of Results*

For each measurement or sample taken pursuant to the requirements of this

PERMIT ISSUED
Date FEB 11 1980

permit, the permittee shall record the following information:

a. The exact place; date; and time of sampling;

b. The dates the analyses were performed;

c. The person(s) who performed the analyses;

d. The analytical techniques or methods used; and

e. The results of all required analyses.

6. *Additional Monitoring by Permittee*

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report Form. Such increased frequency shall also in indicated.

7. *Records Retention*

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Director or the Regional Administrator.

A. MANAGEMENT REQUIREMENTS

1. *Change in Discharge*

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit more frequently than or at a level in excess of that authorized shall constitute a violation of the permit. Any anticipated facility expansions; production increases, or process modifications which will result in new, different, or increased discharges of pollutants must be reported by submission of a new NPDES application or, if such changes will not violate the effluent limitations specified in this permit, by notice to the permt issuing authority of such changes. Following such notice, the permit may be modified to specify and limit any pollutants not previously limited.

2. *Noncompliance Notification*

If, for any reason, the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit, the permittee shall provide the Director and the Regional Administrator with the following information, in writing, within five (5) days of becoming aware of such condition:

a. A description of the discharge and cause of noncompliance; and

b. The period of noncompliance, including exact dates and times; or, if not corrected, the anticipated time the noncompliance is expected to continue, and steps being taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

3. *Facilities Operation*

The permittee shall at all times maintain in good working order and operate as efficiently as possible all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

4. *Adverse Impact*

The permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitations specified in this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

5. *Bypassing*

Any diversion from or bypass of facilities necessary to maintain compliance with the terms and conditions of this permit is prohibited, except (i) where unavoidable to prevent loss of life or severe property damage, or (ii) where excessive storm drainage or runoff would damage any facilities necessary for compliance with the effluent limitations and prohibitions of this permit. The permittee shall promptly notify the Director and the Regional Administrator in writing of each such diversion or bypass.

6. *Removed Substances*

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in a manner such as to prevent any pollutant from such materials from entering navigable waters.

PART II.A.7. SAFEGUARDS TO ELECTRIC POWER FAILURE

In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall:

a. Maintain in good working order an alternate power source sufficient to operate the wastewater control facilities; or if such alternate power source is not in existence, shall:

b. Halt, reduce or otherwise control all discharge upon the reduction, loss or failure of the primary source of power.

Hilo Coast Processing Company
RECEIVED
FEB 11 1980

PERMIT ISSUED
Date FEB 11 1980

B. RESPONSIBILITIES

1. *Right of Entry*

The permittee shall allow the Director, the Regional Administrator, and/or their authorized representatives, upon the presentation of credentials:

a. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit; and

b. At reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect any monitoring equipment or monitoring method required in this permit; and to sample any discharge of pollutants.

2. *Transfer of Ownership or Control*

In the event of any change in control or ownership of facilities from which the authorized discharges emanate, the permittee shall notify the succeeding owner or controller of the existence of this permit by letter, a copy of which shall be forwarded to the Director and the Regional Administrator.

3. *Availability of Reports*

Except for data determined to be confidential under Section 308 of the Act, all reports prepared in accordance with the terms of this permit shall be available for public inspection at the offices of the Director and the Regional Administrator. As required by the Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Act.

4. *Permit Modification*

After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

a. Violation of any terms or conditions of this permit;

b. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

5. *Toxic Pollutants*

Notwithstanding Part II, B-4 above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in such effluent standard or prohibition) is established under Section 307(a) of the Act or Chapter 342, Hawaii Revised Statutes for a toxic pollutant which is present in the discharge and such standard or prohibition is more stringent than any limitation for such pollutant in this permit, this permit shall be revised or modified in accordance with the toxic effluent standard or prohibition and the permittee so notified.

6. *Civil and Criminal Liability*

Except as provided in permit conditions on "Bypassing" (Part II, A-5) and "Power Failures" (Part II, A-7), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

7. *Oil and Hazardous Substance Liability*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities; liabilities; or penalties to which the permittee is or may be subject under Section 311 of the Act or Chapter 342, Hawaii Revised Statutes.

8. *State Laws*

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable State law or regulation under authority preserved by Section 510 of the Act.

9. *Property Rights*

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations.

10. *Severability*

The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

PART III — OTHER REQUIREMENTS

A. *Definitions*

"Director" means the Director of Health or his duly authorized Agent.

B. *Reapplication:*

The permittee shall reapply for a permit not later than 180 days before this permit expires on the application forms then in use.

C. The Director may, upon request of the permittee, and after public notice, revise or modify a Schedule of Compliance in an issue permit if he determines good and valid cause (such as an act of God, strike, flood, materials shortage, or other event over which the permittee has little or no control) exists for such revision.

PERMIT ISSUED
Date FEB 11 1980

D. 1. The permittee shall have a sufficient number of color photographs taken so as to accurately record the appearance of the area of the receiving waters which is influenced by the discharge, and a reference area which is not influenced by the discharge, but which is in its natural condition. Color prints or slides of the photographs shall be included in the reports required in Part I.C.2. Each print or slide shall be identified by the date and time of day the photograph was taken, the location of the camera and the location of the area in the photograph.

In addition, for each day during which suspended solids are monitored, the permittee shall monitor and record the number of tons processed by the mill of total gross cane.

2. Quality Control

The permittee shall calibrate and perform maintenance procedures on all monitoring and analytical instrumentation at sufficiently frequent intervals to ensure accuracy of measurements or shall ensure that both activities will be conducted.

E. The permittee shall submit to the Director and Regional Administrator by January 30 of each year, an annual summary of the quantities of all chemicals, listed by both chemical and trade names, which are used for cooling and/or boiler water treatment and for wastewater treatment, which are discharged.

F. Definitions

<u>Excessive Storm Drainage or Runoff:</u>

That which results from a greater than ten (10) years, 24-hour storm, as defined by the National Weather Service.

<u>Discrete Sample:</u>

An individual sample collected in less than 15 minutes.

<u>Composite Sample:</u>

A combination of no fewer than eight individual samples obtained at equal time intervals over the specified sampling period. The volume of each individual sample shall be proportional to the discharge flow rate at the time of sampling. The sampling period shall equal the discharge period, or 24-hours, whichever is shorter.

<u>Gross Cane:</u>

The total quantity of sugar cane, soil, and associated debris which is received at the mill for processing.

G. Zone of Mixing

Not later than February 1, 1982, the permittee shall apply to the State of Hawaii for a zone of mixing for the discharge(s) authorized by this permit, and shall submit a copy of such application to the Regional Administrator. Thereafter, the permittee shall take such actions as may reasonably be required to assure that the zone of mixing shall be granted and effective not later than July 1, 1982. Within thirty (30) days after the zone of mixing is granted, the permittee shall submit a copy of the zone of mixing to the Regional Administrator.

PERMIT ISSUED
Date FEB 11 1980

HILO COAST PROCESSING COMPANY
FUEL GRADE ETHANOL PLANT
SOIL EXPLORATION REPORT

PEPEEKEO, HAWAII
TAX MAP KEY: 2-8-07: POR. 53

To:
HILO COAST PROCESSING COMPANY

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

JANUARY 16, 1981

APPENDIX H

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

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

January 16, 1981

HILO COAST PROCESSING COMPANY
P. O. Box 18
Pepeekeo, Hawaii 96783

Gentlemen:

Subject: Hilo Coast Processing Company
Fuel Grade Ethanol Plant
Soil Exploration Report
(for foundation design purposes)
Pepeekeo, Hawaii

Transmitted herewith is our soil exploration report for foundation design considerations for the proposed Hilo Coast Processing Company Fuel Grade Ethanol Plant, Pepeekeo, Hawaii.

The soil conditions at the site indicated about 5 to 15 ft of clayey silt (weathered volcanic ash) underlain by decomposed rock to about 16 to 30 ft followed by lava rock. The ash soil has a high water content and is highly compressible.

The volcanic ash surface soil has sufficient in-situ bearing strength for light one-story structures. Because of its high moisture content, however, the ash has poor remolded strength. Care should be taken so that the in-situ soils are not remolded, if it is to be used for bearing.

Light, one-story flexible structures may be supported on spread footings or mats bearing on the surface ash soil. Heavier structures should be supported on spread, mat or pier foundations extending thru the surface ash soil and bearing on the decomposed rock layer or on pile foundations.

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

Respectfully submitted,

WALTER LUM ASSOCIATES, INC.

By Edward K. Watanabe
Edward K. Watanabe

SHL/EKW:lw

CONTENTS

HILO COAST PROCESSING COMPANY
FUEL GRADE ETHANOL PLANT
SOIL EXPLORATION REPORT

PEPEEKEO, HAWAII
TAX MAP KEY: 2-8-07: POR. 53

SCOPE OF EXPLORATION

The purpose of this exploration was to evaluate the general soil conditions for foundation design considerations for the proposed Hilo Coast Processing Company, Fuel Grade Ethanol Plant at Pepeekeo, Hawaii.

This report has been prepared for the exclusive use of Hilo Coast Processing Company and their design consultants as a guide in the design of this specific project. The report has not been prepared for use by other parties and may not contain sufficient information for other uses.

This report includes field explorations, laboratory test results, general foundation design guidelines and limitations.

PROJECT CONSIDERATIONS

The proposed plan includes several types of structures. At the time of the exploration, the sizes of the structures were not definitely set. Generally, they may be described as follows:

Molasses Tanks	50-ft diameter by 25 ft high
Ethanol Tanks	50-ft diameter by 25 ft high
Fermentation Tanks	25-ft diameter by 25 ft high
Distillation Towers	6-ft diameter by 102, 95 and 50 ft high
Stillage Evaporation Unit	80 ft by 100 ft

Boiler	40 ft by 40 ft
Fuel Storage Building	100 ft by 200 ft by 25 ft high
By-product Storage Building	100 ft by 120 ft by 25 ft high

The unit weights of the materials to be stored may vary from about 10 p.c.f. to 100 p.c.f. Floor loads may be from little to 2500 p.s.f. or more.

Minor grading and some paving are planned.

FIELD EXPLORATION

Seventeen borings were made at the site. The approximate locations of the borings are shown on the Boring Location Sketch.

Borings were made with 4-in. diameter augers using tungsten carbide finger bits. Soil samples were recovered with 3-in. o.d. thin-wall tube samplers pushed hydraulically and with a standard split spoon sampler driven with a 140-lb hammer falling 30 inches.

Rock core samples were recovered with "BX" double tube core barrel with a tungsten carbide or a diamond coring bit.

LABORATORY TESTS

Laboratory tests included: natural water content and density, grain-size analysis, Atterberg limit, laboratory vane shear, unconfined compression, unconsolidated undrained triaxial, direct shear, consolidation, soil pH, soil resistivity, ASTM 1557-70 density and CBR.

A summary of the laboratory test results is given in Tables IA thru IG.

GEOLOGIC AND SOIL DESCRIPTIONS BY OTHERS

According to Stearns, H. T., Macdonald, G. A. and U. S. Geological Survey, "Geologic and Topographic Map, Island of Hawaii," USGS, 1945, the geologic formation at the site falls under the classification of:

Pml - Hamakua volcanic series.

Lava flows, chiefly basaltic capped by Pahala ash.

According to the U. S. Soil Conservation Service, "Soil Survey of Island of Hawaii, State of Hawaii," December 1973, the surface soils may be classified as:

HoC - Hilo silty clay loam, 0 - 10% slope.
HoD - Hilo silty clay loam, 10 - 20% slope.
HoE - Hilo silty clay loam, 20 - 35% slope.
Unified Soil Classification - OH.
Shrink-swell potential - high.
Corrosivity - moderate.

SOIL CLASSIFICATION SYSTEM USED IN THIS REPORT

Soil samples were first visually classified in the field and then subjected to selected tests in the laboratory. The soil descriptions were then modified in general conformance with the "Unified Soil Classification System," whenever applicable.

GENERAL SITE CONDITIONS

The site is located about 500 ft northwesterly of the Hilo Coast Processing Company Sugar Mill, and generally on the easterly side of the existing manager's house.

An existing paved road in an east-west alignment divides the site into two portions.

The portion of the site north of the road is rectangular shaped, about 250 ft by 350 ft. The area was recently cleared of sugarcane. A power line crosses the middle of the area in an east to west direction. The area generally sloped down toward the east with a gradient of about 3%.

The portion of the site south of the existing road is triangular shaped, about 700 ft by 600 ft. The area is generally covered with lawn grass and other plantings. Four single-story wooden structures are located near the western and southern edges of the site. The manager's house was not occupied at the time of exploration. The other three houses were occupied. The area generally sloped down toward southeast at a gradient of about 3 to 5%.

A drainage gully, about 25 to 30 ft deep with side slopes varying from 1H:1V to 3H:1V, is located south of the site.

Paved driveways were noted on the site. Overhead and underground utilities were also noted.

INTERPRETATION OF SOIL CONDITIONS

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

> A surface layer of tannish-brown clayey silt (weathered volcanic ash) to about 5 to 15-ft depth, underlain by mottled gray and brown decomposed rock to about 16 to 30 ft. Below this was gray lava rock to about 40 ft, the maximum depth drilled.

Water was noted in the borings at 16 to 28-ft depths during the field explorations. The water appeared to be drill water.

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

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

DISCUSSION AND RECOMMENDATIONS

The proposed Fuel Grade Ethanol Plant facilities includes various structures with varying loads.

Some minor grading may involve cut and fill of a few feet to create level pads for the proposed structures.

The proposed site slopes down gently towards the southeast at a 3 to 5% gradient with a drainage gully located along the south side.

The soils at the site appear to be soft clayey silt (weathered volcanic ash), about 5 to 15 ft thick, underlain by decomposed rock to about 16 to 30 ft followed by gray lava rock. The surface clayey silt (volcanic ash) has a high water content and is highly compressible, sometimes classified as an "MH-OH" material according to the Unified Soil Classification System.

The surface volcanic ash soil has sufficient in-situ bearing strength for foundations supporting light structures. Because of the high moisture content, however, the remolded strength is low. Care should be taken in the design so that the in-situ soils are not remolded.

John F. Mink

CONSULTANT
WATER RESOURCES · EARTH SCIENCES
P.O. Box 4452
Honolulu, Hawaii 96813
(808)671-0793

March 16, 1981

Mr. Jerry Allen
Vice President
C. Brewer & Co.
827 Fort Street
Honolulu, Hawaii 96813

Dear Sirs:

Enclosed is a report on the feasibility of developing a large fresh groundwater supply, on the order of 5000 gpm, for the proposed ethanol plant near Pepeekeo, Hawaii. As a result of evaluating the data available to me and examining the site, I conclude that it will be feasible to obtain good quality water in the amount you need.

The report recommends the way to go about developing the groundwater. I will be pleased to continue working with you when you decide to go ahead with the project.

Sincerely,

John F. Mink

APPENDIX I

GROUNDWATER AVAILABILITY FOR THE PROPOSED ETHANOL PLANT AT PEPEEKEO

JOHN F. MINK

March 16, 1981

GROUNDWATER CONDITIONS AND DEVELOPABILITY
NEAR PEPEEKEO, HAWAII

March 16, 1981

Summary of Findings

1. The flow of fresh groundwater in the vicinity of the Hilo Coast Processing complex is large and can be successfully exploited.

2. Two types of groundwater occur, one called perched water, which is found in small aquifers at various heights above sea level, and the other called basal water, which occurs as a lens of fresh water floating on sea water. The perched water is much less voluminous than the basal water and is developable only with small capacity wells. Basal water is safely developable with large capacity wells. The two small wells (mauka well and makai well) at Pepeekeo pump a combination of perched and basal water; the processing plant cooling water wells pump basal water.

3. Water for the proposed ethanol plant would have to be taken from the basal aquifer. To insure a reliable yield of low salinity water, new wells will have to be shallower than the currently operating cooling wells and fitted with smaller pumps.

4. Because of the depth (300 feet below sea level) of the three wells at the processing plant and the size of

the pump (5500 gpm) in each well, these wells provide only brackish water. When the three wells are pumped simultaneously the output is about one half sea water.

5. At least three wells, and preferably four, with capacities not exceeding 1750 gpm will be needed to yield a continuous flow of 5000 gpm of low salinity water for the ethanol plant.

6. Location of the well field at the proposed ethanol plant will decrease the quality of the water produced by the processing plant's cooling wells. The salinity of these wells could be expected to rise by approximately 25 percent.

Recommendations

1. For planning purposes, assume need for a well field designed as follows:

a. Four wells of 1750 gpm capacity each.

b. The wells located at the proposed ethanol plant site along a line parallel to the coast with a minimum distance between adjacent wells of 125 feet. This siting assumes that an increase in salinity at the presently operating cooling wells is acceptable.

c. Well borings to have a total depth of 250 feet (100 feet below sea level) and to be cased with 18-inch diameter blank casing to ten feet below sea level (depth of 160 feet below ground elevation of 150 feet). The 90 feet of open hole below the blank casing to have a diameter of 16 inches.

2. Before final decisions are made on the above plan, drill the first boring as an exploratory-production well and submit it to controlled step drawdown and sustained pumping tests. The results of the tests will determine the final number of wells to be drilled, their pump capacities, and their configuration. A separate small diameter boring to ascertain subsurface hydrogeological conditions is not necessary. The total cost of four wells, cased and equipped with pumps, would be about $760,000.

Introduction

The Pepeekeo region in the neighborhood of the Hilo Coast Processing Company has an abundance of exploitable groundwater occurring as both perched water on ash beds or dense lava flows and as a basal lens floating on salt water. The perched water is by far the less voluminous of the two and is developable only by means of relatively small wells having capacities of a few hundred gallons per minute. The basal water, on the other hand, occurs in a thick lens that could yield fresh water to wells with pump capacities between 1000 and 2000 gpm. The three large wells that presently are pumping from the lens to provide cooling water are too deep and are fitted with pumps too large to yield fresh water, however.

Two small wells inland of the cooling water wells pump relatively minor amounts of groundwater but on a continuous basis. The output of these wells includes both perched and basal water. In normal weather the perched water component probably dominates while during droughts the basal lens is likely to be the main contributor.

Groundwater Resources

Pepeekeo falls within the wettest climatic zone on the island of Hawaii. Rainfall exceeds 125 inches per year at the coast and increases to a maximum of more than 250 inches per year on the lower slopes of Mauna Kea. Much of the rain flows overland to the sea as surface runoff, but a large fraction ultimately percolates to a very extensive Ghyben-Herzberg groundwater lens.

The area is underlain by the Hamakua volcanic series which consists principally of ordinary basalts transitional to andesites near the surface. Lying as a discontinuous mantle on the Hamakua series is the Pahala Ash, which occasionally reaches a thickness of about 20 feet. The basalts of Hamakua series are very permeable, the andesites only moderately so, and the Pahala Ash even less so. The Ghyben-Herzberg lens occurs mainly within the lower permeable basalt.

Intercalated within the Hamakua series are poorly permeable ash beds which serve as perching members for high level water not in hydraulic continuity with the deeper lens. Because of the high regional rainfall, the perched water bodies contain appreciable volumes of fresh groundwater.

The only sediments of note are gravel and alluvial material in stream beds. No fine grain marine sediments or fossil corals, or any combination of sediments giving rise to normal caprock, are present. The lavas of the Hamakua series are directly exposed to the sea at the coast. However, the high head (8 feet) of the basal lens so near the coast suggests that unrestricted outflow to the sea is prevented by some sort of caprock, probably massive and dense andesitic lava flows.

A very large flux of groundwater passes through the aquifer. Near Pepeekeo Point the basal head within a few hundred feet of the sea is more than eight feet, which may be compared with heads further up the coast of only two to five feet at Ookala and Paauilo and down the coast at Hilo of only three to four feet.

Perched water was encountered while drilling one of the small wells in 1946, which was the first attempt to exploit groundwater in the area. The highest water table initially stood about 150 feet above sea level but stabilized at about 130 feet. The well had to be extended to 25 feet below sea level to provide an acceptable yield. At this depth it penetrated into the basal lens but nevertheless the water pumped was predominantly from perched aquifers. The second small well reached to 60 feet below sea level, into the basal lens, yet much of the water it initially yielded, and may still yield, is from perched aquifers. Characteristics of the perched water markedly differ from the basal water. Among the major differences are temperature (average 72°F in perched water, 68°F basal); pH (average 6.5 to 7.0 perched, 7.0 to 7.5 basal); silica (approximately 10 to 20 mg/l greater in basal water); and chloride (less than 15 mg/l perched, more than 20 mg/l basal).

The three large capacity wells near the mill penetrate deep into the basal aquifer. They were drilled in 1971-72 for cooling water, evidently with the main objective of providing a very large volume rate without regard to quality. All three wells have their bottoms 300 feet below sea level and are cased and grouted to 45 feet below sea level. The open bore below the casing in each well is 24 inches in diameter. The borings were driven so deep in order to yield more than 5000 gpm at a small drawdown. To achieve this extraordinary capacity, quality was necessarily sacrificed. For a basal lens with a head of eight feet, the midpoint of the transition zone (the 50 percent sea water depth) is 320 feet below sea level, nearly coincident with the bottom of each well. In effect, these wells obtain most of their flow from the transition zone.

The first cooling well was tested in 1971 at 3500 gpm when it was only 154 below sea level. It initially yielded water with 125 mg/l chloride. However, the drawdown of 19 feet was considered excessive so the well was deepened. Final initial chloride content was 800 mg/l at 300 feet below sea level. Wells 2 and 3 were drilled to -300 feet without an interim test. The initial chloride in Well 2 was 570 mg/l and in Well 3 it was 330 mg/l. However, by 1975 chloride in Well 3 had reached 3000 mg/l and was probably at least as high in the other two wells. The salinity is much higher today, reaching as high or higher than 9000 mg/l chloride (about one half sea water) when the three pumps are running simultaneously. When only two pumps are on, the usual practice, the chloride content of the mixed flow apparently falls to about 4000 mg/l. Because of their depth and the size of their pumps, these wells as employed today can never produce fresh water. They are not a rational model to follow in designing the ethanol plant wells.

Groundwater Development for the Proposed Ethanol Plant

Groundwater of excellent quality pumped at moderately high to high rates is obtainable at the proposed ethanol plant site but two basic considerations must be addressed. The first is the design of the wells in which diameter and depth of well, depth of casing, pump size, and distance between wells are the principal factors. The second is probable increase in salinity in the already highly brackish cooling water wells. The degree of increase is not quantifiable without extensive pumping tests, but expectably greater salinization would take place if the new wells were placed at the proposed site than if they were located some distance north or south of it. The plant site is directly up the groundwater gradient from the cooling wells. A preliminary calculation using a straight forward linear mixing model suggests that if the new wells were located at the plant site and withdrew a steady total of 5000 gpm, the salinity of the cooling wells during the normal pumping pattern (two wells on simultaneously, one at rest) would increase to 12000 mg/l chloride. This simple model is suggestive only; it probably exaggerates the increase.

To insure that the groundwater extracted near the ethanol plant site sustained low salinity under all conditions, the wells cannot be either as large in capacity or as deep as the three cooling wells. Consideration of the known groundwater hydraulics and hydrogeology of the area suggests that the maximum depth of each well should be no more than 100 feet below sea level, the maximum capacity should be 1750 gpm (2.5 mgd) or less, and the spacing between adjacent wells should be no less than about 125 feet. Diameter of the open bore below the casing should be about 16 inches and the casing diameter about 18 inches. Blank casing should not extend more than a few feet below sea level. These are preliminary design features, subject to revision.

The above pump capacity constraint means that at least three wells are needed and perhaps four to safely guarantee yield and quality. Assume that a steady rate of 5000 gpm is required for the plant; a minimum of three 1750 gpm wells would meet the requirement but without having a standby well available. If pumping tests indicated that 1500 gpm was the allowable maximum capacity for each well, a minimum of four wells would be needed. At this stage it is reasonable to think in terms of four wells to allow for having to use somewhat smaller capacities than the suggested 1750 gpm maximum. Final well design, including pump capacity, will have to be determined by testing the first well to be drilled.

A preliminary small diameter test hole to measure water level and provide subsurface lithology is not necessary. Subsurface hydrogeological conditions are determinable from analyses of other wells in the area. What is needed are step drawdown and sustained pumping tests at the proposed well field. This testing would be part of the program to drill wells for the plant. An exploratory-production well would first be drilled and thoroughly tested. The results of the tests would determine final design features of each well and of the entire well field.

Recommendations

The following recommendations lean on the side of caution so that the computed costs are probably somewhat high. Location of the wells is at the site of the ethanol plant, which assumes that the expected increase in salinity at the existing cooling wells is an acceptable tradeoff.

1. Drill four wells to a depth of 100 feet below sea level (total depth 250 feet from ground elevation 150 feet). Cost of drilling and casing each well with 160 feet of 18 inch casing, approximately $115,000. Total for four

wells, approximately $460,000.

2. Outfit with 1750 gpm pumps, unless tests dictate smaller size. Cost per pump, installed and tested, approximately $75,000. Total cost four pumps, $300,000.

3. Distance between adjacent wells 125 to 150 feet.

These recommendations are based on existing knowledge of groundwater conditions in the Pepeekeo region and on the professed goal of supplying good quality water (less than several hundred mg/l chloride) on a sustained basis. Should the quality of the water not be a severe constraint, then three wells at higher capacities would be acceptable. However, three wells at 2000 gpm each, for instance, would result in salinities of greater than 1000 mg/l chloride in the long run. It is not reasonable to expect that the needs of the ethanol plant could be met by only two wells.

JOHN F. MINK
Hydrologist-Geologist

State California
Registered Geologist 364

March 19, 1981

Quality of Groundwater at the
Proposed Ethanol Plant, Pepeekeo
(addendum to my report of 3/16/81)

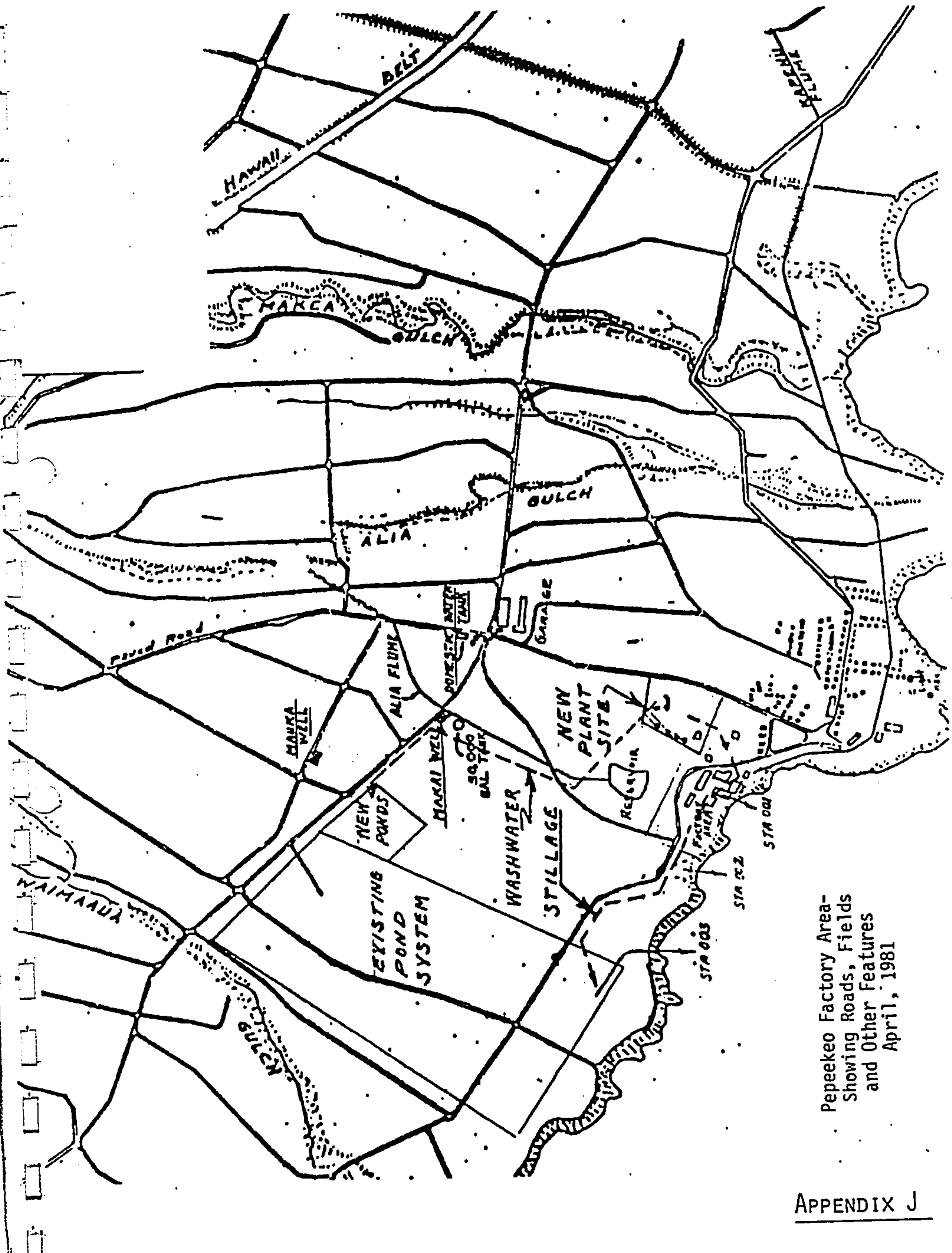
At the proposed ethanol plant the basal lens has a head of about nine feet and the salinity of the water before pumping is expected to be less than 100 mg/l chloride. Pumping will induce vertical flow carrying greater salinity than the undisturbed horizontal stream lines, but the final mixture at rates of pumping of 1750 gpm per well or less will not likely exceed 300 mg/l chloride. I base this conclusion on analogies with similar environments elsewhere and on the fact that the three cooling wells yielded high quality water for some time even at extreme pumping rates(to 6200 gpm).

The initial chloride content at cooling well 1 was 110 mg/l at a pump rate of 2500 gpm: at 6500 gpm it increased to 800 mg/l. In well 2 the initial chloride was 370 to 570 mg/l at 6200 gpm. In well 3 it was 215 to 333 mg/l at 6200 gpm. All of the wells were drilled to 300 feet below sea level, which is unusually deep for a lens with a head of 8 feet.

Not very many heavy metal analyses of Hawaiian groundwaters are in accessible data files, surprisingly. More analyses of surface waters have been made, but some of these samples actually are flow from ground water springs. Cadmium and lead have rarely been detected. A deep well on West Maui into basalt similar to that at Pepeekeo showed no lead at the .01 mg/l detection level and only copper (.02 mg/l) and zinc(.015 mg/l) of the other heavy metals. The low flow, consisting of groundwater, of several streams on Oahu show no lead, cadmium, mercury and chromium while exhibiting a few nano-grams/l of copper, zinc and arsenic.

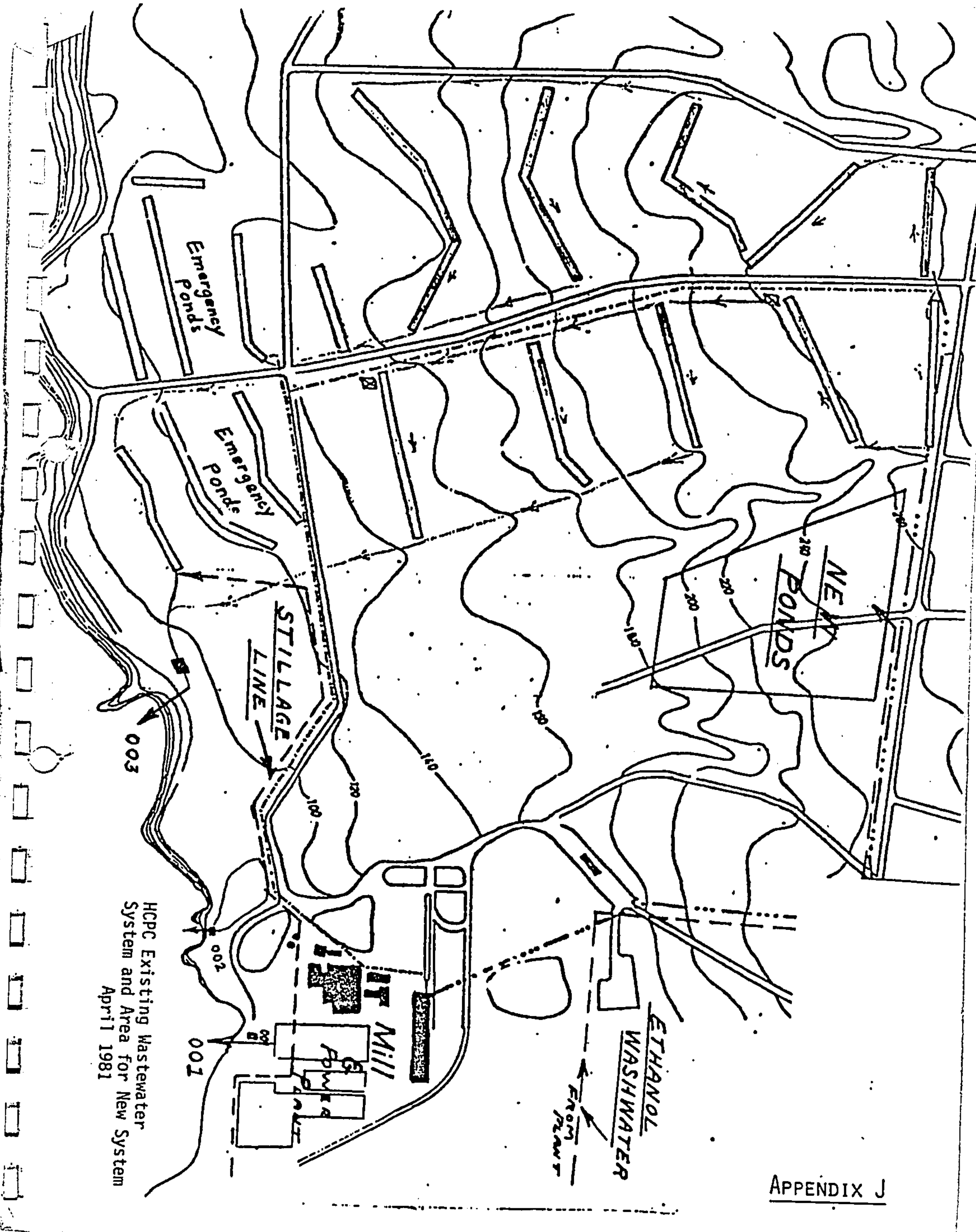
Unless the geological environment at Pepeekeo is unique for Hawaii, which is not likely, the concentration of heavy metals in the ground-water at the proposed well sites will be either non detectable or less than .01 mg/l.

John F. Mink



Pepeekeo Factory Area-
Showing Roads, Fields
and Other Features
April, 1981

APPENDIX J



HCPC Existing Wastewater System and Area for New System April 1981

APPENDIX J

JAN 19 1983